Socioeconomics of North Coast Fisheries in the Context of Marine Protected Area Formation

Report to the California Sea Grant College Program

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Humboldt State University
Founded in 1913, Humboldt State University is a comprehensive, residential campus of the California State University system. As of 2016 HSU had nearly 8,800 students and 566 faculty members, and offered 51 majors and 12 graduate programs in 3 Colleges. HSU hosts the Humboldt Marine Sciences & Coastal Institute, formed in 2013 to develop and promote interdisciplinary marine and coastal research, education, and outreach. HSU's vision is to be the campus of choice for individuals who seek above all else to improve the human condition and our environment, and to be the premier center for the interdisciplinary study of the environment and its natural resources.

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Powered by the vision of a world where people and nature thrive together, Ecotrust advances social equity, environmental well-being, and economic opportunity for all. Since 1991, we have partnered with local communities from California to Alaska to build new ways of living and doing business. From forestry to finance, food access to green building, we bring bold ideas into action. Our goal is to foster a more natural model of development that builds resilience among people and the places they live.

Acknowledgements
Conducting research in coastal communities is as challenging as it is rewarding. We have learned a tremendous amount from the commercial fishermen who provided guidance and feedback during this study as well as the countless other community members, state agency staff, and observers of this project. We are deeply thankful to the commercial and CPFV fishermen who participated in this project and for making time in their busy schedules, overcoming sometimes considerable reservations, and sharing their knowledge and experience with us. We are also grateful for the volunteer work of Mr. Terry Tillman, retired CDFW analyst, who shared his deep knowledge of CDFW databases with the project team. We thank Debbie Aseltine-Neilson at CDFW for providing us with data for this report.

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EXECUTIVE SUMMARY

INTRODUCTION AND METHODS:

In this report we provide a summary of the methods and major findings from a fisheries study conducted by researchers at Humboldt State University and Ecotrust. This three-year study provides baseline and initial change findings regarding commercial fishing and commercial passenger fishing vessel (CPFV) activity, and participant perceptions, in the North Coast region of California. California's North Coast region includes the coastal area from the Oregon/California border southward to Alder Creek near Point Arena.

The primary goals of this project were to inform long-term marine protected area (MPA) monitoring efforts by gathering up-to-date socioeconomic information to illustrate historical trends, establishing an initial post-MPA baseline, and assessing initial changes since MPA implementation (December 19, 2012) for the commercial fishing and CPFV fleet in the North Coast region of California.

This study is a part of the larger MPA monitoring effort, entitled the *MPA Baseline Program*, which was tasked with characterizing the ecological and socioeconomic conditions and changes within the North Coast region since MPA implementation. This study addresses the Baseline Program's objective of establishing a benchmark of human use patterns and economic conditions against which future MPA effects and benefits can be measured.

We would like to emphasize that the purpose of this report is not to measure or assess the impact of MPAs on human uses in the study region. To quantitatively measure the impact of MPAs requires robust long term data sets in both pre- and post MPA periods that enable analyses to account or control for the complex interplay of regulatory, environmental, and socioeconomic factors that drive change in human use patterns. Such a study was beyond the scope of this project, but the information we collected can be used to help better understand the complex system of coastal and ocean human uses and inform future research efforts to measure and quantify the impact of MPAs.

As part of the baseline MPA monitoring effort, this report provides three sets of primary findings:

1. A baseline characterization of spatial fishing patterns and socioeconomic status of commercial and CPFV fishermen in the North Coast region;
2. An assessment of initial spatial and socioeconomic changes following MPA implementation, including quantitative information about fishermen's perceptions of marine management activities in the region;
3. Qualitative data about the socioeconomic context of North Coast fishing communities and the impacts of MPAs gathered from focus group meetings held in key North Coast regional fishing ports.

To generate these findings, our research team conducted extensive outreach and engagement with the fishing occupational community in the region. The team formed a Fisherman Advisory Council (FAC) comprised of eight representatives from all the major regional ports and fisheries targeted in the study. The FAC provided input in the study design, assisted with recruiting participants for the study, and provided insights on findings from the study. In the summer of 2014 the team conducted in-person interviews with 163 commercial fishermen and 15 CPFV operators to gather post-MPA baseline socioeconomic data and spatial fishing data for the year 2013.

The team also convened five focus groups with 4-10 participants in each of the major fishing ports of the region, together comprising 30 (commercial and CPFV) fishermen. Additionally, we summarized commercial fishing landings data from 1992 to 2014 obtained from the California Department of Fish and Wildlife (CDFW) to explore historical economic trends and initial changes in North Coast commercial fisheries. We also summarized CPFV logbook data from CDFW for the period 1992 through 2014.

Thus, this report provides information drawn from both primary sources (interviews and focus groups) and secondary sources (CDFW). Survey and focus group results are influenced by who chooses to participate. Survey response rates were generally a bit higher for fishermen from higher ex-vessel income categories, meaning that responses are somewhat more heavily weighted towards the most active and successful participants. While it is very difficult to infer motivation for participation in a survey, one would expect participation to be higher among fishermen with strong opinions (either positive or negative) that they sought to share with researchers. As a final note, neither the primary nor the secondary data includes information on fishery participant's ethnicity, race, or socioeconomic status. The lack of such information can lead to unintended under-participation by very low income people, or people with less proficiency with English (though our field team was multi-lingual). Gathering such information should be a priority for future research.

COMMERCIAL FISHING

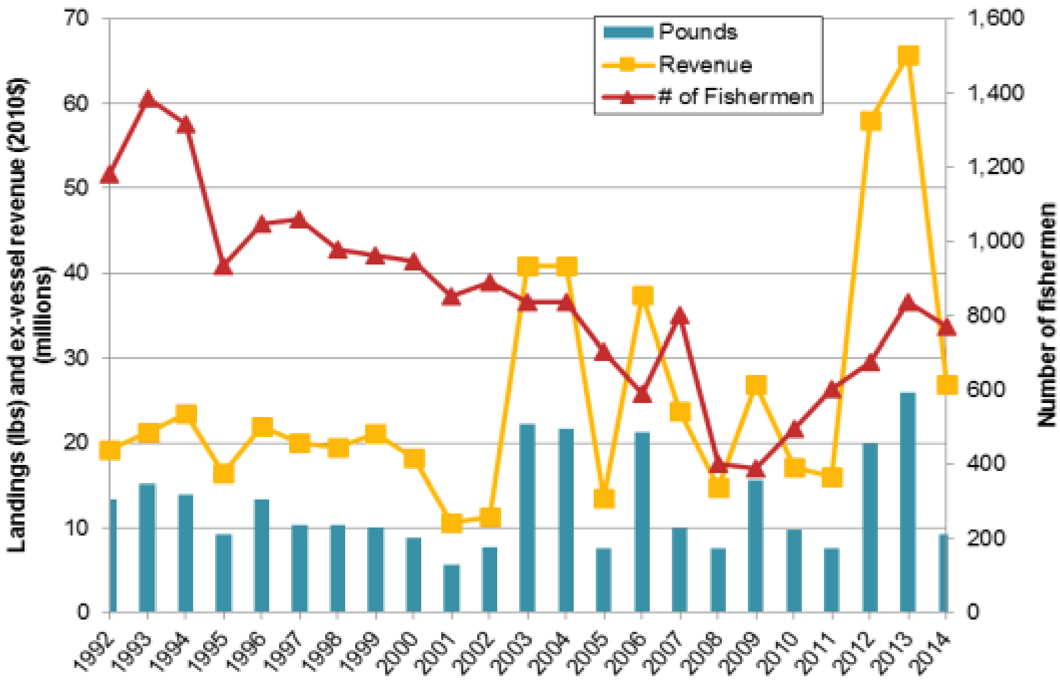
The cold, nutrient-rich waters of the North Coast region of California provide habitat for a variety of fish species common to the Northeastern Pacific coastal region. Fisheries exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood.

Commercial Fishing Key Findings

Baseline Conditions

- Baseline survey data were gathered for 2013, a year in which overall ex-vessel revenues were at peak levels relative to recent years, primarily due to the Dungeness crab fishery. The timing of this project was exogenously determined and was not selected for such a year. It is important to note that economic outcomes for fishermen in 2013 may result in a distorted understanding of fishery socioeconomic conditions, which is why we include CDFW data going back to 1992 for comparison purposes. While fishermen are accustomed to the vicissitudes of their livelihood, nonetheless, fisherman attitudes and perceptions must be viewed in appropriate context.
- From Figure ES 1 one can see that the overall number of commercial fishermen targeting fisheries of interest on the North Coast of California declined from a high of approximately 1,400 in 1993 to approximately 400 in 2009, with modest recovery to just over 800 in 2013.
- Overall pounds of fish landed in targeted fisheries of interest to this study fluctuated from year to year with a modest upward trend, while ex-vessel fishing revenue (in constant 2010 dollars) in targeted fisheries of interest fluctuated with a general increasing trend. These revenues experienced a sharp upward spike to over $60 million in 2013, followed the next year by a sharp decline to under $30 million in 2014.

Figure ES 1. North Coast region commercial landings, ex-vessel revenue, and number of fishermen, fisheries of interest, 1992–2014



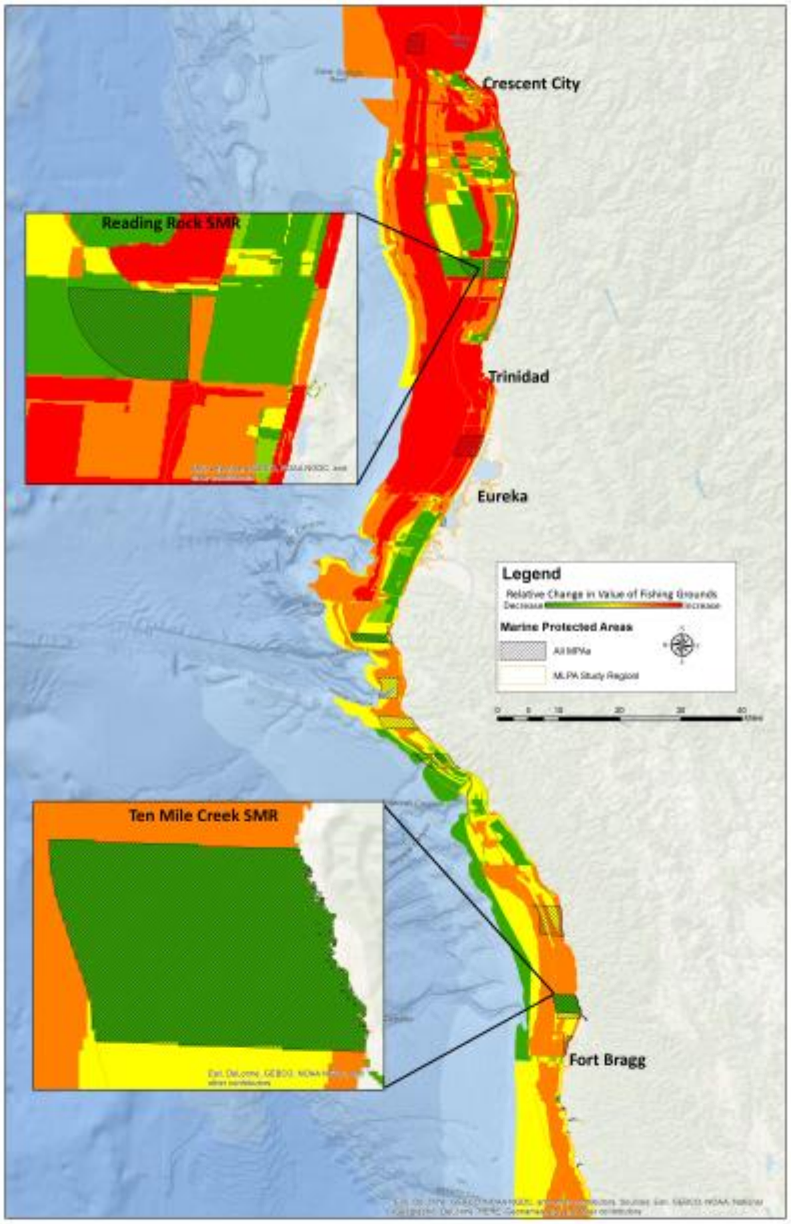
- In terms of the commercial fisheries focused on in this study, Dungeness crab was the dominant fishery in terms of both pounds landed and ex-vessel revenue.
- Crescent City and Eureka area ports together accounted for approximately 70% to 80% of all pounds of fish landed in the North Coast region since the early 1990s, and a slightly lower percentage of ex-vessel revenue. Dungeness crab dominates landings and ex-vessel revenue in Crescent City, Trinidad, and Eureka. Urchin, salmon, and Dungeness crab dominate landings and ex-vessel value in Fort Bragg.
- In terms of smaller ports, Dungeness crab and salmon dominate commercial landings in Shelter Cove, while urchin dominates commercial landings in Albion.
- On average, survey respondents received nearly 88% of their 2013 income from commercial fishing, and used on average 57.4% of that income to pay operating costs.

Initial Changes Following MPA Formation

- As this is primarily a baseline study, determining whether durable, long-term changes have occurred in the pattern of fishing activity following MPA formation, including the spatial distribution of effort and targeted fishery, is largely beyond the scope of this report. Fishing activity is influenced by a multitude of non-MPA factors including ocean conditions, patterns of abundance, and market conditions. The limited post-MPA data available for this report provides insight into initial changes, but precludes definitive analysis of the influence of MPAs on fishing activity.

- In response to whether MPAs had affected their fishing, a total of 73% of commercial fishermen respondents stated that MPAs had directly affected their fishing, ranging from a high of 88% for urchin divers, to a low of 47% for Dungeness crab fishermen.
- Of those reporting MPAs affected their fishing, the most frequently cited effect was *cannot fish in (or go to) traditional grounds/areas* (65%). Other common effects mentioned were *crowding in areas not restricted by MPAs*; *diminishing economic opportunities in fishing*; and *poor communication of the locations of MPAs, leading to ticketing and heavy fines*.
- Only 10% of commercial fishermen indicated that MPAs caused them to move homeport location or fish out of another port.
- Dungeness crab is the dominant fishery in the North Coast region, and of the 28 individual North Coast MPA sites, Reading Rock SMR and Ten Mile SMR were most frequently cited by those targeting Dungeness crab as having affected their commercial fishing activity in 2013 (see Map ES 1).
- Salmon trollers also cited Ten Mile SMR as having affected their commercial fishing activity in 2013, along with Ten Mile Beach SMCA.
- The research team conducted a longitudinal event study of 37 urchin divers before and after MPA formation, designed to investigate changes to income, fishery dependence, and port utilization associated with MPA formation. No evidence was found for significantly lower post-MPA fishing revenue, for changes in the level of dependence on the urchin fishery, or for changes in spatial dependence on the key urchin ports of Fort Bragg and Albion.
- Commercial fishermen were also asked about the importance of participation in multiple targeted fisheries as a way to cope with MPA formation. All told, 88% of respondents indicating that participation in multiple fisheries was either very important or important. Respondents indicated that a multi-fishery participation strategy stabilized year-to-year fishing income, allowed for better capital utilization, and increased fishing income.
- Marketing channel usage reported by commercial fishermen were traditional fish processors (40%), direct sales of various kinds (23%), sales to live fish buyers (15%), sales to fish cooperatives (2%), and sales to farmer's market or street fairs (1%).
- In terms of initial changes following MPA formation on the North Coast, there was no clear pattern of recent changes in fishing income (nearly 66% reported no change, with other responses almost equally reporting increases or decreases).
- There was also no clear overall pattern in terms of perceived fishing success in 2013 relative to the last ten years, though salmon trollers and urchin divers generally reported better recent success than most other fisheries due to recent closed seasons (salmon) and urchin quality reduction and die off due to El Niño and kelp reduction.

Map ES 1. Reported displacement of Dungeness crab commercial fishing effort inside Ten Mile SMR and Reading Rock SMR



COMMERICAL PASSNEGER FISHING VESSEL (CPFV) OPERATORS

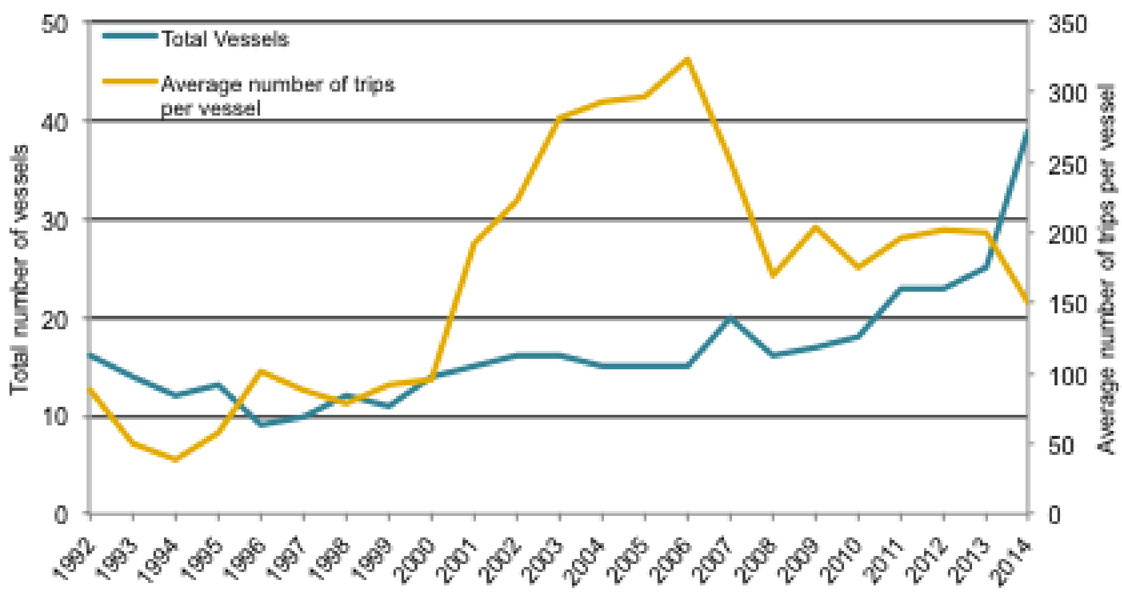
Commercial Passenger Fishing Vessels (CPFV) represent a relatively modest amount of fishing activity in the North Coast region, with recent evidence of growth. These vessels make a business of taking members of the public to recreationally fish, and for many people without fishing boats this is the only way to experience fishing on the open ocean. As CPFV is an emerging industry that provides clients with an enhanced understanding of the importance of the North Coast region's marine resources, this report included CPFV activity in its findings. As with the team's commercial fishing research, the focus was on providing a baseline characterization of CPFV fishermen in the North Coast region; assessing initial changes following MPA implementation; and describing qualitative insights into perceptions of how the North Coast region's MPA network affects CPFV fishing activity.

CPFV Key Findings

Baseline Conditions

- As shown in Figure ES 2, there has been an increasing number of CPFV operators in the North Coast region since the early 1990s, rising from 9 in the late 1990s to 39 in 2014.
- There was a corresponding increase in total annual North Coast region CPFV trips in that time period (from fewer than 1,000 to nearly 6,000), though the average number of trips per vessel has declined since approximately 2006.

Figure ES 2. Total number of CPFV vessels and average number of trips per vessel, North Coast region, 1992-2014



- North Coast CPFV operators generally target rockfish, lingcod, and salmon, while rockfish, Dungeness crab, and salmon dominate their catch.
- CPFV activity in Eureka area ports has risen sharply since approximately 2006, and likewise in Trinidad since 2000. In contrast, CPFV activity in Fort Bragg peaked in the mid-2000s, declined along with salmon fishing opportunities at the time, but has recovered to roughly 1990s levels since 2010.
- CPFV operators on average are younger (44) and have less fishing experience (9.5) than commercial fishermen.
- CPFV operators received on average $84,300 in gross annual economic revenue, or an average annual net revenue after expenses of $31,191 in 2013. CPFV operators took on average 110 fishing trips and nearly 16 non-consumptive (mostly whale-watching or sunset cruise) trips in 2013, charging on average $130 per passenger per fishing trip and $83 per non-consumptive trip.

Initial Changes Following MPA Formation

- In terms of MPA influence on CPFV operations on the North Coast, nearly 79% of respondents indicated that MPA formation affected their participation in the rockfish/lingcod fishery. This perhaps not surprising, as MPAs tended to be located in rocky reef areas that serve as habitat for rockfish and lingcod.
- In terms of CPFV operators targeting rockfish/lingcod, 79% indicated they could no longer fish in traditional grounds, and nearly 43% indicated they had to travel longer distances to fish.
- No more than about 27% of CPFV respondents indicated that MPAs affected their fishing in other targeted fisheries.
- CPFV respondents generally did not report changes to their annual operating income between 2009 and 2013 (before and after MPA formation), with the exception of those seeking tuna and Dorado (the grounds for which generally do not overlap state MPAs).
- CPFV respondents generally reported either significantly/somewhat higher or no change to the number of trips taken between 2009 and 2013.

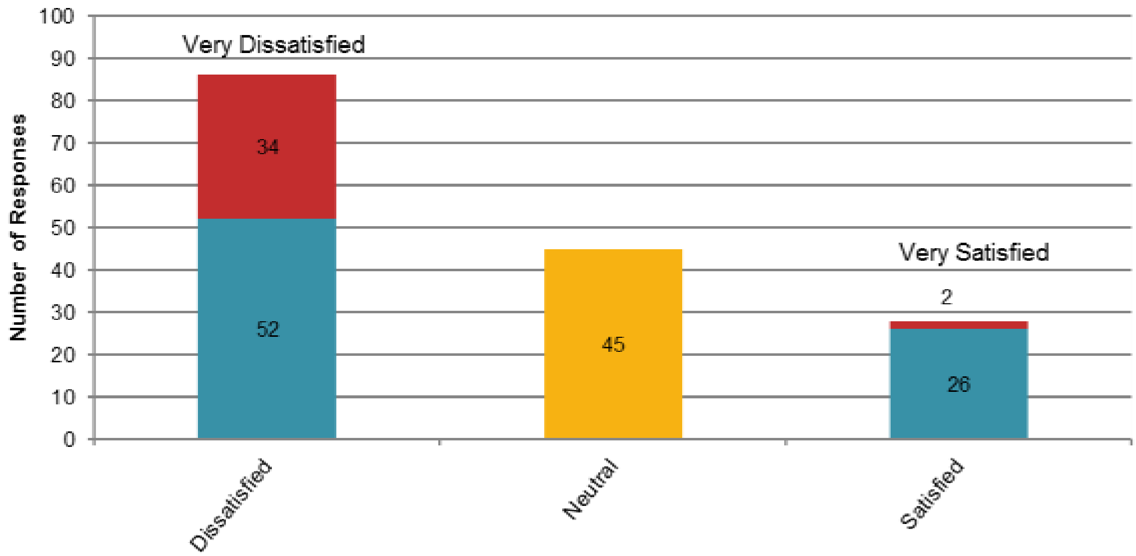
PERCEPTIONS OF ECOLOGY AND MANAGEMENT (COMMERCIAL AND CPFV PARTICIPANTS)

In addition to gathering baseline socioeconomic data about the commercial and CPFV fisheries of the North Coast, our team collected data about commercial and CPFV fishermen's perceptions of the ecology and management of the North Coast marine environment. The survey included questions about perceptions of the MPA network and planning process, attitudes toward management entities, and perceptions of the local marine environment. Results combine responses from commercial and CPFV respondents.

<u>Findings</u>

- When asked about their overall satisfaction with the North Coast MPA planning process, about three times as many respondents were dissatisfied than satisfied, as shown in Figure ES 3. Over 95% of respondents perceived some level of conflict in the MPA planning process, with the reported conflict ranging from minor to very serious.
- In contrast, when asked about their overall satisfaction with inclusion of local input in the North Coast MPA planning process, similar numbers expressed dissatisfaction and satisfaction, with approximately 30% of respondents indicating they felt neutral. A similar pattern emerged when respondents were asked about their satisfaction with the location of MPAs in the region, though more respondents indicated they were very dissatisfied with the locations than indicated they were very satisfied with the locations.

Figure ES 3. Respondent satisfaction with the overall MPA planning process for the North Coast MPA network



- Respondents overwhelmingly disagreed with the statement that North Coast MPAs would improve ocean health or improve their net income, and they overwhelmingly agreed that there was enough ocean protection before MPAs were put into place.
- Respondents targeting Dungeness crab, salmon, and urchin were mostly neutral on MPA effects on abundance. Nearly a third of respondents targeting nearshore finfish thought MPAs would increase that species group's abundance, while over 40% of urchin divers thought MPAs would reduce urchin abundance.
- Respondents generally indicated low levels of trust in organizations such as the Ocean Protection Council, the Marine Life Protection Act Initiative, and the CDFW, and slightly higher than neutral levels of trust in university researchers and other North Coast fishermen.
- Over 70% of respondents indicated moderate to strong access to regulatory information, with most of that information coming from word of mouth, CDFW, internet sources, and fisherman's organizations.
- Modest numbers of respondents saw some anthropogenic threats to targeted fish species due to water pollution, land-based development (primarily salmon trollers, also including water diversions and habitat), ocean acidification (primarily urchin divers), and poor resource management.

FISHING OCCUPATIONAL COMMUNITY FOCUS GROUPS (COMMERCIAL AND CPFV PARTICIPANTS)

The research team conducted five focus group conversations with commercial and CPFV participants from each of the major ports in the region. The conversations were semi-structured allowing for fishermen to express their knowledge and attitudes about MPAs and marine processes. Topics of discussion included: the historical context of the fishing ports prior to the implementation of MPAs, perceptions of MPAs and the planning process, knowledge of the local marine environment, and hopes for the future of their fishing ports.

- Focus group participants highlighted the importance of understanding the historical context of their ports and fishing communities leading into the implementation of the California North Coast Marine Protected Area Network in 2012.
- Focus group participants expressed a belief that increased regulations have restricted their access to key fisheries, their ability to make a living fishing, and the ability of new and young people to enter into commercial or CPFV fishing careers.
- Focus group participants described how they have witnessed a sharp decline in the number of active fishermen and vessels operating out of their ports over the course of their fishing careers. Along with this decline, focus group participants also reported declines in quality or availability of key port infrastructure to support commercial fisheries in the North Coast ports.
- Focus group participants described overall declines in the number of fish buyers and fish processors connected to their ports. Some reported that only one or two main fish processors remain in their ports, reducing competition and strengthening the ability of fish buyers to dictate price and other aspects of fish sales.
- Focus group participants expressed relief that adverse economic and other effects from the MPA network were not be as bad or extensive as they could have been, due to active commercial and CPFV fisherman involvement in the MPA planning process. However, many expressed a belief that the MPA planning process did not genuinely include fishermen's views and perspectives.
- Participants indicated that some of the original proposals for MPA locations would have had profound effects on their livelihoods and that additional MPAs in new locations could have adverse socioeconomic effects.

CONCLUSION

Ocean fishing is an iconic activity in the North Coast region of California, with deep roots across generations of fishermen and fishery-dependent communities. There is a declining number of commercial fishermen working the waters of the North Coast region, and the average age is rising. Historically important fisheries such as salmon and groundfish have diminished, placing greater importance on Dungeness crab as a mainstay for commercial fishing. In contrast, CPFV operations are growing in number and importance in the region.

Our findings indicate a general perception of modest effects from MPA formation, due in part to fishermen engagement with the MPA process. Participants report displacement of commercial fishing primarily for a few MPAs (Ten Mile SMR, Ten Mile Beach SMCA, Reading Rock SMR, and Pyramid Point SMCA). CPFV operators participating in this study indicate displacement from some favorable fishing grounds for rockfish due to MPA formation. Focus group participants indicate concern about the cumulative effects of regulations on fishing opportunities, and about opportunities for young people. Declining numbers of vessels and fishermen is seen as having an adverse effect on port infrastructure, markets, and the overall vitality of the industry.

It is our hope that the data collected and lessons learned through this project will provide a socioeconomic and spatial baseline of human use patterns that can help guide future MPA monitoring efforts. We also hope that these data can be used to build a time series data set on how human uses and the socioeconomic health of fishermen and coastal communities are changing over time. This type of robust longitudinal dataset that provides both socioeconomic characterization and spatial patterns on human uses would provide much needed information to a wide array of marine planning and management applications and help inform socially and economically responsible management measures.

1. INTRODUCTION

The coastal ocean waters of California's North Coast, the region from the Oregon/California border southward to Alder Creek near Point Arena (Map 1), have served as a rich and complex resource supporting human settlements for thousands of years. As Pomeroy et al. (2011) note, "since long before white settlement, the natural resources of the North Coast have been a critical source of sustenance and cultural significance to local Indian tribes (pg 2)." Gold, soon followed by redwood timber resources, served as the economic foundation for Euro-American settlement of the region in the 1850s.

The North Coast's commercial salmon gillnet fishery developed in the mid- to late 1800s, feeding large cannery operations on many regional rivers. Following a fishery collapse and shutdown of most canneries, a salmon troll fishery established itself in the region by 1916 (Boydstun et al., 2008). A groundfish trawl fishery out of Fort Bragg/Noyo is documented from as early as the 1920s (Pomeroy et al, 2011).

The North Coast region's Dungeness crab fishery took shape as World War II was ending and traps were replacing hoop net gear (Hankin and Warner, 2001). Beginning in the late 1960s the North Coast region's economy began shifting away from resource dependence, and today a diverse services-based economy is the dominant source of jobs in the region (Hackett, 1999). With all these changes, marine capture fisheries continue to play a role in supporting port communities in the North Coast region into the 21st century.

On December 19, 2012, as part of the Marine Life Protection Act (MLPA) Initiative, the California Fish and Wildlife Commission (CFWC) designated 20 marine protected areas (MPAs) within the North Coast state waters of California. This study is a part of the baseline marine protected area monitoring effort to characterize the ecological and socioeconomic conditions and changes within the North Coast region since MPA implementation. MPAs have the potential to affect a wide variety of consumptive and non-consumptive activities.

It is beyond the scope of this project to assess the socioeconomic dimensions of all these use types. After a detailed scoping discussion (outlined in section 3.2) project proponents decided to focus the assessment on two uses with a great likelihood to experience impacts from MPA formation: commercial and charter or commercial passenger fishing vessel (CPFV) fishing.

As part of the baseline marine protected area monitoring effort, this report provides three sets of primary findings:

- A baseline characterization of spatial fishing patterns and socioeconomic status of commercial and CPFV fishermen[1] in the North Coast region;
- An assessment of initial spatial and socioeconomic changes following MPA implementation, including quantitative information about fishermen's perceptions of marine management activities in the region;
- Qualitative data about the socioeconomic context of North Coast fishing communities and the impacts of MPAs gathered from focus group meetings held in key North Coast regional fishing ports.

[1] The term 'fishermen' is used to denote people who fish. In the California fishing occupational community this is the preferred term regardless of gender.

Our baseline characterization of the North Coast region's commercial fishing and CPFV fleet provides a foundation for understanding the current socioeconomic status of North Coast fishing communities. Our baseline characterization provides a benchmark of socioeconomic conditions and spatial fishing patterns against which future MPA effects can be measured. While the North Coast MPA network has only been in place since 2012, we also provide an assessment of initial spatial and socioeconomic changes following their implementation.

Assessing historical trends along with initial changes in socioeconomic conditions, spatial fishing patterns, and participants' perceptions of management and ocean ecology that followed MPA implementation will help inform how MPAs along with other factors influence observed changes. Gathering input from commercial fishery participants on their perceptions of fishery conditions and the efficacy of regulation integrates local working knowledge and engages stakeholders in the process of gauging socioeconomic conditions relating to MPA implementation.

The results from this project will support a 5-year management review of the North Coast region's MPA network. In this review the California Department of Fish and Wildlife (CDFW) will make management recommendations to the California Fish and Wildlife Commission based on findings from the baseline MPA monitoring projects and other sources of information. This project was developed in close coordination with the MPA Monitoring Enterprise (Monitoring Enterprise), a program of the California Ocean Science Trust, in partnership the California Department of Fish and Wildlife. Support was provided by the California Sea Grant College Program and the California Ocean Protection Council (OPC).

The primary goal of this project was to inform long-term MPA monitoring efforts by gathering up-to-date socioeconomic information to illustrate historical trends, establish a post MPA baseline, and assess initial changes since MPA implementation for the commercial fishing and CPFV fleet in the North Coast region of California. More broadly, the results from this project will inform future management actions by providing data and analysis for stakeholders and resource managers alike. To accomplish this goal our research team conducted extensive outreach to the fishing occupational community in the region, including forming a Fisherman Advisory Council (FAC), and developed and deployed an interactive, web browser-based interview and mapping instrument that was customized to the North Coast region and project objectives.

Commercial fishermen and CPFV operators were interviewed by field staff using a computer-based survey tool that included a process of assessing the relative spatial importance of various fishing grounds. The survey instrument was set up for field staff on laptop computers to collect geo-referenced information from fishermen about the extent and relative importance of California North Coast marine waters and related economic data. Data collection occurred during the summer and fall months of 2014.

The data were then compiled in aggregate form into spatial datasets (e.g., raster data layers, kernel density layers, pdf maps), and various .csv files and delivered to the California Sea Grant College Program and MPA Monitoring Enterprise. We would like to emphasize that no individual survey participant's information is reported, and that only data in the aggregated form (requiring three or more fishermen in each data point) is reported. In addition to the structured interviews, field staff also held a series of focus-group meetings in various North Coast fishing communities. This report details the approach and methods we used to collect, analyze, verify, and interpret the various data sets utilized in this project.

The main body of this report consists of two main sections – a region-wide profile of commercial and CPFV fishing, and individual port-level fishing occupational community profiles, each of which address commercial fishing and CPFV activity. To help better facilitate the use of the data presented in this report in accordance with the Monitoring Enterprises' monitoring framework, each subsection is further broken out into the MPA monitoring framework components of 'baseline characterization' and 'initial changes'.

Furthermore, specific spatial baseline and spatial change sections are provided in this report to organize all the information about spatial data into specific sections rather than distributing them throughout the report. These sections detail the spatial data sets and map products developed as part of this project and that are available for dissemination. To better organize and present all the map products we have created a separate Map Appendix to complement this technical report.

We would like to emphasize that the purpose of this report is not to measure or assess the formal economic impact of MPAs on commercial and CPFV fishery participants and the region as a whole. Measuring the economic impact of MPAs would require robust long term economic data sets in both pre and post MPA periods to support analyses of causal relationships that account for other changing regulatory, environmental, and economic factors driving economic change in regional fishing activity.

Such an impact assessment would also require updating the COFHE California commercial fishery economic impact assessment models (Hackett et al., 2009), and would require a longer period of post-MPA data gathering than was available for this project, and thus was beyond the scope of this project. The information we have collected can be used to help better understand baseline fishing conditions and initial changes that are associated with MPA formation in the North Coast region of California.

2. ONLINE DATA PORTAL

A large amount of commercial and commercial passenger fishing vessel (CPFV) data are collected and compiled as part of the California MPA Baseline monitoring program. However, presenting this data in a paper-based and static format limits its accessibility and usability. As an alternative the project team has developed an online data explorer to allow users to more easily access and dynamically explore California state fisheries data.

This interactive Fisheries Data Explorer can be found at http://oceanspaces.org/fisheries-data-viewer and allows you to visualize data from commercial fisheries and commercial passenger fishing vessels, across the State. Using data collected and managed by the California Department of Fish and Wildlife (CDFW), the Explorer lets you dynamically view summarized data from the commercial fishing sector on the number of fishermen, pounds of fish landed, and revenue from fish landed. The Explorer also lets you view commercial passenger fishing vessel data such as the number of anglers, vessels, trips and fish caught from specific fisheries and ports.

The Explorer only displays data for fisheries in state waters (three nautical miles from shore). The data presented in the Explorer are summarized and aggregated to ensure confidentiality. No personal information is displayed. Areas where data are missing is due to confidentiality protocols where data points with fewer than three fishermen/operators cannot be publicly displayed.

The project team worked closely with the California Ocean Science Trust and the California Department of Fish and Wildlife to design and develop this online data explorer.

3. SURVEY AND ANALYSIS METHODS

3.1. Fisherman Advisory Council

Cooperation and collaboration with fishermen from the North Coast region was central for the successful completion of this research project. To facilitate this collaboration, the team formed a Fisherman Advisory Council (FAC) made up of eight representatives from all the major regional ports and fisheries targeted in the study. The FAC served three important functions throughout the project.

First, the FAC gave fishermen an opportunity to provide input on research design so that the research findings could be useful to them – as well as to scientists, managers, and the public. Second, the members of the FAC were able to assist us with outreach in the region's fishing communities, particularly when our field staff was looking to recruit participants for the survey and the focus groups. Finally, FAC data review helped ensure that the study results most accurately reflected the socioeconomic conditions of the fisheries in the region.

We selected members of the FAC based on their experience working on management processes, their interest and willingness to be involved, and with a goal to capture a variety of fisheries, sizes of operation, and home ports (Table 1). Over the course of the three year project we hosted four different meetings of the FAC. Meeting dates and topics are included in Table 2

Table 1. FAC Representatives

Name:	**Home Port (s):**	**Nearshore Fisheries:**
Dan Platt	Fort Bragg	Commercial salmon and nearshore finfish
Tom Trumper	Fort Bragg	Commercial urchin
Kevin Riley	Shelter Cove	Charter and commercial crab and salmon
Tim Klaussen	Eureka	Charter
Aaron Newman	Eureka	Commercial crab and salmon
John Collins	Eureka/Trinidad	Charter and commercial crab and salmon
Craig Goucher	Trinidad	Commercial crab
Rob Wakefield	Crescent City	Commercial crab

Table 2. FAC Meeting Dates and Purposes

Date:	**Meeting Purpose/Activity:**
4/28/14	- Gain feedback on overall research approach - Gain feedback on draft survey instrument - Seek support and advice for recruiting study participants
8/12/15	- Present initial/draft results of the survey and focus groups - Gain feedback and insights into survey and focus group results - Gain feedback on draft heat maps delineating fishing grounds
8/1/16	- Present results of economic analysis of CDF&W landings data - Seek insights into key patterns and trends
11/20/16	- Present draft final results

(individual)	- Gain feedback on the report contents and findings

3.2. Fisheries and Ports of Interests

MPAs have the potential to affect a wide variety of consumptive and non-consumptive activities. Depending on location these activities could potentially include commercial or recreational fishing, pleasure boating, shipping, naval traffic, aquaculture, American Indian cultural or consumptive uses, discharges from dredging or other activities, energy generation, or scientific research.

Characterizing the universe of activities that could be affected by MPAs is beyond the scope of all but the most ambitious and intensive projects. Accordingly, one of our first tasks was to narrow our focus to a regionally relevant subset of these activities that is most important in terms of scale, and most likely to be affected by MPA formation.

The project was motivated by the need to inform a 5-year management review of the North Coast MPAs, and to do so in a cost- and time-effective manner. The task of identifying the scope of research was undertaken in collaboration with the California Department of Fish and Wildlife, the MPA Monitoring Enterprise, and the North Coast fishing occupational community. It was determined that a separate study would be undertaken to analyze MPA effects on American Indian cultural and consumptive uses.

In the context of the MPA network in the North Coast region of California, it was determined that coastal marine capture fisheries would be the appropriate focus of our effort. User groups of interest would be commercial fishermen and recreational anglers guided by operators of commercial passenger fishing vessels (CPFVs).

The following is the list of key commercial fisheries targeted for this project. Formation of this list was guided by a goal of focusing on coastal marine capture fisheries most likely to be affected by MPA formation. The final fisheries list was developed in collaboration with the California Department of Fish and Wildlife, the MPA Monitoring Enterprise, and the North Coast fishing occupational community to define when applicable the species groupings that compose a fishery. The fisheries of interest for this project are:

1. Dungeness crab–trap (*Cancer magister*)
2. Nearshore finfish–fixed gear
    a. Nearshore finfish–dead–hook & line
    b. Nearshore finfish–dead–longline
    c. Nearshore finfish–live–hook & line
    d. Nearshore finfish–live–longline
    e. Nearshore finfish–live–trap
3. Salmon–troll (*Oncorhynchus tshawytscha*)
4. Urchin–dive (*Strongylocentrotus franciscanus*)

The nearshore finfish fishery is a state fishery grouping managed through the California Nearshore Fishery Management Plan which consists of the following 19 species: Rockfish, gopher (*Sebastes carnatus*); Rockfish, black (*S. melanops*); Rockfish, black-and-yellow (*S. chrysomelas*); Rockfish, blue (*S. mystinus*); Rockfish, kelp (*S. atrovirens*); Rockfish, copper (*S. caurinus*); Rockfish, grass (*S. rastrelliger*); Rockfish, brown (*S. auriculatus*); Rockfish, quillback (*S. maliger*); Rockfish, china (*S. nebulosus*); Rockfish, calico (*S. dallii*); Treefish (*S. serriceps*); Rockfish, olive (*S. serranoides*); Cabezon (*Scorpaenichthys marmoratus*); California sheephead

(*Semicossyphus pulcher*); California scorpionfish (*Scorpaena guttata*); Kelp greenling (*Hexagrammos decagrammus*); Rock greenling (*Hexagrammos lagocephalus*); and Monkeyface prickleback (*Cebidichthys violaceus*).

Based on California Department of Fish and Wildlife landings data, the commercial fishing ports of interest for this project are defined as (Map1):

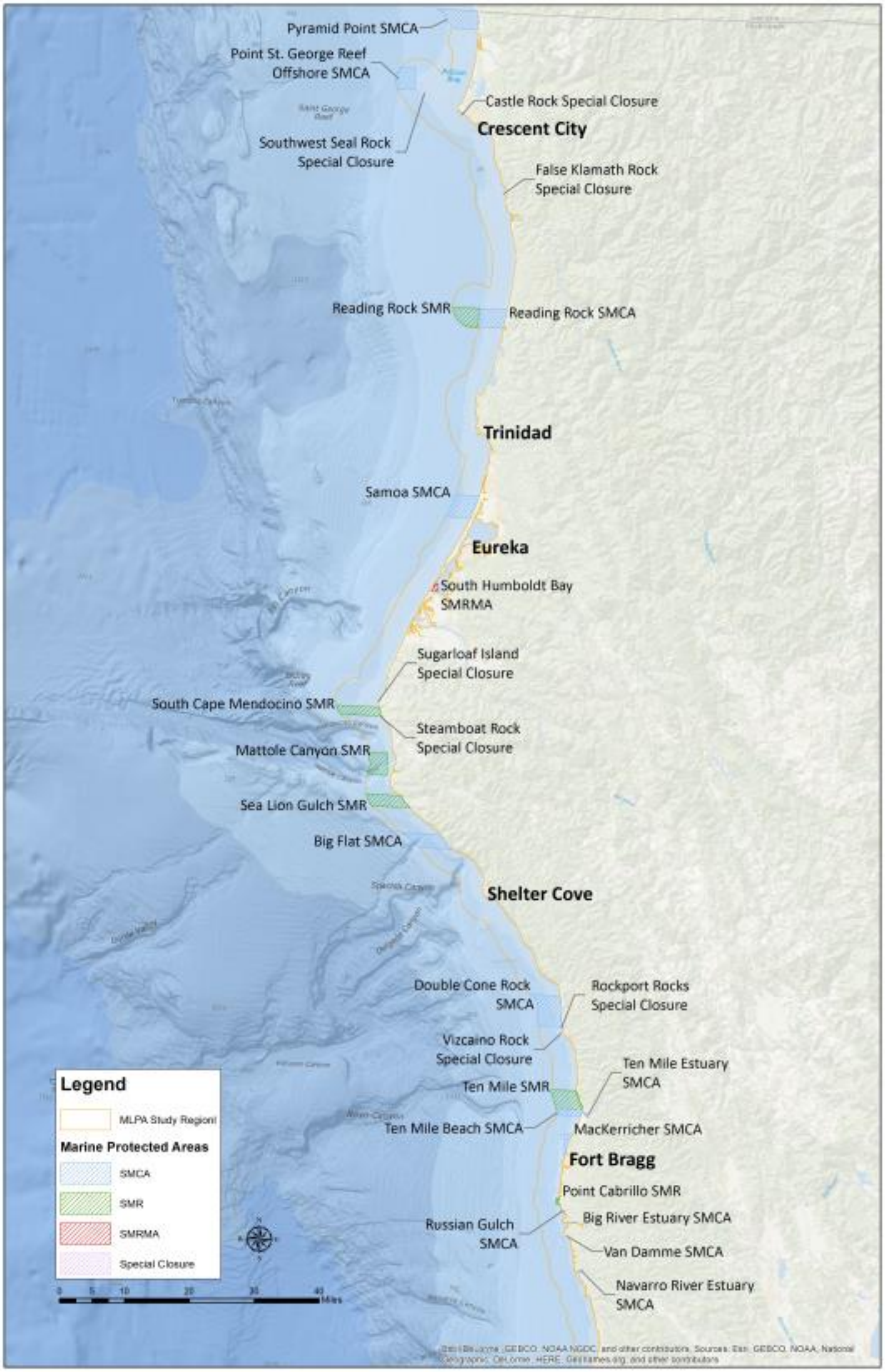
1. Crescent City
2. Trinidad
3. Eureka
4. Shelter Cove
5. Fort Bragg
6. Albion

To simplify how data are presented, we grouped smaller minor ports with major ports along the California North Coast. Please see Table 3 below for a listing of how smaller ports were grouped with our ports of interest.

Table 3. List of port groupings

<table>
<tr><th>Individual Port</th><th>Port Group</th></tr>
<tr><td>Albion</td><td>Albion</td></tr>
<tr><td>Crescent City</td><td rowspan="2">Crescent City Area Ports</td></tr>
<tr><td>Klamath</td></tr>
<tr><td>Orick</td><td rowspan="6">Eureka Area Ports</td></tr>
<tr><td>Arcata</td></tr>
<tr><td>Fields Landing</td></tr>
<tr><td>Humboldt Bay</td></tr>
<tr><td>Eureka</td></tr>
<tr><td>King Salmon</td></tr>
<tr><td>Elk</td><td rowspan="4">Fort Bragg Area Ports</td></tr>
<tr><td>Fort Bragg</td></tr>
<tr><td>Little River</td></tr>
<tr><td>Westport</td></tr>
<tr><td>Shelter Cove</td><td>Shelter Cove</td></tr>
<tr><td>Trinidad</td><td>Trinidad</td></tr>
</table>

Map 1. Map of North Coast study region with major ports and MPAs



3.3. CDFW Landings Data Analysis Methods

Under a non-disclosure agreement with the California Department of Fish and Wildlife (CDFW), aggregated data presented in this report on the region's commercial fisheries of interest, and commercial passenger fishing vessel activities, was developed in collaboration with CDFW staff.

Commercial fisheries data were summarized using ex-vessel landings receipt data contained in the CDFW's Commercial Fisheries Information System (CFIS) database. As the CFIS database is continually updated it is important to document the date the CFIS database was queried so that the status of the data sets used are known. All data from 1992 to 2014 were transmitted to project staff in November 2015. Commercial passenger fishing vessel (CPFV) data were summarized using CPFV logbook data. Data from 1992 to 2014 were also transmitted to project staff in November 2015.

All dollar values presented in this report are "real" or inflation-adjusted values, reported in constant 2010 dollars. Upon advice from CDFW data analysis staff, inflation adjustment was carried out using the Implicit Price Deflator for Gross Domestic Product from the U.S. Bureau of Economic Analysis. It is important to note that ex-vessel revenues provide only a partial view of economic conditions in North Coast regional fisheries, as revenues do not account for differences in operating costs, and thus profitability, across fisheries.

Thus an effort is made to show the portion of these revenues that go towards covering direct operating costs. Moreover, ex-vessel revenues do not account for regional economic multiplier effects associated with formal economic impact assessment, which we noted earlier is beyond the scope of this study.

Finally, we present only a subset of the landings data available—following CDFW data confidentiality protocol we used the "rule of 3" and suppressed all landings and logbook data with fewer than 3 fishermen. We strived to summarize the landings and logbook data in the most compelling and visual formats. We have consistently color-coded fisheries throughout the report and presented data in consistently formatted and scaled graphs in order to facilitate quick reference of specific fisheries and comparison across fisheries or ports.

We avoid repetition whenever possible and recognize there are many more ways to query and analyze the data, however, throughout this report we aimed to present the most relevant and informative analyses possible. Recall that the online data viewer is available for those seeking other ways to organize the data.

3.4. Survey Data Collection and Analysis Methods

While California commercial landings receipts are required to include spatial catch location using 10 by 10 nautical mile blocks, Erwin et al. (1997) note that about 75% have errors, including incorrect or missing block information. Due to concerns about the quality of catch block data from landings receipts, this project has developed GIS and survey-based methods to gather more accurate spatial data about the North Coast fisheries.

Our project approach builds on methods developed in previous socioeconomic fisheries studies on the West Coast of the United States (Chen et al. 2012 and 2013; Steinback et al. 2010; Scholz et al. 2004; 2005; 2006a; 2006b; 2008; 2010; 2011a; 2011b). These methods make use of demonstrated novel approaches for collecting, compiling, and analyzing spatial fishing patterns and associated economic information at various geographic resolutions.

The resulting information supports the design and assessment of various marine spatial planning efforts (e.g., marine protected areas and wave energy siting). Moreover, the spatial mapping methods used in this study have been assessed against CDFW commercial fishing logbook data (Wilen and Abbott, 2006). The assessment was designed to validate the methodology of interviewing fishermen to map their commercial fishing grounds and assign value/importance by allocating 100 pennies across their fishing grounds. The spatial fishing patterns of fishermen interviewed were found to have reflected actual behavior (when examining logbook data). Furthermore, in using our sample method, the group of fishermen who were not interviewed but participated in the fishery exhibited similar spatial fishing patterns (when examining logbook data) as those interviewed. The proven methods, successes, and lessons learned in these past projects were directly applied to the methods and tools deployed in this project.

Specifically, the project team's approach involved several steps that are designed to engage the fishing occupational community throughout the project from project/survey design to the development of final products. These steps are generally categorized below:

1. Fishing occupational community outreach/engagement;
2. Survey questions and survey tool design;
3. Data collection;
4. Data analysis;
5. Review and validation of data analysis results; and
6. Final reporting.

The project team conducted a series of outreach meetings with key fishing occupational community members and fishing organizations/associations in the region as a first step in the project. From this we developed our Fisherman Advisory Council to guide project work and review work products. In the following sub-sections, we describe our data collection and analysis methods in detail.

3.4.1. Interview Sampling Method

The project team carried out field work in the summer and fall months of 2014 to collected data on the 2013 post MPA implementation fishing calendar year. To determine a sampling method for the commercial fishing sector, the project team compiled CDFW commercial fishing ex-vessel revenue and landings data and as well as contact data (phone numbers taken from the CDFW permits database). We then organized these data into port-fishery combinations to identify commercial fishermen to interview in each target fishery in each port in the region.

As fishermen may land fish in more than one port, the port specific listing of commercial fishermen was not a mutually exclusive list. Thus we could not conduct a random sample of fishermen at the port level as this would bias the sample towards fishermen who land in multiple ports. Furthermore, implementing any systematic or random sample strategy is difficult as at times fishermen are unwilling to participate in interviews. Our experience is that at times fishermen who make a relatively small amounts of revenue in a fishery are less invested in participating in interviews which in itself creates a sample bias and together essentially results in a convenience sample.

Given the considerations above, project staff set out to contact every commercial fisherman in the landings database in each of our port-fishery lists with the sampling goal of interviewing as many fishermen as possible. For the purpose of this project, the project team defines a commercial fisherman as an individual who has commercial fishery landings data (pounds and ex-vessel revenue) associated with his/her commercial license number (L number).

Given our sample strategy, we sought to investigate how our sample was spread across the various ex-vessel revenue ranges for each fishery. This was important as ideally gathering baseline economic information from the commercial fishing fleet would be representative of the fishing occupational community as a whole, and represent information from fishermen across varying revenue ranges. To investigate how our sampling was distributed across these revenue ranges we stratified each fishery into four revenue strata.

Overall we interviewed 163 commercial fishermen, many of whom participated in multiple fisheries. The data in Table 4 represent all interviews with North Coast regional fishermen who had recorded commercial landings in 2013. The number of commercial fishermen interviewed in each target fishery, compared to the total number of fishermen in the landings database, separated by the four revenue stratification levels, is given in Table 4. We indicated the approximate revenue range when possible for each stratification to demonstrate the multitude of relatively small dollar values that are landed by individuals in each fishery.

This multitude of small landings may be due to several reasons, including fish caught as bycatch in a different fishery but were still landed/sold; fishermen who were trying out a new fishery or new gear type for a fishery and thus had relatively small landings; families of fishermen who fish together and land their catch on various “L” numbers of family members—sometimes just once or twice for an individual; fishermen from outside the region who landed only once or a few times in the region; or fishermen who must land some amount of catch to maintain a permit but do not actively fish the permit as a major income source.

In 2013, the field staff contacted every CPFV operator with landings in 2013 for participation in the study. Overall 15 operators participated in the survey.

Table 4. Number of commercial fishermen interviewed as a percentage of each quartile revenue strata for each fishery, 2013, North Coast region

Fishery	Revenue strata (quartiles)	Number of individuals with 2013 landings	Number of individuals interviewed with 2013 landings	Percentage of individuals in landings strata interviewed	Approximate 2013 Revenue Strata Range (2010$)
Dungeness crab - trap	**Total**	**290**	**123**	**42%**	**$54,320,095**
	1	73	36	49%	$282,600 - $892,200
	2	72	34	47%	$133,400 - $282,500
	3	72	27	38%	$44,700 - $133,300
	4	73	26	36%	$200 - $44,600
Nearshore finfish - hook-line (dead)	**Total**	**19**	**12**	**63%**	**$38,758**
	1	5	5	100%	$2,210 - $16,900
	2	4	2	50%	$210 - $2,200
	3	3	1	33%	$110 - $200
	4	7	4	57%	$0 - $100
Nearshore finfish - hook-line (live)	**Total**	**22**	**14**	**64%**	**$148,642**
	1	6	6	100%	$9,100 - $38,000
	2	5	2	40%	$2,600 - $9,000

	3	4	2	50%	$900 - $2,500
	4	7	4	57%	$100 - $800
Nearshore finfish - longline (dead)	**Total**	**3**	**3**	**100%**	**$491**
	1	1	1	100%	$260 - $310
	2	0	0	0%	$200 - $250
	3	1	1	100%	$110 - $190
	4	1	1	100%	$0 - $100
Nearshore finfish - longline (live)	**Total**	**6**	**3**	**50%**	**$19,273**
	1	2	2	100%	$5,300 - $8,600
	2	1	1	100%	$2,700 - $5,200
	3	1	0	0%	$400 - $2,600
	4	2	0	0%	$60 - $300
Nearshore finfish - trap (live)	**Total**	**8**	**3**	**38%**	**$17,710**
	1	2	1	50%	$2,400 - $10,000
	2	2	1	50%	$500 - $2,300
	3	1	1	100%	$300 - $400
	4	3	0	0%	$30 - $200
Red urchin - dive	**Total**	**39**	**17**	**44%**	**$2,708,634**
	1	10	6	60%	$106,300 - $197,300
	2	9	5	56%	$58,300 - $106,200
	3	10	5	50%	$24,900 - $58,200
	4	10	1	10%	$670 - $24,800
Salmon - troll	**Total**	**326**	**75**	**23%**	**$8,414,423**
	1	81	32	40%	$195,800 - $195,700
	2	82	19	23%	$15,700 - $37,700
	3	81	11	14%	$6,000 - $15,600
	4	82	13	16%	$0 - $5,900

3.4.2. Interview Protocol

Building upon our experience conducting large scale human use data collection projects with fishing communities, the project team has established rigorous field staff training procedures and interview protocols to ensure that:

1. Field staff are able to effectively engage in conversations with fishermen about the goals/objectives of this project and the larger MPA monitoring/assessment effort this project will inform;
2. Sensitive fishermen contact information is kept secure and confidential;
3. Fishermen are properly informed of the research project goals and possible risk and agreements on data use before the fishermen engages in an interview;
4. Fisherman data remains confidential and is securely stored, transmitted, and analyzed;
5. Interviews are conducted professionally and consistently; and
6. High quality data are consistently collected across interviews.

To accomplish this, project team staff trained in human subject research protocols conducted extensive training with field staff on proper research protocols and interview approach and procedures. This training included providing background on the project team's project history with fishing communities, the Marine Life Protection Act planning process, the MPA monitoring program, and possible reservations fisherman may have to participate in interviews in order for field staff to effectively engage in meaningful conversations with fishermen to solicit interviews. Furthermore, field staff were trained in being aware and respectful of the sensitivities of collecting fishing data and were provided with human subjects research protocols to ensure field staff are aware of proper ways of presenting the research goals and risks to fishermen and that proper informed consent is obtained before interviews begin. The research team sought and obtained Humboldt State University Institutional Review Board approval for this project (Protocol # 13-002). Through this process, the team developed consent forms to be presented to and signed by study participants prior to their participation in any aspect of the research.

Furthermore, strict procedures and mechanisms were put in place so that individual fisherman (or CPFV operator/owner) information is kept secure and confidential throughout the project from data collection to transmission, analysis, report development, and subsequent storage of the data. Interviews were conducted under individual non-disclosure consent forms and all data were collected on password protected laptop computers. Furthermore, data collection and analysis protocols were utilized which masks all names and identifying characteristics of an individual's fishing grounds.

Field staff were also fully trained in how to ask survey questions and capture responses in a consistent manner. The field staff coordinator initially conducted fisherman interviews with each field staff member to ensure the quality of interviews and periodically conducted fisherman interviews with field staff throughout the field season to ensure that interview quality was maintained. Furthermore, survey data were checked as it was transmitted to the Point 97 main office and reviewed by Point 97 staff to ensure quality data were being captured consistently across field staff.

3.4.3. Interview Procedure

The data collection methods in this project were designed to complement existing data previously acquired from commercial fishermen in the North Coast region (see Scholz et al. 2009) before the MPA network was established. Interviews in this project were conducted in person using a one-on-one interview format. All interview data were entered directly into a spatially enabled survey tool developed by Point 97 (a company of Ecotrust) powered by its Viewpoint survey platform technology.

Field staff used the survey tool to collect non-spatial survey data (e.g., demographics, basic operating information, descriptive fishing characteristics, effects of MPAs and other factors, and associated qualitative questions) and to map areas representing a participant's fishing grounds. The survey tool's mapping component utilizes NOAA nautical charts, which can be zoomed in and out to reveal more detailed nautical charts, and moved directionally (similar to Google Maps) to allow fishermen to draw fishing areas in their natural sizes (polygons) rather than confining responses to a statistical grid or to political boundaries.

All interviews followed a shared protocol:

1. Interviews begin with an explanation of the project goals/objectives, the types of data collected, how data will be analyzed, possible risks of participating in the interview, and any other project information the fisherman would like to discuss.
2. The fisherman was presented an informed consent form agreement which allows HSU and Ecotrust to utilize interview data, however, the agreement binds Ecotrust to present data only in the aggregate form and to never release individual data or the identities of those interviewed.
3. Non-spatial survey data were collected on questions pertaining to individual fisherman characteristics, overall fishing operations, and perceptions of marine resource management.

4. Non-spatial survey data were collected for each fishery/activity within a commercial fisherman's portfolio.
5. Fishing grounds were mapped following these steps. These steps are repeated to map each fishery separately:
    a. Establish a maximum extent: Using the electronic nautical charts embedded in survey tool, fishermen were asked to identify the maximum extent north, south, east, and west they would target a fishery. This was done to orient the map to the full extent of their fishing area before fishermen were asked to identify/delineate specific fishing grounds.
    b. Map fishing grounds: Within this maximum extent, fishermen were then asked to delineate the area(s) they fish for a particular species/fishery in a given time period. Under the guidance of the fisherman, field staff drew these fishing areas in the survey tool and record associated boundary information for each area such as depth limits and geographic landmarks.
    c. Assign value: Fishermen were then asked to rank these fishing areas using a weighted percentage — in which they split and distribute 100 points or '100 pennies' over the various fishing areas based on their relative importance.

3.4.4. Data Review and Verification

There are several data review and verifications steps applied throughout this project. The following standard quality assurance and quality control (QAQC) steps were conducted:
1. Editing of spatial data by project staff based on notes from interviews and when required to standardize the data (e.g. clipping a shape to the shoreline or specific depth);
2. Review by each participant of his/her individual maps and information; and
3. Review by fishing occupational community, through group and individual meetings, to verify aggregated results

The collection of spatial data has an inherently higher margin of error and thus several QAQC steps were implemented in our project to ensure the spatial data collected were of the highest quality possible. First, notes were taken on the boundaries of each fishing area drawn during an interview with a fisherman. Once spatial data were collected and transmitted to Ecotrust staff for analysis, each spatial dataset was checked against spatial data notes to ensure fishing areas are drawn to the indicated depth limits and spatial extent. Furthermore, if any spatial outliers were identified within a given fishery, individual fishermen were contacted to verify their spatial dataset is accurate.

Second, each individual fisherman was mailed maps of his/her fishing grounds for each fishery they provided spatial information on to review/verify its accuracy. These individual maps were printed on security paper that cannot be photocopied, and were mailed with a return addressed and stamped envelope and contact information so fisherman could easily communicate any changes to their spatial data. Third, once all spatial fishing data were aggregated, these maps were reviewed by the fishing occupational community through the Fisherman Advisory Council, with their input shared with project team staff.

The data review meetings with the fishing occupational community were complimentary to the individual interviews, and took a synergistic approach that was important in several ways. Review meetings were an opportunity to review and verify map products as well as share other data analysis results. In particular, review included having the fishing occupational community assist in interpreting logbook data analysis results, review drafts of the project report, discuss project next steps, build trust between project staff and the fishing occupational community, and continue established relationships.

For review meetings, map products were reviewed for errors. It should be emphasized that spatial data sets were not augmented based on the where an individual who reviewed the map(s) thought areas of importance should be. Instead, the purpose of reviewing the map products was to ensure there were no large errors in the data sets made while collecting, editing, and compiling of the data.

Examples of errors might include fishing areas that extend beyond regulatory depth limits, geographic areas in which the fishery occurs (e.g., nearshore finfish grounds extending into rockfish conservation area boundaries), or exclusion areas in which no fishing is allowed. Based on our experience, having the community review these map products helped ground-truth the data sets, produce data sets that were of higher quality, and helped establish transparency and trust between researchers and the fishing occupational community.

Data validation with independent data sets was an important step in providing rigorous research methods, as data collected in any survey were subject to the inconsistencies of memory, subjective judgment, and possible deliberate falsification. Furthermore, validating data sets may also reveal possible sample biases, which can inform interpretation of survey results. Much of the data the project team collected in this project from commercial fishermen are novel, or similar data sets to our knowledge do not exist or are not readily accessible to compare survey results.

To verify the spatial fishing data sets, commercial logbook data could have been used, though those data only exist for some fisheries, and the data is confidential at the individual level and would take considerable resources to compile and analyze at the aggregate level. Furthermore, the spatial scale in which data are collected with logbooks (10 by 10 mile square blocks) are at a much larger scale than the project team’s data, making it difficult to compare data sets.

In light of the difficulties in obtaining and/or analyzing existing data sets to compare our results, the project team thoroughly reviewed all data sets with the fishing occupational community to ensure all data products submitted were verified and accepted by the fishing occupational community and are of the best quality possible.

3.4.5. Spatial Data Analysis Methods

In this section we further detail how spatial data were analyzed in this project. The project team’s methodology to analyze spatial fishing data collected was developed and refined through collaboration with fishing communities across California during the MLPA process (Scholz et al. 2011a). The analysis of the fishing grounds information is broadly comprised of two components: determination of the fishing grounds and determination of relative (economic) importance. Below we present a detailed methodology for how spatial data were weighted, analyzed, and aggregated for the commercial fishing sector’s spatial fishing data.

As stated above, all fishermen were asked to map fishing grounds for each fishery separately. For each commercial fisherman, individual spatial fishing data were weighted based on the ex-vessel revenue for the year 2013 from each specific fishery/activity. For CPFV fishermen, individual spatial data was weighted based on self-reported gross revenue split by fishery as no economic data is gathered by CDFW for CPFV operators/fishermen.

The following is a detailed methodology of how we analyzed and aggregated individual spatial fishing data to create port and region level spatial data sets on the relative importance of fishing areas. We would like to emphasize that fishermen are asked to map each fishery separately and the spatial data analysis methodology detailed below is conducted for each fishery separately as well.

Step 1: Individual weighted fishing grounds
During the interview process, each fisherman was presented with a navigable nautical chart (e.g., interviewer could zoom in/out and move the map around) contained within the mapping portion of the survey tool. Fishermen were then asked to direct field staff to draw polygons or areas that could be of any shape or size. Each fisherman was asked to identify his or her fishing grounds for a particular fishery if fishing from any port in the North Coast region. This may include mapping areas outside the study region such as north or south of the study region. Furthermore, these fishing grounds could be one or more set of polygon/areas and together they *comprise his or her total fishing grounds for a particular fishery.*

Once the fishing area(s) were mapped, we then asked fishermen to allocate some portion of 100 pennies to each fishing area (or if there is only one fishing area all 100 pennies would be allocated to that area by default) such that the sum of the pennies allocated across his/her fishing areas for a particular fishery equals to 100. This was done to determine the relative importance of fishing areas in comparison to each other.

Step 2: Standardize and apply economic value to individual fishing grounds
The second step was to apply economic value to the individual fishing areas, and distribute that value spatially based on the proportion of pennies allocated to each fishing area. For commercial fishermen we utilized the reported ex-vessel revenue for each fisherman earned from a fishery (found in the CDFW landings data). We then distributed that economic value across the fishing area(s) in proportion with the number of pennies allocated to a specific fishing area. For example, if a commercial fisherman's ex-vessel revenue from rockfish was $50,000 and one fishing area was assigned 50 pennies, then we would allocate $25,000 in economic value to that specific fishing area. This allocation of economic value was applied to each individual spatial fishing data set.

Individual spatial fishing data were weighted based on the specific fisherman's ex-vessel revenue (or gross revenue for CPFV fishermen) for a specific fishery for the full calendar year 2013. To standardize each data set for aggregation we then converted each fisherman's fishing ground data layer (polygon layer) for a particular fishery into a 100 x 100-meter cell size grid or raster layer.

Step 3: Aggregate individual fishing ground values to port level data set
To aggregate the individual fishing ground data layers (raster layers) we simply summarized the values in each cell across the individual raster data layers for all respondents in a given landing port. The resulting data set is a 'heat map' depicting the relative value of fishing areas for a given fishery in a given port.

Step 4: Aggregate port level data sets to regional data sets
To create regional level data sets for a specific fishery, each port data layer was further weighted by the port's total ex-vessel revenue for the specific fishery (for the given year of interest). Ex-vessel revenue was captured from CDFW landings data and then combined into a regional data layer. We applied the total ex-vessel revenue to each port level data layer when combining data layers in order to control for any sample bias at the port level. For example, if

we interviewed more fishermen in a given port it may not necessarily mean that the economic value of that port was greater than that of another port in which we interviewed less commercial fishermen.

Applying this aggregation weight was done by distributing the total ex-vessel revenue value across the respective port level data layer proportionally by the value in each raster cell. Each of these port level raster data layers were then aggregated by summing the values in each raster cell across the port data layers in the region.

3.4.6. Non-spatial Data Analysis Methods

The design of survey questions within this project was largely modeled from survey questions developed through the survey work Ecotrust conducted during the MLPA planning process (2005-2011) in other regions of California. The survey was further developed through review with key informants and the Fisherman Advisory Council to tailor the questions to the North Coast region and gather additional contextual socioeconomic data.

Moreover, HSU senior staff developed several new questions, including questions about the importance of multi-fishery participation and perceptions of the ecology and management of the MPA network. The survey questions were designed so that fishermen could easily provide answers/estimates from readily available knowledge commonly known by fishermen. For the instances in which fishermen were unable to provide answers using on-hand information, field staff later followed up with the individual to collect the information or the information was omitted when calculating averages.

All non-spatial survey data were exported from the survey tool to an MS Access database and then imported into MS Excel files, which were then summarized into tabular format primarily using pivot table queries. As emphasized above, all data for ports or fisheries with fewer than three respondents have been withheld from publication to protect the confidentiality of the survey respondents. An asterisk, '*', can be found in the data tables in which data has been suppressed. A dash, '–', in the data tables indicates a zero value or that data was not collected for a given port-fishery combination. Often if data were not collected in a given port-fishery combination the fishery does not occur or is not a significant fishery in a port (e.g., is not a target fishery).

Commercial fishing landings and CPFV logbook data points with less than three fishermen were suppressed and to ensure the confidentiality of fishermen data. Secondary suppression was also done when appropriate in order to prevent the back calculation of suppressed data points from regional totals. In ports with suppressed landings data, the data were not deleted from the aggregate port totals, but instead coded and included as 'other'.

In the report, there are several survey summary tables that report out on characteristics of fishing activities/income from the year 2009. These averages were taken from a study conducted by Point 97/Ecotrust in 2009 (Scholz et al. 2011). We provide this information to investigate possible initial economic change since 2009.

3.1. Focus Group Data Collection and Analysis Methods

In addition to collecting survey data, our project team conducted a series of focus group conversations with fishermen from the major ports in the region. The development of focus groups with a number of individuals to discuss key issues is a well-recognized qualitative methodology in the social sciences (Krueger, 2009; Morgan 1997) that has been increasingly utilized in a fisheries context (Coulthard 2008; Hampshire et al. 2004; Lobe and Berkes 2004; Ochiewo 2004). In the summer of 2014, we conducted five focus groups with 4-10 participants in each of the major ports of the region (Table 5). A total of 30 different fishermen (commercial and charter) participated in the focus group conversations.

Table 5. Summary of the participation in and timing of focus groups

Port:	**# of Participants:**	**Date:**
Fort Bragg	6	7/2/14
Shelter Cove	4	6/12/14
Eureka	10	7/11/14
Trinidad	5	8/6/14
Crescent City	5	7/28/14
TOTAL:	**30**	

Focus groups provided an opportunity to gather qualitative information about the background, context, and concerns of fishing communities from the North Coast region. The field staff recruited for the focus groups with an aim to gather a diverse set of participants based on fishery(s) they participated in, size of operation, and age.

Fishermen were told about the focus group at the same time they were given an opportunity to participate in the survey. The field staff then followed-up with a diverse spectrum of those who were interested and scheduled a time for the meeting when the most participants could attend. Focus group meetings were held in locations that were relevant to the fishing occupational community such as offices for fishing marketing associations, a local inn, or the local harbor district office. Meetings were held in the evening and food was provided.

Focus groups followed a semi-structured format. The moderator brought a list of discussion topics or questions, but the conversation was given room to wander and the fishermen-participants played a large role in directing the conversation. Focus groups were arranged by port and each conversation covered the following five topics: (1) Background information on the history and current state of the fishing occupational community/port including trends in participation, infrastructure changes and needs, and regulatory structures; (2) perceptions of and effects from the newly implemented MPA network; (3) local ecological knowledge of the marine resources surrounding the MPA network; (4) attitudes towards the science and management of marine resources in the area; and (5) hopes for the future of their fishing occupational community. All participants agreed so focus groups were recorded. All participants gave permission to be directly quoted, but many wished to remain anonymous so no names will be utilized in this report.

Recordings from the focus groups were transcribed. After listening and reading through the focus group conversations, the project developed a set of codes based on themes that were observed throughout the five different focus groups (Table 6). The team then coded all of the transcripts for those themes using the qualitative data analysis software Atlas.ti. From this coding, the team was able to generate a robust analysis of the key findings or themes expressed in focus group conversations.

Table 6. List of codes used to analyze the focus group data

Code:	Code Description:
Historical context	Descriptions of past regulations, "how it used to be", any information about the ports pre-MPA implementation.
Economics	Comments specifically discussing money, fisheries/market values, and any specific numbers attributed to these topics. Some overlap with historical context.
Future	Comments related to general hopes or plans for the future of fisheries or ports. Ideas for what would work better or what fishers would like to see in the future.
Perceptions of MPAs	Comments about the management and implementation of the North Coast MPA network and potential effects from the network.
Perceptions of management	Perceptions of management regimes in general, not specific to MPAs. Includes talk about other existing regulations, and general views on the relationship between managers and fishermen.
Local ecological knowledge	Quotes and comments related to how ecosystems work, how species function/fluctuate, where to find them, and instances that LEK is used to inform an opinion as to why or why not an MPA would be functional.
Collaborative management	Ideas and expressions of interest specifically surrounding working in collaboration with scientists, and how to do so. Collaborative management was discussed both regarding MPAs and other fisheries management.

Before we proceed to the results of this study, recall that baseline survey data were gathered for 2013, a year in which (as will be shown below) overall regional ex-vessel revenues were at peak levels relative to recent years, primarily due to the Dungeness crab fishery. The timing of this project was exogenously determined and was not selected for such a year. It is important to note that economic outcomes for fishermen in 2013 may result in a distorted understanding of fishery socioeconomic conditions, which is why we include CDFW data going back to 1992 for comparison purposes. While fishermen are accustomed to the vicissitudes of their livelihood, nonetheless, fisherman attitudes and perceptions must be viewed in appropriate context. For example, it is possible that fishermen would have a more negative view of fish abundance, fishery management, and MPA effects in more economically "normal" years.

4. NORTH COAST REGION FISHING OCCUPATIONAL COMMUNITY PROFILE

The general regional trend in commercial fishing has been a decline in the number of fishermen and higher average landings and ex-vessel revenue (all in constant 2010 dollars) per fisherman. As shown in Figure 5 later in this report, in 1992 there were 1,191 North Coast commercial fishermen active in the fisheries of interest for this report (fisheries of interest are defined in section 3.2). Total ex-vessel revenue was $19,181,047, and total landings were 13,348,013 pounds.

Total numbers of commercial fishermen actually peaked at around 1,400 in the early 1990s before declining steadily to fewer than 400 in 2009, with modest increase thereafter. At the state level, the total number of commercial fishermen in California declined from 5,919 in 1992 to 2,108 in 2014, indicating that the number of commercial fishermen active in the North Coast region has fallen less precipitously than in the state overall.

In 2014 there were 770 North Coast commercial fishermen active in the fisheries of interest for this report, or about 65% of the number in 1992. By way of comparison, total civilian employment in Del Norte, Humboldt, and Mendocino Counties combined in 2014 was approximately 100,000 (California Employment Development Department, 2017). Total ex-vessel revenue (gross commercial fishing income) was $26,890,974 in 2014, and total landings were 9,273,314 pounds. Note that estimated total income in Del Norte, Humboldt, and Mendocino Counties in 2014 was approximately $5.6 billion (United States Census, 2017).

One can infer from the preceding information that commercial fishing is small relative to the region's overall economy (direct employment and income below 1% of the region's total). Commercial fishing has an out-sized role in the region's port economies, however, generating additional "multiplier effect" jobs and income for inputs such as bait, ice, fuel, and repair (Hackett et al., 2009), and essential support for maintenance of marina and port infrastructure.

The commercial Dungeness crab fishery has played a dominant role in both landings and value among the fisheries of interest in the North Coast region since 1992, and in that regard it serves as a mainstay for the North Coast region's commercial fishing industry. The top three fisheries of interest by ex-vessel value in the North Coast region in 1992 were Dungeness crab, urchin, and nearshore finfish (dead with hook and line gear).

In 2014, the top three fisheries of interest were Dungeness crab, salmon, and urchin. The region's top three fisheries of interest in terms of landings in 1992 were Dungeness crab, urchin, and nearshore finfish (dead with hook and line gear). In 2014, the top three fisheries by landed poundage were Dungeness crab, urchin, and salmon (see Figure 9 and Figure 10 later in this report for additional details).

Fishermen in the region have faced a number of challenges linked to fish abundance and fishery regulation. Examples include salmon closures in 2008-09; concerns about rockfish depletion leading to Rockfish Conservation Area regulations beginning in 2002; and the urchin fishery collapse due to El Nino 2004-05 and the loss of kelp. A positive change for North Coast commercial fishermen was the very large 2014 harvest of Dungeness crab, and relatively high average $4.12 price per pound – the highest per pound price in 22 years.

While the number of active commercial fishermen has declined both statewide and in the North Coast region, the number of commercial passenger fishing vessel (CPFV) operators and angler passengers has grown sharply since the late 1990s. In 1992 there were 13 CPFV vessels that took 1,399 trips with a total sum of 11,240 passengers. In that year an average of 108 annual trips per vessel were made, with an average of 8 anglers per trip and 865 annual anglers per vessel. The number of CPFV vessels actually declined to 4 in 1996, though the number of vessels steadily rose thereafter.

By 2014 there were a peak of 40 CPFV vessels operating in the North Coast region that took nearly 6,000 trips with a total of 44,077 angler passengers. In 2014 CPFV operators took an average of 147 trips per vessel, with an average of 7 anglers and 1,102 annual anglers per vessel. Rockfish species dominated the target species group and CPFV catch since the 1990s. Dungeness crab and salmon were also important components of CPFV catch in this time period, with lingcod being another important target species (see Figure 17, Figure 18, and Figure 20 later in this report for details).

As with the other MPA regional baseline studies, the project did not collect data about the ethnic or racial identity, or socioeconomic status, of participants in the survey. While some of this information is available from the US Census for populations at geographical scales such as counties, to our knowledge such information has not been gathered on participants in the commercial and CPFV industries in California. Anecdotal evidence suggest that Hispanic individuals are playing an increasing role in the industry as crew members and vessel captains – particularly in the ports of Fort Bragg and Eureka. Additionally, accounts from the community indicate individuals with Native American ancestry have played important roles in commercial and charter fishing in the North Coast region. Demographic data necessary to identify these patterns definitively, however, are not available.

The project team did gather data about the gender make-up of the captains, vessel-owners, and CPFV operators who participated in the survey. The study revealed the commercial captains and vessel owners in the North Coast region are overwhelmingly (97.5% overall) male. In Trinidad, Shelter Cove, Fort Bragg, and Albion, 100% of respondents were male. Whereas in Crescent City 95% were male and in Eureka 96% were male. Age of respondents emerged as an important factor in study results, and is summarized below. The average age of commercial fishermen on the North Coast was 53.9. These statistics align with commentary from focus groups with commercial fishermen, who highlighted the “graying of the fleet” – or the aging demographic of commercial fishermen as a potential challenge for their ports. Several fishermen expressed worries about what would happen to local fishing industries when current captains and vessel operators retired.

From the data gathered in the survey, it is difficult to determine how socioeconomic backgrounds and status have driven change and/or patterns in North Coast fishing occupational communities. Anecdotal information from conversations with fishermen and data gathered in focus group conversations indicate that entry into commercial fishing careers has gotten more expensive with the rising cost of entry permits and quota shares. These trends could serve to make entry into commercial fishing vessel operation or ownership more difficult for individuals from socioeconomically disadvantaged backgrounds. This study did not collect data on the overall income level or socioeconomic background of survey participants, so it cannot provide definitive data to describe these types of patterns. This study did compile information about the distribution of North Coast fishermen’s revenue from participation in nearshore commercial fisheries. The study shows that there are a variety of operation sizes and levels of participation in the fisheries of interest. In the region fishermen were fairly evenly distributed within four revenue strata or quartiles of the fisheries of study.

4.1. North Coast Commercial Fishing Baseline Characterization

In the following section of the report we summarize the primary data collected from commercial fisherman interviewed by the research team in 2014.

In Table 7 below, the total number of commercial fishermen interviewed by project staff is organized by target fishery and homeport. It is important to note that the numbers shown in Table 7 differ from those in Table 4. This difference is due to the fact that the project timeline required the team to begin interview field work in summer 2014, before we had received definitive CDFW commercial fishery participant data for the 2013 calendar year. As a result, some commercial fishermen were inadvertently interviewed by project staff who claimed 2013 landings, but who in fact did not commercially fish in 2013. Consequently Table 7 includes some North Coast region commercial fishermen who did not have 2013 landings.

Homeport is identified in Table 7 by the fisherman interviewed by field staff, and homeport is typically where fishermen land the majority of their catch. While each fisherman may participate in more than one of the target fisheries, each is associated with a single homeport. For example, we interviewed 37 fishermen who indicated that Crescent City was their homeport. Of these, 36 participated in the Dungeness crab - trap fishery, and 15 participated in the salmon – troll fishery, indicating that some participated in both fisheries.

The count of commercial fishermen interviewed by regional homeport is Eureka (46), Fort Bragg (43), Crescent City (37), Trinidad (10), Shelter Cove (9), and Albion (3), for a total of 148 unique individual fishermen. The team also interviewed 15 fishermen who participated in North Coast regional fisheries of interest but who had homeports outside the region.

Table 7. Number of commercial fishermen interviews conducted by home port, 2013, North Coast region

Fishery	**Albion**	**Crescent City**	**Eureka**	**Fort Bragg**	**Shelter Cove**	**Trinidad**	**Ports Outside the Region**	**Grand Total**
Dungeness crab - trap	--	36	42	22	5	8	13	126
Nearshore finfish- dead - hook and line	--	3	3	1	4	1	0	12
Nearshore finfish dead - longline	--	1	1	1	--	--	0	3
Nearshore finfish live - hook and line	--	9	--	6	--	--	0	15
Nearshore finfish live - longline	1	3	--	1	--	--	0	5
Nearshore finfish live - trap	--	--	--	3	--	--	0	3
Salmon - troll	--	15	32	22	5	4	9	87
Urchin - dive	3	--	--	13	--	--	2	18
All target fisheries (unique individuals)	**3**	**37**	**46**	**43**	**9**	**10**	**15**	**163**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

As shown below in

Table **8**, the average fisherman across all fisheries of interest was 53.9 years old at the time of interview and had 27.6 years of experience commercial fishing. On average, participants in the nearshore finfish dead – longline fishery were the oldest (65.3), while those active in the salmon – troll fishery were the youngest (50.1).

It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery. This average, for all target fisheries, is for unique individuals and includes each individual only once, regardless of the number of fisheries in which they participated. The oldest individual we interviewed was 88 years old, while the youngest was 21 years old.

Table 8. Average age and years of experience commercial fishing in 2013, North Coast region

	Age			Years of experience		
Fishery	**n**	**Average**	**St.Dev**	**n**	**Average**	**St. Dev**
Dungeness crab - trap	126	52.7	13.5	126	27.8	11.8
Nearshore finfish- dead - hook and line	12	59.9	13.7	12	31.2	12.9
Nearshore finfish dead - longline	3	65.3	21.7	3	32.0	8.0
Nearshore finfish live - hook and line	15	57.0	10.5	15	28.1	7.1
Nearshore finfish live - longline	5	63.0	16.3	5	34.0	6.4
Nearshore finfish live - trap	3	61.7	12.2	3	27.7	0.6
Salmon – troll	87	50.1	15.5	87	25.6	13.7
Urchin – dive	18	55.5	13.3	18	24.9	11.2
All target fisheries (unique individuals)	**148**	**53.9**	**12.2**	**148**	**27.6**	**14.2**

Source: Current study.

Fishermen were asked what share of their personal income came from commercial fishing in the 2013 calendar year. As shown in Table 9 below, the average percentage of personal income from commercial fishing in 2013 was 87.9%. Fishermen were not asked to respond in regards to their fishing as a whole.

Table 9. Share of income from overall commercial fishing in 2013, North Coast region

	Number of Responses	**Average**	**Standard Deviation**
All target fisheries (unique individuals)	**148**	**87.9%**	**21.0%**

Source: Current study

Fishermen were asked what percentage of their ex-vessel revenue went towards their overall commercial fishing operating costs (not just fisheries of interest). Fishermen were asked to respond in regards to their overall fishing effort, as it is difficult to fully separate fishing costs by fishery. For example, there are fixed costs such as vessel maintenance that are shared across fisheries, and some variable costs may be shared when a given trip is used to target more than one fishery. As shown in Table 10, fishermen reported that in 2013 on average 57.4% of their revenue was spent on operating costs.

Table 10. Percentage of total gross fishing revenue used for overall operating costs, 2013, North Coast region

	Number of Responses	**Average**	**Standard Deviation**
All target fisheries (unique individuals)	**148**	**57.4%**	**24.4%**

Source: Current study.

We asked fishermen how many years of experience and how many days per year they spent targeting each of the fisheries in which they participate. As indicated in Table 11, nearshore finfish dead - longline fishermen have been fishing the longest, on average 42 years. Fishermen participating in the nearshore finfish live–hook and line fishery had the fewest number of years of experience of all the target fisheries, 23.4 years. Fishermen spent the fewest number of days targeting nearshore finfish live–trap in 2013, an average of just 16 days. The fishery with the highest average number of days fished per year was urchin–dive, which was targeted an average of 101.9 days in 2013.

Table 11. Years of experience and number of days (per year) targeting specific fisheries in 2013, North Coast region

	Years of experience			**Number of days targeting specific fisheries**		
Row Labels	**Number responding**	**Average**	**Standard Deviation**	**Number responding**	**Average**	**Standard Deviation**
Dungeness crab - trap	113	27.0	12.1	106	72.4	45.7
Nearshore finfish- dead - hook and line	11	26.9	15.5	10	47.3	39.9
Nearshore finfish dead - longline	2	42.0	11.3	2	31.0	26.9
Nearshore finfish live - hook and line	14	23.4	10.0	14	29.6	28.5
Nearshore finfish live - longline	4	23.8	8.2	3	45.7	41.8
Nearshore finfish live - trap	3	26.3	16.2	3	16.0	13.9
Salmon – troll	70	24.0	15.1	67	44.8	29.9
Urchin – dive	16	27.6	9.8	15	101.9	46.9
All target fisheries (unique individuals)	**148**	**26.0**	**13.0**	**140**	**60.6**	**43.8**

Source: Current study.

Fishermen were also asked how many crew members they used for each fishery, and what percentage of their total gross ex-vessel revenue was spent on crew costs. Across targeted fisheries, fishermen reported using an average of 1.5 crew members, as one can see in Table 12 below. The Dungeness crab–trap fishery utilized the highest average number of crew (2 on average per boat) and therefore also reported the highest percentage of ex-vessel revenue spent on crew (31.4%). The average share of fishery-specific ex-vessel revenue spent on fuel was highest for the nearshore finfish live–hook and line fishery (14.5%) and lowest for the nearshore finfish live–trap fishery (4.7%).

Table 12. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, North Coast region

	Number of crew			Percent revenue towards crew			Percent revenue towards fuel		
Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab – Trap	126	2	1	125	31.4%	11.2%	116	11.2%	7.6%
Nearshore finfish- dead - hook and line	10	1	1	10	11.0%	15.1%	10	12.4%	14.2%
Nearshore finfish dead - longline	2	1	0	2	30.0%	0.0%	2	12.5%	10.6%
Nearshore finfish live - hook and line	14	1	1	14	14.4%	16.7%	14	14.5%	18.9%
Nearshore finfish live - longline	4	1	1	4	23.5%	15.8%	4	5.3%	1.0%
Nearshore finfish live - trap	3	0	1	3	6.7%	11.5%	3	4.7%	5.0%
Salmon - troll	76	1	1	75	16.2%	12.9%	73	12.9%	11.9%
Urchin - dive	14	1	1	14	14.5%	22.4%	11	13.6%	6.2%
All targeted fisheries (unique individuals)	**144**	**1.5**	**1**	**144**	**23.4%**	**15.3%**	**134**	**11.9%**	**10.4%**

Source: Current study.

North Coast fishermen were also asked whether MPAs had affected their fishing, and if so, what specific, direct effects MPAs had on specific fisheries in 2013. This was asked as an open ended question, and responses were categorized as fishermen provided their response. Table 13 provides the most common responses by category. A total of 73% of respondents stated that MPAs directly affected their fishing.

Of those who responded Yes, the most frequently cited effect was (A), Cannot fish in (or go to) traditional grounds/areas (65%). The second most frequently cited effect was answer E, 'Other'. The most common 'Other' effects mentioned were crowding in areas not restricted by MPAs; diminishing economic opportunities in fishing; and poor communication on the locations of MPAs, leading to possible ticketing and heavy fines.

Table 13. Share of respondents indicating specific direct effects by MPAs

Row Labels	**Number responding**	**Have MPAs affected your fishing?**	**A**	**B**	**C**	**D**	**E**
Dungeness crab - trap	126	47%	41%	11%	3%	4%	27%
Nearshore finfish- dead - hook and line	12	67%	58%	33%	25%	33%	25%
Nearshore finfish dead - longline	3	67%	67%	33%	0%	33%	33%
Nearshore finfish live - hook and line	15	53%	40%	13%	13%	7%	33%
Nearshore finfish live - longline	5	60%	60%	0%	20%	0%	40%
Nearshore finfish live - trap	3	67%	33%	33%	33%	0%	33%
Salmon - troll	87	68%	63%	19%	15%	8%	29%
Urchin - dive	18	88%	75%	25%	19%	25%	56%
All target fisheries (unique individuals)	**148**	**73%**	**65%**	**21%**	**13%**	**10%**	**42%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly effected by MPAs

Fishermen were also asked which MPAs had affected their fisheries in 2013. In Table 14 below we list the MPAs that our respondents cited as having affected specific targeted fisheries during 2013. Twenty-seven MPAs on the North Coast affected targeted fisheries in 2013. Of those, Ten Mile SMR (B) affected the largest number of fishermen (77 total responses), followed by Reading Rock SMR (L) (40 responses) and Ten Mile Beach SMCA (O) (38 responses).

Table 14. Which MPAs have affected your fishing in this fishery in 2013?, North Coast region

Row Labels	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**V**	**W**	**X**	**Y**	**Z**	**AA**	**AB**
Anchovy - Fishery	--	--	--	--	--	--	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dungeness crab - trap	--	18	--	1	--	--	1	--	5	--	--	26	11	13	--	3	1	--	--	--	2	1	--	1	--	--	4	--
Lingcod - Hook and Line/Longline	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Nearshore finfish- dead - hook and line	--	--	1	--	1	--	3	--	3	--	--	2	--	1	--	2	1	1	--	--	2	3	--	1	--	1	1	--
Nearshore finfish dead - longline	--	1	--	--	1	--	--	--	1	--	--	--	1	--	1	--	--	--	--	--	1	--	--	--	--	--	--	--
Nearshore finfish live - hook and line	--	3	1	2	--	--	--	--	--	--	--	2	1	--	1	--	2	--	--	1	--	1	--	2	--	2	--	--
Nearshore finfish live - longline	--	1	--	--	--	--	--	--	--	--	--	1	1	1	2	--	1	--	--	1	1	--	--	--	--	--	--	--
Nearshore finfish live - trap	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salmon - troll	1	43	1	4	1	--	2	2	3	--	1	7	7	2	29	1	6	1	1	--	2	4	2	1	--	5	3	1
Urchin - dive	--	10	--	5	1	--	--	--	1	--	1	1	--	1	5	--	2	1	1	--	1	1	--	--	--	2	--	1
All Target Fisheries	**1**	**77**	**3**	**13**	**4**	**0**	**6**	**2**	**13**	**0**	**2**	**40**	**22**	**19**	**38**	**6**	**13**	**3**	**2**	**2**	**9**	**10**	**2**	**5**	**0**	**10**	**9**	**2**

Source: Current study.
-- indicates that the port/fishery was not sampled or a zero value data point

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were then asked about the importance of targeting multiple fisheries. Research by Hackett et al. (2015) indicates that multi-fishery participation has a strong and significant association with fishermen who sustain active participation (rather than exit commercial fishing) following a regulatory event that restricts fishing opportunities. Hackett et al. utilized a regulatory event study methodology that longitudinally tracked individual commercial fishermen participating in four different California fisheries.

