SOCIO-ECONOMICS OF THE MOSS LANDING COMMERCIAL FISHING INDUSTRY

Report to the Monterey County Office of Economic Development

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SOCIO-ECONOMICS OF THE MOSS LANDING COMMERCIAL FISHING INDUSTRY

Executive Summary

Caroline Pomeroy and Michael Dalton
June 2003

Moss Landing Harbor (MLH) is among the most important commercial fishing ports in California. It recently ranked third in the state in terms of pounds landed and fourth in ex-vessel revenues. The Moss Landing community relies on commercial fishing as a major source of income. Over the past several years, the commercial fishing industry and community at MLH have undergone important changes. In response, the Monterey County Office of Economic Development (OED) contracted us to conduct a study of the socio-economics of the commercial fishing industry at MLH. The over-arching goal of the study was to document its social and economic value and the issues, needs and concerns of its participants to better inform County decision-making about infrastructure investments and other efforts to enhance the industry's economic vitality.

The study was guided by four objectives: 1) to assess recent and current trends in fishing activity associated with MLH, 2) to estimate the direct economic value of the commercial fishing industry at MLH, 3) to identify opportunities and constraints to the MLH commercial fishing industry, and 4) to compare MLH to other working harbors in the region.

The research focused on four groups most directly associated with the MLH commercial fishing industry: fishermen, resident fish buyers and fishery-support businesses, and the Harbor. (Study of non-resident fish buyers and fishery-support businesses was beyond the scope of this project, but will be done in subsequent projects.) We surveyed 38 commercial fishermen, 4 resident fish buyers, 3 resident fishery-support business owners, and Harbor management, collected additional field data through ethnographic observation and interviews, and used archival data sources including landings data from the Pacific Fisheries Information Network database. This executive summary highlights the study's key findings.

Socio-Economic Profile and Estimated Direct Economic Value of the Moss Landing Commercial Fishing Industry

The commercial fishing industry at Moss Landing includes about 125 resident and 175 non-resident fishing operations, 7 resident and dozens of non-resident fish buyers, and 9 local businesses and many more located outside Moss Landing that provide goods and services to the industry.

Total employment for the operations surveyed was:

- 88 skippers and crew,
- 307 full-time and 825 part-time fish receiving and processing employees,
- 9 full-time and 3 part-time fishery-support business employees, and
- 10 Harbor employees.

All of these jobs, except for those in receiving and processing, are at Moss Landing. Most of the receiving and processing jobs are located at fish buyers' processing facilities elsewhere within and outside the County.

The direct economic value of commercial fishing at MLH is estimated to be between $18 million and $25 million per year (real values in year 2000 dollars), based on the following values, by fishery-related sector:

- Fishing operations: $6.7 million
- Fish buyers: $7.5 million
- Fishery-support businesses: $0.2 million
- Moss Landing Harbor: $10.1 million

Commercial Fishermen and Fishing Operations

Among the Moss Landing commercial fishermen surveyed, about 80% reside in Monterey County, 16% reside elsewhere in California, and 5% reside in Oregon. Over 80% of those surveyed reported Moss Landing as their homeport. Surveyed skippers' fishing experience averaged 28 years overall and 18 years at Moss Landing. Many fish at multiple locations along the California coast, with some fishing as far north as Alaska (for salmon) and as far west as the Western Pacific (for highly migratory species such as albacore tuna). Most fish multiple fisheries as part of their annual round and to adapt to environmental, economic and regulatory variability and uncertainty. Common combinations are salmon and albacore troll (perhaps with crab trap), hook-and-line for diverse groundfish (flatfish, roundfish and rockfish) species, coastal pelagic species (CPS, i.e., anchovy, sardine and squid) purse seine perhaps complemented by San Francisco Bay herring gillnet and Alaska salmon gillnet, and longline or gillnet for multiple species.

Moss Landing commercial fishing operations vary considerably in terms of vessel characteristics, equipment, gear, permits and personnel. Together, these features affect the seaworthiness, earning capacity, adaptability and economic viability of the fishing operation, the skipper and the crew.