Accordingly, fishermen in our 2014 interviews could respond to the 'importance of targeting multiple fisheries' question by selecting one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 15 below, 88% of respondents indicated that participation in multiple fisheries was either very important or important, with nearly 75% of respondents cited multiple fisheries as very important. Clearly multi-fishery participation is considered to be an important strategy employed by commercial fishermen for sustaining active participation.

If fishermen responded that multi-fishery participation was very important or important, they were then asked why that was the case. The question was asked as an open ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer. Respondents indicated that a multi-fishery participation strategy stabilized year-to-year fishing income, allowed for better capital utilization, and increased fishing income. In particular, the most frequent response (n=189) was that multi-fishery participation 'stabilizes year-to-year variation in commercial fishing income,' followed by the statement that multi-fishery participation 'increases my annual commercial fishing income' (n=129).

Table 15. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, North Coast region

			Degree of importance					Reasons for importance			
Fishery	**Number of respondents**	**No response**	**Very Important**	**Important**	**Neither Important nor Unimportant**	**Unimportant**	**Very Unimportant**	**A**	**B**	**C**	**D**
Dungeness crab - trap	113	2	92	14	4	1	--	55	94	48	36
Nearshore finfish- dead - hook and line	12	--	11	1	--	--	--	8	9	6	4
Nearshore finfish dead - longline	3	--	1	--	--	1	1	2	1	1	2
Nearshore finfish live - hook and line	15	--	14	1	--	--	--	12	14	10	6
Nearshore finfish live - longline	5	--	3	1	--	--	1	4	3	3	4
Nearshore finfish live - trap	3	--	2	1	--	--	--	2	2	1	1
Salmon - troll	78	4	62	8	2	2	1	42	61	29	22
Urchin - dive	16	2	5	4	1	5	--	4	5	3	3
All target fisheries (unique individuals)	**148**	**4**	**110**	**20**	**5**	**8**	**1**	**129**	**189**	**101**	**78**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, North Coast region fishermen were asked what strategies they used to market their catch. They were given ten possible categories of response, listed in Table 16 below as answers A through J. Respondents were allowed to provide more than one answer. Marketing channel usage reported by commercial fishermen were traditional fish processors (40%), direct sales of various kinds (23%), sales to live fish buyers (15%), sales to fish cooperatives (2%), and sales to farmer's market or street fairs (1%).

Table 16. Strategies used to market catch, 2013, North Coast region

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	1	4	85	5	27	24	36	6	5	10
Nearshore finfish- dead - hook and line	2	3	5	1	3	2	4	1	2	2
Nearshore finfish dead - longline	1	0	2	0	0	0	1	0	1	0
Nearshore finfish live - hook and line	0	1	9	2	3	4	13	0	1	3
Nearshore finfish live - longline	0	0	3	0	2	0	4	0	0	1
Nearshore finfish live - trap	0	1	2	1	1	1	2	0	0	0
Salmon - troll	0	6	63	7	23	25	19	6	4	5
Urchin - dive	0	2	14	2	3	1	2	0	2	4
All target fisheries (unique individuals)	**3**	**11**	**110**	**11**	**33**	**31**	**42**	**6**	**10**	**16**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

4.2. North Coast Commercial Fishing: Initial Changes

Fishermen interviewed in our study were asked how they saw their income from commercial fishing changing between 2009 (pre MPA period) and 2013 (post MPA period). They were asked to select one of the following options: Significantly Higher, Somewhat Higher, No Change, Somewhat Lower, or Significantly Lower.

The question did not ask how MPA formation affected their fishing income, and so the response data below cannot be construed as having a causal link to MPA formation, but is merely an association. As shown below in Table 17, the majority of respondents saw no change to their fishing income between 2009 and 2013.

Table 17. Perceived change in share of personal income from commercial fishing between 2009 and 2013, North Coast region

	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**146**	**10.3%**	**9.6%**	**65.8%**	**6.8%**	**7.5%**

Source: Current study.

Respondents were asked what factors they saw as contributing to the change in the share of their income deriving from commercial fishing. This was asked as an open-ended question, with responses categorized later by project staff.

The most commonly cited reason for changes in the share of income deriving from commercial fishing were changes in regulations, changes in fish abundance/presence, and changes in the market/economy (Table 18). Most of the “Other” responses were personal reasons, including retirement, changes in jobs or business incomes, degree of fishing experience, or caregiving for family members.

Table 18. Factors most affecting change in the share of personal income from fishing, 2009-2013, North Coast region

	Number of Responses	A	B	C	D	E
All target fisheries (unique individuals)	**85**	**13**	**13**	**15**	**9**	**35**

Source: Current study.

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Fishermen were asked what share of their gross ex-vessel revenue went towards their overall commercial fishing operating costs. Fishermen were not asked to respond for each fishery they participated in, but rather in regards to their fishing as a whole. Overall, fishermen reported that in 2013 on average 57.4% of their gross revenue was spent on operating costs. Again we emphasize that this question is asked about overall commercial fishing operating costs across all fisheries, not individual operating costs for a particular fishery.

Fishermen were asked separately for each fishery they participated in to compare their success in the fishery in 2013 to that of the prior ten years. Respondents were allowed to give one answer per fishery. As shown in Table 19 below, respondents were given the option of responding in one of the following categories: (1) Significantly better; (2) Somewhat better; (3) The same; (4) Somewhat worse; and (5) Significantly worse. Respondents were also allowed to answer that they had not participated in the given fishery during the last ten years.

Responses were fairly evenly split across categories. The most common answer was 'significantly worse' (18.9% of responses), driven by the responses in the Dungeness crab-trap fishery (23.8%). The second most common answer was 'the same' (18.4% of responses), followed by 'significantly better' (17.5%) and 'somewhat worse' (17.1%). 12.9% of respondents had not participated in the fishery in question in previous seasons.

Table 19. Perceived success in fishing in 2013 compared to last ten years, North Coast region

Fishery	Number of respondents	Did not participate previously	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	113	5.7%	14.3%	19.0%	17.1%	21.9%	23.8%
Nearshore Finfish Dead - Hook and Line	12	--	--	11.1%	22.2%	33.3%	33.3%
Nearshore Finfish Dead - Longline	3	--	--	--	--	50.0%	50.0%
Nearshore Finfish Live - Hook and Line	15	16.7%	8.3%	16.7%	41.7%	8.3%	8.3%
Nearshore Finfish Live - Longline	5	--	--	--	50.0%	50.0%	--
Nearshore Finfish Live - Trap	3	50.0%	--	50.0%	--	--	--
Salmon - Troll	78	26.5%	29.4%	16.2%	13.2%	11.8%	4.4%
Urchin - Dive	16	6.7%	13.3%	33.3%	33.3%	13.3%	--
All target fisheries (unique individuals)	**148**	**12.9%**	**17.5%**	**15.2%**	**18.4%**	**17.1%**	**18.9%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point

A summary of statewide commercial landings in California from 1992–2014 is provided in Figure 1. Landings fluctuated greatly over the study period, with a peak in 2000 at almost 554 million pounds, and a low in 2003 at 275 million pounds. By the end of the study period, total landings reached 357 million pounds. In 1992, ex-vessel revenue increased from $152 million to $211 million in 1996 before generally declining to a low in 2008. In 2009, ex-vessel revenue increased again and reached a peak in 2013 at $243 million.

Overall, landings and ex-vessel revenue for the state of California increased by 20% and 44% respectively from 1992 to 2014. Meanwhile, the number of fishermen consistently declined over most of the study period, with slight recovery after 2009. Point to point, numbers of active commercial fishermen in the state declined by 64% overall, from 5,920 in 1992 to 2,108 in 2014.

Total commercial landings, ex-vessel revenue, and number of fishermen over the study period who were active in the North Coast region are summarized in Figure 2. Total landings peaked in 1992 at 74.6 million pounds, bottomed out in 2011 at 25.3 million pounds and ended the study period at 33.0 million pounds. The number of active commercial fishermen peaked in 1994 at 1,400, declined until reaching a low point in 2008 with only 370 active fishermen. The number of fishermen then recovered somewhat, growing to 600 in 2014.

The recovery in numbers of active commercial fishermen in the North Coast region was somewhat more marked than for the state overall. Ex-vessel revenue (in constant 2010 dollars) declined overall from 1992 ($49.1 million) through 2002 (nearly $24.8 million). The second half of the study period proved to be more volatile with multiple spikes and subsequent declines in revenue, with the general trend being an increase. The most notable spike in revenue came in 2012 and 2013 with the overall high ex-vessel revenue point for the study period occurring in 2013 at $77.3 million.

Figure 1. State of California total commercial landings, ex-vessel revenue, and number of fishermen, 1992–2014

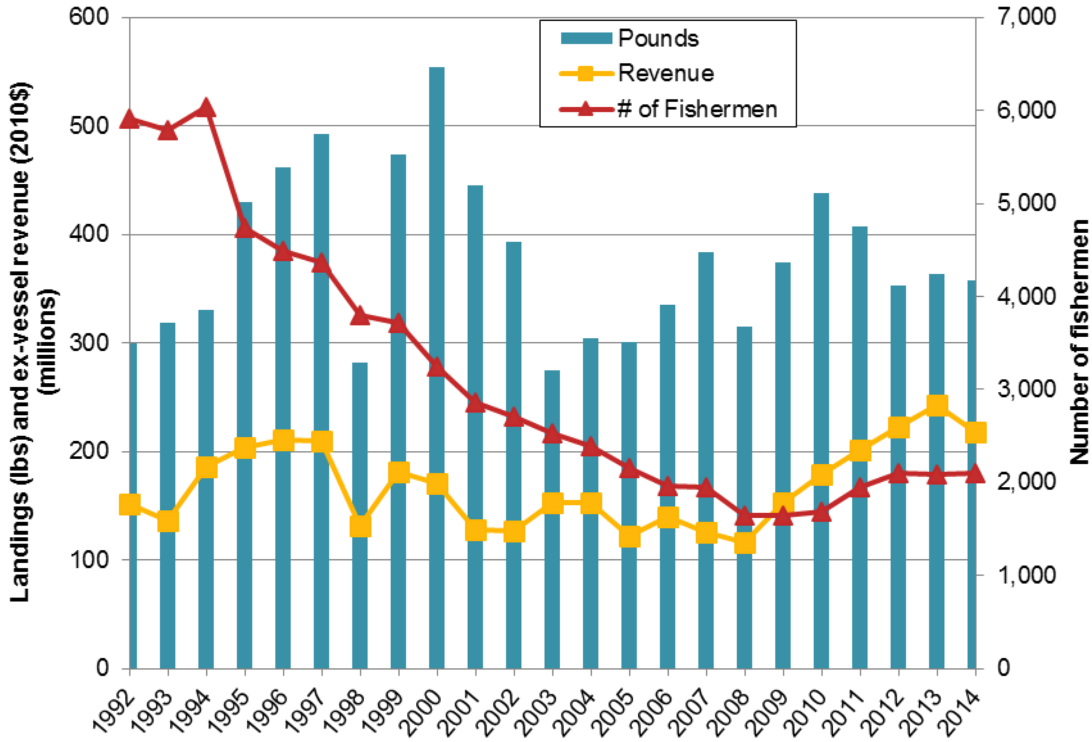
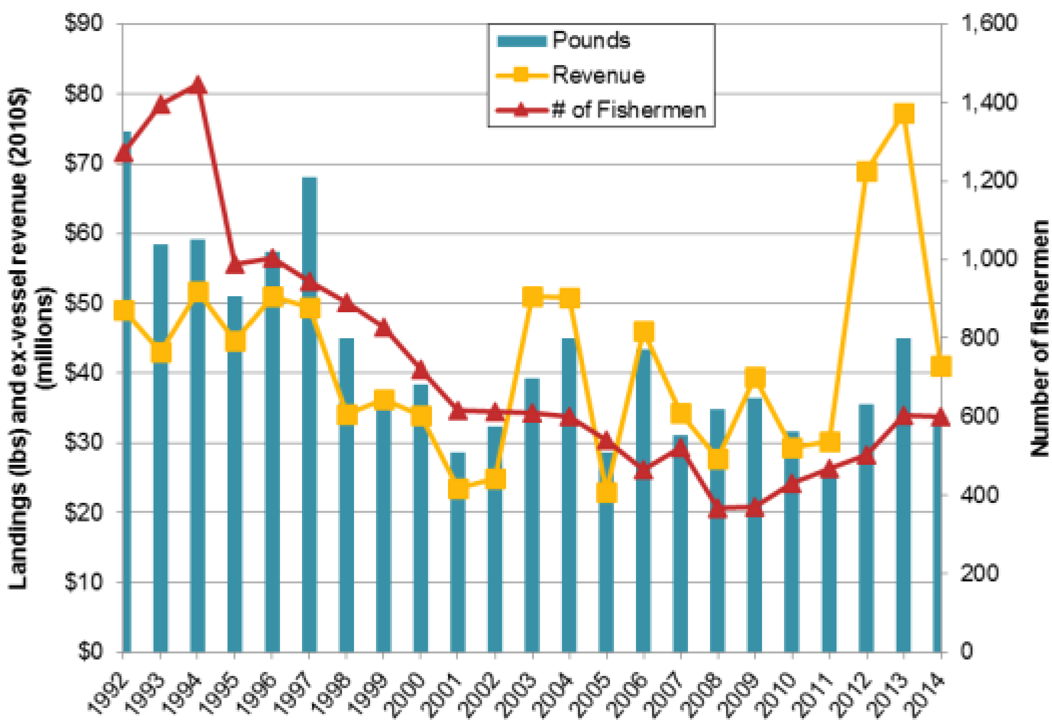
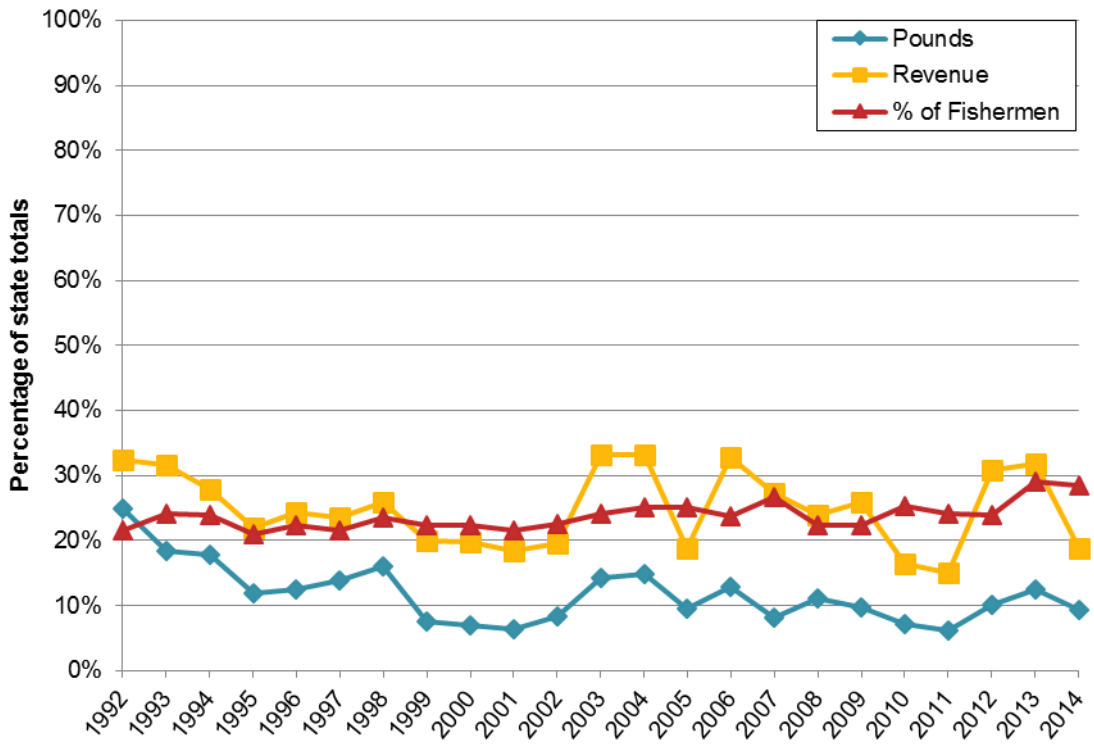


Figure 2. North Coast region total commercial landings, ex-vessel revenue, and number of fishermen, all fisheries, 1992–2014



The North Coast region's share of statewide landings, ex-vessel revenue, and number of active commercial fishermen exhibited relatively little year-to-year fluctuation from 1992-2014, as shown in Figure 3. There was modest decline in the North Coast region's share of statewide landings, some fluctuation in the region's share of statewide ex-vessel revenue, and a generally rising share of statewide number of active commercial fishermen. The region's share of statewide active commercial fishermen grew from 22% in 1992 to a near high of 29% in 2014.

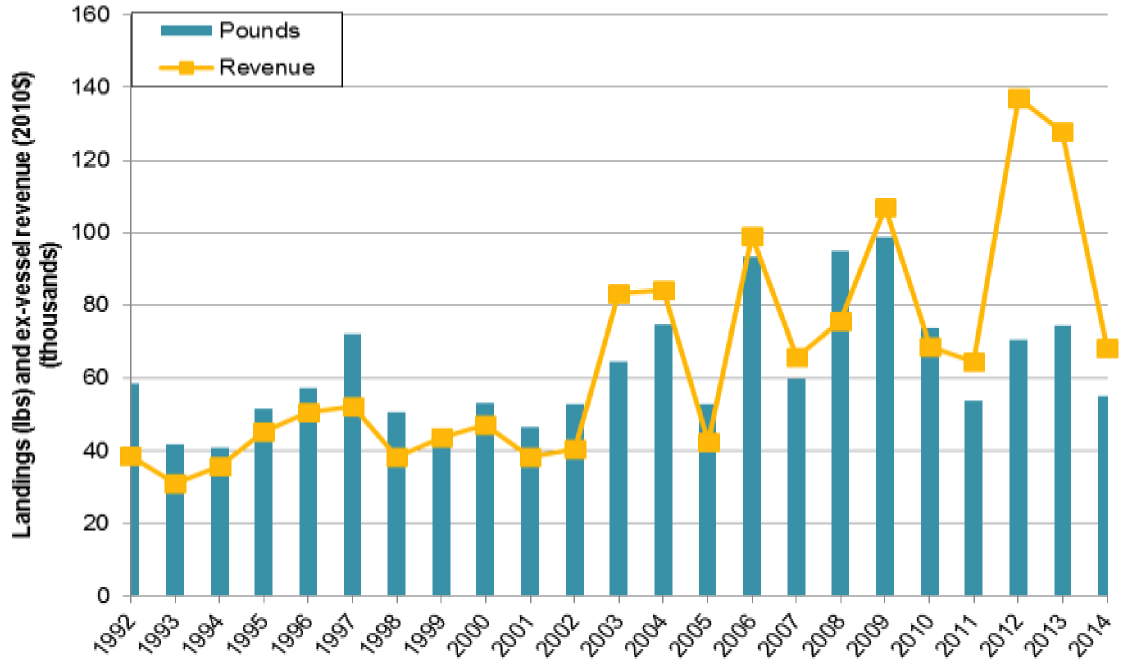
Figure 3. North Coast region total commercial landings as a percentage of state commercial landings and ex-vessel revenue, 1992–2014



Average annual landings and ex-vessel revenue for North Coast regional commercial fishermen generally increased between 1992 and 2014, as shown in Figure 4. Attrition in the overall number of commercial fishermen concentrated landings and fishing revenue in fewer hands. Overall, the average commercial fisherman in the North Coast region landed 62,000 pounds and earned an average of $65,000 in ex-vessel revenue.

From 1992-2002, commercial landings and revenue remained relatively stable, with an average of 54,600 pounds and $42,000 per fisherman. In the following 12 years, values of landings and revenue per fisherman fluctuated but generally increased. The peak average poundage of landings over the duration of the study period was 98,700 pounds in 2009, while peak average revenue was $137,000 in 2012.

Figure 4. Average commercial landings and ex-vessel revenue per fisherman in the North Coast region, 1992–2014



A great deal of useful information on North Coast regional commercial fishing in fisheries of interest is summarized in Figure 5, with trends very similar to those shown for all North Coast regional fisheries in Figure 2. One key trend is a decline in the number of regional commercial fishermen active in fisheries of interest through 2009, with a moderate rebound thereafter.

One can also see a generally rising trend in total pounds landed and ex-vessel revenue, with higher inter-annual fluctuations after 2002. Fishermen indicated this peak was due to a spike in Dungeness crab-trap landings, as well as higher Dungeness crab prices in 2012 and 2013.

One can see from Figure 6 that the fisheries of interest in this study (recall that fisheries of interest are defined in section 3.2) represent a rising share of total North Coast regional commercial landings and ex-vessel revenue. In fact, since 2002 the fisheries of interest have contributed a majority of total regional ex-vessel revenue.

Figure 5. North Coast region commercial landings, ex-vessel revenue, and number of fishermen, fisheries of interest, 1992–2014

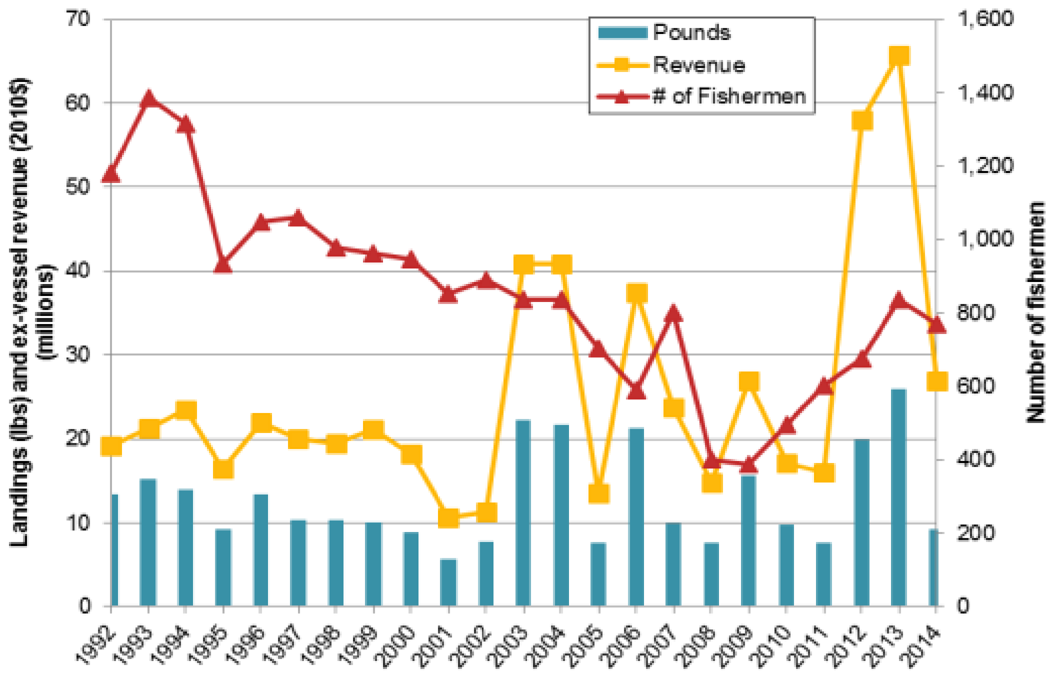
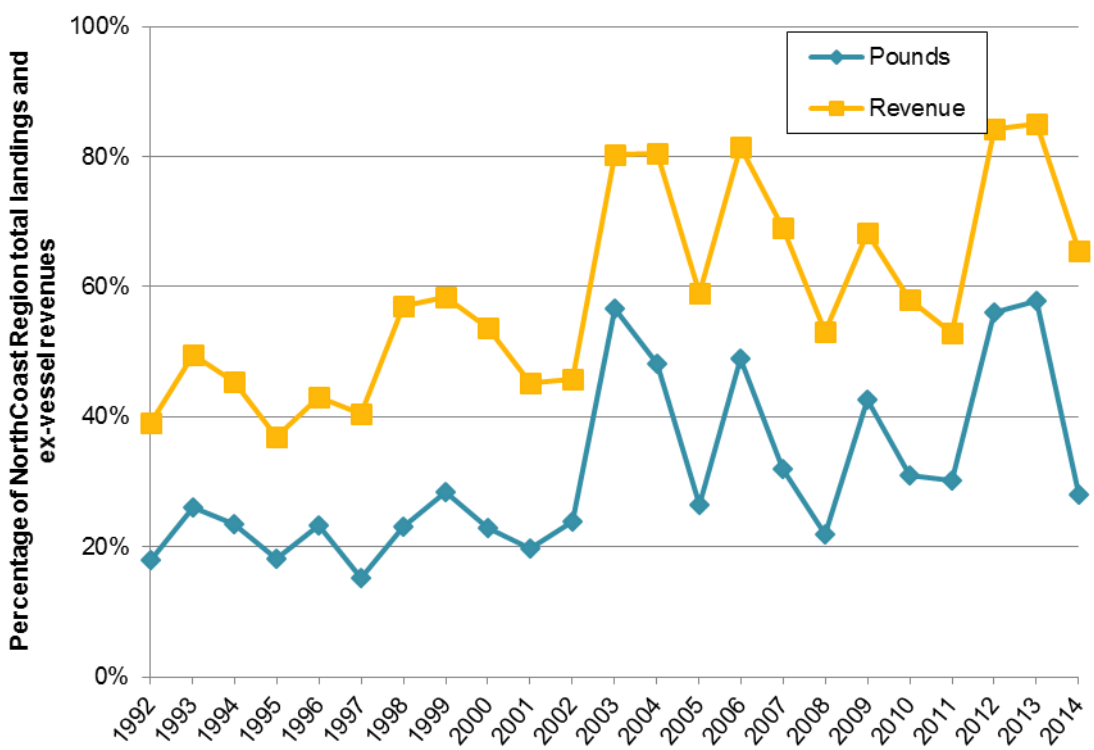


Figure 6. Fisheries of interest as a percentage of all commercial fisheries landings and ex-vessel revenue in the North Coast region, 1992–2014



In Table 20 we provide summary information on the top 15 “other” North Coast regional fisheries that are not included in the fisheries of interest in this report, usually due to the location of these fisheries or their scale. These top 15 fisheries together represent approximately 92 share of the total ex-vessel revenue derived from fisheries other than those in the fisheries of interest grouping.

Table 20. Top 15 'Other' fishery ex-vessel revenue and landings, North Coast region, 1992-2014

		Sum Total (1992-2014)	
Species Group	**Gear**	**Ex-Vessel Revenue**	**Pounds Landed**
Other Flatfish	Bottom trawl	$75,735,156	156,240,995
Shrimp/Prawn	Bottom trawl	$63,722,093	120,789,528
Sablefish	Bottom trawl	$49,933,438	36,996,353
Thornyhead	Bottom trawl	$48,358,656	54,340,997
Sablefish	Longline	$22,662,118	10,691,001
Shelf–Slope Rockfish	Bottom trawl	$19,605,245	42,287,681
Sablefish	Trap	$13,983,046	8,104,362
Albacore Tuna	Troll	$12,293,910	11,617,705
Albacore Tuna	Hook-line	$9,107,137	9,174,404
Other Groundfish	Midwater trawl	$8,286,880	134,275,032
Shrimp/Prawn	Trap	$5,758,019	1,361,348
Smeltlike Fish	Brail/dip net	$5,483,312	14,785,185
Swordfish	Other-misc	$3,951,324	1,812,455
Swordfish	Gill net	$3,191,292	785,668
Hagfish	Trap	$3,153,131	6,007,990

From Figure 7 one can see that in the early 1990s the “other” fisheries (not included in the fisheries of interest in this report) far exceeded those of the fisheries of interest. Yet total landings in these other fisheries declined until about 2003 and then generally stabilized at levels comparable to the fisheries of interest. The fisheries of interest are relatively of higher value, however, as one can see from Figure 8. The relatively greater inter-annual variation in total regional ex-vessel value of the fisheries of interest is driven by the Dungeness crab fishery, as we will show in the next set of diagrams.

Figure 7. 'Other' fisheries vs fisheries of interest landings in the North Coast region, 1992–2014

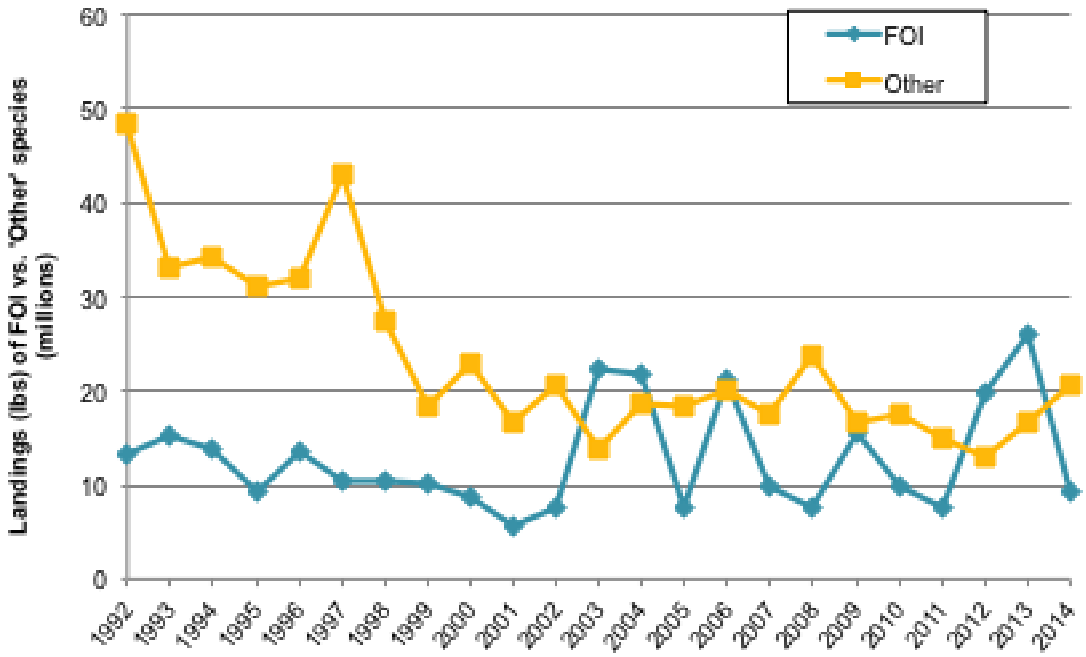
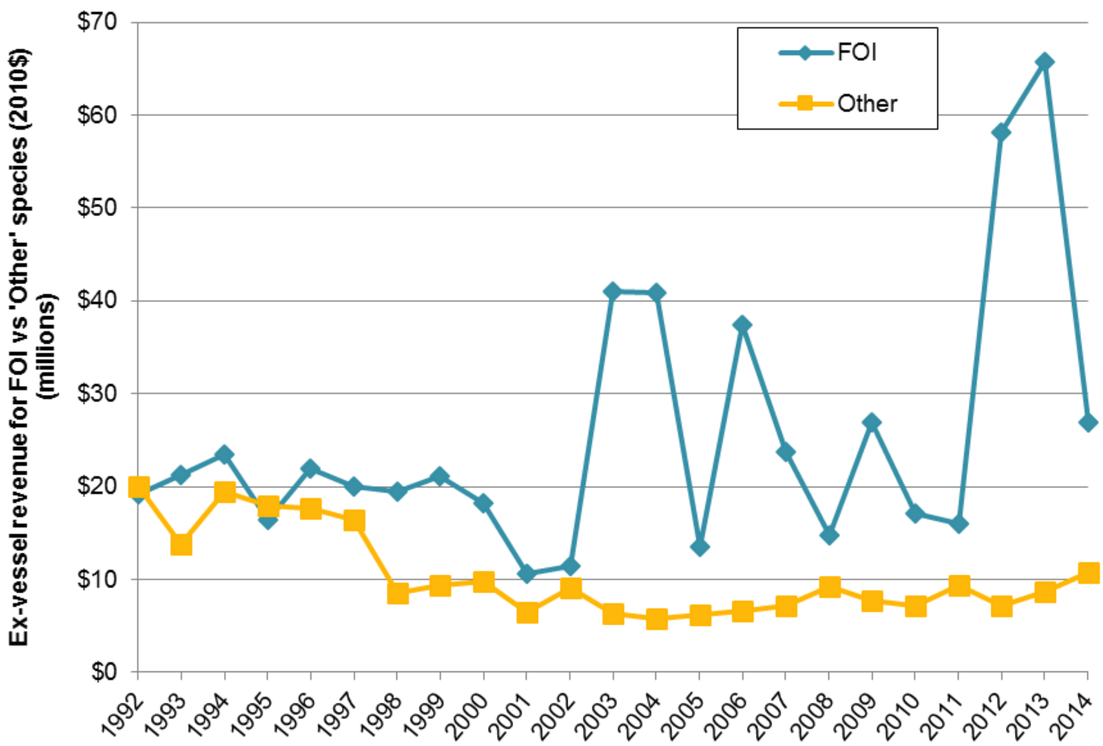


Figure 8. 'Other' fisheries vs fisheries of interest ex-vessel revenue in the North Coast region, 1992–2014



In Figure 9 and Figure 10 we refine our look at total North Coast regional landings and ex-vessel revenue for the commercial fisheries of interest. Most notably, one can see that the Dungeness crab fishery made up the great majority of landings and ex-vessel revenue throughout the study period. The Dungeness crab fishery on average represented 71% of total landings and 79% of total ex-vessel revenue throughout the study period. In 2013, a high of 20.9 million pounds of Dungeness crab were landed, which brought in $54.3 million of total ex-vessel revenue.

Fishermen noted that in 2012 and 2013 the price per pound for Dungeness crab increased significantly compared to recent previous years. However, in 2014 there was a decrease in pounds landed and revenue in the Dungeness crab fishery due to a delay in the commercial season opening. From 1992-2014, a combined total of 222 million pounds were landed within the Dungeness crab fishery.

Urchin-dive and salmon-troll were the other key constituents to total landings and ex-vessel revenue in the region's fisheries of interest during the study period. There were several years during the study period in which salmon landings were nearly completely absent. Fishermen noted that the salmon-troll fishery was quite weak in 2006 and was essentially closed in 2008-2009.

Moreover, fishermen informants stated that 2010 was a very poor year for the fishery as well, which is reflected in the near total lack of salmon landings in those years. The urchin and salmon fisheries brought in an annual average of 19% and 5% of the total landings, respectively, and 11% and 8% of annual ex-vessel revenue from 1992-2014.

Figure 9. North Coast region commercial landings for fisheries of interest, 1992–2014

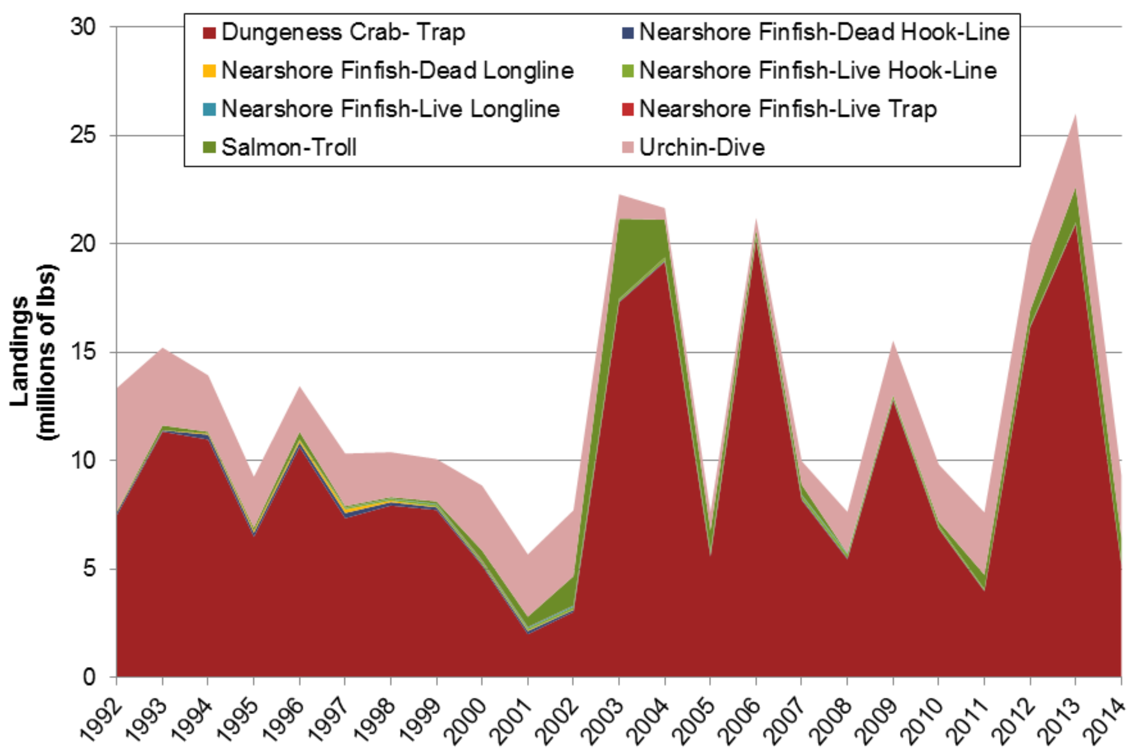
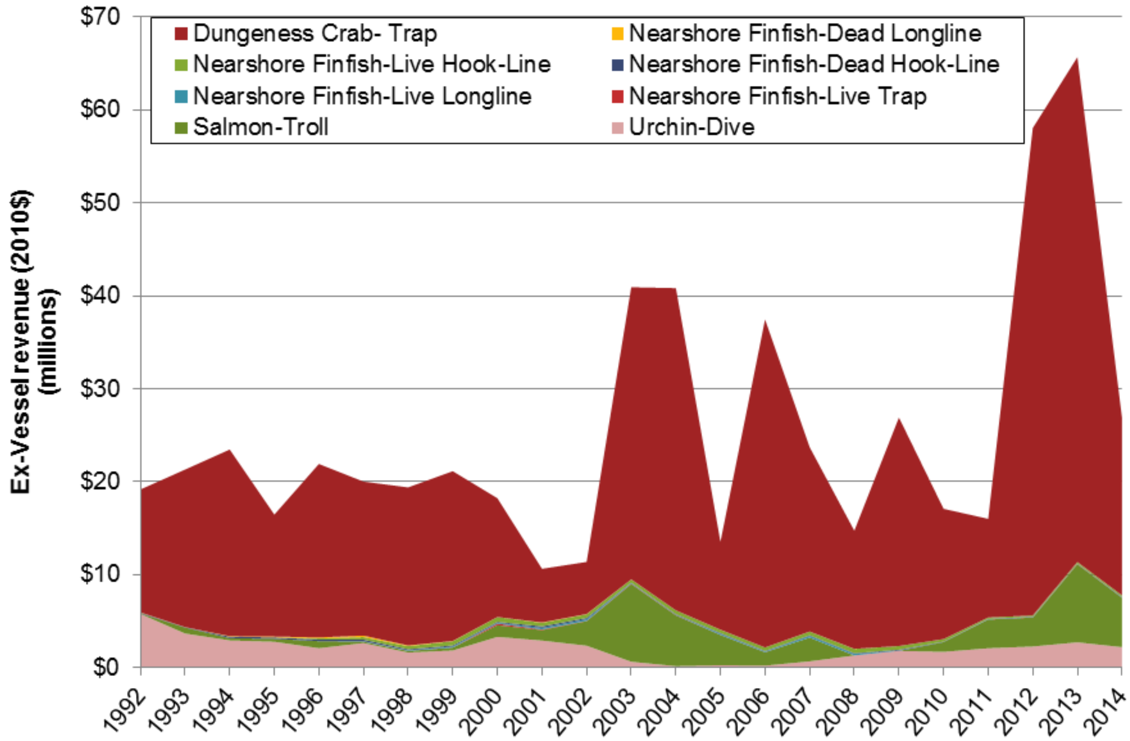


Figure 10. North Coast region commercial ex-vessel revenues for fisheries of interest, 1992–2014



The number of regional commercial fishermen active in each fishery of interest is described in Figure 11**.** One can see that the number of fishermen targeting Dungeness crab and urchin declined precipitously in the first 10 years of the study period and generally stabilized thereafter. Participation in the Dungeness crab fishery declined from a high of 659 in 1993 to only 247 in 2014. Fishermen in the urchin-dive fishery also peaked at 420 in 1992, but declined to just 55 in 2014. The number of commercial fishermen targeting salmon fluctuated with no clear pattern, with the fluctuations generally corresponding to the quality of salmon fishing opportunities and the extent of season openings.

The price per pound for each of the fisheries of interest over the study period is summarized in Figure 12. One can see that average prices (in constant 2010 dollars) were relatively steady over the study period, with most prices modestly rising over time. The highest price within the fisheries of interest was $5.72 per pound in 2007 for salmon, while the lowest value was $0.35/lb. for urchin in 2004.

Figure 11. North Coast region, number of commercial fishermen participating in each fisheries of interest, 1992-2014

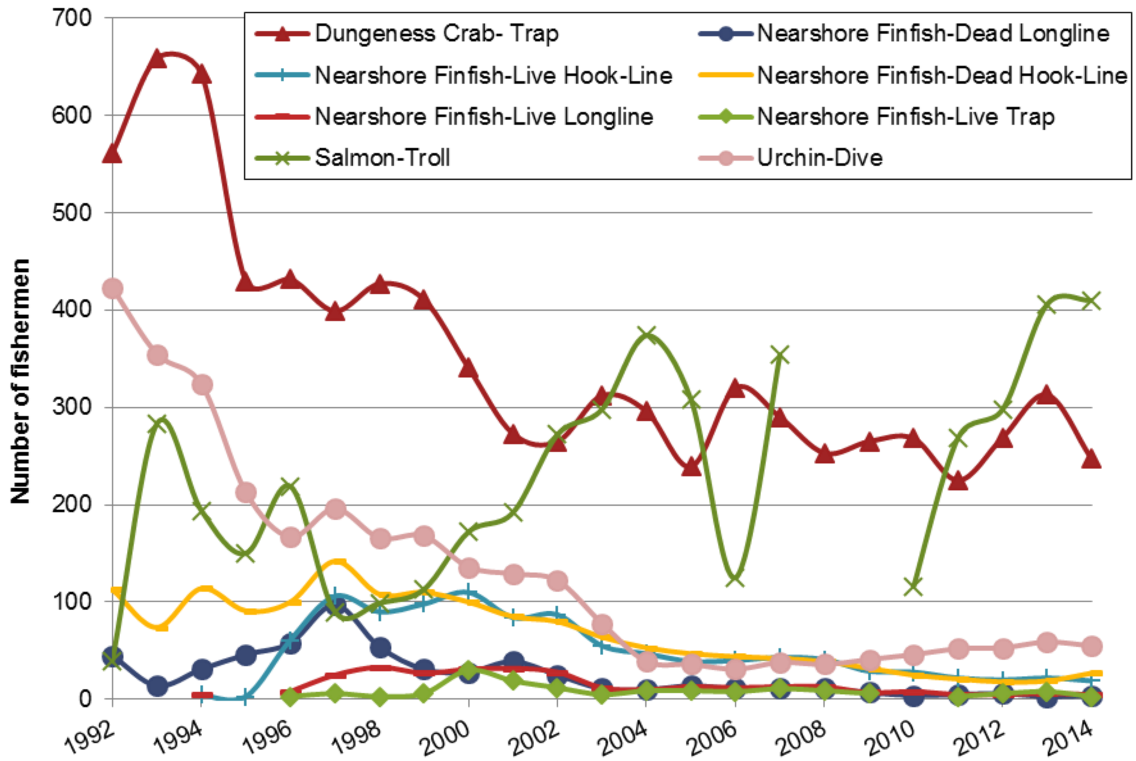
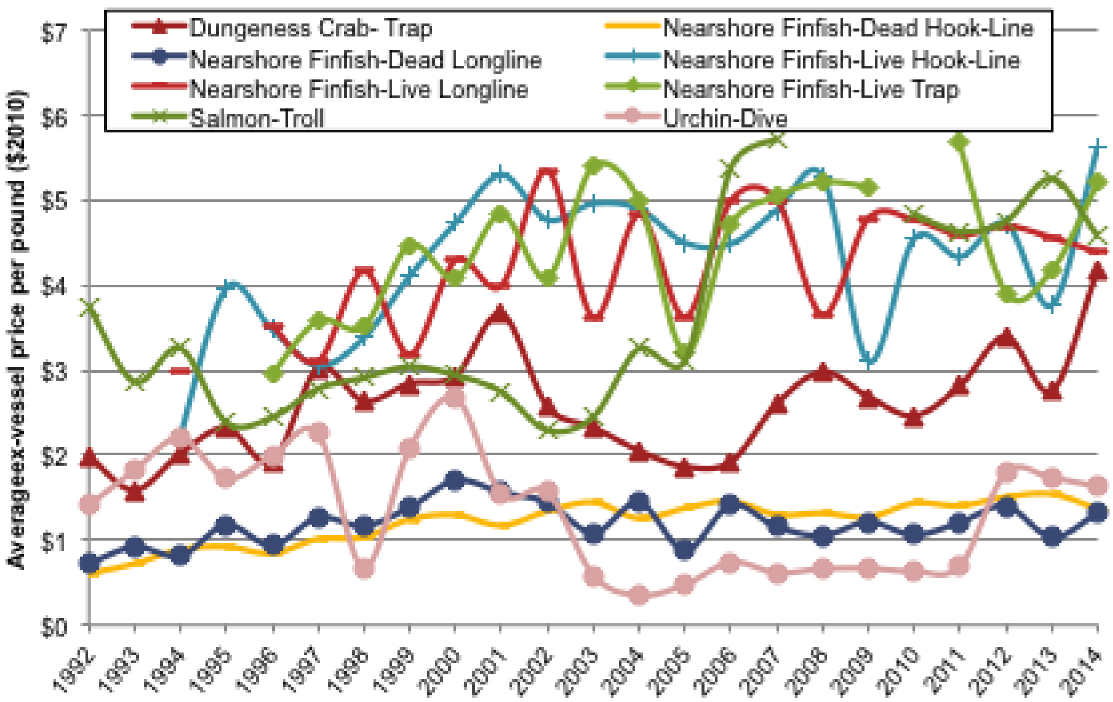


Figure 12. North Coast region average ex-vessel prices for commercial fisheries of interest, 1992-2014



From Figure 13 one can see that Crescent City (39.0%) and Eureka (37.4%) were the ports with the highest average share of total regional commercial landings for all fisheries during the study period, while Shelter Cove (0.1%) and Albion (1.6%) brought in the smallest shares. Although Crescent City had the highest average share of total regional commercial landings, that share declined moderately during the study period. In Figure 14 we provide regional landings share data for our fisheries of interest. One key difference is Fort Bragg's higher share of landings for fisheries of interest, relative to all fisheries.

Figure 13. Commercial landings by North Coast region ports, all fisheries, 1992–2014

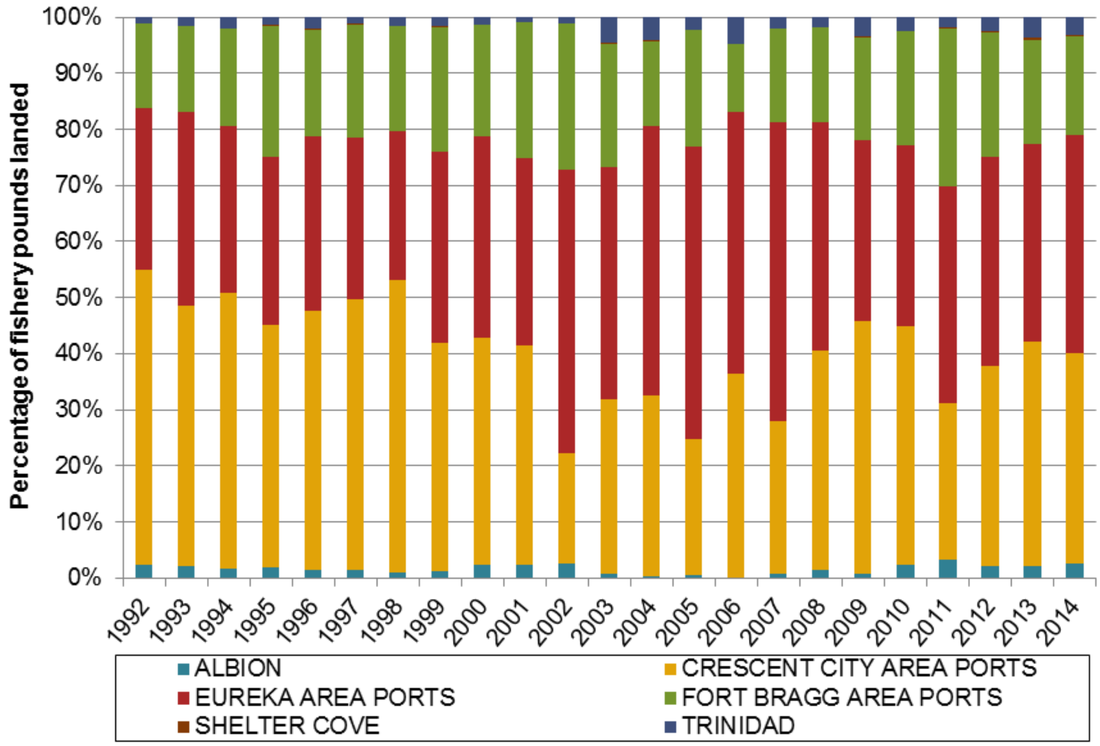
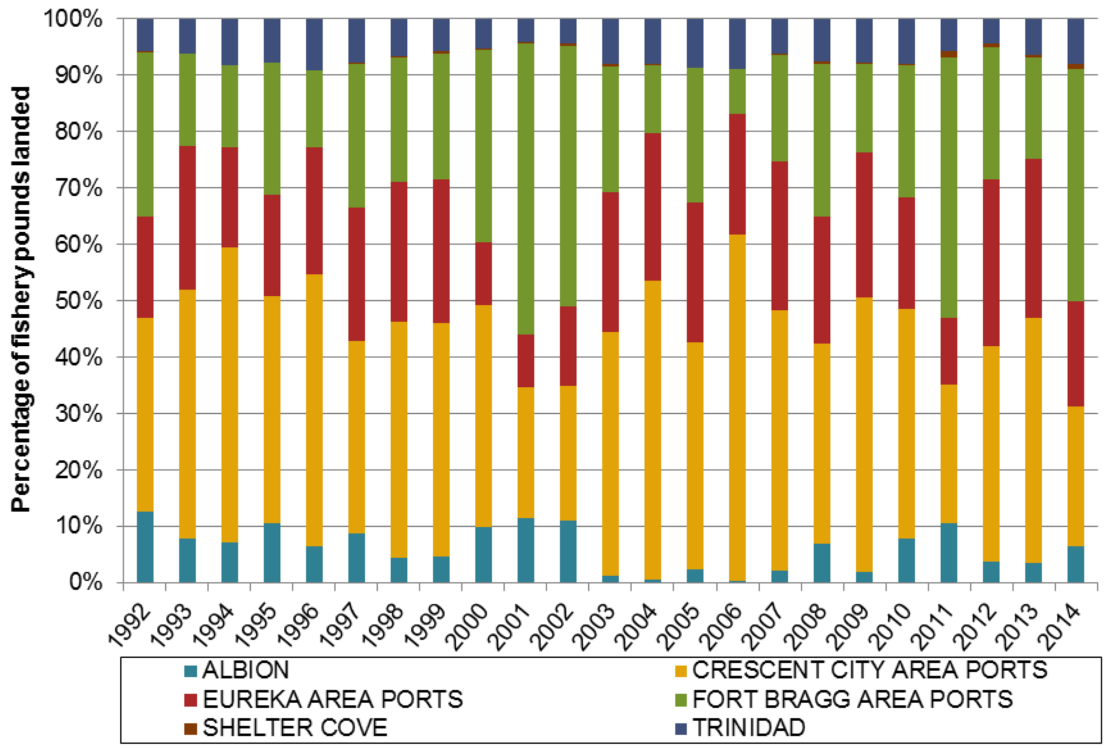


Figure 14. Commercial landings by North Coast region ports, fisheries of interest, 1992-2014



Similar to the data for regional shares of commercial landings, in Figure 15 and Figure 16 we show regional shares of ex-vessel revenue for all fisheries and for fisheries of interest. As with landings, Crescent City (39.2% and 43.5%) and Eureka (31.8% and 23.9%) generally brought in the highest share of annual average ex-vessel revenue for all fisheries and the fisheries of interest. Fort Bragg generally had a higher share of regional ex-vessel revenue for the fisheries of interest than for all fisheries. Albion's share of regional ex-vessel revenue generally declined over the study period.

Figure 15. Commercial ex-vessel revenue by North Coast region ports, all fisheries 1992–2014

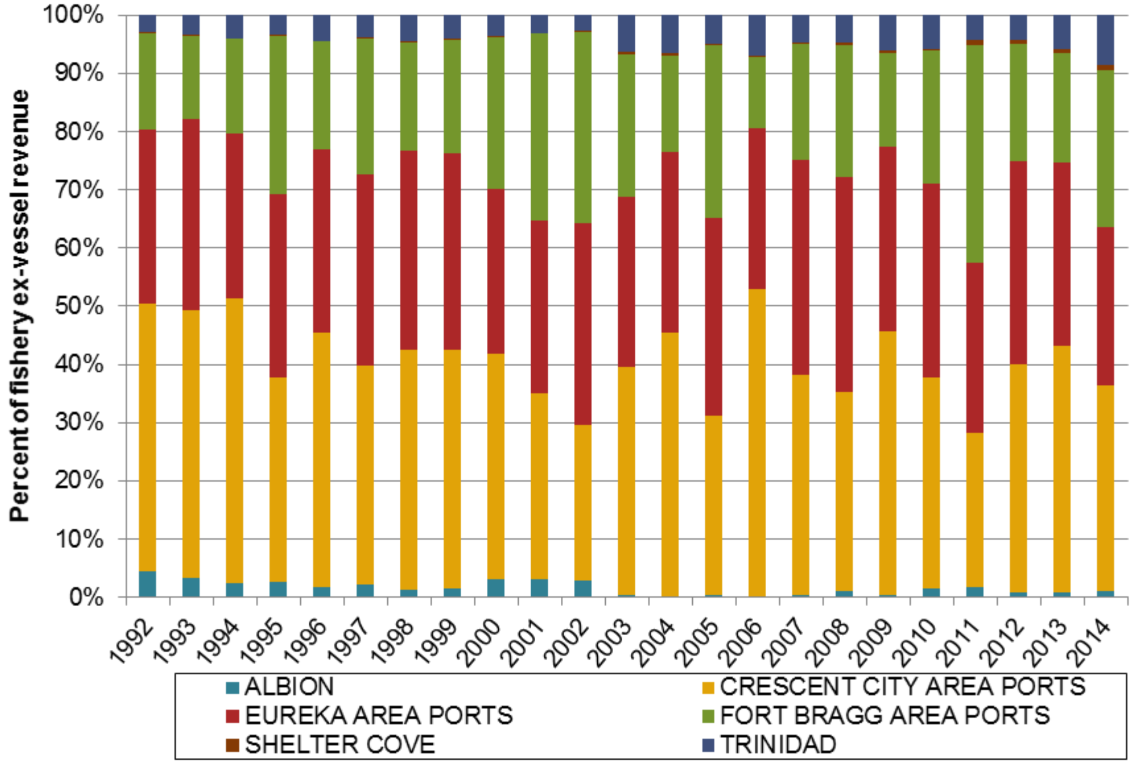
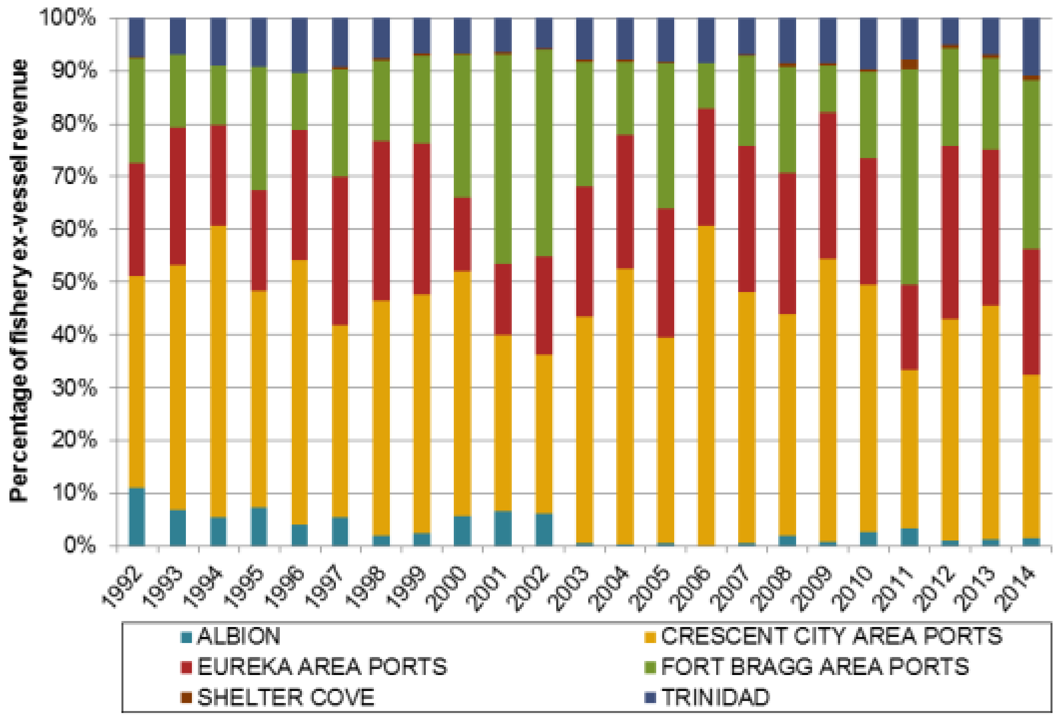


Figure 16. Commercial ex-vessel revenue by North Coast region ports, fisheries of interest, 1992-2014



4.3. North Coast CPFV Baseline Characterization

Commercial Passenger Fishing Vessel (CPFV) operations represent a relatively modest amount of fishing activity in the North Coast region, though CPFV activity has grown in recent years. In particular, there has been a rising number of CPFV operators in the North Coast region since the early 1990s, rising from approximately five in the late 1990s to 40 in 2014. There was a corresponding increase in total annual North Coast region CPFV trips in that time period (from fewer than 1,000 to nearly 6,000), though the average number of trips per vessel has declined since approximately 2006.

North Coast CPFV operators generally target rockfish, lingcod, and salmon, while their catch is dominated by rockfish, Dungeness crab, and salmon. CPFV activity in Eureka area ports has risen sharply since approximately 2006, and likewise in Trinidad since 2000. In contrast, CPFV activity in Fort Bragg peaked in the mid-2000s, declined along with salmon fishing opportunities at the time, but has recovered to roughly 1990s levels since 2010.

Establishing a baseline characterization of the North Coast region CPFV fleet provides a benchmark of economic conditions and spatial fishing patterns in which future MPA effects can be measured**.** In the CPFV baseline characterization sections found throughout this report we summarize the primary data collected from CPFV operator interviews carried out in the summer and fall of 2014.

We interviewed 15 CPFV owners/operators as shown in Table 21**,** and gathered information about their 2013 fishing year**.** All 15 were either owner/operators or operators who knew enough about the business to answer all questions contained in the interview. There were no CPFV operations in Albion or Crescent City; in Shelter Cove, only two CPFV operators completed interviews, thus the results are not displayed due to confidentiality constraints. Shelter Cove results are incorporated into region-wide summaries and averages.

As shown in Table 22, the average individual we interviewed was 44 years old, has 12.7 years of experience owning a CPFV boat (if applicable) and 9.5 years of experience operating a CPFV boat (if applicable). On average, respondents reported that 71.5 percent of their income came from operating and/or owning a CPFV boat. Additional sources of income are listed below in Table 23.

Table 21. Number of CPFV interviews completed, 2013 fishing year, North Coast region

Port	Individuals Interviewed
Eureka	4
Fort Bragg	5
Shelter Cove	2
Trinidad	4
Total	**15**

Source: Current study.

Table 22. CPFV Survey response statistics, North Coast region

	Response	Standard Deviation	Number Responding
Individuals Interviewed	15	--	--
Average age	44	13.7	15
Average number of years owning CPFV boat/s	12.7	12.0	12
Average number of years operating CPFV boat/s	9.5	7.5	15
Average percent income from CPFV operations in 2013	71.5%	29.7%	15

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 23. Sources of income in 2013 in addition to CPFV operation, North Coast region

Response	Number responding
River charter fishing business	1
Truck driving	1
Other misc full-time work (full-time)	1
Other misc work (part-time)	1
Sale of personal land	1
Commercial fishing	5
Total number responding (unique individuals)	**10**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in Table 24, the average CPFV owner/operator in the North Coast region reported earning a gross revenue (GR) of $84,300 in 2013. Additionally, respondents across the region reported they spent an average of 13.9 percent of their GR on fuel, 13.8 percent on crew, and 35.3 percent on other operational expenses. After deducting these three costs, respondents in the region made an average net revenue of $31,191 in 2013.

Table 24. Average gross revenue (GR) from CPFV to operating costs, North Coast region

	Number responding	Average response	Standard deviation
Total GR 2013	10	$84,300	$35,721
% GR to fuel	14	13.9%	8.7%
% GR to crew	14	13.8%	16.2%
% GR to all other operating costs	14	35.3%	17.4%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All 15 respondents operated consumptive trips (e.g., fishing trips) in 2013, while 10 respondents also operated non-consumptive trips (e.g. whale watching or sunset cruises), as shown in Table 25. On average, consumptive trips were conducted more frequently, were more expensive, and had more passengers per trip than non-consumptive trips.

For example, whereas the average price of consumptive trips was $136 per passenger, for non-consumptive trips it was $83 per passenger. Consumptive trips also tended to have more passengers (7.3 on average) as compared to non-consumptive trips (5.8 on average). Also, the average annual number of consumptive trips taken by CPFV operators far outstripped the average annual number of non-consumptive trips (110.1 vs. 15.9, respectively).

Table 25. CPFV trip statistics, 2013, North Coast region

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	15	--	--	10	--	--
Average number of trips	14	110.1	40.2	9	15.9	22.8
Average number of passengers (per trip)	15	7.3	3.4	10	5.8	5.6
Average price per passengers (per trip)	15	$136	$54	8	$83	$71
Average number of crew (per trip)	14	0.7	0.6	9	0.7	0.5

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

One can see from Table 26 that salmon was targeted by the largest number of CPFV respondents on consumptive trips (15), and on average drew the largest number of CPFV fishing days (61.9 on average). Salmon also generated the largest percentage of gross revenue (39.7 percent) compared to other target fisheries and activities.

Of all consumptive trips, tuna/dorado drew the smallest number of fishing days (12.7 percent) and the smallest percentage of gross revenue (10.7%). The only reported non consumptive trip type was whale watching, with four respondents indicating they conducted whale watching trips in 2013. These trips generated an average of 11.3 percent of the average respondents' GR, respectively.

Table 26. Number of days and percentage of GR targeting fishery/activity in 2013, CPFV, North Coast region

			Number of days targeting species (2013)			Share of GR from fishery/activity (2013)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	California halibut	1	1	*	--	1	*	--
	Dungeness crab	8	8	43.5	18.6	8	22.0%	11.3%
	Pacific halibut	11	11	14.4	14.3	11	18.1%	21.3%
	Rockfish/lingcod	14	14	53.4	29.7	14	35.8%	23.1%
	Salmon	15	15	61.9	26.8	15	39.7%	20.3%
	Tuna/dorado	4	4	12.7	5.9	4	10.7%	12.5%
Activity	Whale watching	4	4	41.7	17.6	4	11.3%	7.8%
All target fisheries (unique individuals)		**15**	**15**	**43.8**	**29.3**	**15**	**28.3%**	**21.8%**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 27 we summarize the reported effects of MPAs on specific CPFV fisheries in the North Coast region in 2013, as reported to us by CPFV operators interviewed for this report. In general, the rockfish/lingcod fishery was the most strongly affected by MPAs, with 78.6% of respondents indicating that MPAs had effected the fishing in this fishery.

CPFV operators were asked for specific effects of MPAs on their operations as an open-ended question. Of the specific effects described by respondents, the most commonly cited for rockfish/lingcod fishermen was answer A, "Cannot fish in or go to traditional grounds/areas" (78.6%). The second-most common was answer D, "Need to travel longer distances to fish" (42.9%). For the remaining fisheries, less than half of all respondents indicated that MPAs had affected that fishery. The second-most affected fishery was Pacific halibut, with 27.3% of respondents indicating that MPAs had affected the fishery. The salmon fishery was affected the least (13.3% of respondents).

Table 27. Direct effects of MPAs on specific fisheries, 2013, North Coast region

	Fishery/Activity	Number of respondents	Have MPAs effected your fishing?	A	B	C	D	E
Fishery	California halibut	1	--	--	--	--	--	--
	Dungeness crab	8	--	--	--	--	--	--
	Pacific halibut	11	27.3%	27.3%	--	--	--	9.1%
	Rockfish/lingcod	14	78.6%	78.6%	7.1%	--	42.9%	21.4%
	Salmon	15	13.3%	13.3%	6.7%	--	6.7%	--
	Tuna and dorado	4	25.0%	25.0%	--	--	25.0%	--
Activity	Whale watching - Activity	4	--	--	--	--	--	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Shifted fishing effort into areas in which weather is less predictable
C	Moved homeport location or fish out of another port
D	Need to travel longer distances to fish/conduct activity in other areas
E	Other ways directly/indirectly effected by MPAs

In Table 28 we report responses regarding which MPAs affected specific CPFV fisheries in 2013. As Table 27 above indicates, the rockfish/lingcod fishery was most affected by MPAs. From Table 28 one can see that those targeting rockfish/lingcod were affected by the largest number of individual MPAs as well (11 total). In general, the MPA that affected the most respondents from all fisheries, as well as rockfish/lingcod specifically, was answer C, Ten Mile SMR. Four respondents from the rockfish/lingcod fishery, and two respondents from the salmon fishery, indicated that Ten Mile SMR had affected their fishery. Three respondents from the rockfish/lingcod fishery indicated that Reading Rock SMR had affected their fishery.

Table 28. Which MPAs have affected specific CPFV fisheries, 2013, North Coast region

	Fishery/Activity	A	C	E	G	I	L	O	R	U	V	Z	AA
Fishery	California halibut	--	--	--	--	--	--	--	--	--	--	--	--
	Dungeness crab	--	--	--	--	--	--	--	--	--	--	--	--
	Rockfish/lingcod	1	4	1	1	2	3	--	1	1	2	1	1
	Salmon	--	2	--	--	--	--	1	--	--	--	--	--
Activity	Whale watching	--	--	--	--	--	--	--	--	--	--	--	--
All target fisheries (unique individuals)		**1**	**4**	**1**	**1**	**2**	**3**	**1**	**1**	**1**	**2**	**1**	**1**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Point Cabrillo SMR	**O**	Ten Mile Beach SMCA
B	Klamath Rock Special Closure	**P**	Sea Lion Gulch SMR
C	Ten Mile SMR	**Q**	Vizcaino Rock Special Closure
D	South Humboldt Bay SMRMA	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

4.4. North Coast CPFV: Initial Changes

Reported changes in percentage of income respondents derive from CPFV operations by fishery from 2009 (pre MPA period) to 2013 (post MPA period) in the North Coast region is summarized in Table 29. Across all fisheries/activities, the largest group of respondents (42.9%) indicated no change in the percentage of their income from CPFV operation between 2009 and 2013. The next largest group, 21.4%, indicated 'Significantly higher' income in 2013 as compared to 2009; the next largest two groups, each with 14.3% of respondents, indicated 'Somewhat higher' and 'Significantly lower'. Within specific activities, Pacific halibut fishermen stated that their percentage of income from CPFV operation was 'Significantly higher' in 2013 (30%), while tuna and dorado fishermen stated that it was 'Significantly lower' (66.7%).

Table 29. Change in share of income from Commercial Passenger Fishing Vessel (CPFV) from 2009 to 2013, North Coast region

	Fishery/Activity	Number of responses	Percent response: Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
Fishery	California Halibut	15	--	*	--	--	--
	Dungeness Crab	7	--	28.6%	42.9%	14.3%	14.3%
	Pacific Halibut	10	30.0%	10.0%	30.0%	10.0%	20.0%
	Rockfish/Lingcod	13	15.4%	15.4%	46.2%	7.7%	15.4%
	Salmon	14	21.4%	14.3%	42.9%	7.1%	14.3%
	Tuna and Dorado	3	--	33.3%	--	--	66.7%
Activity	Whale Watching	4	--	25.0%	50.0%	25.0%	--
All fisheries/activities (unique individuals)		**15**	**21.4%**	**14.3%**	**42.9%**	**7.1%**	**14.3%**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In addition to indicating a perceived change, respondents were asked an open-ended question about what factors they felt had contributed to the change in the share of their income coming from CPFV operations. Factors reportedly causing changes in the share of overall income from operating CPFVs between 2009 and 2013 across the North Coast region are given in Table 30. The responses varied widely, and the most common "Other" response was that the respondent did not own a CPFV vessel in 2009 (3 responses).

Table 30. Factors causing changes in the share of overall income from CPFV, 2009-2013, North Coast region

Response	**Number responding**
Changes in the market/economy	1
Changes in fish abundance/presence	2
Changes in regulations	1
Personal reasons	2
Other	10
Total number responding (unique individuals)	**15**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

All CPFV operators were asked to compare the number of consumptive and non-consumptive trips taken in 2013 to that of the previous five years. As shown below in Table 31, individuals were given the option of responding in one of the following categories: 1) Significantly higher; 2) Somewhat higher; 3) No change; 4) Somewhat lower; and 5) Significantly lower.

All told, 44.4 percent of Pacific halibut operators indicated that the number of trips for this fishery has been significantly higher and 22.2 percent reported that the number of trips was 'Somewhat higher' when comparing 2013 to 2009. Pacific halibut also contained the largest group of fishery respondents that reported that the number of trips was 'Somewhat lower' (22.2%), However. Dungeness crab was the fishery in which the largest group of respondents perceived 'No change' in the number of trips (33.3%).

Table 31. Changes in the number of trips, 2009 to 2013, North Coast region

	Fishery/Activity	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower
Fishery	California Halibut	1	--	*	--	--
	Dungeness Crab	6	--	50.0%	33.3%	16.7%
	Pacific Halibut	9	44.4%	22.2%	11.1%	22.2%
	Rockfish/Lingcod	12	25.0%	33.3%	25.0%	16.7%
	Salmon	13	30.8%	30.8%	23.1%	15.4%
	Tuna and Dorado	3	33.3%	66.7%	--	--
Activity	Whale Watching	4	--	50.0%	25.0%	25.0%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

CPFV respondents' perceptions of success in specific fisheries or non-fishing activities in 2013 in comparison to the last ten years are summarized in

Table **32**. For two of the fisheries, the largest group of respondents indicated that the level of success was ‘The same’ in 2013 in comparison to the last ten years. These fisheries were Pacific halibut and rockfish/lingcod. For Dungeness crab, the largest group of respondents indicated that success was either ‘The same’ or ‘Significantly worse’ (33.3% each). For salmon, the largest group of respondents indicated that success was ‘Significantly better’ or ‘Somewhat better’ (28.6% each).

Table 32. Perceived success in fishery/activity in 2013 compared to last ten years, CPFV, North Coast region

	Fishery	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	California halibut	1	--	--	--	*	--	--
	Dungeness crab	6	--	16.7%	16.7%	33.3%	--	33.3%
	Pacific halibut	8	18.2%	18.2%	--	27.3%	--	9.1%
	Rockfish/lingcod	13	7.7%	--	15.4%	46.2%	15.4%	15.4%
	Salmon	14	7.1%	28.6%	28.6%	21.4%	14.3%	--
	Tuna and dorado	2	--	--	*	*	--	--
Activity	Whale watching	3	--	--	--	33.3%	--	66.7%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

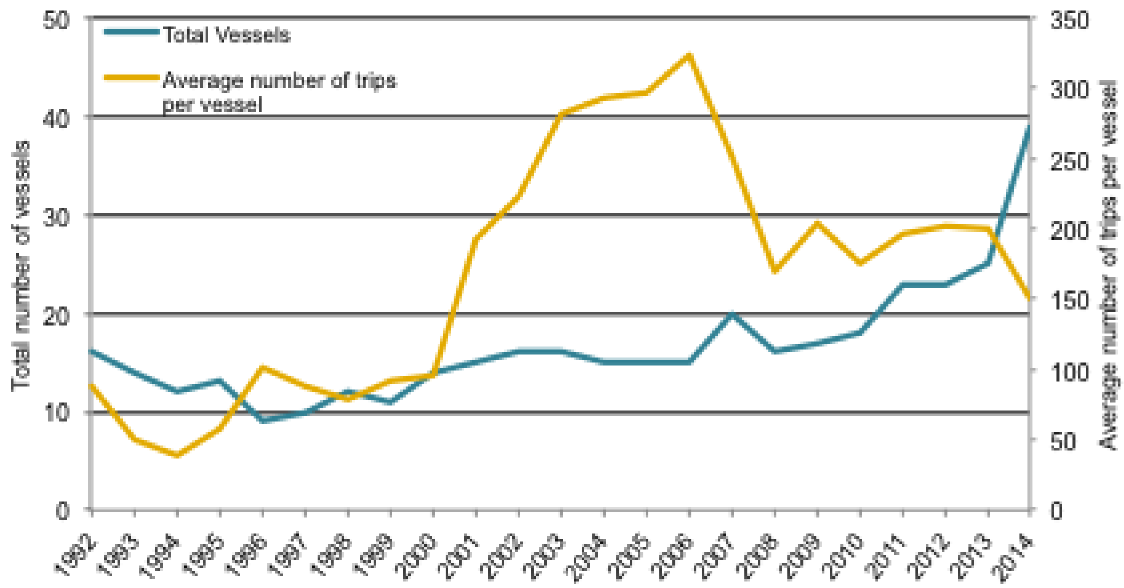
** indicates data were collected but cannot be shown due to confidentiality constraints*

Summary information on the total number of CPFV vessels and the average number of trips per vessel for the North Coast region in Figure 17. For the entire 1992 to 2014 study period in the North Coast region, on average there were 28,235 anglers taking a total of 2,934 trips per year, serviced by an average of 14 CPFV vessels each making on average 211 annual trips and carrying an average of 9 anglers per trip.

One can also see the trend in numbers of CPFV vessels in the region in Figure 17. The total number of CPFV vessels working out of Northern California ports initially decreased to a low of 9 vessels in 1996, and thereafter remained a fairly modest rise in the number of vessels with a peak of 39 vessels in 2014.

The average annual number of trips per vessel generally increased from its overall low in 1994 (38 trips) until 2006 where the trend peaked at 324 trips. Starting in 2007, there was a steep decline, and, with the exception of 2009, the downward trend continued until the end of the study period, where the average annual number of CPFV trips was 151.

Figure 17. Total number of CPFV vessels and average number of trips per vessel, North Coast region, 1992-2014



The total annual number of CPFV trips in the region generally increased over the study period, from fewer than 500 in the mid- 990s to nearly 6,000 in 2014, as shown in Figure 18. The average number of anglers per trip started and ended the study period at around 7-8, with a peak value of about 12 in the 2000s.

From Figure 19 one can see that the total annual number of anglers on regional CPFV trips, and the average annual number of anglers per vessel, both peaked just prior to the salmon closures, followed by sharp declines. While the total number of anglers on regional CPFV trips began recovering after 2010, the average annual number of anglers per CPFV vessel remained relatively steady around approximately 1,5000 anglers per vessel, reflecting the even greater increase in the number of regional CPFV operators since 2010.

Figure 18. Total number of CPFV trips and average number of anglers per trip, North Coast region, 1992-2014

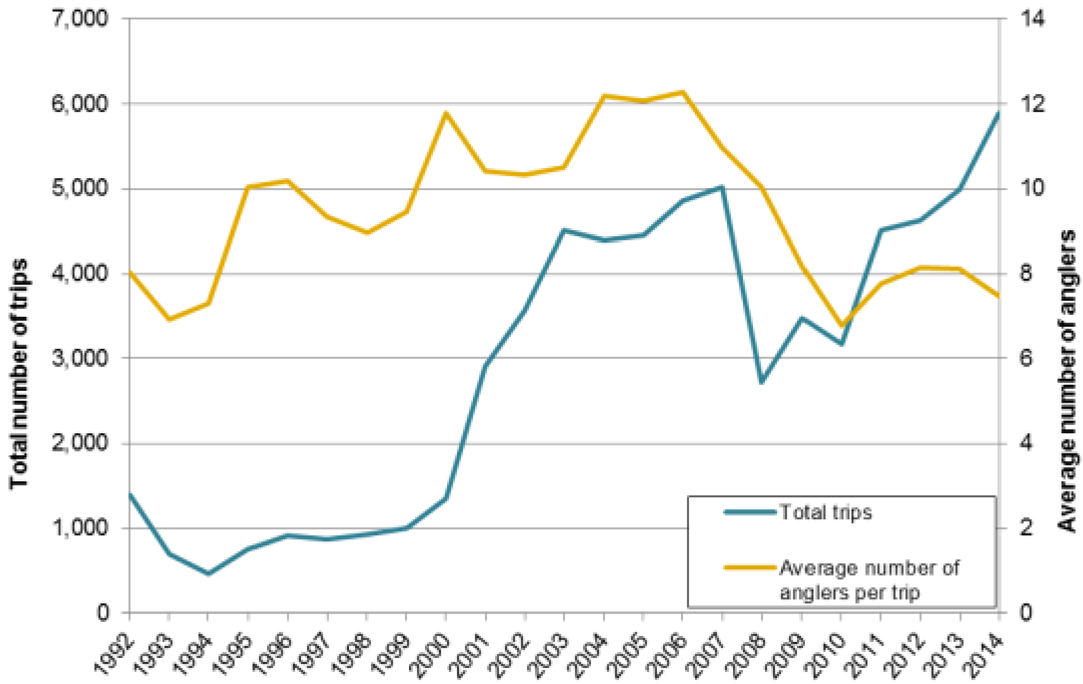
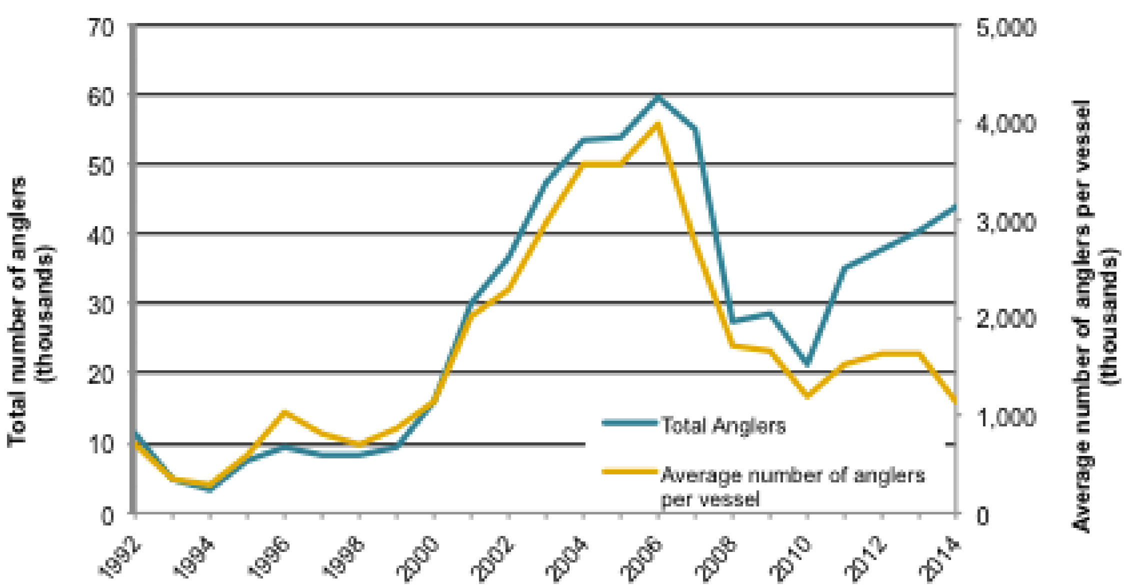


Figure 19. Total number of CPFV anglers and average number of anglers per vessel, North Coast region, 1992-2014



Most of the fish caught by anglers on regional CPFV trips were in the rockfish group at 864,215 fish together comprising 70.8% of the total, as shown in Figure 20. Dungeness crab and salmon were the other major constituents of the regional CPFV catch. The maximum observed CPFV catch value was in 2006 at 92,670 fish, while the minimum observed value was in 1994 at 13,070 fish. Please note that not all fisheries are displayed in Figure 20.

CPFV target fisheries data is provided in Figure 21. Note that data were suppressed for 1992-1994 to protect confidential information. The most targeted CPFV fishery was the rockfish group making up an average of 51% of trips from 1995-2014, followed by salmon and lingcod.

Albacore Tuna was the least frequently targeted fishery with an average of just 0.4% of all targeted trips throughout the study period. All fisheries experienced a sharp decline in 2008 due to the salmon closure. Lingcod and rockfish group show a brief one-year increase following the salmon fishery collapse of 2008. All fisheries subsequently rebounded in 2011 and reached a combined total of 9,265 trips by 2014.

Information on the average annual change in the number of vessels, trips, and anglers over the study period is given in
Figure 22. These data indicate what has already been pointed out, namely the general rise in CPFV activity, punctuated by the decline in activity during the salmon closure period, and the subsequent recovery thereafter.

Figure 20. CPFV total number of fish caught for each fishery, North Coast region, 1992-2014

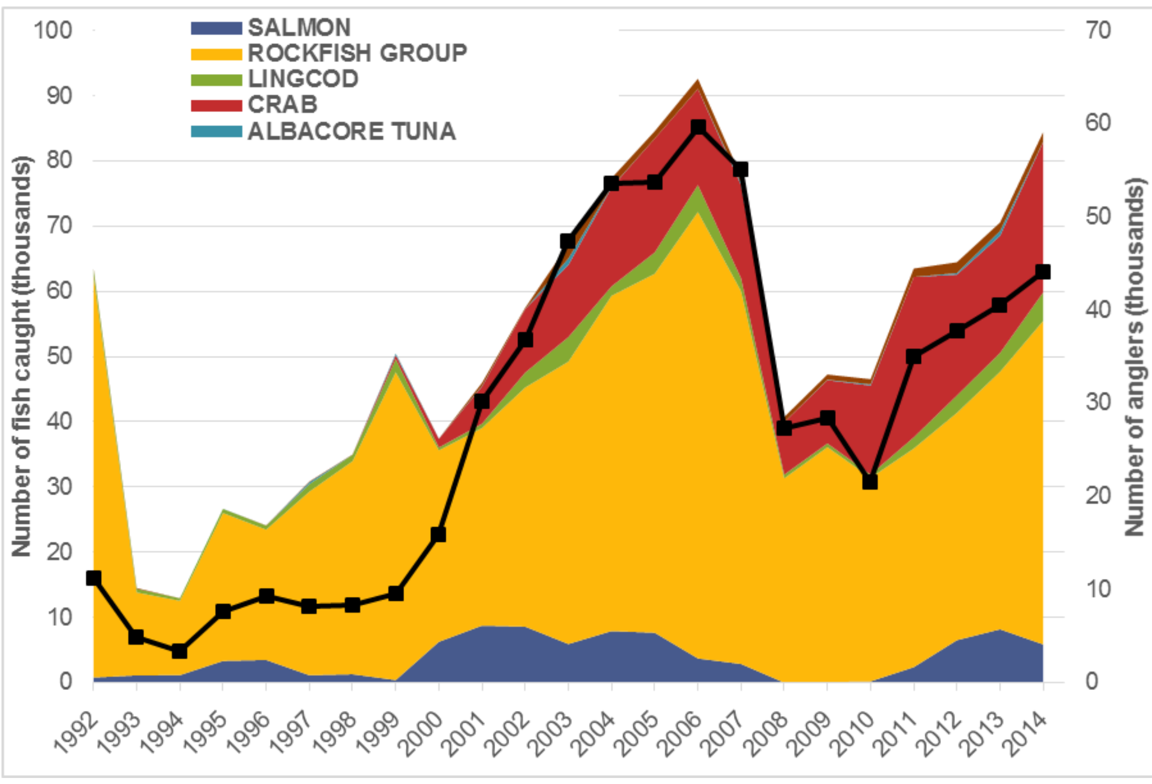


Figure 21. Total number of CPFV trips for each target fishery, North Coast region, 1992-2014

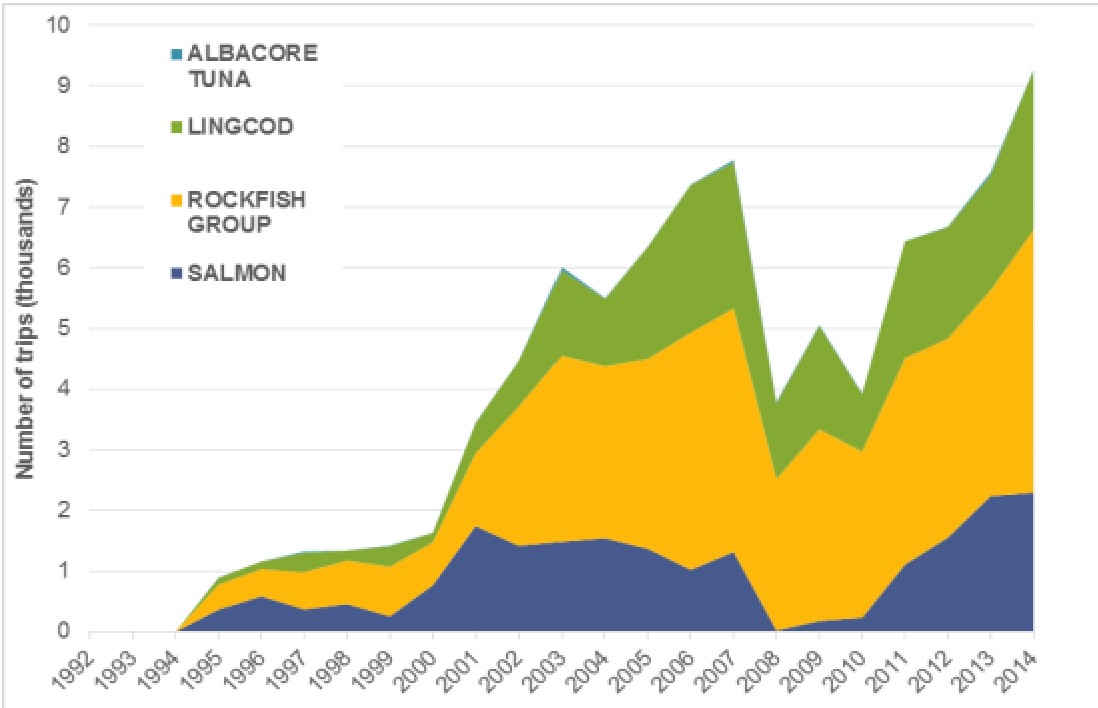
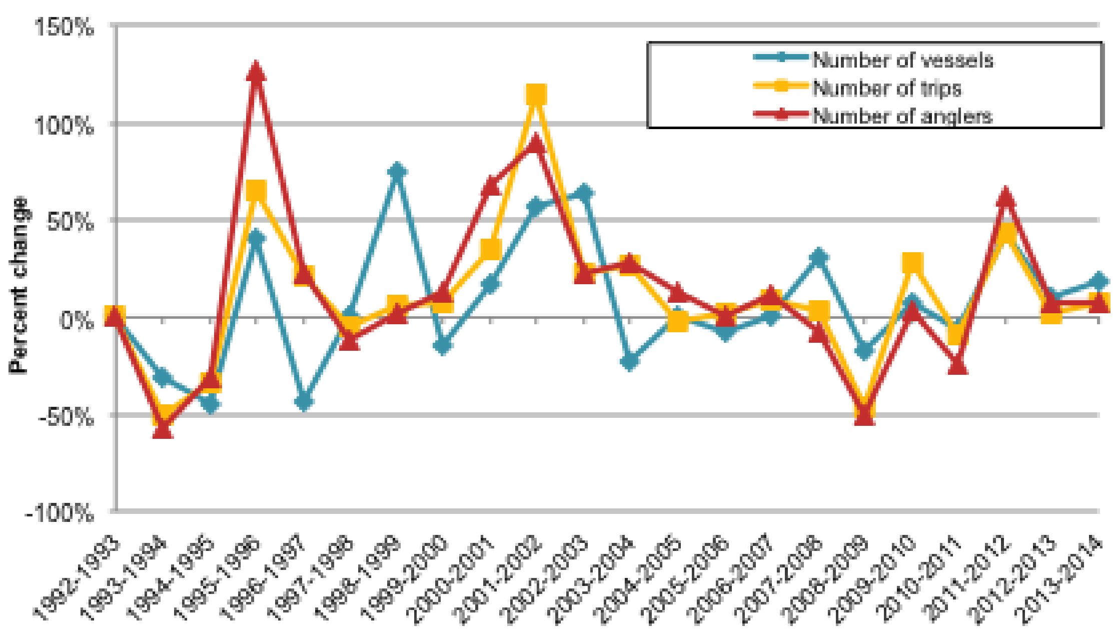


Figure 22. Percent change in number of vessels, trips, and anglers, North Coast region, 1992-2014



5. ALBION PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

The port of Albion, California is the southernmost port of the North Coast region located at the mouth of the Albion River in Mendocino County, 16 miles south of Fort Bragg. Fishing is an important part of the social economic fabric of the community of Albion. The port has tended to be a home for smaller-scale, community-based fishing operations, as geographical limitations prevent larger vessels from operating there.

The Mendocino County General plan notes that Albion's shallow harbor entrance limits vessel size and requires entry and exit at high tide. Facilities are minimal, and currently there is no assured public access to the water. The port includes a small number of boat slips and is next waterfront RV and tent campsites for rent.

The Mendocino County General Plan goes on to note that dredging, paved access, and slips with electricity and water are needed. In terms of land use, the flats area at Albion is reserved in the General Plan for industries that must be on or near the water, with principally permitted uses being fishing and boating uses, including boat mooring, launching, storage, servicing, supply, construction and repair. (County of Mendocino, 2009). The Census Bureau's American Community Survey estimated a 2015 population of 303 for the Albion Census Designated Place (United States Census, 2016).

The past decades have seen a decline in the number of commercial fishermen operating out of the port. In the early 1990's over 100 commercial vessels (in the fisheries of interest) operated out of Albion, in 2014, there were just 20 Albion-based commercial fishermen, who represented 2.6% of the region's total. The average age of Albion's fishermen is 62.8, and they have 29.5 years of experience on average. They are 8.9 years older than the regional average. Albion, unlike the other five North Coast ports, has not served as homeport for a CPFV operator over the entire study period.

In recent years Albion has been a regionally important urchin port, and has served as the homeport for 29.1% of the region's urchin divers. Urchin has been Albion's number one fishery, having brought in an average total annual ex-vessel revenue of $624,451 over the study period. Albion-based urchin divers have consistently landed urchin every year from 1992-2014, and they land more pounds of urchin than all the other fisheries in Albion combined. The loss of kelp due to El Nino has contributed to the lower landings of urchin in 2014, which has continued into the present according to FAC members from this port.

For the last 22 years, the nearshore fishery was second to the urchin fishery with the live fish landings and revenue on average 78% higher than dead landings. This port has historically had an average of 8,976 (1992-2014) pounds of live nearshore finfish landed annually. The live nearshore finfish market brings the highest price of all the fisheries here of $4.86 per pound.

Salmon ranked as the second highest landings after urchin in Albion for 2012-13, but in those years there were no landings for nearshore dead fish, so there was not a third place fishery. Years that had landings for live nearshore finfish were years that they were second only to urchin in terms of landings. In 2007-09 there were no Albion landings in the fisheries of interest. The changes in state regulation of rockfish in 2002 (Rockfish Conservation Areas) and salmon fisheries (2008-2009 closure) have affected the landings in this port as well as in the region.

Fishermen from Albion responded that they were directly affected by both Ten Mile SMR and Ten Mile SMCA. These MPAs effected the fishermen of Albion by needing to travel longer distances to fish in other areas, and in other ways not specified in their survey answers.

5.1. Albion Commercial Fishing Baseline Characterization

As shown in Table 33 below, the average age for commercial fishermen in Albion was 8.9 years older than the regional average, and average years of experience was 1.9 years longer than the regional average. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Please note that we only show the urchin dive fishery information. We interviewed 3 fishermen in total. One of the fishermen we interviewed participated in two fisheries, though we do not show that fishery information to preserve confidentiality. We do incorporate that information in table rows calculating information for ‘All target fisheries’.

Table 33. Average age and years of experience commercial fishing in 2013, Albion

	Age			Years of experience		
Fishery	**Number of respondents**	**Average**	**Standard Deviation**	**Number of respondents**	**Average**	**Standard Deviation**
Urchin - dive	3	62.3	7.6	3	26.7	14.7
All target fisheries (unique individuals)	**3**	**62.3**	**7.6**	**3**	**26.7**	**14.7**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As we show in Table 34, Albion fishermen reported that on average they made 92.5% of their total annual personal income from commercial fishing in 2013.

Table 34. Percent income from overall commercial fishing from 2013, Albion

Fishery	Number of respondents	Average	Standard Deviation
Urchin - dive	3	90.0%	17.3%
All target fisheries (unique individuals)	**3**	**90.0%**	**17.3%**

Source: Current study

Fishermen in Albion were asked what percentage of their gross fishing revenue was used for overall operating costs. As shown in

Table **35**, the average was 19.3%, with a total of three respondents. Urchin – dive fishermen reported a higher than average percentage (22.3%).

Table 35. Percentage of total gross fishing revenue used for overall operating costs in 2013, Albion

Fishery	Number of respondents	Average	Standard Deviation
Urchin - dive	3	22.3%	24.0%
All target fisheries (unique individuals)	**3**	**22.3%**	**24.0%**

Source: Current study

Fishermen were asked how many years of experience and how many days they spent targeting each of the fisheries in which they participated. In Table 36 one can see that the average years of experience targeting all target fisheries in Albion was 28.5 years, while the average annual number of days targeting specific fisheries was 55.0 days for all target fisheries.

Table 36. Years of experience and number of days targeting specific fisheries in 2013, Albion

	Years of experience			Number of days targeting specific fishery		
Fishery	Number of respondents	Average	Standard Deviation	Number of respondents	Average	Standard Deviation
Urchin - dive	3	32.7	5.0	3	60.0	18.0
All target fisheries (unique individuals)	**3**	**28.5**	**9.3**	**3**	**55.0**	**17.8**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
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Fishermen were also asked how many crew they used for each fishery and what share of their fishery-specific ex-vessel revenue was spent on their crew. Albion respondents reported using an average of 0.5 crew member and spending 7.8% of their fishing income on fuel, as one can see in Table 37 below.

Table 37. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Albion

	Number of crew			Percent revenue towards crew			Percent revenue towards fuel		
Fishery	Number of Respondents	Average	Standard Deviation	Number of Respondents	Average	Standard Deviation	Number of Respondents	Average	Standard Deviation
Urchin - dive	3	0.7	0.6	3	--	--	3	9.0%	5.3%
All target fisheries (unique individuals)	**3**	**0.5**	**0.6**	**3**	**--**	**--**	**3**	**7.8%**	**5.0%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen were also asked an open-ended question about whether MPAs had affected their fishing, and if so, what specific, direct effects MPAs had on particular fisheries in 2013. Answers are summarized in Table 38 below. Of the respondents who answered this question in Albion, 66.7% answered that MPAs had affected their fishing. Half gave answer A, "Cannot fish in or go to traditional grounds/areas", and the other half gave answer B, "Need to travel longer distances to fish in other areas", and 66.7% also gave answer E, "Other."

Table 38. Direct effects of MPAs on specific fisheries 2013, Albion

Fishery	Number responding	Have MPAs effected your fishing?	A	B	C	D	E
Urchin - dive	3	66.7%	33.3%	--	--	33.3%	66.7%
All target fisheries (unique individuals)	**3**	**66.7%**	**33.3%**	**--**	**--**	**33.3%**	**66.7%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly effected by MPAs

Respondents were asked which MPAs had effected their fisheries in 2013, and were provided with a comprehensive list of MPAs, given below. In Table 39 below we list the MPAs that our respondents cited as having effected specific fisheries in Albion during 2013. According to respondents, only two North Coast MPAs affected specific targeted fisheries in Albion (just one affected fishery was reported, urchin – dive). The MPAs affecting the urchin fishery were Ten Mile SMR and Ten Mile Beach SMCA.

Table 39. Which MPAs have affected specific fisheries 2013, Albion

Fishery	Number of respondents	B	O
Urchin - dive	2	1	1
All target fisheries (unique individuals)	**2**	**1**	**1**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure

G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were asked about the degree of importance and reasons of importance of participating in multiple targeted fisheries in their community. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 40 below, two responded this was Important and one responded it was Unimportant.

If fishermen responded that multi-fishery participation was very important or important, they were then asked why that was the case. The question was asked as an open ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer. The only answer provided was an “Other” categorized response.

Table 40. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Albion

	Degree of importance			**Reasons for importance**			
Fishery	**Number of respondents**	**Important**	**Unimportant**	**A**	**B**	**C**	**D**
Urchin - dive	3	1	2	--	--	--	1
All target fisheries (unique individuals)	**3**	**1**	**2**	**--**	**--**	**--**	**1**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, respondents were asked what strategies they used to market their catch. They were given ten possible responses, listed below as answers A through J. Respondents were allowed to provide more than one answer. As one can see in Table 41, all of the respondents cited either C, Sell to traditional processor; G, Sell to live fish buyers; or both.

Table 41. Strategies used to market catch in 2013, Albion

Fishery	Number of respondents	A	B	C	D	E	F	G	H	I	J
Urchin - dive	3	--	--	3	--	--	--	1	--	--	--
All target fisheries (unique individuals)	**3**	**--**	**--**	**3**	**--**	**--**	**--**	**2**	**--**	**--**	**--**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

5.1. Albion Commercial Fishing Initial Changes

Fishermen were also asked how they felt their income from commercial fishing had changed between 2009 and 2013. They were asked to select one of the following options; significantly higher, somewhat higher, no change, somewhat lower, or significantly lower. As shown below in Table 42, all respondents in all target fisheries perceived either no change, or lower. No respondents perceived any increase in personal income from commercial fishing in Albion.

Table 42. Perceived change in share of personal income from commercial fishing between 2009 to 2013, Albion

Fishery	Number of respondents	Significantly higher	Somewhat higher	No change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**3**	**--**	**--**	**33.3%**	**33.3%**	**33.3%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

In addition to indicating a perceived change, respondents were asked what factors they felt had contributed to the change in the share of their income coming from commercial fishing. This was asked as an open-ended question. In

Table **43** we list the reported reasons for the change as well as the number of responses for that reason for each fishery.

Table 43. Factors most affecting changes in share of personal income from commercial fishing between 2009 - 2013, Albion

Fishery	Number of respondents	A	B	C	D	E
All target fisheries (unique individuals)	**3**	**--**	**1**	**--**	**1**	**1**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Fishermen were asked separately for each fishery they participated in to compare his/her success in the fishery in 2013 to that of the last ten years. As shown in Table 44 below, respondents were given the option of responding in one of the following categories: 1) significantly better; 2) somewhat better; 3) the same; 4) somewhat worse; and 5) significantly worse. All respondents in Albion who answered this question gave answers 3 or 4: the same, or somewhat worse.

Table 44. Perceived success in fishing in 2013 compared to last ten years, Albion

Fishery	Number of respondents	No answer	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Urchin - dive	3	1	--	--	100.0%	--	--
All target fisheries (unique individuals)	**3**	**--**	**--**	**--**	**66.7%**	**33%**	**--**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point

Commercial landings, ex-vessel revenue, and number of fishermen for all fisheries in the North Coast port of Albion over the study period, 1992-2014, are given in Figure 23. The general trend is decline in numbers of commercial fishermen since 1997, and a decline in ex-vessel revenue with a minor rebound starting in 2010. Landings decreased overall by 65% from a high of 1.7 million pounds in 1992 to 595,000 pounds in 2014, with an overall low recorded in 2006 of only 44,000 pounds landed.

InFigure 24 we provide the same information as in Figure 23, except for fisheries of interest rather than all fisheries. Again, the overall trend is a decline in the number of active commercial fishermen and ex-vessel revenue in Albion.

From Figure 25 we can see the port of Albion's share of the North Coast region's total number of active commercial fishermen, ex-vessel revenue, and pounds of landings. In terms of annual averages, Albion contributed 6.2% of the region's landings, 3.3% of revenue, and 5.9% of the number of fishermen.

Figure 23. Commercial landings, ex-vessel revenues, and number of fishermen, 1992–2014, Albion, all fisheries

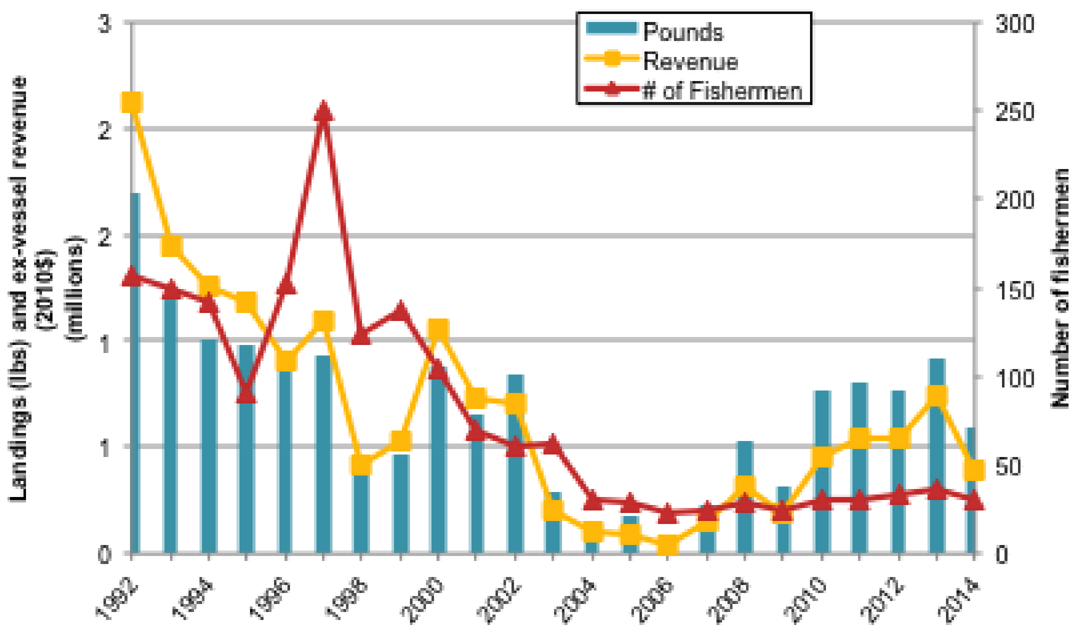


Figure 24. Commercial landings, ex-vessel revenues, and number of fishermen, Albion, 1992–2014, fisheries of interest

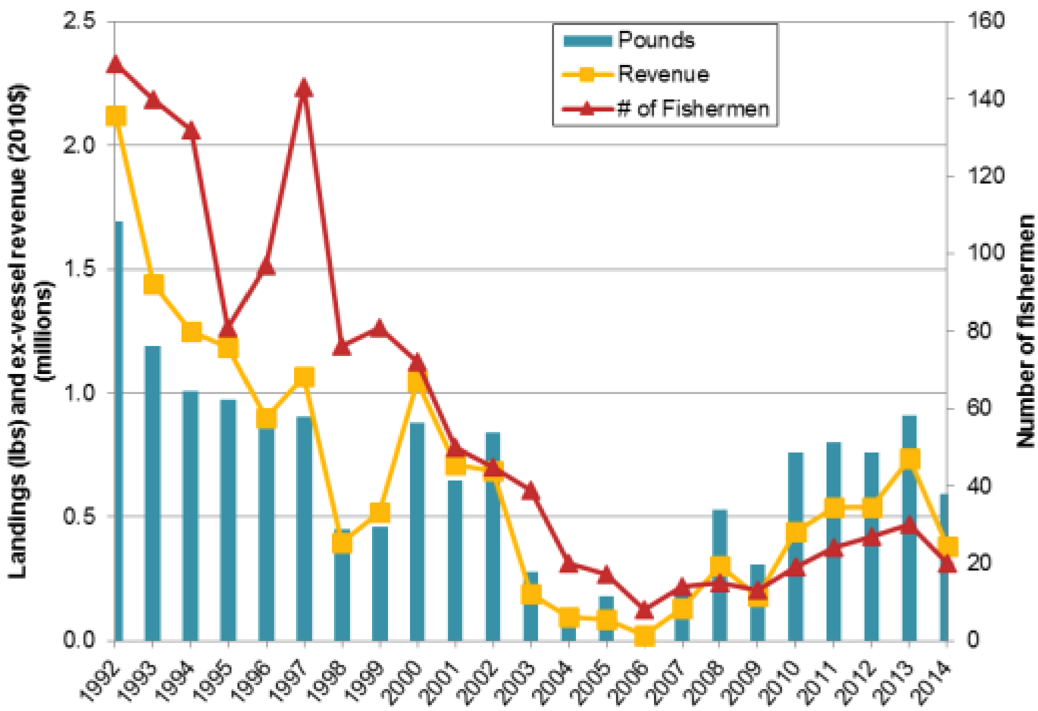
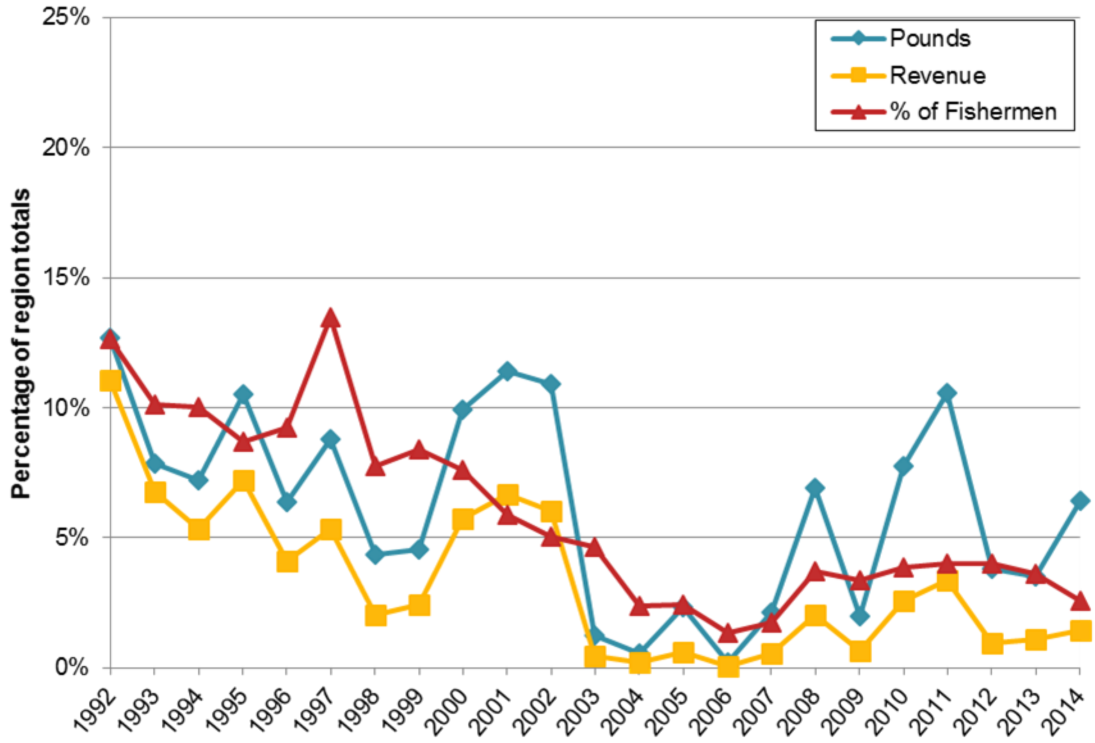


Figure 25. Fisheries of interest landings, revenue, and number of fishermen as a share of regional totals, Albion, 1992-2014



Urchin-dive has been by far the dominant fishery of interest throughout the duration of the study period in Albion, in terms of both landings and ex-vessel value as shown in Figure 26 and Figure 27. Peak landings during the study period totaled nearly 1.7 million pounds in 1992. Urchin diving generated almost $2.1 million in ex-vessel revenue in that year alone, and totaled over $14.3 million (Figure 27) over the entire duration of the study period.

As one would expect, the great majority of commercial fishermen in Albion were urchin divers during the study period (Figure 28). In 1996 there was a brief shift of effort targeted at the nearshore finfish- hook-line live fishery and, to a lesser extent, the nearshore finfish- hook-line dead fishery from 1996-1999. Commercial landings, ex-vessel revenue, and number of fishermen all experienced a decline from 1992-2006. After 2006 ex-vessel revenues and landings started to rebuild, but finished much lower than the overall peak in 1992.

Figure 26. Commercial landings for fisheries of interest, Albion, 1992-2014

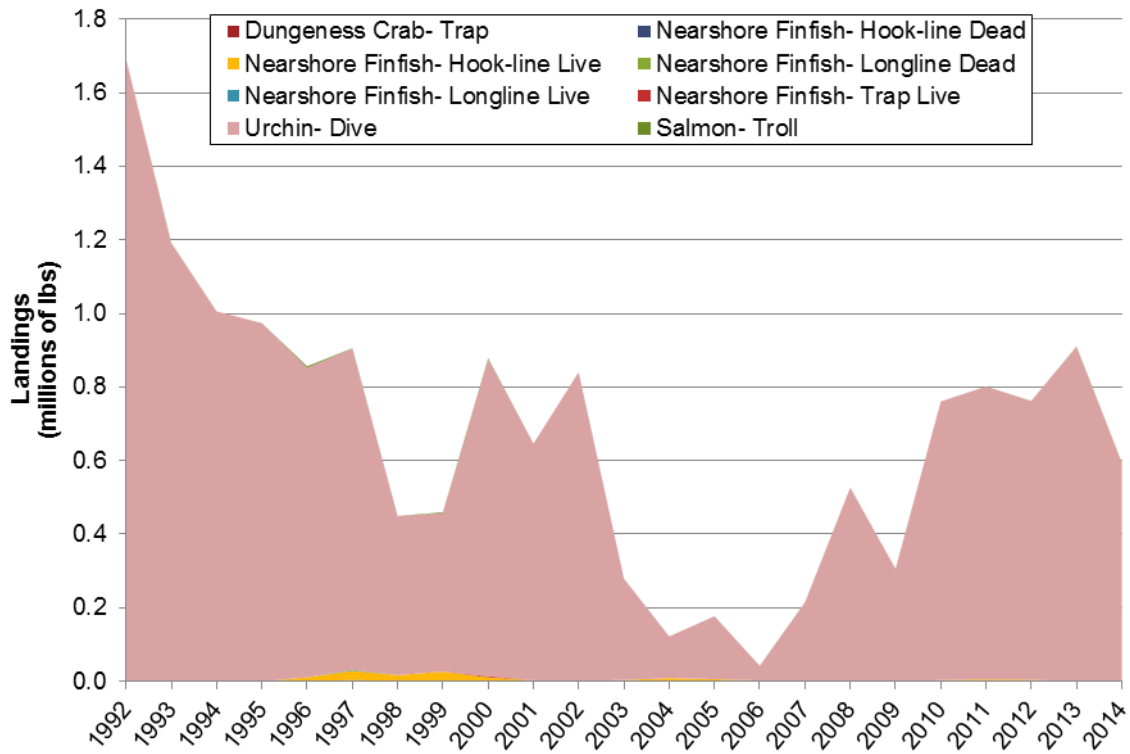
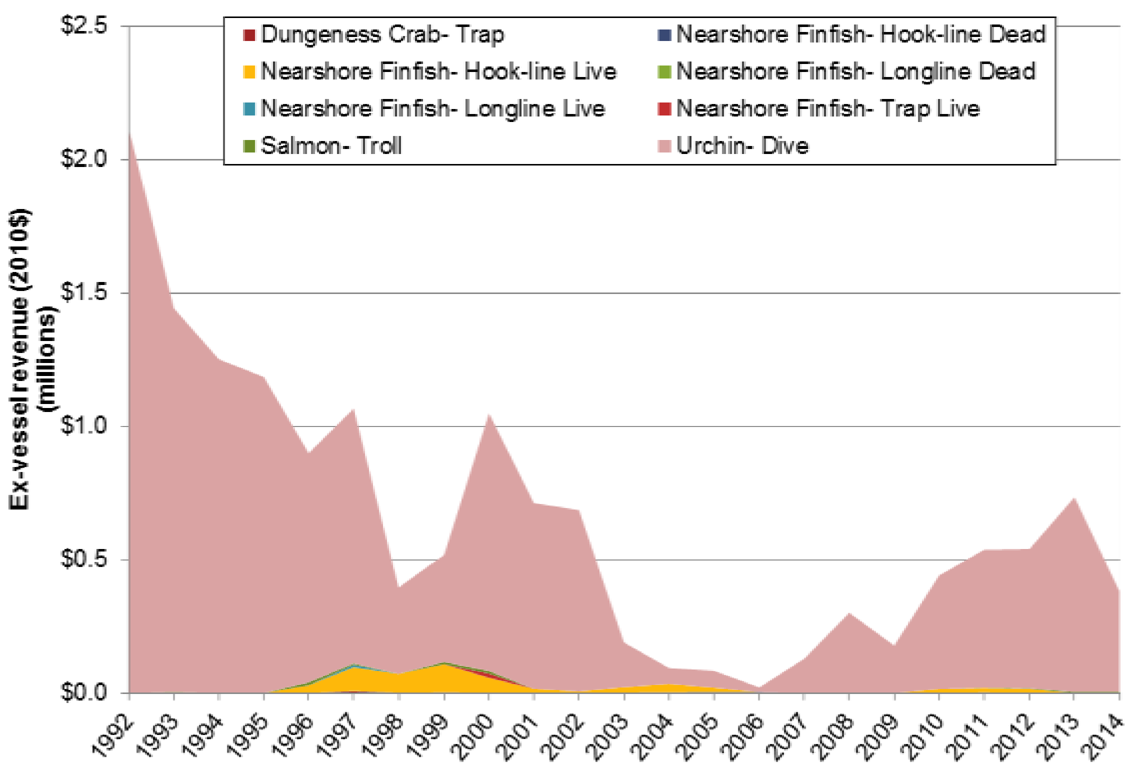


Figure 27. Ex-vessel revenue for fisheries of interest, Albion, 1992-2014



The shift from urchin-dive to nearshore finfish- hook-line in the late 1990s into the early 2000s can be seen in Figure 28. The trend in

Figure 28 could perhaps be explained in part by the relative price per pound shown in Figure 29. In 1996, the price per pound for nearshore finfish- hook-line live was nearly triple ($3.00) the price of urchin per pound ($1.09). Nearshore finfish- hook-line live reached an overall high in 2003 at $7.16/pound while urchin-dive hovered below $1.00/ pound for the majority of the study period.

Figure 28. Number of fishermen for fisheries of interest, Albion, 1992-2014

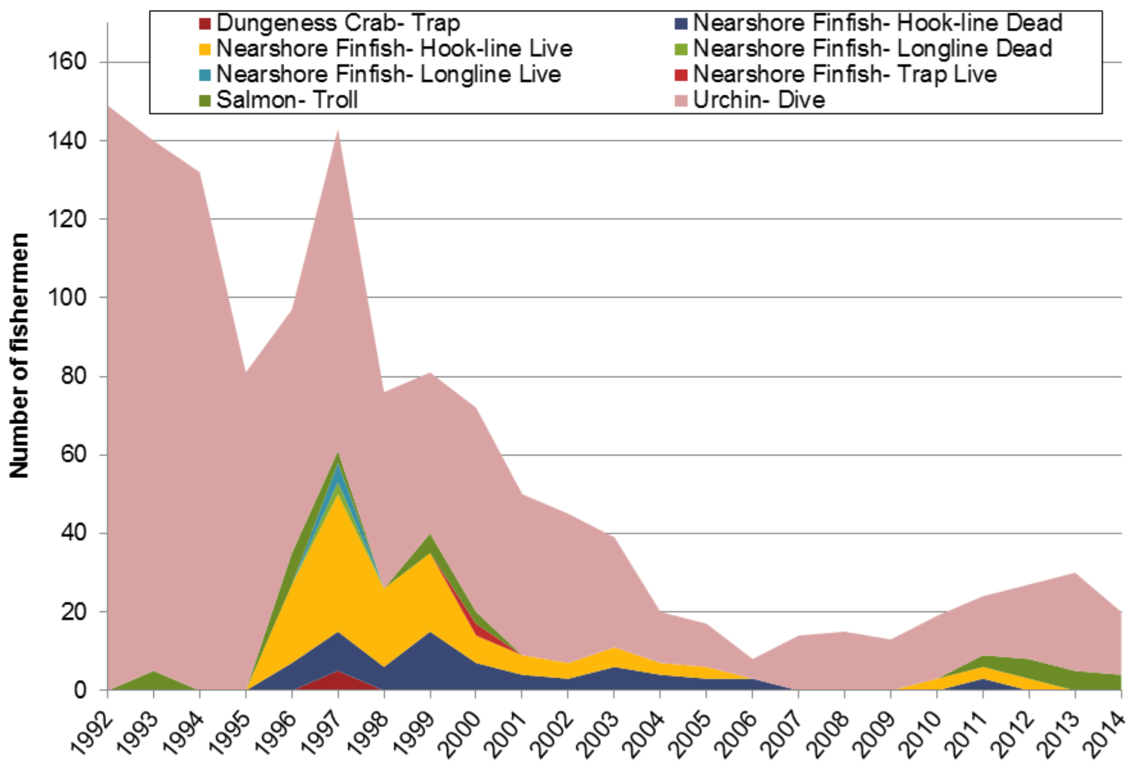
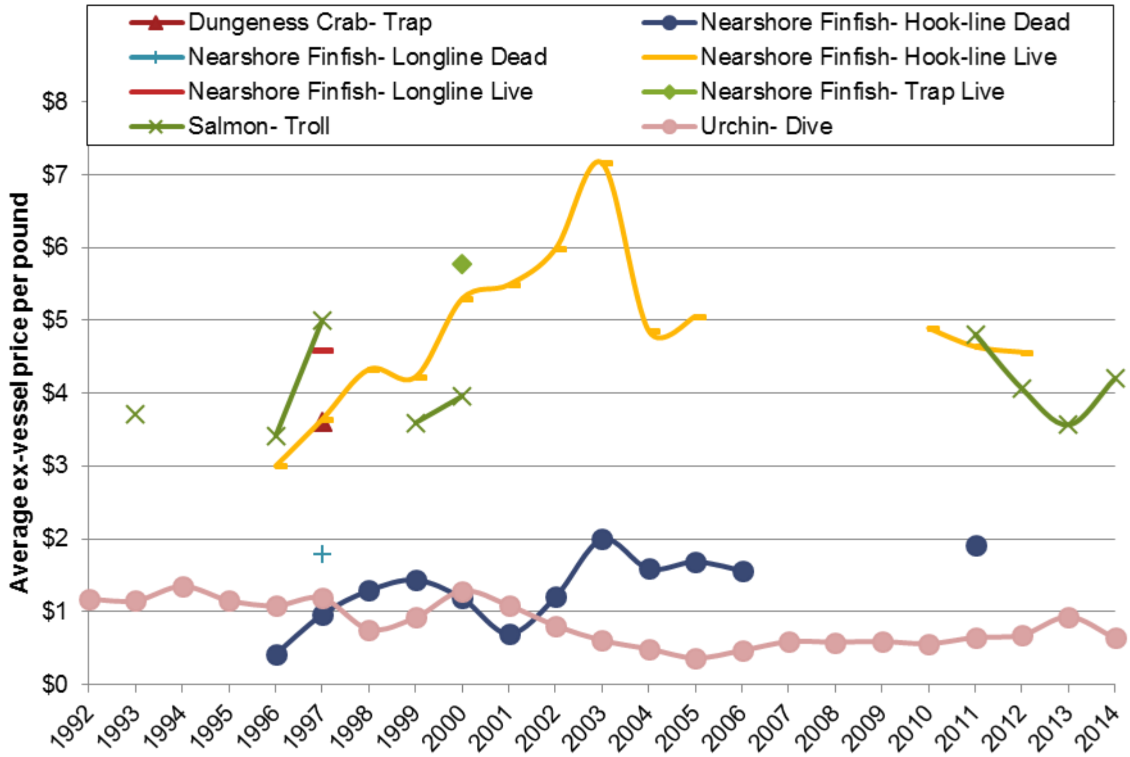


Figure 29. Average ex-vessel price over time, Albion, 1992-2014



Average annual landings, ex-vessel revenue, and number of active commercial fishermen for each of Albion's key fisheries of interest are shown in Figure 30 and Figure 31.

Figure 30. Nearshore finfish- hook line- live: Average pounds, revenue, and number of fishermen, Albion, 1992-2014

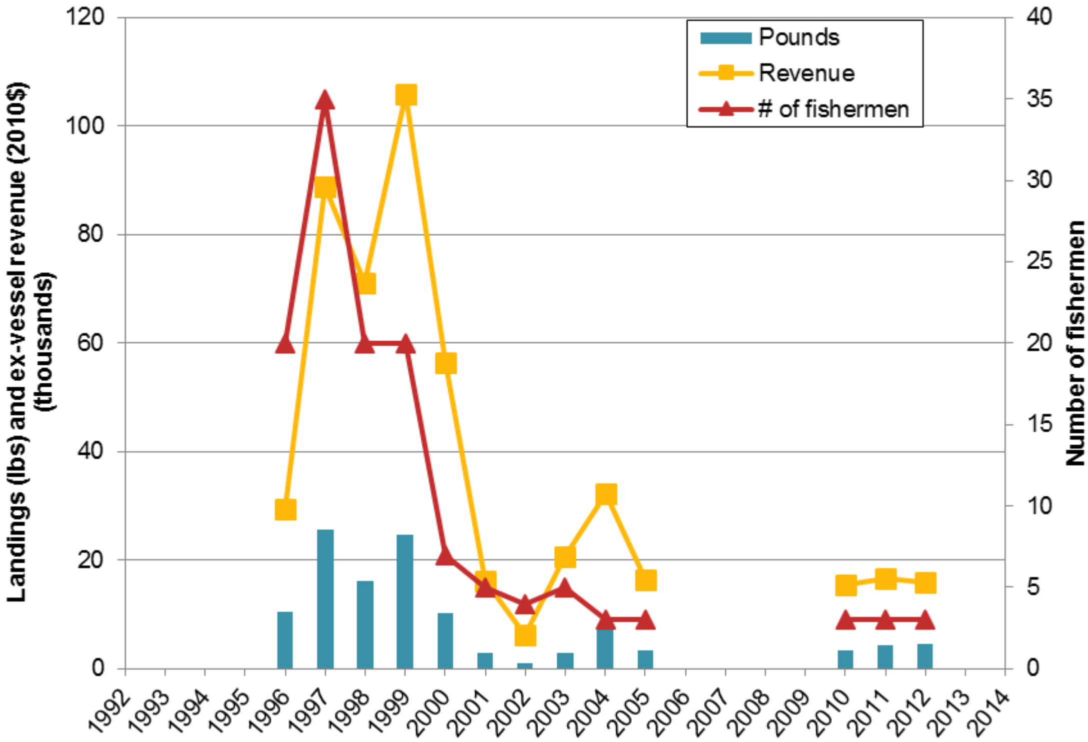
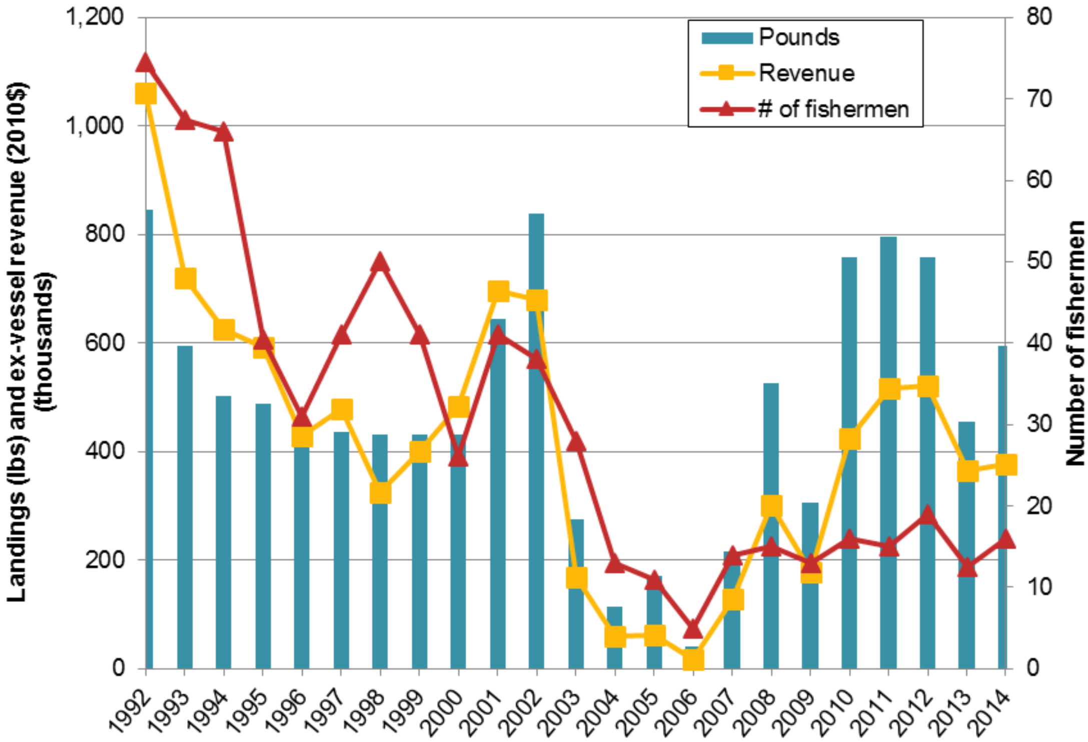


Figure 31. Urchin- dive: Average pounds, revenue, and number of fishermen, Albion, 1992-2014



Average ex-vessel revenue and landings per fisherman in the urchin-dive fishery were generally more consistent over the duration of the study period, and posted strong gains from 2007-2014 when compared to the average pounds landed and average ex-vessel revenues in the Nearshore finfish- hook-line live fishery (
Figure 32 and
Figure 33). Urchin yielded a high average of 53,000 pounds and over $34,000 per fisherman in 2011 while nearshore finfish- hook-line live yielded an average high of nearly 2,400 pounds and $10,700 per fisherman in 2004.

Figure 32. Nearshore finfish- hook line- live: Average pounds, revenue per fisherman, Albion, 1992-2014

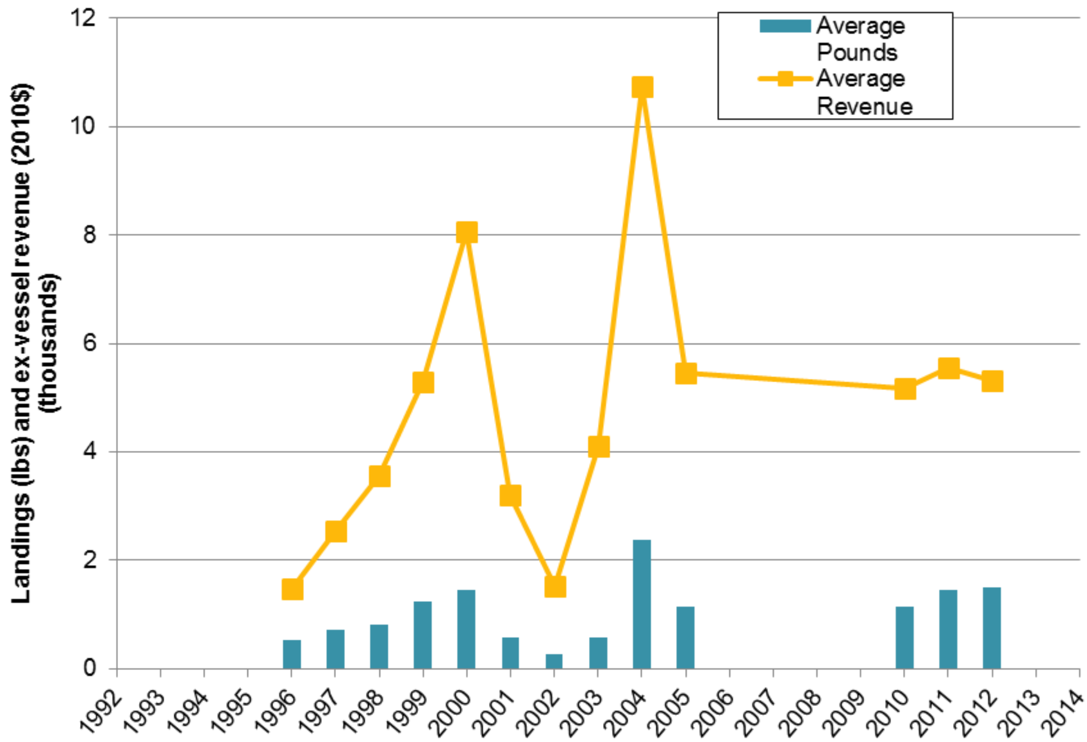
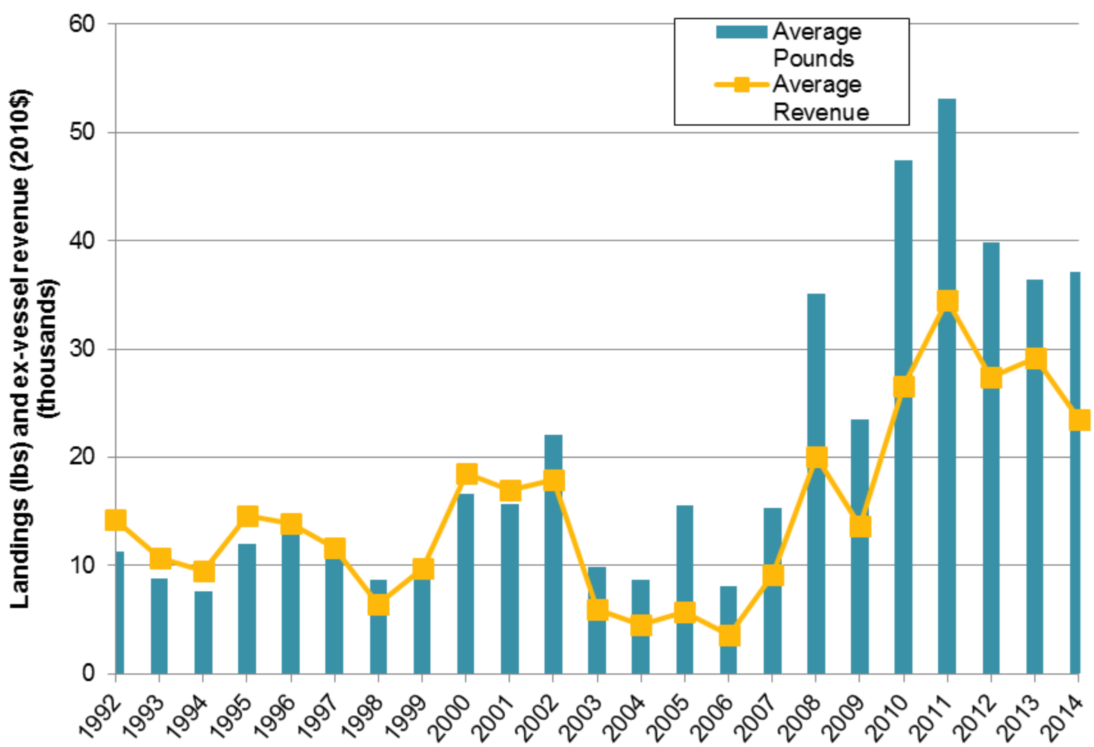


Figure 33. Urchin- dive: Average pounds, revenue per fisherman, Albion, 1992-2014



6. CRESCENT CITY PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

Crescent City is an important commercial fishing port on the California coast and in the North Coast region. According to National Marine Fisheries Service (NMFS) data, Over the past two decades, Crescent City has consistently ranked within the top 10 ports of California in terms of landed value and weight, many years ranking as the number two or three port in the state in terms of landed value. Additionally, since 1994, Crescent City has consistently represented between 30-60% of the commercial fishing revenue on the North Coast.

Crescent City had 129 commercial fishermen making landings in the fisheries of interest in 2014, together representing 17% of the region's total. In contrast, there were 334 fishermen in the fisheries of interest using the port in 1994, more evidence of fleet contraction in the North Coast region. In 2014, the port's Dungeness crab fleet of 97 fishermen (or 13% of the regional total) made a disproportionately large 23% of the region's total Dungeness crab landings.

In 2014, the price for Dungeness crab rose to $4.05 per pound, which was the highest in the past 20 years and an increase of $1.27 per pound from the previous year. This upswing in the market contributed to the large rise in ex-vessel revenues for Dungeness crab in Crescent City—representing a total of 42% of the region's Dungeness crab ex-vessel revenue in 2014.

Crescent City fishermen tend to operate at a larger scale and to treat commercial fishing as a full-time job. On average, commercial fishermen we interviewed relied on fishing for 92.6% of their income – substantially higher than the regional average of 88%. Commercial fishermen we interviewed in Crescent City have an average age of 54 (similar to the regional average of 53 years) and an average of 27 years of experience commercial fishing (similar to the regional average of 28 years).

The Crescent City fishing occupational community has shown great resilience in the face of a number of challenges including damaging natural disasters. In 1964 a tsunami devastated the harbor, destroyed 289 homes and businesses, and took 11 lives. Almost 40 years later in November 2006, another tsunami hit Crescent City, which exacerbated shoaling and damaged the inner boat basin, especially G- and H-docks, where 35 slips were lost (Ma, 2008). Again in 2011 a tsunami destroyed the harbor and one life was lost (Anton and Li, 2011).

Both aging infrastructure and the shape of their harbor had contributed to the vulnerability of the port, which left them with damages in the tens of millions over time. Fortunately, by 2014, the Crescent City harbor had been rebuilt with over $50 million from state and federal disaster grants. After the rebuilding process, it was named the first tsunami-resistant marina on the West Coast of the US (Miller, 2014).

The port has experienced other challenges including the loss of nearly all of its trawl fleet since the federal Pacific groundfish vessel buy-back program was enacted in 2003. Overall declines in commercial fishing activity has contributed to a contraction in the number of related businesses such as fish buyers and processers and gear shops, leaving fewer choices for commercial operators. However, Crescent City's proximity to rich fishing grounds, easy and safe access, and key services available for the fishing occupational community has helped sustain this group.

There remains a number of services near the harbor to support the fishing industry such as several commercial processors and an icehouse, hoist, dockside slips, fuel dock, wastewater, and indoor vessel repair. However, dredging, dredging material disposal, and wastewater treatment plant costs are areas of concern for the port moving forward (Pomeroy et al., 2011).

Of the fishermen interviewed in this port, 64% indicated that the marine protected areas (MPA) of Reading Rock SMR and Pyramid Point SMCA have affected their fishing opportunities. Findings from focus group sessions also highlighted how vulnerable this group is to volatility and changes in market prices, seasonal variations, and the changes in regulations. Fishermen responded that it is very important to participate in multiple fisheries to stabilize year to year variation of income, and to increase annual income, but it appears that they are nevertheless highly reliant on the Dungeness crab fishery.

CPFV logbook data show that the top three targeted CPFV fisheries as rockfish, Lingcod, and salmon. In 2014, the majority of CPFV landings were rockfish, with lingcod being a close second. Crescent City has not had a consistent CPFV presence until 2011, which grew to a peak of 4 CPFV operators in 2014. In 2014, CPFV trips had an average size of 6 anglers per vessel and overall between 1992-2014 the port had an annual average of 2,242 anglers per year.

The resiliency of Crescent City fishermen to natural disasters, economic downturns, and impacts on fishing opportunities is notable. The rebuilt tsunami-resistant harbor with modern infrastructure and its proximity to fishing grounds may help sustain commercial and CPFV fishing in this important North Coast regional port.

6.1. Crescent City Commercial Fishing Baseline Characterization

The average Crescent City fishermen that we interviewed was 54.5 years old, and respondents had an average of 27.6 years of experience as commercial fishermen, as shown in Table 45 below. The average age of commercial fishermen in Crescent City was 0.6 years older than the regional average, while average years of experience was about the same.

Of the target fisheries, nearshore finfish live – hook and line fishermen were oldest on average (59.3 years), and salmon – troll fishermen were the youngest on average (51.3 years). However, the most experienced fishermen, in terms of years commercial fishing as a whole, were Dungeness crab – trap fishermen (28.7 years on average), and the least experienced were nearshore finfish dead – hook and line (22.0 years).

Table 45. Average age and years of experience commercial fishing in 2013, Crescent City

		Age		Years of experience	
Fishery	**Number of Respondents**	**Average**	**Standard Deviation**	**Average**	**Standard Deviation**
Dungeness crab - trap	36	54.3	11.6	28.7	13.3
Nearshore finfish- dead - hook and line	3	58.0	3.6	22.0	10.0
Nearshore finfish dead - longline	1	*	--	*	`
Nearshore finfish live - hook and line	9	57.4	7.5	27.7	12.0
Nearshore finfish live - longline	3	59.3	3.2	25.7	14.0
Salmon - troll	15	51.3	14.3	27.5	15.8
All target fisheries (unique individuals)	**37**	**54.5**	**11.3**	**27.6**	**13.4**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in Table 46, Crescent City fishermen on average made 92.6% of their total personal income from commercial fishing in 2013.

Table 46. Percent income from overall commercial fishing from 2013, Crescent City

	Number of respondents	Average	Standard Deviation
All target fisheries (unique individuals)	**37**	**92.6%**	**19.5%**

Source: Current study

Fishermen in Crescent City were asked what percentage of their ex-vessel revenue was used to cover operating costs in 2013. We asked this as an "overall fishing" question because attributing operating costs to specific fisheries is difficult given the inherent shared costs involved in fishing (e.g. boat maintenance, slip rental, or fuel costs for trips targeting multiple fisheries). As displayed in Table 47 below, the average share of ex-vessel revenue used to cover operating costs by Crescent City fishermen is 67.2%.

Table 47. Percentage of total gross fishing revenue used for overall operating costs, 2013, Crescent City

	Number of respondents	Average	Standard Deviation
All target fisheries (unique individuals)	**37**	**67.2%**	**20.5%**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen in Crescent City were asked how many years of experience and how many days they spent targeting each of the fisheries in which they participated in 2013. As shown in

Table **48**, the average years of experience in all target fisheries in Crescent City was 29.1 years. On average, Dungeness crab – trap fishermen had the most experience targeting their fishery (31.4 years), and salmon – troll fishermen had the least (24.3 years).

The average annual number of days targeting specific fisheries was 53.3 for all target fisheries. On average, nearshore finfish dead – hook and line fishermen spent the largest average number of days targeting their fishery in 2013 (70.5), followed by Dungeness crab – trap (63.0 days). Nearshore finfish live – hook and line fishermen spent the least average number of days targeting their fishery in 2013 (31.5 days).

Table 48. Years of experience and number of days targeting specific fisheries in 2013, Crescent City

Fishery	Years of experience: Number of respondents	Years of experience: Average	Years of experience: Standard Deviation	Number of days targeting fishery: Number of respondents	Number of days targeting fishery: Average	Number of days targeting fishery: Standard Deviation
Dungeness crab - trap	36	31.4	10.5	33	63.0	26.9
Nearshore finfish- dead - hook and line	3	27.3	12.2	2	70.5	38.9
Nearshore finfish dead - longline	--	--	--	--	--	--
Nearshore finfish live - hook and line	8	27.3	10.3	8	31.5	33.4
Nearshore finfish live - longline	2	27.5	10.6	2	48.5	58.7
Salmon - troll	12	24.3	13.7	12	39.2	21.5
All target fisheries (unique individuals)	**37**	**29.1**	**11.3**	**34**	**53.3**	**30.2**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Crescent City fishermen were also asked how many crew they used for each fishery, and what share of their ex-vessel revenue was spent on their crew and on fuel. Their responses are summarized in Table 49 below. On average, Crescent City fishermen hired 2.0 crew members, with Dungeness crab – trap fishermen hiring the largest average number of crew members (2.6), followed by nearshore finfish live – longline (2.0).

The average percentage of ex-vessel revenue spent on crew was 28.4%. On average, Dungeness crab – trap fishermen spent the largest percentage of revenue of crew (34.6%), and nearshore finfish dead – hook and line fishermen spent the least (10%).The average percentage of gross revenue spent on fuel was 11.4%. On average, salmon – troll fishermen spent the largest percentage of their gross revenue on fuel (17.1%), and nearshore finfish live – longline fishermen spent the least (5.5%).

Table 49. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Crescent City

	Number of crew			**Share of revenue towards crew**			**Share of revenue towards fuel**		
Fishery	**n**	**Average**	**Standard deviation**	**n**	**Average**	**Standard deviation**	**n**	**Average**	**Standard deviation**
Dungeness crab - trap	36	2.6	0.8	36	34.6%	7.7%	34	10.8%	6.4%
Nearshore finfish- dead - hook and line	3	0.7	1.2	3	10.0%	17.3%	3	8.0%	2.6%
Nearshore finfish dead - longline	--	--	--	--	--	--	--	--	--
Nearshore finfish live - hook and line	8	1.1	1.4	8	19.9%	18.6%	8	8.6%	5.7%
Nearshore finfish live - longline	2	2.0	0.0	2	32.0%	2.8%	2	5.5%	0.7%
Salmon - troll	12	0.9	0.3	12	19.5%	7.2%	12	17.1%	15.1%
All target fisheries (unique individuals)	**37**	**2.0**	**1.1**	**37**	**28.4%**	**12.7%**	**35**	**11.4%**	**9.0%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen were also asked whether MPAs had affected their fishing; and if so, what specific, direct effects MPAs had on specific fisheries in 2013. Respondents were given five possible answers to this question, and allowed to provide more than one answer. From Table 50 one can see that, of the respondents who answered this question, 64.9% of respondents answered that MPAs had affected their fishing. Of those who responded Yes, the most frequently cited effect was (A), Cannot fish in or go to traditional grounds/areas (48.6% of all respondents). The second most frequently cited effect was (E), Other (35.1% of respondents). The most commonly cited "Other" effects described crowding of fish-abundant areas not covered by MPAs, especially in the Dungeness crab – trap fishery.

Table 50. Direct effects of MPAs on specific fisheries in 2013, Crescent City

Fishery	Number responding	Have MPAs effected your fishing?	A	B	C	D	E
Dungeness crab - trap	36	50.0%	36.1%	2.8%	--	--	27.8%
Nearshore finfish- dead - hook and line	3	66.7%	33.3%	--	--	--	33.3%
Nearshore finfish dead - longline	1	--	--	--	--	--	--
Nearshore finfish live - hook and line	9	44.4%	33.3%	--	--	--	33.3%
Nearshore finfish live - longline	3	66.7%	66.7%	--	33.3%	--	33.3%
Salmon - troll	15	40.0%	40.0%	6.7%	13.3%	6.7%	13.3%
All target fisheries (unique individuals)	**37**	**64.9%**	**48.6%**	**5.4%**	**5.4%**	**0.2%**	**35.1%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved home port location or fish out of another port
E	Other ways directly/indirectly effected by MPAs

Fishermen in Crescent City were asked which MPAs had affected their fisheries in 2013, and were provided with a comprehensive list of MPAs, given below. In Table 51 below we provide a list of the MPAs that our respondents cited as having affected specific targeted commercial fisheries in Crescent City during 2013.

Thirteen MPAs on the North Coast affected targeted fisheries in 2013. Of those, Reading Rock SMR affected the largest number of fishermen respondents (12 individuals), followed by Pyramid Point SMCA (7 individuals). Of the fisheries affected, the one with the largest number of respondents to this question was Dungeness crab – trap (18 individuals), following by salmon – troll (12 individuals).

Table 51.Which MPAs have affected specific fisheries in 2013, Crescent City

Fishery	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Dungeness Crab - Trap	--	--	--	--	--	--	1	--	--	--	--	9	2	6	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Nearshore Finfish Dead - Hook and Line	--	--	1	--	--	--	--	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	1	--	--	1	--
Nearshore Finfish Dead - Longline	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nearshore Finfish Live - Hook and Line	--	--	1	--	--	--	--	--	--	--	--	2	--	--	--	--	--	--	--	1	--	--	--	2	--	--	--	--
Nearshore Finfish Live - Longline	--	--	--	--	--	--	--	--	--	--	--	1	--	1	1	--	1	--	--	1	1	--	--	--	--	--	--	--
Salmon - Troll	--	4	--	--	--	--	--	--	1	--	--	1	--	1	3	--	1	--	--	--	1	--	--	--	--	--	--	--
All target fisheries (unique individuals)	**--**	**4**	**1**	**--**	**--**	**--**	**1**	**--**	**1**	**--**	**--**	**12**	**2**	**7**	**3**	**--**	**1**	**--**	**--**	**1**	**1**	**--**	**--**	**2**	**--**	**--**	**2**	**--**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were asked about the degree of importance and reasons of importance of participating in multiple targeted fisheries in their community. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 52 below, all respondents indicated that multi-fishery participation was either 'Very Important' or 'Important'.

If fishermen responded that multi-fishery participation was very important or important, they were then asked why that was the case. The question was asked as an open-ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer. The top two responses were that it 'Stabilizes year-to-year variation in my commercial fishing income' and 'Increases my annual commercial fishing income'.

Table 52. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Crescent City

		Degree of importance		Reasons for importance			
Fishery	**Number of respondents**	**Important**	**Very Important**	**A**	**B**	**C**	**D**
Dungeness crab - trap	36	4	32	19	30	17	11
Nearshore finfish- dead - hook and line	3	--	3	2	2	1	3
Nearshore finfish dead - longline	1	--	*	*	*	*	*
Nearshore finfish live - hook and line	9	--	9	7	8	6	5
Nearshore finfish live - longline	3	--	3	3	3	3	2
Salmon - troll	15	2	13	6	12	5	5
All target fisheries (unique individuals)	**37**	**4**	**33**	**20**	**30**	**17**	**12**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, respondents in Crescent City were asked what strategies they used to market their catch. They were given ten possible responses, listed below in Table 53 as answers A through J. Respondents were allowed to provide more than one answer. The most frequently cited market strategy was C, Sell to traditional processor (28 individuals), followed by G, Sell to live fish buyers (16 individuals), and E, Sell to other wholesalers/middlemen (10 individuals).

Table 53. Strategies used to market catch, 2013, Crescent City

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	--	--	27	1	10	7	15	1	1	3
Nearshore finfish- dead - hook and line	--	--	1	--	--	--	3	--	--	1
Nearshore finfish dead - longline	--	--	--	--	--	--	1	--	--	--
Nearshore finfish live - hook and line	--	--	5	--	3	--	9	--	1	3
Nearshore finfish live - longline	--	--	1	--	2	--	3	--	--	1
Salmon - troll	--	--	14	1	5	5	4	1	--	1
All target fisheries (unique individuals)	**--**	**--**	**28**	**1**	**10**	**7**	**16**	**1**	**1**	**4**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

6.1. Crescent City Commercial Fishing Initial Changes

Fishermen in Crescent City were also asked how they saw their income from commercial fishing changing from 2009 to 2013. They were asked to select one of the following options; Significantly higher, Somewhat higher, No change, Somewhat lower, or Significantly lower.

As shown below in Table 54, a large majority of respondents in all target fisheries (80.6%) perceived no change. A small minority of respondents (10.4%) perceived somewhat higher income. Less than 5% of respondents each reported significantly higher (4.5%), somewhat lower (3.0%); and significantly lower (1.5%) incomes.

Table 54. Perceived change in share of personal income coming from commercial fishing between 2009 and 2013, Crescent City

Fishery	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**37**	**4.5%**	**10.4%**	**80.6%**	**3.0%**	**1.5%**

Source: Current study

In addition to indicating a perceived change, fishermen in Crescent City were asked an open-ended question of what factors they felt had contributed to the change in the share of their income coming from commercial fishing between 2009 and 2013. In Table 55 we provide a list of the indicated reasons for the change, as well as the number of responses for each fishery. The most common response (3 individuals) indicated, ‘Changes in fish abundance/presence’.

Table 55. Factors most affecting changes in share of personal income coming from commercial fishing between 2009 and 2013, Crescent City

	Number of survey respondents	A	B	C	D	E
All target fisheries (unique individuals)	**37**	**2**	**3**	**0**	**2**	**5**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Fishermen in Crescent City were asked separately for each fishery they participated in to compare his/her success in the fishery in 2013 to that of the last ten years. As shown in Table 56 below, fishermen were given the option of responding in one of the following categories: (1) Significantly better; (2) Somewhat better; (3) The same; (4) Somewhat worse; and (5) Significantly worse. Respondents were also allowed to indicate that they had not participated in that fishery in previous seasons.

The most frequently cited answer (23.6%) was Significantly Worse; the second most cited answer/s were The Same and Somewhat Better (18.2% each). Dungeness crab – trap fishermen were most likely to answer both Significantly Worse (37.5%) *and* Significantly Better (18.8%), while salmon – troll fishermen were most likely to answer Somewhat Better (33.3%). Salmon – troll fishermen were also most likely to respond that they had not participated in that fishery in previous seasons (33.3%).

Table 56. Perceived success in fishing in 2013 compared to last ten years, Crescent City

Fishery	Number responding	Did not participate	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	36	--	18.8%	15.6%	12.5%	15.6%	37.5%
Nearshore Finfish Dead - Hook and Line	3	--	--	--	--	100.0%	--
Nearshore Finfish Dead - Longline	1	--	--	--	--	--	--
Nearshore Finfish Live - Hook and Line	9	14.3%	14.3%	14.3%	42.9%	14.3%	--
Nearshore Finfish Live - Longline	3	--	--	--	50.0%	50.0%	--
Salmon - Troll	15	33.3%	8.3%	33.3%	16.7%	--	8.3%
All target fisheries	**37**	**9.1%**	**14.5%**	**18.2%**	**18.2%**	**16.4%**	**23.6%**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

In Figure 34 we summarize trend data on commercial landings, ex-vessel revenue, and number of fishermen for all fisheries in the North Coast port of Crescent City over the study period, 1992-2014. Key trends include a sharp decline in the number of active commercial fishermen, increased inter-annual ex-vessel revenue volatility, and a degree of decline in landings.

In Figure 35 we provide the same trend data for Crescent City, but in this case restricted to fisheries of interest. Again, one can see a decline in the number of active commercial fishermen, though not as dramatic. We also see a volatile but generally increasing ex-vessel revenue and landings trend.

On average annually for fisheries of interest, Crescent City contributed 40.1% of the region's landings, reaching a maximum of 61.4% in 2006 and a minimum of 23.3% in 2001, as shown in Figure 36. The region's share of commercial fishermen with a Crescent City homeport averaged 29.1% annually, reaching a high of 44.2% in 2009 and a low of 16.8% in 2014. Most notably, Crescent City's share of the region's overall annual ex-vessel revenue averaged 43.5%, reaching a maximum in 2006 at 60.5% and a low of 29.9% in 2011.

Figure 34. Commercial landings, ex-vessel revenues, and number of fishermen, Crescent City, 1992–2014, all fisheries

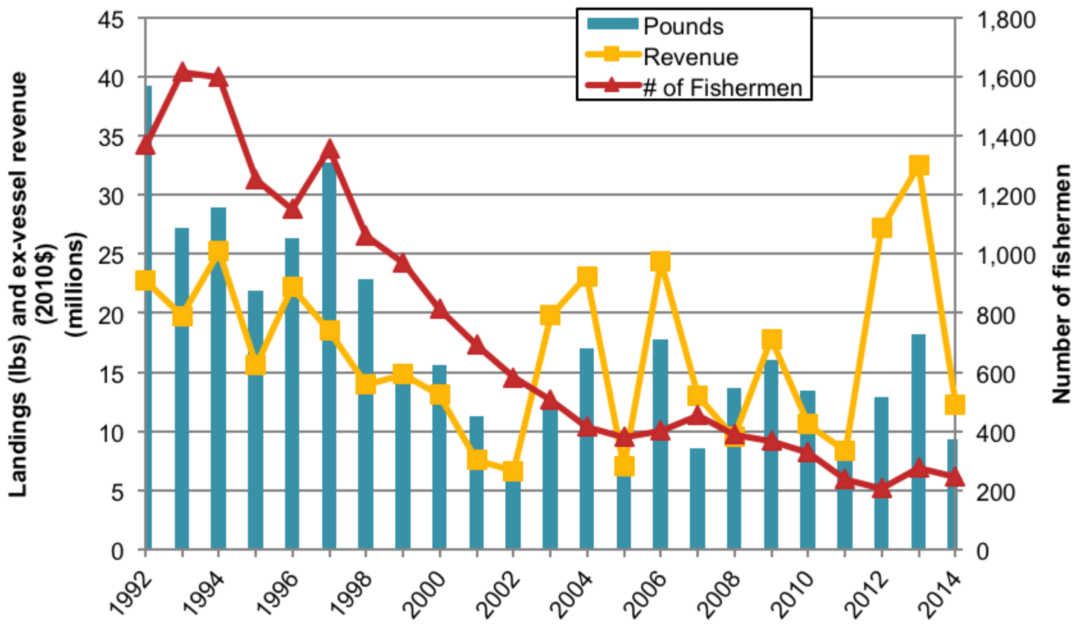


Figure 35. Commercial landings, ex-vessel revenues, and number of fishermen, Crescent City, 1992–2014, fisheries of interest

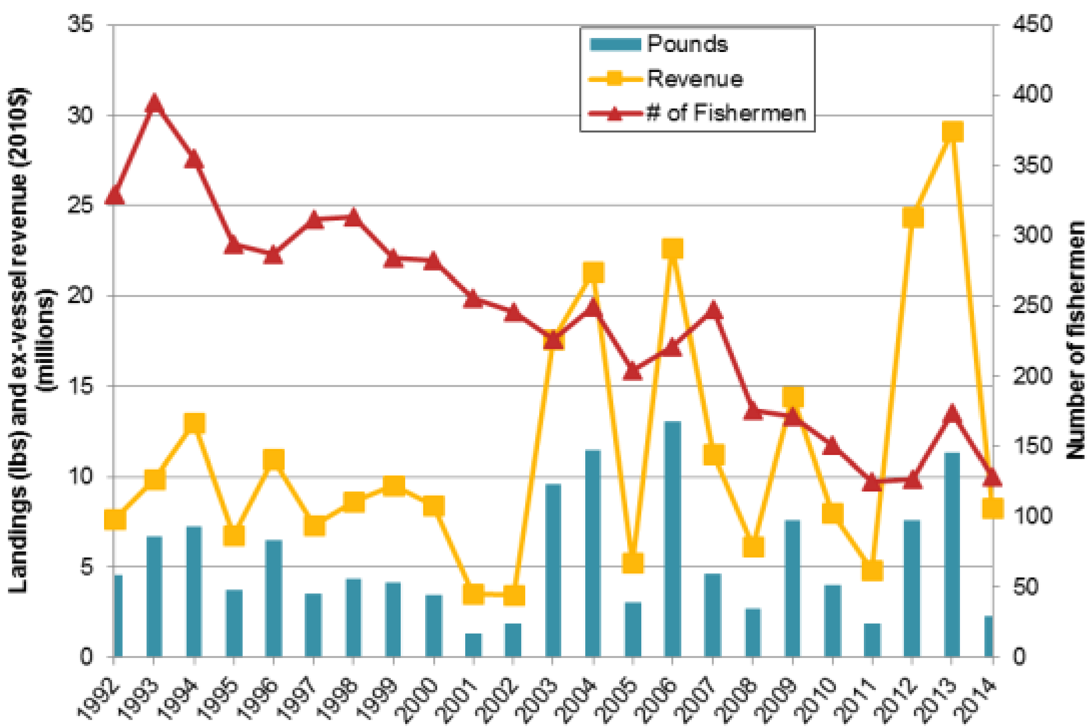
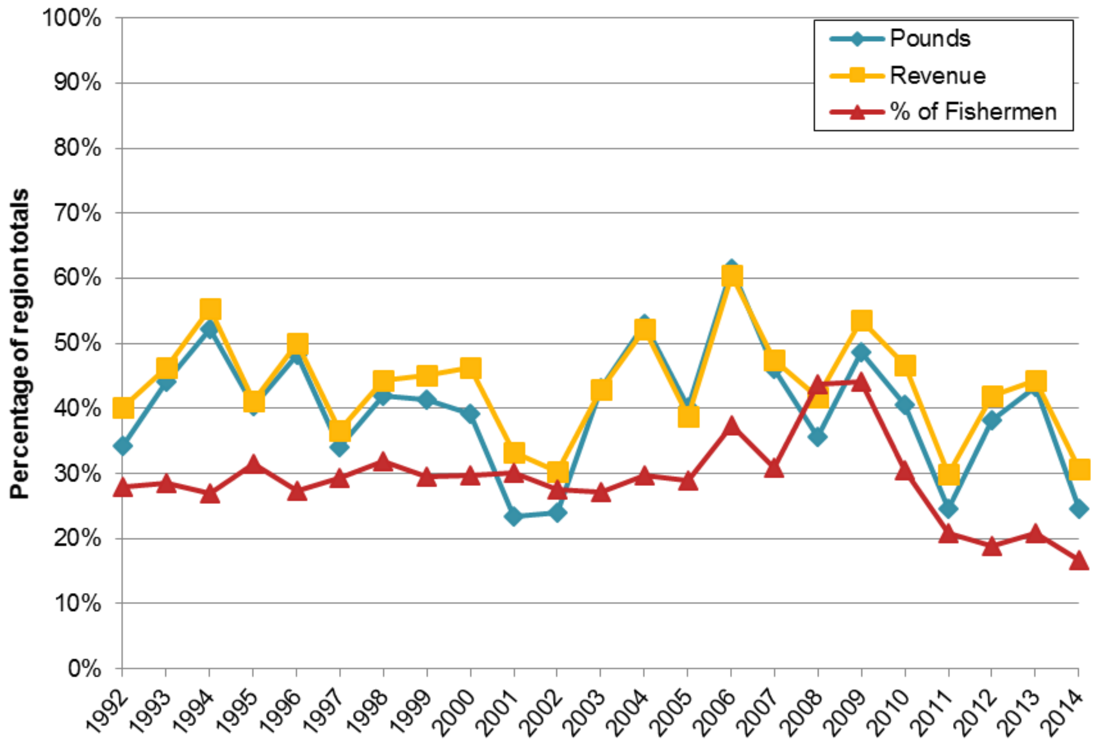


Figure 36. Fisheries of interest landings, revenue, and number of fishermen as a percentage of regional totals, Crescent City, 1992-2014



The Dungeness crab fishery was overwhelmingly the mainstay of Crescent City in terms of commercial landings (Figure 37) and ex-vessel revenue (Figure 38). Dungeness crab-trap averaged 5.3 million pounds per year over the duration of the study period and totaled 122.2 million pounds ($254.6 million of ex-vessel revenue) by the end of 2014. Nearshore finfish-hook-line dead and nearshore finfish- hook-line live were minor in comparison. As to be expected, most commercial fishermen in Crescent City targeted Dungeness crab, within an overall port trend of declining numbers of active commercial participants, as shown in Figure 39.

Figure 37. Commercial landings for fisheries of interest, Crescent City, 1992-2014

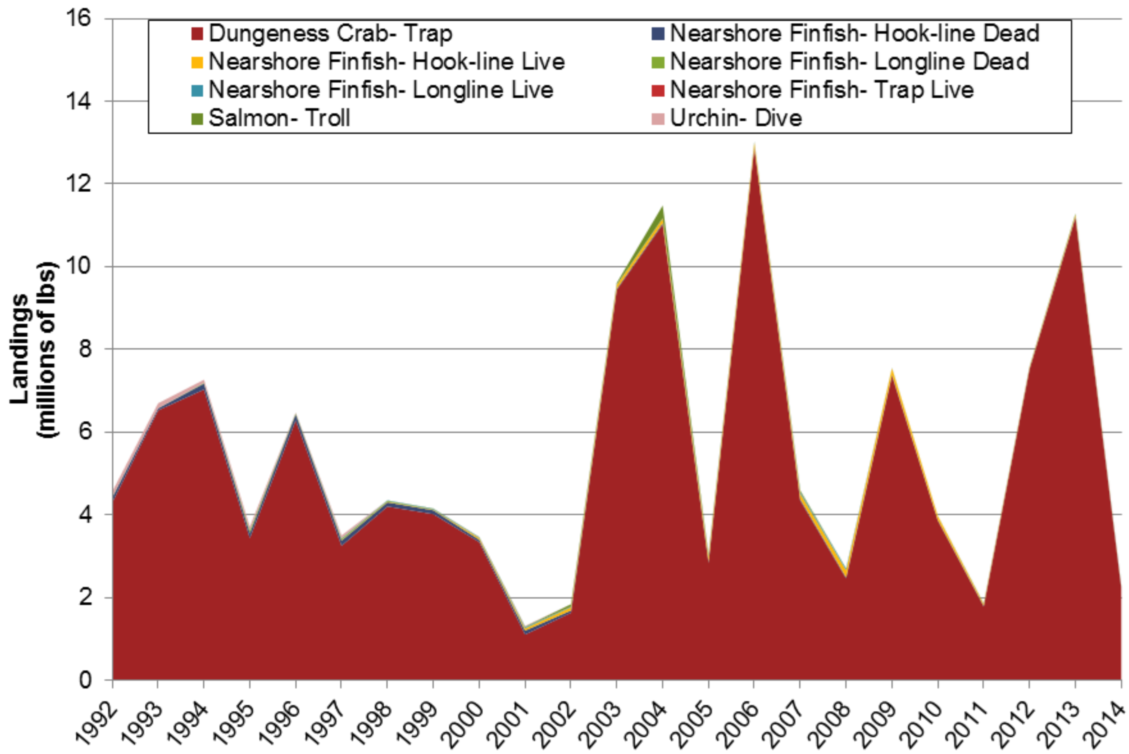


Figure 38. Ex-vessel revenue for fisheries of interest, Crescent City, 1992-2014

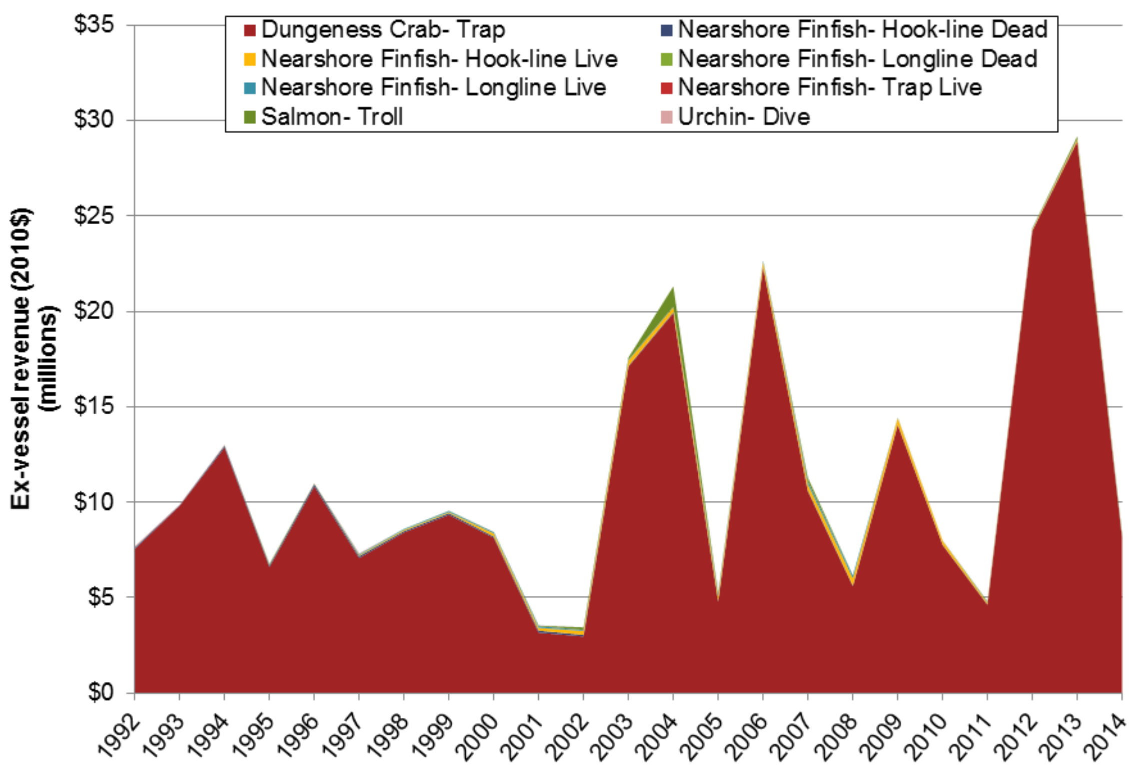
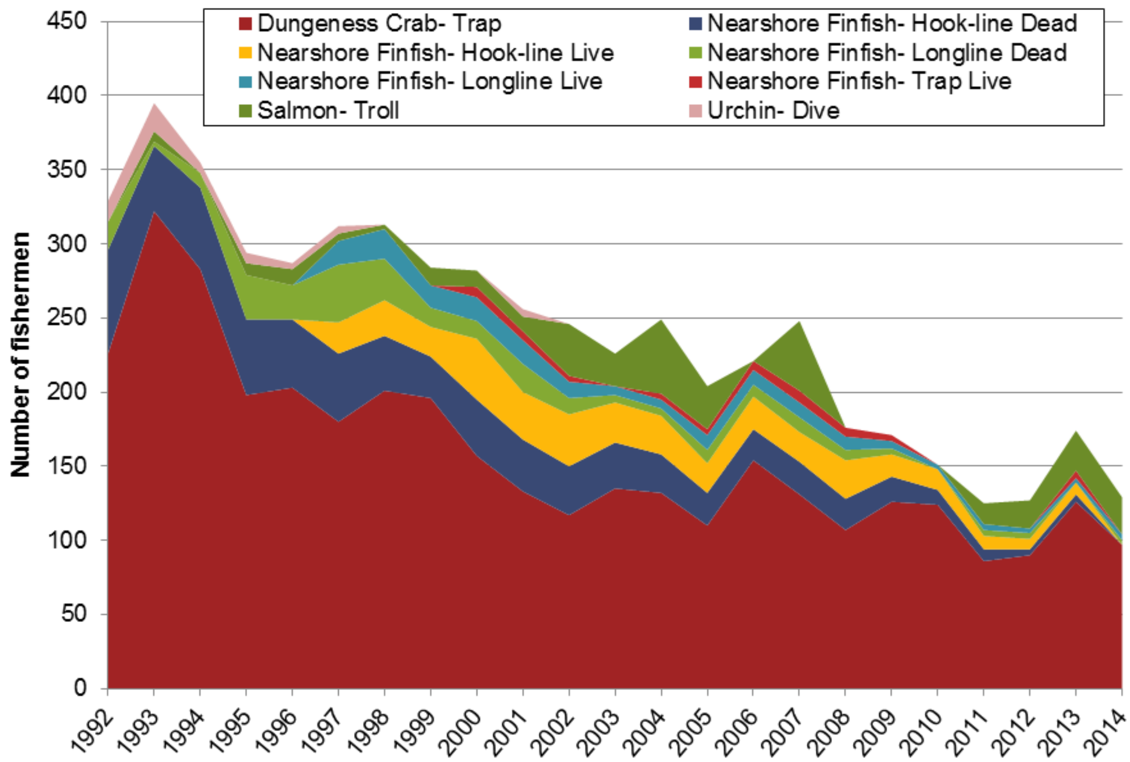
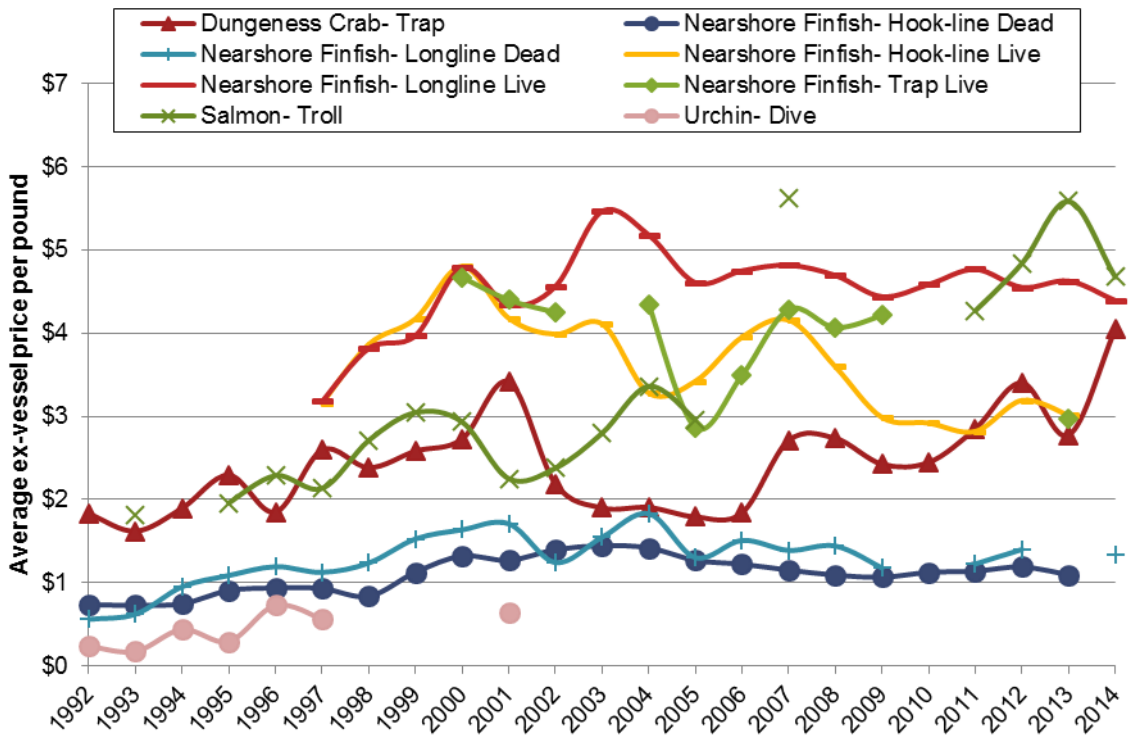


Figure 39. Number of fishermen for fisheries of interest, Crescent City, 1992-2014



In
Figure 40 we plot the average ex-vessel price over time. One can also see that Dungeness crab and salmon prices per pound grew strongly in the last several years of the study period.

Figure 40. Average ex-vessel price over time, Crescent City, 1992-2014



Relevant fisheries of interest for Crescent City include Dungeness crab- trap (Figure 41), nearshore finfish- hook-line dead (
Figure 42), nearshore finfish- hook-line live (
Figure 43), nearshore finfish- longline live (
Figure 44) and salmon-troll (
Figure 45). These diagrams provide some focused insight into key fisheries for Crescent City.

Figure 41. Dungeness crab- trap: Average pounds, revenue, and number of fishermen, Crescent City, 1992-2014

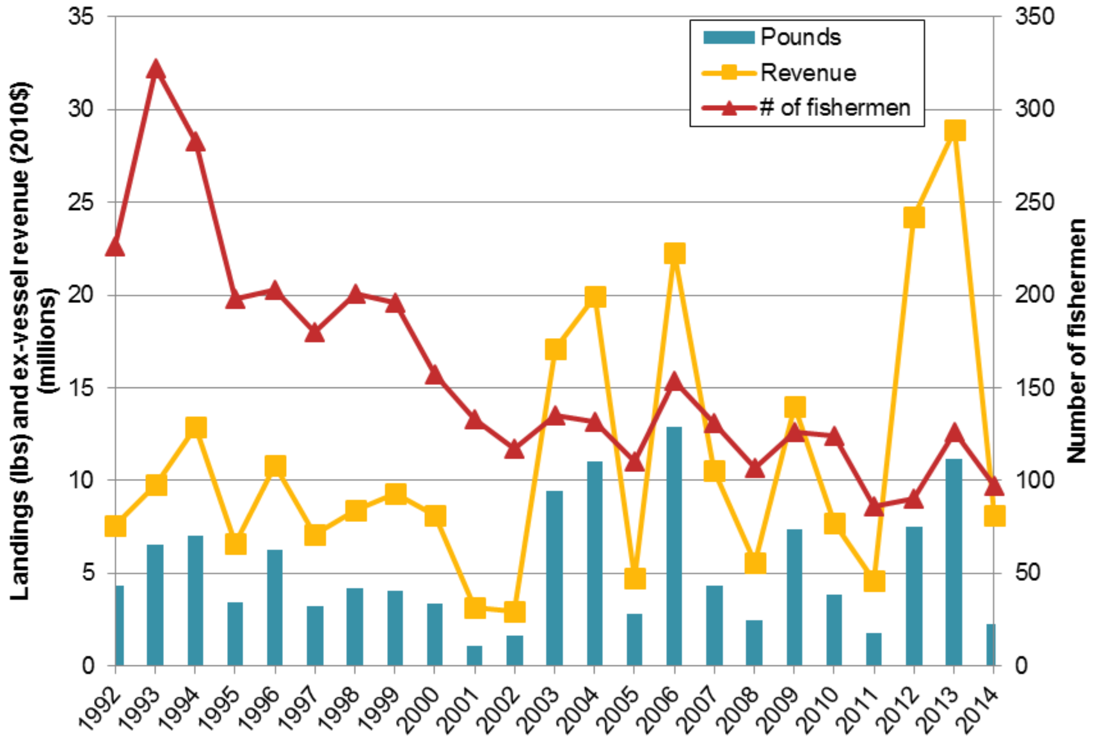


Figure 42. Nearshore finfish- hook- line dead: Average pounds, revenue, and number of fishermen, Crescent City, 1992-2014

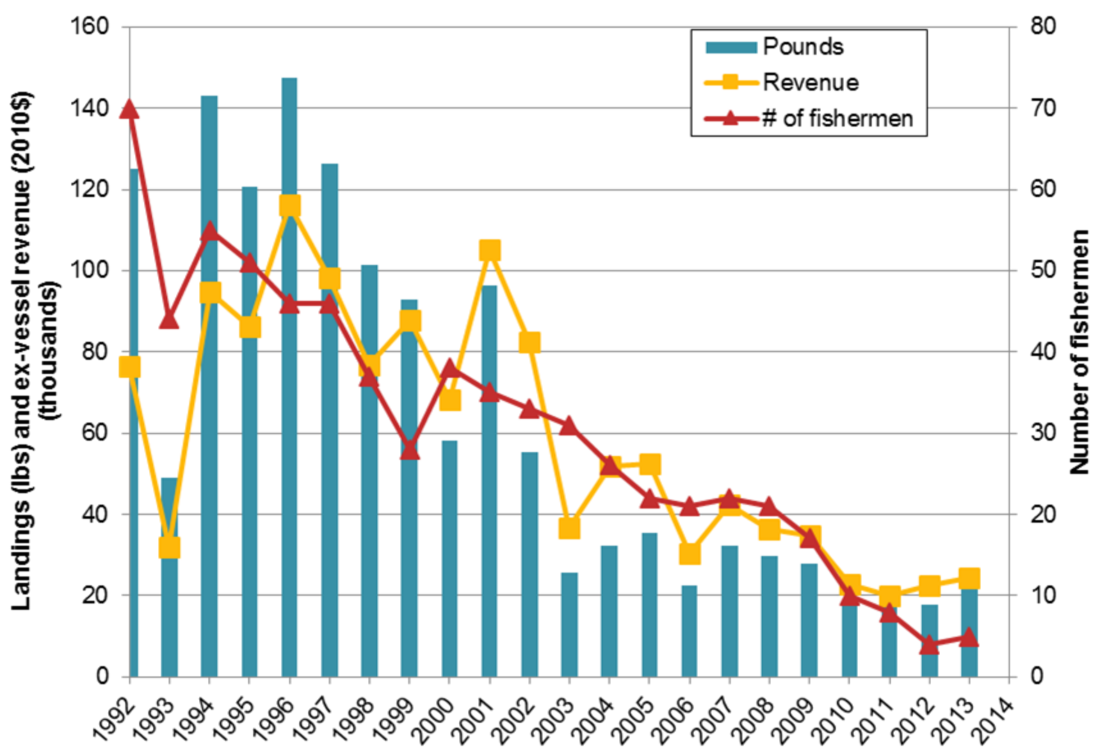


Figure 43. Nearshore finfish- hook line- live: Average pounds, revenue, and number of fishermen, Crescent City, 1992-2014

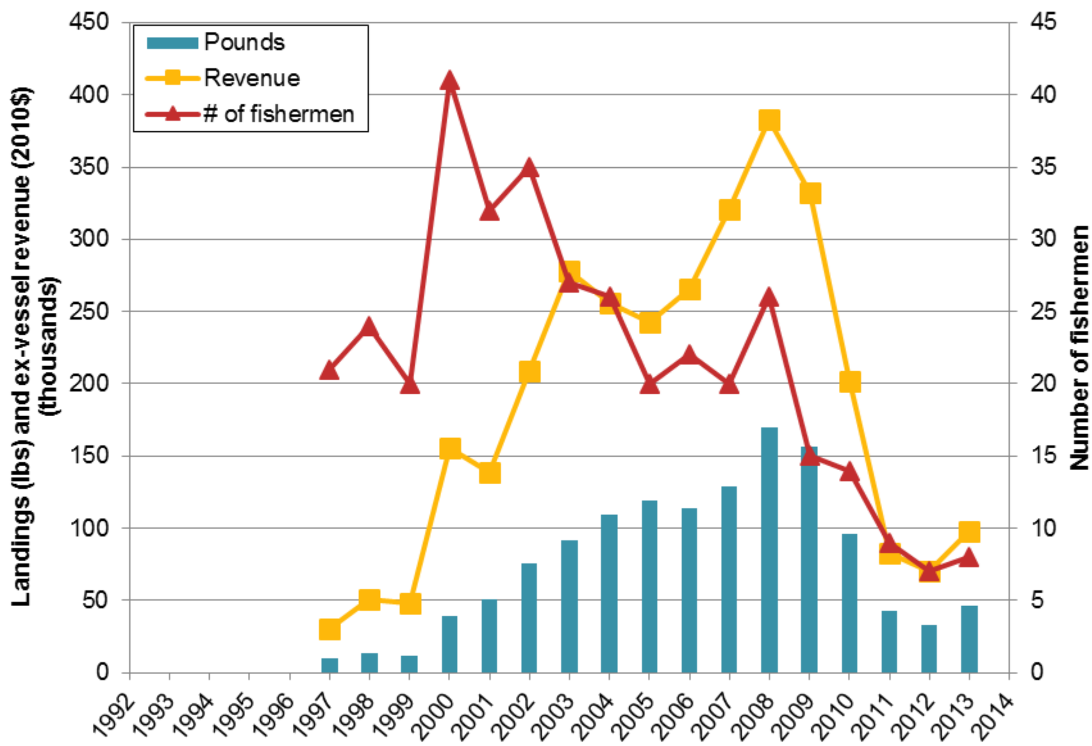


Figure 44. Nearshore finfish- longline- live: Average pounds, revenue, and number of fishermen, Crescent City, 1992-2014

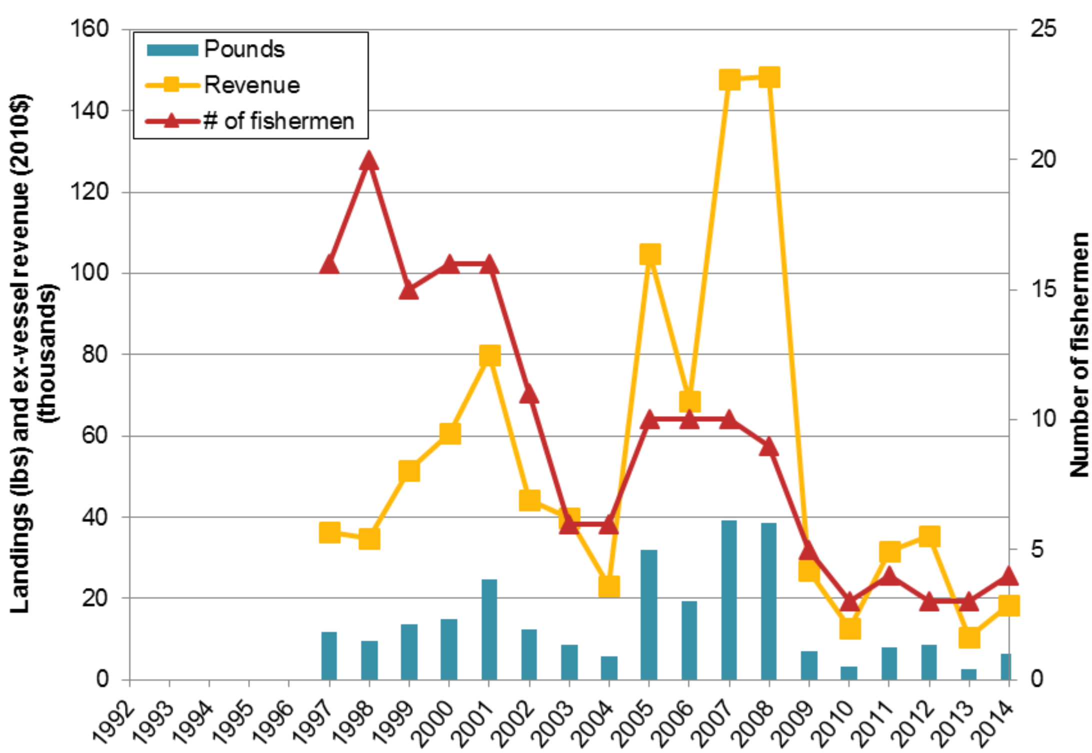


Figure 45. Salmon- troll: Average pounds, revenue, and number of fishermen, Crescent City, 1992-2014

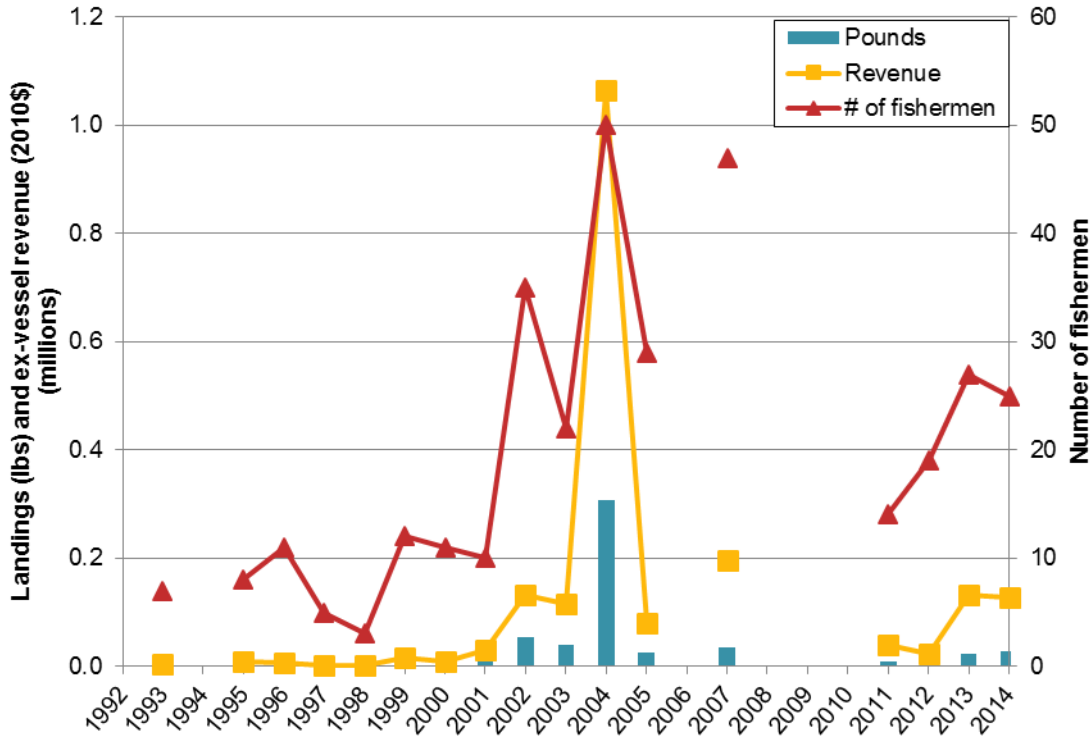


Figure 46,
Figure 47,
Figure 48, Figure 49, and Figure 50 show the average annual landings and revenues *per fisherman* in Crescent City. From these figures (in particular the vertical axes of these figures) one can clearly see how Dungeness crab has served as the mainstay for commercial fishermen in Crescent City, and by extension for the port and commercial fishing occupational community.