More than half (58%) of the skippers surveyed reported family currently involved in fishing with them or involved in some other aspect of the business. Just over a third characterized their fishing operation as a family business. Surveyed skippers reported an annual average of $60,000 to $76,000 gross revenues from fishing from 1999 through 2001. On average, they depend on fishing income for 80% of their household income.

Moss Landing fishing operations represent considerable financial investments. Average vessel purchase price (over the past several decades, unadjusted for inflation) was $119,217, while replacement costs averaged $382,095. Re-sale values averaged only $162,455, however, reflecting concerns about current economic and regulatory conditions in some fisheries. Replacement costs for equipment and gear averaged about $42,000 and $26,000, respectively.

Moss Landing fishermen incur significant operating costs that contribute to the economies of Moss Landing, the County, and the many other places they purchase goods and services. A subsample of 18 skippers, primarily representing smaller, less labor- and capital intensive operations, provided data on annual expenditures for 1999 through 2001. Conservatively estimated, that group's average annual expenditures were more than $720,000.

Fish Buyers

Moss Landing's resident fish buyers, who have 11 to 60 years of experience in the fishing industry, have carved out distinct niches in species received, products produced and markets

served. They include one live fish buyer, three CPS receiver/processors, and three multi-species buyers. Three are based at Moss Landing; four are based elsewhere in Monterey County.

Although fish receiving is their primary activity at Moss Landing, many are vertically integrated, and are engaged in processing, wholesale, distribution and/or retail operations as well. Most of these other activities occur elsewhere in Monterey and Santa Cruz Counties where necessary space and infrastructure are available.

Fish receiving operations at Moss Landing are undergoing substantial change, especially with the opening of the Santa Cruz Cannery Building, the renovation of K-dock, and the planned opening of a restaurant and fish market at North Harbor in Fall 2003.

Three of the four surveyed fish buyers provided expenditure data for 1999 through 2001. Their annual average expenditures were nearly $1.5 million at Moss Landing and $11.3 million overall.

Fishery-Support Businesses

Nine locally based fishery-support businesses provide a diversity of goods and services to the commercial fishing industry at Moss Landing. These businesses include a fuel dock/small marine supply store, a boatyard, a marine covers shop, electrical, diesel, hydraulic, metalwork and other service providers, and a dry storage facility. Other businesses in the Monterey Bay area also support and depend on the Moss Landing commercial fishing industry.

The three businesses surveyed have operated at Moss Landing for between 28 and 50 years. They depend on the commercial fishing industry for 18 to 75% of their business. Together, their annual expenditures averaged nearly $650,000 for 1999 through 2001.

The Harbor

Moss Landing Harbor is an important provider of goods and services to the commercial fishing industry, and the research and tourism communities. It provides berthing and other amenities, and essential services such as dredging. The Harbor has a limited revenue base and aging infrastructure, but is developing strategies and seeking funding for long-term maintenance dredging and dock replacement. It recently completed renovation of the Santa Cruz Cannery Building and adjacent K-dock to support the commercial fishing industry.

The Harbor's average annual expenditures for 1999 through 2001 were about $10 million. Because of the public goods nature of the Harbor's goods and services, it is difficult to separate expenditures related to the commercial fishing industry from those for other Harbor users.

Trends in the Major Moss Landing Area Fisheries

Over the long term (1981-2001), the most important fisheries at Moss Landing in terms of ex-vessel revenues have been salmon, groundfish, and highly migratory species (HMS), each with average revenues around $1.5 million per year.

More recently (1999-2001), salmon revenues have slumped at Moss Landing (and statewide), while revenues for coastal pelagic species (CPS) reached almost $2.5 million per year. The

number of vessels that land salmon at Moss Landing has actually increased, while the number statewide has decreased.

The CPS fishery has exhibited dramatic boom and bust cycles recently for squid, and historically for sardine. Sardine landings have increased recently with corresponding increases in ex-vessel revenues, and have driven the recent boom in the CPS fishery at Moss Landing.

The West Coast groundfish fishery is experiencing severe regulatory constraints that have resulted in recent declines in vessels, landings, and ex-vessel revenues. Although ex-vessel revenues at Moss Landing have been relatively stable recently, 2003 management actions are likely to result in reduced revenues.