Figure 46. Dungeness crab- trap: Average pounds, revenue per fisherman, Crescent City, 1992-2014

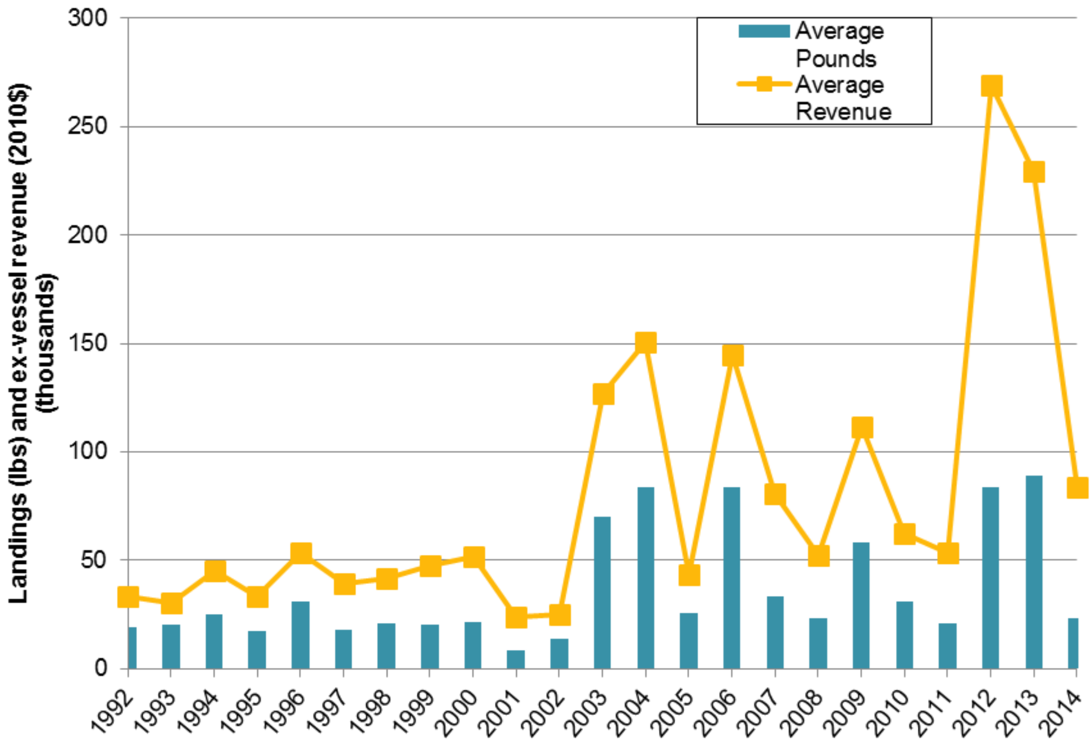


Figure 47. Nearshore finfish- hook line- dead: Average pounds, revenue per fisherman, Crescent City, 1992-2014

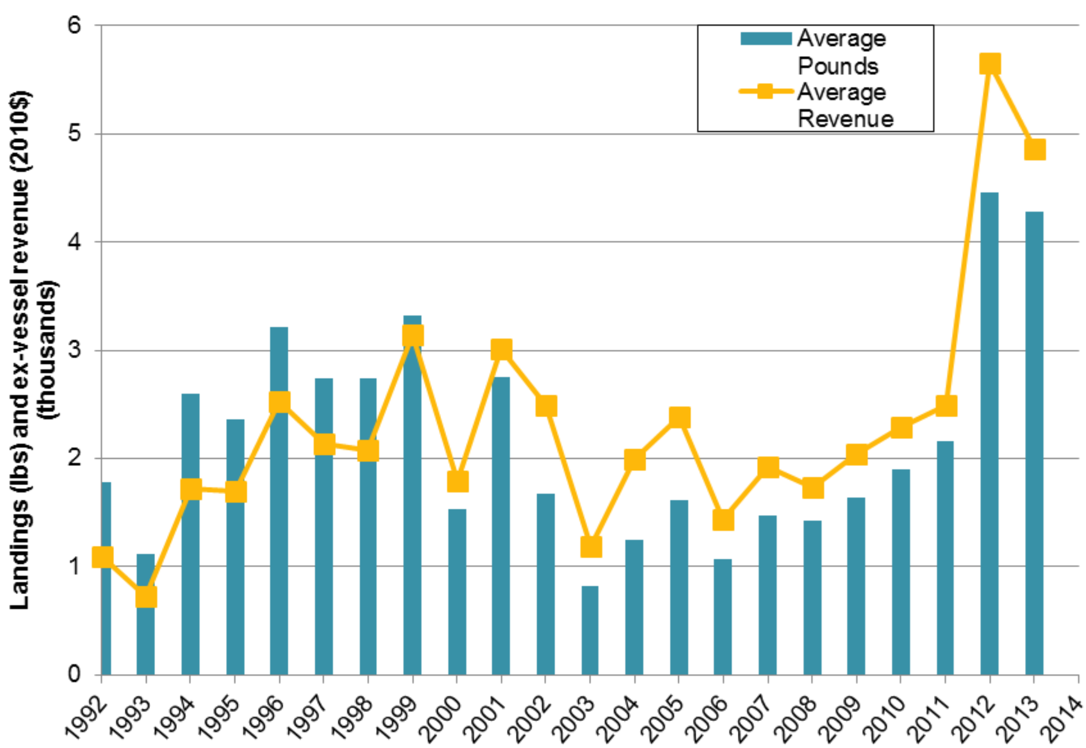


Figure 48. Nearshore finfish- hook line- live: Average pounds, revenue per fisherman, Crescent City, 1992-2014

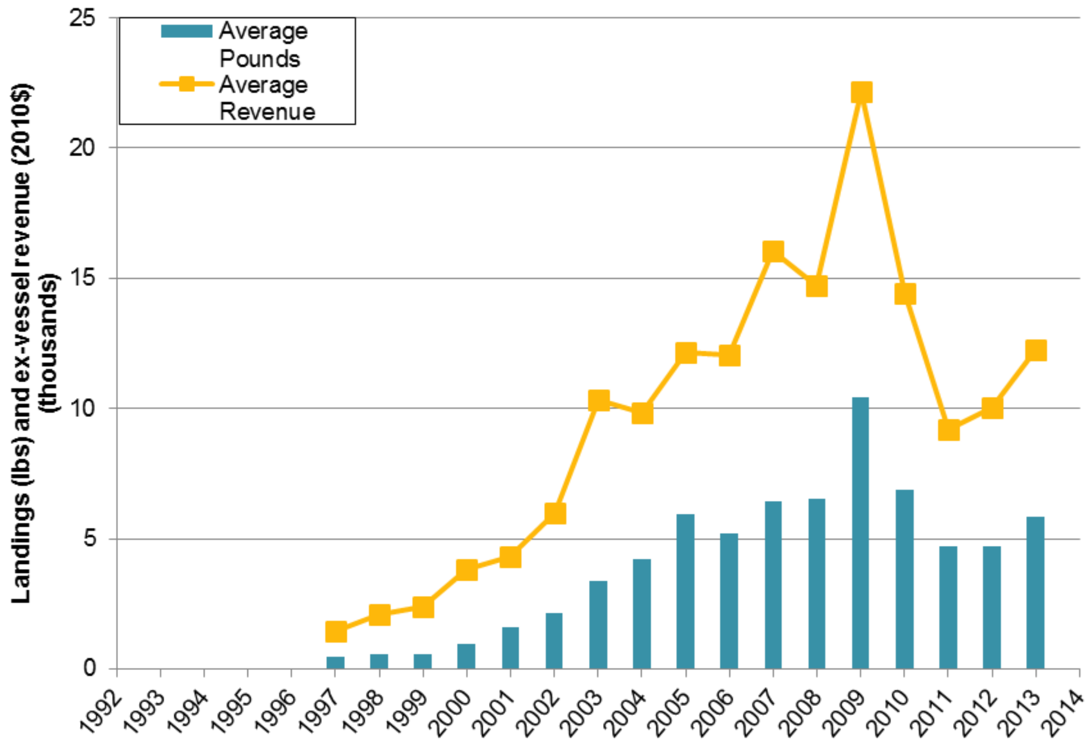


Figure 49. Nearshore finfish- longline- live: Average pounds, revenue per fisherman, Crescent City, 1992-2014

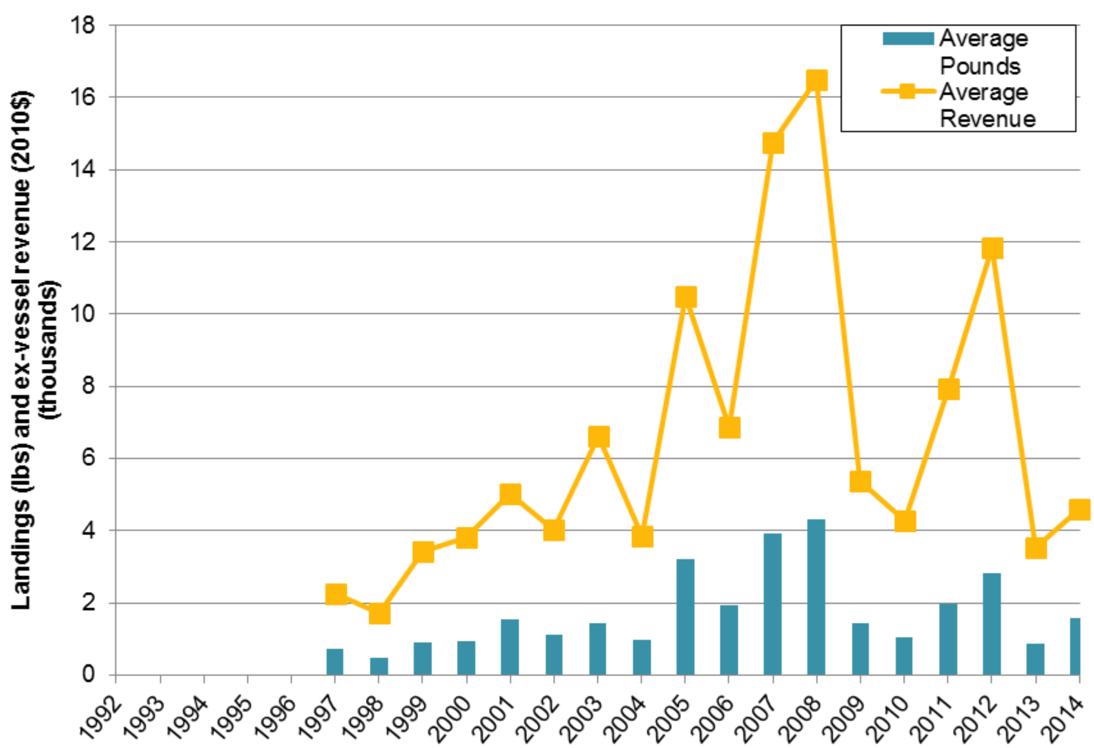
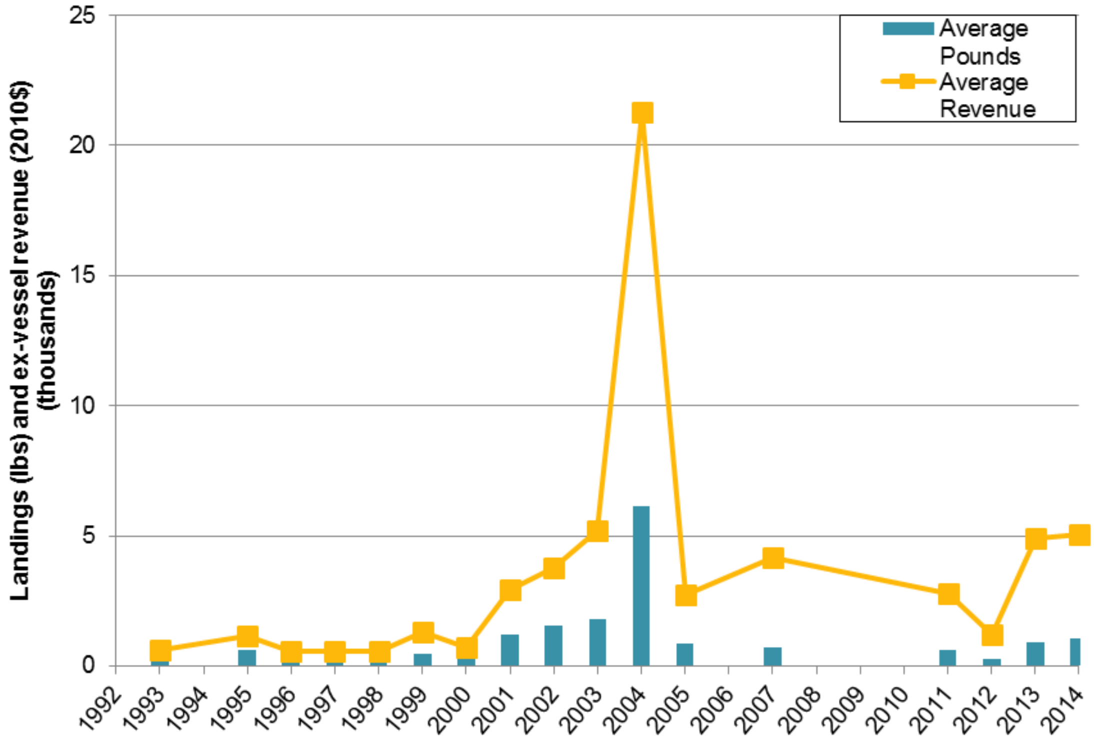


Figure 50. Salmon- troll: Average pounds, revenue per fisherman, Crescent City, 1992-2014



7. EUREKA PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

For the purpose of this report, the port of Eureka includes landings and fishing activities from the following sub-ports: Orick, Arcata, Fields Landing, Humboldt Bay, King Salmon, and Eureka. The port of Eureka itself is defined by fishing activity based out of Humboldt Bay. Like Crescent City, Eureka is a prominent fishing port that is steeped in a long history of commercial and recreational fishing. Since the 1930's Eureka had been historically the center of the North Coast commercial trawl fleet, with high volumes of groundfish landings along with salmon and Dungeness crab (Pomeroy et al., 2011).

According to NMFS data, in the past decade, Eureka has consistently ranked within the top 10 ports in California in terms of landed value. In 2013, 2012, 2009, and 2008, it was the third or fourth largest port in the state in landed value. Additionally, Eureka fishermen represent 22% of the North Coast region's commercial fleet. In recent years, Eureka landings and value has been dominated by Dungeness crab. Eureka brought in approximately 31% of the region's ex-vessel revenue and landings in the Dungeness crab fishery in 2014.

Along with traditional marine capture fisheries, the mariculture industry has been a growing presence in Humboldt Bay, with recent growth in seed and larvae production. In 2009, the California State Assembly Proclamation Recognized Humboldt Bay as the "Oyster Capital of California." Since that time, there has been expansion of oyster seed and larvae production as Humboldt Bay is recognized as being in a unique position for producing disease-free seed and larvae, which are exported along the West Coast (Coomber, 2015).

Woodley Island Marina provides important infrastructure in the port of Eureka. It has two marine terminals, a fuel dock, hoists, ship chandler, café and bar, laundry, guest docks, boat sales, rental lessons, and 237 slips for both commercial and recreational boaters. Fields Landing is home to boat building and repair, as well as charter and commercial fishing, a restaurant, and an RV park (Humboldt Bay Harbor, Recreation, and Conservation District, 2016b).

This port is heavily reliant on the Corps of Engineers' annual dredging of shipping channels so that vessels can safely "cross the bar" through the entrance of Humboldt Bay and access docks and marinas in the harbor. The Humboldt Bay entrance channel is historically second only to the Columbia River in terms of dangerous crossings on the West Coast of the US (Lynch, 2012). The CPFV fleet is the largest in the North Coast region, having grown from 7 to 17 vessels between 2007 and 2014.

Commercial and CPFV fishermen, represented by the Humboldt Fishermen's Marketing Association, were (along with others in the region) active stakeholder participants in discussions concerning the siting of MPAs in the region. While beyond the scope of this report, the port of Eureka also supports a substantial recreational fishing fleet. Recreational fishermen have self-organized into a group called Humboldt Area Salt Water Anglers (HASA) and this group was also active in MPA discussions.

Eureka, like the other North Coast fishing ports, has experienced a contraction of the commercial fishing fleet over the past two decades. The number of active commercial fishermen in the fisheries of interest has fallen by approximately half, from 297 participants in 1994 to 147 in 2014. A number of factors have contributed to declining numbers of commercial fishermen, including costly limited access permits, increasing fishing restrictions, declines in port support businesses and infrastructure, and fewer young people entering the business. Another contributing factor is heavy dependence on the highly variable Dungeness crab fishery. This dependence derives in part from restrictions in other formerly important fisheries prior to MPA formation, such as salmon closures and groundfish restrictions. Fisheries with the highest revenue were Dungeness crab and salmon. Relatively high prices in 2014 ($4.18/lb for Dungeness crab and $4.33/lb for salmon) were considered hopeful signs for the industry.

From our interview data, in 2013, we found that Eureka commercial fishermen were on average 52 years of age (somewhat younger than the regional average of 53 years) and had an average of 26 years of experience in commercial fishing (somewhat lower than the regional average of 28 years). By contrast, CPFV fishermen from Eureka were on average 46 years old with 5 years of CPFV experience. 2007 marked the beginning of a consistent presence for the Eureka CPFV fleet. In 2013, Eureka CPFV operators had an average of 5 anglers per trip and 101 trips per year, with top landings of Dungeness crab, rockfish, and salmon respectively over the duration of their historical logbook data.

When Eureka fishermen were questioned during the survey about which MPA's had affected their fishing most, they emphasized Ten Mile SMR, Reading Rock SMR, and Ten Mile Beach. Eureka fishermen who claimed they had been affected by MPAs expressed concern about not being able to fish in traditional grounds. CPFV operators targeting rockfish and lingcod also reported being displaced from some fishing grounds by MPAs. Although these locations are not adjacent to Eureka, for some they had been their traditional grounds.

Aging infrastructure and the reduction of businesses that support the industry has created an economic vulnerability. The closure of Eureka Fisheries, and Eureka Ice and Cold Storage in the early 2000s offer some examples. Local government has recognized the aging of infrastructure in the port and responded by investing more than $60 million over the past 20 years for waterfront revitalization, including the construction of the Fishermen's Terminal Building.

As with most of the North Coast ports, Eureka has seen many challenges over the years, and those we spoke with fear that there are more to come. Declines in commercial fishing participation, reduction in fisheries access, the aging of commercial fishermen, the dependency on a highly variable Dungeness crab fishery, and worries over the economics of maintaining port infrastructure and support businesses are important challenges for the port to address moving forward. Importantly the fishing fleet and marketing association are well organized and politically active. Additionally, local government entities such as the City of Eureka and the Humboldt Bay Harbor District have a record of taking actions to support the vitality of the region's working waterfront.

7.1. Eureka Commercial Fishing Baseline Characterization

The average commercial fisherman with a Eureka homeport that we interviewed was 52.3 years old and had an average of 26.0 years of experience as a commercial fisherman, as shown in Table 57 below. Average age in Eureka was 1.6 years younger than the North Coast regional average, and average years of experience was 1.6 years less than the regional average. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in specific fisheries of interest.

Of the target fisheries, fishermen participating in the nearshore finfish dead – hook and line fishery were oldest on average (57.7 years) and with the most experience (28.7 years), while salmon – troll fishermen were the youngest on average (50.5 years) and with the least experience (23.8 years).

Table 57. Average age and years of experience commercial fishing in 2013, Eureka

	Age			Years of Experience		
Fishery	Number of Respondents	Average	Standard Deviation	Number of Respondents	Average	Standard Deviation
Dungeness crab - trap	42	53.0	11.0	42	27.0	12.7
Nearshore finfish- dead - hook and line	3	57.7	4.0	3	34.3	5.7
Nearshore finfish dead - longline	1	*	--	1	*	--
Salmon - troll	32	50.5	12.7	32	23.8	14.9
All target fisheries (unique individuals)	**46**	**52.3**	**11.6**	**46**	**26.0**	**13.5**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in Table 58 below, Eureka fishermen on average reported making 89.1% of their total personal income from commercial fishing in 2013.

Table 58. Percent income from overall commercial fishing in 2013, Eureka

	Number responding	Average	Standard Deviation
All target fisheries (unique individuals)	**46**	**89.1%**	**18.6%**

Source: Current study

Fishermen in Eureka were asked what percentage of their gross fishing revenue was used for overall operating costs in 2013. This was asked as an overall fishing question as it is difficult to separate operating costs by individual fisheries due to inherent shared costs involved in fishing (e.g. boat maintenance, slip rental, or fuel costs for trips targeting multiple fisheries). As shown in Table 59 below, the average share of total ex-vessel revenue used for covering overall operating costs was reported to be 58.8%.

Table 59. Percentage of total gross fishing revenue used for overall operating costs in 2013, Eureka

	Number of respondents	Average	Standard deviation
All target fisheries (unique individuals)	**43**	**58.8%**	**20.7%**

Source: Current study

Commercial fishermen in Eureka were asked how many years of experience and how many days they spent targeting each of the fisheries in which they participated in 2013. The responses are summarized in Table 60 below. The average years of experience targeting all target fisheries in Eureka was 24.6 years. On average, of all fisheries with significant numbers of survey respondents, Dungeness crab – trap fishermen had the most experience targeting their fishery (25.2 years), and nearshore finfish dead – hook and line had the least (20.0 years).

The average number of days targeting specific fisheries was 59.3 for all fisheries. On average, Dungeness crab - trap fishermen spent the largest average number of days targeting their fishery in 2013 (71.3). An FAC member noted that days spent targeting Dungeness crab likely includes days setting out traps (e.g., initial soak time) or actively moving or collecting the traps. Fishermen targeting salmon – troll spent the fewest average number of days fishing (47.6 days).

Table 60. Years of experience and number of days targeting specific fisheries in 2013, Eureka

	Years of experience			**Days targeting specific fisheries**		
Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab - trap	42	25.2	11.4	41	71.3	49.5
Nearshore finfish- dead - hook and line	2	20.0	--	2	--	--
Nearshore finfish dead - longline	1	*	--	1	*	--
Salmon - troll	32	23.9	15.6	31	47.6	32.2
All target fisheries (unique individuals)	**46**	**24.6**	**13.1**	**46**	**59.3**	**44.5**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Eureka commercial fishermen were also asked how many crew they used for each fishery, and what share of their ex-vessel revenue was spent on their crew and on fuel. As shown in Table 61 below, on average, Eureka fishermen hired 1.7 crew members. The average percentage of ex-vessel revenue spent on crew was 26.0%. On average, Dungeness crab – trap fishermen spent the largest percentage of revenue on crew (31.5%), and salmon - troll fishermen spent the least (19.6%). The average percentage of ex-vessel revenue spent on fuel was 10.7%. On average, Dungeness crab – trap fishermen spent the largest percentage of their ex-vessel revenue on fuel (11.1%), and salmon – troll fishermen spent the least (10.7%).

Table 61. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Eureka

	Number of crew			**Share of revenue towards crew**			**Share of revenue towards fuel**		
Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab - trap	42	2.3	1.3	41	31.5%	9.2%	38	11.1%	6.0%
Nearshore finfish- dead - hook and line	1	--	--	1	--	--	1	--	--
Nearshore finfish dead - longline	1	*	--	1	*	--	1	*	--
Salmon - troll	32	0.9	0.6	32	19.6%	14.0%	30	10.2%	5.5%
All target fisheries (unique individuals)	**46**	**1.7**	**1.3**	**46**	**26.0%**	**13.1%**	**43**	**10.7%**	**5.9%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Eureka commercial fishermen were also asked whether MPAs had affected their fishing, and if so, to describe those direct effects for 2013. This was asked as an open ended question and respondents could provide more than one answer. Responses are summarized in Table 62 below. Of the respondents who answered this question, 63.0% answered that MPAs had affected their fishing. Of those who responded Yes, the most frequently cited effect was (A), Cannot fish in or go to traditional grounds/areas (58.7% of respondents). The second most frequently cited effect was (E), Other (41.3% of respondents). Common write-in “Other” responses including crowding of fish-abundant areas not protected by MPAs; inconvenience in not being able to anchor in newly protected areas; loss of economic opportunity; and indirect effects through negatively affecting other fishermen.

Table 62. Direct effects of MPAs on specific fisheries in 2013, Eureka

Fishery	Number of respondents	Have MPAs impacted your fishing?	A	B	C	D	E
Dungeness crab - trap	42	33.3%	33.3%	9.5%	4.8%	4.8%	23.8%
Nearshore finfish- dead - hook and line	3	66.7%	66.7%	33.3%	33.3%	33.3%	33.3%
Nearshore finfish dead - longline	1	*	*	*	--	*	--
Salmon - troll	32	81.3%	68.8%	25.0%	15.6%	3.1%	37.5%
All target fisheries (unique individuals)	**46**	**63.0%**	**58.7%**	**23.9%**	**13.0%**	**4.3%**	**41.3%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly effected by MPAs

Commercial fishermen in Eureka were asked which MPAs had affected their fishing activities in 2013, and were provided with a comprehensive list of MPAs, given below. We list the MPAs that respondents cited as having affected specific targeted fisheries in Eureka during 2013 in Table 63 below. As can be seen in Table 63, twenty-four MPAs on the North Coast affected targeted fisheries in 2013. Of those, Ten Mile SMR (B) affected the largest number of fishermen respondents (22), followed by Reading Rock SMR (L) with 12 respondents, and Ten Mile Beach (O) with 12 respondents. Of the fisheries affected, the one with the largest number of respondents to this question was Salmon - troll (70 total responses), following by Dungeness crab -Trap (25 total responses).

Table 63. Which MPAs have affected specific fisheries in 2013, Eureka

Fishery	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Dungeness Crab - Trap	--	3	--	1	--	--	--	--	2	--	--	9	5	1	--	--	1	--	--	--	2	--	--	1	--	--	--	--
Nearshore Finfish Dead - Hook and Line	--	--	--	--	1	--	1	--	1	--	--	--	--	--	--	1	--	1	--	--	1	1	--	--	--	1	--	--
Nearshore Finfish Dead - Longline	--	--	--	--	1	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--
Salmon - Troll	1	20	1	2	1	--	1	2	1	--	1	4	3	1	12	1	4	1	1	--	1	4	2	1	--	3	1	1
All target fisheries (unique individuals)	**1**	**22**	**1**	**3**	**3**	**--**	**2**	**2**	**5**	**--**	**1**	**12**	**8**	**2**	**12**	**2**	**5**	**2**	**1**	**--**	**5**	**4**	**2**	**2**	**--**	**3**	**1**	**1**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were asked about the degree of importance and reasons of importance of participating in multiple targeted fisheries in their community. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 64 below, all but one respondent indicated that multi-fishery participation was either 'Very Important' or 'Important.'

An FAC member from Eureka noted that multi-fishery participation has become much more important than in the past. Another FAC member from Eureka observed that fishermen recognize the desirability of multi-fishery participation, but the reality is that Dungeness crab currently dominates fishing opportunities in the Eureka area, and declines in salmon troll opportunities attenuate fishermen's ability to participate in multiple fisheries in a meaningful way.

If fishermen responded that multi-fishery participation was very important or important, as they nearly all did, they were then asked why that was the case. The question was asked as an open-ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer. The top two responses were that it 'Stabilizes year-to-year variation in my commercial fishing income' and 'Increases my annual commercial fishing income'.

Table 64. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Eureka

		Degree of importance				Reasons for importance			
Fishery	**Number responding**	**Very Important**	**Important**	**Neither Important nor Unimportant**	**Unimportant**	**A**	**B**	**C**	**D**
Dungeness crab - trap	42	32	7	1	1	20	37	14	12
Nearshore finfish- dead - hook and line	3	3	--	--	--	1	3	1	1
Nearshore finfish dead - longline	1	--	--	--	*	--	--	--	--
Salmon - troll	32	26	4	1	--	18	29	11	8
All target fisheries (unique individuals)	**46**	**36**	**7**	**1**	**1**	**21**	**41**	**14**	**12**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, respondents in Eureka were asked what strategies they used to market their catch. They were given ten possible options, listed below in Table 65 as answers A through J. Respondents were allowed to provide more than one answer. The most frequently cited market strategy was C, Sell to traditional processor (38 individual responses), followed by G, Sell to live fish buyers (14 individual responses), and F, Sell off own vessel (10 responses). An FAC member from Eureka noted that the challenge with direct sales is that fishermen must take time off from fishing to do that, which raises the opportunity cost of that marketing strategy.

Table 65. Strategies used to market catch in 2013, Eureka

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	1	1	34	2	7	9	14	4	3	3
Nearshore finfish- dead - hook and line	--	--	2	--	2	1	1	1	--	--
Nearshore finfish dead - longline	1	--	1	--	--	--	--	--	1	--
Salmon - troll	--	1	28	2	6	8	8	4	2	1
All target fisheries (unique individuals)	**1**	**1**	**38**	**2**	**7**	**10**	**14**	**4**	**3**	**3**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

7.2. Eureka Commercial Fishing Initial Changes

Fishermen in Eureka were also asked how they saw their income from commercial fishing changing from 2009 to 2013. They were asked to select one of the following options; significantly higher, somewhat higher, no change, somewhat lower, or significantly lower. No strong pattern emerged. As shown below in

Table **66**, a majority of respondents in all target fisheries (62.1%) perceived no change. A minority of respondents perceived somewhat higher income (13.7%) or significantly higher income (13.7%). Less than 10% of respondents each reported somewhat lower (3.2%); and significantly lower (7.4%) incomes.

Table 66. Perceived change in share of personal income coming from commercial fishing between 2009 and 2013, Eureka

	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**46**	**13.7%**	**13.7%**	**62.1%**	**3.2%**	**7.4%**

Source: Current study.

In addition to indicating a perceived change, fishermen in Eureka were asked what factors they saw as contributing to the change in the percentage of their income coming from commercial fishing between 2009 and 2013. This was asked as an open-ended question. In Table 67 we list the reason for the change as well as the number of responses for each fishery. Of those who answered this question, the most common answer was categorized as 'Changes in the market/economy'.

Table 67. Factors most affecting changes in share of personal income coming from commercial fishing between 2009 and 2013, Eureka

	Number of respondents	A	B	C	D	E
All target fisheries (unique individuals)	**46**	**6**	**3**	**5**	**2**	**14**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Commercial fishermen in Eureka were asked separately for each fishery they participated in to compare his/her success in the fishery in 2013 to that of the last ten years. As shown in Table 68 below, respondents were given the option of responding in one of the following categories: (1) Significantly better; (2) Somewhat better; (3) The same; (4) Somewhat worse; and (5) Significantly worse. Again no strong pattern emerged. The most popular answer (26.0%) was 'Significantly better'; the second most popular answer/s were 'The same' (21.9%) and 'Somewhat better' (19.2%). salmon – troll fishermen were most likely to answer 'Significantly better' (41.9%), while Dungeness crab – trap fishermen were most likely to answer 'The same' (27.5%) or 'Somewhat better' (20.0%). Salmon – troll fishermen were also most likely to respond that they had not participated in that fishery in previous seasons (19.4%).

Table 68. Perceived success in fishing in 2013 compared to last ten years, Eureka

Fishery	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	40	7.5%	15.0%	20.0%	27.5%	15.0%	15.0%
Nearshore Finfish Dead - Hook and Line	1	--	--	--	--	--	*
Nearshore Finfish Dead - Longline	1	--	--	--	--	--	*
Salmon - Troll	31	19.4%	41.9%	19.4%	16.1%	3.2%	--
All target fisheries (unique individuals	**41**	**12.3%**	**26.0%**	**19.2%**	**21.9%**	**9.6%**	**11.0%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

In Figure 51 we summarize commercial landings, ex-vessel revenue, and number of commercial fishermen for all fisheries in the North Coast port of Eureka over the study period, 1992-2014. As in other regional ports, the overall trend was a decline in numbers of active commercial fishermen and fluctuations in both ex-vessel income and landings over the study period.

In Figure 52 we provide that same trend data for our fisheries of interest. One difference relative to Figure 51 is that the declining trend in numbers of active commercial fishermen was less robust, as participation generally declined but experienced sharper fluctuations over the study period. Landings and ex-vessel revenue both revealed a fluctuating rising trend over the course of the study period.

Figure 51. Commercial landings, ex-vessel revenues, and number of fishermen, Eureka, 1992–2014, all fisheries

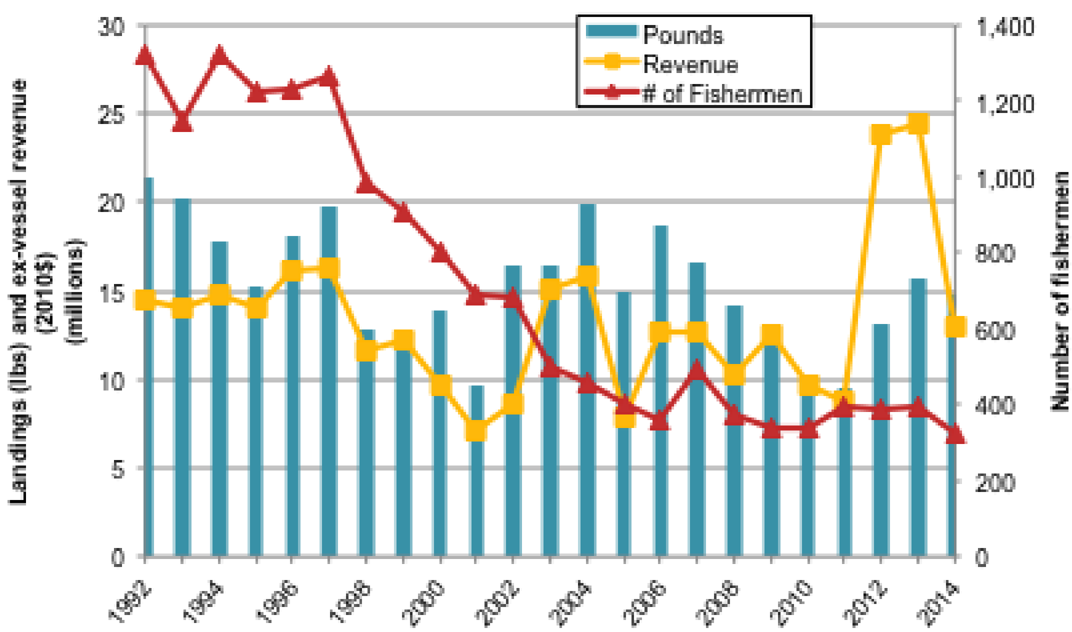
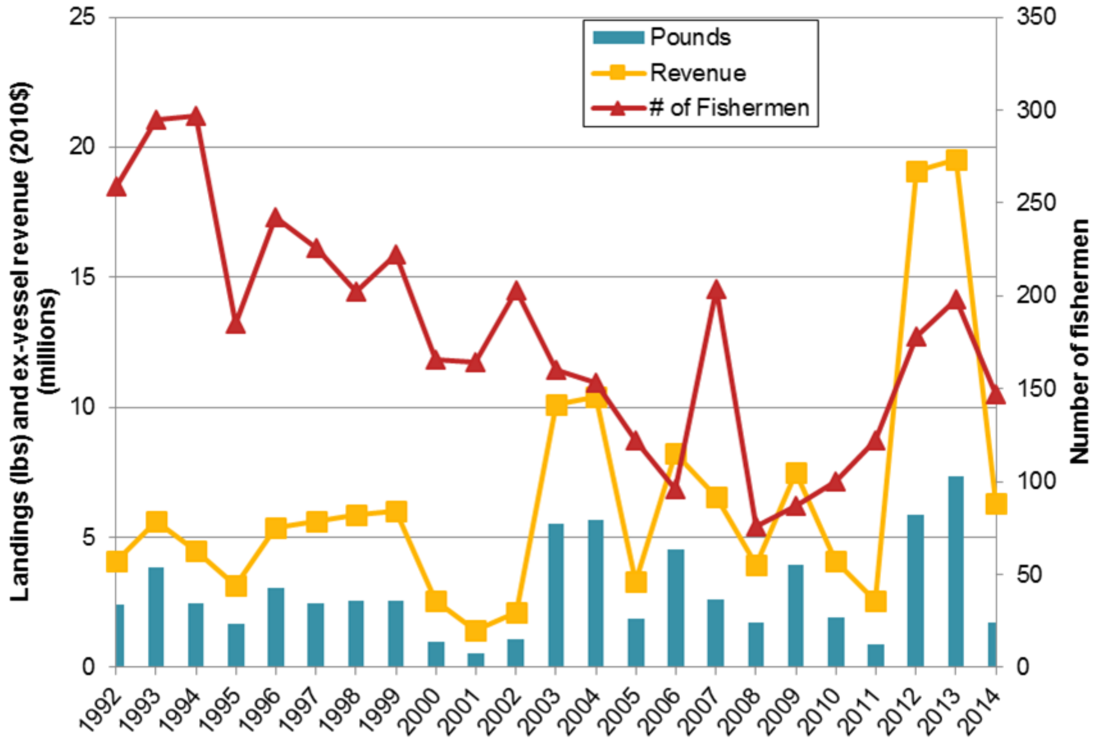
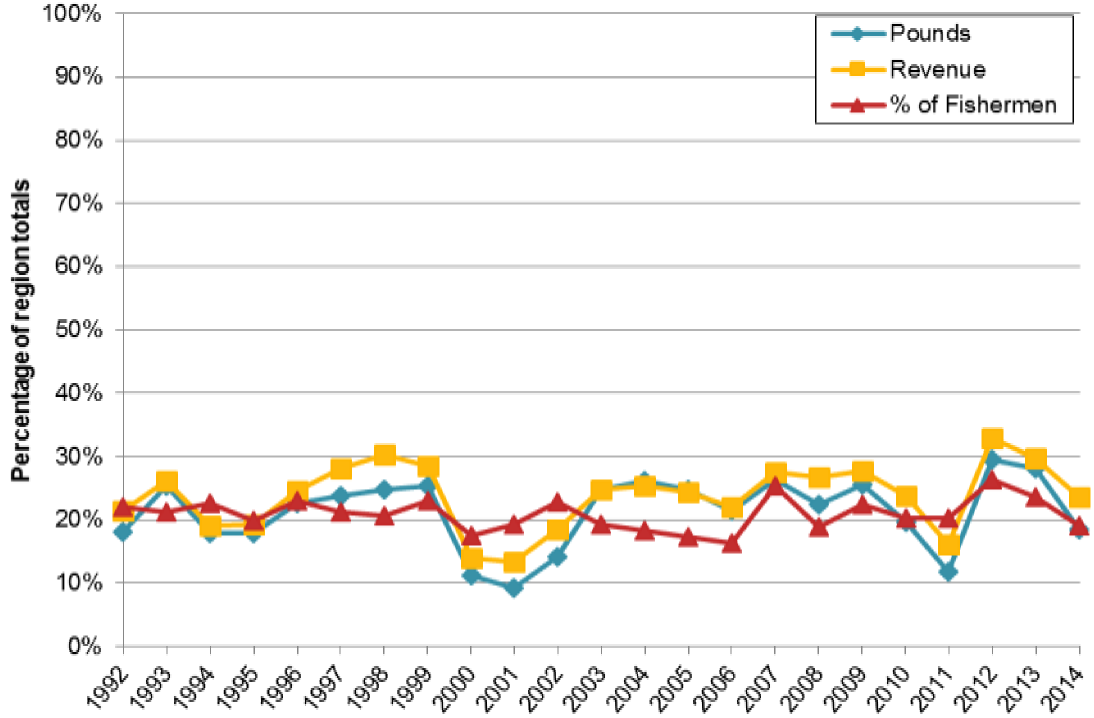


Figure 52. Commercial landings, ex-vessel revenues, and number of fishermen, Eureka, 1992–2014, fisheries of interest



From Figure 53 one can see that from an annual average perspective, Eureka accounted for roughly 20% to 30% of total regional landings and ex-vessel revenue over the study period, and had a similar share of the region's active commercial fishermen.

Figure 53. Fisheries of interest landings, revenue, and number of fishermen as a percentage regional totals, Eureka, 1992-2014



Dungeness crab made up the overwhelming majority of Eureka commercial landings and ex-vessel revenue within the fisheries of interest over the duration of the study period (Figure 54 and Figure 55). One can clearly see how Dungeness crab serves as the economic mainstay of the Eureka commercial fishing fleet. The next-most significant fishery was Salmon-troll with an overall peak in 2013 with 190,000 pounds landed (and $976,000 in ex-vessel revenue) and a total low in 1992 with 718 pounds caught (and $2,700 in ex-vessel revenue).

Relative to Eureka landings and value, there was somewhat greater diversity in targeted fisheries. Although the majority of Eureka commercial fishermen targeted the Dungeness crab-trap fishery, 22% of fishermen targeted salmon-troll, and 6.2% targeted nearshore finfish- hook-line dead, as shown in
Figure 56.

Figure 54. Commercial landings for fisheries of interest, Eureka, 1992-2014

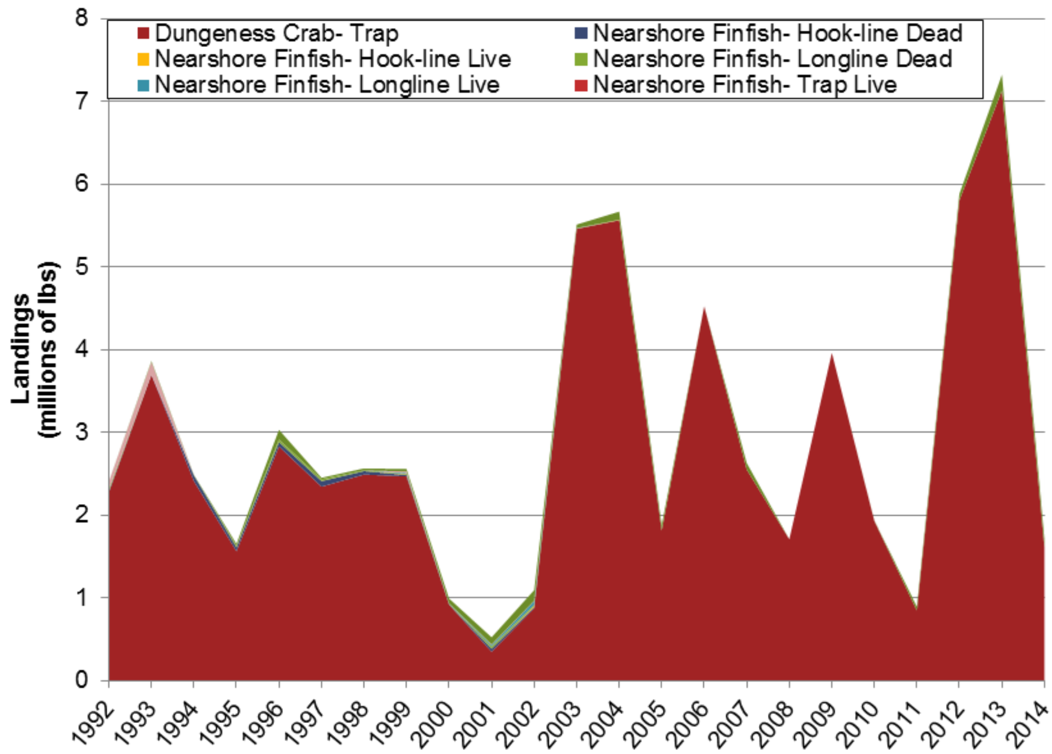


Figure 55. Ex-vessel revenue for fisheries of interest, Eureka, 1992-2014

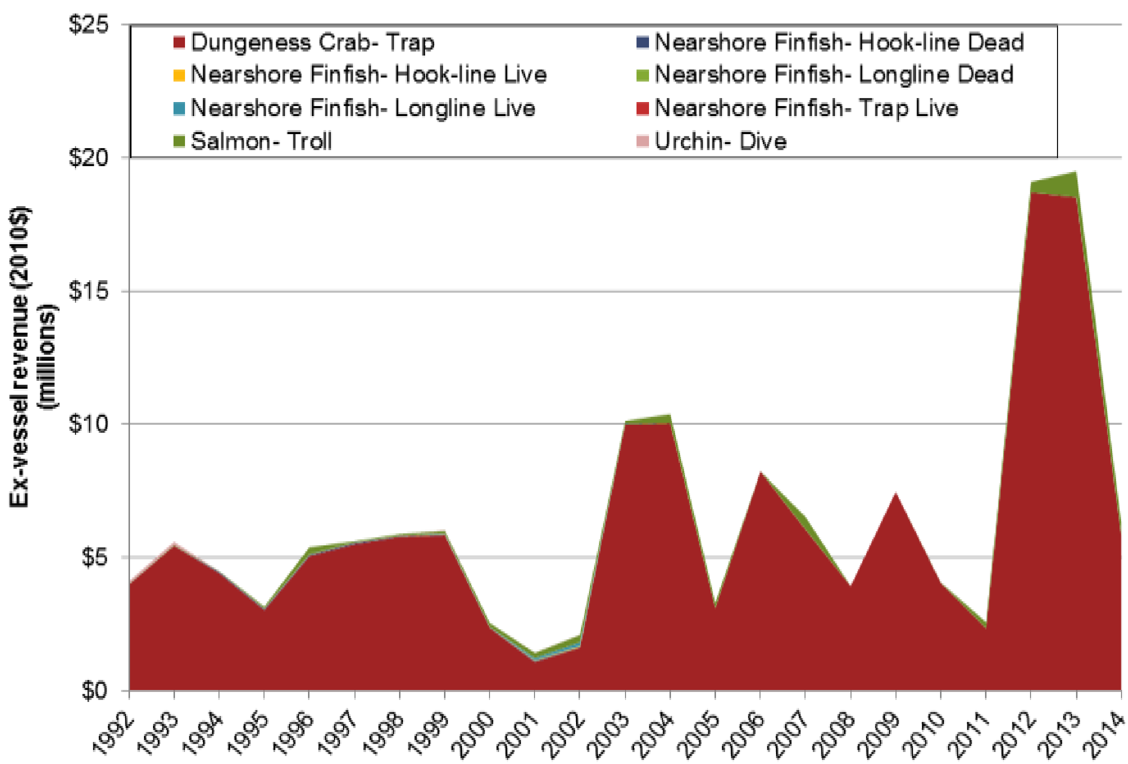
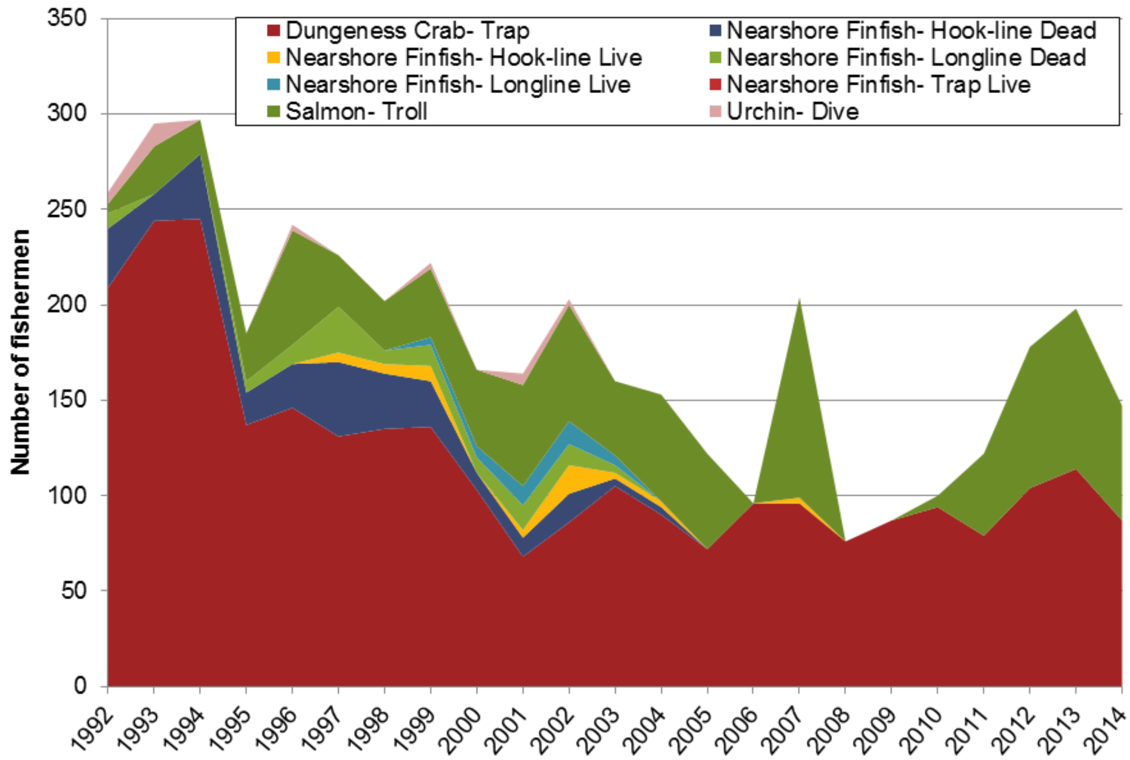


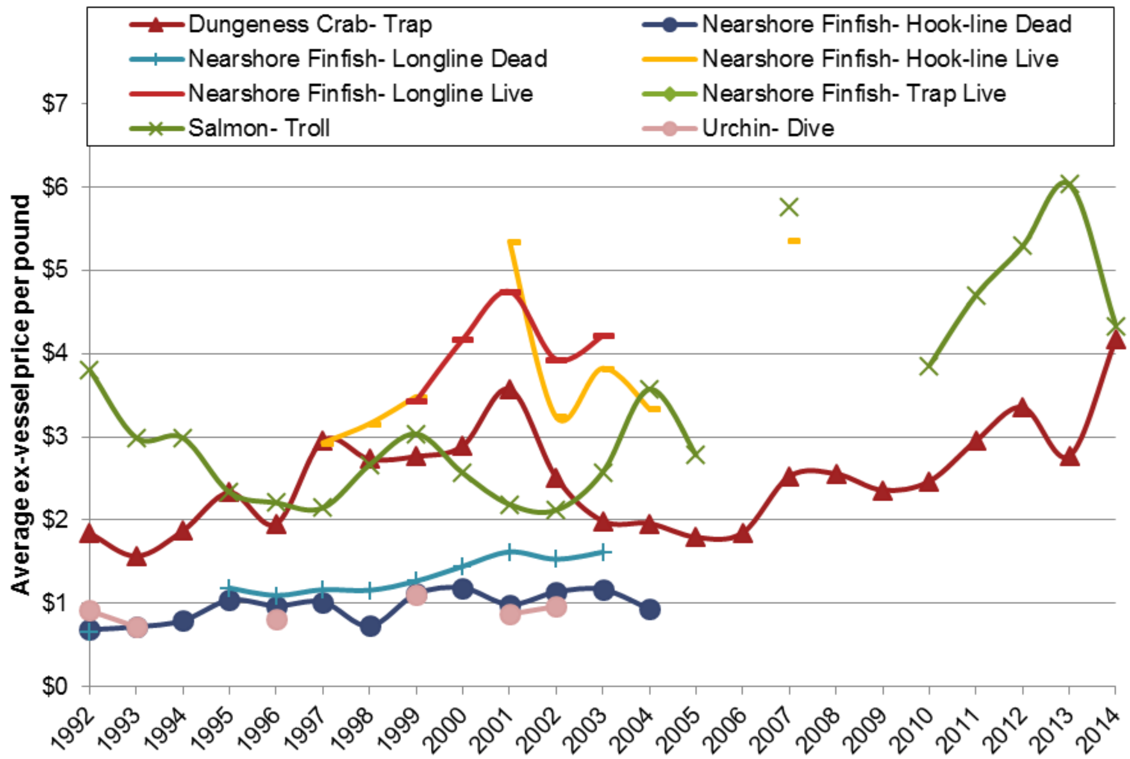
Figure 56. Number of fishermen for fisheries of interest, Eureka, 1992-2014



In

Figure 57 we summarize annual average ex-vessel price by fishery over the duration of the study period. One can see a generally rising price per pound for Dungeness crab over the study period (in constant 2010 dollars), as well as relatively strong salmon prices.

Figure 57. Average ex-vessel price over time, Eureka, 1992-2014



Key fisheries of interest for Eureka include Dungeness crab-trap and Salmon-Troll. In Figure 58 and
Figure 59 we summarize trends in landings, ex-vessel revenue, and number of active commercial fishermen for these two key fisheries of interest. Since the late 1990s there have been roughly 100 commercial fishermen landing Dungeness crab in Eureka. One can also see a strong recovery in the number of commercial fishermen landing salmon in the post-closure period.

We summarize average annual landings per commercial fisherman for these two key fisheries in Figure 60 and
Figure 61. The sharp amplitude of average annual fishing revenue from Dungeness crab and from salmon provides a clear indication of the motivation for multi-fishery participation to stabilize inter-annual fishing income.

Figure 58. Dungeness crab- trap: Average pounds, revenue, and number of fishermen, Eureka, 1992-2014

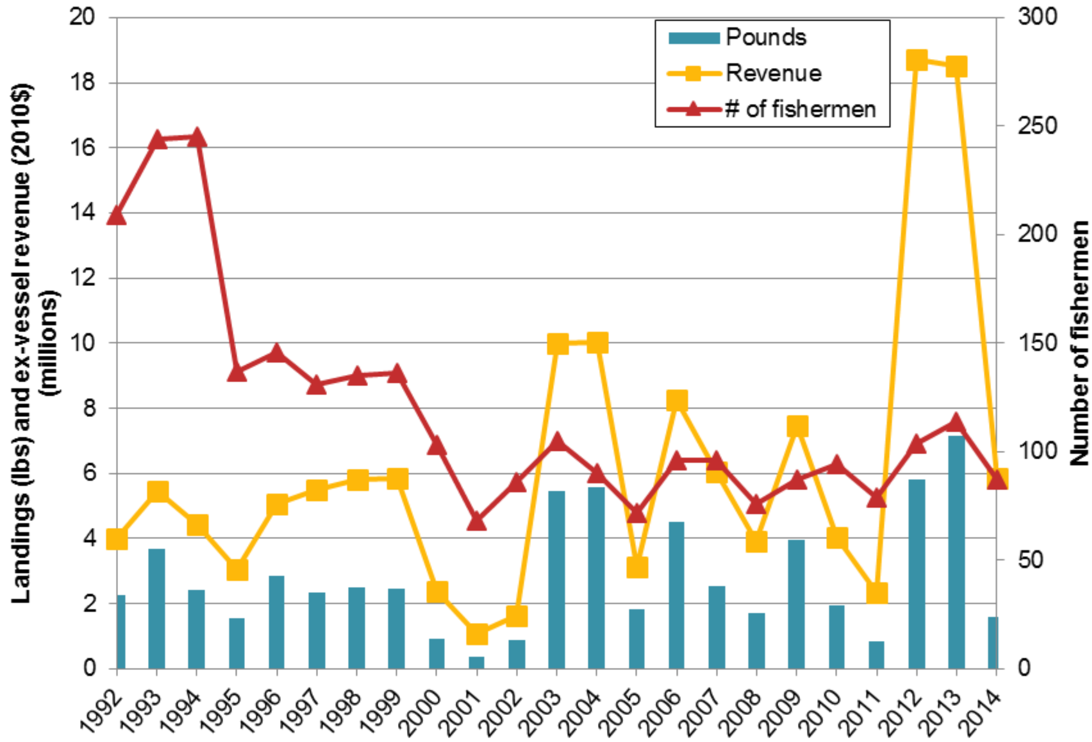


Figure 59. Salmon- troll: Average pounds, revenue, and number of fishermen, Eureka, 1992-2014

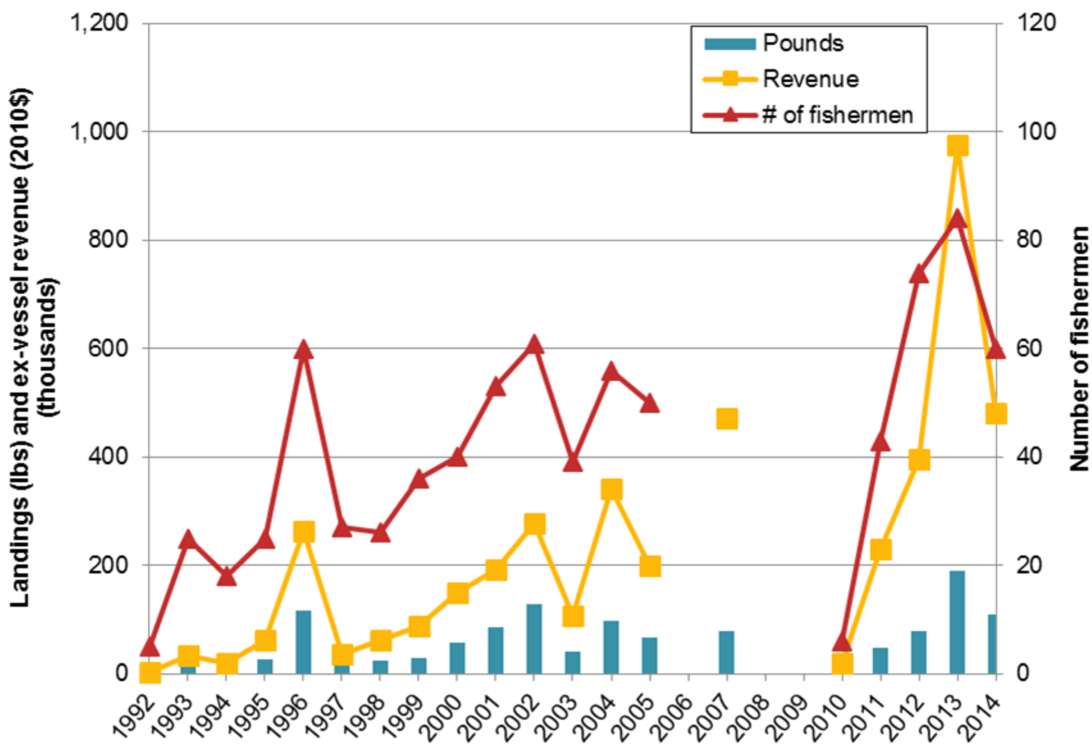


Figure 60. Dungeness crab- trap: Average pounds, revenue per fisherman, Eureka, 1992-2014

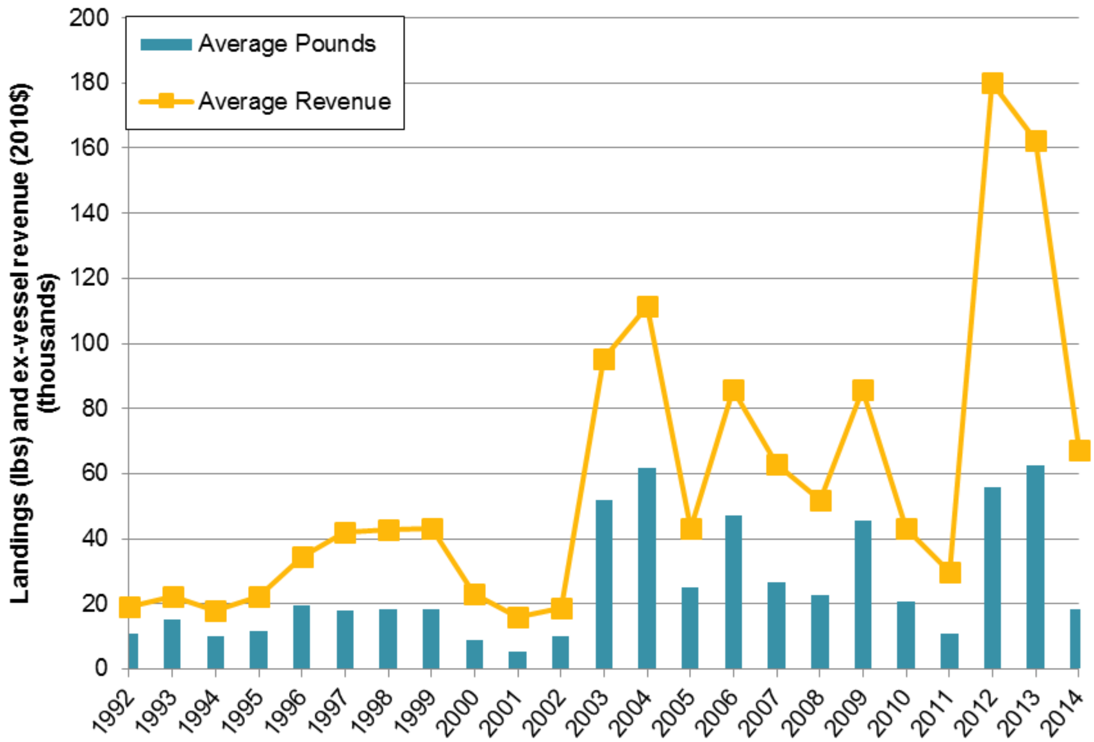
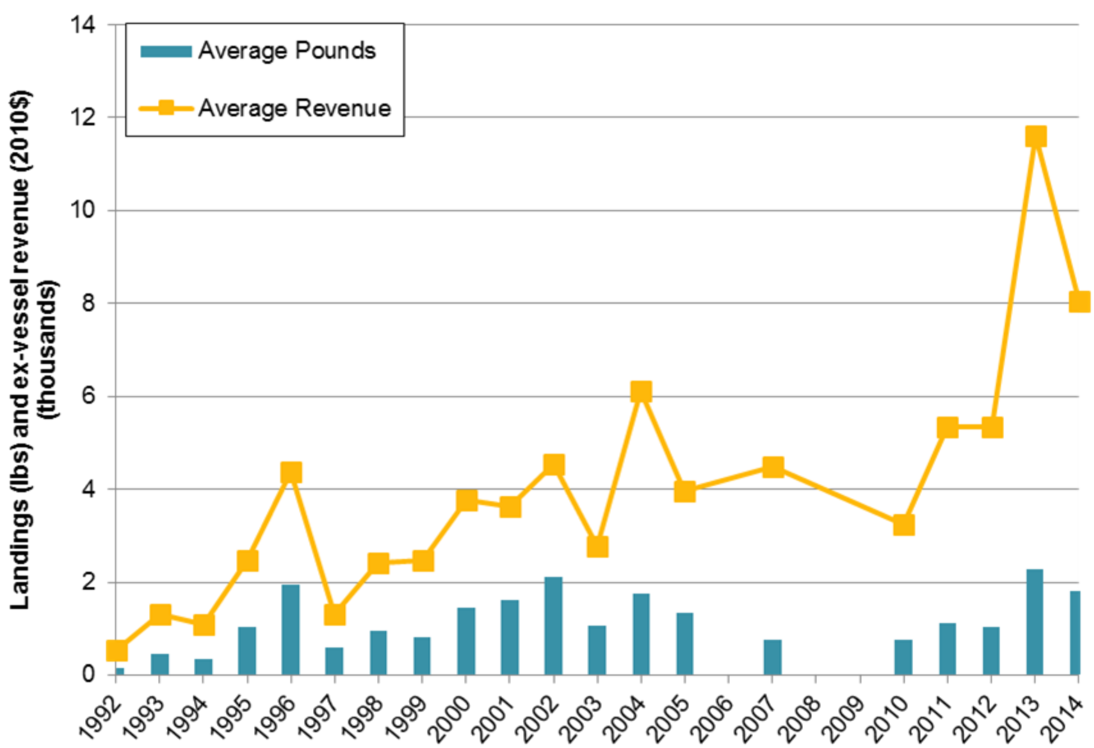


Figure 61. Salmon- troll: Average pounds, revenue per fisherman, Eureka, 1992-2014



7.3. Eureka CPFV Baseline Characterization

As shown in Table 69, the average CPFV operator we interviewed in Eureka was 45.8 years old, had 5.5 years of experience owning a CPFV vessel (if applicable), and 5.5 years of experience operating a CPFV vessel. On average, respondents reported that 60.0 percent of their income came from operating and/or owning a CPFV vessel. Three of the four CPFV operators indicated they had an additional source of income besides their CPFV operation. One indicated he had a river charter fishing business, one indicated he had sold personal land, and one mentioned commercial fishing (Table 70).

Table 69. CPFV survey response statistics, 2013, Eureka

	Response	**Standard deviation**	**Number responding**
Individuals Interviewed	4	--	--
Average age	45.8	8.8	4
Average number of years owning CPFV boat/s	5.5	4.1	4
Average number of years operating CPFV boat/s	5.5	4.1	4
Average percent income from CPFV operations in 2011	60.0%	33.7%	4

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 70. Sources of income in 2013 in additional to CPFV operation, Eureka

Response	**Number responding**
River charter fishing business	1
Sale of personal land	1
Commercial fishing	1
Total number responding (unique individuals)	**4**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

The average CPFV owner/operator in Eureka reported earning a gross revenue (GR) of $79,500 in 2013, as shown in Table 71. Additionally, respondents reported they spent an average of 18.5% of GR on fuel, 1.8% on crew, and 30.5% on all other operating costs. After costs, respondents in Eureka made an average net income of $39,114 in 2013.

Table 71. Average gross revenue (GR) from CPFV to operating costs, 2013, Eureka

	Number responding	Average response	Standard deviation
Total GR 2013	4	$79,500	$32,879
% GR to fuel	4	18.5%	11.3%
% GR to crew	4	1.8%	2.4%
% GR to all other operating costs	4	30.5%	13.7%

Source: Current Study

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In Table 72 below we provide information on average number of trips, passengers, average price, and number of crew for consumptive and non-consumptive CPFV trips in Eureka during 2013. All four CPFV respondents led consumptive fishing trips in 2013, and three led non-consumptive trips (e.g. whale watching). The average number of consumptive trips taken by CPFV operators in 2013 was 101.3, and the average number of non-consumptive trips was 0.7.

The price of an average consumptive fishing trip out of Eureka was $168, and it included an average of 5 passengers and 0.5 crew on board. CPFV operators charged on average $114 per passenger for non-consumptive trips, which had on average 3 passengers and 0.7 crew on board.

Table 72. CPFV trip statistics, 2013, Eureka

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	4	--	--	3	--	--
Average number of trips	4	101.3	32.8	3	0.7	0.6
Average number of passengers (per trip)	4	5.0	0.8	3	3.0	2.6
Average price per passengers (per trip)	4	$168	$12	3	$114	$101
Average number of crew (per trip)	4	0.5	0.6	3	0.7	0.6

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

For each fishery and activity they targeted in 2010, CPFV fishermen were asked how many days they spent targeting that fishery/activity and what share of their GR they received from that fishery/activity (Table 73). On average, respondents spent 38.6 days targeting specific fisheries, and earned 30.7% of their GR from the target fishery.

Table 73. Number of days and percentage of GR targeting fishery/activity in 2013, CPFV, Eureka

			Number of days targeting species (2013)			Share of GR from fishery/activity (2013)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	Dungeness crab	1	1	*	--	1	*	--
	Rockfish/lingcod	4	4	18.3	2.9	4	17.7%	13.3%
	Salmon	1	1	*	*	1	*	*
	Tuna and dorado	1	1	*	--	1	*	--
All target fisheries (unique individuals)		**4**	**4**	**38.6**	**30.5**	**4**	**30.7%**	**24.8%**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

The reported direct effects of MPAs on specific fisheries targeted by Eureka CPFV operators in 2013 are summarized in Table 74. The rockfish/lingcod fishery was most strongly affected by MPAs, with 66.7% of respondents from that fishery indicating that MPAs had effected their fishing. Of the specific effects on rockfish/lingcod fisheries reported, the most commonly cited effect was answer A, ‘Cannot fish in or go to traditional ground/areas’ (66.7% of respondents).

The Pacific halibut fishery was second most strongly affected by MPAs, with 25% of respondents indicating that MPAs had affected their fishing. None of the other fisheries were affected by MPAs as reported by respondents. An FAC member and CPFV operator noted that the salmon troll fishery is very important for Eureka trips, particularly in inclement ocean conditions, as salmon grounds can be accessed just beyond the harbor entrance, while targeting rockfish or lingcod necessitates longer transit times.

Table 74. Direct effects of MPAs on specific CPFV fisheries, 2013, Eureka

	Fishery	**Number of respondents**	**Have MPAs effected your fishing?**	**A**	**B**	**C**	**D**	**E**
Fishery	Dungeness crab	1	--	--	--	--	--	--
	Rockfish/lingcod	3	66.7%	66.7%	--	--	33.3%	33.3%
	Pacific halibut	4	25.0%	25.0%	--	--	--	--
	Salmon	4	--	--	--	--	--	--
	Tuna and dorado	1	--	--	--	--	--	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Shifted fishing effort into areas in which weather is less predictable
C	Moved homeport location or fish out of another port
D	Need to travel longer distances to fish/conduct activity in other areas
E	Other ways directly/indirectly effected by MPAs

In Table 75 we summarize respondent comments on which MPAs affected each CPFV fishery in Eureka, if any, in 2013. Five MPAs affected the rockfish/lingcod fishery, and no other specific MPAs were mentioned as affecting any other fisheries. These five MPAs were Steamboat Rock Special Closure, Mattole Canyon SMR, Reading Rock SMR, Sugarloaf Island Special Closure, and South Cape Mendocino SMR.

Table 75. Which MPAs have affected specific CPFV fisheries, 2013, Eureka

	Fishery	E	I	L	R	U
Fishery	Dungeness crab	--	--	--	--	--
	Rockfish/lingcod	1	1	1	1	1
	Salmon	--	--	--	--	--
All target fisheries (unique individuals)		**1**	**1**	**1**	**1**	**1**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Point Cabrillo SMR	**O**	Ten Mile Beach SMCA
B	Klamath Rock Special Closure	**P**	Sea Lion Gulch SMR
C	Ten Mile SMR	**Q**	Vizcaino Rock Special Closure
D	South Humboldt Bay SMRMA	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

7.4. Eureka CPFV Initial Changes

Changes in the share of income respondents earned from CPFV operations from 2009 to 2013 are summarized in Table 76. Three-quarters (75%) of Eureka CPFV respondents reported a “Significantly higher” share of income from CPFV operations in 2013 compared to 2009. The remaining quarter reported a “Significantly lower” share of income from CPFV operations over that time period.

Table 76. Change in share of income from Commercial Passenger Fishing Vessel (CPFV) operation, 2009 to 2013, Eureka

		Percent response				
	Number responding	**Significantly higher**	**Somewhat higher**	**No change**	**Somewhat lower**	**Significantly lower**
All fisheries (unique individuals)	**4**	**75.0%**	**--**	**--**	**--**	**25.0%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

In addition to indicating a perceived change, respondents were asked an open-ended question regarding the factors they saw as contributing to that change in the share of their income coming from CPFV operations over the five-year time period described above. From Table 77 one can see that there is no clear consensus across CPFV operators for changes in the share of their income from CPFV operations from 2009 to 2013.

Table 77. Factors causing changes in share of overall income from CPFV, 2009 to 2013, Eureka

Response	**Number responding**
Changes in the market/economy	1
Changes in fish abundance/presence	1
Changes in regulations	--
Personal reasons	1
Other	4
Total number responding (unique individuals)	**4**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Changes in the number of CPFV trips taken out of Eureka between 2009 and 2013 are shown in Table 78. All respondents reported either ‘Significantly higher’ or ’Somewhat higher’ numbers of trips, consistent with the overall growth of CPFV operations in the North Coast region. The largest group of respondents, across all fisheries, reported ‘Significantly higher’ numbers of trips across the five-year timespan. Trips targeting Pacific halibut and salmon had the largest proportions of ‘Significantly higher’ responses (75% each).

Table 78. Changes in the number of trips, 2009 to 2013, Eureka

	Fishery/Activity	Number responding	Significantly higher	Somewhat higher
Fishery	Dungeness Crab	1	--	*
	Pacific Halibut	4	75.0%	25.0%
	Rockfish/Lingcod	3	66.7%	33.3%
	Salmon	4	75.0%	25.0%
	Tuna and Dorado	1	--	*

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

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In Table 79 we summarize respondents' perceived success as CPFV operators in 2013 compared to the last ten years, reported by fishery. Some results by fishery were suppressed to preserve confidentiality. CPFV operators generally saw their success in 2013 as either the same or significantly better than the previous ten years.

Table 79. Perceived success in CPFV fishery/activity in 2013 compared to last ten years, Eureka

	Fishery	Number responding	Did not participate in previous seasons	Significantly better	The same
Fishery	Dungeness crab	1	--	--	*
	Pacific halibut	4	25.0%	50.0%	25.0%
	Rockfish/lingcod	3	33.3%	--	66.7%
	Salmon	4	25.0%	75.0%	--
	Tuna and dorado	1	--	--	*

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

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From Figure 62 one can see the sharp growth in numbers of CPFV vessels operating out of Eureka, with considerable variation in annual average number of trips per vessel. Congruent with the rapid growth of CPFV operations is an associated rise in the total number of CPFV trips out of Eureka, as shown in Figure 63, which together resulted in relatively steady average numbers of anglers per trip.

Nonetheless, the annual average number of anglers per CPFV vessel ultimately declined from its 2011 peak, as shown in Figure 64, suggesting the growth in CPFV operations exceeded growth in annual numbers of anglers seeking such trips in Eureka.

Figure 62. Total number of CPFV vessels and average number of trips per vessel, Eureka, 1992-2014

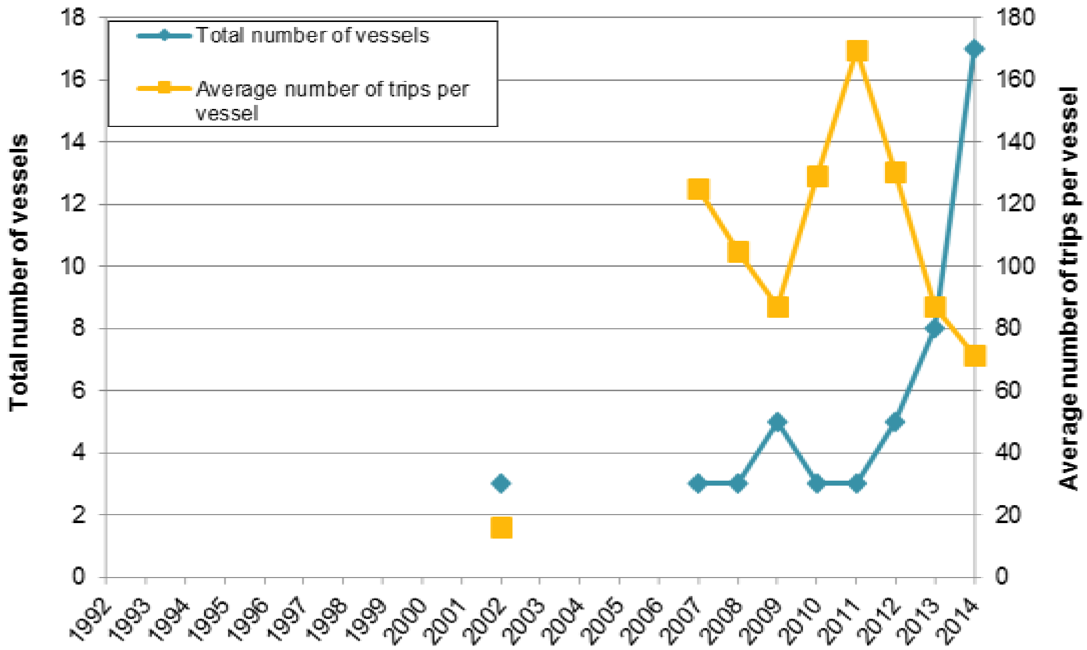


Figure 63. Total number of CPFV trips and average number of anglers per trip, Eureka, 1992-2014

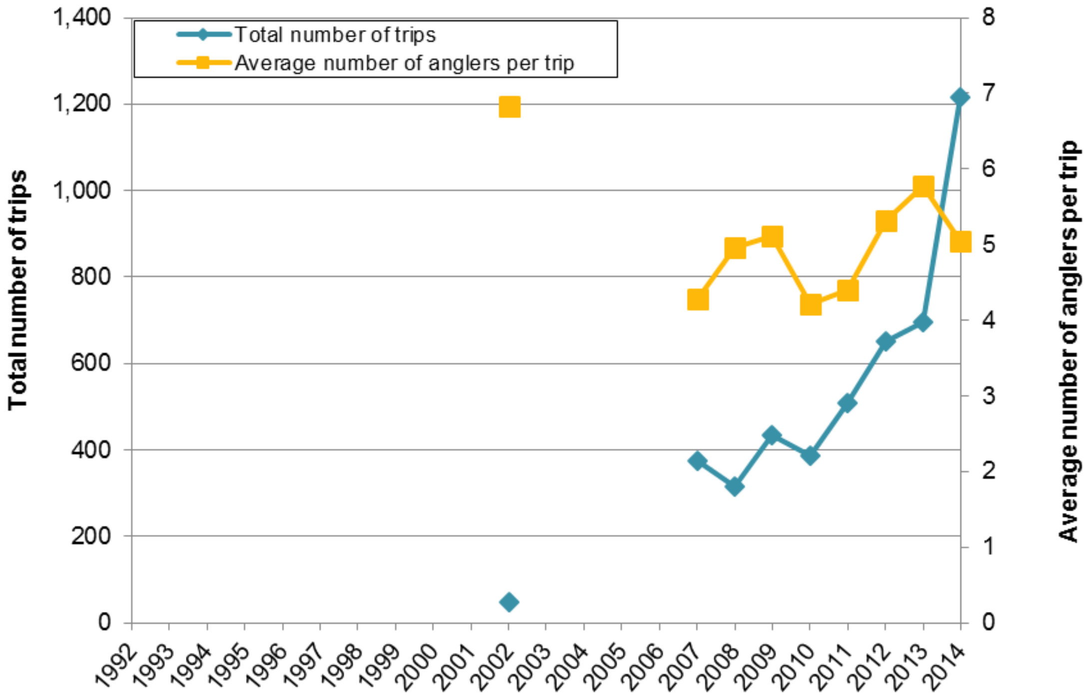
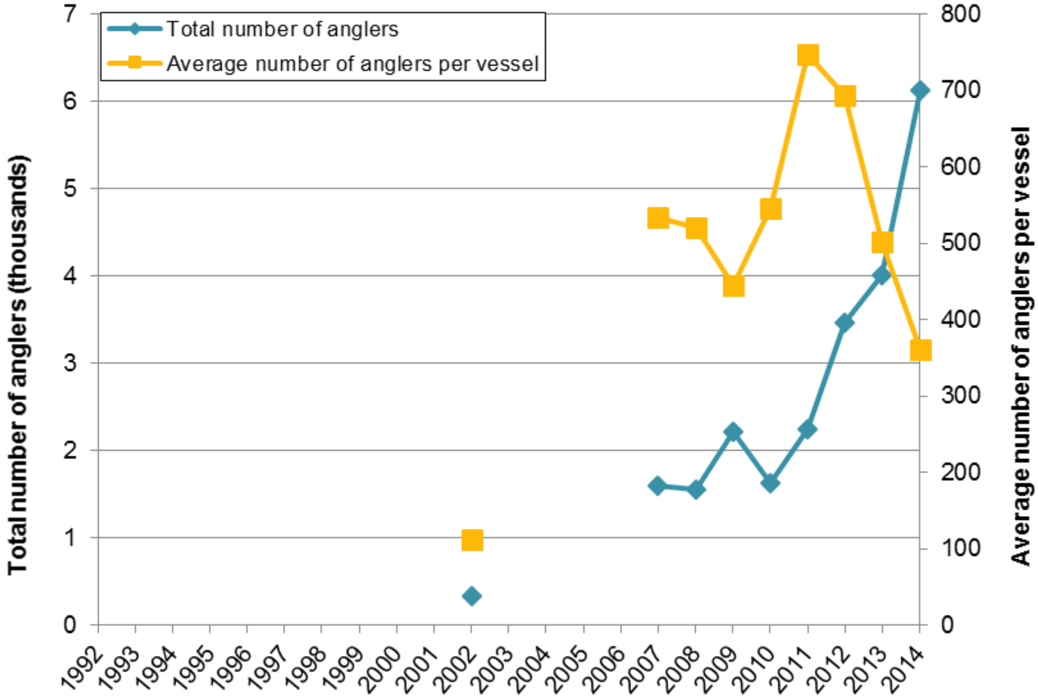
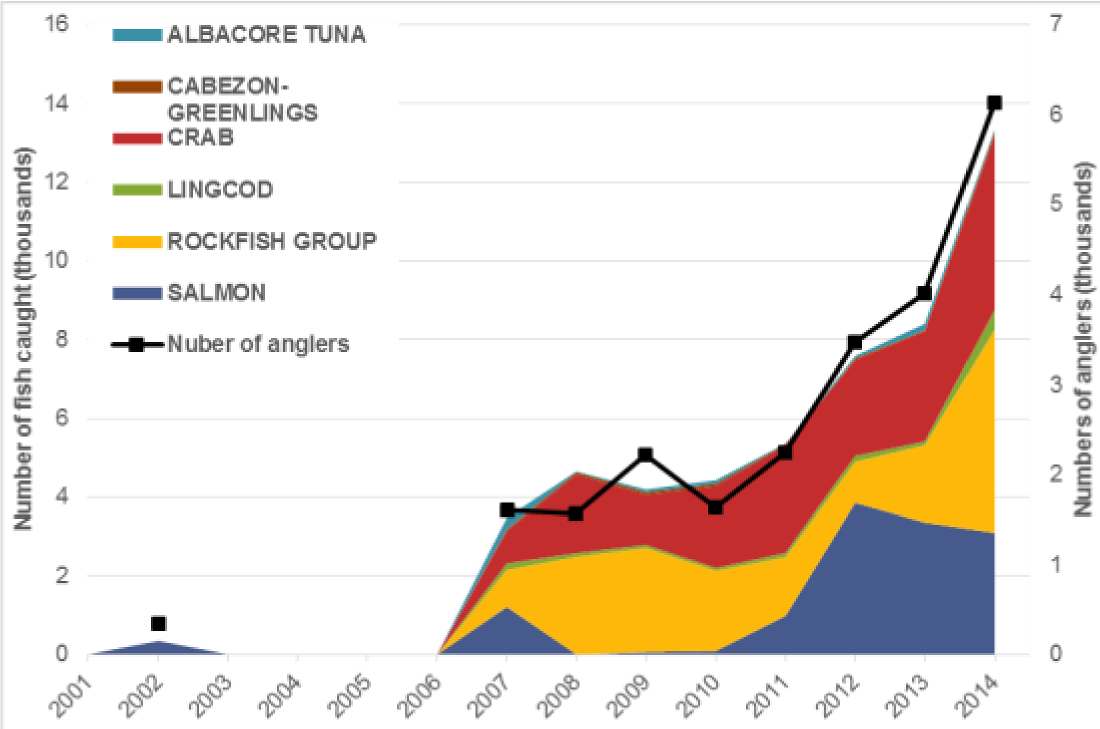


Figure 64. Total number of CPFV anglers and average number of anglers per vessel, Eureka, 1992-2014



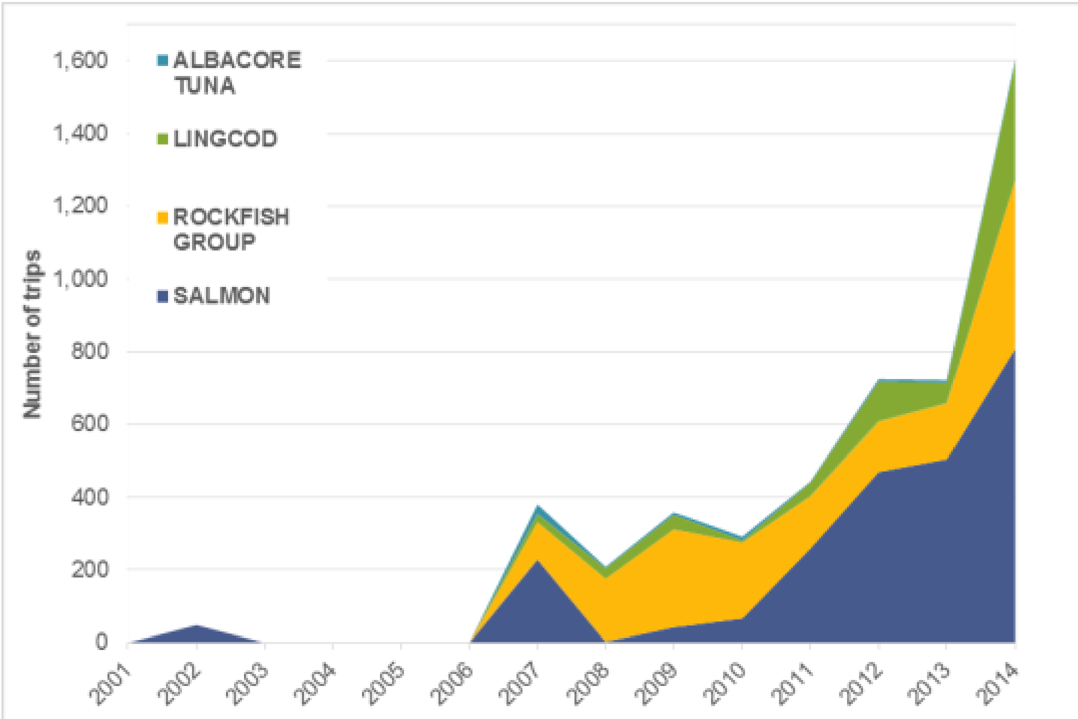
The data for total number of fish caught by species or species group on Eureka-based CPFV trips in Figure 65 is suppressed in certain years prior to 2007 in order to preserve confidentiality due to small numbers of Eureka-based CPFV operators. Key fisheries from which fish were caught were Dungeness crab, the rockfish group, and salmon, with very small numbers of lingcod and albacore.

Figure 65. CPFV total number of fish caught for each fishery, Eureka Area, 2001-2014 *no data for 1992-2001



Summary information on the annual number of Eureka-based CPFV trips by targeted fishery over the study period is provided in Figure 66. These data clearly show the importance of salmon trips for Eureka CPFV operators. As one of our FAC members had indicated, in inclement conditions CPFV vessels can easily access salmon grounds just outside the Eureka harbor entrance, whereas rockfish and lingcod trips require more transit distance and exposure to rough conditions.

Figure 66. Total number of CPFV trips for each target fishery, Eureka Area, 2001-2014 *no data from 1992-2001



8. FORT BRAGG PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

Noyo Harbor, Fort Bragg's commercial fishing port at the mouth of the Noyo River, is also a prominent fishing port in California and the North Coast region, consistently ranking in the top 10 commercial ports in California in terms of ex-vessel value. Fort Bragg stands out among other ports in the North Coast region in terms of its prominence in the salmon and urchin fisheries. Fort Bragg has historically served as an important landing location for salmon in California, and in many years has been the top commercial salmon landing port in the North Coast region.

In the 1980's Fort Bragg emerged as the North Coast's center for the region's urchin fishery, as our analysis will show in greater detail below (Kalvass et al., 2004). A new and relatively lucrative market was created whereby fresh urchin landed in Fort Bragg was air freighted directly to Japan. In 2014, the port had over $1.8 million of landed value in the urchin fishery. The other key commercial fishery for Fort Bragg is Dungeness crab.

Noyo Harbor Marina has 256 berths, and the harbor can accommodate commercial vessels up to 65 feet (Noyo Harbor District, 2016). The harbor has two boat ramps, a storage yard, and a work hoist (Pomeroy et al, 2011). Other Noyo Harbor fishery support businesses include Tommy's Marine Service and Supply, which provides dockside engine and vessel repair, and several fish buyers (Ocean Fresh, Caito Fisheries).

Dolphin Isle Marina is a public facility farther upstream from Noyo Harbor with another 150 slips that provide many recreational fishermen a base. Dolphin Isle Marina also has 85 full-hookup RV sites, a fuel dock, a fish cleaning station, showers, a deli, a laundry room, and bait and tackle (Dolphin Isle Marina, 2016). Harbor and fishing activities are heavily dependent on dredging, which remains an area of consideration for the port moving forward (Pomeroy et al., 2011).

In 2014 there were 384 Fort Bragg commercial fishermen active in fisheries of interest, with almost 80% of them targeting the salmon fishery. Another 40 target Dungeness crab and 38 dive for urchin. Overall, the port has seen a decline in terms of the number of commercial fishing vessels operating out of the port. The general trend featured a decline in the number of active commercial fishermen through 2009, followed by a moderate increase through 2014.

Across all North Coast commercial fisheries in 2014, Fort Bragg fishermen landed an average of 41.4% of the region's catch and collected 31.9% of the region's ex-vessel revenue. Fort Bragg's share of the region's ex-vessel revenues in 2014 was considerably higher than the twenty-year average of 19.0%. In 2014, the top three commercial fisheries in Fort Bragg by ex-vessel revenue were salmon, Dungeness crab, and urchin, respectively.

Fort Bragg sustained an active group of CPFV operators over the entire study period, with 8 vessels active in 2014, and Fort Bragg featured the third largest number of trips among all North Coast regional ports in 2014. CPFV operators have usually targeted Lingcod, rockfish, and salmon over the study period.

Based on focus group responses, concerns expressed by Fort Bragg fishermen include the decline in fishing participation, rising average age of commercial fishermen, and decline in infrastructure and support industries. Major changes in ocean conditions such as El Niño affect the upwelling of cold, nutrient-rich water and consequently the marine food chain for fisheries of interest, leading to at times highly variable inter-annual fishing opportunities. Fishermen and local government entities have begun to take an active role in waterfront planning, and instituting a number of innovative strategies to support local fisheries.

As noted, Fort Bragg supports the most diversity in terms of the number of fisheries that contribute to overall port revenue. Comparatively high inputs from the salmon and urchin fisheries may act a buffer against some of the extreme inter-annual variability shown in other North Coast ports that are dependent on Dungeness crab.

8.1. Fort Bragg Baseline Characterization

The average Fort Bragg commercial fisherman that we interviewed was 54 years old and had an average of 28.3 years of experience as a commercial fisherman, as shown in Table 80 below. Average age was just 0.1 years older than the regional average, and years of experience was 0.7 years more than the regional average.

Note that this question inquired about the years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Table 80. Average age and years of experience commercial fishing in 2013, Fort Bragg

	Age			Years of experience		
Fishery	**n**	**Average**	**Standard deviation**	**n**	**Average**	**Standard deviation**
Dungeness crab - trap	22	51.6	12.0	22	28.0	15.4
Nearshore finfish- dead - hook and line	1	*	--	1	*	--
Nearshore finfish dead - longline	1	*	--	1	*	--
Nearshore finfish live - hook and line	6	56.3	6.9	6	28.7	8.7
Nearshore finfish live - longline	1	*	--	1	*	--
Nearshore finfish live - trap	3	61.7	0.6	3	27.7	12.2
Salmon - troll	22	52.3	13.9	22	28.0	16.7
Urchin - dive	13	54.4	12.0	13	24.0	14.6
All target fisheries (unique individuals)	**43**	**54.0**	**12.2**	**43**	**28.3**	**15.3**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in Table 81 below, Fort Bragg fishermen on average received 87.5% of their total personal income from commercial fishing in 2013.

Table 81. Percent income from overall commercial fishing in 2013, Fort Bragg

	Number responding	**Average**	**Standard deviation**
All target fisheries	**40**	**87.5%**	**20.9%**

Source: Current study

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Fort Bragg commercial fishermen were asked what share of their ex-vessel revenue was used to cover overall operating costs. This question was framed in the context of overall fishing activity, as it is very difficult to separate out the inherent shared costs involved in fishing (e.g. boat maintenance, slip rental, or fuel costs for trips targeting multiple fisheries). As shown in Table 82, Fort Bragg fishermen spent an average of 55.2% of their ex-vessel revenue on fishing-related costs.

Table 82. Percentage of total gross fishing revenue used for overall operating costs in 2013, Fort Bragg

	Number of respondents	Average	Standard Deviation
All target fisheries (unique individuals)	**36**	**55.2%**	**27.2%**

Source: Current study.

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Fort Bragg commercial fishermen were asked how many years of experience they had, and how many days per year they spent targeting each of the fisheries in which they participated. Results are provided in Table 83. These fishermen averaged 23.3 years of experience in the industry. On average urchin - dive fishermen had the most experience targeting their fishery (26.5 years), while nearshore finfish live – hook and line had the least (18.3 years).

The average annual number of days targeting specific fisheries was 58.6 for all target fisheries. On average, urchin - dive fishermen spent the largest average annual number of days targeting their fishery in 2013 (112.4 days), followed by Dungeness crab – trap (56.5 days). Nearshore finfish live – trap fishermen spent the fewest average annual number of days targeting their fishery in 2013 (16.0 days).

Table 83. Years of experience and number of days targeting specific fisheries in 2013, Fort Bragg

	Years of experience			Days targeting specific fishery		
Fishery	**Number of respondents**	**Average**	**Standard deviation**	**Number of respondents**	**Average**	**Standard Deviation**
Dungeness crab - trap	22	21.4	11.7	19	56.5	43.2
Nearshore finfish- dead - hook and line	1	*	--	*	*	--
Nearshore finfish dead - longline	1	*	--	*	*	--
Nearshore finfish live - hook and line	6	18.3	7.4	6	27.2	23.2
Nearshore finfish live - longline	1	*	--	--	--	--
Nearshore finfish live - trap	3	26.3	16.2	3	16.0	13.9
Salmon - troll	17	23.8	16.3	15	45.5	25.7
Urchin - dive	13	26.5	10.4	12	112.4	46.3
All target fisheries (unique individuals)	**43**	**23.3**	**13.0**	**38**	**58.6**	**46.8**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

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Fort Bragg commercial fishermen were asked how many vessel crew they used for each fishery, and what share of their ex-vessel revenue was spent on crew and fuel costs. Responses are summarized below in Table 84. Fort Bragg fishermen on average utilized 1.3 crew members. On average, fishermen targeting Dungeness crab – trap and urchin - dive hired the most crew members (2.2 and 1.5, respectively). nearshore finfish live – trap and nearshore finfish live – hook and line fishermen on average each used the fewest crew (on average only 0.3 per vessel).

The average share of ex-vessel revenue spent on crew across all fisheries of interest was 20.5%. Fishermen targeting Dungeness crab spent the largest percentage of revenue on crew (31.3%), and nearshore finfish live - trap fishermen spent the smallest share (6.7%). Note that one of our FAC members from Fort Bragg indicated that this latter figure seemed low, and that 10-20% was more typical in the nearshore finfish live - trap fishery. The average share of ex-vessel revenue spent on fuel across all fisheries was 14.9%. On average, fishermen in the nearshore finfish live – hook and line fishery spent the largest share of ex-vessel revenue on fuel (22.3%), and nearshore finfish live – trap fishermen spent the smallest share (4.7%).

Table 84. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Fort Bragg

	Number of crew			**Percent revenue towards crew**			**Percent revenue towards fuel**		
Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab - trap	22	2.2	1.1	22	31.3%	15.3%	19	14.2%	12.5%
Nearshore finfish- dead - hook and line	1	*	--	1	*	--	1	*	--
Nearshore finfish dead - longline	1	*	--	1	*	--	1	*	--
Nearshore finfish live - hook and line	6	0.3	0.5	6	7.0%	11.1%	6	22.3%	27.5%
Nearshore finfish live - longline	1	*	--	1	*	--	1	*	--
Nearshore finfish live - trap	3	0.3	0.6	3	6.7%	11.5%	3	4.7%	5.0%
Salmon - troll	16	0.6	0.5	16	12.1%	12.6%	16	16.2%	18.3%
Urchin - dive	10	1.5	1.2	10	18.8%	24.0%	7	15.6%	5.7%
All target fisheries	**39**	**1.3**	**1.1**	**39**	**20.5%**	**18.0%**	**34**	**14.9%**	**15.5%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

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Fort Bragg commercial fishermen were asked whether MPAs had affected their fishing, and if so, to provide an open-ended description of the specific effects of MPAs on particular fisheries in 2013. A summary of the responses is provided in Table 85. Of the respondents who answered this question, 90.7% answered that MPAs had affected their fishing. Of those who indicated they were affected, the most frequently cited effect was (A), Cannot fish in or go to traditional grounds/areas (86.0% of individual respondents). The second most frequently cited effect was (E), Other (46.5% of respondents), followed by (B), Need to travel longer distances to fish in other areas (32.6% of respondents. Most common "Other" responses were financial effects; increased time and effort; loss of opportunities; frustration; and hazards due to crowding and bottlenecks of vessels in popular fishing and transit areas.

Table 85. Direct effects of MPAs on specific fisheries in 2013, Fort Bragg

Fishery	Number of respondents	Have MPAs effected your fishing?	A	B	C	D	E
Dungeness crab - trap	22	90.9%	86.4%	31.8%	4.5%	13.6%	36.4%
Nearshore finfish- dead - hook and line	1	*	*	*	*	*	*
Nearshore finfish dead - longline	1	*	*	*	*	*	*
Nearshore finfish live - hook and line	6	66.7%	50.0%	33.3%	33.3%	16.7%	33.3%
Nearshore finfish live - longline	1	*	*	*	*	*	*
Nearshore finfish live - trap	3	66.7%	33.3%	33.3%	33.3%	0.0%	33.3%
Salmon - troll	22	68.2%	68.2%	22.7%	18.2%	9.1%	27.3%
Urchin - dive	13	92.3%	84.6%	30.8%	23.1%	23.1%	53.8%
All target fisheries (unique individuals)	**43**	**90.7%**	**86.0%**	**32.6%**	**18.6%**	**16.3%**	**46.5%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

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A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly effected by MPAs

Fort Bragg commercial fishermen were asked to name the specific MPAs that had affected their fisheries in 2013, and were provided with a comprehensive list given below. In Table 86 below we list the MPAs that our respondents cited as having affected specific fisheries in Fort Bragg during 2013. Eighteen of these MPAs were reported to have affected fisheries targeted by Fort Bragg fishermen in 2013. Of those, (B) Ten Mile SMR, affected the largest number of respondents (30 individuals), followed by (O) Ten Mile Beach SMCA (15 individuals), (D) Point Cabrillo SMR (9 individuals), and (M) Other (8 individuals). Written “Other” responses included locations outside the North Coast MPA region: Point Reyes, Bolinas, Stewart’s Point, Salt Point, Point Arena, Farallones, Drake’s Bay, Saunders Reef, and Bodega Head.

Table 86. Which MPAs have affected specific fisheries 2013, Fort Bragg

Fishery	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Dungeness Crab - Trap	--	15	--	--	--	--	--	--	3	--	--	5	3	1	--	3	--	--	--	--	--	1	--	--	--	--	1	--
Nearshore Finfish Dead - Hook and Line	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	1	--	--	--	--	--	--
Nearshore Finfish Dead - Longline	--	1	--	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Nearshore Finfish Live - Hook and Line	--	3	--	2	--	--	--	--	--	--	--	--	1	--	1	--	2	--	--	--	--	1	--	--	--	2	--	--
Nearshore Finfish Live - Longline	--	1	--	--	--	--	--	--	--	--	--	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Nearshore Finfish Live - Trap	--	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salmon - Troll	--	14	--	1	--	--	--	--	--	--	--	--	2	--	10	--	1	--	--	--	--	--	--	--	--	2	--	--
Urchin - Dive	--	9	--	5	1	--	--	--	1	--	1	1	--	1	4	--	2	1	1	--	1	1	--	--	--	2	--	1
All target fisheries (unique individuals)	**--**	**30**	**--**	**8**	**1**	**--**	**--**	**--**	**4**	**--**	**1**	**6**	**5**	**2**	**15**	**3**	**4**	**1**	**1**	**--**	**1**	**2**	**--**	**--**	**--**	**5**	**1**	**1**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Fort Bragg respondents were asked about the degree of importance, and reasons for importance, of participating in multiple targeted fisheries. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 87 below, almost 75% indicated that multi-fishery participation was either 'Very Important' or 'Important.'

If fishermen responded that multi-fishery participation was very important or important, they were then asked why that was the case. The question was asked as an open ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer. The top two responses were that it 'Stabilizes year-to-year variation in my commercial fishing income' and 'Increases my annual commercial fishing income'.

Table 87. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Fort Bragg

		Degree of importance					Reasons for importance			
Fishery	**Number responding**	**Very Important**	**Important**	**Neither Important nor Unimportant**	**Unimportant**	**Very Unimportant**	**A**	**B**	**C**	**D**
Dungeness crab - trap	22	18	2	1	--	--	11	18	9	7
Nearshore finfish- dead - hook and line	1	*	--	--	--	--	*	*	*	--
Nearshore finfish dead - longline	1	--	--	--	--	*	*	--	--	*
Nearshore finfish live - hook and line	6	5	1	--	--	--	5	6	4	1
Nearshore finfish live - longline	1	--	--	--	--	*	*	--	--	*
Nearshore finfish live - trap	3	2	1	--	--	--	2	2	1	1
Salmon - troll	22	15	1	1	2	1	11	14	7	5
Urchin - dive	13	5	3	1	3	--	4	5	3	2
All target fisheries (unique individuals)	**43**	**26**	**6**	**2**	**5**	**1**	**18**	**27**	**11**	**10**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, commercial fishermen in Fort Bragg were asked what strategies they used to market their catch. They were given ten possible responses, listed below in Table 88 as answers A through J. Respondents were allowed to provide more than one answer. The most frequently cited market strategy was (C), Sell to traditional processor (33 individual responses), followed by (F), Sell off own vessel (19 individual responses), (G), Sell to live fish buyers (17 individual responses), and (E) Sell to other wholesalers/middlemen (17 individual responses).

Table 88. Strategies used to market catch, 2013, Fort Bragg

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	--	1	17	2	6	4	5	--	--	3
Nearshore finfish- dead - hook and line	--	--	1	--	--	1	--	--	--	--
Nearshore finfish dead - longline	--	--	1	--	--	--	--	--	--	--
Nearshore finfish live - hook and line	--	1	4	2	--	4	4	--	--	--
Nearshore finfish live - longline	--	--	1	--	--	--	--	--	--	--
Nearshore finfish live - trap	--	1	2	1	1	1	2	--	--	--
Salmon - troll	--	2	15	4	7	8	5	--	1	2
Urchin - dive	--	2	11	2	3	1	1	--	2	4
All target fisheries (unique individuals)	**--**	**5**	**33**	**7**	**11**	**10**	**9**	**--**	**3**	**7**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

8.2. Fort Bragg Commercial Fishing Initial Changes

Commercial fishermen were also asked how they saw their income from commercial fishing changing from 2009 to 2013, covering the period before and immediately after MPA formation. They were asked to select one of the following options; significantly higher, somewhat higher, no change, somewhat lower, or significantly lower.

As one can see in Table 89, no clear trend emerges from the data. The majority of respondents in all target fisheries (63.8%) perceived no change. A minority of respondents perceived either significantly lower or somewhat lower income (8.7% each), or somewhat higher income (7.2%). The smallest group of respondents reported significantly higher income (5.8%).

Table 89. Perceived change in share of personal income coming from commercial fishing between 2009 and 2013, Fort Bragg

	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**43**	**6.1%**	**7.7%**	**67.6%**	**9.3%**	**9.3%**

Source: Current study.

In addition to indicating a perceived change, respondents were asked an open-ended question regarding the factors they believed had contributed to the change in the share of their income coming from commercial fishing.

As summarized in Table 90, the most commonly cited reason for changes in share of income coming from commercial fishing was changes in regulations. Most of the “Other” responses were personal reasons, including retirement, changes in jobs or business incomes, degree of fishing experience, or caregiving for family members.

Table 90. Factors most affecting changes in share of personal income coming from commercial fishing between 2009 and 2013, Fort Bragg

	Number of respondents	A	B	C	D	E
All target fisheries (unique individuals)	**43**	**1**	**3**	**6**	**--**	**11**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Fort Bragg commercial fishermen were asked separately for each fishery they participated in to compare his/her success in the fishery in 2013 to that of the last ten years. As summarized in Table 91 below, respondents were given the option of responding in one of the following categories: (1) significantly better; (2) somewhat better; (3) the same; (4) somewhat worse; and (5) significantly worse.

Average responses varied somewhat by fishery with no overall pattern. The most frequent response (26.7%) was 'Somewhat worse', followed by 'Somewhat better' (20.0%) and 'Significantly worse' (15.0%). Only 8.3 percent of respondents indicated that fishing was 'Significantly better', while 13.3% indicated 'The same.' Fishermen in the Dungeness crab – trap fishery were more likely than other groups to report that fishing in 2013 was "somewhat worse" (38.1%). Among the target fisheries with more than 5 respondents, those targeting the urchin – dive fishery were more likely than other groups to report that fishing in 2013 was "somewhat better" (38.5%). 16.7% of all fishermen in target fisheries had not participated in that fishery ten years earlier.

Table 91. Perceived success in fishing in 2013 compared to last ten years, Fort Bragg

Fishery	Number responding	Did not participate in previous seasons	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	21	9.5%	--	19.0%	4.8%	38.1%	28.6%
Nearshore Finfish Dead - Hook and Line	1	--	--	--	--	--	*
Nearshore Finfish Dead - Longline	1	--	--	--	--	*	--
Nearshore Finfish Live - Hook and Line	5	20.0%	--	20.0%	40.0%	--	20.0%
Nearshore Finfish Live - Longline	1	--	--	--	*	--	--
Nearshore Finfish Live - Trap	2	50.0%	--	50.0%	--	--	--
Salmon - Troll	16	31.3%	18.8%	6.3%	6.3%	31.3%	6.3%
Urchin - Dive	13	7.7%	15.4%	38.5%	23.1%	15.4%	--
All target fisheries (unique individuals)	**43**	**16.7%**	**8.3%**	**20.0%**	**13.3%**	**26.7%**	**15.0%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

In Figure 67 we summarize commercial landings, ex-vessel revenue, and number of fishermen for all fisheries in the North Coast port of Fort Bragg over the study period, 1992-2014. The general trend featured a decline in the number of active commercial fishermen through 2009, followed by a moderate increase through 2014. Pounds landed generally declined from a 1997 peak and then stabilized on a fluctuating trend, while total ex-vessel revenue (in constant 2010 dollars) generally increased with large inter-annual variation.

The same information is summarized in Figure 68, but for fisheries of interest. The decline in numbers of active commercial fishermen was much lower than for all fisheries, and the recovery after 2009 was stronger. There was no clear trend in pounds of fish landed, and total ex-vessel revenue generally rose strongly with substantial inter-annual variation.

Over the entire study period, Fort Bragg-based commercial fishermen on average represented 36.0% of the North Coast region's total headcount, while their landings were 25.2% of the region's total and their ex-vessel revenues were 20.9% of the total for the region. regional revenue over the duration of the study period. There is at most a slight upward temporal trend in Figure 69 with moderate inter-annual variation.

Figure 67. Commercial landings, ex-vessel revenues, and number of fishermen, Fort Bragg, 1992–2014, all fisheries

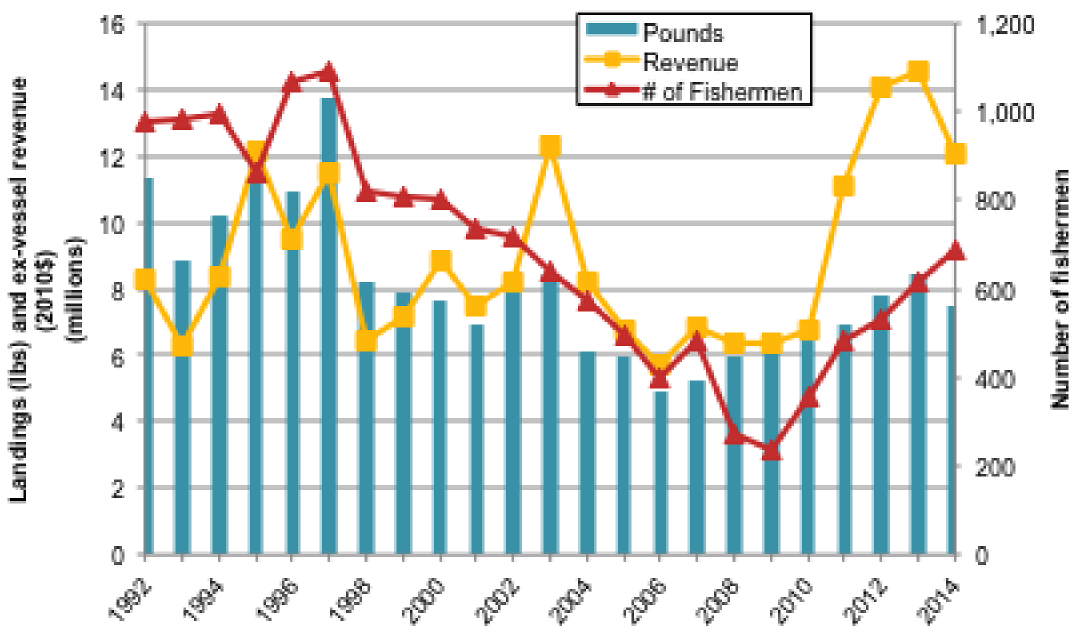


Figure 68. Commercial landings, ex-vessel revenues, and number of fishermen, Fort Bragg, 1992–2014, fisheries of interest

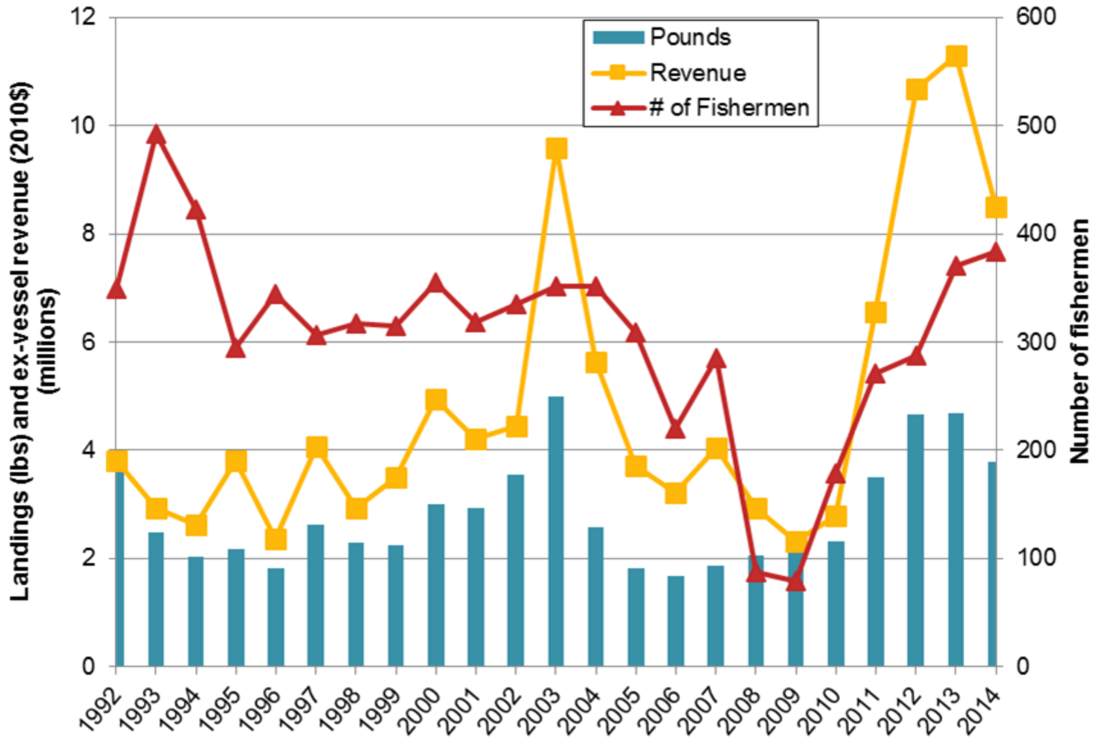
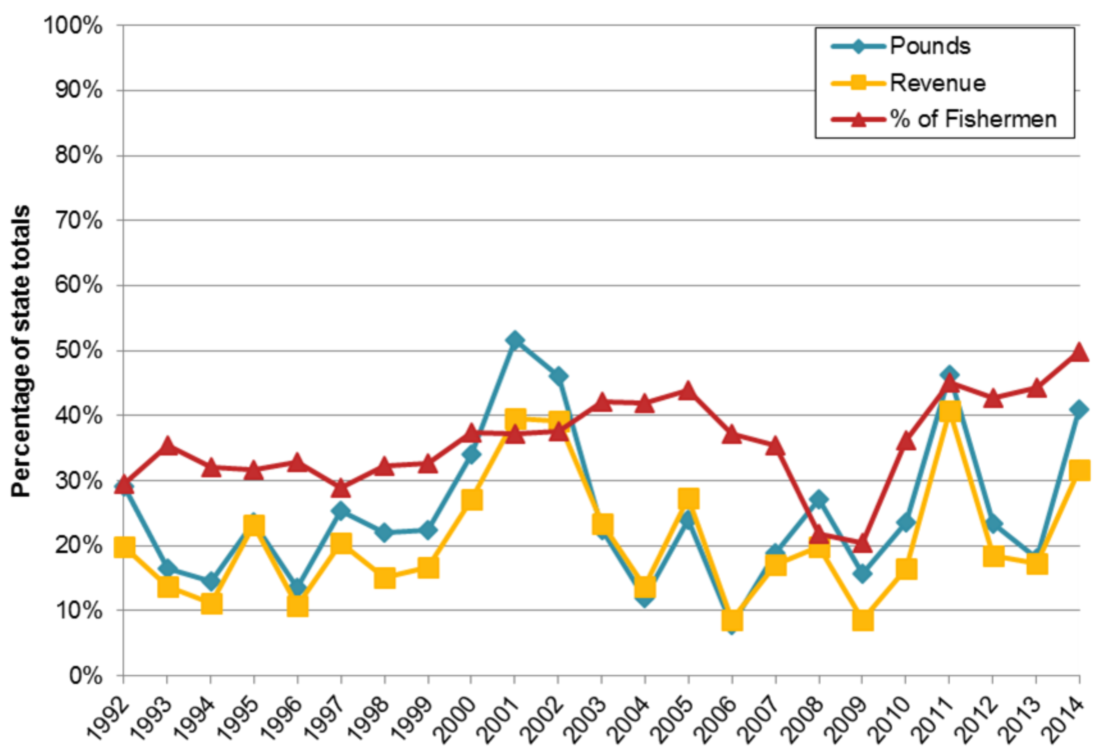


Figure 69. Fisheries of interest landings, revenue, and number of fishermen as a percentage of port-wide totals, Fort Bragg, 1992-2014



Landings and ex-vessel revenue in Fort Bragg were dominated by urchin, salmon, and Dungeness crab. As summarized in Figure 70 and Figure 71, urchin landings peaked in 1992, bringing in 3.7 million pounds (and $3.5 million in total ex-vessel revenue). Salmon landings peaked in 2003 at 3.5 million pounds (and $7.9 million in total ex-vessel revenue), while Dungeness crab landings peaked in 2012 with 1.8 million pounds landed (and $6.2 million in ex-vessel revenue).

One can see in

Figure 72 that there was a generally declining number of commercial fishermen targeting urchin and nearshore finfish working out of Fort Bragg, highly fluctuating numbers of salmon fishermen linked to fishery abundance, and fairly steady numbers of Dungeness crab fishermen.

Figure 70. Commercial landings for fisheries of interest, Fort Bragg, 1992-2014

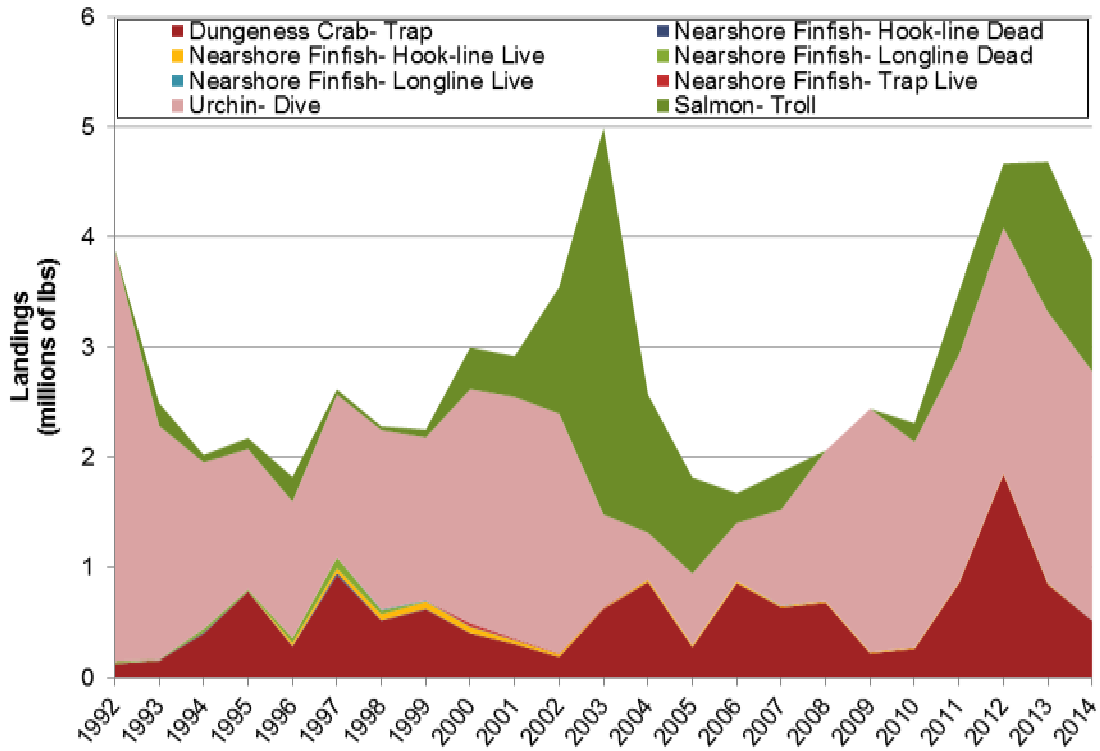


Figure 71. Ex-vessel revenue for fisheries of interest, Fort Bragg, 1992-2014

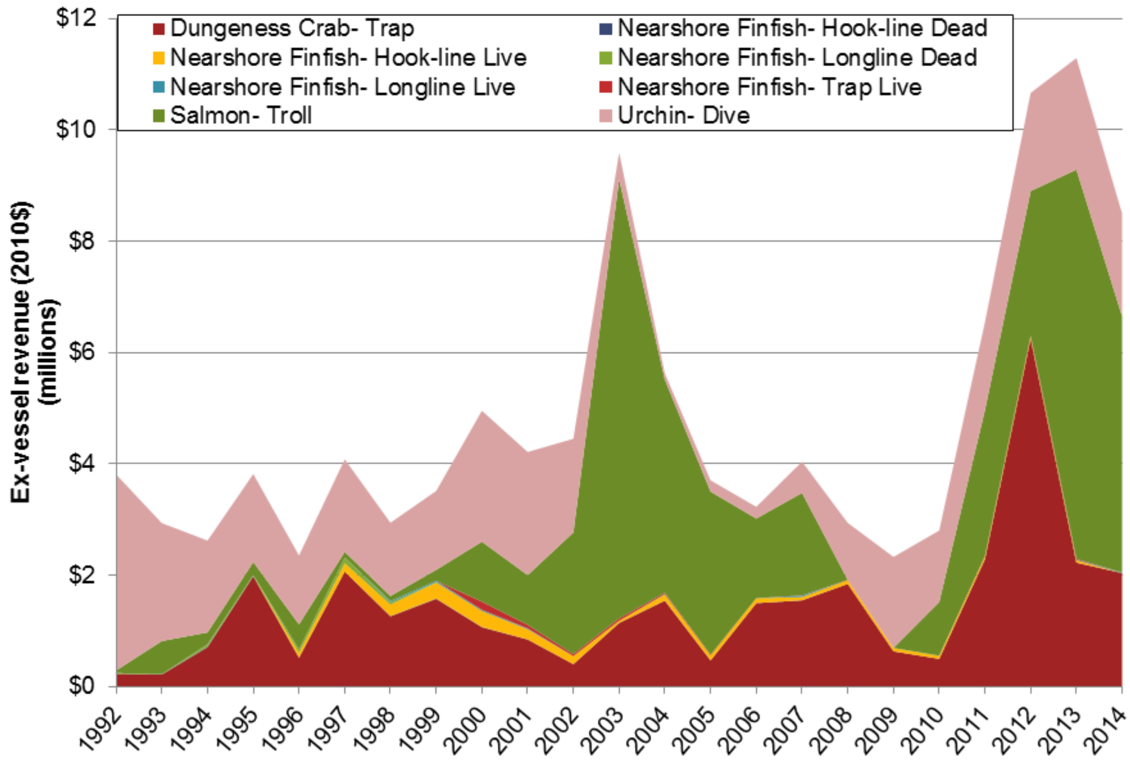
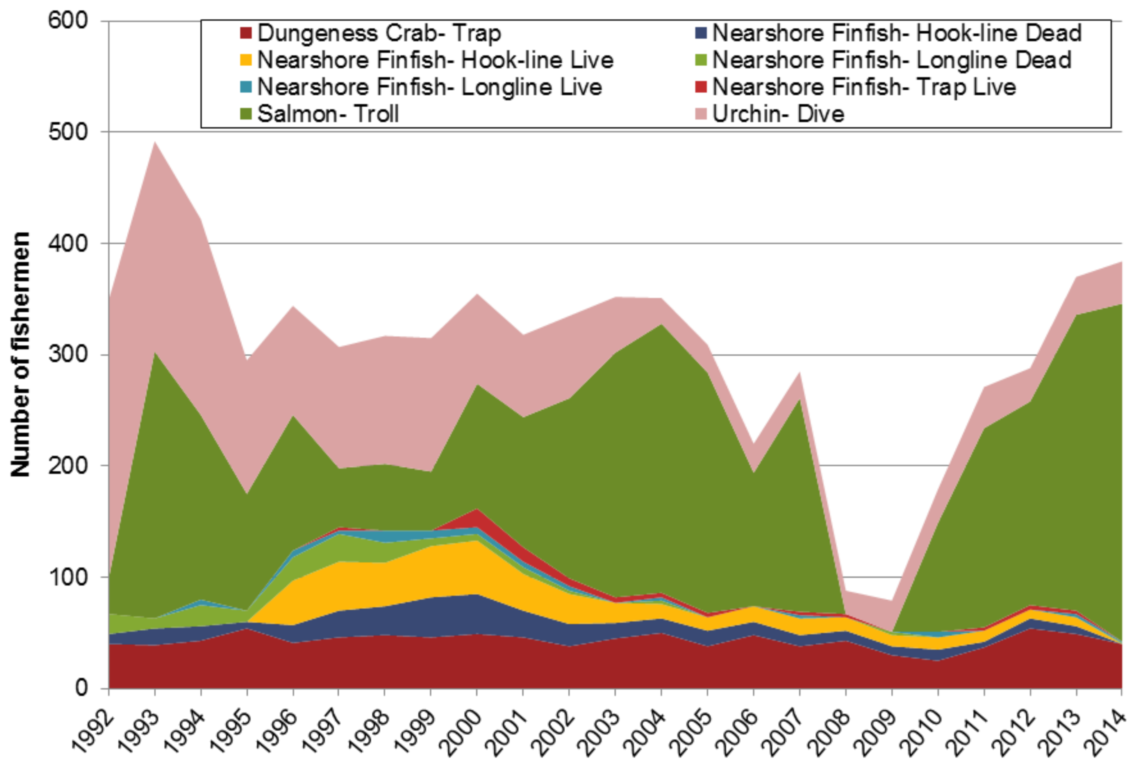
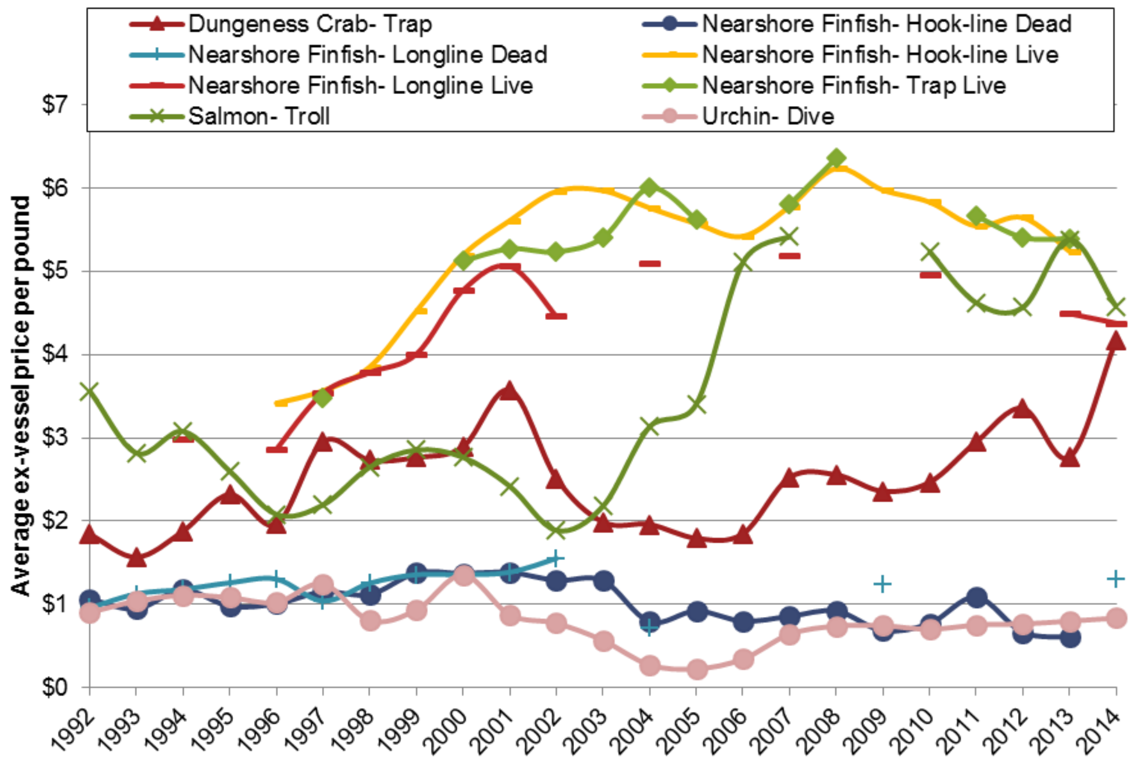


Figure 72. Number of fishermen for fisheries of interest, Fort Bragg, 1992-2014



Information on the average annual price per pound (in constant 2010 dollars) by fishery over the course of the study period is provided in Figure 73. Highest prices were obtained in the nearshore finfish- trap (and hook and line) live fisheries. Dungeness crab and salmon prices generally rose over the study period, while urchin and nearshore finfish (dead delivered condition) prices generally declined or held steady.

Figure 73. Average ex-vessel price over time, Fort Bragg, 1992-2014



Relevant fisheries of interest for Fort Bragg include Dungeness crab-trap (Figure 74), nearshore finfish- hook-line live (
Figure 75), salmon-troll (Figure 76), and urchin-dive (Figure 77). The diagrams summarize annual landings, ex-vessel revenue, and numbers of active commercial fishermen working out of Fort Bragg over the study period.

Figure 74. Dungeness crab- trap: Average pounds, revenue, and number of fishermen, Fort Bragg, 1992-2014

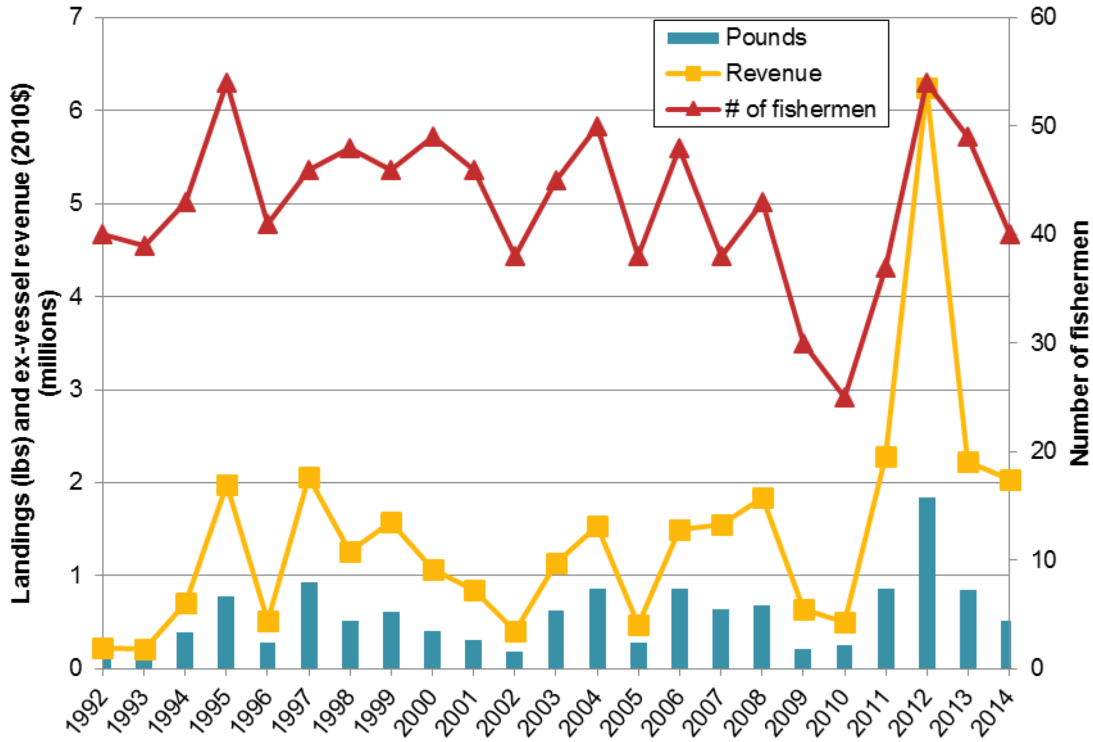


Figure 75. Nearshore finfish- hook line- live: Average pounds, revenue, and number of fishermen, Fort Bragg, 1992-2014

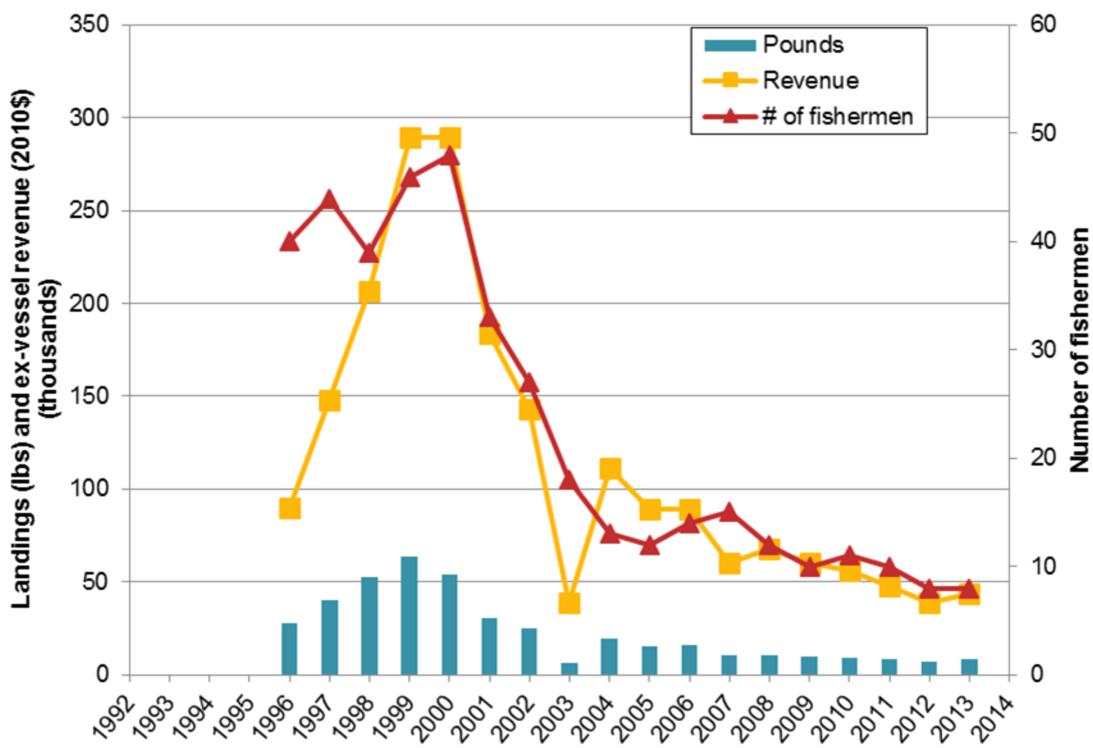


Figure 76. Salmon- troll: Average pounds, revenue, and number of fishermen, Fort Bragg, 1992-2014

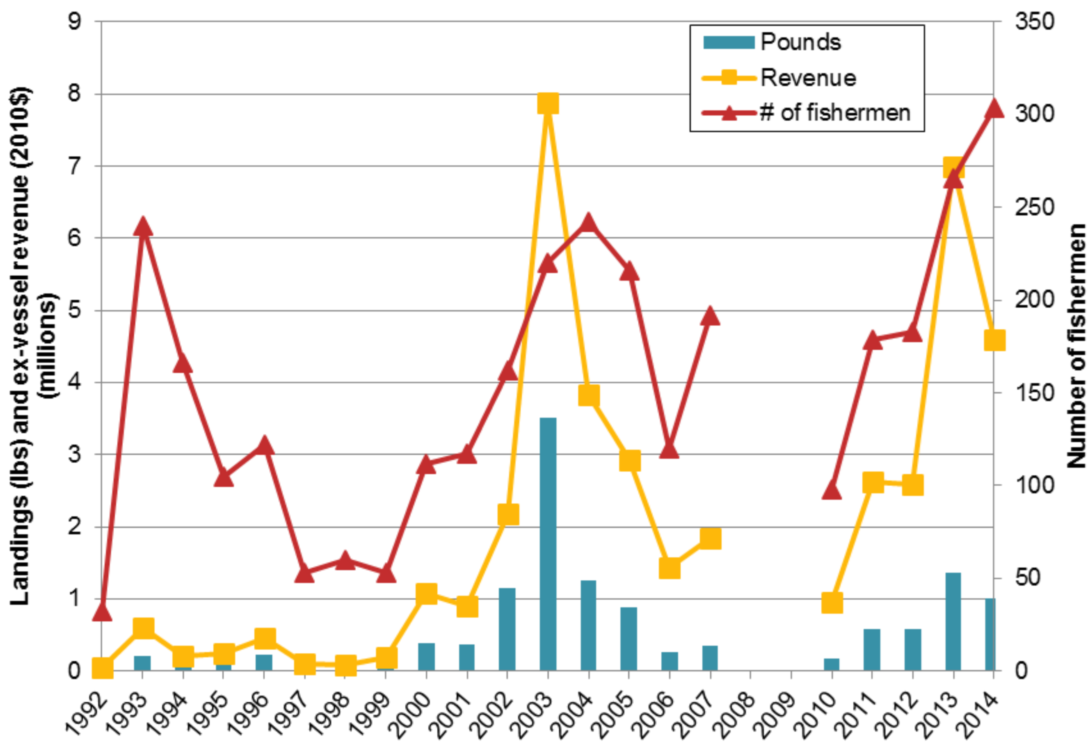
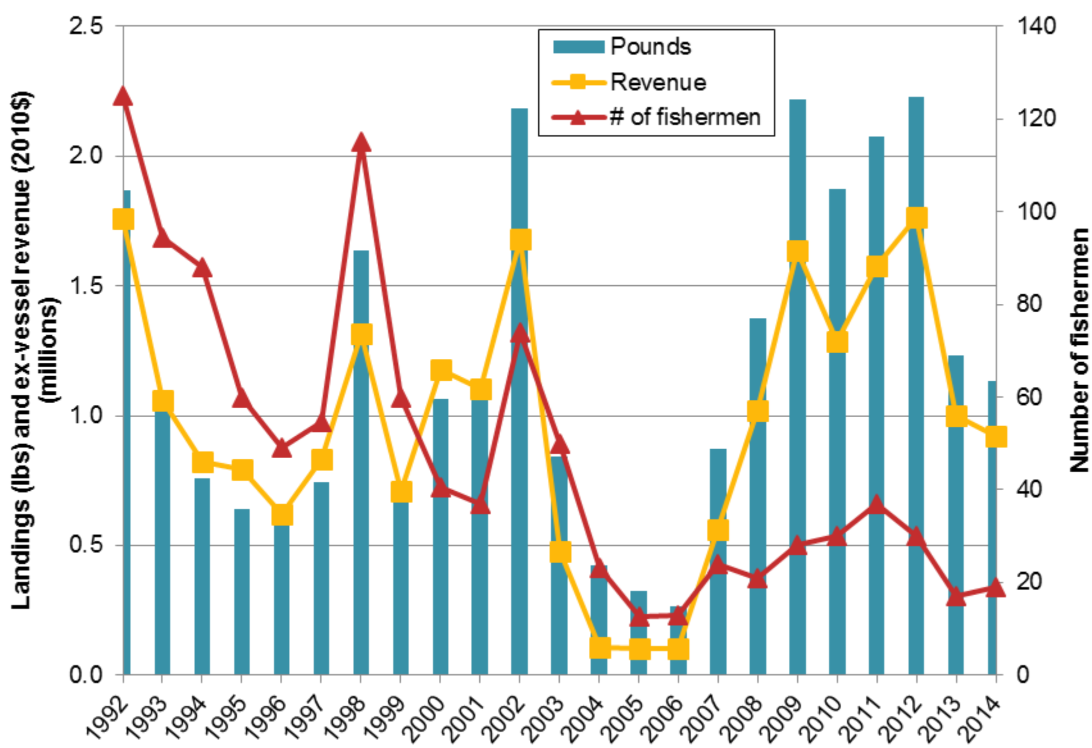


Figure 77. Urchin- dive: Average pounds, revenue, and number of fishermen, Fort Bragg, 1992-2014



Average annual landings and ex-vessel revenue per commercial fisherman working from Fort Bragg is given for each fishery of interest in Figure 78, Figure 79, Figure 80, and Figure 81.

One can see from these data that Fort Bragg had one of the more diversified portfolios of landings in the fisheries of interest of all ports in the North Coast region over the study period. Substantial average annual ex-vessel revenue per vessel was generated in the urchin, Dungeness crab, and salmon fisheries.

Figure 78. Dungeness crab- trap: Average pounds, revenue per fisherman, Fort Bragg, 1992-2014

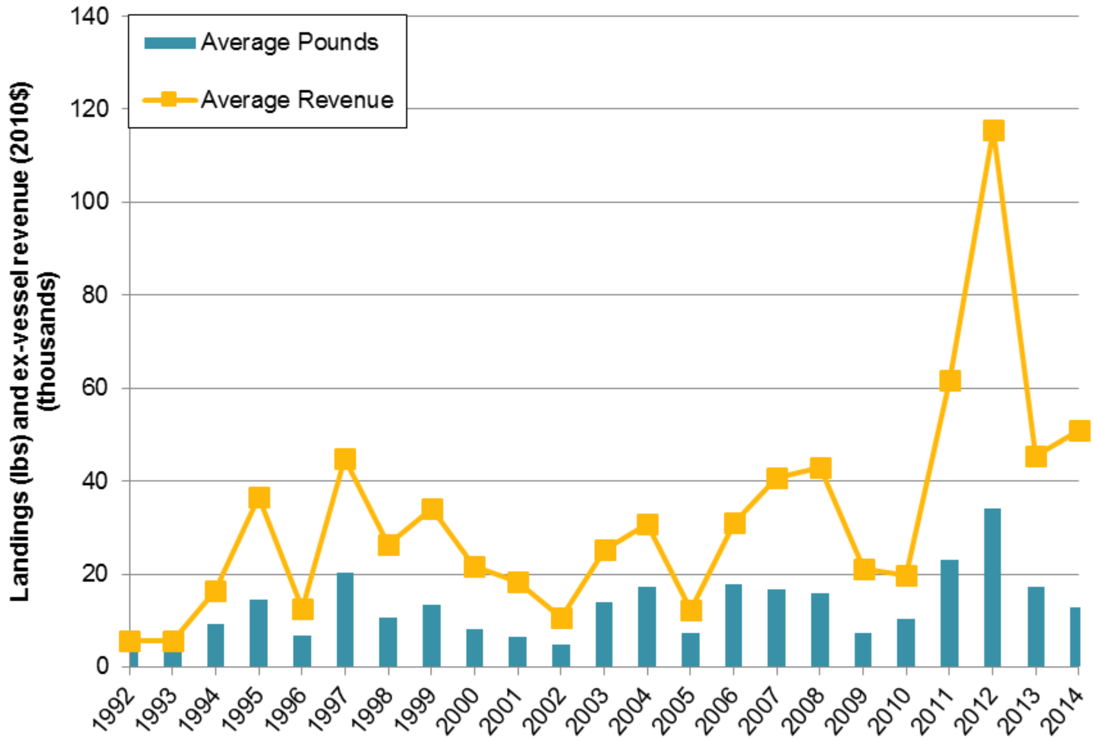


Figure 79. Nearshore finfish- hook line- live: Average pounds, revenue per fisherman, Fort Bragg, 1992-2014

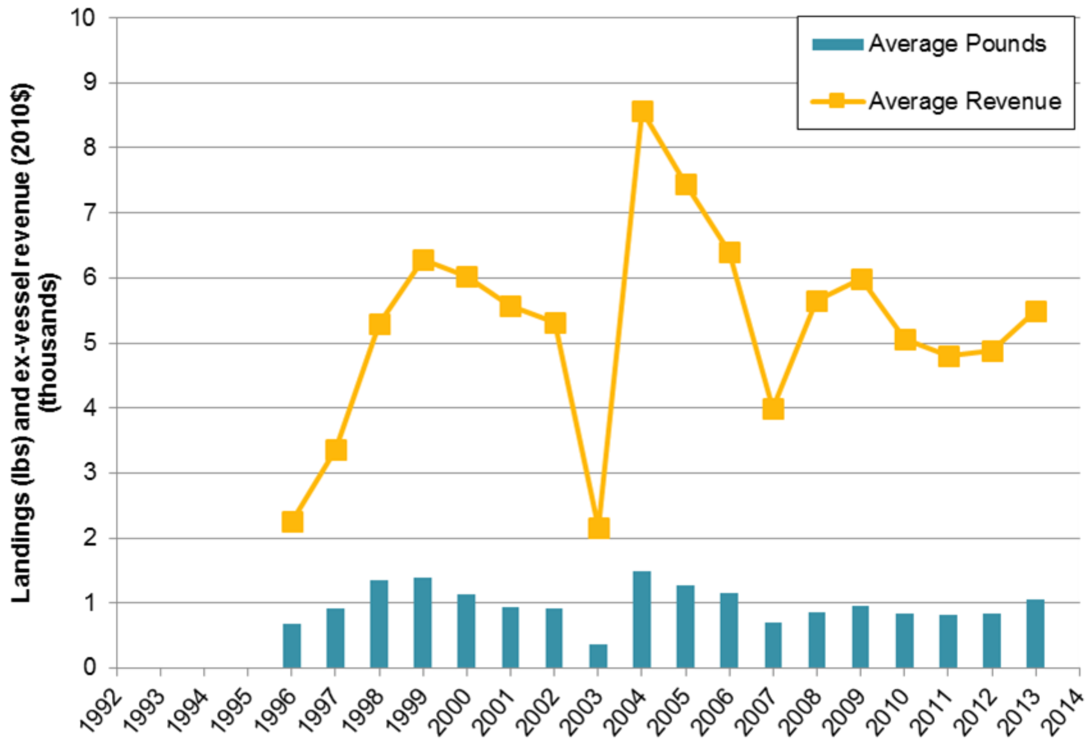


Figure 80. Salmon- troll: Average pounds, revenue per fisherman, Fort Bragg, 1992-2014

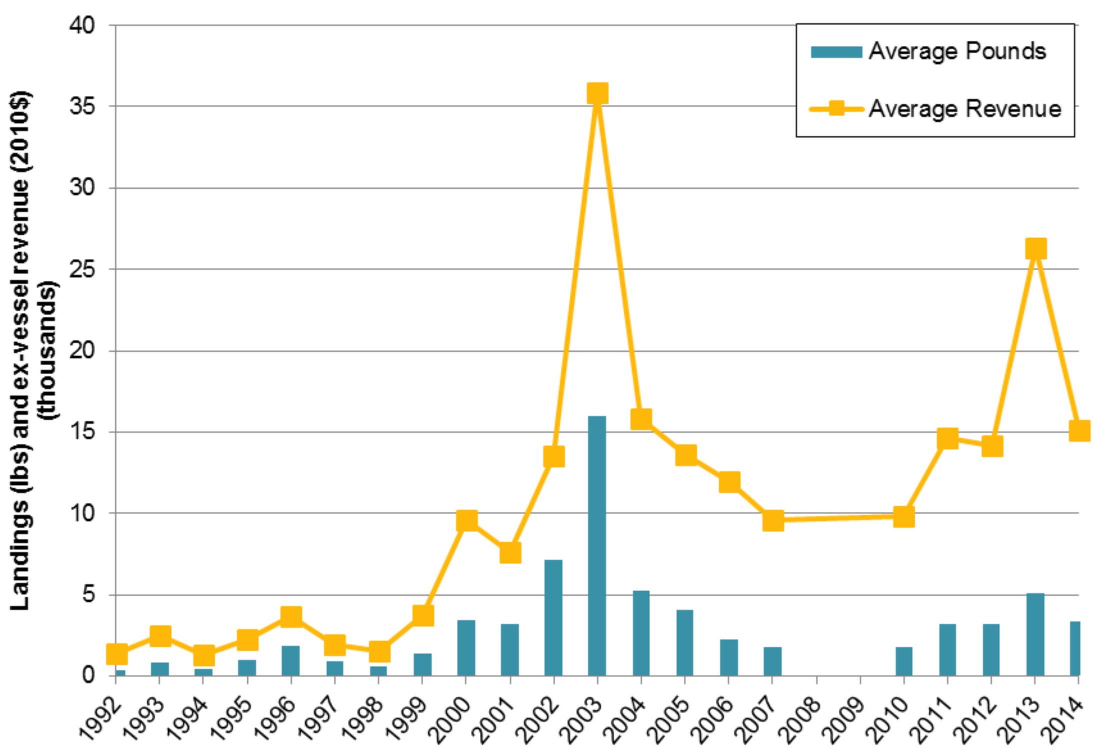
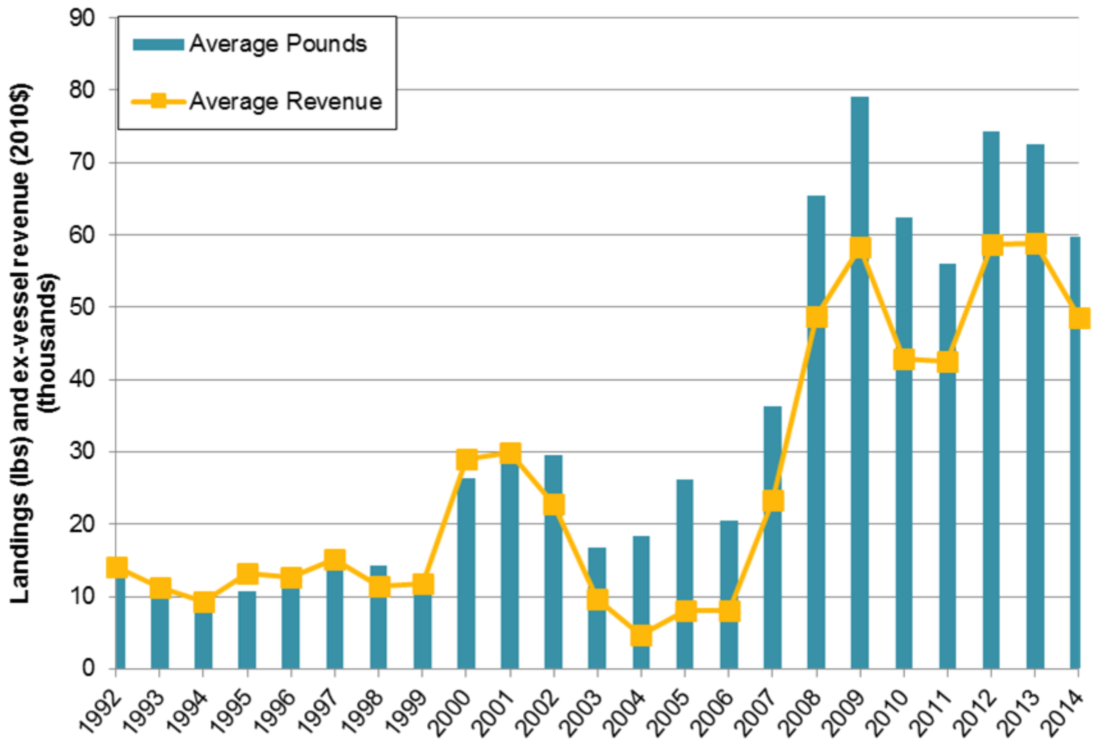


Figure 81. Urchin- dive: Average pounds, revenue per fisherman, Fort Bragg, 1992-2014



8.3. Fort Bragg CPFV Baseline Characterization

As shown in Table 92, the average CPFV operator we interviewed in Fort Bragg was 50.8 years old, has 18.4 years of experience owning a CPFV vessel (if applicable), and 12.6 years of experience operating a CPFV vessel. On average, respondents reported that 90.0 percent of their income came from operating and/or owning a CPFV vessel.

As one can see in Table 93, three of the five CPFV operators we interviewed in Fort Bragg indicated they had an additional source of income besides their CPFV operation. One indicated he drove a truck, and the other two gave general responses, 'Another full-time job' and 'Needed to work other jobs'.

Table 92. CPFV survey response statistics, 2013 fishing year, Fort Bragg

	Response	**Standard deviation**	**Number responding**
Individuals Interviewed	5	--	--
Average age	50.8	14.7	5
Average number of years owning CPFV boat/s	18.4	15.6	5
Average number of years operating CPFV boat/s	12.6	8.0	5
Average percent income from CPFV operations in 2011	90.0%	22.4%	5

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Table 93. Sources of income in 2013 in addition to CPFV operation, Fort Bragg

Response	**Number responding**
Drove truck	1
Total number responding (unique individuals)	**1**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 94 we summarize average gross revenue (GR) from CPFV operations in 2013, and the average share of GR going to key operating cost categories in Fort Bragg in 2013. On average, 15.0% of GR went to fuel, 9.8% to crew, and 41.4% to all other operating costs. Total operating costs as a percentage of GR were thus 66.2% on average. Average total GR in Fort Bragg in 2013 was reported as $105,000 (based on three responses). Our best estimate of average net income after operating costs is thus $35,490.

Table 94. Average gross revenue (GR) from CPFV to operating costs, Fort Bragg

	Number responding	Average response	Standard deviation
Total GR 2013	3	$105,000	$35,000
% GR to fuel	5	15.0%	8.7%
% GR to crew	4	9.8%	2.1%
% GR to all other operating costs	5	41.4%	16.8%

Source: Current Study

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CPFV trip statistics for Fort Bragg in 2013 are summarized in Table 95. All five respondents reported taking consumptive trips; four out of five reported taking non-consumptive trips (e.g., whale watching). On average, consumptive trips were taken more frequently (110.0 vs. 45.6 trips during 2013), and cost more to the passenger ($96 vs. $33 per trip). The average number of passengers on consumptive versus non-consumptive trips was comparable (9.0 vs. 8.0), as was the average number of crew (1.3 vs. 1.0).

Table 95. CPFV trip statistics, 2013, Fort Bragg

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	5	--	--	4	--	--
Average number of trips	4	110.0	42.6	3	45.0	13.2
Average number of passengers (per trip)	5	9.0	4.9	4	8.0	5.4
Average price per passengers (per trip)	5	$96	$26	3	$33	$3
Average number of crew (per trip)	4	1.3	0.5	3	1.0	0.0

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

CPFV fishermen working out of Fort Bragg were asked how many days per year they spent targeting each fishery or non-consumptive activity in 2013, and what share of their total 2013 GR was generated from that fishery/activity. Results are reported below in Table 96. Of the fisheries with sufficient respondents to report results, the largest average number of days was spent targeting the salmon fishery, which also generated the largest share of GR (48.0% on average).

Table 96. Number of days and percentage of GR targeting CPFV fishery/activity in 2013, Fort Bragg

			Number of days targeting species (2013)			Share of GR from fishery/activity (2013)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	Dungeness crab	2	2	*	*	2	*	*
	Rockfish/lingcod	5	5	52.5	25.0	5	29.0%	12.4%
	Salmon	5	5	72.5	27.5	5	48.0%	19.2%
	Tuna and dorado	1	1	*	--	1	*	--
Activity	Whale watching	3	3	41.7	17.6	3	11.3%	7.8%
All target fisheries (unique individuals)		**5**	**5**	**43.9**	**29.5**	**5**	**26.3%**	**19.1%**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 97 below we summarize the reported direct effects of MPAs on specific CPFV fisheries for operators working out of Fort Bragg in 2013. Respondents reported that the rockfish/lingcod fishery was most strongly affected by MPAs, with all respondents from that fishery indicating that MPAs had affected their fishing. Of the specific effects reported, the most commonly cited effect was answer A, 'Cannot fish in or go to traditional ground/areas' (100%). The salmon fishery was second most strongly affected by MPAs, with 40% of respondents indicating that MPAs had affected their fishing, and answer A the most commonly cited effect (40%).

Table 97. Direct effects of MPAs on specific CPFV fisheries, 2013, Fort Bragg

	Fishery/Activity	**Number of respondents**	**Have MPAs effected your fishing?**	**A**	**B**	**C**	**D**	**E**
Fishery	Dungeness crab	2	--	--	--	--	--	--
	Rockfish/lingcod	5	100.0%	100.0%	--	--	60.0%	--
	Pacific halibut	3	33.3%	33.3%	--	--	--	--
	Salmon	5	40.0%	40.0%	20.0%	--	20.0%	--
	Tuna and dorado	1	--	--	--	--	--	--
Activity	Whale watching	3	--	--	--	--	--	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Shifted fishing effort into areas in which weather is less predictable
C	Moved homeport location or fish out of another port
D	Need to travel longer distances to fish/conduct activity in other areas
E	Other ways directly/indirectly effected by MPAs

In Table 98 we summarize the MPAs that reportedly affected each CPFV fishery in Fort Bragg in 2013. Three MPAs were reported as affecting the rockfish/lingcod fishery, and two MPAs were reported as affecting the Salmon fishery. No other specific MPAs were mentioned as affecting any other fisheries. The MPA most commonly cited as having affected these fisheries was Ten Mile SMR (answer C): 4 respondents from the rockfish/lingcod fishery, and 2 respondents from the salmon fishery, indicated that this MPA had affected their fishing. All five unique individual respondents in Fort Bragg reported being affected by Ten Mile SMR through at least one fishery.

Table 98. Which MPAs have affected specific CPFV fisheries, 2013, Fort Bragg

	Fishery/Activity	**A**	**C**	**O**	**V**
Fishery	Dungeness crab	--	--	--	--
	Rockfish/lingcod	1	4	--	1
	Salmon	--	2	1	--
Activity	Whale watching	--	--	--	--
All target fisheries (unique individuals)		**1**	**5**	**1**	**1**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Point Cabrillo SMR	**O**	Ten Mile Beach SMCA
B	Klamath Rock Special Closure	**P**	Sea Lion Gulch SMR
C	Ten Mile SMR	**Q**	Vizcaino Rock Special Closure
D	South Humboldt Bay SMRMA	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

8.4. Fort Bragg CPFV Initial Changes

In Table 99 we report changes in the percentage of income respondents earned from CPFV operations between 2009 and 2013, before and immediately after MPA formation. No clear trend emerged. 60% of all respondents reported 'No change' in the percentage of income from CPFV operations in 2013 as compared to 2009; 20% of respondents reported 'Somewhat lower' percentage, and the remaining 20% of respondents reported 'Significantly lower' percentage.

Table 99. Change in share of income from Commercial Passenger Fishing Vessel (CPFV) operations, 2009 to 2013, Fort Bragg

		Percent response				
	Number responding	**Significantly higher**	**Somewhat higher**	**No change**	**Somewhat lower**	**Significantly lower**
All fisheries (unique individuals)	**5**	**--**	**--**	**60.0%**	**20.0%**	**20.0%**

Source: Current study

In addition to indicating a perceived change in income between 2009 and 2013, Fort Bragg respondents were asked an open-ended question regarding the factors they saw as having contributed to the change in the share of their income coming from CPFV operations. Responses are summarized in Table 100. Three of the five respondents answered this question; two reported 'Other' factors, and one reported 'Personal reasons'. Changes in the market/economy, fish abundance/presence, or regulations were not reported as relevant factors.

Table 100. Factors causing changes in % of overall income from CPFV, 2009 to 2013, Fort Bragg

Response	**Number responding**
Changes in the market/economy	--
Changes in fish abundance/presence	--
Changes in regulations	--
Personal reasons	1
Other	2
Total number responding (unique individuals)	**3**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Changes in the number of CPFV trips by fishery between 2009 and 2013 in Fort Bragg are described in

Table **101**. Of all fisheries, Pacific halibut fishermen were most likely to report ‘Significantly higher’ numbers of trips in 2013 as compared to 2009 (33.3%) but also the most likely to report ‘Somewhat lower’ number of trips (66.7%). Whale watching was the only non-consumptive trip reported; respondents were equally likely to report ‘Somewhat higher’ number of trips, ‘No change’ in the number of trips, or ‘Somewhat lower’ number of trips (33.3% each).

Table 101. Changes in the number of CPFV trips, 2009 to 2013, Fort Bragg

	Fishery/Activity	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower
Fishery	Dungeness Crab	2	--	--	*	*
	Pacific Halibut	3	33.3%	--	--	66.7%
	Rockfish/Lingcod	5	20.0%	20.0%	20.0%	40.0%
	Salmon	5	20.0%	20.0%	20.0%	40.0%
	Tuna and Dorado	1	*	--	--	--
Activity	Whale Watching	3	--	33.3%	33.3%	33.3%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 102 we summarize Fort Bragg respondents' perceptions of success in CPFV fishing compared to the last ten years. All of the CPFV operators targeting the Pacific halibut fishery, 40% of rockfish/lingcod fishermen, and 20% of salmon fishermen indicated that success in CPFV fishing in their fishery was 'The same' as in previous years. 40% of rockfish/lingcod fishermen and 40% of Salmon fishermen indicated that CPFV fishing in their fishery was 'Somewhat worse' compared to previous years. Only 20% of salmon fishermen indicated that success in CPFV fishing was 'Significantly better'; no respondents in any fishery indicated that success in CPFV fishing was 'Significantly worse'.

Table 102. Perceived success in CPFV fishery/activity in 2013 compared to last ten years, Fort Bragg

	Fishery	Number responding	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Fishery	Dungeness crab	2	*	--	--	--	*
	Pacific halibut	2	--	--	100.0%	--	--
	Rockfish/lingcod	5	--	20.0%	40.0%	40.0%	--
	Salmon	5	20.0%	20.0%	20.0%	40.0%	--
	Tuna and dorado	--	--	--	--	--	--
Activity	Whale watching	3	--	--	33.3%	--	66.7%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

On average annually over 1992-2014, there were 21,196 total CPFV anglers taking a total of 1,692 trips, serviced by 7 vessels each making an average of 239 annual trips and carrying 12 anglers per trip out of Fort Bragg. Over the course of the entire study period Fort Bragg was, by far, the most popular CPFV port in the North Coast region.

The total number of vessels operating out of Fort Bragg port group has fluctuated over the study period, but ended up settling close to the average (7 vessels) by 2014, as shown in Figure 82. The peak occurred in 2002 and 2003 at 10 vessels and reached lows in 1996, 1997, and 2009 at only 4 vessels. The average number of trips per vessel steadily rose from 1993 until a peak of 497 trips in 2006 followed by an overall drop to 195 trips in 2014.

From Figure 83 one can see a steady increase in the average annual number of anglers for each Fort Bragg CPFV trip over the study period. The total annual number of Fort Bragg CPFV trips grew sharply during the early 2000s and then collapsed around the time of the salmon fishery closure. The peak period of annual CPFV trips from Fort Bragg was the highest recorded of all North Coast regional ports through the study period.

The total number of anglers, and the average number of anglers per Fort Bragg CPFV vessel, followed a similar pattern of peaking in the early 2000s and then collapsing back to 1990s levels around the time of the salmon closure (Figure 84).

Figure 82. Total number of CPFV vessels and average number of trips per vessel, Fort Bragg, 1992-2014

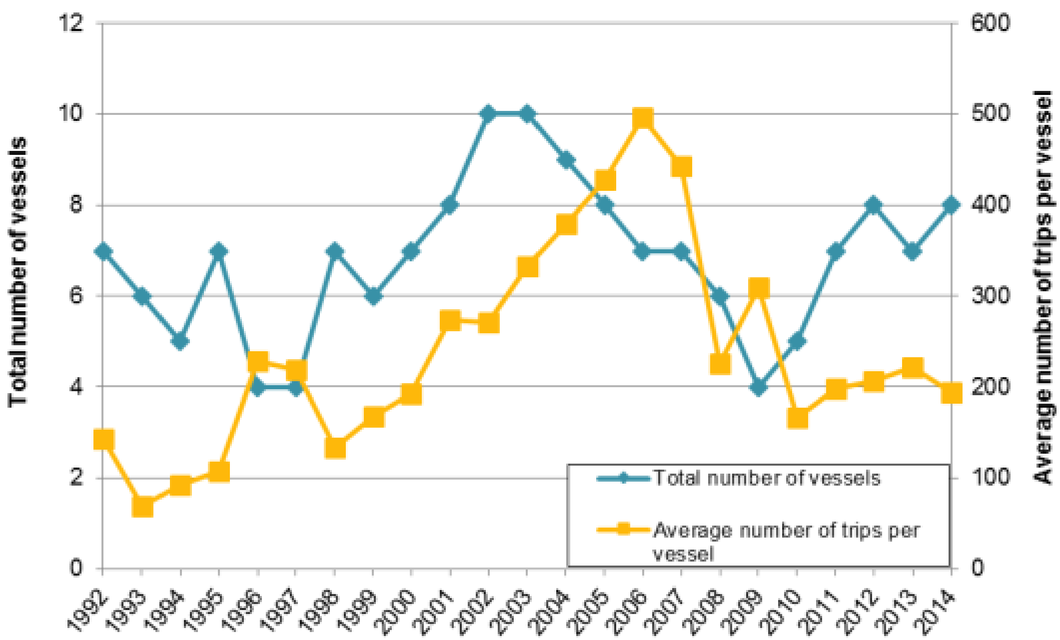


Figure 83. Total number of CPFV trips and average number of anglers per trip, Fort Bragg, 1992-2014

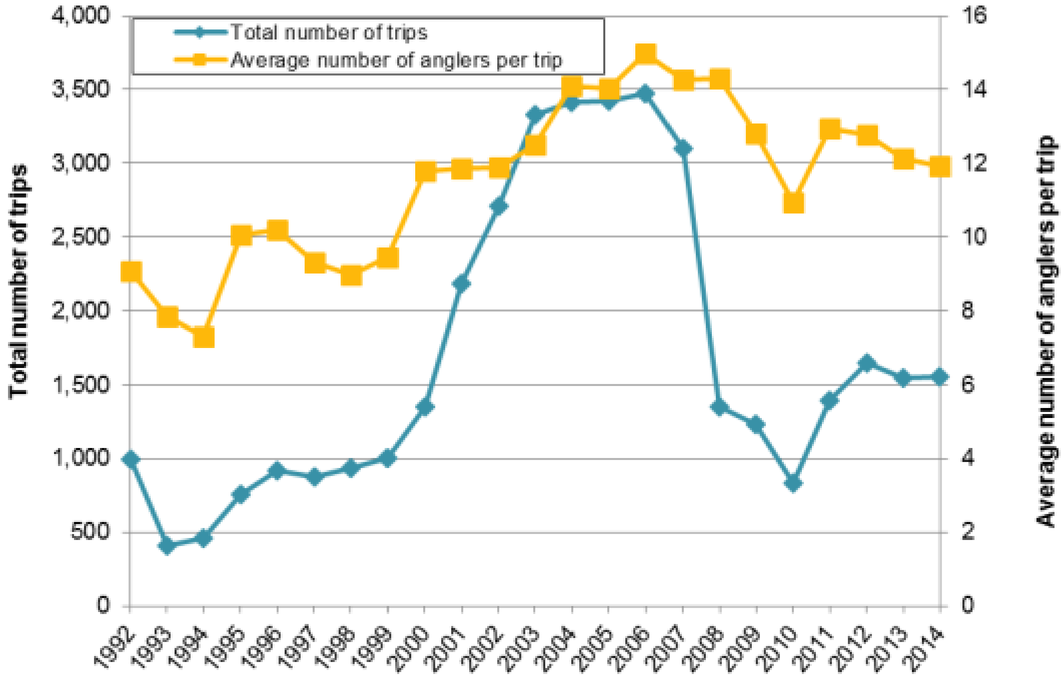
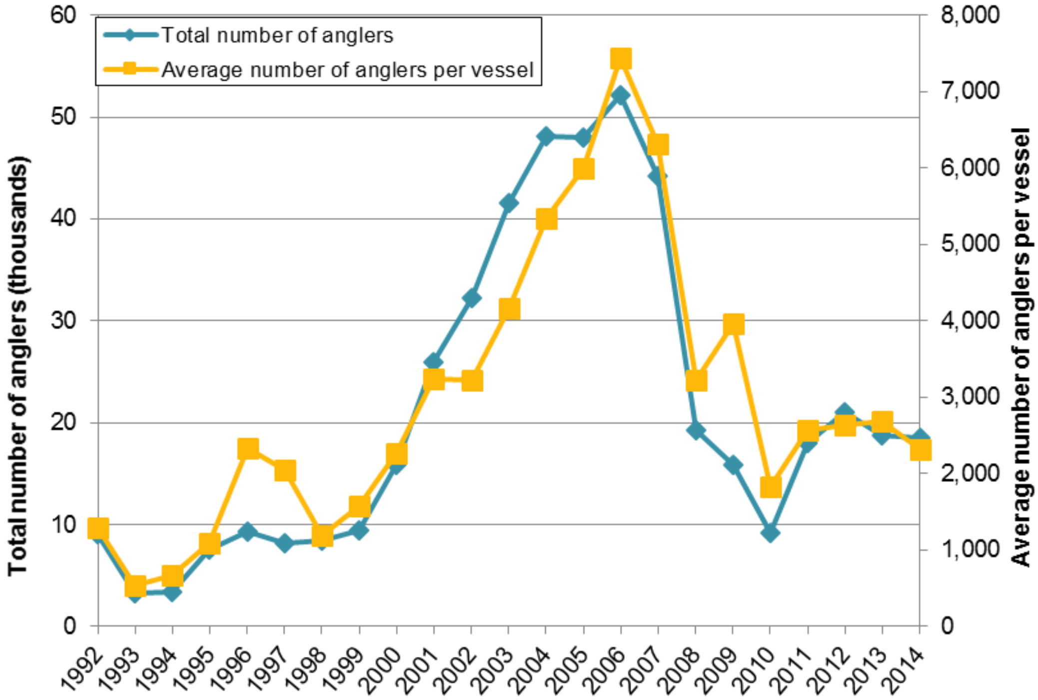


Figure 84. Total number of CPFV anglers and average number of anglers per vessel, Fort Bragg, 1992-2014



In terms of Fort Bragg CPFV catch, the three most important were from the rockfish group, Dungeness crab, and salmon, as shown in Figure 85. Over the entire study period the rockfish group accounted for nearly 74% (602,199) of the catch, while Dungeness crab and salmon together accounted for just over 20% (107,846 and 63,013 respectively) of the total catch. The general trend was a peak in activity followed by a sharp decline around the same time as the salmon closure. There has also been a somewhat rising level of importance for Dungeness crab.

Total annual number of CPFV trips by targeted fishery is shown in Figure 86. Key CPFV target fisheries were rockfish, salmon, and lingcod. Again, the trend shows a sharp peak followed by a collapse around the time of the salmon closure. While lingcod was a very important targeted fishery, it does not represent a very large share of total CPFV catch in Figure 85.

Figure 85. CPFV total number of fish caught for each fishery, Fort Bragg, 1992-2014

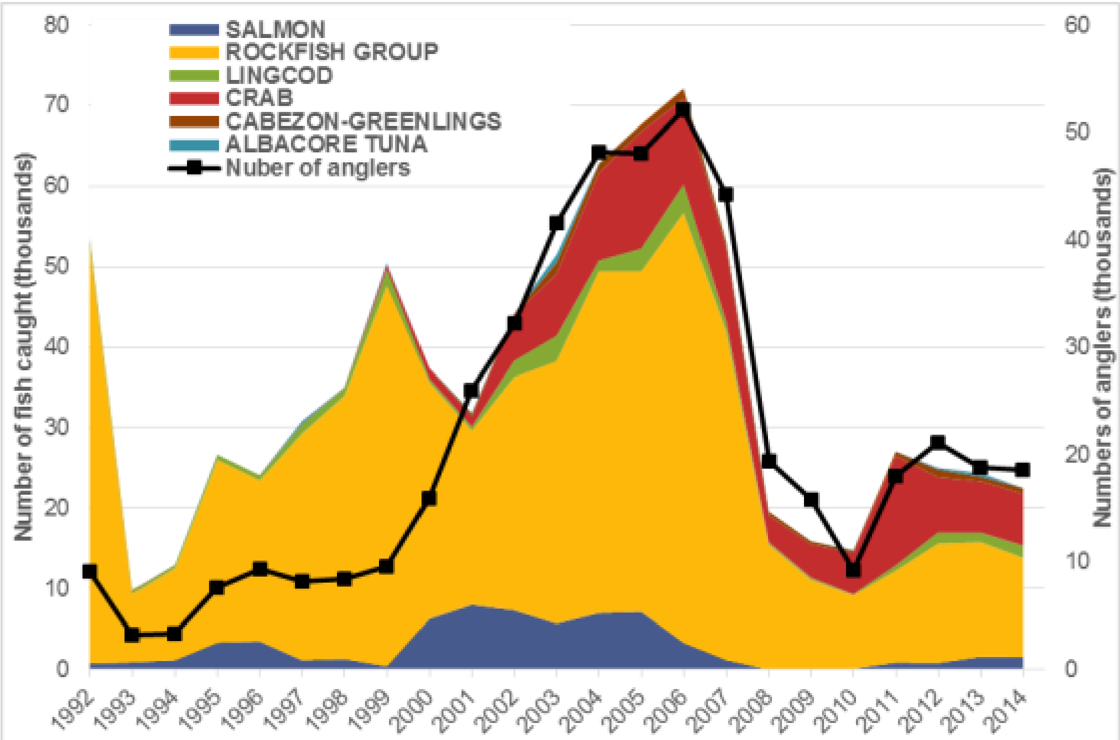
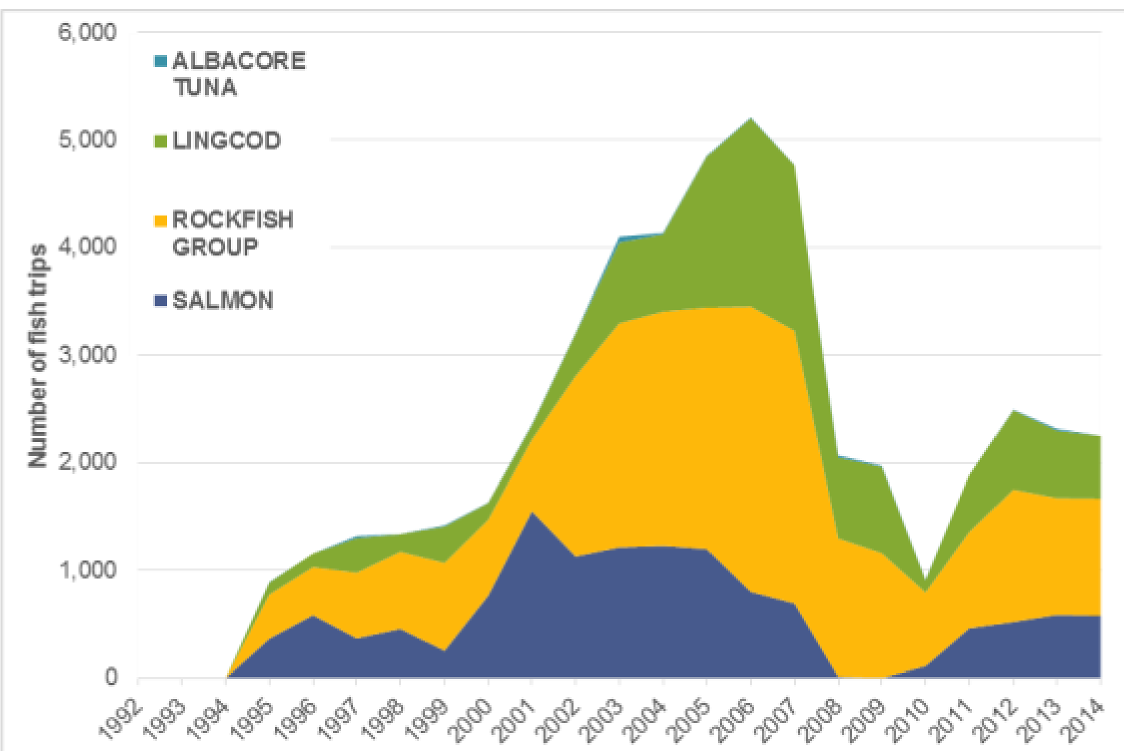


Figure 86. Total number of CPFV trips for each target fishery, Fort Bragg, 1992-2014



9. SHELTER COVE PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

Shelter Cove, along with Albion, is one of the smallest commercial fishing ports in the North Coast region of California in terms of landings and number of fishermen. The cove faces south, providing an important port of refuge from northwesterly winds and seas. Shelter Cove is located in the middle of a long stretch of very rocky, rugged and mostly inaccessible coastline of the “Lost Coast” region of northwestern California. It is the only open-ocean boat launch for approximately 50 miles to the north (Pedrazzini boat ramp at Cock Robin Island near Loleta) and 30 miles to the south (Noyo Harbor, Fort Bragg).

In terms of road access, Shelter Cove may be one of the most remote fishing ports in the state, as the drive involves an hour-long trip down a small, winding, and at times unreliable road after exiting US Highway 101. Due to the area’s remoteness, recreational and commercial fishing are an important part of the community’s social and economic fabric. Many residents live more subsistence lifestyles where harvested marine resources make up an important component of their diet. As a result of this dependence on marine resources, regulations and restrictions such as MPAs have the potential to greatly affect local livelihoods.

The Humboldt Bay Harbor, Recreation, and Conservation District maintains the Shelter Cove harbor, breakwater jetty, boat launch and fish cleaning station. The Harbor District recently upgraded some Shelter Cove facilities, improving the breakwater, restrooms, access road and fish cleaning station (Humboldt Bay Harbor, Recreation, and Conservation District, 2016a). Boats may be self-launched from trailers or carried into the water by a tractor boat launch service available on site. Parking is available adjacent to the launching area or uphill in the visitor parking area where there are restaurants, shops, public restrooms, a small private airport, the historic Mendocino Lighthouse, and fish cleaning facilities.

Fishermen affectionately recall the commercial fishing seasons of the 1980s where they recall that over 100 colorful small commercial skiffs referred to as the “Mosquito Fleet” would come to Shelter Cove to target local fisheries, particularly salmon. Fishermen could offload and sell their catch, refuel, have a meal, stay in a hotel, or use a telephone. The port was considered well organized with a fishermen’s association, and a local fish buyer that sold to local markets as well as out of the area.

Due to various factors, the number of active commercial fishermen has declined, as elsewhere in the North Coast region. The Shelter Cove commercial fishing occupational community sees itself as having been hit hard by regulations and restructuring in the region’s commercial fisheries, including salmon closures in the Klamath Management Zone and restructuring of the California groundfish fisheries. By the 1990s, the fleet was a fraction of its former self. On average Shelter Cove fishermen are older than those in any other port in the North Coast region (with the exception of Albion, which had a small sample size) with an average age of 56. Members of the community are concerned that few young people are entering commercial fishing in the area.

In 2014 the commercial fishing fleet homeported in Shelter Cove consisted of approximately 31 “day” fishermen who launch their vessels, fish, and return the vessels to land at the end of the day. Angler trips on CPFV boats have increased, which aligns with other tourism amenities available in the area. In 2013, the port had three active CPFV operators. Additionally, recreational fishermen from outside the area bring their boats to Shelter Cove to fish during open seasons, bringing needed business to the local tourism economy. In recent years Dungeness crab has dominated landings in this port, with salmon and nearshore finfish (dead) making up the rest of the top three fisheries in 2014. Shelter Cove makes up an average of 0.1% of all commercial landings, and 0.6% for fisheries of interest in the North Coast region.

There are some hopeful signs for the future of the port. Shelter Cove is the only port in the North Coast region that showed a stable and at times growing trend in the number of commercial fishermen, pounds landed, and revenue over the course of the 1994-2014 study period. The port experienced an increase in the level of participation and ex-vessel revenue from 2010 to 2013. The trend towards growth in commercial fisheries, along with renewed investment in the waterfront infrastructure by the Humboldt Bay Harbor, Recreation and Conservation District, bodes for the future of this fishing occupational community.

9.1. Shelter Cove Baseline Characterization

The average Shelter Cove commercial fisherman that we interviewed was 55.6 years old and had an average of 30.8 years of experience, as shown in Table 103 below. Average age was 1.7 years older than the regional average, and average years of experience was 3.2 years more than the regional average. It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Table 103. Average age and years of experience commercial fishing in 2013, Shelter Cove

	Age			**Years of experience**		
Fishery	**Number of respondents**	**Average**	**Standard deviation**	**Number of respondents**	**Average**	**Standard deviation**
Dungeness crab - trap	5	47.6	17.1	5	25.6	19.6
Nearshore finfish- dead - hook and line	4	70.3	14.6	4	38.3	17.1
Salmon - troll	5	52.0	18.1	5	30.0	16.6
All target fisheries (unique individuals)	**9**	**55.6**	**18.3**	**14**	**30.8**	**17.3**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in Table 104, Shelter Cove fishermen on average made 65.6 percent of their total personal income from commercial fishing in 2013.