The open access rockfish (OAR) fishery has experienced a steady decline in vessels, pounds landed and ex-vessel revenues recently, while ex-vessel prices have been relatively stable. Concerns about the condition of some OAR species, however, have prompted management measures that are likely to further constrain the fishery.

The HMS fishery experienced a major boom during the 1980s that was followed by sharp declines in landings and ex-vessel prices in the 1990s, although the number of vessels landing HMS species has been relatively stable at Moss Landing.

Major Issues and Needs of the Moss Landing Commercial Fishing Industry

The economic vitality of the commercial fishing industry at Moss Landing depends on several factors including a healthy marine environment and fish stocks, fishery and environmental management that protects those resources while allowing for their use, and infrastructure that enables and promotes safe, cost-effective and productive operations. The major issues and needs of the Moss Landing commercial fishing industry fall into three inter-related categories: 1) regulatory constraints, 2) short- and long-term economic challenges, and 3) infrastructure and maintenance needs.

Regulatory constraints

Regulatory constraints pertain to both fishing and land-based aspects of commercial fishing, support business and Harbor operations. Primary fishery management issues are recent cuts in allowable groundfish catches, the Rockfish Conservation Area closure, and state and federal initiatives to establish networks of marine reserves along the California coast. Fishermen and others want to know more about the science, assist in its design and evaluation, and contribute their own local ecological knowledge to the management process. There is growing interest among fishermen, scientists and managers in collaborative and cooperative research to address these issues and fishery management information needs.

Coastal management actions also pose challenges to the industry, support businesses and the Harbor. Multiple and sometimes conflicting regulations and permitting procedures delay and increase the cost of essential functions including dredging, bulkhead maintenance and repair, erosion control, dock repair and replacement, and boatyard and fuel dock operations.

Short- and long-term economic challenges

Moss Landing's commercial fishing industry and support businesses face considerable short- and long-term economic challenges. In general, revenues are not keeping pace with increasing

operating costs. Decreases in allowable catches for some species coupled with stagnant or declining prices have made it difficult for some fishermen to pay their slip fees and do basic vessel maintenance. The resulting reduced revenues limit the ability of support businesses and the Harbor to support themselves, and to provide goods and services to the larger community, as well as the industry. Reduced landings limit fish buyers' ability to provide a dependable supply of fish to their markets, and can result in loss of those markets to other sources.

In an attempt to interrupt this negative chain of events, federal funds were made available to groundfish fishery participants following the Federal Groundfish Disaster declaration in 2000. The California Groundfish Disaster Stipend (GDS) Program, however, was not well adapted to the particular needs and interests of commercial fishery participants, and has been accessed by few Moss Landing fishermen.

Longer-term economic challenges follow from the persistence of the short-term conditions noted above and include access to fishery resources, adequate and diversified sources of revenue to the Harbor to support dock repair or replacement, maintenance dredging and other activities to update and support its infrastructure and operations. The commercial fishery-related sectors considered here have developed strategies to adapt to most short-term environmental, economic and regulatory challenges. Adapting to long-term challenges and their cumulative effects, however, will likely require external support.

Infrastructure and maintenance needs

Infrastructure maintenance and development issues are critical at Moss Landing. The most pressing needs are dock maintenance and improvement; maintenance and catastrophic event dredging; and South Harbor bulkhead repair. All of these are essential to safe and efficient navigation and use of the harbor, but are costly in terms of financial, time and personnel resources required to deal with complex and expensive permitting procedures, as well as actual construction and operation. Failure to address these needs jeopardizes the viability of the commercial industry and the Harbor.

Additional infrastructure developments could enhance the economic viability of the commercial fishing industry by limiting the leakage of economic resources outside Moss Landing. However, these developments also require financial and other resources that are not readily available, and it is not clear that current fishing activity in the region and at Moss Landing could support new businesses. Moreover, Moss Landing lacks the industrial infrastructure, available land, and zoning needed for new fish processing and fishery-support businesses.

Recommendations

The following recommendations are offered to the County and its Office of Economic Development for ways it could assist the commercial fishing industry at Moss Landing to help insure its viability and foster its vitality.

Regulatory Constraints

- Support the industry, related businesses and the Harbor in local, state and federal policy-making arenas.

- Develop an ombudsman program or other mechanism to coordinate the County’s environmental initiatives and regulations that affect the industry and the Harbor, to

eliminate redundancy, resolve conflicting mandates, and increase efficiency of permitting and related processes.

- Establish a centralized, well-publicized and accessible information clearinghouse for relevant county, state and federal regulations.

- Disseminate information on grant and loan programs to the Harbor directly, and to the fishing industry and related businesses through their social networks and communication channels.

- Provide funds for collaborative and cooperative research that involves fishermen (and their knowledge, skills, expertise and fishing vessels) and local scientists to augment and improve information on local fisheries and marine ecosystems.

Short- and Long-Term Economic Challenges

- Provide or facilitate low-interest loans or lines of credit to the fishing industry to offset costs such as slip fees during the off-season or when severe restrictions on allowable catches are imposed.

- Provide or facilitate the establishment of an insurance pool for commercial fishermen to help reduce their insurance costs and better insure their vessels.

- Adjust or develop re-training programs to better meet fishery participants' background, skills, resources and needs.

- Provide low-interest loans or grants to the commercial fishing industry, fishery-support businesses and the Harbor to address infrastructure needs to insure safe, efficient and economically productive operations.

Infrastructure and Maintenance Needs

- Work with the Harbor to identify and secure loans or grants to support dock replacement and, in the interim, dock maintenance and repair.

- Provide low-interest loans or grants to support maintenance dredging.

- Support Harbor efforts to gain Army Corps of Engineers, California Coastal Commission and other relevant agency support for dredging, bulkhead repair and other projects essential to safe navigation and efficient commerce at Moss Landing.

- Provide low-interest loans or grants to support the development of a centralized fish market where fishermen can sell their catch directly to the public.

- Provide assistance with permitting, locating a site for, and establishing such a market.

- Work with the fishing community and associated businesses to further explore the need for and constraints to additional businesses to support the commercial fishing industry, determine the economic implications of such growth for both existing and prospective businesses, and develop incentives to retain existing businesses and attract new ones.

SOCIO-ECONOMICS OF THE MOSS LANDING COMMERCIAL FISHING INDUSTRY

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DISCLAIMER

The work reported in this document was conducted under contract to the Monterey County Office of Economic Development. The authors retained intellectual freedom regarding authorship of the analytical content and the narrative description of their analyses. Therefore any views and opinions expressed in the report (other than those attributed to study participants) are strictly those of the authors, and do not necessarily reflect the views or opinions of industry participants, Moss Landing Harbor, Steering Committee members, or the County of Monterey.

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In addition, this report was informed by Pomeroy's prior research on the squid/wetfish, salmon troll fishery and the nearshore skiff fishery at Big Creek, and by Dalton's ongoing research on the groundfish trawl fishery. Pomeroy and FitzSimmons' study of the squid fishery was funded by Grant Number NA66RG0477 from the National Sea Grant College Program, National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, project number R/MA-39 through the California Sea Grant College System, and in part by the California State Resources Agency, with matching funds provided by the Institute of Marine Sciences, UC Santa Cruz. Pomeroy's study of the Channel Islands squid fishery was conducted under contract to NOAA; her study of the statewide wetfish fishery (with S. Hackett) was funded by the California Seafood Council. The salmon troll and Big Creek studies were funded by NOAA grant number NA87FE0447, and by the California Marine Ecological Reserves Research Program, grant number R/BC-2, respectively. These studies (as well as the present effort) benefited immeasurably from the contributions, insights and good will of fishery participants, resource managers and scientists. Monica Hunter, Marc Los Huertos, Natalie McKinney, Doug Reese and Chris Wilcox variously provided invaluable assistance on these studies. Dalton's study of the groundfish fishery with S. Ralston is supported in part by the National Sea Grant College Program under NOAA Grant Number NA06RG0142, Project R/MA-42 through the California Sea Grant College Program; in part by the California State Resources Agency. Support for this work is gratefully acknowledged. The views expressed herein do not necessarily reflect the views of these organizations.