Table 104. Percent income from overall commercial fishing in 2013, Shelter Cove

	Number responding	**Average**	**Standard deviation**
All target fisheries (unique individuals)	**9**	**65.6%**	**28.8%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Fishermen were asked what share of their ex-vessel revenue was used for overall commercial fishing operating costs. As shown below in Table 105, the average was 35.4%, with fishermen targeting the nearshore finfish dead- hook and line fishery having the highest share of ex-vessel revenue going towards overall operating costs (52.5%), with those targeting salmon – troll having the lowest (23.0%).

Table 105. Percentage of total gross fishing revenue used for overall operating costs in 2013, Shelter Cove

Fishery	Number of respondents	Average	Standard Deviation
Dungeness crab - trap	5	34.2%	26.9%
Nearshore finfish- dead - hook and line	4	52.5%	38.0%
Salmon - troll	5	23.0%	6.3%
All target fisheries (unique individuals)	**9**	**35.4%**	**26.8%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Shelter Cove commercial fishermen were asked how many years of experience and how many days they spent targeting each of the fisheries in which they participated. As shown below in Table 106, the average years of experience targeting all target fisheries in Shelter Cove was 31.2 years. On average, those in the nearshore finfish dead – hook and line fishery had the most experience targeting their fishery (38.8 years). The average number of days per year targeting specific fisheries was 80.8 for all target fisheries. On average, Dungeness crab – trap fishermen spent the largest average annual number of days targeting their fishery in 2013 (134.2 days), followed by nearshore finfish dead – hook and line (76.3 days).

Table 106. Years of experience and number of days targeting specific fisheries in 2013, Shelter Cove

	Years of experience			**Days targeting specific fishery**		
Fishery	**Number of respondents**	**Average**	**Standard deviation**	**Number of respondents**	**Average**	**Standard Deviation**
Dungeness crab - trap	5	24.6	19.7	5	134.2	57.2
Nearshore finfish- dead - hook and line	4	38.8	16.5	4	76.3	23.2
Salmon - troll	5	31.8	15.0	5	31.0	34.0
All target fisheries	**9**	**31.2**	**16.9**	**9**	**80.8**	**59.5**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Shelter Cove commercial fishermen were asked how many crew they used for each fishery, and what share of their ex-vessel revenue from each fishery was spent on crew and on fuel. Responses are summarized below in Table 107. The average number of crew members among Shelter Cove fishermen was 0.5. An FAC member indicated that many Shelter Cove fishermen fish alone, which explains this very low average crew number.

The average share of ex-vessel revenue spent on crew was 7.1%. On average, Dungeness crab fishermen spent the largest percentage of revenue on crew (12.0%), and salmon - troll fishermen spent the least (2.0%). The average share of ex-vessel revenue spent on fuel was 12.9%. On average, nearshore finfish live – hook and line fishermen spent the largest share of ex-vessel revenue on fuel (21.3%), and Dungeness crab - trap fishermen spent the least (9.4%).

Table 107. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Shelter Cove

	Number of crew			Percent revenue towards crew			Percent revenue towards fuel		
Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab - trap	5	0.8	0.8	5	12.0%	12.5%	5	9.4%	1.3%
Nearshore finfish- dead - hook and line	4	0.5	1.0	4	7.5%	15.0%	4	21.3%	20.2%
Salmon - troll	5	0.2	0.4	5	2.0%	4.5%	5	9.6%	7.1%
All target fisheries	**9**	**0.5**	**0.8**	**9**	**7.1%**	**11.2%**	**9**	**12.9%**	**11.8%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Shelter Cove commercial fishermen were also asked whether MPAs had affected their fishing, and if so, what specific, direct effects MPAs had on particular fisheries in 2013. This latter question was open ended. In Table 108 we provide a summary of the responses by fishery. Of the respondents who answered this question, a majority (55.6% of respondents) answered that MPAs had affected their fishing. Of those who responded Yes, the most frequently cited effect was (A), Cannot fish in or go to traditional grounds/areas (55.6% of respondents).

Table 108. Direct effects of MPAs on specific fisheries in 2013, Shelter Cove

Fishery	Number of respondents	Have MPAs impacted your fishing?	A	B	C	D	E
Dungeness crab - trap	5	--	--	--	--	--	--
Nearshore finfish- dead - hook and line	4	50.0%	50.0%	50.0%	25.0%	25.0%	25.0%
Salmon - troll	5	60.0%	60.0%	--	--	--	20.0%
All target fisheries	**9**	**55.6%**	**55.6%**	**22.2%**	**11.1%**	**11.1%**	**22.2%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly impacted by MPAs

Respondents were asked which MPAs had impacted their fisheries in 2013, and were provided with a comprehensive list of MPAs, given below. In Table 109 below we list the MPAs that our respondents cited as having impacted specific fisheries in Shelter Cove during 2013. Six MPAs on the North Coast affected targeted fisheries in 2013. Of those, (G) Big Flat SMCA affected the largest number of fishermen respondents (3 responses), followed by (I) Mattole Canyon SMR (2 responses). An FAC member indicated that Big Flat SMCA affected Dungeness crab fishing, and Mattole Canyon SMR affected most all Shelter Cove commercial fishermen.

Table 109. Which MPAs have affected specific fisheries in 2013, Shelter Cove

Fishery	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Dungeness crab - trap	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nearshore finfish- dead - hook and line	--	--	--	--	--	--	2	--	2	--	--	--	--	--	--	1	--	--	--	--	1	1	--	--	--	--	--	--
Salmon - troll	--	--	--	--	--	--	1	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All target fisheries	**--**	**--**	**--**	**--**	**--**	**--**	**3**	**--**	**2**	**--**	**--**	**--**	**1**	**--**	**--**	**1**	**--**	**--**	**--**	**--**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	**--**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were asked about the importance, and reasons for importance, regarding participating in multiple targeted commercial fisheries. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 110 below, all 9 Shelter Cove commercial respondents indicated that multi-fishery participation was 'Very Important' or 'Important.'

If fishermen responded that multi-fishery participation was very important or important, they were then asked an open-ended question regarding why that was the case. Responses were categorized by the interviewer as fishermen provided their response. Respondents could provide more than one answer.

The top three responses were that it 'Stabilizes year-to-year variation in my commercial fishing income', 'Increases my annual commercial fishing income', and 'More completely utilizes my vessel, gear, and other capital equipment'.

Table 110. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Shelter Cove

		Degree of importance		Reasons for importance			
Fishery	**All target fisheries**	**Very Important**	**Important**	**A**	**B**	**C**	**D**
Dungeness crab - trap	5	4	1	2	4	3	3
Nearshore finfish- dead - hook and line	4	3	1	3	2	2	0
Salmon - troll	5	4	1	3	3	2	3
All target fisheries (unique individuals)	**9**	**7**	**2**	**5**	**6**	**5**	**3**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, commercial fishermen in Shelter Cove were asked what strategies they used to market their catch. They were given ten possible responses, listed below in Table 111 as answers A through J. Respondents were allowed to provide more than one answer. The most frequently cited market strategy was (C), Sell to traditional processor (6 individual responses), followed by (B), Sell directly to restaurants (5 individual responses) and (E), Sell to other wholesalers/middlemen (4 individual responses).

Table 111. Strategies used to market catch in 2013, Shelter Cove

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	--	2	5	--	3	2	2	--	--	--
Nearshore finfish- dead - hook and line	2	3	1	1	1	--	--	--	2	1
Salmon - troll	--	3	4	--	4	2	2	--	--	--
All target fisheries (unique individuals)	**2**	**5**	**6**	**1**	**4**	**2**	**2**	**0**	**2**	**1**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

9.2. Shelter Cove Commercial Fishing Initial Changes

Shelter Cove commercial fishermen were asked how they saw their income from commercial fishing changing from 2009 to 2013, before and immediately after MPA formation. Their options were significantly higher, somewhat higher, no change, somewhat lower, or significantly lower. As summarized in Table 112, there was a wide range of responses with no clear pattern.

Table 112. Perceived change in share of personal income coming from commercial fishing between 2009 and 2013, Shelter Cove

Fishery	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**9**	**51.0%**	**--**	**33.2%**	**43.4%**	**25.5%**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point

In addition to indicating a perceived change, respondents were asked an open-ended question regarding the factors they saw as contributing to the change in the share of their income coming from commercial fishing. Reasons for any changes are summarized in Table 113. The most frequent responses were (C) (4 individual responses), Changes in regulations, and (E) Other (3 individual responses).

Table 113. Factors most affecting changes in share of personal income coming from commercial fishing between 2009 and 2013, Shelter Cove

Fishery	Number of respondents	A	B	C	D	E
All target fisheries (unique individuals)	**9**	**3**	**2**	**4**	**2**	**3**

Source: Current study
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Shelter Cove commercial fishermen were asked to compare his/her success in each individual fishery in 2013 to that of the last ten years. As shown in Table 114 below, respondents were given the option of responding in one of the following categories: (1) significantly better; (2) somewhat better; (3) the same; (4) somewhat worse; and (5) significantly worse. The most frequent response (30.8%) was Somewhat Worse, followed by Significantly Worse (23.1%). Moreover, 23.1% of fishermen in Shelter Cove had not participated in the specified target fishery ten years earlier.

Table 114. Perceived success in fishing in 2013 compared to last ten years, Shelter Cove

Fishery	Number of respondents	Did not participate	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	5	25.0%	—	—	—	50.0%	25.0%
Nearshore Finfish Dead - Hook and Line	4	—	—	25.0%	25.0%	25.0%	25.0%
Salmon - Troll	5	40.0%	—	—	20.0%	20.0%	20.0%
All target fisheries (unique individuals)	**9**	**23.1%**	**--**	**7.7%**	**15.4%**	**30.8%**	**23.1%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

Figure 87Information on trends in commercial landings, ex-vessel revenue, and number off fisherman for all fisheries for the port of Shelter Cove over the study period, 1992-2014, is given in Figure 87. On average annually, Shelter Cove accounted for 0.1% of the region’s total landings (48,000 pounds), 0.3% of total ex-vessel revenue ($131,000), and 1.5% of all North Coast regional commercial fishermen (28), for all fisheries. These data show substantial inter-annual variation in numbers of active commercial fishermen and total ex-vessel value, with a notable increase after 2010. The decline in active commercial fishermen seen in so many other North Coast regional ports is less strong a trend in Shelter Cove.

Trend data for fisheries of interest in Shelter Cove are given in Figure 88. Unlike most other North Coast regional fishing ports, Shelter Cove has seen a generally increasing trend for numbers of active commercial fishermen, total landings, and total ex-vessel revenue over the study period. As in other regional ports, one can see substantial year-to-year fluctuations in these values, and a sharp increase after 2010.

Over the course of the study period, Shelter Cove saw a modest increase in its share of the region's total active commercial fishermen, as shown in Figure 89. Shares of regional total pounds landed and ex-vessel value remained well below 5% for the entire study period.

Figure 87. Commercial landings, ex-vessel revenues, and number of fishermen, Shelter Cove, 1992–2014, all fisheries

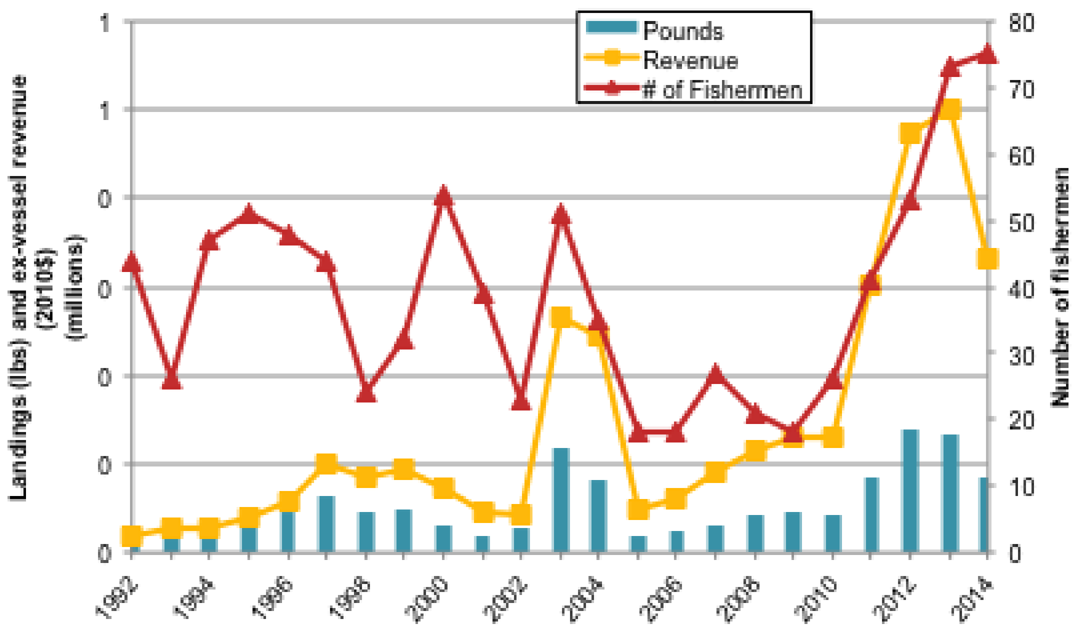


Figure 88. Commercial landings, ex-vessel revenues, and number of fishermen, Shelter Cove, 1992–2014, fisheries of interest

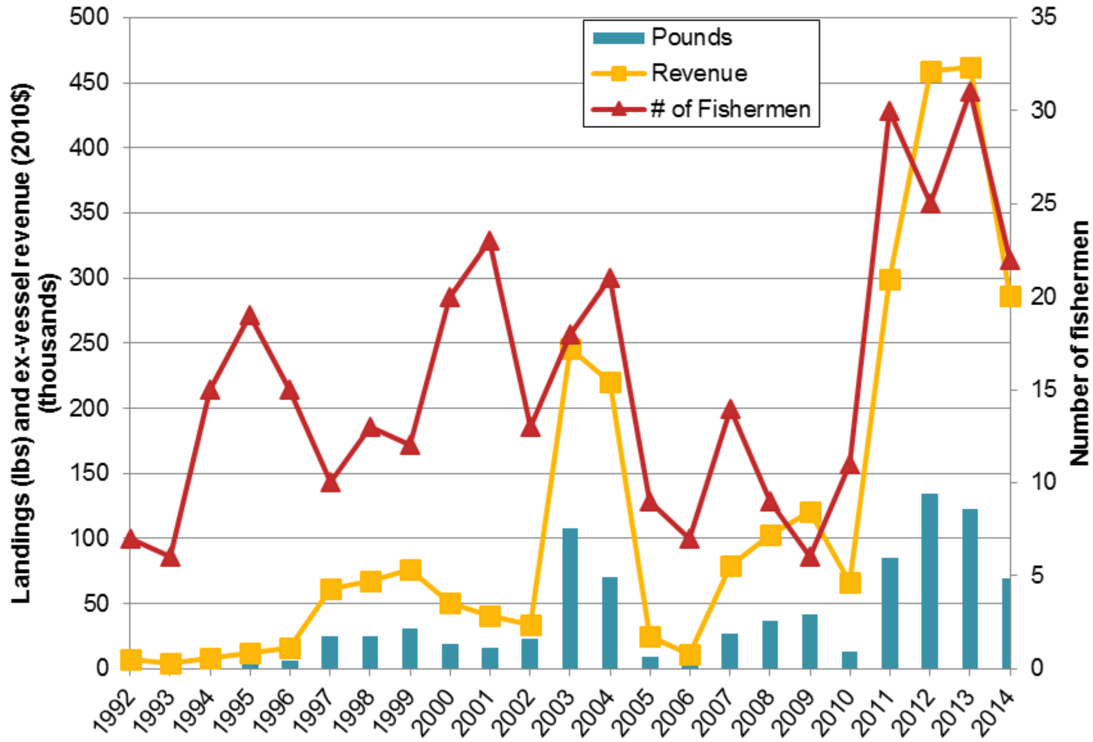
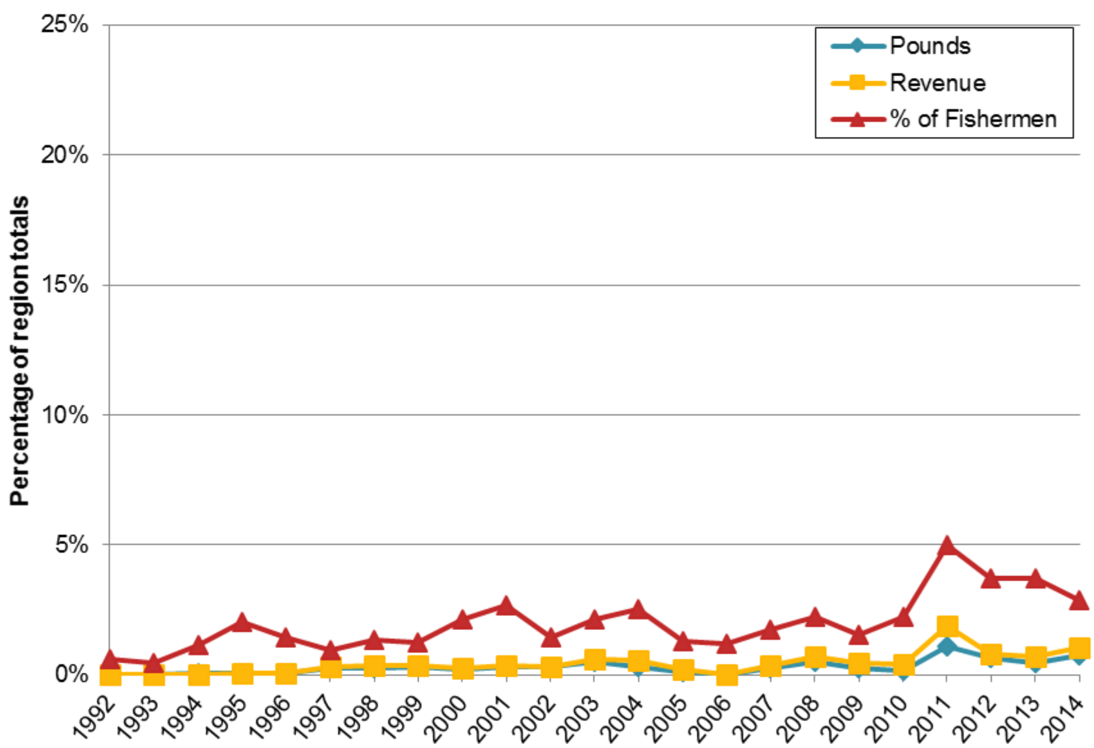


Figure 89. Fisheries of interest landings, revenue, and number of fishermen as a percentage of regional totals, Shelter Cove, 1992-2014



Trends in total Shelter Cove landings and ex-vessel revenue for fisheries of interest over the course of the study period are given in Figure 90 and Figure 91. The data show strong inter-annual variation, with Dungeness crab and salmon generally serving as the dominant fisheries of interest in Shelter Cove.

One can see in
Figure 92 that while Dungeness crab and salmon dominate landings, relatively large numbers of Shelter Cove commercial fishermen also target the nearshore finfish- hook-line dead fishery (22%). These values also show considerable year-to-year fluctuations.

Figure 90. Commercial landings for fisheries of interest, Shelter Cove 1992-2014

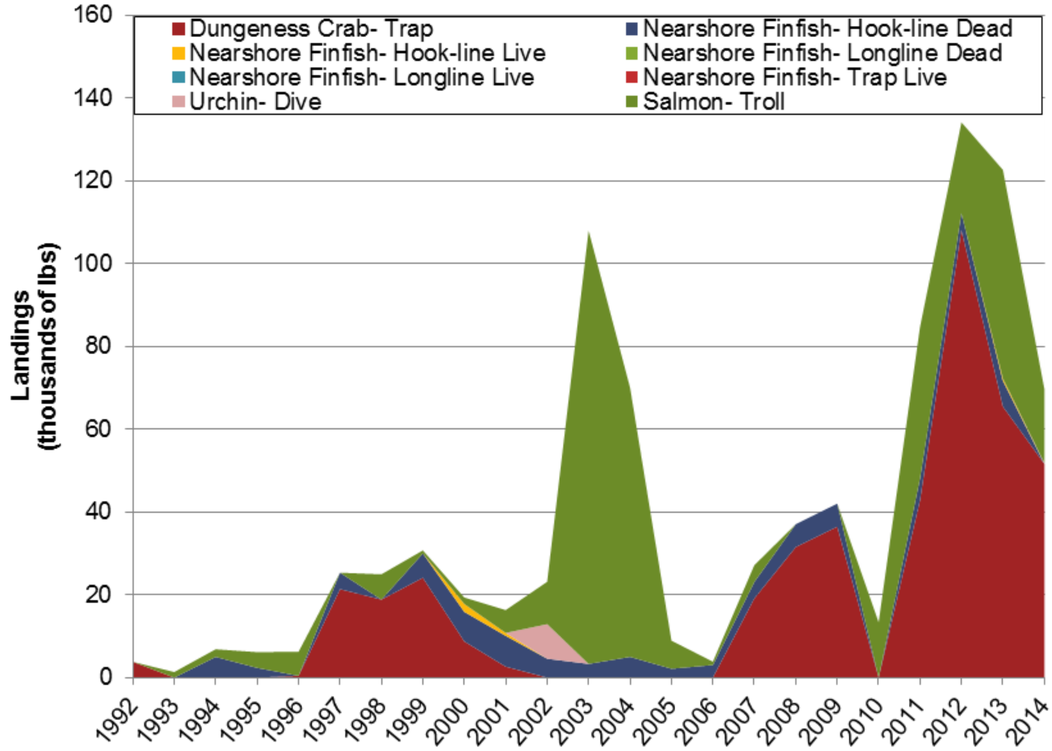


Figure 91. Ex-vessel revenue for fisheries of interest, Shelter Cove, 1992-2014

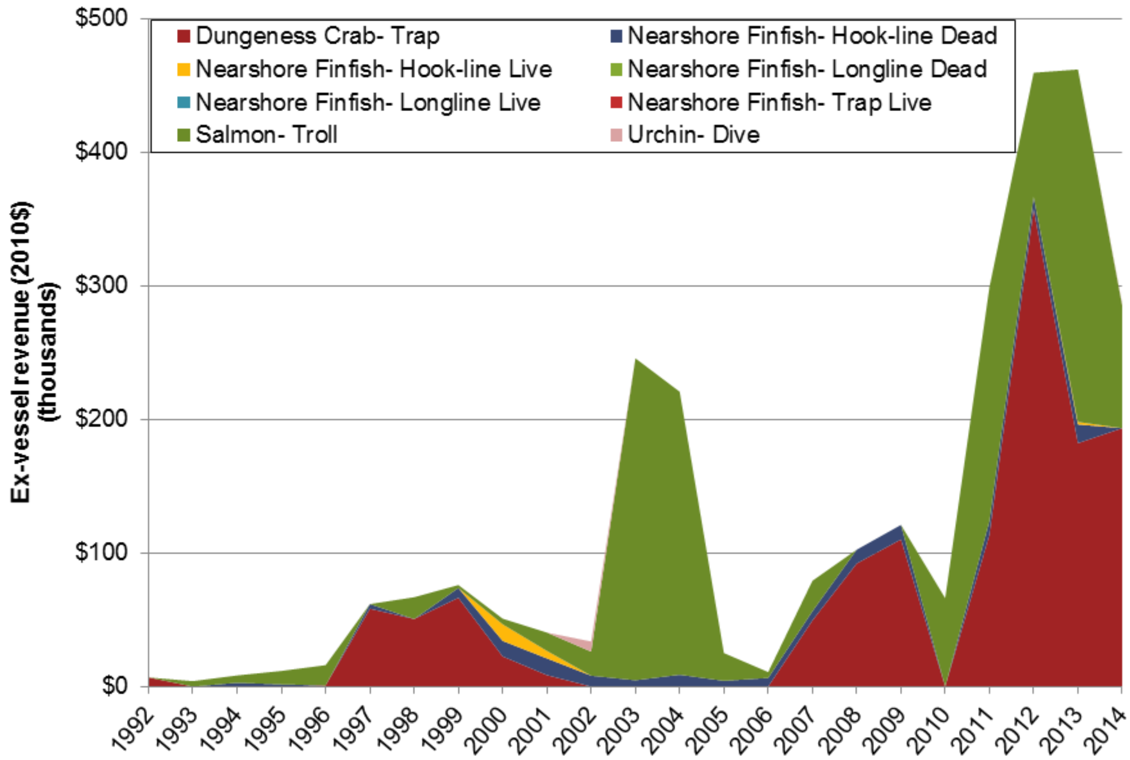
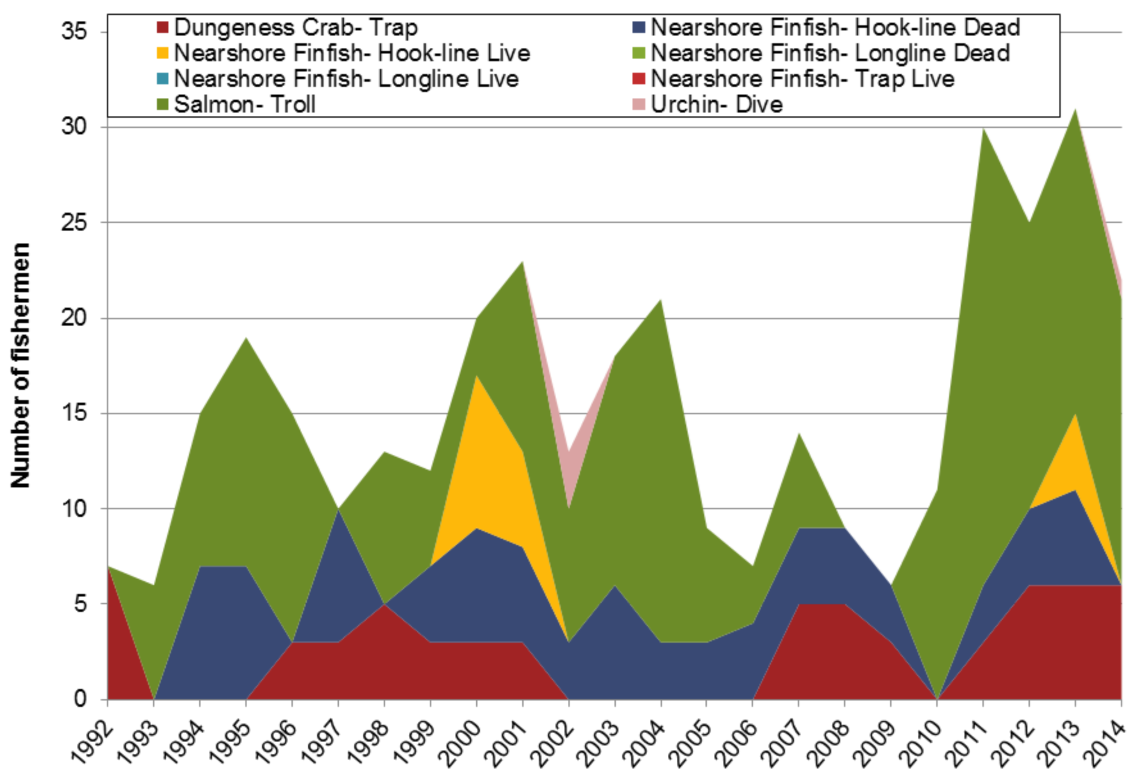
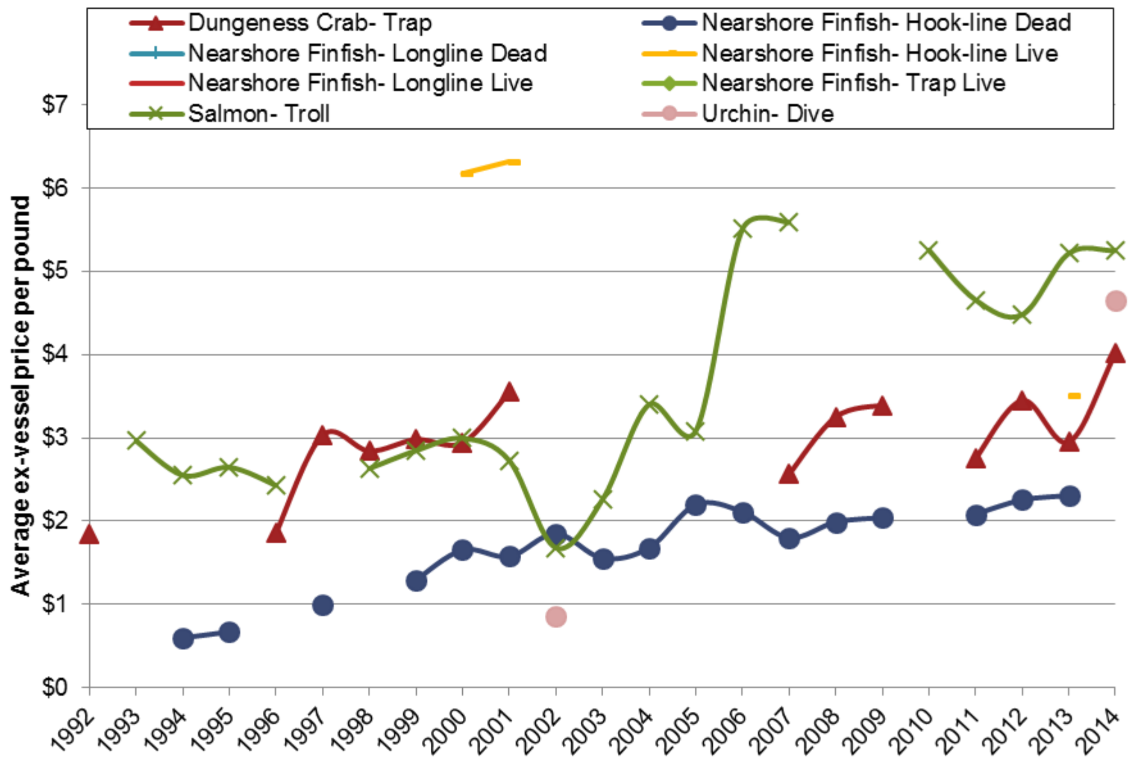


Figure 92. Number of fishermen for fisheries of interest, Shelter Cove, 1992-2014



Trend data on annual average ex-vessel price per pound by fishery is given in Figure 93. Salmon and Dungeness crab consistently commanded the highest price per pound over the course of the study period, while nearshore finfish hook-line live generated relatively high prices in the few years where activity in that fishery was recorded for Shelter Cove by CDFW.

Figure 93. Average ex-vessel price over time, Shelter Cove, 1992-2014



Trend data for numbers of active commercial fishermen, landings, and ex-vessel revenue is broken out for the key species of interest for Shelter Cove in Figure 94, Figure 95, and Figure 96. One can clearly see the importance of Dungeness crab and salmon to sustaining commercial fishing in Shelter Cove over the study period.

Figure 94. Dungeness crab- trap: Average pounds, revenue, and number of fishermen, Shelter Cove, 1992-2014

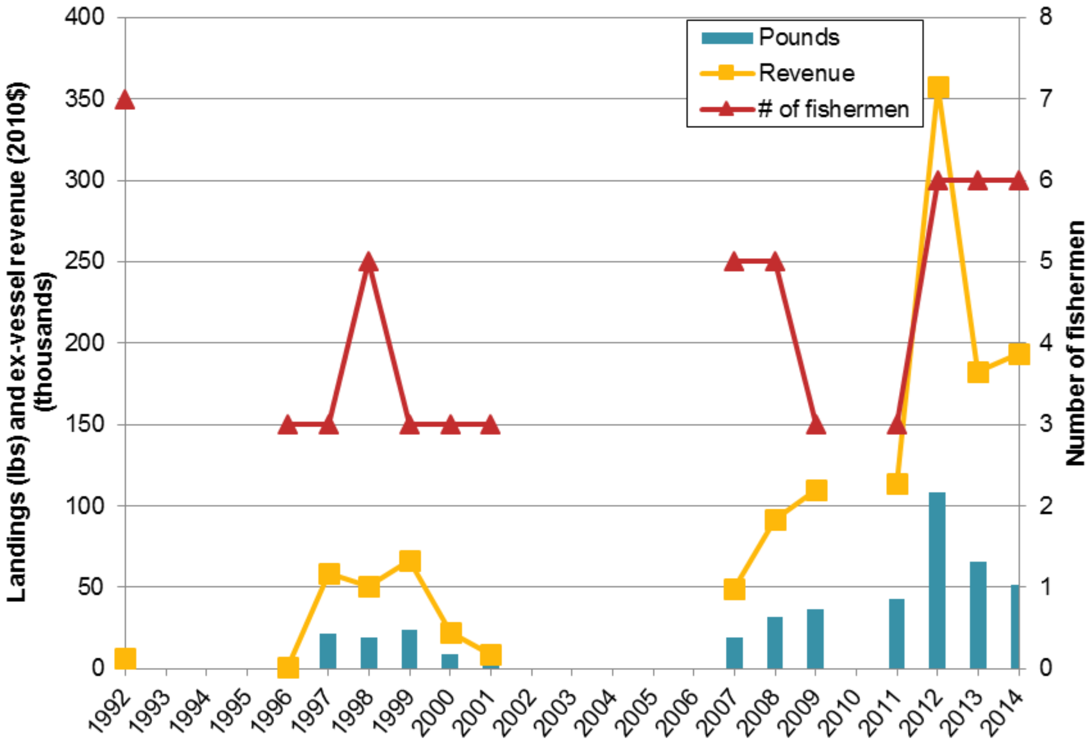


Figure 95. Nearshore finfish- hook-line- dead: Average pounds, revenue, and number of fishermen, Shelter Cove, 1992-2014

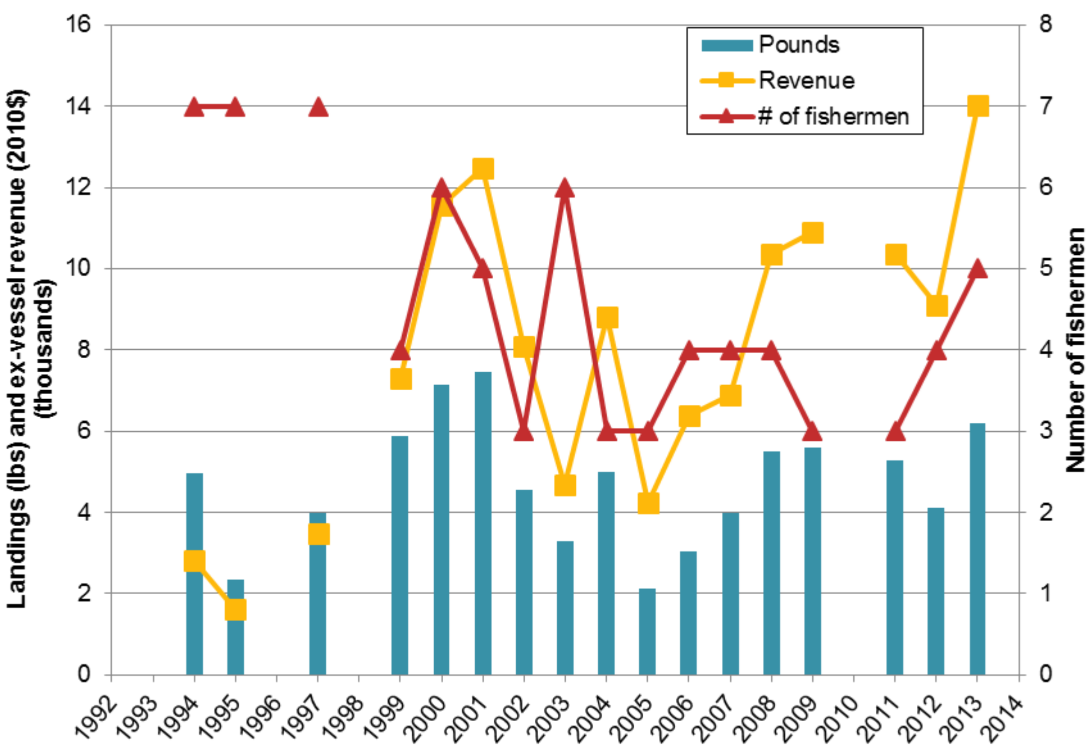
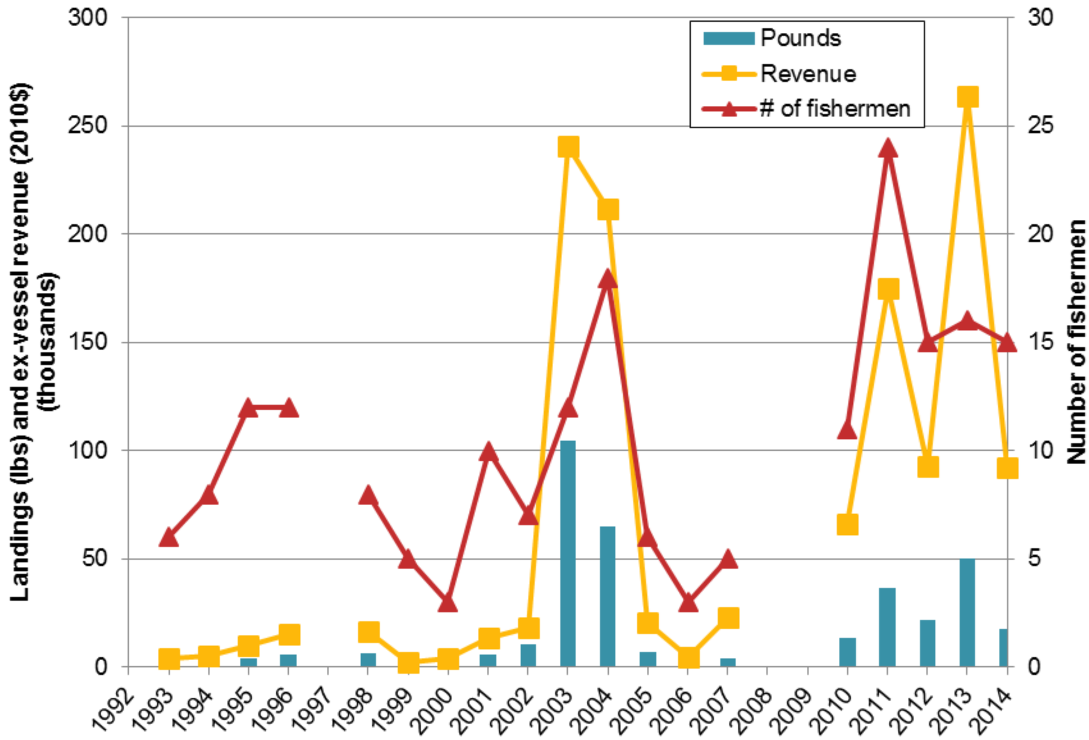


Figure 96. Salmon- troll: Average pounds, revenue, and number of fishermen, Shelter Cove, 1992-2014



Average landings and ex-vessel revenue per fisherman targeting the Dungeness crab- trap fishery over the course of the study period are summarized in Figure 97. The same information is provided in Figure 98 and Figure 99 for fishermen targeting the nearshore finfish hook-line dead fishery and the salmon-troll fishery.

The two mainstay commercial fisheries (Dungeness crab and salmon) show considerable inter-annual variation in average landings and ex-vessel revenue per fisherman. These data provide background for why all Shelter Cove respondents indicated the importance of multi-fishery participation, with most noting its importance to stabilizing inter-annual fishing income.

Figure 97. Dungeness crab- trap: Average pounds, revenue per fisherman, Shelter Cove, 1992-2014

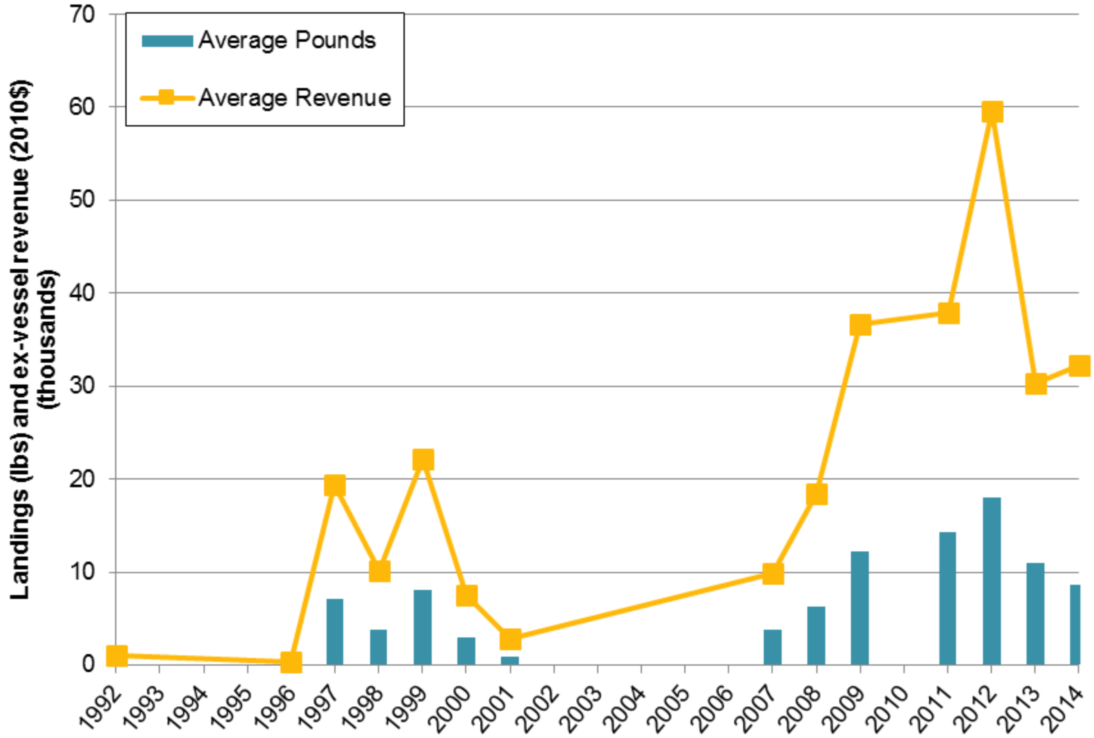


Figure 98. Nearshore finfish- hook line- dead: Average pounds, revenue per fisherman, Shelter Cove, 1992-2014

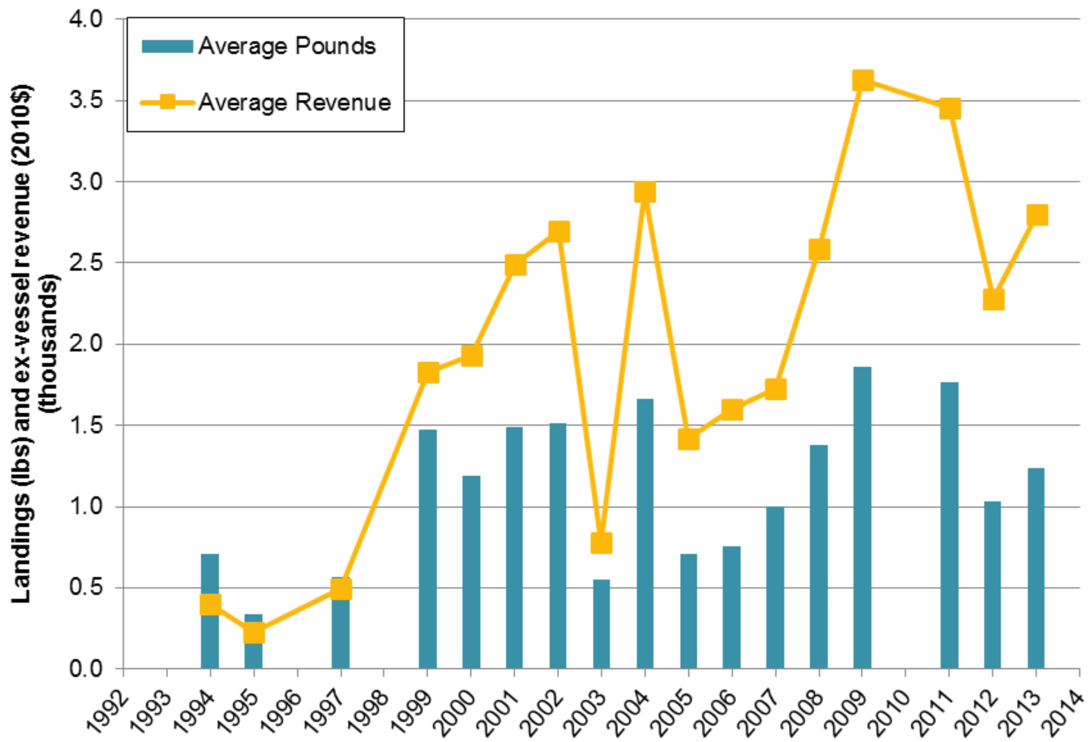
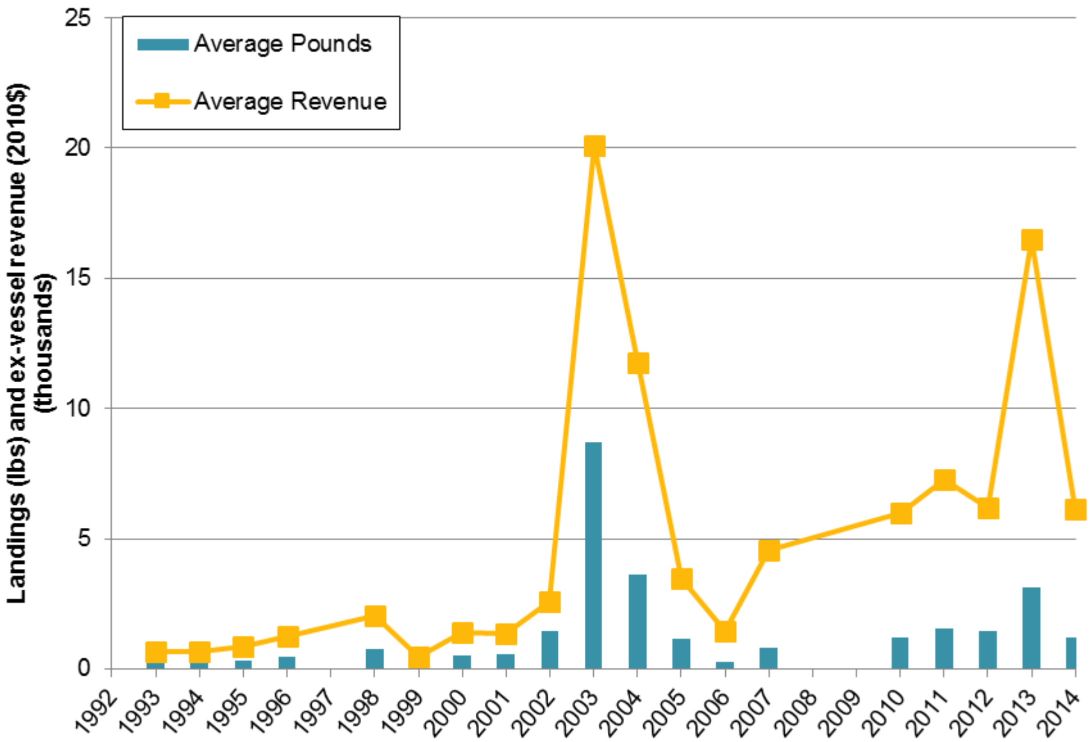


Figure 99. Salmon- troll: Average pounds, revenue per fisherman, Shelter Cove, 1992-2014



10. TRINIDAD PORT FISHING OCCUPATIONAL COMMUNITY PROFILE

The small North Coast regional port community of Trinidad is known for its parks, tourism, ecological importance, HSU's Telonicher Marine Lab, and for its relatively new dock. The scenic small town of approximately 300 draws both destination visitor stays and tourist stops from nearby US Highway 101. In terms of cultural identity, the fishing industry is a prominent part of the Trinidad community.

In addition to fishing, key Trinidad attractions include Trinidad Head (added to the California Coastal National Monument in January 2017), Trinidad State Beach, and a scenic rocky coastline to the North and South featuring many secluded pocket coves. Trinidad is ecologically important, and in 1974 the kelp forest ecosystem surrounding Trinidad Head were designated by the State of California as the Trinidad Head Area of Special Biological Significance, one of 34 in California.

Trinidad Rancheria purchased the pier and harbor facilities in 2000, which include a boat ramp, tackle shop, and parking lot. The wooden pier was built in 1946 and was in need of repair and piling replacement. In 2012 the Trinidad Rancheria completed rebuilding the pier into a state of the art concrete and steel working dock and unloading facility. The new dock is capable of bearing the weight of large tractor-trailers that can now drive onto the dock during peak Dungeness crab season (Durham, 2012).

Trinidad does not have a marina with slips, but it does provide both seasonal and permanent moorings for commercial vessels as well as pleasure boats. When not actively engaged in fishing effort, many commercial fishermen who homeport out of Trinidad relocate their vessels to the Woodley Island marina in Eureka, or haul out their vessels to store or repair. The strong tourist draw supports a group of Trinidad CPFV operators who target rockfish in the areas nearby rocky reefs.

Between 1994 and 2014, Trinidad commercial fishermen made an average of 2.3% of the North Coast region's total landings, and 4.7% of the region's total ex-vessel revenues, with the overwhelming majority landings generated from the Dungeness crab fishery. The Dungeness crab fishery has brought in an average ex-vessel revenue of just under $2 million over the study period. In 2014, there were 17 active commercial fishermen in Trinidad who received $2,892,845 in ex-vessel revenues from Dungeness crab, which was 15.1% of the region's total.

Trinidad's count of CPFV operators has been relatively steady from 2001-2014, with an average fleet size of 5 vessels. CPFV operators had an average trip size of 6 anglers per boat, and took an average of 241 annual trips. Trinidad was second only to Fort Bragg for the highest total number of North Coast regional CPFV trips over the study period.

10.1. Trinidad Baseline Characterization

The average Trinidad commercial fisherman that we interviewed was 54.8 years old and had an average of 29.2 years of experience as a commercial fisherman, as shown in Table 115 below. The average age of Trinidad commercial fishermen was 0.9 years older than the regional average, and years of experience was 1.6 years more than the regional average.

It should be noted that this question inquired about the number of years of experience an individual had commercial fishing as a whole, not the number of years of experience they had in a specific fishery.

Table 115. Average age and years of experience commercial fishing in 2013, Trinidad

	Age			Years of experience		
Fishery	**Number of respondents**	**Average**	**Standard deviation**	**Number of respondents**	**Average**	**Standard deviation**
Dungeness crab - trap	8	60.6	10.0	8	33.9	9.9
Nearshore finfish- dead - hook and line	1	*	--	1	*	--
Salmon - troll	4	48.5	16.2	4	24.3	20.1
All target fisheries	**10**	**54.8**	**14.0**	**10**	**29.2**	**14.3**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As one can see in

Table **116**, Trinidad fishermen on average made 81.5% of their total personal income from commercial fishing in 2013.

Table 116. Percent income from overall commercial fishing in 2013, Trinidad

	Number responding	Average	Standard deviation
All target fisheries	**10**	**81.5%**	**21.1%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Trinidad commercial fishermen were asked what share of their overall annual ex-vessel revenue was used to cover their overall operating costs. This question was asked as an overall fishing question, as attributing operating costs to specific fisheries is difficult due to the inherently shared nature of some fishing costs (e.g. boat maintenance, slip rental, or fuel costs for trips targeting multiple fisheries). As shown below in Table 117, the average operating cost was 50.0% of commercial fishing revenue across the 10 respondents to this question.

Table 117. Percentage of total gross fishing revenue used for overall operating costs in 2013, Trinidad

	Number of respondents	Average	Standard Deviation
All target fisheries	**10**	**50.0%**	**15.4%**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point
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Trinidad commercial fishermen were asked their years of experience and how many days they spent targeting each of the fisheries in which they participated. As shown in Table 118, the average years of experience across all target fisheries in Trinidad was 26.7 years. On average, those targeting the Dungeness crab - trap fishery had the most experience (34.4 years). The average annual number of days targeting specific fisheries was 89 days for all target fisheries. On average, those targeting the Dungeness crab - trap fishery spent the largest average annual number of days fishing in 2013 (115.6 days), followed by those targeting salmon – troll (55.0 days).

Table 118. Years of experience and number of days targeting specific fisheries in 2013, Trinidad

Fishery	Number of respondents	Average	Standard deviation	Number of respondents	Average	Standard Deviation
Dungeness crab - trap	8	34.4	9.3	8	115.6	37.2
Nearshore finfish- dead - hook and line	1	*	--	1	*	--
Salmon - troll	4	15.0	10.8	4	55.0	47.8
All target fisheries	**10**	**26.7**	**13.5**	**10**	**89.0**	**52.2**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

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Trinidad fishermen were also asked how many crew they used for each fishery, and what share of their fishery-specific ex-vessel revenue was spent on crew and on fuel. Responses are summarized in Table 119. The average number of crew members among Trinidad fishermen was one; and the average share of fishery-specific ex-vessel revenue spent on crew was 23.0%.

On average, fishermen targeting the Dungeness crab – trap fishery hired the most crew members (2) and spent the largest share of their ex-vessel revenue on crew (28.6%). The average share of ex-vessel revenue spent on fuel was 8.0%. On average, those targeting the salmon – troll fishery spent the largest share of their ex-vessel revenue on fuel (11.3%), and Dungeness crab - trap fishermen spent the least (6.6%).

Table 119. Number of crew and share of fishery-specific ex-vessel revenue going towards crew and fuel in 2013, Trinidad

Fishery	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Dungeness crab - trap	8	1.8	0.5	8	28.6%	9.4%	7	6.6%	4.0%
Nearshore finfish dead - hook and line	1	*	--	1	*	--	1	*	--
Salmon - troll	4	1.0	0.8	4	13.8%	12.5%	4	11.3%	6.3%
All target fisheries	**10**	**1.5**	**0.7**	**10**	**23.0%**	**12.0%**	**10**	**8.0%**	**5.0%**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Trinidad fishermen were asked whether MPAs had affected their fishing, and if so, to describe (open-ended) what specific, direct effects MPAs had on specific fisheries in 2013. Responses are summarized in Table 120 by fishery. Of the respondents who answered this question, 5 out of 13 answered that MPAs had affected their fishing. Of those who responded Yes, the most frequently cited effects were (A), Cannot fish in or go to traditional grounds/areas (4 responses), and (E), and Other (4 responses). Written-in "Other" responses included increased fishing pressure due to the presence of boats from other ports, and increased competition.

Table 120. Direct effects of MPAs on specific fisheries in 2013, Trinidad

Fishery	Number of respondents	Have MPAs impacted your fishing?	A	B	C	D	E
Dungeness crab – Trap	8	12.5%	--	--	--	--	25.0%
Nearshore finfish- dead - hook and line	1	*	*	--	--	*	--
Salmon - troll	4	75.0%	75.0%	25.0%	25.0%	50.0%	50.0%
All target fisheries	**10**	**50.0%**	**40.0%**	**10.0%**	**10.0%**	**30.0%**	**40.0%**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

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A	Cannot fish in or go to traditional grounds/areas
B	Need to travel longer distances to fish in other areas
C	Shifted fishing effort into areas in which weather is less predictable
D	Moved homeport location or fish out of another port
E	Other ways directly/indirectly impacted by MPAs

Respondents were asked which MPAs had impacted their fisheries in 2013, and were provided with a comprehensive list of MPAs, given below. MPAs that our respondents cited as having affected specific fisheries during 2013 are listed in Table 121. Six MPAs on the North Coast affected targeted fisheries in Trinidad in 2013. Of those, (L) Reading Rock SMR affected the largest number of fishermen respondents (4 individual responses), followed by (B) Ten Mile SMR, (O) Ten Mile Beach SMCA, and (AA) Reading Rock SMCA, each with two individual responses.

Table 121. Which MPAs have affected specific fisheries in 2013, Trinidad

Fishery	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Dungeness crab - trap	--	--	--	--	--	--	--	--	--	--	--	2	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nearshore finfish- dead - hook and line	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Salmon - troll	--	2	--	--	--	--	--	--	1	--	--	2	--	--	2	--	--	--	--	--	--	--	--	--	--	--	2	--
All target fisheries	**--**	**2**	**--**	**--**	**--**	**--**	**--**	**--**	**1**	**--**	**--**	**4**	**1**	**--**	**2**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**--**	**2**	**--**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Respondents were asked about the degree of importance, and reasons for importance, of participating in multiple targeted fisheries. Respondents were given the option of responding in one of the following categories: 1) Very Important; 2) Important; 3) Neither Important nor Unimportant; 4) Unimportant; and 5) Very Unimportant. As shown in Table 122 below, all of the respondents indicated either 'Very Important' or 'Important.' An FAC member from this port indicated that while fishermen recognize the value of multi-fishery participation, for many in Trinidad it is not a viable option.

If fishermen responded that multi-fishery participation was very important or important, they were then asked why that was the case. The question was asked as an open ended question and responses were categorized as fishermen provided their response. Respondents could provide more than one answer.

The top three responses were that it 'Stabilizes year-to-year variation in my commercial fishing income', 'Increases my annual commercial fishing income', and 'More completely utilizes my vessel, gear, and other capital equipment'.

Table 122. Degree of importance and reasons for importance of participation in multiple targeted fisheries, 2013, Trinidad

		Degree of importance		Reasons for importance			
Fishery	**Number of respondents**	**Important**	**Very Important**	**A**	**B**	**C**	**D**
Dungeness crab - trap	8	2	6	3	5	5	3
Nearshore finfish- dead - hook and line	1	--	*	*	*	*	--
Salmon - troll	4	--	4	4	3	4	1
All target fisheries	**10**	**2**	**8**	**5**	**7**	**7**	**3**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

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A	Increases my annual commercial fishing income
B	Stabilizes year-to-year variation in my commercial fishing income
C	More completely utilizes my vessel, gear, and other capital equipment
D	Other

Finally, respondents in Trinidad were asked what strategies they used to market their catch. They were given ten possible responses, listed below in Table 123 as answers A through J. Respondents were allowed to provide more than one answer.

The most frequently cited market strategy was (C) Sell to traditional processor (9 individual responses), followed by (G), Sell to live fish buyers (8 individual responses). An FAC member from Trinidad indicated that in general there are two fish buyers who serve the Trinidad dock, though usually not at the same time.

Table 123. Strategies used to market catch in 2013, Trinidad

Fishery	A	B	C	D	E	F	G	H	I	J
Dungeness crab - trap	--	--	7	--	--	--	7	--	2	--
Nearshore finfish- dead - hook and line	--	1	1	1	1	1	1	1	1	--
Salmon - troll	--	1	4	1	2	1	3	1	1	--
All target fisheries	**--**	**1**	**9**	**1**	**2**	**1**	**8**	**1**	**3**	**--**

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Sell at farmers market or street fairs
B	Sell directly to restaurants
C	Sell to traditional processor
D	Sell directly to prearranged individual customers
E	Sell to other wholesalers/middlemen (excluding traditional processors)
F	Sell off own vessel
G	Sell to live fish buyers
H	Sell at a fish cooperative
I	Sell directly to retailers
J	Other

10.2. Trinidad Commercial Fishing Initial Changes

Commercial fishermen in Trinidad were asked how they saw their income from commercial fishing changing from 2009 to 2013, before and immediately after MPA formation. They were asked to select one of the following options; significantly higher, somewhat higher, no change, somewhat lower, or significantly lower.

As one can see in Table 124, the majority of respondents (53.9%) perceived no change. A minority of respondents perceived significantly higher income (23.1%), somewhat higher income (15.4%), or somewhat lower income (7.7%).

Table 124. Perceived change in share of personal income coming from commercial fishing between 2009 and 2013, Trinidad

	Number responding	Significantly higher	Somewhat higher	No Change	Somewhat lower	Significantly lower
All target fisheries (unique individuals)	**10**	**23.1%**	**15.4%**	**53.8%**	**7.7%**	**--**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point

In addition to indicating a perceived change, respondents were asked what factors they saw as having contributed to any change in the share of their income coming from commercial fishing. This was asked as an open ended question. In Table 125 we list the reasons for the change as well as the number for each fishery. Answers were split relatively evenly across responses, with (D) Personal reasons receiving two (the most) responses.

Table 125. Factors most affecting changes in share of personal income coming from commercial fishing between 2009 and 2013, Trinidad

	Number of respondents	A	B	C	D	E
All target fisheries	**10**	**1**	**1**	**0**	**2**	**1**

Source: Current study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

A	Changes in the market/economy
B	Changes in fish abundance/presence
C	Changes in regulations
D	Personal reasons
E	Other

Trinidad commercial fishermen were asked separately for each fishery they participated in to compare his/her success in the fishery in 2013 to that of the last ten years. As shown in Table 126 below, respondents were given the option of responding in one of the following categories: (1) significantly better; (2) somewhat better; (3) the same; (4) somewhat worse; and (5) significantly worse. One can see that economic conditions for Trinidad commercial fishermen has generally been seen as improving over the last ten years. The most popular answer (46.2%) was Significantly Better, followed by Somewhat Better (23.1%) and The Same (23.1%).

Table 126. Perceived success in fishing in 2013 compared to last ten years, Trinidad

Fishery	Number of respondents	Did not participate	Significantly better	Somewhat better	The same	Somewhat worse	Significantly worse
Dungeness Crab - Trap	8	--	37.5%	37.5%	25.0%	--	--
Nearshore Finfish Dead - Hook and Line	1	--	--	--	*	--	--
Salmon - Troll	4	25.0%	75.0%	--	--	--	--
All target fisheries (unique individuals	**10**	**7.7%**	**46.2%**	**23.1%**	**23.1%**	**--**	**--**

Source: Current study.
— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Trinidad trend data for commercial landings, ex-vessel revenue, and number of active commercial fisherman for all fisheries over the study period is given in Figure 100. In terms of general trends, one can see steadily declining numbers of active commercial fishermen homeporting from Trinidad, along with generally rising ex-vessel revenue. Both ex-vessel revenue and landings feature substantial inter-annual variation, as one would expect for a fishing port dominated by the highly variable Dungeness crab fishery.

That same trend data for fisheries of interest is summarized in Figure 101. The two diagrams (Figure 100 and Figure 101) look very similar, which is because Dungeness crab (a fishery of interest) is by far the dominant commercial fishery in Trinidad over the study period.

Figure 100. Commercial landings, ex-vessel revenues, and number of fishermen, Trinidad, 1992–2014, all fisheries

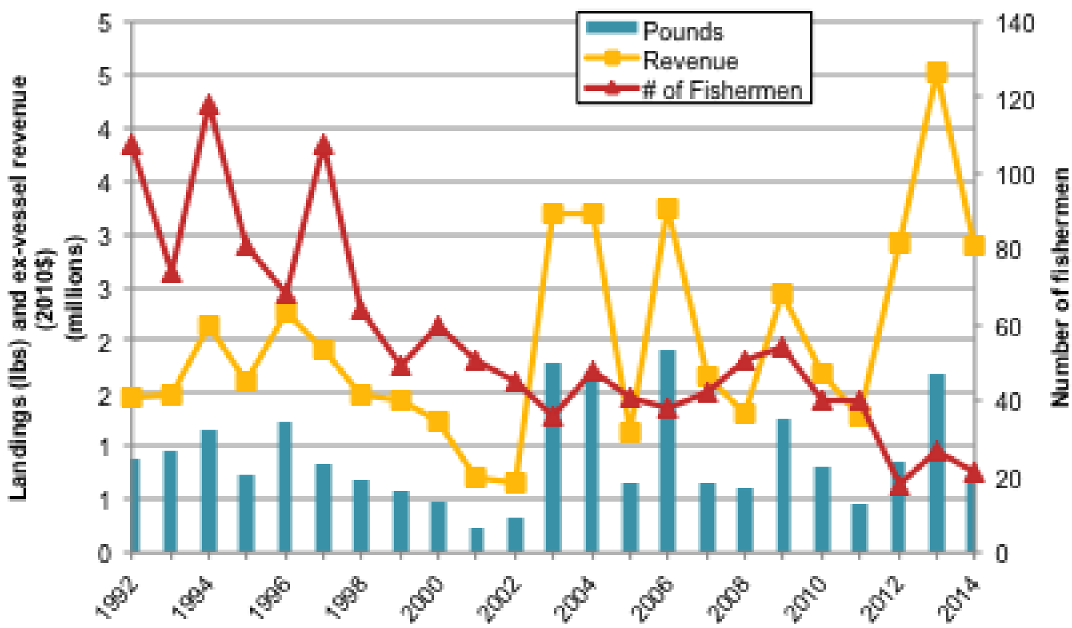
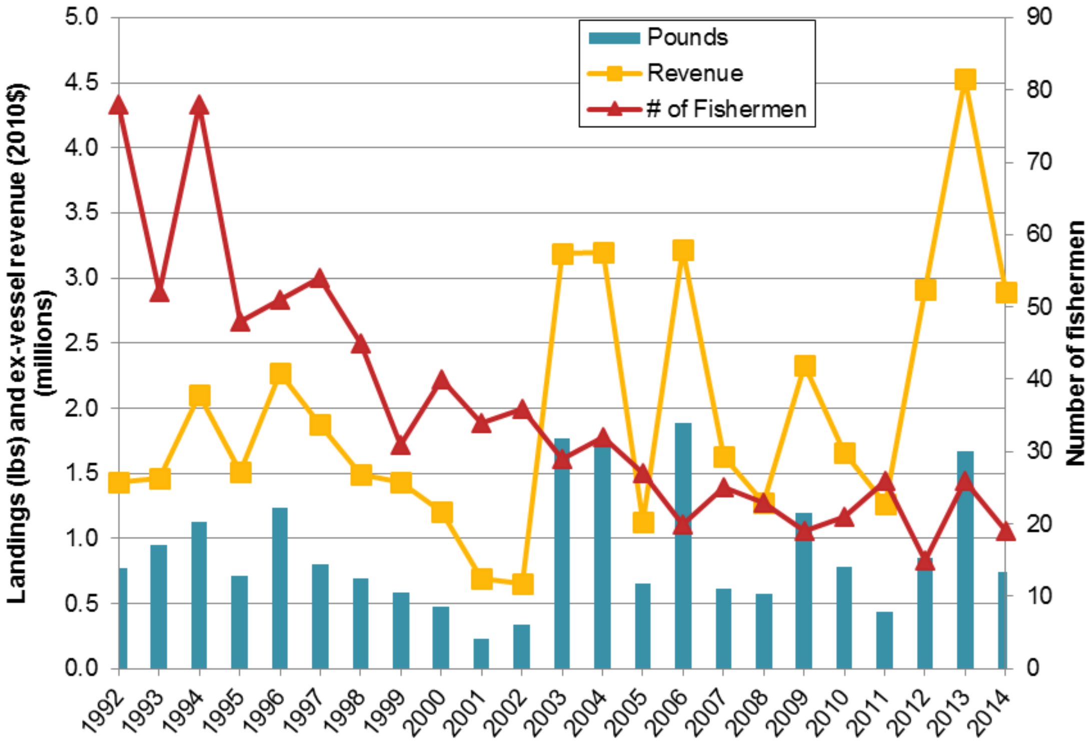
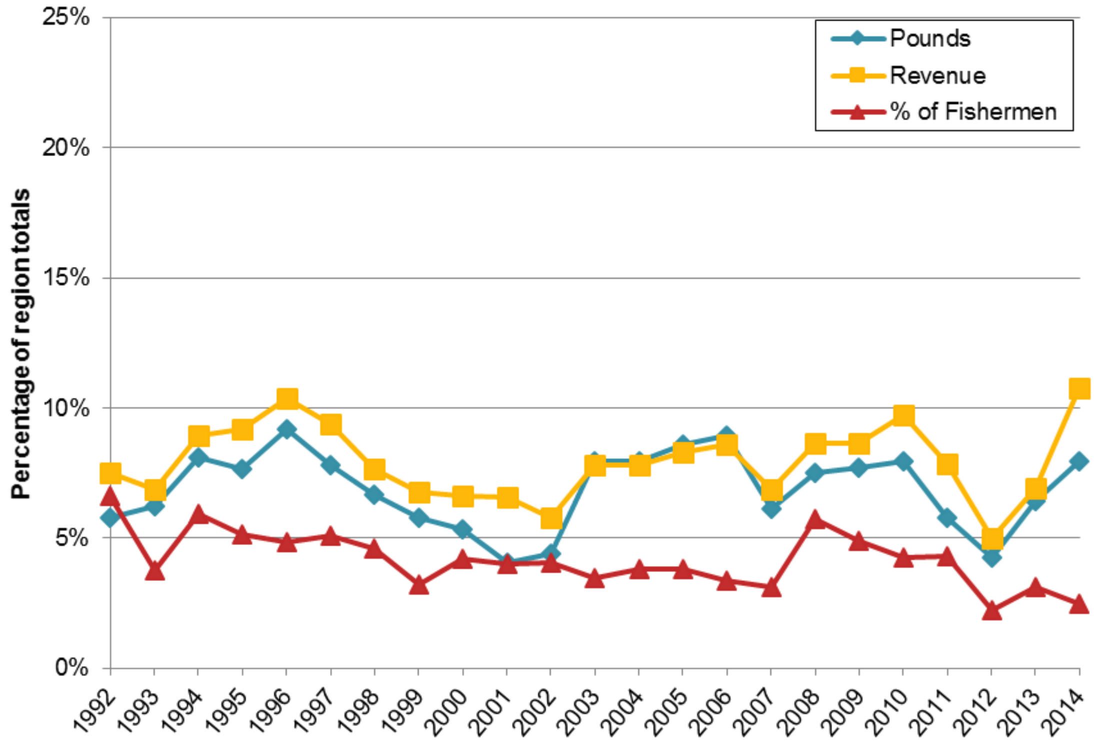


Figure 101. Commercial landings, ex-vessel revenues, and number of fishermen, Trinidad, 1992–2014, fisheries of interest



As one can see in Figure 102, Trinidad's annual ex-vessel revenue and landings were consistently between 5% and 10% of the total for the North Coast region. In contrast, Trinidad's regional share of active commercial fishermen declined from about 5% to about 2.5% over the course of the study period.

Figure 102. Fisheries of interest landings, revenue, and number of fishermen as a percentage of regional totals, Trinidad, 1992-2014



Dungeness crab-trap was overwhelmingly highest grossing fishery of interest (in terms of ex-vessel revenue) in Trinidad during the study period, as one can see in Figure 103 and Figure 104. In fact, 99% of the landings (20.6 million pounds) and 99% of the total ex-vessel revenue ($45 million) came from the Dungeness crab fishery in Trinidad over the entire study period.

The second-highest grossing fishery of interest in Trinidad was salmon-troll, with a total of 49,000 pounds and $182,000 over the course of the entire study period. The sharp year-to-year fluctuations in the Dungeness crab-trap fishery provides a clear indication for why all Trinidad fishermen scored multi-fishery participation as being important, with most noting its value in reducing inter-annual variation in fishing income.

Trends in the number of active commercial fishermen by fishery of interest for Trinidad are shown in Figure 105. As one would expect from the preceding diagrams, most Trinidad commercial fishermen target Dungeness crab.

Figure 103. Commercial landings for fisheries of interest, Trinidad, 1992-2014

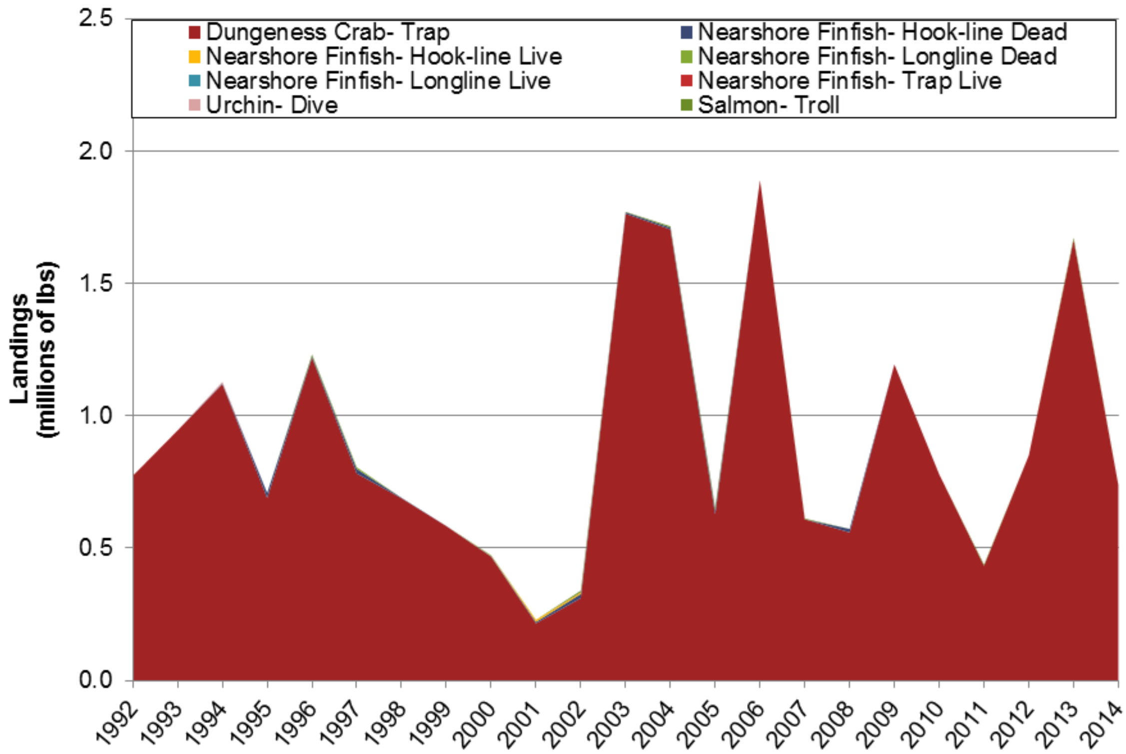


Figure 104. Ex-vessel revenue for fisheries of interest, Trinidad, 1992-2014

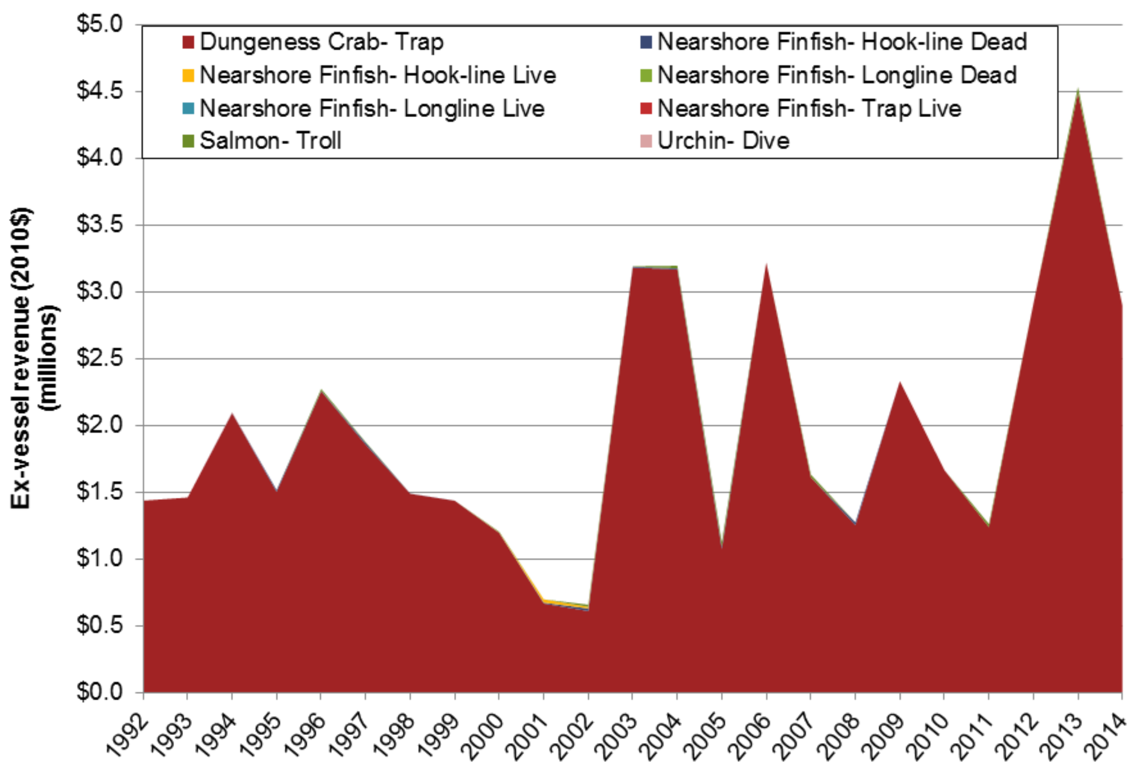
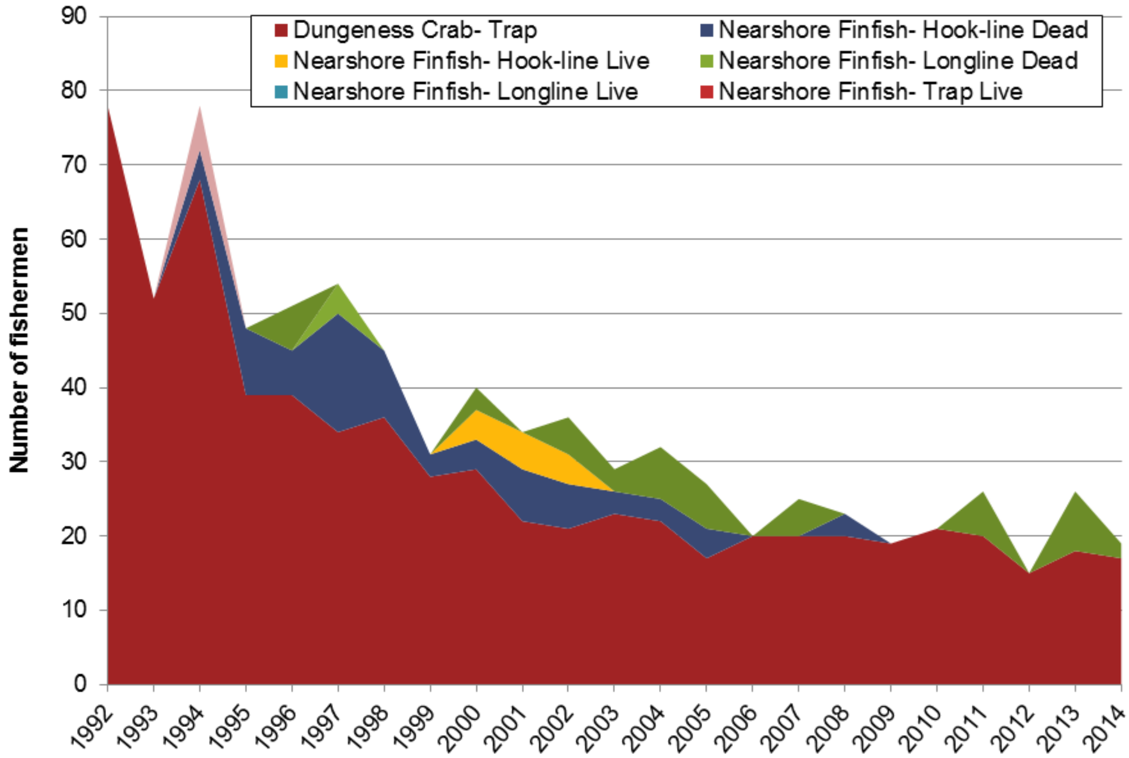
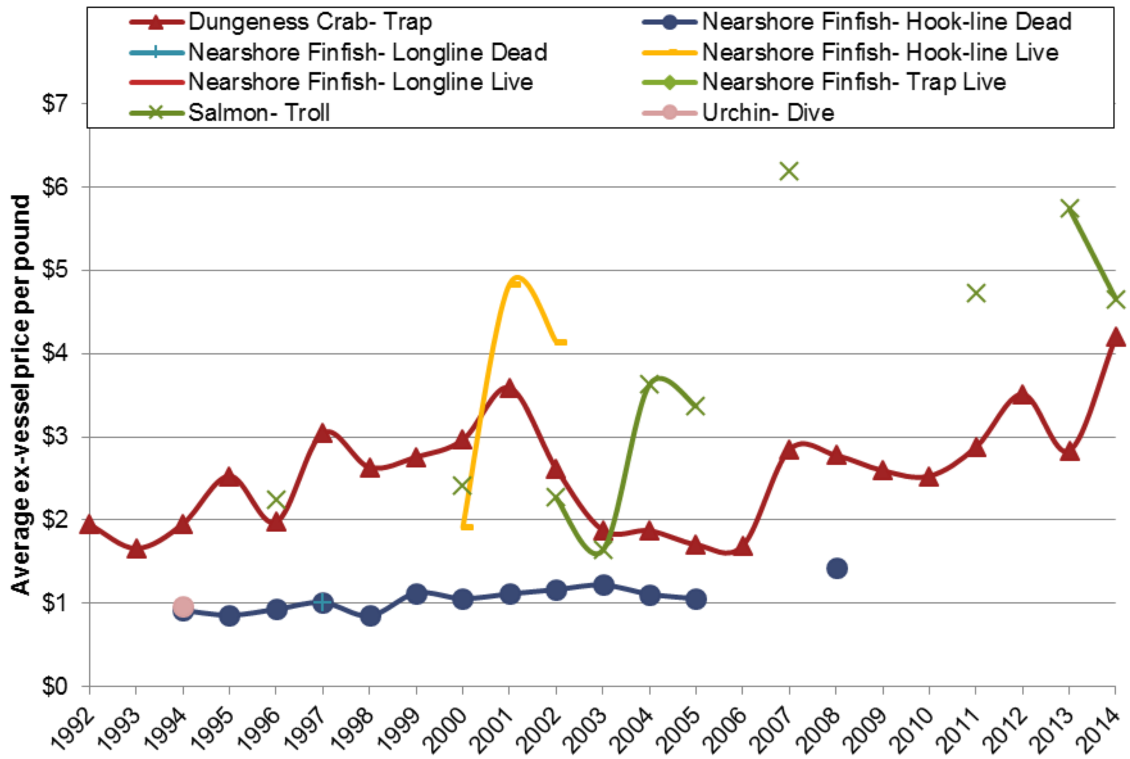


Figure 105. Number of fishermen for fisheries of interest, Trinidad, 1992-2014



We summarize average ex-vessel price over time for Trinidad in Figure 106. These trend data show generally rising Dungeness crab prices (in constant 2010 dollars), and sporadically strong prices for salmon and for nearshore finfish-hook-line live.

Figure 106. Average ex-vessel price over time, Trinidad, 1992-2014



Trend data for Trinidad's Dungeness crab-trap fishery is provided in Figure 107 and Figure 108. The first shows trends in number of active commercial fishermen, landings, and ex-vessel revenue, while the second shows average landings and ex-vessel revenue per fisherman. Most notable in these diagrams is the generally rising average annual ex-vessel revenue from fishing Dungeness crab, indicating the effects over time from spreading overall landings across the shrinking Trinidad commercial fleet.

Figure 107. Dungeness crab- trap: Average pounds, revenue, and number of fishermen, Trinidad, 1992-2014

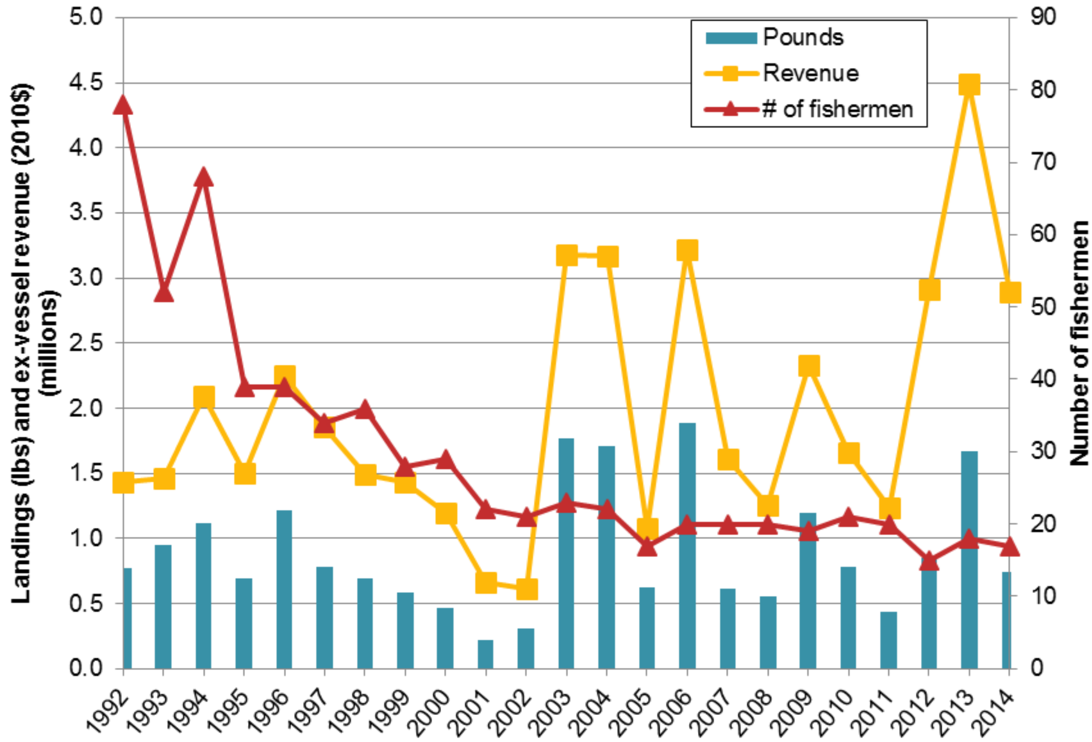
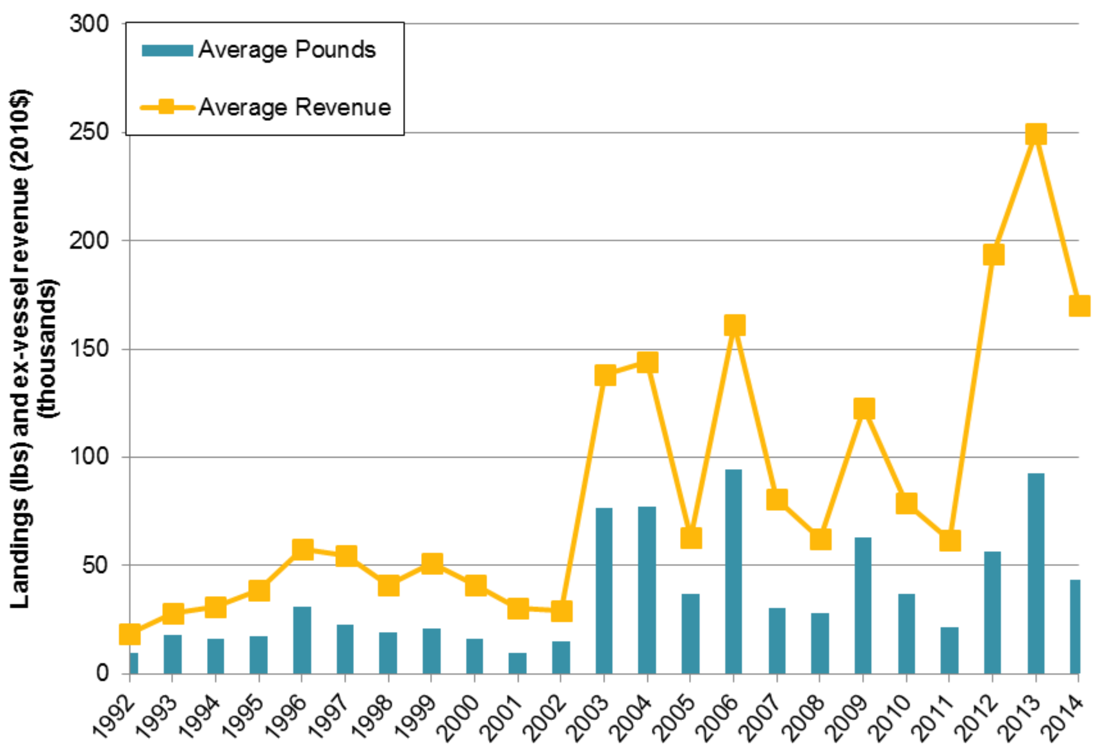


Figure 108. Dungeness crab- trap: Average pounds, revenue per fisherman, 1992-2014



10.3. Trinidad CPFV Baseline Characterization

As shown in Table 127, the average CPFV operator we interviewed in Trinidad was 41.0 years old, has 15.5 years of experience owning a CPFV vessel (if applicable), and 12.5 years of experience operating a CPFV vessel. On average, respondents reported that 55.8 percent of their income came from operating and/or owning a CPFV vessel.

Table 127. CPFV survey response statistics, 2013 fishing year, Trinidad

	Response	**Standard deviation**	**Number responding**
Individuals interviewed	4	--	--
Average age	41.0	17.0	4
Average number of years owning CPFV boat/s	15.5	12.0	2
Average number of years operating CPFV boat/s	12.5	9.3	4
Average percent income from CPFV operations in 2011	55.8%	30.3%	4

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

As shown below in Table 128, three of the four CPFV operators we interviewed in Trinidad indicated they had an additional source of income besides their CPFV operation: for all three of these operators, commercial Dungeness crab fishing provided that additional income.

Table 128. Sources of income in 2013 in additional to CPFV operation, Trinidad

Response	**Number responding**
Commercial crabbing	3
Total number responding (unique individuals)	**3**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

Summary information on average gross revenue (GR) earned by CPFV operators in Trinidad in 2013, and the average percentage of that revenue that was used to cover operating costs, is given in Table 129. The average CPFV owner/operator in Trinidad reported spending 5.3% of GR on fuel, 32.5% of GR on crew, and 20.0% on all other operating costs. On average 57.8% of GR earned by CPFV operators in Trinidad went to operating costs.

Table 129. Average gross revenue (GR) from CPFV to operating costs, Trinidad

	Number responding	Average response	Standard deviation
Total GR 2011	2	*	*
% GR to fuel	3	5.3%	0.6%
% GR to crew	4	32.5%	20.6%
% GR to all other operating costs	3	20.0%	5.0%

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

CPFV trip statistics for Trinidad in 2013 are provided in Table 130. All four respondents conducted consumptive fishing trips in 2013, and two of the four conducted non-consumptive trips. The average number of consumptive trips taken by CPFV operators in 2013 was 141.3; the price per person of the average consumptive trip out of Trinidad was $104, and had on average 8.3 passengers and 0.3 crew on board. As fewer than three CPFV operators provided information on non-consumptive trips, we suppressed comparison data to preserve confidentiality.

Table 130. CPFV trip statistics, 2013, Trinidad

	Consumptive trips			Non consumptive trips		
	Number responding	Response	Standard deviation	Number responding	Response	Standard deviation
Number of people reporting trips	4	--	--	2	--	--
Average number of trips	4	141.3	37.5	2	*	*
Average number of passengers (per trip)	4	8.3	2.6	2	*	*
Average price per passengers (per trip)	4	$104	$5	1	*	--
Average number of crew (per trip)	4	0.3	0.5	1	*	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 131 we summarize changes in the number of CPFV trips taken out of Trinidad between 2009 and 2013. All respondents reported either 'Somewhat higher' or 'No change' in the numbers of trips. For the rockfish/lingcod and salmon fisheries, 33.3% of respondents indicated 'Somewhat higher' numbers of trips, and 66.7% of respondents indicated 'No change'.