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Caroline Pomeroy and Michael Dalton

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SECTION 1: INTRODUCTION

Over the past several years, Moss Landing has undergone important social, economic and infrastructure changes due to changes in the local and broader biophysical, social, economic and political environments. The commercial fishing industry at Moss Landing has been affected by many of these changes. To better adapt to and help shape these changes, members of the local commercial fishing community approached Monterey County's Office of Economic Development (OED), requesting that a study of the commercial fishing industry at Moss Landing be conducted to document its social and economic value, and the issues, needs and concerns of its participants. The results of such a study could then be used to inform policy-making within and beyond the County on several topics, from infrastructure investments to marine resource management.

In August 2000, the Monterey County OED issued a request for bids to conduct a socio-economic study of the commercial fishing industry at Moss Landing Harbor. In March 2002, following efforts to better define the scope of the project given the limited resources available, the County issued a contract to us for the work reported in this document.

We used the combined approaches of natural resource sociology (Pomeroy) and economics (Dalton) to conduct the study. We collected data using ethnographic interviews and observation, surveys and archival research methods, and used both qualitative and quantitative methods to analyze the data. (See Appendix A for a detailed description of the methods used.) The objectives of the study were:

1. To assess recent and current trends in fishing activity associated with Moss Landing Harbor (MLH);

2. To estimate the direct economic value of the commercial fishing industry at MLH;

3. To identify opportunities and constraints to the MLH commercial fishing industry; and

4. To compare MLH to other working harbors in the region.

The results of the research are presented as follows. Section 2 (following this introduction) presents a brief overview of Moss Landing as a social and economic entity and its business and residential communities. Section 3 provides an overview of the major commercial fisheries at Moss Landing and their management. Section 4 addresses trends in landings for those fisheries over the past two decades, with particular attention to recent events. Section 5 provides an in-depth description of the commercial fishing industry at Moss Landing Harbor, including an historical overview and socio-economic profiles of its participants. Section 6 presents an estimate of the direct economic value of the commercial fishing industry at Moss Landing, based on the data provided in the previous two sections. Section 7 entails a comparison of the

Monterey Bay's three harbors, Santa Cruz, Moss Landing and Monterey. Section 8 focuses on issues, concerns and needs articulated by study participants, including suggestions for ways that Monterey County, and its Office of Economic Development, might assist the industry to insure and enhance its economic viability. Section 9 concludes the report with a summary of emerging issues and recommendations to the County. Appendices that include methodological details, supplementary figures and tables, and project staff biographies follow the body of the report.

Context of the Study

Before proceeding with the substance of the report, it is important to note the context in which the research was conducted. We focus especially on events that have directly or indirectly affected the commercial fishing industry, as these most directly affected our observations of and interactions with industry participants and others at Moss Landing.

In January 2000, the Federal Government declared the West Coast Groundfish Disaster after the National Marine Fisheries Service (NMFS) determined that a number of groundfish stocks, including several targeted by many Moss Landing commercial fishermen, were in poor condition. Scientific assumptions made to date had been determined to be insufficiently conservative given the life histories of those species. Moreover, a capacity assessment conducted by the Economics Subcommittee of the Pacific Fishery Management Council's (PFMC) Scientific and Statistical Committee (SSC) determined that the groundfish fleet - composed of trawl, trap and line fishing operations - was roughly twice that size needed to harvest the allowable catch (SSC 2000). The PFMC's Groundfish Fishery Strategic Plan subsequently recommended that harvest capacity in all sectors of the fishery be reduced by at least 50% in order to balance harvest capacity with resource productivity, and allow for an economically and biologically sustainable fishery (PFMC 2000a: 13). Since then, monthly and bi-monthly catch limits for several species have been cut, and time and area closures have occurred in the groundfish fishery. One that most directly affected the participants in this study was NMFS' September 1, 2002 closure of the central California nearshore fishery through the end of the year, announced August 29, 2002. Another was the closure of the continental shelf from 60 to 250 fathoms north of Cape Mendocino, and 60 to 150 fathoms from there to the Mexican border, effective January 1, 2003.