Table 131. Changes in the number of CPFV trips, 2009-2013, Trinidad

	Fishery/Activity	Number responding	Somewhat higher	No Change
Fishery	Dungeness Crab	2	*	*
	Pacific Halibut	1	--	*
	Rockfish/Lingcod	3	33.3%	66.7%
	Salmon	3	33.3%	66.7%
Activity	Whale Watching	1	*	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

For each fishery and non-consumptive activity targeted in 2010, Trinidad CPFV fishermen were asked how many days per year they spent targeting that fishery/activity and what share of their GR they received from that fishery/activity. Responses are summarized below in Table 132. Rockfish/lingcod was targeted the most days per year on average (78.8), and generated the largest average share of total GR (57.0%), across all fisheries in Trinidad in 2013.

Table 132. Number of days and percentage of GR targeting CPFV fishery/activity, 2013, Trinidad

			Number of days targeting species (2013)			Share of GR from fishery/activity (2013)		
	Fishery/activity	**Number interviewed**	**Number responding**	**Average**	**Standard deviation**	**Number responding**	**Average**	**Standard deviation**
Fishery	Dungeness crab	3	3	53.3	20.8	3	32.0%	2.8%
	Rockfish/lingcod	4	4	78.8	27.8	4	57.0%	31.2%
	Salmon	4	4	47.5	30.1	4	24.5%	13.7%
Activity	Whale watching	1	1	--	--	1	--	--
All target fisheries (unique individuals)		**4**	**4**	**51.8**	**33.5**	**4**	**33.3%**	**26.4%**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

Respondent's views of the direct effects of MPAs on specific CPFV fisheries in Trinidad in 2013 are summarized in Table 133. The rockfish/lingcod fishery was the only one reported as being affected by MPAs, with 50% of respondents from that fishery indicating that MPAs had affected their fishing. Of the specific effects reported, the most commonly cited effect was answer A, 'Cannot fish in or go to traditional ground/areas', which was cited by 50% of all respondents. No other fisheries reported being affected by MPAs, nor cited any specific effects.

Table 133. Direct effects of MPAs on specific CPFV fisheries, 2013, Trinidad

	Fishery/Activity	Number of respondents	Have MPAs impacted your fishing?	A	B	C	D	E
Fishery	Dungeness crab	3	--	--	--	--	--	--
	Rockfish/lingcod	4	50%	50%	--	--	25%	25%
	Pacific halibut	2	--	--	--	--	--	--
	Salmon	4	--	--	--	--	--	--
Activity	Whale watching	1	--	--	--	--	--	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In Table 134 below we indicate which MPAs affected each fishery in Trinidad in 2013 according to our respondents. Two MPAs affected the rockfish/lingcod fishery, and no other specific MPAs were mentioned as affecting any other fisheries. These MPAs were Reading Rock SMR (answer L, with 2 responses), and Reading Rock SMCA (answer AA, with 1 response).

Table 134. Which MPAs have affected specific CPFV fisheries, 2013, Trinidad

	Fishery	L	AA
Fishery	Dungeness crab	--	--
	Rockfish/lingcod	2	1
	Salmon	--	--
	Whale watching	--	--
All target fisheries (unique individuals)		**2**	**1**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point
** indicates data were collected but cannot be shown due to confidentiality constraints*

A	South Humboldt Bay SMRMA	**O**	Ten Mile Beach SMCA
B	Ten Mile SMR	**P**	Sea Lion Gulch SMR
C	Klamath Rock Special Closure	**Q**	Vizcaino Rock Special Closure
D	Point Cabrillo SMR	**R**	Sugarloaf Island Special Closure
E	Steamboat Rock Special Closure	**S**	Russian Gulch SMCA
F	Van Damme SMCA	**T**	Southwest Seal Rock Special Closure
G	Big Flat SMCA	**U**	South Cape Mendocino SMR
H	Point St. George Reef Offshore SMCA	**V**	Double Cone Rock SMCA
I	Mattole Canyon SMR	**W**	Samoa SMCA
J	Navarro River Estuary SMCA	**X**	Castle Rock Special Closure
K	MacKerricher SMCA	**Y**	Big River Estuary SMCA
L	Reading Rock SMR	**Z**	Rockport Rocks Special Closure
M	Other	**AA**	Reading Rock SMCA
N	Pyramid Point SMCA	**AB**	Ten Mile Estuary SMCA

Trinidad respondent's views of their success in CPFV fishing compared to the last ten years are summarized in Table 135. 33% of Rockfish/lingcod fishermen and 66.7% of salmon fishermen indicated that success in CPFV fishing in their fishery was 'Somewhat better' than in previous years; 66.7% of rockfish/lingcod fishermen and 33.3% of salmon fishermen indicated that CPFV fishing in their fishery was 'The same' compared to previous years.

Table 135. Perceived success in CPFV fishery/activity in 2013 compared to last ten years, Trinidad

	Fishery	Number responding	Did not participate in previous seasons	Somewhat better	The same	Significantly worse
Fishery	Dungeness crab	3	--	--	--	*
	Pacific halibut	2	*	--	--	--
	Rockfish/lingcod	4	--	33.3%	66.7%	--
	Salmon	4	--	66.7%	33.3%	--
Activity	Whale watching	1	--	--	--	--

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

10.4. Trinidad CPFV Initial Changes

Changes in the share of income respondents received from CPFV operations between 2009 and 2013 are shown in Table 136. Three-quarters (75%) of all respondents reported a 'Significantly higher' share of their income from CPFV operations in 2013 as compared to 2009. One-quarter of respondents reported 'Somewhat lower' percentage of income from CPFV operations across the five-year timespan.

Table 136. Change in share of overall income from CPFV operations, 2009-2013, Trinidad

			Percent response	
	Fishery/activity	Number responding	Significantly higher	Somewhat lower
Fishery	Dungeness Crab	3	66.7%	33.3%
	Pacific Halibut	2	*	--
	Rockfish/Lingcod	4	75.0%	25.0%
	Salmon	4	75.0%	25.0%
Activity	Whale Watching	1	--	*
All activities (unique individuals)		**4**	**75.0%**	**25.0%**

Source: Current study.

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

In addition to indicating a perceived change, Trinidad CPFV respondents were asked what factors they saw as having contributed to the change in the percentage of their income coming from CPFV operations. This question was asked as an open-ended question. Responses are summarized in Table 137. The only cited answer was "Other". There were no write-in responses to this question.

Table 137. Factors causing changes in share of overall income from CPFV operations, 2009-2013, Trinidad

Response	Number responding
Changes in the market/economy	--
Changes in fish abundance/presence	--
Changes in regulations	--
Personal reasons	--
Other	2
Total number responding (unique individuals)	**2**

Source: Current Study

— indicates that the port/fishery was not sampled or a zero value data point

** indicates data were collected but cannot be shown due to confidentiality constraints*

On average annually over 1992-2014, there were 7,316 anglers taking a total of 1,276 trips serviced by 5 vessels, each making an average of 241 trips annually and carrying 6 anglers per trip out of Trinidad. Note that we had to exclude reporting data from 1994-2000 in order to preserve confidentiality.

From Figure 109 one can see the steady rise in the total number of CPFV vessels, and average number of trips per vessel, over the portion of the study period for which we can report data. Congruent with these data is the steady rise in the total number of CPFV trips out of Trinidad over the study period, as shown in Figure 110. Unlike in some other North Coast regional fishing ports, the average annual number of anglers per CPFV vessel also generally increased over the study period, as shown in Figure 111.

Figure 109. Total number of CPFV vessels and average number of trips per vessel, 1992-2014

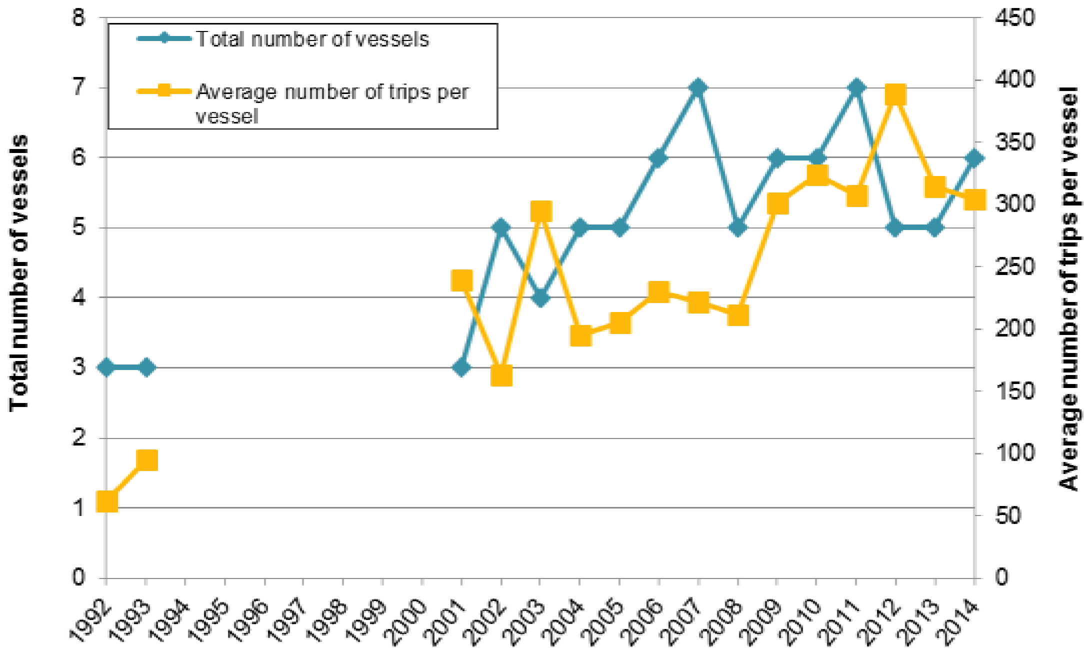


Figure 110. Total number of CPFV trips and average number of anglers per trip, 1992-2014

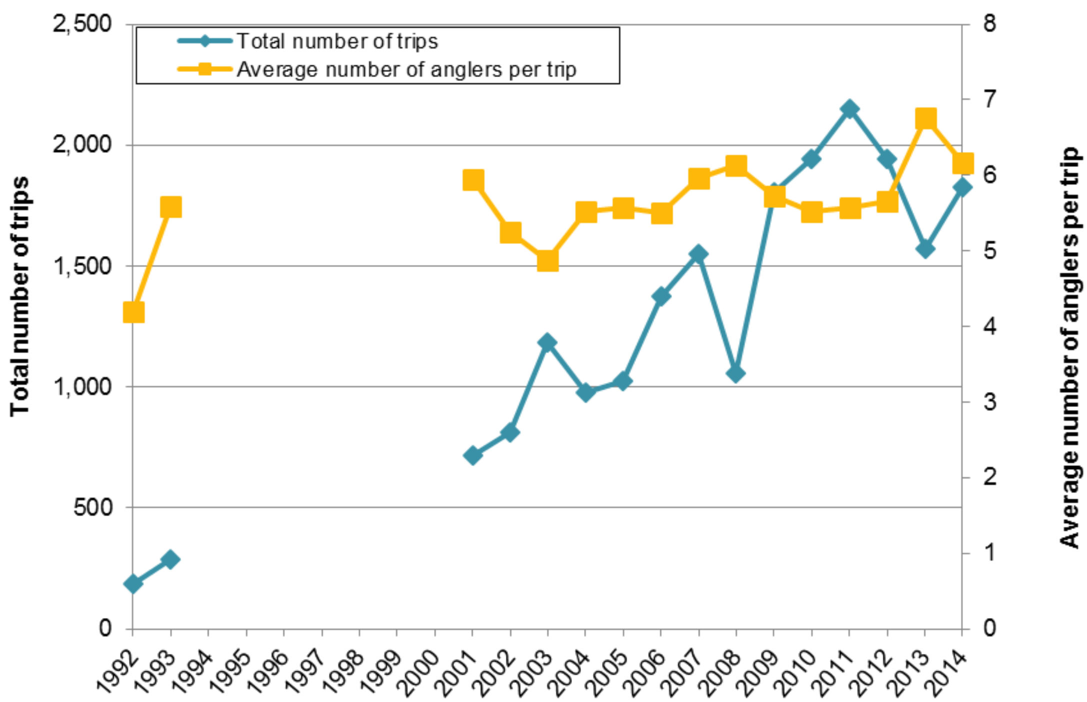
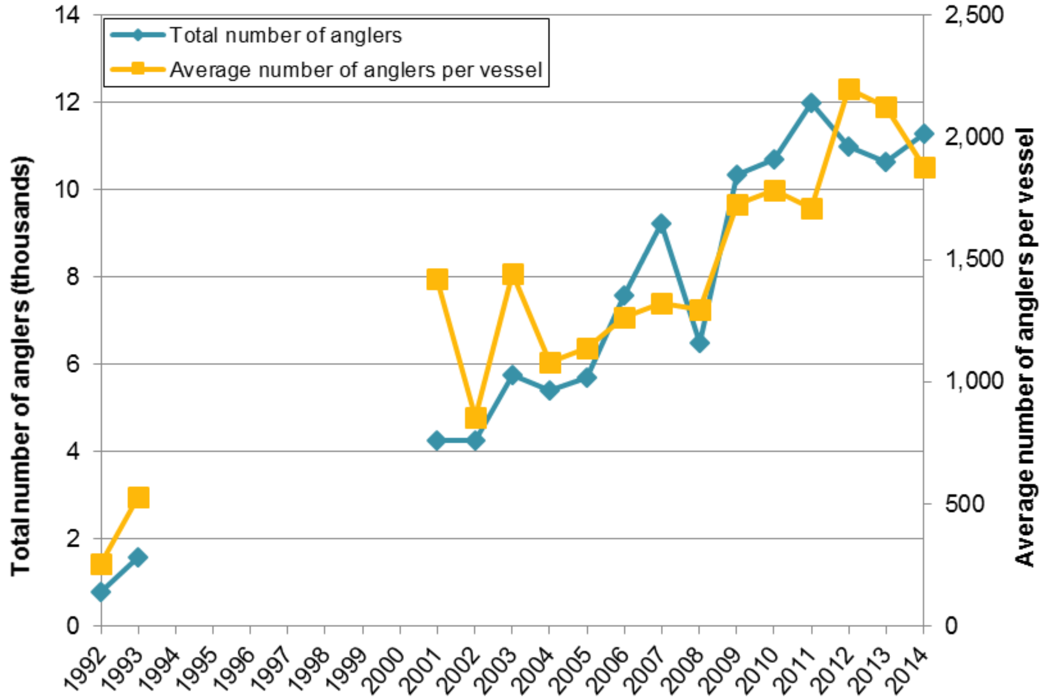


Figure 111. Total number of CPFV anglers and average number of anglers per vessel, 1992-2014



The Rockfish group made up the great majority of the fish caught on CPFV vessels out of Trinidad during the study period (Figure 112). Dungeness crab was the second-most caught species caught, while lingcod, salmon and albacore tuna combined made up less than 5% of the total fish caught. From

Figure 113 one can see that rockfish, lingcod, and salmon were the top-targeted species on Trinidad CPFV trips during the study period.

Figure 112. CPFV total number of fish caught for each fishery, 1992-2014

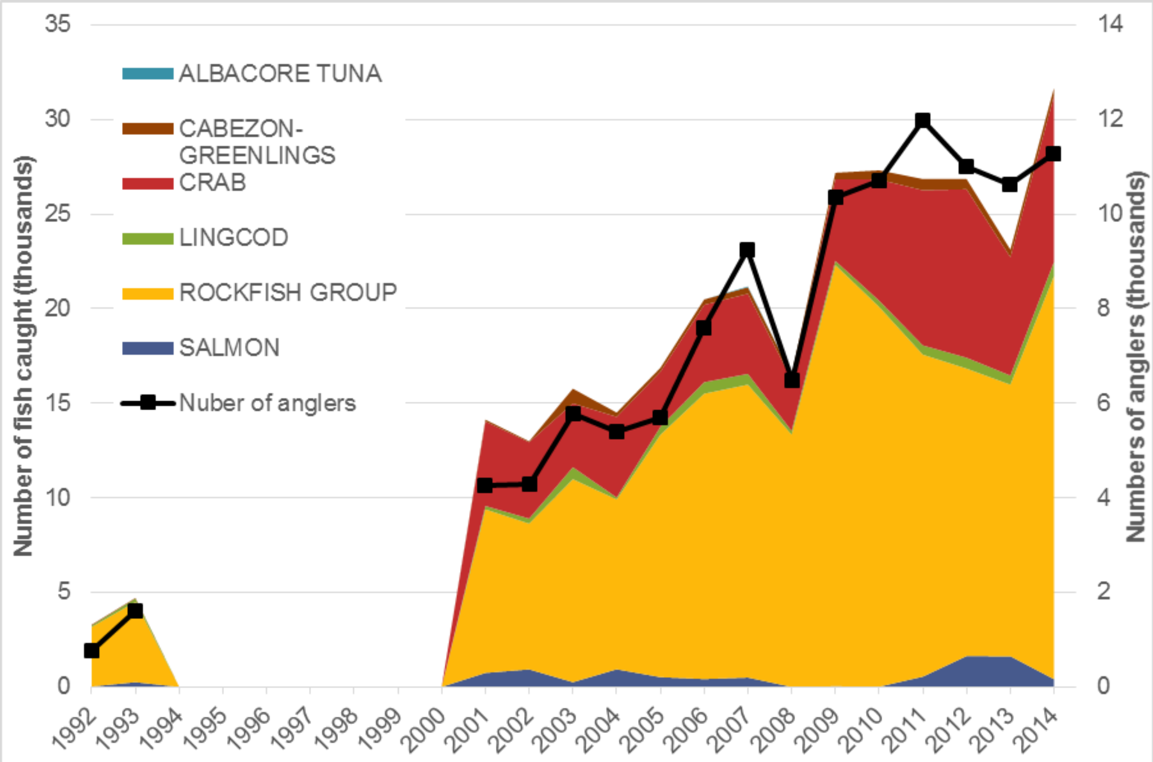
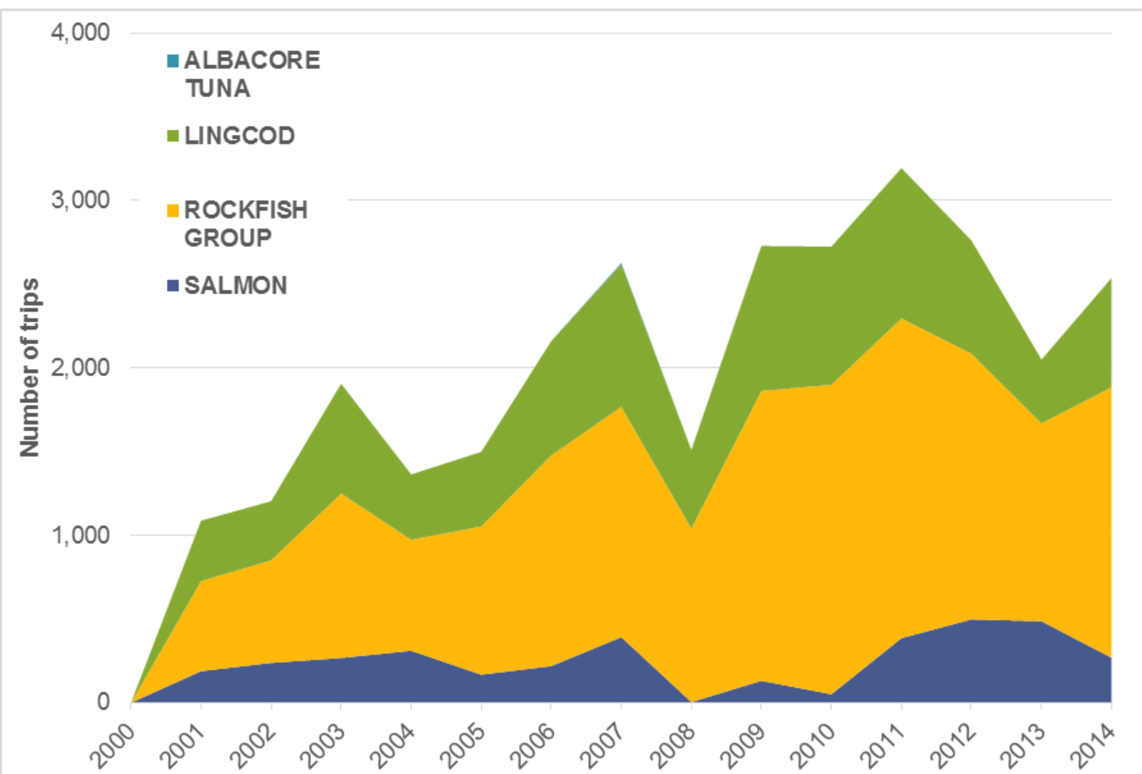


Figure 113. Total number of CPFV trips for each target fishery, 2000-2014 *no data from 1992-2000



11. NORTH COAST FISHERIES SPATIAL BASELINE AND INITIAL CHANGES

11.1. Commercial Fishing Spatial Baseline and Initial Changes

In this section, we describe the available data and maps that depict the spatial fishing patterns for specific commercial fisheries at the port and region level. There are two sets of map products for commercial fisheries:

- Map products depicting the post MPA (2013) spatial fishing patterns and
- Map products depicting the change in spatial fishing patterns between pre MPA (2000-2009) and post MPA (2013) periods.

The full detailed methodology of how post MPA data were collected, analyzed, and reviewed can be found in the methods section of this report and the full methodology of how the pre MPA spatial data were collected can be found in Scholz et al. (2011).

In Table 138 below we list the map products that are available as a part of this report. If a specific fishery at either the port or region level is listed both a post-MPA map and spatial change (between pre and post MPA) map is available. This table of maps also includes information as to the number of fishermen interviewed whom contributed to pre and post MPA datasets and maps and the share of ex-vessel revenue they represent.

Please note, the number of fishermen who participated in the mapping portion of the interview may in some cases differ from the number of fishermen who participated in the non-spatial portion of the survey/interview as some fishermen opted to not provide fishing ground information. Only maps with 3 or more fishermen are available for use due to confidentiality protocols as indicated in the table below. All maps products can be found in the separate Map Appendix that complements this report.

11.1.1. Spatial Change in Commercial Fishing Patterns

In our map products we examine change in the spatial extent and relative value of commercial fishing areas for the North Coast region. To do this we utilized a pre-MPA spatial fishing dataset collected from commercial fishermen interviews in 2009 as part of the MLPA planning process. The pre-MPA dataset was collected by asking fishermen to map and value their fishing grounds based on their cumulative fishing experience and these individual data were then weighted using an average yearly gross revenue from 2000 to 2009.

This pre-MPA data collection approach differs slightly from the method in which the post-MPA data set was collected. In particular, for the post-MPA period fishermen were asked to map his/her post-MPA fishing grounds for the year 2013, and ex-vessel revenue from the year 2013 was used to weight the data. Despite these differences in data collection methods, the two data sets are generally representative of pre and post MPA period fishing grounds and their relative stated value.

This analysis utilized the raster math functions in ArcGIS to calculate the difference between the pre-MPA and post-MPA data. To conduct this analysis, we utilized a snap grid, which is a raster layer that provides the overarching spatial extent and a common structure to build our raster layer products. The snap grid gave us the structure to perform a cell by cell (100-meter square cell size) comparison.

Each dataset was also analyzed as a relative dataset in which each data set was standardized to a 0 to 1 index, which supplied a common index of values allowing us to make direct comparisons between the raster layers. Below these series of maps illustrate the location in which fishing grounds have increased or decreased in relative value between the two survey efforts.

It is important to emphasize that these are maps depicting the spatial change in relative value, not ex-vessel revenue. Only relative value surfaces (also known as a 'heat map') developed for the pre and post-MPA datasets were used in this analysis. Ex-vessel revenue was not applied to the 'heat map' value surfaces, though ex-vessel revenue was used to weight the aggregation of individual fishing grounds. We chose to utilize a relative value surface because spatial change in ex-vessel revenue levels may not yield useful information, especially when considering the large magnitudes of normal inter-annual variation in ex-vessel revenue that could overwhelm any analysis depicting spatial change in ex-vessel revenue levels.

Consequently, the results below are simply an examination of changes in the relative values/importance of fishing grounds provided by respondents by fishery—not spatial changes in ex-vessel revenue levels across the two datasets. For example, an area that depicts an increase in relative value does not directly translate to an increase in revenue derived from that area. The interpretation should be that the area has increased in relative value across pre and post MPA periods.

In general, the spatial change maps developed for this report provide indications of shifts or displacement in fishing effort – this can be observed particularly in areas designated as no-take MPAs. Due to the year-to-year variability in spatial fishing patterns, it is difficult to conclude with precision the locations to which fishing effort was shifted. Nonetheless, our spatial change analysis generally serves as an indicator of changes in pre and post MPA fishing patterns, acknowledging that these spatial fishing patterns are also influenced by a multitude of non-MPA factors including ocean conditions, patterns of abundance, and market conditions.

As is the case with all analyses, an unbiased and representative sample size across both pre and post data sets would improve the robustness of results and foster more rigorous analysis of emerging trends. In Table 138 we list the region-fishery and port-fishery combinations for which we were able to conduct a spatial change analysis. Furthermore, we provide the number of fishermen interviewed in each spatial data set in pre and post MPA periods, as well as the share of total ex-vessel revenue represented, to help facilitate interpretation of the representativeness and reliability of spatial change analysis results.

We would like to note that the spatial fishing data sets from collected in 2009 are not available to the public and thus are not provided here in this report. As a part of the nondisclosure agreement for collecting these datasets as part of the MLPA planning process, the resulting maps were only approved for use by the Regional Stakeholder Group, and have not subsequently been approved for any public release.

Table 138. Listing of map products available with associated information on the number of fishermen and share of revenue presented in the maps

Fishery	Port	Post MPA				Pre MPA			
		Total 2014 Revenue ($2010)	% Revenue Represented in Map	Total # of Fishermen in Landings	# of Fishermen Represented in Map	Annual Average Revenue 2000-2009 ($2010)	% Revenue Represented in Map	Total # of Fishermen in Landings	# of Fishermen Represented in Map
Dungness crab - trap	Crescent City	$28,901,074	36%	126	40	$10,840,226	45%	306	61
	Eureka	$18,500,287	33%	110	41	$5,324,552	68%	164	79
	Fort Bragg	$2,187,892	39%	44	14	$1,071,037	69%	97	45
	Shelter Cove	$182,162	81%	6	5	$35,787	91%	6	2
	Trinidad	$4,488,202	49%	18	8	$1,827,733	80%	38	18
	Region	**$54,334,969**	**36%**	**290**	**103**	**$19,208,381**	**56%**	**558**	**140**
Nearshore finfish - dead - hook & line	Shelter Cove	$13,605	89%	5	3	$8,430	97%	7	5
	Region	**$38,078**	**46%**	**16**	**6**	**$86,832**	**74%**	**161**	**41**
Nearshore finfish - live - hook & line	Crescent City	$97,772	86%	8	5	$257,713	70%	74	16
	Fort Bragg	$43,485	42%	8	3	$112,592	50%	67	14
	Region	**$147,473**	**69%**	**22**	**8**	**$403,504**	**61%**	**173**	**39**
Nearshore finfish - live - longline	**Region**	**$15,448**	**95%**	**6**	**3**	**$110,867**	**68%**	**59**	**22**
Salmon - troll	Eureka	$967,300	35%	68	20	$167,665	64%	110	53
	Fort Bragg	$7,029,876	22%	262	42	$2,757,489	29%	479	63
	Shelter Cove	$280,156	62%	16	6	$64,615	71%	14	13
	Region	**$8,488,648**	**25%**	**325**	**55**	**$3,264,862**	**33%**	**555**	**85**
Urchin - dive	Albion	$726,659	38%	18	5	$316,747	74%	49	28
	Fort Bragg	$1,990,350	47%	24	10	$1,045,017	63%	108	29
	Region	**$2,735,378**	**44%**	**39**	**14**	**$1,376,187**	**65%**	**139**	**34**

11.2. CPFV Spatial Baseline

In this section we summarize the available data and maps that depict the spatial fishing patterns for specific commercial fisheries at the port and region level.

In Table 139 below we list the post MPA (2013) period map products that are available for the CPFV sector. We did not provide spatial change maps for the CPFV sector due to direct feedback from our Fisherman Advisory Council. Due to the differences in the number of CPFV operators interviewed in pre and post MPA periods the spatial change maps provided misleading and erroneous results. Therefore, we do not include these maps in our final deliverables.

Please note, the number of CPFV operators who participated in the mapping portion of the interview may differ from the number of operators who participated in the non-spatial portion of the survey/interview, as some fishermen opted to not provide fishing ground information. Only maps with three or more CPFV operators are available for use due to confidentiality protocols as indicated in the table below. All maps products can be found in the separate Map Appendix that complements this report.

Table 139. Listing of map products available and the number of CPFV operators represented in each map

Fishery	Port	Post MPA (2013) # of CPFV Operators in Map
Dungeness crab	**Region**	**7**
Pacific halibut	Eureka	4
	Region	**7**
Rockfish/lingcod	Eureka	3
	Fort Bragg	4
	Region	**11**
Salmon	Eureka	4
	Fort Bragg	4
	Region	**12**

12. PERCEPTIONS OF ECOLOGY AND MANAGEMENT

Scholars and resource managers alike are increasingly recognizing the importance of social perceptions data as an input to environmental management in general (Bennett 2016), and to management of MPAs specifically (Christie 2005; Leleu et al. 2003; Pita et al. 2010; Bennett & Dreaden 2016; McClanahan et al. 2002). Bennett (2016) states that, “Studies of the perceptions of local people can provide important insights into observations, understandings and interpretations of the social impacts, and ecological outcomes of conservation; the legitimacy of conservation governance; and the social acceptability of environmental management” (p. 582).

In the context of MPAs, perceptions data can provide local ecological knowledge to contribute to management discussions and can help to inform outreach strategies, the design of governance structures, and the development of regulations in MPAs in order to best position them for success.

Near the end of the survey used to generate primary data for this report, we asked commercial and CPFV fishermen a series of questions related to their perceptions of the ecology and management of nearshore marine resources -- particularly as they relate to MPAs and targeted fisheries of interest. From results presented in earlier sections of this report, recall that commercial respondents had on average 28 years of experience, and CPFV fishermen had on average about 10 years of experience. Through this direct long-term experience interacting with local marine resources, fishermen have developed knowledge that may offer a useful contribution to regional resource management and public policy.

Survey questions about fishermen’s perceptions of the ecology of marine resources provided a means to collect this local ecological knowledge in a format that could be communicated to mangers and the broader public. The survey also included questions about fishermen’s perceptions of the management and implementation of the MPA network, as well as questions about marine management broadly.

Survey questions addressed perceptions of the MPA planning process, including the extent to which planners included local fishing occupational community input. We also asked fishermen about the perceived level of conflict in the MPA planning process, their level of trust in marine management agencies, and their access to information about management and regulations. This data provides a baseline about fishermen’s perceptions of MPAs and local marine management that can be used to help design better outreach strategies and that can be measured in the future to assess possible change over time.

For this section, the responses from commercial (n = 163) and CPFV (n = 15) respondents were combined for a total sample size of 178. Due to time constraints, the voluntary nature of participation, and other concerns, not all respondents answered all of these questions. Moreover, some answered the questions but then indicated they lacked enough information to do so. Self-reported uninformed responses are not reported. In addition, we asked resource specific questions only to fishermen who targeted those species. Consequently, the sample size for each question is listed next to the question or in the written text related to a given question.

12.1. Perceptions of Management and the MPA Planning Process

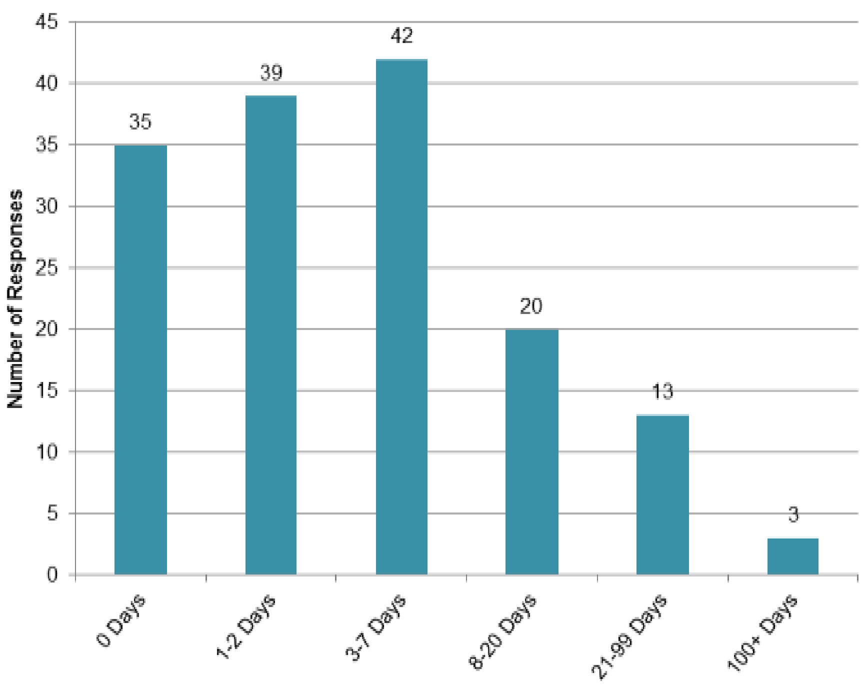
Question 1: *Overall approximately how much time did you spend (days) on involvement in the MPA process? N = 152*

Across all respondents the mean number of days involved in the MLPA planning process was 13.6 days with a standard deviation of 51.87 days. The large standard deviation indicated some significant outliers, and so the frequency was also run excluding any outliers with more than 100 days of involvement (n=3). The adjusted mean for days of involvement per respondent was 6.86 days with a standard deviation of 12.35 days.

As one can see in Figure 114, only 35 respondents indicated that they did not spend any full days participating in the process. Of those who did participate, a total of 81 spent between 1 and 7 days of their time involved in the process. 36 spent more than 7 days in the process, and a few outliers, presumably port or community representatives, spent more than 100 days on the MPA process.

As this question was not asked in the socioeconomic assessment of the other three MPA network regions in California, results cannot be compared to reveal whether these means are relatively high or low for involvement.

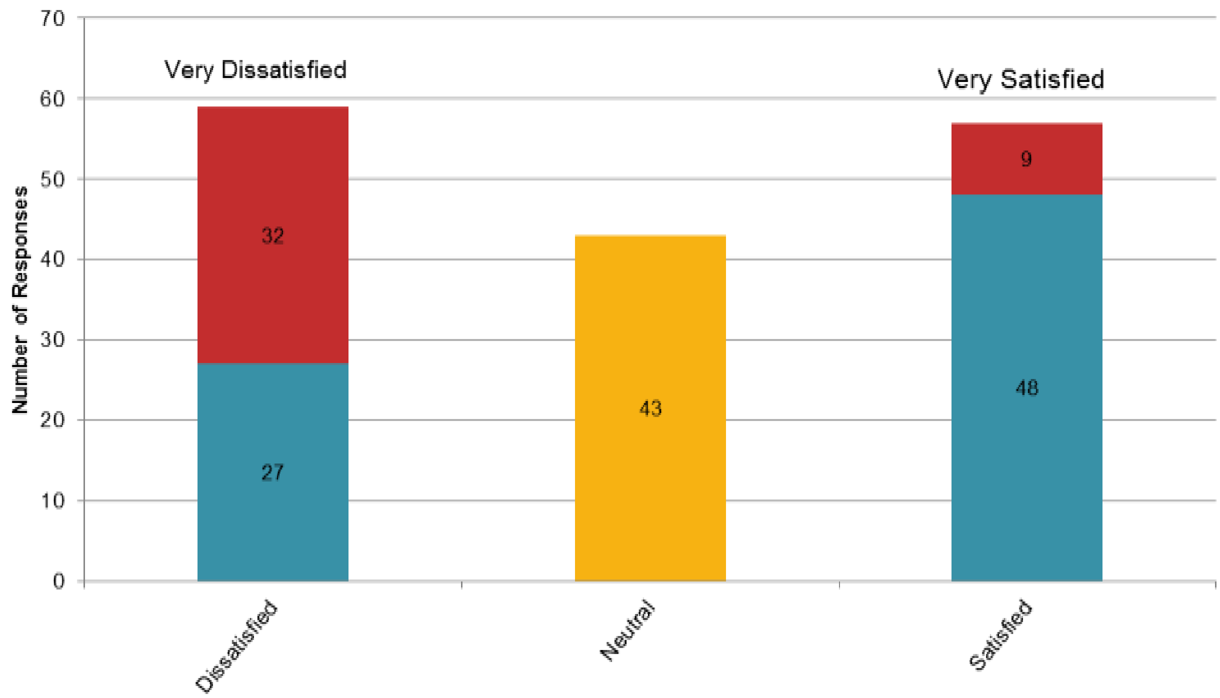
Figure 114. Days of involvement in the MPA process



Question 2: *How satisfied were you with the inclusion of local input in the North Coast MPA planning process? N = 159*

Respondents indicated a wide range of satisfaction with the level of local input to the North Coast MPA planning process (Figure 115). A total of 43 respondents were neutral on the level of input, and 57 were satisfied overall. It can be seen, however, that of those generally satisfied only nine individuals were strongly satisfied. Overall, 59 respondents expressed some level of dissatisfaction, with more than half of those expressing strong dissatisfaction.

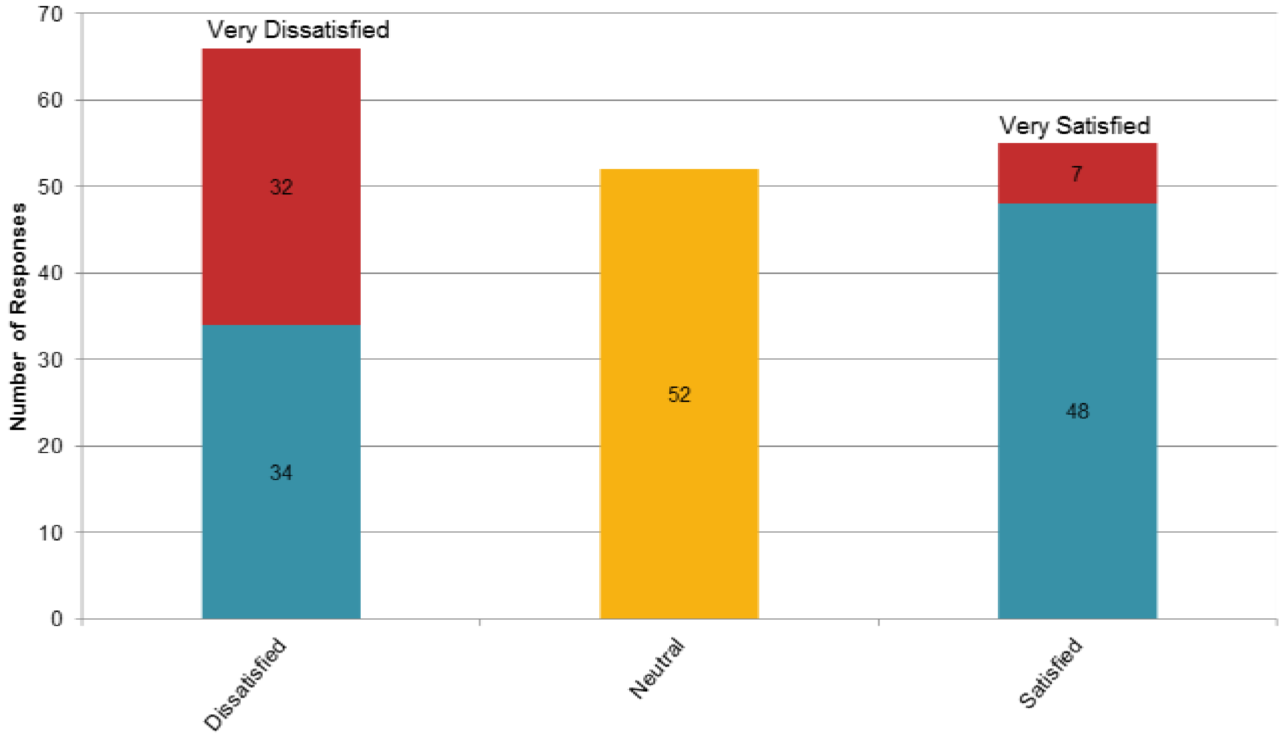
Figure 115. Respondent satisfaction with local input to the North Coast MPA planning process



Question 3: *How satisfied are you with the location of the North Coast MPA network? N = 173*

Respondents fell into roughly equal-sized groups, with 55 indicating overall satisfaction, 66 dissatisfaction, and 52 having a neutral perspective, as shown in Figure 116. Of those dissatisfied, roughly half were strongly dissatisfied, whereas of those satisfied, only seven individuals were strongly satisfied.

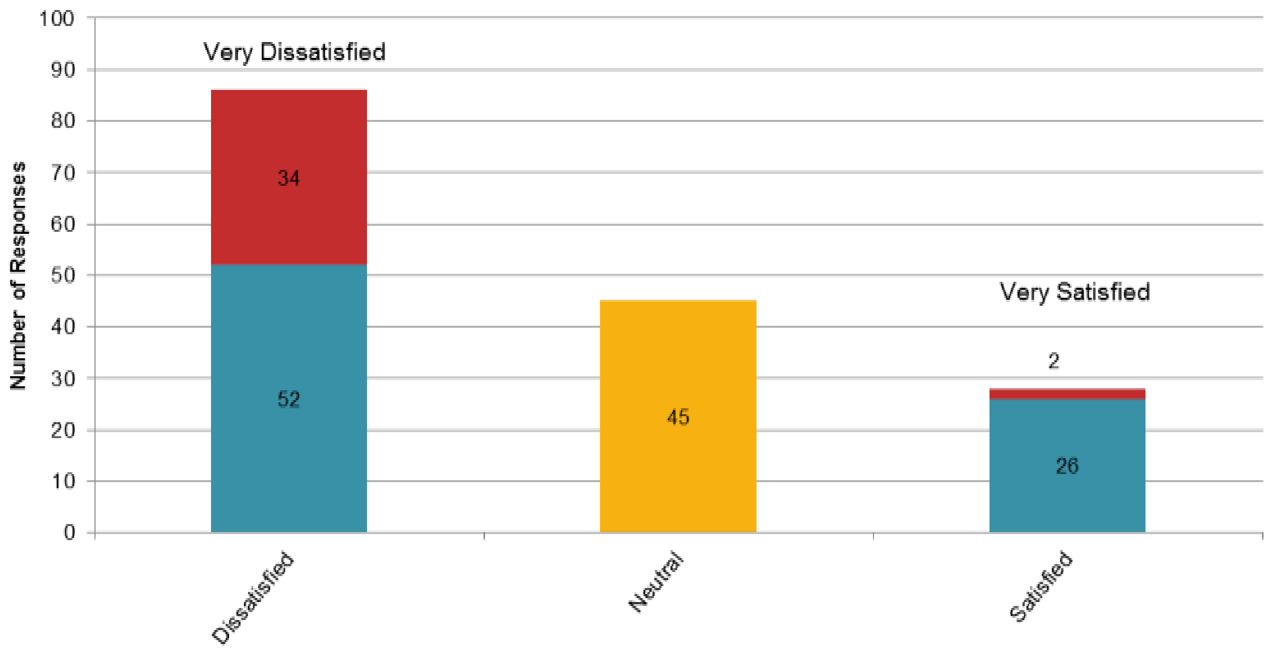
Figure 116. Respondent satisfaction with location of North Coast MPAs



Question 4: *How satisfied are you with the overall North Coast MPA planning process? N = 159*

Results summarized in Figure 117 indicate that respondent's overall level of satisfaction with the MPA planning process was low, with only 28 individuals responding they were satisfied. Of those, only two indicated they were strongly satisfied. Those dissatisfied with the process were the largest category, made up of 86 total respondents. Of these, 34 responded they were strongly dissatisfied.

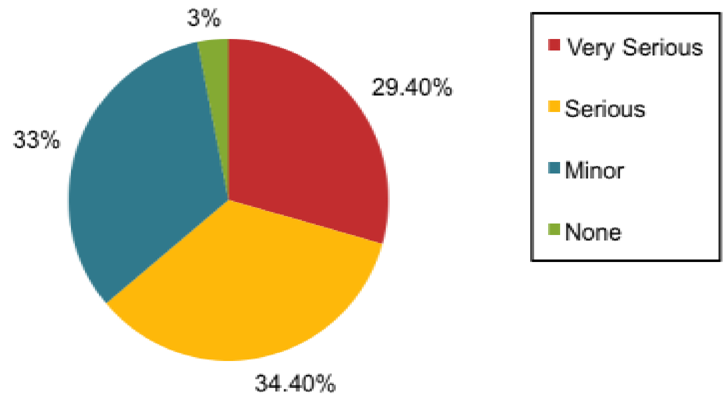
Figure 117. Respondent satisfaction with the overall MPA planning process for the North Coast MPA network



Question 5: *How would you rate the level of conflict over the establishment of the MPA Network? N = 163*

As shown in Figure 118, over 60% of respondents rated the level of conflict in the MPA process as either very serious or serious. Another third of respondents saw the level of conflict as being minor. Only 3% of respondents reported that there was no conflict in the process.

Figure 118. Respondent ratings of the level of conflict in MPA process



12.2. Response to Statements Section

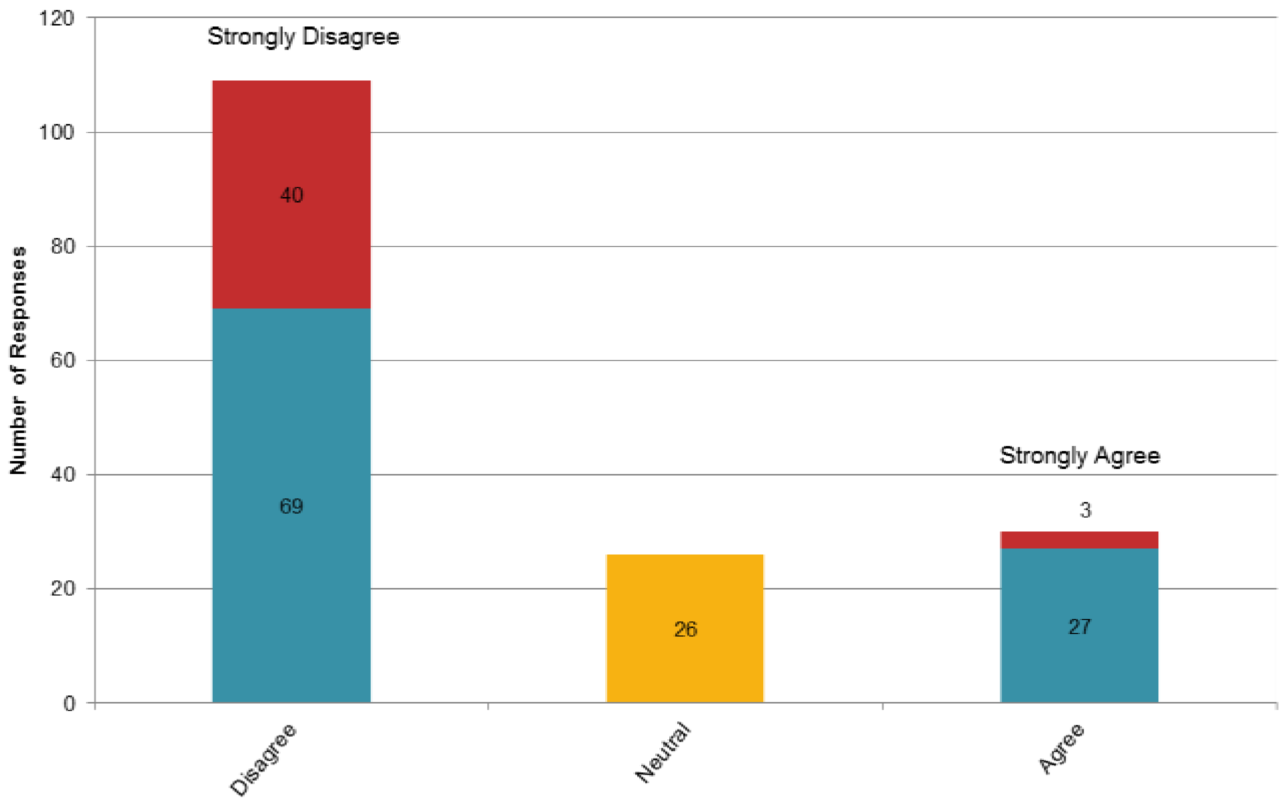
The following series of MPA perception and trust questions were designed to be read as a statement with the respondent selecting from a Likert scale their level of agreement with the statement:

Question 6a: *Over time, the North Coast MPA network will improve overall ocean health. N = 175*

Although not shown on the chart, ten respondents indicated that they did not know or did not have enough information to answer this question. Of those who answered the question, the great majority of respondents disagreed with the statement that the MPA network itself would improve overall ocean health (Figure 119).

All told, 109 respondents expressed some level of disagreement that MPA would improve ocean health. Another 26 were neutral, and 30 respondents agreed with the statement.

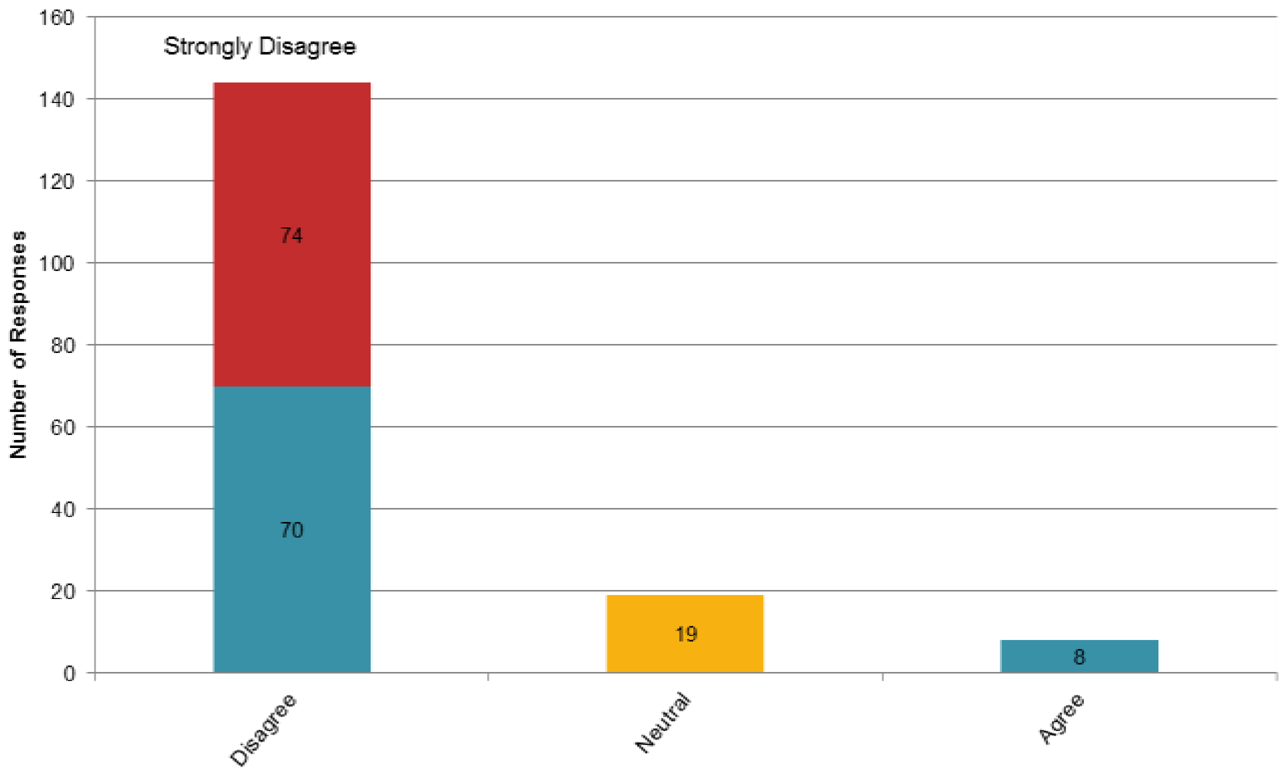
Figure 119. Respondent level of agreement, North Coast MPAs will improve ocean health



<u>Question 6b:</u> *Over time, the North Coast MPA network will improve my net income from fishing. N = 178*

Although not shown on the chart, seven respondents indicated that they did not know or did not have enough information to answer this question. In Figure 120 we show that of those who answered the question, 144 of the 178 respondents disagreed or strongly disagreed with the statement that the MPA network would improve their net income. This group was divided almost equally between disagree and strongly disagree.

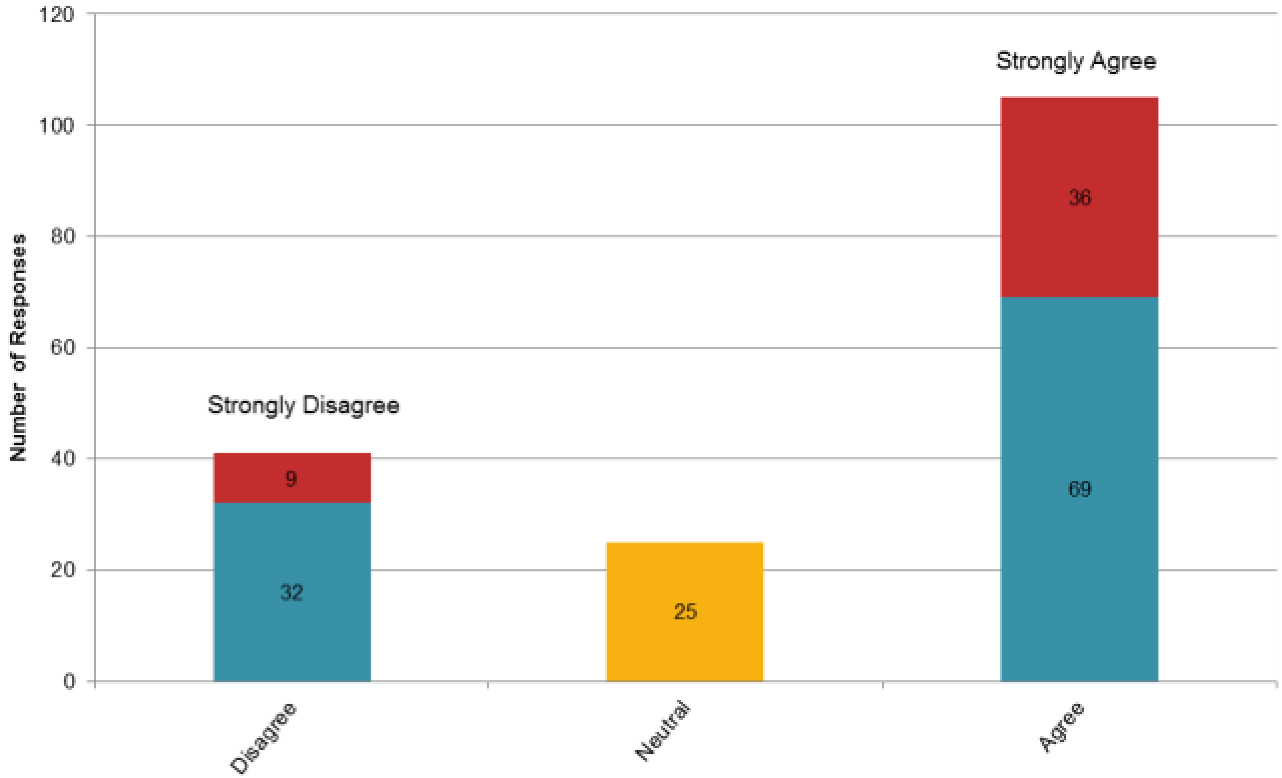
Figure 120. Respondent level of agreement, North Coast MPAs will improve their net income



<u>Question 6c:</u> *Before the MPAs, enough was being done to protect and enhance marine environments already. N = 174*

Three respondents indicated that they did not know or did not have enough information to answer this question. Of the 174 who responded, 105 agreed with the statement that enough was already being done to protect the marine environment before the MPA network, as shown in Figure 121. Of those, about one third strongly agreed.

Figure 121. Respondent level of agreement, there was enough ocean protection before MPAs were formed



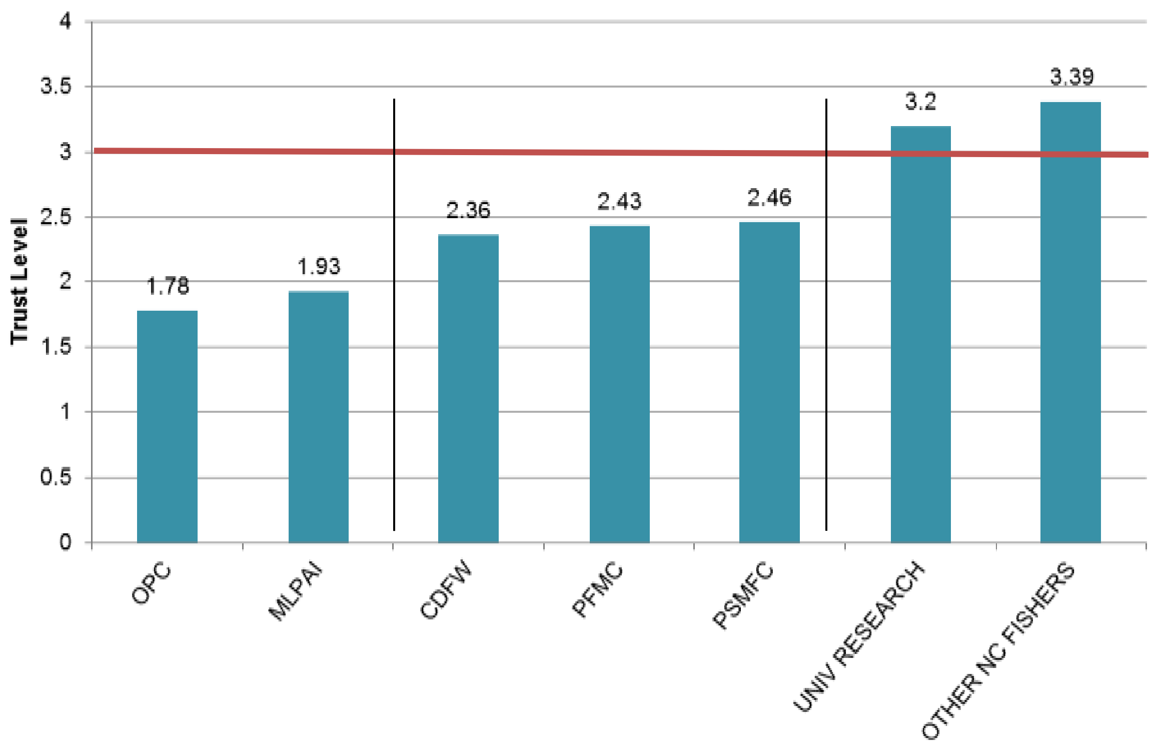
Question 7:

- ***A.*** *I trust the California Ocean Protection Council (OPC); N = 177*
- ***B.*** *I trust the Marine Life Protection Act Initiative (MLPAI); N = 177*
- ***C.*** *I trust the California Department of Fish and Wildlife (CDFW); N = 176*
- ***D.*** *I trust the Pacific Fisheries Management Council (PFMC); N = 175*
- ***E.*** *I trust the Pacific States Marine Fisheries Commission (PSMFC); N = 174*
- ***F.*** *I trust university researchers; N = 177*
- ***G.*** *I trust other North Coast fishermen; N = 173*

Respondents were asked to indicate their level of agreement with the trust statements listed above (questions 7a-g) using a Likert scale from 1 to 5, with 1 indicating strong disagreement (low trust) and 5 indicating strong agreement (high trust). Respondents also had the option to answer that they did not know who the entity/group was.

The mean value of all the Likert scale responses received for each question statement (excluding those who did not know who the group was) is provided in Figure 122. Note that the red line indicates the "neutral" scale value of 3. A small number of fishermen refused to answer certain questions, and thus the response sample size for each question is listed above.

Figure 122. Respondent mean levels of trust in fisheries-related entities

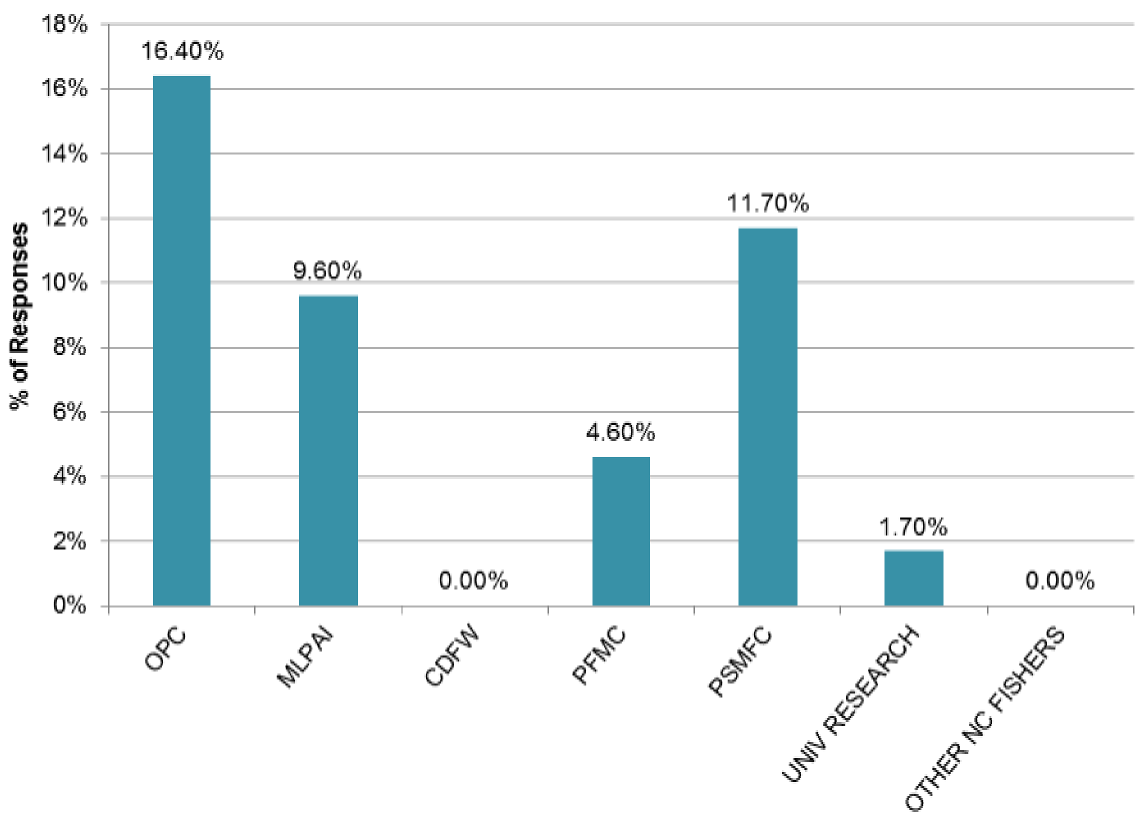


The vertical black lines in Figure 122 indicate three groups that emerged from the data. In the first group, OPC and MLPAI have overall "very low trust", both with means below 2. The second category, "low trust", contains entities with mean trust values above 2 but below 3 or neutral. These include CDFW, PFMC, and PSMFC. The third category, "moderate trust", contains the groups of university researchers and other North Coast fishermen, both with mean values above 3 or “neutral” but still below 4 and well below the maximum level of trust at 5.

It is important to note that response bias could result in these mean values being inflated relative to the overall population of commercial and CPFV fishermen. Fishermen who agreed to participate in the survey may have higher levels of trust in general when comparted to those who refused to participate. It is also possible that mean response values may be pulled down by those motivated to participate by very negative views they wished to share.

Mean trust should be interpreted in the context of how familiar respondents were with some of these organizations. FAC members told us that many fishermen would not know what the OPC or the MLPAI do, and might then judge the organization based on name alone. In Figure 123 below we show the percentage of respondents who were unfamiliar with the organizations listed above. The OPC had by far the highest percentage of respondents who were unfamiliar with them (16.4%), which could explain in part the reported low level of trust. Awareness of the MLPAI and PSMFC was also relatively low, as at least 9% of respondents were unfamiliar with those entities.

Figure 123. Percentage of respondents unfamiliar with listed organizations



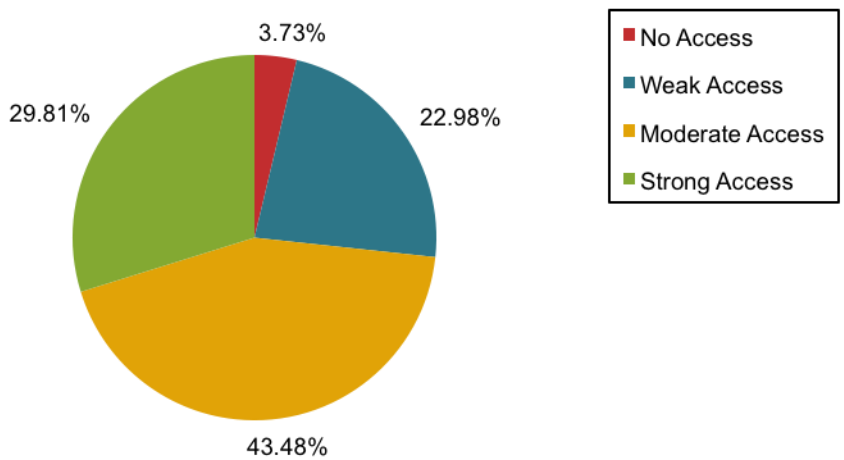
12.3. Access to Information

The survey included a series of questions related to fishermen's assess to regulatory information. Responses to these questions could help inform management outreach strategies.

Question 8: *How do you rank your access to quality information about fishing regulations? N = 177*

As shown in Figure 124, almost half of the participants (43.2%) responded that they had moderate access to regulatory information, with the next largest category reported strong access (31.3%), showing that almost three quarters of respondents feel they had sufficient access to regulatory information.

Figure 124. Respondent perceptions of their access to regulatory information

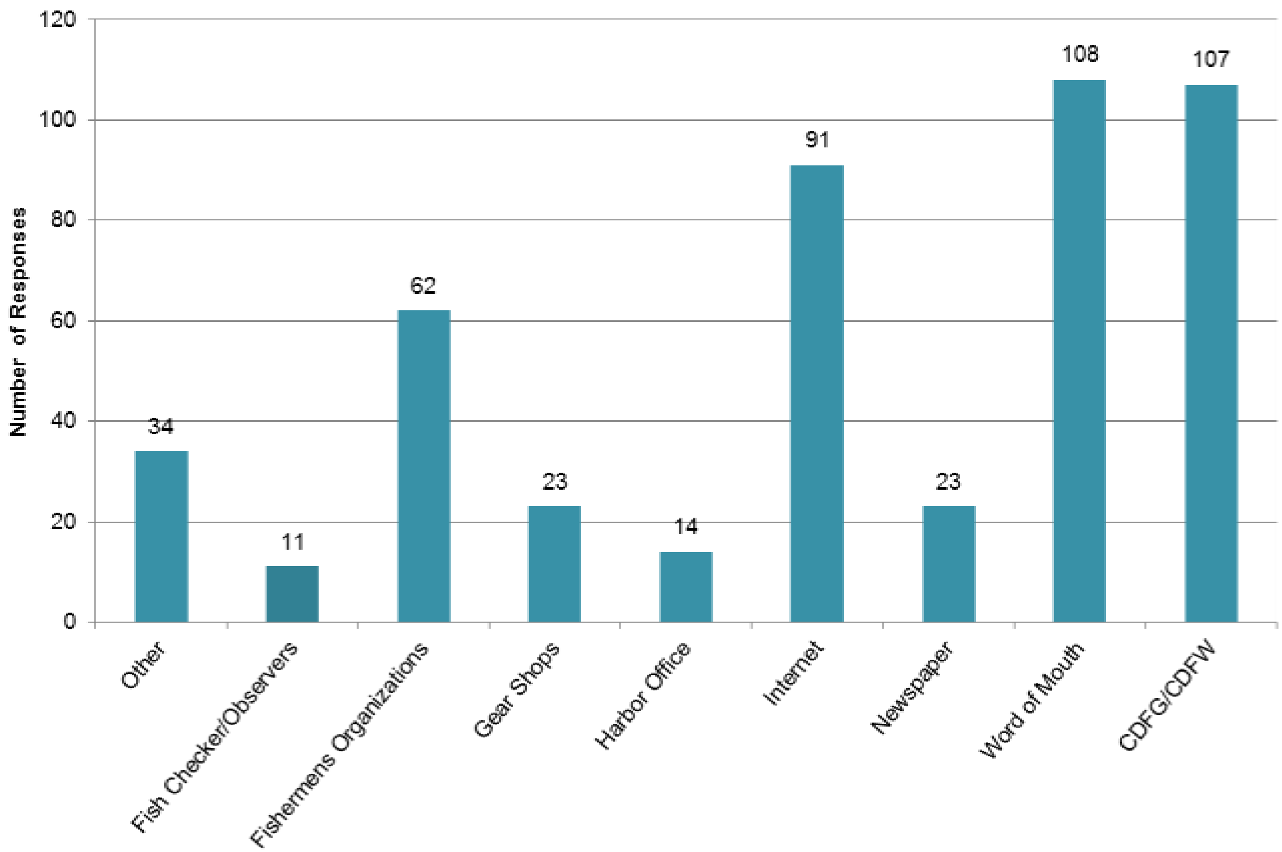


<u>Question 9:</u> *Generally where do you get your information about regulations and updates related to the North Coast fisheries? N = 178*

Of nine options, respondents were directed to choose up to three of their most commonly used sources. A qualitative answer box was included to specify which fishermen's organizations (if any), and to elaborate on an "Other" response.

From Figure 125 one can see that the top three sources of regulatory information were word of mouth (108), California Department of Fish and Wildlife (107), and the Internet (91). Fishermen's organizations were also an important source of regulatory information with 62 responses, as did 'other' with 34. All other categories had fewer than 24 responses. The 'other' category could be further broken down into 'snail mail' with 10, 'NOAA' and 'were involved with management' with 4, and 'fuel dock/processing plants' and 'fisherman's publications' with 3.

Figure 125. Respondent sources of regulatory information



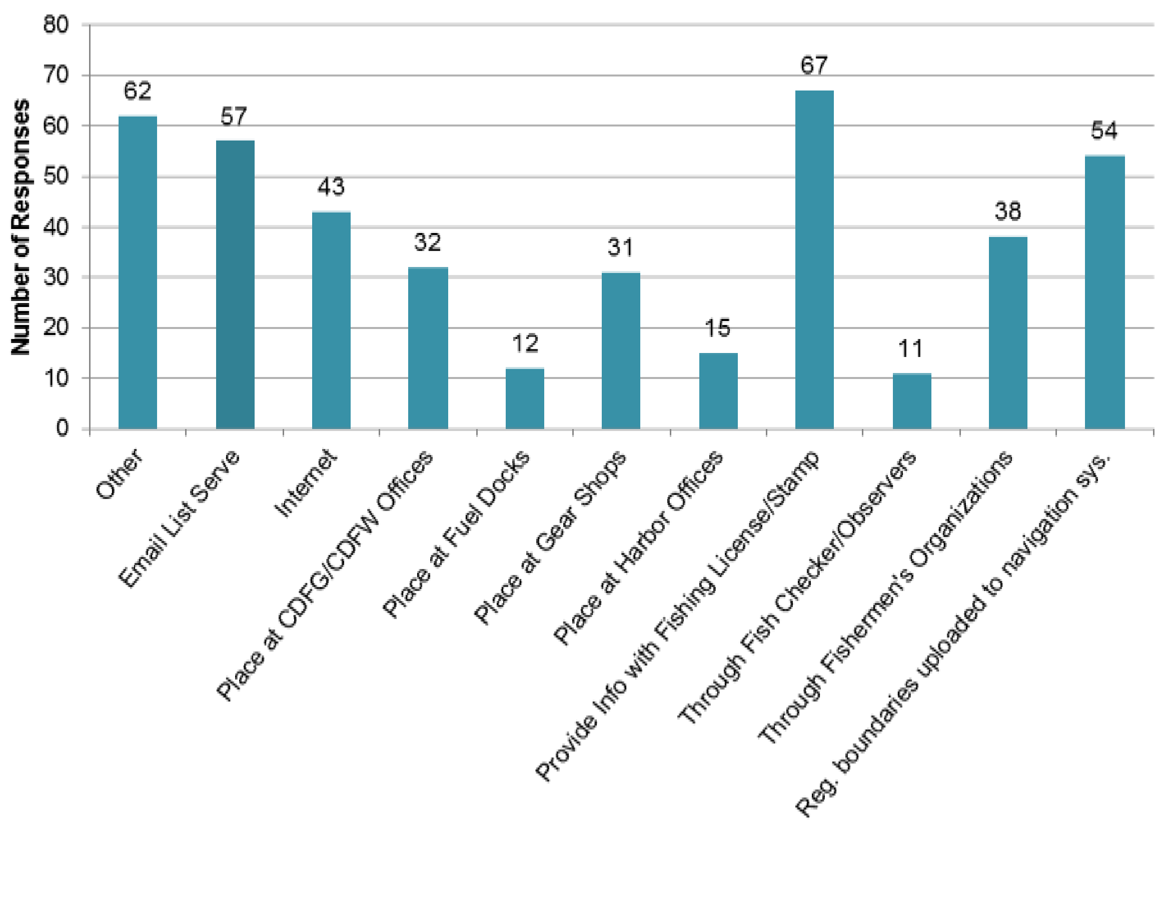
Question 10: *What would be the best way for managers or scientists to communicate information about the North Coast fisheries to you? N = 178*

Of 11 options, respondents were directed to choose up to three choices best answering this question. Fishermen could also provide open-ended responses to identify specific fishermen's organizations (if any), and to elaborate on an "Other" response. From Figure 126, one can see that in addition to 'other,' high numbers of responses were given for 'email list-serve'; 'providing information with fishing licenses or stamps'; and 'allowing fishermen to upload regulatory boundaries to their navigation systems' (each with over 50 responses).

Categories chosen by 30-50 respondents included putting information on the internet, placing information at CDFW Offices, placing information at gear shops, and communicating information through fishermen's organizations.

Categories with fewer than 30 responses were counted as 'other' in the diagram. Breaking out the 'other' category, key responses were 'snail mail' (25), 'handouts or booklets' (5), and 'phone call or hotline' (4). Responses from both the current and preferred means of regulatory communication indicated that fish checkers and observers may not be ideal candidates for information dispersal.

Figure 126. Respondent's preferred method of regulatory communication



12.4. Fisheries Specific Questions

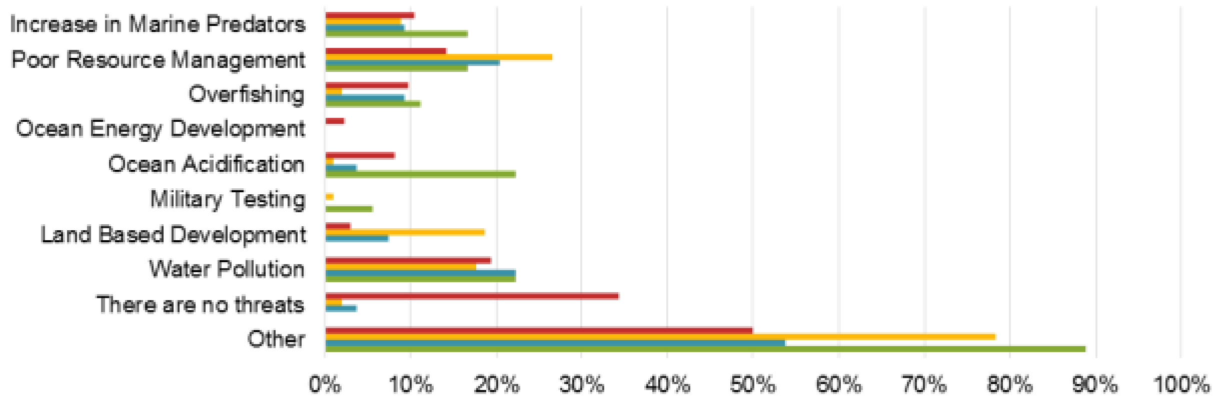
In addition to broad perceptions questions, the survey also included fishery specific questions related to the ecology and management of those specific species. For questions 11 and 12 results will presented by fishery. The four fisheries of economic interest for this study include crab, salmon, near shore finfish, and urchin. Results for nearshore finfish combine all responses across gear types and landed condition. Fishery specific questions only include responses from individuals who actively participate in the fishery of interest. Sample size for each question is listed in the text.

Question 11: *What factor(s) do you believe are the biggest threats to the overall health of this resource?*

Respondent perceptions of threats to overall health of fisheries of interest in the North Coast region are summarized in Figure 127. Many responses did not fit into our original response categories. 'Other' had the highest number of responses for each fishery. Breaking out the 'other' responses by fishery, for Dungeness crab the most frequent 'other' responses were similar to 'no threats,' 'natural conditions or cycles,' and 'climate change.'

For salmon, the most frequent 'other' responses included versions of 'poor resource management,' as well as 'dams and water diversions,' 'natural conditions and habitat,' and 'climate change.' For nearshore finfish, the most frequent 'other' response was 'natural conditions and habitat,' along with 'shifting pressure/effort.' For the urchin fishery, the most frequent 'other' response was 'natural conditions and habitat,' followed by 'shifting pressure/effort.'

Figure 127. Respondent's perceptions of threats to overall health of fisheries of interest



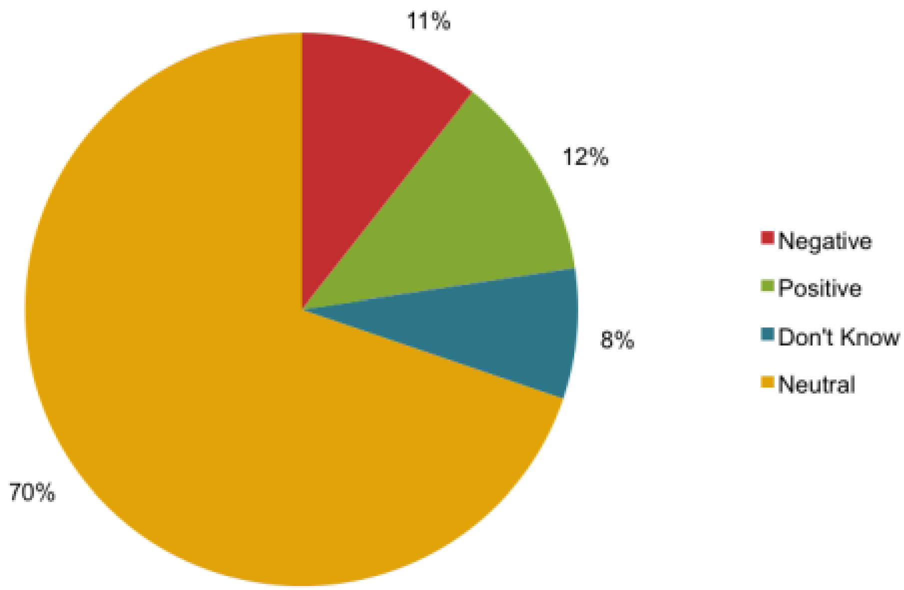
	Other	There are no threats	Water Pollution	Land Based Development	Military Testing	Ocean Acidification	Ocean Energy Development	Overfishing	Poor Resource Management	Increase in Marine Predators
Crab	50.00%	34.30%	19.40%	3.00%	0%	8.20%	2.20%	9.70%	14.20%	10.40%
Salmon	78.40%	2.00%	17.60%	18.60%	1.00%	1.00%	0%	2.00%	26.50%	8.80%
Nearshore Finfish	54%	3.70%	22.20%	7.40%	0%	3.70%	0%	9.30%	20.40%	9.30%
Urchin	88.90%	0%	22.20%	0%	5.60%	22.20%	0%	11.10%	16.70%	16.70%

% of Responses

<u>Question 12:</u> *What effect do you think the North Coast MPA network will have on the health of this resource?*

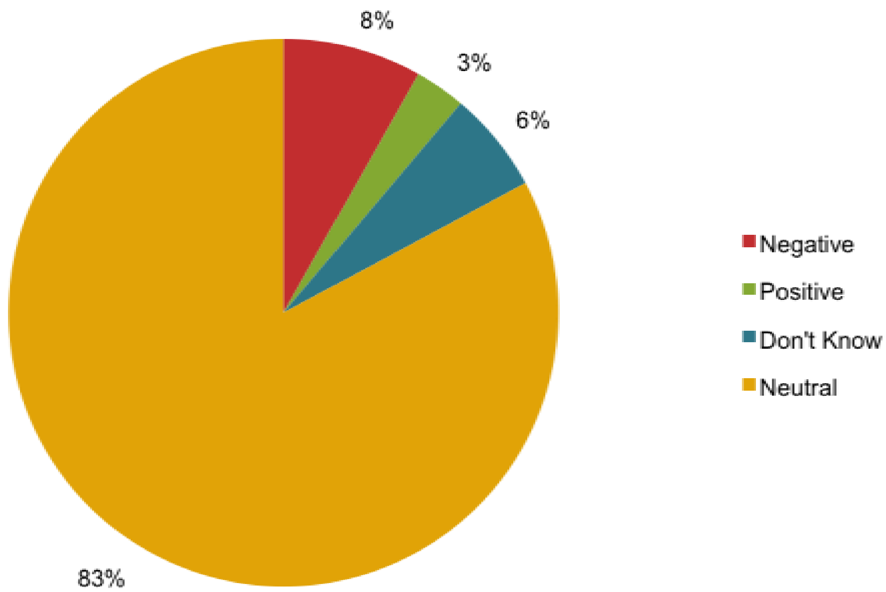
Participants in the Dungeness crab fishery (N = 123) most frequently responded that the MPA network would have neutral or no effect on the health of the Dungeness crab fishery (69.7%), with the remaining responses divided between positive and negative effects or 'don't know' (Figure 128).

Figure 128. Crab fishermen's perceptions of MPA effects on health of Dungeness crab fishery



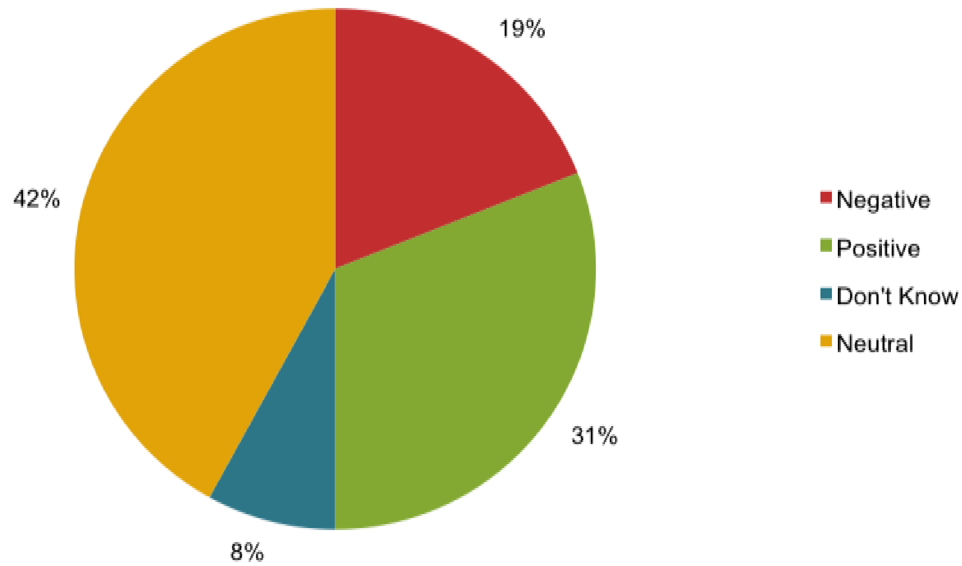
Salmon fishermen's (N = 73) perceptions of the effect of MPAs on the health of the salmon fishery are summarized in Figure 129. As with Dungeness crab, the overwhelming response was 'neutral' or no effect, with fewer than 10% of respondents indicating positive or negative effects or 'don't know.'

Figure 129. Salmon fishermen's perceptions of MPA effects on health of salmon fishery



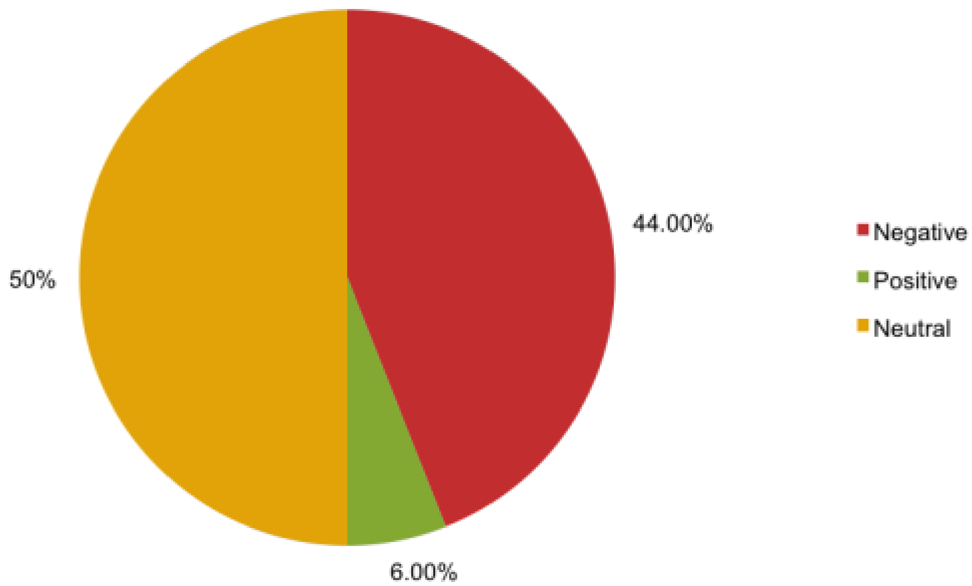
Nearshore finfish fishermen's (N = 38) perceptions of the potential effects of MPAs on the finfish resource are summarized in Figure 130. Unlike the North Coast region's Dungeness crab and salmon fisheries, a substantial fraction of nearshore finfish fishermen (31%) saw MPAs as having a positive effect on the nearshore finfish fishery. The most common response was 'neutral' or no effect, with 19% indicating 'negative effects.'

Figure 130. Nearshore finfish fishermen's perceptions of MPA effects on health of nearshore finfish fishery



All told, 18 urchin divers responded to questions about MPA effects on urchin resources. From Figure 131 one can see that most urchin divers believed that MPAs would either have a neutral (50%) or negative (44%) effect on the health of the urchin fishery. An FAC member who targets urchin indicated that many urchin divers fear no-take MPA areas could result in unchecked urchin population growth due to a lack of harvest pressure and predators such as sea otters, leading to “urchin barrens” denuded of kelp.

Figure 131. Urchin diver’s perceptions of MPA effects on health of urchin fishery

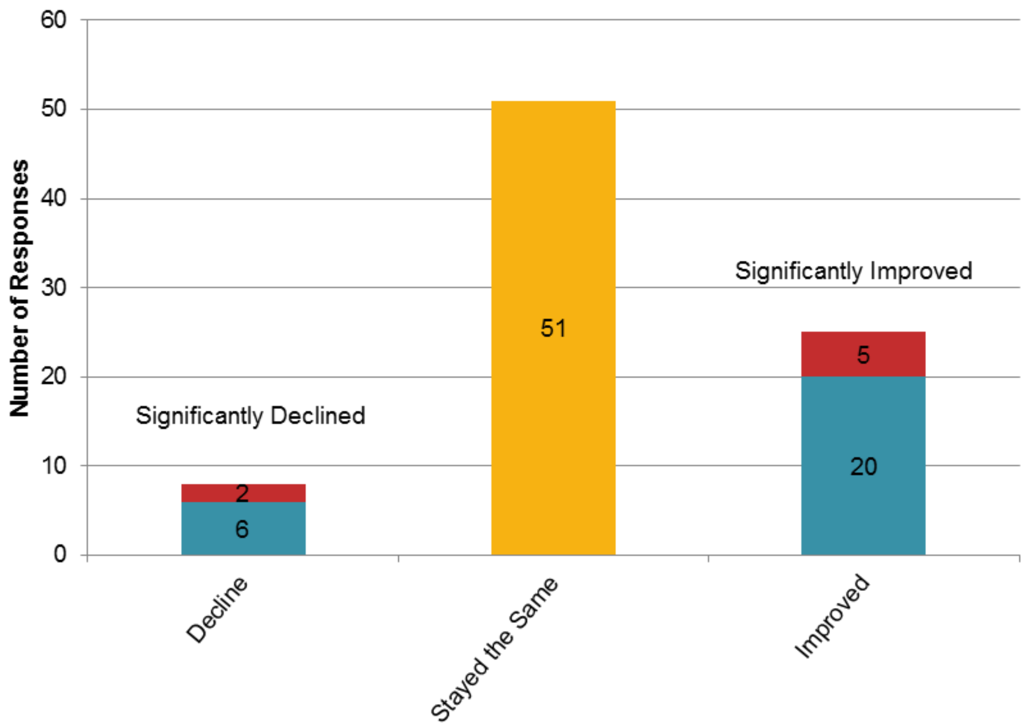


<u>Question 13:</u> *Over the past 10 years would you say that the population size of this marine resource has increased, declined, or stayed the same?*

All told, 95 Dungeness crab fishermen answered this question in relation to crab resources. Of those, 11 indicated that they did not have enough information to answer the question. Responses from those who had enough information to answer the question are summarized in Figure 132. The largest group – 51 respondents – indicated that they thought the size of the resource has stayed the same over the past 10 years.

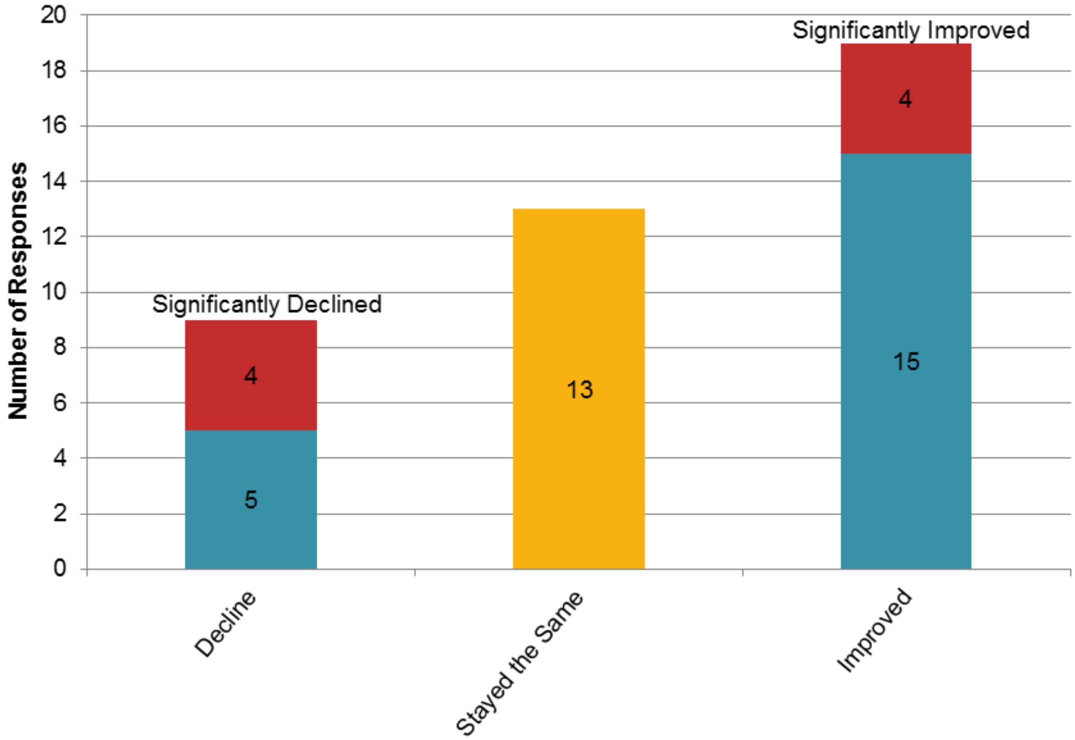
As several FAC members remarked, Dungeness crab populations fluctuate naturally due to ocean conditions and other reasons that are likely unrelated to fishing pressure. Several fishermen indicated that they believed the “sex, size, season” management of the Dungeness crab fishery in place for many years in California has allowed for reproductive success and overall resource stability.

Figure 132. Dungeness crab fishermen’s perceptions of 10-year changes in Dungeness crab population



A total of 59 salmon fishermen answered this question in relation to salmon resources. Of those, 18 indicated that they did not have enough information to answer the question. Responses from those who had enough information to answer the question are summarized in Figure 133. 32 respondents believed that the resource has stayed the same or improved over the past 10 years.

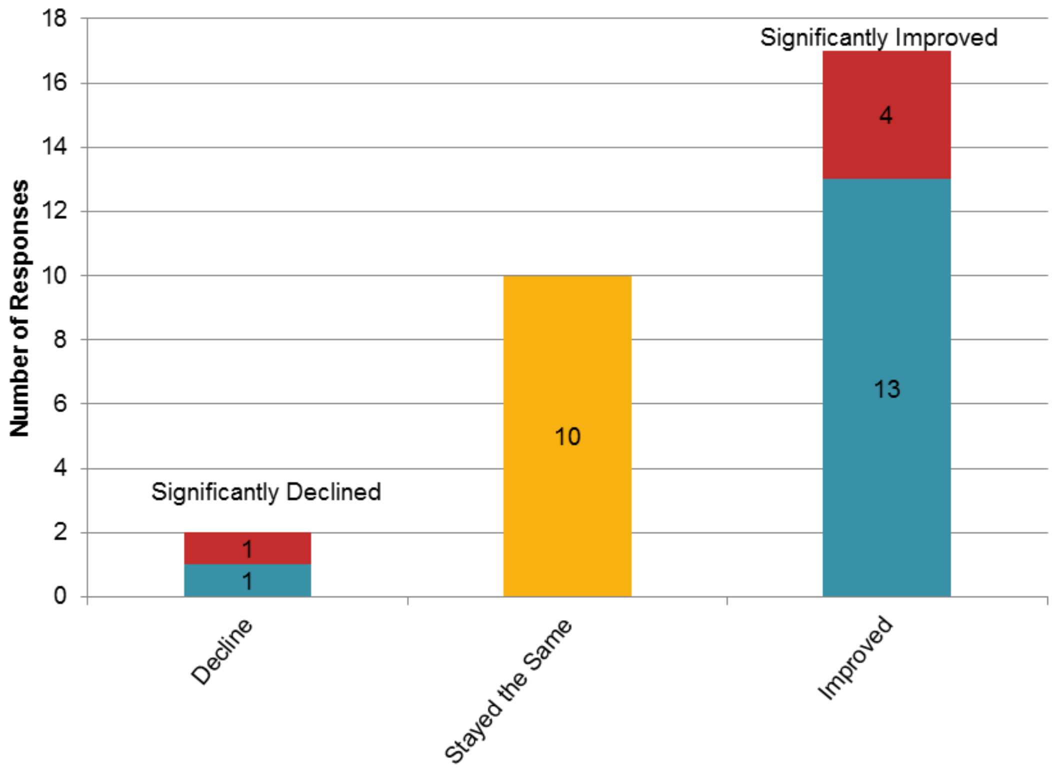
Figure 133. Salmon fishermen's perceptions of 10-year changes in salmon population



Perceptions of change in the nearshore finfish fishery (all conditions) over the last 10 years are summarized in Figure 134. In total, 30 nearshore finfish fishermen answered the question, and of those, 1 indicated that he or she did not have enough information to answer the question.

Of those who had enough information to answer the question, 17 responded that abundance in the nearshore finfish species group has generally improved over the past decade, with 4 responding significantly improved. 10 responded that the population had stayed the same, and just 2 that it has declined.

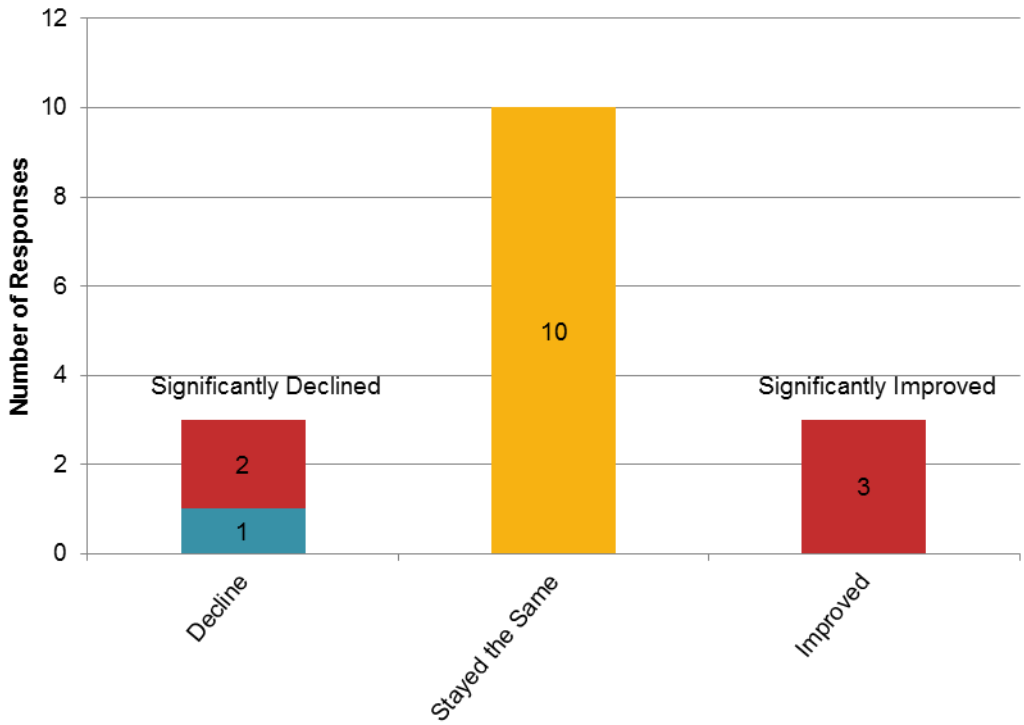
Figure 134. Nearshore finfish fishermen's perceptions of 10-year changes in nearshore finfish population



Summary information on perceptions of changes in the abundance of urchin in the North Coast region over the last 10 years is given in Figure 135. Seventeen urchin divers responded to this question and one indicated that he or she did not have enough information to answer the question.

Of those who had enough information to answer the question, 10 responded that the abundance of urchin species has generally stayed the same over the past decade. Remaining responses were equally divided between improvement and decline.

Figure 135. Urchin diver's perceptions of 10-year changes in urchin population



13. PORT-LEVEL FISHING OCCUPATIONAL COMMUNITY FOCUS GROUPS

Port level focus group provided an opportunity for fishermen to communicate their experiences with fishing and with the MPA network in a less structured format. The focus groups generated rich qualitative data that supplemented the project's quantitative findings and provided an additional window into the socioeconomic context of the North Coast fishing communities as they reacted to the implementation of MPAs. Additionally, these conversations with fishermen allowed for a better understanding of why patterns in the quantitative data were occurring and how those patterns were affecting fishermen on the ground.

Fishermen who participated in the focus groups reported that they appreciated having that chance to communicate with us directly about their thoughts and concerns, rather than to have their ideas and responses directed by the structure of a survey. After transcribing the conversations and coding them for key themes (Table 6), the project team identified three broad issues came up repeatedly in all the focus group conversations and in all of the ports: historical context, perceptions of the MPA network, and visions for the future. Summary information on fishermen views of these issues is given below. For each theme, the report provides an overview of fishermen responses on the topic followed by a list of sample quotes from the focus group discussion. To maintain the authenticity of fishermen responses, the quotes are presented as they were spoken in focus groups without any editing for grammar or flow.

13.1. Historical Context

In all five focus group conversations, fishermen highlighted the importance of understanding the historical context of their ports and fishing communities leading into the implementation of the California North Coast Marine Protected Area Network in 2012. In all conversations, fishermen presented perceptions of increased regulation and overall decline in their fishing communities. Many fishermen described how they have witnessed a severe decline in the number of active vessels operating out of their ports over the course of their fishing careers.

One fisherman from Shelter Cove noted that when he started he remembered 60 vessels commercial fishing out of Shelter Cove, whereas now he views that number to be around seven. In Crescent City, a fishermen described the decline in one particular fishery, where he reported seeing the number of active participants drop from 70 to 8. A fisherman from Fort Bragg recalled that there used to be 300-400 boats commercial fishing in the port, and now he believes that number has dropped to 15-16 vessels in the crab and salmon fisheries.

Along with the declines in the number of fishermen or active vessels, fishermen also reported declines in the infrastructure to support commercial fisheries in the North Coast ports. Fishermen reported their ports losing fuel docks and ice facilities, as well as declines in the quality of other infrastructure to support commercial fishing such as docks and off-loading facilities.

Fishermen also mentioned that they have witnessed a decline in the number of fish buyers and receiver/processors connected to their ports. Some ports have reported that only one or two main fish processors remain in their ports. They state that the decline in the number of buyers has meant less competition among buyers, so buyers are better able to set price and other terms related to fish sales.

Fishermen also described a history of increased regulation in their fisheries and expressed a belief that those regulations have restricted their access to key fisheries, their ability to make a living fishing, and the ability for new and young people to enter into commercial or charter fishing careers. Key regulations discussed included the collapse and subsequent restructuring of the groundfish fishery, including the groundfish vessel buyback program; salmon restrictions with the formation of the Klamath Management Zone (KMZ); the implementation of limited entry and permits in most California fisheries; and the establishment of spatial rockfish closures called rockfish conservation areas (RCAs).

Fishermen have reported that increasing restrictions across a wider range of fisheries has created challenges for them in terms of making a living – particularly since it has reduced their ability to diversify and participate in multiple fisheries. Many were worried that due to lack of diversification, many fishermen have become too reliant on one fishery: crab. They also expressed concerns that restrictions have made it harder for new people to enter commercial fisheries, and were worried about what that might mean in terms of passing down the legacy of fishing on the North Coast to the next generation.

Sample Quotes:

- In my fishery where there were 70 people doing what I did in mid-nineties, there is now 4 to 8 people that on the water, 4 of them on a regular basis but I have to admit that the last 2 months it has been 1 or 2 of us on a regular basis because of the way we've lost our infrastructure. We only have one buyer who buys live rockfish because of the reduction of fish…we used to have hundreds and hundreds of tons of groundfish coming to this port and flow through the port. When lot of it was cut in the late seventies-eighties early nineties a lot was cut here at the port. Now we only have a few boats. – Crescent City Fisherman

- I personally have seen all the changes. Since the implementation of 200 mile limits when they started restricting us there, the economic effect of that was disastrous, I mean there used to be 300-400 boats fishing out of this harbor, now there's 15-16 commercial salmon and crab boats. – Fort Bragg fisherman

- There are a lot less salmon fishermen…Markets, you can no longer sell fish here, you have to drive them somewhere; price of doing business; personally myself in the late 90s they gave us September to fish for salmon, it's like growing corn in January. And my last season I caught one fish, 1998, and I just quit because I had to pay land taxes that I could no longer afford to have a salmon boat. – Shelter Cove Fisherman

- The charter has changed. There used to be, what half a dozen charter boats? That would take like 15 to 25 people and stuff, and uh, I don't know what was the final nail in the coffin but I think it was the, was it a salmon closure in the early 80's. – Eureka Fisherman

- There was a couple major things that happened; there was the whole groundfish disaster, and then, uh the, implementing the RCA [Rockfish Conservation Areas], which I mean, a lot of us made our living in that RCA…When they implemented the MPA, all those spots where we fished we couldn't fish any more…But there was that and then as a result, that was one results of the groundfish disaster, another one was they did a big buyback on the trawlers and the trawlers were really what kept Fort Bragg and all the fish companies going. – Fort Bragg Fisherman

- Trinidad crab fisherman it's about the only commercial fishery to participate in anymore. The only profitable thing that I can do here in Trinidad. – Trinidad Fisherman

- Crab is huge. Everybody dips into the crab and basically probably keeps almost everybody alive…But when we had bad crab seasons everybody hurts and there is not really any way to make it up because they can't flow into another fishery. When it was open, you could flow into other fisheries when there was a bad fishery. – Crescent City Fisherman

- I have to try to learn how to become a better salmon fisherman, because all of our eggs are in one basket now. And I used to have multiple things that I could do - all those things are off the table now. And some of the stuff we talked about you know when everybody started in the 70's, you can't do any of those things anymore, you know. They're not available to you. I couldn't even go out with a ring net and get crabs. There's nothing that you could do if you don't already have the permits in place that's gonna make you survive. – Eureka Fisherman

- What is going to happen in 15 years when some of us aren't going to be able or won't be on a boat? Or 10 years, whatever it is. How do we move our business into someone else's hands? How do we, as I've said earlier, transmit our body of knowledge? – Crescent City Fisherman

- But there is nothing in the crab fishery that is, I mean any regulation or anything that has caused the decrease in the number of boats. It's, pretty soon it's going to be age that is going to be the main factor that causes this decrease. – Trinidad Fisherman

13.2. Perceptions of MPA Network Effects and Process

When discussing potential economic or social effects of the new MPA network, fishermen indicated that there may be some modest effects from the network, but they also expressed relief that the effects from the network would not be as bad or extensive as they initially feared.

Some fishermen expressed concerns that the closure at Ten Mile would affect their salmon fishing in that area, others indicated that some closures in the northern part of the state could affect fishermen from Oregon and northern California, and beach fishermen (for smelt and other species) indicated that the Samoa beach closure could affect their fishing.

As noted, across all ports, fishermen indicated that the effects from the MPA network could have been a lot worse. They said that as a result of their political involvement in the process, they ended up with a network that would limit the adverse effects on the fishing occupational community. They said that some of the initial proposals for MPA locations that were circulated when the process started could have devastated some of their fishing communities.

Fishermen from Shelter Cove stated that an early proposal involved the closure of an area just offshore of their community. They said if that had been put in place important subsistence, recreational, and commercial fishing would have essentially been shut down. This is because most Shelter Cove fishermen use small boats that would not have been able to transit longer distances beyond the proposed MPA to do their fishing. Likewise, fishermen from Trinidad said that initial proposals to put an MPA from Trinidad Head to Patrick's Point would have devastated important commercial, recreational, and subsistence fishing in that area.

While fishermen felt relief that the effects from the MPA network would not be so severe, they very clearly expressed that more MPAs or MPAs in different locations could contribute to substantial effects to their already declining fishing communities. In the conversations, many expressed fear that more MPAs would or could be added at a later date. They did not want mangers to take the considerably lesser effects from this MPA network as a sign that more MPAs could be added.

Finally, fishermen provided insights relating to the process by which the MPA network was implemented. Although many fishermen were pleased that their interests and concerns were taken into consideration and that the MPA network was designed in a way that limited effects, many still had concerns about the way the process was run overall. Concerns that fishermen expressed about the process included:

- Fishermen did not feel that MPA process organizers sufficiently took into account the historical and cumulative regulatory context in which fishing communities on the North Coast operate.
- Some felt that the MPA process was not transparent, and there were particular concerns about the fact that part of the implementation was funded through private money from conservation organizations.
- Some fishermen believed that MPA process organizers came to the region with their minds made up about what would happen, and that efforts to include stakeholders in the process were not genuine.
- Fishermen expressed concerns about the science that was used in the development of the network, worrying that for this region there often was not enough good data available and feeling that fishermen's knowledge of the marine environment was not taken into consideration.

Sample Quotes:

- I know it's [the MPA network] gonna affect us in commercial salmon and crab, the closure right here at Ten Mile, that one there, already has affected the salmon fishermen and the crab fishermen, crab I couldn't tell you if it's a good or a bad thing, for the salmon it's not good, we can't go through that whole area where the salmon live. So it puts more pressure on the other outside areas and that kinda stuff. And all the rest of the fishery that I've seen over the years everything has always been "don't help the fishermen, get rid of em, or restrict em more". –Fort Bragg Fisherman

- The MPA probably more, would affect my beach fishing because they have closed some sections of beach like on mad River, and those were some of the major areas I fished for red tails. – Eureka Fisherman

- I mean, we got what we had and to me, I know it hurts a few people but it could have a lot worse. –Crescent City Fisherman

- I hate to say it, but me personally it's not effecting me that much but I just don't know if me saying that is going to make someone up the road say "we could put more in, didn't hurt em", you know what I mean? –Trinidad Fisherman

- I was scared the hell out of it at first, right? I mean, the original plan just cut this whole area off... We were scared to death, you know, we just said well it's all over...It was going to be a blanket closure. It was going to be if you had a big boat and lots of money you could fish here; otherwise, me and him, me and him couldn't get to any of those spots. – Shelter Cove Fishermen

- I felt it turned out to be a pretty good process up here compared to, you know I was in contact with guys in southern California and central coast, and ours was last, and all those other areas they did and they talked like the process didn't work for them at all. It sounded like they took all their best fishing grounds, and that they didn't listen to them. – Eureka Fisherman

- I was pretty amazed actually that we had anything to say, any effect on anything. I was completely amazed. I mean, I was ready to move out of the Cove, trying to find something else to do. –Shelter Cove Fisherman

- One of the grievances that I think a lot of us have with the MLPA initiative is that they acted as though they were the first ones in town and there has never been restrictions on fishing before. –Eureka Fisherman

- We are not happy with anything about the MLPA initiative. I'm very thankful that our stakeholders minimized the damage to the extent they did. –Eureka Fisherman

- All these closures they put in they put them in here with no scientific study of why or what for. Doesn't matter, it's 'readily available science'. That was how they got away with doing all this with no science, they worded it the most 'readily available science'. It doesn't matter if a study was done 20 years ago you know, or if they were doing a transect for abalone in the sand. –Fort Bragg Fisherman

- And the other thing is that whole thing was privately funded. How does that get off? I mean how do you do that? That brings up the nasty, nasty concept of class warfare doesn't it? Get the working class people the hell off the ocean. Leave it for the scientists and the tourists. –Eureka Fishermen

- I think there's a consensus that it was a serious railroad job all the way through. But it basically said you're gonna come to an agreement, or we're doing it to you and we're gonna do it to you anyway, so you better come to an agreement that we agree with. There was very little latitude, very little room for creative thinking or input that might actually benefit the oceans, they had it all preconceived in their minds what they were gonna do. –Eureka Fisherman

- One of my many fears is that the MLPA won't be the last incident of this sort that we see. Because, well the NGOs have a constant need for funding, they need to generate a crisis that will open the checkbooks and we're an easy target, because we're not very politically powerful, we can be vanquished. –Eureka Fisherman

13.3. Visions for the Future

Fishermen also discussed what they would like to see for the future of their fishing communities. Many fishermen talked about wanting to see better relationships with fisheries science and management entities. They expressed a desire for managers to better consider fishermen's knowledge and input in decision-making. Fishermen believed that they had important knowledge to contribute to management and that at present it wasn't always taken into consideration.

In several of the ports, fishermen expressed a desire to work collaboratively with fisheries scientists to gather better data about the marine environment. Several fishermen explicitly offered up their vessels and their time to assist scientists with collecting better data and to try to show scientists some of the trends that they have been seeing in their own waters. A few fishermen positively recounted working with fisheries scientists on projects related to the baseline monitoring of the MPAs.

In discussions, fishermen indicated their hopes for a better economic and social future for their ports. Some expressed a hope that California fisheries management would move towards a direction of considering the health of fishing communities and economies in addition to the health of fish species. These desires for the future took many forms including: more community and small scale fishermen access to key fisheries such as salmon and groundfish, better infrastructure, better marketing and sales opportunities, and more opportunities and a clearer pathway for young people to enter into the fishery.

Sample Quotes:

- You want to base your management for the health of the species too but also for the people to continue to make a living, to increase your economy of the town, the bars, the restaurants, motels, everything. – Fort Bragg Fisherman

- As far as the communities too though, you know the reason, it would be good for the community if you could get these plants working again. – Crescent City Fisherman

- You know I've always thought that permits are a privilege in any fishery that we are in. Why should I be able to profit from the value of that permit? When I'm done with it it should be somebody else's and they shouldn't be charged for it. – Trinidad Fisherman

- I think that the managers, the actual biologists that work for the National Marine Fisheries Service they know that they're not getting any information they need on the nearshore fish, like the yellow eye, they know that, and, but the connection needs to be made with people that are handing out the money, that it needs to go to collaborative research to really see what's going on. –Fort Bragg Fisherman

- Well, what I would like to see is some kind of serious work on water quality control. And I think it's probably more of an issue to California or around cities than here but I think we should really understand how water pollution and water conditions affect stocks and because those are things that are, I think have a big basis in how the productivity of the oceans moves and changes. – Crescent City Fisherman

- It would be nice if they [scientists] would collaborate with us because then we're gonna know that the science is real or not. – Fort Bragg Fisherman

- In all fairness, I would take one of my weekend days and take a scientist out, and I would dive with them, I'd hold the other end of the line, I'd go do whatever they need me to do to help they do what they need to do you know, just to show you know that this is real, this isn't some kind of made up engineered facts or anything, this is what the bottom of the ocean looks like. – Fort Bragg Fisherman

14. EXPLORING THE EFFECT OF MPA FORMATION ON URCHIN DIVERS: A REGULATORY EVENT STUDY ANALYSIS

Did the establishment of MPAs in the North Coast region of California affect commercial fishermen who depend on North Coast fisheries for their livelihoods? In particular, did such fishermen's average income, targeted fishery participation, or fishing location change significantly between the period before the establishment of the MPAs, and the period following it? To investigate these questions, we conducted a longitudinal regulatory event study analysis of the North Coast region's sea urchin fishery over the period 2008-2014, before and immediately following MPA formation. We employed methods similar to those described in Hackett et al. (2015).

We chose the commercial urchin dive fishery for several reasons. First, given the nature and location of North Coast MPAs, the urchin-dive fishery was hypothesized to likely be relatively affected by MPA formation. Second, available longitudinal data on urchin divers is relatively robust. And third, the urchin-dive fishery is relatively more stable than the other key fisheries of interest – substantial gaps exist in nearshore finfish activity prior to MPA formation, and the Dungeness crab fishery normally experiences substantial inter-annual variations in abundance that could mask MPA effects.

The following tables present the results of our longitudinal analysis of 37 commercial urchin fishermen in the North Coast region of California. These fishermen were active both before and after the creation of regional MPAs, and spatial data on reported on their pre-MPA landings receipts indicated fishing grounds that overlapped with MPAs that were subsequently created.

We analyzed the fishing behavior of these urchin divers, indexed by commercial fishing license number, over the period 2008-2014, encompassing five years prior to the establishment of the MPAs (2008-2012), and the two available years of data after establishment of the MPAs (2013-2014). The post-MPA time period is of shorter duration due to data availability relative to our project timeline.

We investigate changes in average ex-vessel revenues, degree of dependence on the urchin fishery, dependence on Fort Bragg as a landing port, and the overall spatial distribution of fishing locations. We address these topics in the next four sections, respectively.

14.1. Ex-Vessel Revenue

The distribution of ex-vessel revenue by category, using the categorization system in Table 141, is summarized in Table 140. Lower categories stand for lower ex-vessel revenue levels.

In Table 140 we summarize reported values by category, computed by averaging the annual ex-vessel revenue for the pre- and post-MPA time periods, by fisherman, and then binning these averages into categories 1 through 4. Data are provided for each year, as well as averaged for the five years prior to MPA formation, and two years immediately following MPA formation. For example, if a fisherman averaged less than $5,000 in annual ex-vessel revenue across the five years before MPAs were established, then that fisherman was counted for the “5-year Pre-MPA average” as belonging to category 1.

Likewise, if a fisherman averaged between $5,000 and $25,000 in annual ex-vessel revenue across the two years after MPAs were established, then that fisherman was counted for the “2-year Post-MPA average” as belonging to category 2. We can then say that over the 5-year pre-MPA period, two fishermen averaged less than $5,000 in annual ex-vessel revenue; nine averaged between $5,000 and $24,999; and so on.

One immediate observation to note from this exercise is the relatively small number of fishermen whose mean annual fishing income in either period (pre- or post-MPA) fall into category 1, compared to the number of fishermen whose yearly averages fell into higher-income categories. For example, there was an average of two fishermen whose average annual ex-vessel revenue in the pre-MPA period fell into category 1. However, the average number of fishermen who fell into category 1 on a *yearly* basis across the pre-MPA period was 6.6.

This fact suggest that individual fishermen tend to experience yearly fluctuations in ex-vessel revenue that lead them to cross in and out of category 1. To some extent, this result is an artifact of the binning system that we chose. However, it also uncovers a pattern of year-on-year fluctuations in revenues that appears to be a feature of the fishery itself.

Table 140. Distribution of annual ex-vessel revenue by category, by year

Year	**Category**			
	1	**2**	**3**	**4**
2008	13	8	6	10
2009	10	5	10	12
2010	5	10	13	9
2011	2	7	14	14
2012	3	3	15	16
2013	3	2	14	18
2014	7	3	10	17
5 yrs pre-MPA average	2	9	14	12
2 yrs post-MPA average	3	3	13	18

Table 141. Annual Ex-Vessel Revenue Categories

Category Definitions	
1	<$5,000
2	$5,000 - $24,999
3	$25,000 - $74,999
4	>$75,000

The results presented in Table 140 do not provide evidence that urchin fishermen experienced a drop in revenues in the same time period as formation of the MPAs. Rather, the data indicate a drop in the number of fishermen whose annual ex-vessel revenue is in the lowest income category (under $5,000 annually) between 2008 and 2014. The most dramatic decrease occurred between 2008 and 2011, however, *before* the MPAs were established.

In 2014, the second full year after the establishment of North Coast MPAs, the number of urchin fishermen in the lowest-income category increased from three to seven. One can also see an overall increase in the number of fishermen in the *highest* income category (over $75,000) between 2008 and 2014. This upward trend began between 2010 and 2011, before the MPAs were initiated, and continued after they had been established. Though it is too early to draw conclusions, the first two years following MPA formation showed no evidence of the reversal of that trend.

In Table 142 we summarize the distribution of increases and decreases in average annual ex-vessel revenue (income) between the five-year period pre-MPA (2008-2012), and the two-year period post-MPA (2013-2014). Using raw average ex-vessel revenue data (not shown), we find that of the 37 fishermen in the longitudinal analysis, 26 experienced increases in average annual ex-vessel revenue between the two periods, while 11 experienced decreases.

Applying the income categorization system (displayed in Table 141) to the raw ex-vessel revenue data, we find that 11 fishermen experienced an increase in income category corresponding to their average annual ex-vessel revenues across the two periods (say, from 1 to 2). In contrast, 3 fishermen experienced a decrease in income category, while 23 fishermen (the majority of the sample) experienced no change in income category. Taken together, these results imply that most all of the urchin divers in our sample experienced either an increase or no change in their fishing income category from pre- to post-MPA.

Table 142. Distribution of income increases or decreases pre/post MPA

	Increased	**Decreased**	**Did Not Change**
Average Annual Income	26	11	0
Category	11	3	23

In Table 143 we compare the average annual ex-vessel revenue received by fishermen pre- and post-MPA using a two-tailed t-test with a 95% confidence interval (alpha = 5%). We reject the null hypothesis that average annual ex-vessel revenue did not change between the five-year period pre-MPA and the two-year period post-MPA. As the sample size is small and the MPAs are recent, however, it is too early to draw conclusions about the observed positive association between MPAs and average annual incomes.

Our analysis presents evidence of increasing average annual ex-vessel revenues in the post-MPA period. We cannot attribute any causal relationship to this association between the establishment of MPAs and ex-vessel revenues, however, as we have not controlled for other relevant factors such as fish abundance, market conditions, or overall fishing conditions in related fisheries.

Table 143. Comparison of average annual ex-vessel revenue pre- and post-MPA: Paired t-test

	Pre-MPA	Post-MPA
Average	$57,985	$85,639
Variance	2.2. E+09	5.6. E+09
Observations	37	37
Pearson Correlation	0.468	
Hypothesized Mean Difference	0	
df	36	
t Stat	-2.50	
P(T<=t) one-tail	0.01	
t Critical one-tail	1.69	
P(T<=t) two-tail	0.02	
t Critical two-tail	2.03	

14.2. Urchin Dependence

In Table 144 we present the distribution of average annual ex-vessel revenues from urchin diving as a proportion of their total annual ex-vessel revenues, using the categorization system in Table 145. Lower categories indicate less revenue dependence on the urchin fishery, hence greater dependence on other targeted fisheries.

In general, we see that a substantial majority of the urchin divers in our longitudinal sample depend on urchin for the bulk of their fishing revenue. Out of the 37 urchin divers in our sample, the number whose fishing pattern falls into category 4 (over 75% annual ex-vessel revenue from urchin) ranged from 27 (73% of the sample) to 32 (86%) over the course of our pre- and post-MPA study period.

In general, those urchin divers that are not heavily dependent on urchin (outside of category 4) do not depend on it very much; the second-largest category was category 1 (under 25% of annual ex-vessel revenue from urchin), which ranged from 4 observations (11% of the sample) to 9 observations (24%).

Table 144. Distribution of urchin dependence by category, by year

	1	2	3	4
2008	9	0	1	27
2009	8	0	0	29
2010	5	1	1	30
2011	3	1	2	31
2012	4	2	2	29
2013	4	1	0	32
2014	4	1	1	31
5 yrs pre-MPA average	1	4	6	26
2 yrs post-MPA average	3	3	0	31

Table 145. Urchin revenue dependence categories

Category	Definition
1	0% - 25%
2	26% - 50%
3	51% - 75%
4	76% - 100%

As in Table 140 above, the category values are computed by averaging the annual ex-vessel revenue by fisherman across the pre- or post-MPA time periods in our longitudinal sample, and then binning these averages into categories 1 through 4. For example, if a fishermen averaged less than 25% urchin fishery dependence across the five years before the MPA was established, then that fisherman was counted for the 5-year pre-MPA average as belonging to category 1.

Likewise, if a fisherman averaged between 26% and 50% in revenue across the two years after the MPA was established, then that fisherman was counted for the 2-year post-MPA average as belonging to category 2. From the bottom of Table 144 we can then say that over the entire 5-year pre-MPA period, one fisherman averaged less than 25% dependence on urchin; four averaged between 26% and 50%; six averaged between 51% and 75%; and 26 averaged more than 76%.

One immediate observation to note from this exercise is the difference between the number of fishermen who fell into categories 1, 2, and 3 in each individual year pre-MPA, and the number of fishermen whose *average* degree of urchin dependence across the entire five-year pre-MPA period fell into these categories.

For example, while the number of fishermen whose degree of dependence on urchin placed them in category 1 ranged from three to nine individuals over the course of the period 2008-2012, there was only *one* individual whose entire 5-year *average* dependence on urchin fell into that category. Inspecting the raw data, we find that the reason for this result is simply that several of the urchin diver's yearly degree of dependence on urchin fluctuated dramatically across the 2008-2012 period, between as low as 0% and as high as 100%.

These fishermen were likely to experience single years in which their degree of dependence on urchin fell to 25% or below, but their average degree of dependence on urchin tended to be between 26% and 75% (categories 2 and 3). Hence, categories 2 and 3 are over-represented in the averages, relative to the numbers of fishermen within them on any given year, while category 1 is under-represented in the averages.

In general, however, we see that the *average* degree of dependence on urchin as a source of ex-vessel revenue did not change much between pre-MPA and post-MPA periods. In Table 146 below we present summary results on the distribution of changes in urchin revenue dependence, pre- vs. post-MPA, from our longitudinal analysis. Using the raw data on percentages of ex-vessel revenue from urchin, we find 16 fishermen for whom the average degree of dependence on urchin increased between the pre-MPA period (2008-2012) and the post-MPA period (2013-2014), 12 for whom dependence decreased, and 9 for whom dependence did not change.

Binning the raw urchin dependence data into categories across the pre- and post-MPA periods, we find that 8 fishermen experienced an increase in dependence category, 5 experienced a decrease in dependence category, and 24 remained within the same category.

The analysis does not support a hypothesis that MPA formation would limit urchin diving opportunities and force fishermen to target other fisheries, leading to a reduced dependence on the urchin fishery. In fact, we find that in the two years post-MPA, the fishermen in our sample became, on average, slightly *more* dependent on urchin than they had been in the five year pre-MPA period.

Table 146. Distribution of changes in urchin revenue dependence, pre- vs. post-MPA

	Increased	Decreased	Did Not Change
Dependence (raw data)	16	12	9
Dependence (category)	8	5	24

In Table 147 below we present the results of a paired, two-tailed t-test comparing average urchin dependence during the five years pre-MPA and two years post-MPA, with a 95% confidence interval (alpha = 5%) We fail to reject the null hypothesis that the averages of the pre-MPA and post-MPA samples are equal. There is not a significant association between urchin fishery dependence and MPA formation.

Table 147. Comparison of average urchin dependence pre- and post-MPA: Paired t-test

	Pre-MPA	Post-MPA
Average	80.9%	86.2%
Variance	6.0%	9.1%
Observations	37	37
Pearson Correlation	0.6	
Hypothesized Mean Difference	0	
df	36	
t Stat	-1.282	
P(T<=t) one-tail	0.104	
t Critical one-tail	1.688	
P(T<=t) two-tail	0.208	
t Critical two-tail	2.028	

14.3. Fort Bragg Location Dependence

In Table 148 we present the distribution of average dependence on the port of Fort Bragg, measured by the percentage of annual ex-vessel revenues that were generated from urchin landings at that port. This analysis offers some insight into possible spatial changes in landings ports utilized by urchin divers that may have occurred in association with MPA formation. We use the categorization system in Table 149. Lower categories stand for less location dependence on Fort Bragg as a landing port, hence greater dependence on other fishing ports.

Table 148. Distribution of location dependence on Fort Bragg by category, by year

	1	2	3	4
2008	18	1	2	16
2009	13	1	1	22
2010	12	1	1	23
2011	11	2	0	24
2012	14	1	1	21
2013	17	0	0	20
2014	14	0	1	22
5 yrs pre-MPA average	10	2	8	17
2 yrs post-MPA average	13	5	0	19

Table 149. Fort Bragg location dependence categories

Category Definitions	
1	0% - 25%
2	26% - 50%
3	51% - 75%
4	76% - 100%

As in Table 140 and Table 144, the values by category are computed by averaging the ex-vessel revenue across the time period in question, by fishermen, and then binning these averages into the categories 1 through 4. For example, if one of our 37 urchin divers on average earned less than 25% of her or his revenue at Fort Bragg across the five years before the MPA was established, then that fisherman was counted for the 5-year Pre-MPA Average as belonging to category 1.

Moreover, similar to the results in Table 140 and Table 144, the average degree of location dependence across the five years pre-MPA and two years post-MPA differs significantly from the degree of location dependence associated with individual years, due to year-on-year fluctuations in location dependence.

In general, we find that the distribution of location dependence on Fort Bragg is bimodal in that fishermen are either heavily dependent on Fort Bragg for their landings, or are relatively independent from it. For instance, over the study period, the number of fishermen who depended on Fort Bragg for over 75% of ex-vessel revenue (category 4) ranged from 16 (43% of the sample) to 24 (65%).

In contrast, the number of fishermen who depended on Fort Bragg for less than 25% of ex-vessel revenue (category 1) ranged from 11 (30% of the sample) to 18 (49%). The number of fishermen who depended most heavily on Fort Bragg for their ex-vessel revenue exceeded the number whose dependence was the least, but not by a lot. The middle two categories are almost empty, with a maximum of 2 observations in either category over the study period.

Looking at changes between pre-MPA and post-MPA periods in Table 150, one can see that the degree of dependence on Fort Bragg across our sample to be virtually unchanged. Using raw data on percentages of ex-vessel revenue by location, we find that 16 urchin divers experienced increases in the average percentage of ex-vessel revenue earned in Fort Bragg between the pre-MPA and post-MPA periods. In contrast, 16 fishermen experienced decreases in this percentage, and 5 fishermen experienced no change. These data suggest some degree of “churn” in the degree of dependence on the Fort Bragg port as a landing location, with the number of relative “port entrants” balanced out by number of relative “port exits”.

The changes in locational dependence are themselves fairly small on average, however. Binning the location percentage data into the category system in Table 149, we find that 23 of the 37 urchin divers (62% of the sample) experienced no change in landing port dependence category from the pre-MPA to the post-MPA period. Of those that did change location dependence categories, the exact same number experienced increases in dependence and decreases in dependence (7 of each).

Table 150. Distribution of Changes in Fort Bragg Location Dependence, Pre- vs. Post-MPA

Distribution of Increases / Decreases Pre / Post MPA			
	Increased	**Decreased**	**Did Not Change**
Dependence (raw data)	16	16	5
Dependence (category)	7	7	23

In Table 151 below we present the results of a paired, two-tailed t-test comparing mean dependence on Fort Bragg for fishing revenue during the five years pre-MPA and two years post-MPA, with a 95% confidence interval (alpha = 5%) We fail to reject the null hypothesis that the averages of the pre-MPA and post-MPA samples are equal.

Table 151. Comparison of dependence on Fort Bragg for fishing revenues, pre- and post-MPA: Paired t-test

	Pre-MPA	**Post-MPA**
Average	59.3%	56.9%
Variance	15.6%	20.4%
Observations	37	37
Pearson Correlation	0.74	
Hypothesized Mean Difference	0	
df	36	
t Stat	0.455	
P(T<=t) one-tail	0.326	
t Critical one-tail	1.688	
P(T<=t) two-tail	0.652	
t Critical two-tail	2.028	

Average distributions of landing port location for our longitudinal sample over the pre- and post-MPA event study time period are given in Table 152 and Table 153. While in Table 152 we provide the distributions taking into account all observations in our sample, in Table 153 we present the averages across only those fishermen in our sample who were active in the year in question. (Thus, the rows of Table 153 sum to 100%, while those of Table 152 do not.)

These results show small decreases in dependence on Fort Bragg and Albion as urchin landing ports, and small increases in dependence on ports outside the study region. Our analysis of mean dependence on Fort Bragg in Table 151 above indicates that these differences are not statistically significant, however. A similar t-test of mean dependence on Albion yielded essentially identical results, and is not shown here. The categories of “Fort Bragg area ports” and “Other North Coast ports” are nearly empty. Our results provide no significant evidence of an association between MPA formation and the spatial distribution of urchin landings in the North Coast region.

Table 152. Average distribution of landing port locations by year (all fishermen)

	Fort Bragg	Albion	Fort Bragg Area Ports (except Fort Bragg)	Other North Coast Ports	Ports Outside Study Area
2008	47.4%	19.3%	0.0%	0.0%	17.0%
2009	60.7%	16.1%	0.1%	0.0%	15.0%
2010	63.5%	25.4%	0.0%	0.0%	8.4%
2011	65.2%	24.3%	0.1%	0.0%	7.8%
2012	59.6%	21.4%	0.5%	0.2%	12.9%
2013	54.0%	25.0%	0.1%	0.0%	12.8%
2014	59.9%	14.7%	0.0%	0.0%	17.3%
5 yrs pre-MPA average	**59.3%**	**21.3%**	**0.1%**	**0.0%**	**12.2%**
2 yrs post-MPA average	**56.9%**	**19.8%**	**0.1%**	**0.0%**	**15.0%**

Table 153. Average distribution of landing port locations by year (year active fishermen only)

	Fort Bragg	Albion	Fort Bragg Area Ports (except Fort Bragg)	Other North Coast Ports	Ports Outside Study Area
2008	56.6%	23.0%	0.0%	0.0%	20.3%
2009	66.0%	17.6%	0.1%	0.0%	16.3%
2010	65.3%	26.1%	0.0%	0.0%	8.6%
2011	67.0%	25.0%	0.1%	0.0%	8.0%
2012	63.0%	22.6%	0.5%	0.3%	13.7%
2013	58.8%	27.2%	0.1%	0.0%	13.9%
2014	65.2%	16.0%	0.1%	0.0%	18.8%
5 yrs pre-MPA average	**63.6%**	**22.8%**	**0.1%**	**0.1%**	**13.4%**
2 yrs post-MPA average	**62.0%**	**21.6%**	**0.1%**	**0.0%**	**16.4%**

14.4. Additional Questions

The results above suggest that the establishment of North Coast regional MPAs is not associated with reduced ex-vessel revenue, a change in dependence on urchin as a fishing resource, or in the spatial pattern of urchin landings. In fact, average ex-vessel revenue increased post-MPA, though we do not have enough information to assess whether this relationship is causal or merely an association.

Below we present some outstanding questions not addressed by our data analysis, and for which we have limited anecdotal evidence from FAC members.

- Did urchin fishermen anticipate the MPA locations and adjust their fishing effort to accommodate these locations before MPAs were formed, thus defeating the event study methodology?

A close examination of Table 140 above reveals that urchin diver's average ex-vessel revenue began increasing *before* the MPAs were established. Could such a change in revenues reflect changes in effort or location that began in anticipation of MPAs being put into place? Limited anecdotal evidence suggests otherwise. One knowledgeable FAC member we spoke with observed that with the exception of a few, most fishermen did not pay any attention to the MPA process… (and) really didn't know the extent of what was created until they went fishing in 2012 (Aaron Newman, pers. Comm., August 4, 2016).

- Did other, non-revenue-related fishing conditions, such as transit times, change after MPA establishment?

We wondered whether MPAs affected urchin fishermen in ways other than changes in income, fishery dependence, or landings port dependence. For example, did MPA formation result in displacement of urchin fishermen from prime diving locations, leading to location changes not captured by our port dependence data, and hence greater transit times? For this question, the anecdotal answer we received is a tentative yes. A knowledgeable FAC member cited "greater compaction" or greater concentration of divers in prime locations, post-MPA, suggesting greater transit times for at least some divers. However, relative to other MPAs, the North Coast MPAs entailed smaller overall effects on most urchin divers, as they were placed about 10 miles or more from key urchin ports of Ft. Bragg and Albion (Tom Trumper, pers. Comm., August 4, 2016).

15. LESSONS LEARNED AND FUTURE RECOMMENDATIONS

This section reflects on several methodological and overall project lessons learned and recommendations to inform future long-term MPA monitoring efforts.

15.1. Fishing Occupational Community Engagement

Outreach efforts to port communities were initiated at the project's inception and continued throughout the project through the formation of a Fisherman Advisory Council. Building trust and collaborating with fishing communities were important measures of success for our project; however, due to several factors such as: distrust in how information will be used; dissatisfaction with the MPA network planning process and its outcome; and unclear benefits and outcomes of participating in the project, some fishermen were hesitant to participate in the project.

Compared to other MPA study regions, however, we had relatively greater success engaging the fishing occupational community, leading to much higher response rates. These higher response rates are due to several factors. Firstly, the California Ocean Science Trust, California Ocean Protection Council, California Sea Grant, and the California Department of Fish and Wildlife made great efforts to reach out to the North Coast community (including commercial and CPFV fishermen) before and during the development of MPA Baseline Monitoring project proposals. This included community engagement ranging from citizens to fishermen to members of the County Board of Supervisors, and this engagement began early on and involved the agencies responsible for both managing the MPA network as well as the MPA monitoring effort.

The result was greater interest and support in MPA monitoring efforts, as the community was engaged in shaping the MPA monitoring effort from the ground up, and there was clear opportunity to develop community-based projects. This community-wide investment in MPA monitoring efforts from the beginning, even before the request for MPA monitoring proposals was developed, is critical to garnering the community investment and support needed to carry out effective MPA monitoring—especially socioeconomic MPA monitoring efforts. This outreach effort tremendously helped address issues of trust, project intentions, incentives to participate, and use of collected data.

In addition to this MPA monitoring wide engagement, project leaders for this socio-economic report reached out to key fishing occupational community members while developing our specific project proposal to ensure their perspective was incorporated in our proposal. Project leaders also made sure that a Fisherman Advisory Council was in place to keep the fishing occupational community engaged and continually providing feedback to guide and inform the project from start to finish.

A key lesson learned is that implementing efforts to engage fishermen early on, acknowledging and addressing to the extent possible their concerns, and incorporating fishermen in the overall MPA monitoring process is key to building relationships grounded in trust between researchers and the fishing occupational community. Such relationships continue to generate benefits over time in relation to potential future studies once MPA effects have more time to be identified.

Engagement can be done by meaningfully incorporating fishermen into MPA monitoring planning efforts, as well as integrating FAC members in efforts such as project design, data review/analysis, and data dissemination. Such efforts are important to build trust and transparency as well as foster a sense of ownership and legitimacy over the data, information, and process by the fishermen whose livelihood may be affected.

15.2. Existing Data Gaps in Fisheries Data Collection

The California Department of Fish and Wildlife (CDFW) is mandated to gather commercial fisheries data and currently gathers this data through fish landing receipts and fishery logbook data. The data gathered through landing receipts and logbooks provide a wide array of data to inform long term MPA monitoring. As with all long term data collection efforts, tradeoffs must be considered of what data are feasible to gather and how changes in current data collection program affect comparability with previously gathered data.

Fisheries are complex and thus designing comprehensive and robust data collection efforts is a tremendous challenge. In the interest of improving fishery data collection efforts into the future, below we describe recommendations of how data gaps or additional data can be gathered to better inform long term MPA monitoring efforts.

15.2.1. Commercial Landings Receipts

Landing receipts or fish tickets are filled out by the fish buyer who purchases landed fish from a specific commercial fisherman and both the buyer and the fisherman keeps copies of the receipt while a copy is submitted to CDFW for entry into the commercial landings database. As data are provided at the individual fisherman level, these data records can be summarized to the statewide and landing port level for specific fisheries and across fisheries.
In general, the data available and data that may be derived from the commercial fisheries landings database include:

- Number of fishermen making landings in a given port or fishery;
- Pounds, price per pound, and ex-vessel revenue from fish caught;
- Share of an individual’s overall fishing revenue from a given fishery;

- Number of trips taken by individual fishermen for a given fishery and overall (derived from counting unique landing dates); and
- General location of fish caught (10 x 10 nautical mile fish block ID).
- This database also connects to the commercial fishing license database and the vessel registration database so that purchased permits and vessel information/characteristics can be connected to individual fishermen and their fish landings.

There are limitations to the CDFW commercial fisheries landings data, however, which could perhaps be improved upon to provide more robust data for long term MPA monitoring:

- Coarse resolution and inaccuracies in location of where fish are caught:
    - Fishing location information is recorded as a fish block location, which is 10 x 10 nautical mile in size and may be too coarse a resolution needed for effective fisheries management.
    - Only one fish block number may be entered into the fish landings receipts even if a fisherman may have fished in more than one fish block.
    - The fish buyers, whom may not have knowledge of where the fisherman was, are those who fill out the fish landing receipt. Some fish buyers may ask the fisherman where they fished but some may simply fill out an arbitrary fish block number, or leave it blank:
        - An analysis conducted by Ecotrust in 2004 comparing CDFW fish landings block data to that of spatial data collected and mapped through in-person interviews with commercial fishermen revealed large discrepancies in the location of Dungeness crab fishing grounds. CDFW landings data showed the majority of the Dungeness crab fishing grounds value as far offshore and in thousands of fathoms deep waters where fisherman cannot feasibly fish. This analysis revealed possible inaccuracies in fishing location data being recorded in landings receipts.
        - If fish location data were more accurate, summaries could be developed for specific spatial locations. For example, data may be summarized for specific MPAs or a National Marine Sanctuary by simply querying the fishing records that reference the fish blocks contained within a specific boundary. This type of analysis is useful to summarize socioeconomic fishing information to specific jurisdictional boundaries.
- Data do not contain homeport of fishing vessels but rather just the port where fish were landed:
    - This is an important data field to capture for economic analyses, as the economic value of fish landed may not be realized in the port in which fish are landed but rather by the homeport of the fisherman. This is especially true for fisheries such as the Dungeness crab, coastal pelagic, or market squid fisheries in which fishermen from out of state or from other regions of the state are making fish landings in a particular port.
- Delay in available data:
    - Landings receipts forms must be mailed and then manually scanned into the CDFW database. Finalized landings data are only available in June/July the next year, which is a significant delay.

15.2.2. Commercial Fishery Logbooks

Fisheries data is also gathered through commercial fishery logbooks. These logbooks are filled out by fishermen during fishing trips and must be submitted to CDFW each month and a copy of the logbook is kept by the individual fisherman for their records. To the best of our knowledge the fisheries that have commercial fishing logbooks are:

- Lobster–trap
- Spot prawn–trap
- Sea urchin–dive
- Sea cucumber–dive
- Edible seaweed–hand harvest
- Kelp harvest
- Shrimp/prawn–trawl (included pink shrimp, golden/ridgeback prawn, and sea cucumber)
- Live bait (coastal pelagics/market squid)
- Swordfish–harpoon
- Gill and trammel net fisheries (includes sharks, swordfish, white seabass, yellowtail, barracuda, and California halibut)
- Market squid–seine and brail
- California and Pacific halibut–trawl

The CDFW commercial fishing logbooks are different for each fishery but across logbooks there are data elements in common such as estimates in catch (either pounds/tons or number of fish/lobster caught) and the location of the catch (with either fish block number, nearest landmark, and/or latitude and longitude coordinates).

Because of these differences, comparisons across fisheries are difficult beyond simply location of catch and estimated amounts of fish caught. The following are the primary analyses that can be conducted using the CDFW commercial fisheries logbook data:

- Location and amount of fish caught:
  - Since fishermen themselves are filling out these logbooks the data collected on fishing location may be more accurate than the fishing locations indicated on fish landing receipts. Also, more than one fish block may be entered into a logbook, as location data is often collected per fishing event, which provide more accurate data than fishing landing receipts which allow for only one fish block to be indicated where fish were caught.
  - The amount of fish caught may also be summarized from logbook data however, the amount of fish caught may be better estimated in the fish landings receipt data as not all fishermen have the ability to weigh their catch on board their vessel.
- Fishing effort:
  - There are additional data collected in each logbook, which range from fishing depth, number of traps used, and hours fishing, amongst others. Some of this data may be used to calculate fishing effort such as the ratio of pounds caught to hours fishing/number of traps used, which is an important metric to monitor over time.

There are limitations of the CDFW commercial fishery logbook data, however, which perhaps could be improved upon to provide more robust data for long term MPA monitoring:

- Commercial fishing logbook data (that records the location of where fish were caught) often cannot be connected to commercial landings receipt data (how much fish were caught and what port the fish were landed in). Being able to connect these two important data points together would enable researchers/managers to know how much fish was caught in what ocean/coastal locations. This is important information to capture in particular for MPA monitoring, which relies on spatial data.

- Estimates of pounds of fish caught may not be accurate as the fishing landing receipt data, as fish may not be weighed until at time of landing/sale.
- Because of differences across logbooks (e.g. location data captured as GPS coordinates or as closest landmark) it makes it difficult to conduct any comparisons across fisheries using these data. Furthermore, not all state-managed fisheries have logbooks.
- Delay in available data. Logbook forms must be submitted each month and then manually entered into a database. Finalized logbook data are not typically available until several months after submission.

15.3. Suggestions for Distinguishing the Effects of an Aging Fleet and Small-Vessel Business Strategies on Fishing Occupational Communities, from those of MPAs in Long-Term Monitoring

Aging of the fleet – a trend increase in the age of fishery participants over time – has been identified by focus group participants as an issue of concern. Anecdotally, this phenomenon is linked to challenging conditions of entry for younger people into the commercial fishing industry linked to vessel and permit costs, possibly combined with highly variable and uncertain fishing income that may result in an unfavorable risk-adjusted return on investment. This economic environment may also favor a less capital-intensive, small-vessel business strategy. In the Dungeness crab fishery, for example, small-vessel operators may have a niche in servicing traps that are set and retrieved by larger vessels. Phenomena such as the declining number of commercial fishery participants (and resulting impacts on the entire fishing industry complex) may be both a consequence of regulations such as MPAs that attenuate fishing opportunities, and other underlying factors driving changes in the age composition and vessel size classes in the commercial fleet (which may also be influenced by MPA formation).

While this report was hampered by only a few post-MPA years with which to assess initial changes, long-term monitoring could generate a more robust time-series of data on important MPA and non-MPA factors outlined above that, statistically speaking, would provide an empirical basis from which to account for these multiple effects. Additionally, longer-term collection of qualitative data through focus groups or one-on-one interviews with fishermen could be helpful in term of tracking underlying causes for socioeconomic change in specific ports or regions. Fishermen can provide insights from their experiences to help understand why particular patterns are taking place.

15.4. Explore Factors that Affect Economic Well Being

In this report we largely utilize and aggregate individual commercial fishermen and CPFV operator data to develop port and region level analyses in order to examine historical trends, initial changes since MPA implementation, as well as establish a post MPA baseline data set.

A future recommendation we have is to conduct more advanced analyses using individual commercial fisherman and CPFV Operator data to explore typologies of fishermen/operators. Examples of typologies include specific attributes of fishermen/operators (e.g., fishermen who engaged in multi-fishery participation or direct sales of various kinds), and how these types of fishermen/operators are experiencing and coping with change over time. Specifically, some questions to explore include:

- What type of commercial fishermen/CPFV operators are doing better or worse over time?

- What attributes do these fishermen/operators that are doing better or worse have in common—what do they fish for, have they diversified their fishery profile, how much do they fish, and what ports are they from? See preliminary results on multi-fishery participation as a coping strategy in Hackett et al. (2015).
- What type of fishermen/operators have dropped out of fishing over time and why?

We know that the effects of economic change do not unfold evenly across fishermen/operators—some people are more or less able to cope with change depending on their adaptive capacity. The questions above help explore the attributes that may help us better understand what types of people are successfully coping with change and why they are successful. Understanding this can lead to identifying target areas in which to focus policy efforts that help commercial fishermen and CPFV operators cope with economic change, such as the change that follows MPA establishment, in order to better maintain viable livelihoods.

15.5. A Deeper Understanding of the Commercial and CPFV Fishing Industry Complex

There are a variety of other ways that MPAs may affect communities that a broader baseline characterization along with long-term monitoring should address. One of these has to do with ownership transitions. A fishing business, like other small businesses, usually starts out as a family business. Over time, with deaths and retirements, ownership of vessels and related permits transition to new generations or leave family ownership. As noted above, high entry costs or fewer fishing opportunities linked to MPAs may make it difficult for local young people to enter. This process can result in changes such as concentration of fishing effort in the hands of fewer participants, and spatial shifts in effort or in home port locations. Community quota and similar arrangements may help retain local fishing fleet activity over time. A baseline study of family ownership and transitional dynamics in the broader context of adaptation to MPAs would elucidate how these processes affect local fishing occupational communities.

There are a number of businesses that are either supported by, or provide support to, commercial and CPFV fishing activities. Substantial changes in fish landings and revenue has the potential to affect the entire industry complex. If any support businesses were to experience declines or closures, these effects could ripple through the community. Members of the “upstream” commercial and CPFV industry complex include gear and bait shops, ice producers, boat maintenance and repair businesses (and facilities), marina (docking) services, and fuel services, while “downstream” elements include fish buyers, processors, wholesalers, markets, and restaurants (Hackett, 2002; Hackett et al., 2003; Hackett et al., 2004; Hackett et al., 2009). The economics of overall port infrastructure (such as channel dredging) managed by local Harbor Districts is also linked to commercial and CPFV fishing activity. Moreover, by way of economic impact assessment one can model how the fishing industry complex in turn results in induced effects on jobs and income in the broader regional economy (Hackett et al., 2009).

There is thus a closed-loop relationship between the fishing industry, various support industries, marina facilities, the broader port infrastructure, and ultimately the regional economy. In this report we have documented a decline in the size of the commercial fleet in North Coast ports. It is important to note that the scale of commercial and CPFV fishing matters, in that there is a threshold beyond which any further declines result in support businesses and even marina services in a port becoming no longer economically viable. As this is a closed-loop relationship, loss of fishing support services is a part of a downward spiral dynamic in which further commercial and possibly CPFV fishing eventually becomes non-viable.

A broader baseline characterization along with long-term monitoring should therefore include the status of the broader fishing industry complex in North Coast ports. This effort could include the gathering of data about the number, types, and economic status of fishing support industries and infrastructure. As a component of a more holistic focus on the fishing industry complex, it will eventually be important to update the economic impact models developed by Hackett et al. (2009), and to include CPFV and recreational fishing. Doing so would ensure an ongoing capacity for gauging the economic impact of policy changes that impact fishing in the North Coast region.

15.6. Other Communities and Sectors of Interest for Long-Term Socioeconomic Monitoring

Due to resource constraints, this study focused on two key stakeholder groups likely to be affected by MPA implementation – commercial fishermen targeting fisheries in state waters possibly subject to displacement by MPAs, and CPFV operators. There are other stakeholder groups who could be affected by MPA implementation and with further funding and time, efforts could be developed to monitor these users and their potential impacts from MPAs. Several uses that could be important to incorporate in future monitoring include recreational fishing and subsistence fishing.

There is an active recreational fishing community in the North Coast that includes off-shore fishermen who utilize larger motorized vessels, as well as coastal recreationalists using skiffs, canoes, kayaks, and even surf boards to harvest marine resources for sport. In addition, there is an active beach-fishing community in the North Coast that targets nearshore species such as surf perch. These groups of fishermen could be affected negatively or positively by MPA implementation – particularly MPAs close to the shore. Future monitoring could seek to understand the types of marine recreational fishing that take place in the region as well as document the potential effects of MPAs on these uses.

While non-commercial tribal use is an important category that includes subsistence fishing (addressed in a separate MPA baseline study), there is also anecdotal evidence of subsistence fishing taking place among non-tribal members living on the coast as well. Future monitoring efforts could work to document the type and extent of subsistence fishing on the North coast. The proponents of this study are not aware of any previous studies that have documented marine subsistence fishing activities in the region.

Lastly, thanks to reviewer comments, the project team identified a gap in terms of understanding the racial, ethnic, and socioeconomic status of operators in the North Coast commercial and CPFV fleets. Our survey did not include such questions, and the project team could not identify any existing data sources or studies for North Coast fishing occupational communities. Such an effort would be a valuable component of future monitoring activities.

15.7. Advance Digital Fisheries Data Collection Systems

MPA managers are tasked with using ecosystem-based and adaptive management measures to maximize the ecological and economic benefits of MPA to coastal communities into the future. To do so, requires cost-effective and innovative approaches to collecting robust, fine-scale, and spatially explicit socioeconomic fisheries data that will better enable MPA managers to design, monitor, and adapt MPAs to effectively reach stated goals and objectives.

Current socioeconomic data on state-managed fisheries is fragmented and incomplete which limits the ability of managers to provide a comprehensive understanding of the historical, current, and potential future state of fisheries that surround MPAs. This understanding is necessary so that MPA managers can better develop effective management plans that minimize socioeconomic costs to fisherman livelihoods.

Overall, there is great need to collect economic data across all fishing sectors and to conduct regular collection of economic data to continually inform MPA management efforts. Furthermore, significant improvements to spatially referenced catch and effort data can be made to address the limitations highlighted in this report and promote the comparability and utility of existing socioeconomic fisheries data.

Indeed, there is great need to advance current data collection programs toward more streamlined and cost-effective solutions. A promising direction in fisheries data collection is the use of mobile digital data collection technology. Fisheries across the globe are piloting digital logbooks or digital data collection applications using GPS enabled mobile phones or tablet devices. Through these mobile data collection applications, spatial fishing data can automatically be captured using a mobile phone or tablet's GPS unit and associated fishing trip characteristics and economic information may also be digitally captured. This data may then be uploaded to a data server via a cellular data connection after each fishing trip—making data available in near real-time to fisheries managers and fishermen themselves. This type of technology would enable fisheries managers to closely and actively monitor and manage fisheries performance and effectively implement adaptive management approaches.

In California, digital fisheries data collection technology would benefit both long-term MPA monitoring as well as fisheries management. Both initiatives require cost-effective technology solutions that tighten the feedback loop between data collection and data analysis needed to support adaptive management measures. Together this would better enable innovative management approaches to be piloted, tested, and refined to advance the way we manage fisheries so that management costs are lowered, fish stocks are sustainable, and economic benefits to fishing communities are maximized.

Modernizing fisheries data collection programs will not only streamline data collection and delivery but also allow MPA and fishery managers to quickly update data collection forms to respond to changing information needs and emerging uses. Digital data collection allows for the flexibility needed to develop, test, and refine fisheries data collection programs that can be integrated across fishing sectors as well as with biological and ecological data. This ability to quickly and iteratively adapt data collection programs will be key to developing the robust socioeconomic fisheries data needed to explore bio-economic linkages and dynamics that are foundational to ecosystem-based and adaptive management approaches.

15.8. Recommendations of Key Fisheries Monitoring Metrics

On the following page, encapsulated in Table 154 and Table 155, are our recommendations for key metrics for long-term monitoring of the commercial fishing and CPFV sectors. To inform the existing monitoring plan structure we included the key monitoring metrics recommended for consumptive uses detailed in the North Coast MPA monitoring plan and added additional metrics with an associated rationale.

Table 154. Recommendations for key monitoring metrics in the commercial fishing sector

Metric	Purpose	Source
Price per pound, total landings, total revenue	Monitor key commercial fishing metrics. This data may be analyzed at the port, region, and state scales so that nested trend comparisons may be made.	CDFW commercial landings data
Operating costs (average yearly percentages); fishing industry complex	Monitor changing vessel operating costs such as ice, bait, fuel, labor, repair, marina services over time. From this information changes in net revenue for individual fishermen may be calculated. Operating cost percentages can be used to construct new multipliers to estimate economic impacts related to commercial fishing. It is recommended that operating costs be collected at the fishery and vessel configuration level. Also gather count information on components of the local fishing industry complex (ice, bait, fuel, repair, marina service, and buyer/processor businesses) at the port level and link to changes in the commercial fleet.	Survey data
Total number of fishermen landing in key fisheries	Monitor how many fishermen are participating in key fisheries each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CDFW commercial landings data
Total number of trips in key fisheries	Monitor how many total trips fishermen are taking in key fisheries each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CDFW commercial landings data
Landings (pounds and ex-vessel revenue) and trips per fisherman	Monitor how landings (pounds and revenue) and fishing effort may be changing at the individual fisherman level for key fisheries	CDFW commercial landings data
Spatial value of fishing areas	Monitor changes in how coastal/ocean areas are being utilized and valued by fishermen. Data may be analyzed with previous spatial data sets to determine spatial shifts in the value of fishing areas for key fisheries	CDFW commercial landings data
Catch per unit effort (CPUE)	Monitor a key productivity metric. This data may be calculated by examining pounds/ex-vessel revenue per trip for key fisheries.	CDFW commercial landings data
Race, ethnicity, and socioeconomic status of fishermen	These metrics have not been gathered on fishery participants in the past, and provide important demographic information.	Survey data/focus groups
Average share of fishing revenue from key fisheries; multi-fishery participation	Monitor changes in income generated by fishery, and track the number of targeted fisheries fishermen participate in. Multi-fishery participation has been identified as a key coping mechanism to address variability and attenuation in fishing opportunities.	CDFW commercial landings data
Attitudes and perceptions	Monitor and collect contextual information that may help identify key fishery issues and factors driving the change observed in the metrics listed above.	Survey data/focus groups
Key non-MPA factors driving change	Understanding factors driving key changes in the commercial fleet such as the “aging of the fleet,” issues of family fishing business transition and inheritance, and conditions of entry for young people.	Survey data/focus groups

Table 155. Recommendations for key monitoring metrics in the CPFV sector

Metric	Purpose	Source
Landings (number of fish caught)	Monitor how many fish are being caught in key CPFV fisheries. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Average annual gross revenue from CPFV operations	Monitor how gross revenue levels may be changing over time.	Survey data
Average share of revenue from key fisheries/activities	Monitor changes in the average proportion of CPFV operator gross revenue relies upon a specific fishery/activity.	Survey data
Operating costs (average yearly percentages)	Monitor how operating costs may be changing over time. This may be increases/decreases in fuel costs, equipment costs, maintenance costs, crew costs, etc. From this information changes in net revenue for individual CPFV operators may be calculated. These operating cost percentages may also be used to help estimate secondary economic effects upon CPFV support industries.	Survey data
Total number of CPFV vessels operating	Monitor how many vessels are operating, each year. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Total number of CPFV fishing trips	Monitor changes in the number of CPFV fishing trips that are being conducted each year as this is an indicator of economic conditions. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Total number of anglers	Monitor how many anglers are taking CPFV trips each year as this is an indicator of economic conditions. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Catch per unit effort (CPUE)	Monitor the average amount of fish caught per unit of effort. This metric is useful in helping determine changes in fish abundance or the success of fishing trips which is related to customer satisfaction. This metric may be calculated by dividing the number of fish caught (landings) by the number of trips or the number of anglers.	CPFV logbook data
Number of anglers per trip	Monitor the average number of anglers participating in each CPFV fishing trip as this is an indicator of economic conditions. This metric may be calculated by dividing the total number of anglers by the total number of trips. This data may be analyzed at the port, region, and state scales so that nested comparisons may be made of trends over time.	CPFV logbook data
Spatial value of fishing area	Monitor changes in how coastal/ocean areas are being utilized and valued by CPFV operators. Data may be analyzed with previous spatial data sets to determine spatial shifts in the value of fishing areas for key fisheries	Survey data
Attitudes and perceptions	Monitor and collect contextual information that may help identify key CPFV issues and factors driving the change observed in the metrics listed above.	Survey data/focus groups
Job satisfaction/ Well-being/ Quality of life	These social metrics are important to monitor as economic metrics may not reveal changes in personal well-being. For example, a fisherman may be making the same amount of revenue from one year to the next, but his/her quality of life may decline in increased work hours or travel time in order to do so.	Survey data/focus groups

16. CONCLUSION

The intention of this report was to provide information on the historical trends, initial changes since MPA implementation, and a post MPA baseline characterization and description of key commercial and CPFV fisheries and ports in the California North Coast region. It should be noted that in this report we do not account for the formal economic impacts of changes in fishing revenue and how that may affect support industries such as fish processors/buyers, port workers, or crew that benefits and may rely on the business of commercial fishermen and CPFV operators. Indeed, these industries are vital to the success and health of fishing communities and are important to account for in future monitoring efforts.

Our findings indicate relatively little empirical evidence of substantial adverse effects on commercial and CPFV fishermen from MPA formation in the North Coast region, with the caveat that only a brief post-MPA period of analysis was available for this report. We also find a general perception among fishermen of modest effects from MPA formation, due in part to fishermen being able to contribute to the MPA formation process. As 2013 was a peak ex-vessel revenue year, it is possible that fishermen's attitudes about MPAs and perceptions of management would be less positive in more economically “normal” years.

Participants in this study report displacement of commercial fishing primarily for a few MPAs (Ten Mile SMR, Ten Mile Beach SMCA, Reading Rock SMR, and Pyramid Point SMCA). CPFV operators participating in this study indicate displacement from some favorable fishing grounds for rockfish due to MPA formation. Focus group participants indicate concern about the cumulative effects of regulations on fishing opportunities, and about opportunities for young people. Declining numbers of vessels and fishermen is seen as having an adverse effect on port infrastructure, markets, and the overall vitality of the industry.

We must offer the additional caveat that it is difficult to draw empirically-based conclusions regarding the causal effects of MPAs on fishing communities. Drawing out such effects from the data is confounded by a multitude of factors such as other regulatory constraints (e.g., fisheries management policies such as area based closures, quota limits, and limited entry fisheries), fish market variability, macroeconomic conditions, environmental variability/change, and increasing competition for marine space.

Advancing our understanding of how humans utilize, value, and rely upon marine space, however, will be critical to unraveling these interconnections as well as to monitor how MPAs are affecting fishing communities into the future. This information may then be used in adaptive management measures to improve the performance of MPAs towards meeting ecological and socioeconomic goals.

Similarly, it is our hope that the data collected/compiled and lessons learned through this project will be applied to future MPA monitoring efforts to improve how we gather socioeconomic fisheries data and build a time series data set on how human uses and the socioeconomic health of fishing communities are changing over time. Such a robust and longitudinal dataset that provides both socioeconomic characterization and spatial fishing patterns on consumptive human uses could be used for a wide array of marine planning application including the monitoring of MPAs.

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APPENDIX A – SURVEY QUESTIONS

<u>COMMERCIAL FISHING SURVEY</u>

<u>User Group</u><u>: (may select only one)</u>

- Fisherman
- Owner only

Basic Information

1. Location or port of interview
2. First Name
3. Last Name
4. L Number
5. Age
6. Gender
7. Mailing address
8. City
9. State
10. Zip Code
11. Phone
12. Email

<u>Commercial Fisherman Survey</u>
(Hired Captain, Captain/Owner, or Walk-on Diver Survey Question)

Basic Fishing Information

1. In 2013 were you a 1) hired captain, an 2) owner and captain, or a 3) walk-on diver
2. Years of experience commercial fishing as a captain or walk-on diver
3. Percentage of personal income from commercial fishing in California in 2013
4. How has the percentage of your personal income from fishing changed since 2009? <select one from drop down>
    a. Significantly Higher
    b. Somewhat Higher
    c. No Change
    d. Somewhat Lower
    e. Significantly Lower
5. What factors have **<u>most</u>** affected changes in the percent of your personal income from fishing since 2009? <check box-can check more than one>
    a. Changes in the market/economy
    b. Changes in fish abundance/presence
    c. Changes in regulations
    d. Personal reasons

    Other <fill in>

    Explanation <Area box>
6. Other sources of income/employment in 2013 (this includes salmon disaster money) <text box using dashes to separate text>
7. Home port in 2013 (answer required to progress)
8. Homeport in 2009

9. If there is a difference between 2013 and 2009 – Cause of change
10. Number of vessels currently owned/operated in 2013
11. Name of each vessel
12. Vessel length (ft) – of each vessel
13. Vessel motor (hp) – of each vessel

Custom Matrix: Questions 11-13 will be a matrix of 3x3 in which each row is a question and then information for up to 3 vessels may be entered

14. Percentage of total gross fishing revenue used for overall operating costs (California fishing only) (2013)
15. 15. For Urchin Walk-on Divers Only: Percentage of total gross fishing revenue given to boat operating costs (2013)
16. How important is participation in multiple fisheries (rather than a single fishery) as an economic strategy for coping with commercial fishing regulations that reduce fishing opportunities? SCALE 1-5 Very important, important, neither important nor unimportant, unimportant, very unimportant.
17. If you answered "very important" or "important" to question 16 above, then that was because participation in multiple fisheries (select all that are relevant):
    a. increases my annual commercial fishing income.
    b. stabilizes year-to-year variation in my commercial fishing income.
    c. more completely utilizes my vessel, gear, and other capital equipment.
    d. Other _______________.
18. In the past five years what strategies have you used to market your catch? Select all that apply.
    a. Sell to traditional processor
    b. Sell to live fish buyers
    c. Sell to other wholesalers/middlemen (excluding traditional processors)
    d. Sell off own vessel
    e. Sell at farmers market or street fairs
    f. Sell directly to restaurants
    g. Sell directly to retailers
    h. Sell directly to pre-arranged individual customers
    i. Sell at a fish cooperative
    j. Other ___________________________________
19. Notes

Select Fishery:

20. Please select **<u>all</u>** fisheries that the fisherman targeted last year (2013) <checkbox>: **IN BOLD ARE FISHERIES TO MAP**

Fishery	**Gear Type**
Dungeness Crab	**Trap**
Nearshore Finfish Dead	**Hook and Line**
Nearshore Finfish Live	**Hook and Line**
Nearshore Finfish Live	**Longline**
Nearshore Finfish Live	**Trap**
Nerashore Finfish Dead	**Longline**
Urchin	**Dive**
Salmon	**Troll**

Fishery Specific Questions:

21. Number of crew for this fishery (not including themselves or a captain) in 2013.
22. Percentage of fishery specific gross fishing revenue used for fuel (2013)
23. Percentage of fishery specific gross fishing revenue used for crew or labor (including hired captain) (2013)
24. Years participating in this fishery
25. LOBSTER, CRAB & NEARSHORE: Number of traps used for this fishery in 2013
26. Number of days fishing in this fishery in 2013
27. Have the MPAs directly impacted your fishing? (yes/no)
28. If yes, please select ways the fisherman was affected <may check more than one>
    a. Cannot fish in or go to traditional grounds/areas
    b. Need to travel longer distances to fish in other areas
    c. Shifted fishing effort into areas in which weather is less predictable
    d. Moved homeport location or fish out of another port
    e. Other ways directly/indirectly impacted by MPAs. <fill in>
29. If yes, what MPAs have affected you in this fishery:
    a. Use list from the current tool.
30. Are there any specific MPAs that have significantly impacted you in a particular way?
    b. Have2X3 grid, with column one as an area box "MPA" column two check boxes with type of effects, and column three a text box for other effects. Two rows for responses.
31. How would you compare your success in last year's fishery (2013) to the past ten years?
    a. Significantly worse
    b. Somewhat worse
    c. The same
    d. Somewhat better
    e. Significantly better
    f. I did not participate in this fishery in previous seasons
32. Over the past 10 years would you say that your opportunities in this fishery have
    a. Significantly Declined
    b. Declined
    c. Stayed the Same
    d. Improved
    e. Significantly Improved
    f. Don't know
33. Over the past 10 years would you say that the population size of this marine resource has:
    a. Significantly Declined
    b. Declined
    c. Stayed the Same
    d. Improved
    e. Significantly Improved
    f. Don't know
34. What factor(s) do you believe are the biggest threats to the overall health of this resource? Check up to three
    a. Water pollution
    b. Land based development
    c. Increase in marine predators
    d. Over fishing
    e. Ocean Acidification
    f. Land based development

g. Ocean energy development
h. Military testing
i. Poor resource management
j. Other ___________________________________

35. What affect do you think the North Coast MPA network will have on the health of this resource?:
    a. Positive
    b. Neutral
    c. Negative
    d. Don't know

Drawing Portion:

36. Select a fishery
37. Draw a polygon around each of the activity areas as directed by the respondent's specifications
38. Indicated the number of days visited each fishery/activity area
39. input polygon notes such as depth ranges
40. Why is this an important fishing area to you? <box for answer>
41. Weight the activity area polygons – *Rank the importance of each activity area. This is done through the allocation of 100 points distributed over the activity areas by the respondent. (For example, a respondent could have one shape with a value of 100 or 100 areas with a value of one each.)*

Perceptions of Management:

42. What was your level of involvement in the North Coast MPA planning process?
    a. None
    b. Shared concerns with someone who was involved in the process
    c. Attended public meetings but did not make comments
    d. Attended public meetings and made comments
    e. Was a representative on one of the stakeholder groups
    f. Other – fill in box
43. Overall approximately how much time did you spend on involvement in the MPA process?
    XX days
44. How satisfied are/were you with:
    a. The inclusion of local input in the North Coast MPA planning process
    b. The location of the North Coast MPA network
    c. The overall North Coast MPA planning process
        i. Strongly satisfied
        ii. Satisfied
        iii. Neutral
        iv. Dissatisfied
        v. Strongly Dissatisfied
45. How would you rate the level of conflict over the establishment of the MPA Network?
    a. None
    b. Minor
    c. Serious
    d. Very serious
46. Rate your level of agreement with the following statements
    a. The North Coast MPA network will improve overall ocean health

b. Overtime, the North Coast MPA network will improve my net income from fishing
c. Before the MPAs, enough was being done to protect and enhance marine environments already
d. I trust the California Ocean Protection Council
e. I trust the Marine Life Protection Act Initiative
f. I trust the California Department of Fish and Wildlife
g. I trust the Pacific Fisheries Management Council
h. I trust the Pacific States Marine Fisheries Commission
i. I trust university researchers
j. I trust other North Coast fishermen
    i. Strongly disagree
    ii. Disagree
    iii. Neutral
    iv. Agree
    v. Strongly Disagree
    vi. Don't know who/what they are

47. How you rank your access to quality information about fishing regulations?
    a. No access
    b. Weak Access
    c. Moderate Access
    d. Strong Access
48. Generally where do you get your information about regulations and updates related to the North Coast fisheries?
    a. Word of mouth
    b. Internet
    c. Newspaper
    d. Department of Fish and Game/Wildlife
    e. Gear shops
    f. Harbor Office
    g. Fishermen's Organization (such as a marketing association)
    h. Fish checker/observer
    i. Other _________________________
49. What would be the best way for managers or scientists to communicate information about the North Coast fisheries to you? Choose up to three
    a. Internet
    b. Email list-serve
    c. Through fish checkers/observers who are on the docks
    d. Place at Department of Fish and Game/Wildlife Offices
    e. Place at Harbor offices
    f. Place at gear shops
    g. Place at fuel docks
    h. Provide information with your fishing license/stamp
    i. Allow for uploading regulatory boundaries and information into your plotter/navigation system.
    j. Through fishermen's organizations: Please Specify ________________
    k. Other______________________________

<u>Commercial Owner Only Survey Questions</u>

(This is only for those who do not captain their boat and thus should not map but know the economic information for a boat)

Basic Fishing Information

1. Years of experience owning a commercial fishing vessel
2. Percentage of personal income from commercial fishing in California in 2013
3. How has the percentage of your personal income from fishing changed since 2009? <select one from drop down>
    a. Significantly Higher
    b. Somewhat Higher
    c. No Change
    d. Somewhat Lower
    e. Significantly Lower
4. What factors have **<u>most</u>** affected changes in the percent of your personal income from fishing since 2009? <check box-check more than one>
    a. Changes in the market/economy
    b. Changes in fish abundance/presence
    c. Changes in regulations
    d. Personal reasons
    e. Other <fill in>

    Explanation <Area box>
5. Other sources of income/employment in 2013 (this includes salmon disaster money) [separate with DASHES] <text box using dashes to separate text>
6. Number of vessels owned in 2013
7. Name of each vessel
8. Captain of each vessel
9. Federal vessel ID of each vessel
10. State ID of each vessel
11. Vessel length (ft) – of each vessel
12. Vessel motor (hp) – of each vessel

Custom Matrix: Questions 7-12 will be a matrix of 6x3 in which each row is a question and then information for up to 3 vessels may be entered (same matrix as in the operator survey)

13. Percentage of total gross fishing revenue used for fuel (2013) (California only)
14. Percentage of total gross fishing revenue used for crew or labor (including hired captain) (2013) (California only)
15. Percentage of total gross fishing revenue used for all other operating costs (2013) (California only)

    Notes:

CPFV FISHING SURVEY

Survey Questions for CPFV Consumptive and Non-Consumptive

User Group:
- **Owner Only**
- **Operator or Operator/Owner**

Basic Contact/Demographic Information
1. Location or port of interview
2. First Name
3. Last Name
4. Mailing address
5. City
6. State
7. Zip Code
8. Phone
9. Email
10. Age
11. Gender

Commercial Passenger Fishing Vessel
Operator or Operator/Owner Questions

Basic Information
1. In 2013 were you a hired captain or an owner and captain?
2. Number of CPFV boats owned/operated in 2013
3. Vessel name(s) [separate with DASHES] <can be one field separated by dashes>
4. Vessel length(s) [separate with DASHES] <can be just one field separated by dashes and in the same sequence as vessel name>
5. Vessel(s) passenger capacity [separate with DASHES]

CUSTOM MATRIX: For Questions 3-5 a 4x3 matrix with columns for each question and then up to 3 vessel's information

6. Home port in 2013
7. Home port in 2009
8. If there is a difference between 2013 and 2009 – Cause of change
9. Number of years owning CPFV boats
10. Number of years operating CPFV boats
11. Percentage of personal income from owning/operating CPFV boats in 2013
12. How has the percentage of your personal income from owning/operating CPFV boats changed since 2009? <select one from drop down>
    a. Significantly Higher
    b. Somewhat Higher
    c. No Change
    d. Somewhat Lower
    e. Significantly Lower
13. What factors have **most** affected changes in the percent of your personal income from CPFV ownership/operation since 2009? <check box-can check more than one>

a. Changes in the market/economy
b. Changes in fish abundance/presence
c. Changes in regulations
d. Personal reasons
e. Other
    i. Box for notes – Additional information:

14. Other sources of income/employment in 2013 [separate with DASHES] <can be one field separated by dashes>
15. Annual total gross revenue for CPFV operations 2013
16. Percentage of total gross revenue for fuel (2013)
17. Percentage of total gross revenue used for crew/labor (including a hired captain) (2013)
18. Percentage of total gross revenue used for all other operating costs (2013)
19. Average number of passengers on a **consumptive** CPFV trip in 2013:
20. Average price per passenger for **consumptive** CPFV trips in 2013:
21. Number of **consumptive** CPFV trips taken in 2013:
22. How has the number of consumptive CPFV trips changed since 2009? <select one from drop down>
    a. Significantly Higher
    b. Somewhat Higher
    c. No Change
    d. Somewhat Lower
    e. Significantly Lower
23. What factors have **<u>most</u>** affected the change in the number of consumptive CPFV trips since 2009? <check box-can check more than one>
    a. Answer box
24. Average number of crew used per **consumptive** trip (not including hired captain) in 2013:
25. Average number of passengers on a **non-consumptive** CPFV trip in 2013:
26. Average price per passenger for **non-consumptive** CPFV trips in 2013:
27. Number of **non-consumptive** CPFV trips taken in 2013:
28. How has the number of non-consumptive CPFV trips changed since 2009? <select one from drop down>
    a. Significantly Higher
    b. Somewhat Higher
    c. No Change
    d. Somewhat Lower
    e. Significantly Lower
29. What factors have **<u>most</u>** affected the change in the number of non-consumptive CPFV trips since 2009? <check box-can check more than one>
    a. Answer box
30. Average number of crew used per **non-consumptive** trip (not including hired captain) in 2013:

Notes:

Select Fishery/Activity (in BOLD are the fisheries to map)
NOTE: This is a list of fisheries across all of CALIFORNIA not just Southern California
Please select **<u>all</u>** of the fisheries/activities in which the operator participated in last year (2013) <checkbox>:

Names	Fishery/Activity
California Halibut	Fishery

Dungeness Crab	Fishery
Humboldt Squid	Fishery
Pacific Halibut	Fishery
Rockfish/Lingcod	Fishery
Salmon	Fishery
Tuna and Dorado	Fishery
Marine Mammal Viewing	Activity
Whale Watching	Activity

Fishery/Activity Specific Questions

31. Number of days last season (2013) fishing for this species or operating this type of activity
32. Have the MPAs directly impacted your fishing? (yes/no)
33. If yes, please select ways the fisherman was affected <may check more than one>
    a. Cannot fish in or go to traditional grounds/areas
    b. Need to travel longer distances to fish in other areas
    c. Shifted fishing effort into areas in which weather is less predictable
    d. Moved homeport location or fish out of another port
    e. Other ways directly/indirectly impacted by MPAs. <fill in>
34. If yes, select the MPAs which have affected this fishery/activity:
    a. Use list from the current tool.
35. Are there any specific MPAs that have significantly impacted you?
    a. Have2X3 grid, with column one as a scrolling list of MPAs (multiple selection at a time with control key), column two check boxes with type of effects, and column three a text box for other effects. Two rows for responses.
36. How would you compare your success in last year's fishery/activity (2013) to the past ten years?
    a. Significantly worse
    b. Somewhat worse
    c. The same
    d. Somewhat better
    e. Significantly better
    f. I did not participate in this fishery/activity in previous seasons
37. Over the past 10 years would you say that your opportunities in this fishery have
    a. Significantly Declined
    b. Declined
    c. Stayed the Same
    d. Improved
    e. Significantly Improved
    f. Don't know
38. Over the past 10 years would you say that the population size of this marine resource has:
    a. Significantly Declined
    b. Declined
    c. Stayed the Same
    d. Improved
    e. Significantly Improved
    f. Don't know

39. What factor(s) do you believe are the biggest threats to the overall health of this resource? Check up to three
    a. Water pollution
    b. Land based development
    c. Increase in marine predators
    d. Over fishing
    e. Ocean Acidification
    f. Land based development
    g. Ocean energy development
    h. Military testing
    i. Poor resource management
    j. Other ___________________________________
40. What affect do you think the North Coast MPA network will have on the health of this resource?:
    a. Positive
    b. Neutral
    c. Negative
    d. Don't know
41. Percentage of gross revenue from this activity/fishery for 2013. *Must add up to 100% across all fisheries/activities.*

Drawing Portion

42. Select a fishery/activity
43. Draw a polygon around each of the activity areas as directed by the respondent's specifications
44. Indicated the number of days visited each fishery/activity area
45. input polygon notes such as depth ranges
46. Why is this an important fishing area to you? <box for answer>
47. Weight the activity area polygons – *Rank the importance of each activity area. This is done through the allocation of 100 points distributed over the activity areas by the respondent. (For example, a respondent could have one shape with a value of 100 or 100 areas with a value of one each.)*

Perceptions of Management:

50. What was your level of involvement in the North Coast MPA planning process?
    a. None
    b. Shared concerns with someone who was involved in the process
    c. Attended public meetings but did not make comments
    d. Attended public meetings and made comments
    e. Was a representative on one of the stakeholder groups
    f. Other – fill in box
51. Overall approximately how much time did you spend on involvement in the MPA process?
    XX days
52. How satisfied are/were you with:
    a. The inclusion of local input in the North Coast MPA planning process
    b. The location of the North Coast MPA network
    c. The overall North Coast MPA planning process
        i. Strongly satisfied
        ii. Satisfied

    iii. Neutral
    iv. Dissatisfied
    v. Strongly Dissatisfied

53. How would you rate the level of conflict over the establishment of the MPA Network?
    a. None
    b. Minor
    c. Serious
    d. Very serious
54. Rate your level of agreement with the following statements
    a. The North Coast MPA network will improve overall ocean health
    b. Overtime, the North Coast MPA network will improve my net income from fishing
    c. Before the MPAs, enough was being done to protect and enhance marine environments already
    d. I trust the California Ocean Protection Council
    e. I trust the Marine Life Protection Act Initiative
    f. I trust the California Department of Fish and Wildlife
    g. I trust the Pacific Fisheries Management Council
    h. I trust the Pacific States Marine Fisheries Commission
    i. I trust university researchers
    j. I trust other North Coast fishermen
        i. Strongly disagree
        ii. Disagree
        iii. Neutral
        iv. Agree
        v. Strongly Disagree
        vi. Don’t know who/what they are
55. How you rank your access to quality information about fishing regulations?
    a. No access
    b. Weak Access
    c. Moderate Access
    d. Strong Access
56. Generally where do you get your information about regulations and updates related to the North Coast fisheries?
    a. Word of mouth
    b. Internet
    c. Newspaper
    d. Department of Fish and Game/Wildlife
    e. Gear shops
    f. Harbor Office
    g. Fishermen’s Organization (such as a marketing association)
    h. Fish checker/observer
    i. Other ___________________________
57. What would be the best way for managers or scientists to communicate information about the North Coast fisheries to you? Choose up to three
    a. Internet
    b. Email list-serve
    c. Through fish checkers/observers who are on the docks
    d. Place at Department of Fish and Game/Wildlife Offices
    e. Place at Harbor offices
    f. Place at gear shops
    g. Place at fuel docks

h. Provide information with your fishing license/stamp
i. Allow for uploading regulatory boundaries and information into your plotter/navigation system.
j. Through fishermen's organizations: Please Specify _________________
k. Other________________________________

Commercial Passenger Fishing Vessel
Owner Only Questions
(This is only for fishermen who do not captain their boat and thus should not map but know the economic information for a boat or overall socioeconomic status of the business)

1. Number of CPFV boats owned in 2013
2. Number of years owning CPFV boats
3. Percentage of personal income from CPFV boat ownership in 2013
4. How has the percentage of your personal income from CPFV boat ownership changed since 2009? <select one from drop down>
   a. Significantly Higher
   b. Somewhat Higher
   c. No Change
   d. Somewhat Lower
   e. Significantly Lower
5. What factors have **most** affected changes in the percent of your personal income from CPFV ownership/operation since 2009? <check box-can check more than one>
   a. Changes in the market/economy
   b. Changes in fish abundance/presence
   c. Changes in regulations
   d. Personal reasons
   e. Other <fill in>
   Explanation <Area box>
6. Homeport in 2013
7. Homeport in 2009
8. If there is a difference between 2013 and 2009 – Cause of change
9. Other sources of income/employment in 2013 [Separate using DASHES] <textbox>
10. Annual total gross revenue from CPFV operations for 2013
11. Vessel name(s)
12. Names of the captains who operated owner's boats in 2013
13. 2013 GER from each vessel
14. Percentage of total gross revenue for fuel (2013)
15. Percentage of total gross revenue used for crew/labor (including a hired captain) (2013)
16. Percentage of total gross revenue used for all other operating costs (2013)

CUSTOM MATRIX: Questions 11-16 will be a 7x4 matrix in which each row is for a vessel and then each column is: vessel name, percent GER for fuel in 2013, percent GER for crew/labor, and percent of GER for all other operating costs

17. How would you compare your success with last year's CPFV business (2013) to past years (in the last ten years)?
   a. Significantly worse
   b. Somewhat worse
   c. The same
   d. Somewhat better
   e. Significantly better

18. What primary factors affected the success of your CPFV business last year (2013)? <fill in text box)
19. How have recently implemented MPAs impacted your CPFV business? <fill in text box>
20. Notes

APPENDIX B – COMMERCIAL AND CPFV MAP PRODUCTS

Please see the separate map appendix PDF files.