At the state level, the Legislature passed the Nearshore Management Act in 1998 out of concern for the rapidly growing nearshore fishery for live rockfish. A number of interim measures, including minimum sizes and periodic closures, have been implemented by the Department of Fish and Game (DFG). The recently approved Nearshore Fishery Management Plan (FMP) has effected further changes in the fishery, including a limited entry program.

In addition to the groundfish situation, other events created a tenor of uneasiness among commercial fishery participants at Moss Landing. Chief among these are recent initiatives to establish marine reserves through the state's Marine Life Protection Act process and the Monterey Bay National Marine Sanctuary's Management Plan Review process.

SECTION 2: THE MOSS LANDING SETTING

A Brief History

The State Legislature established Moss Landing Harbor District, a political subdivision of the State, in 1947. (See Appendix B, Table B-1 for a timeline.) The Harbor District comprises approximately 370 square miles (Superior Court 2002), including the harbor itself and surrounding lands that comprise Bennett, Elkhorn and Moro Coho sloughs and the Old Salinas River Channel south to Potrero Road (Grenell and Associates 1996) (Figure 2-1). The harbor is subdivided into two areas: North Harbor, which primarily serves recreational boating and other visitor activities, and South Harbor, which primarily serves commercial fishing and marine research.

Prior to its formal establishment as a harbor, Moss Landing was a renowned whaling station and seaport, dating back to 1853 (Grenell and Associates 1996). In the 1860s, Captain Charles Moss and other entrepreneurs settled in the area and started transporting lumber, grain, produce and animal hides by barge on the Salinas River and Elkhorn Slough, then transported these goods overland to inland communities. A 200-ft wharf was constructed to facilitate the loading and unloading of goods. In 1906, however, an earthquake destroyed the wharf and most of the infrastructure. A decade later, interest in Moss Landing as a whaling station was rekindled. A whaling station, built by Captain Dedrick of the California Sea Products Company, began operations in early 1919. It closed, however, in 1926 as a result of declining whale oil prices (as petroleum oil became more widely used), competition with offshore factory ships and the local scarcity of whales (Francis 1997).

Although Moss Landing had had a small-scale fishery since the late 1880s, growth in the sardine fishery in the mid 1930s stimulated new development activity at Moss Landing (Francis 1997). This in turn prompted the formation of the Harbor District about a decade later, in order to develop a safe harbor channel and support newly constructed canneries and reduction plants on the narrow spit of land that extends northwest from the mainland, known as “the Island”. Within five years of the Harbor’s opening, however, the Monterey Bay sardine fishery collapsed (McEvoy 1986). Canneries and reduction plants closed, and many sardine fishermen went south to San Pedro, only to have that fishery collapse a few years later.

Some sardine fishermen and buyers, however, stayed on in the Monterey Bay area, and shifted their focus to other “wetfish” species such as anchovy, mackerel and squid. Other fisheries such as salmon and albacore also grew, helping to fill the gap left by the sardine collapse. Over time, fisheries for groundfish, halibut, spot prawn, crab and other species also developed at Moss Landing. By the mid 1970s, Moss Landing had five fish buyers that received and processed a range of species there. Moss Landing Harbor is now one of the largest commercial fishing ports in California. In 2001, it ranked third (after the Los Angeles and Ventura/Port Hueneme/Oxnard Harbor complexes) in pounds landed, and fourth (after the San Francisco Bay area) in ex-vessel revenues in the state (NMFS 2003).

Historically, Moss Landing has also hosted other economic activities. Soon after the end of World War II, small-scale industrial development began with the establishment of Kaiser Refractories, a chemical plant, and Pacific Gas and Electric Company, a power plant (now owned and operated by Duke Energy). Marine research became a presence at Moss Landing in the 1960s with the establishment of California State University’s Moss Landing Marine Laboratories. That presence expanded considerably in the late 1980s with the opening of the Monterey Bay Aquarium Research Institute (MBARI) on the Island. In addition, Moss Landing

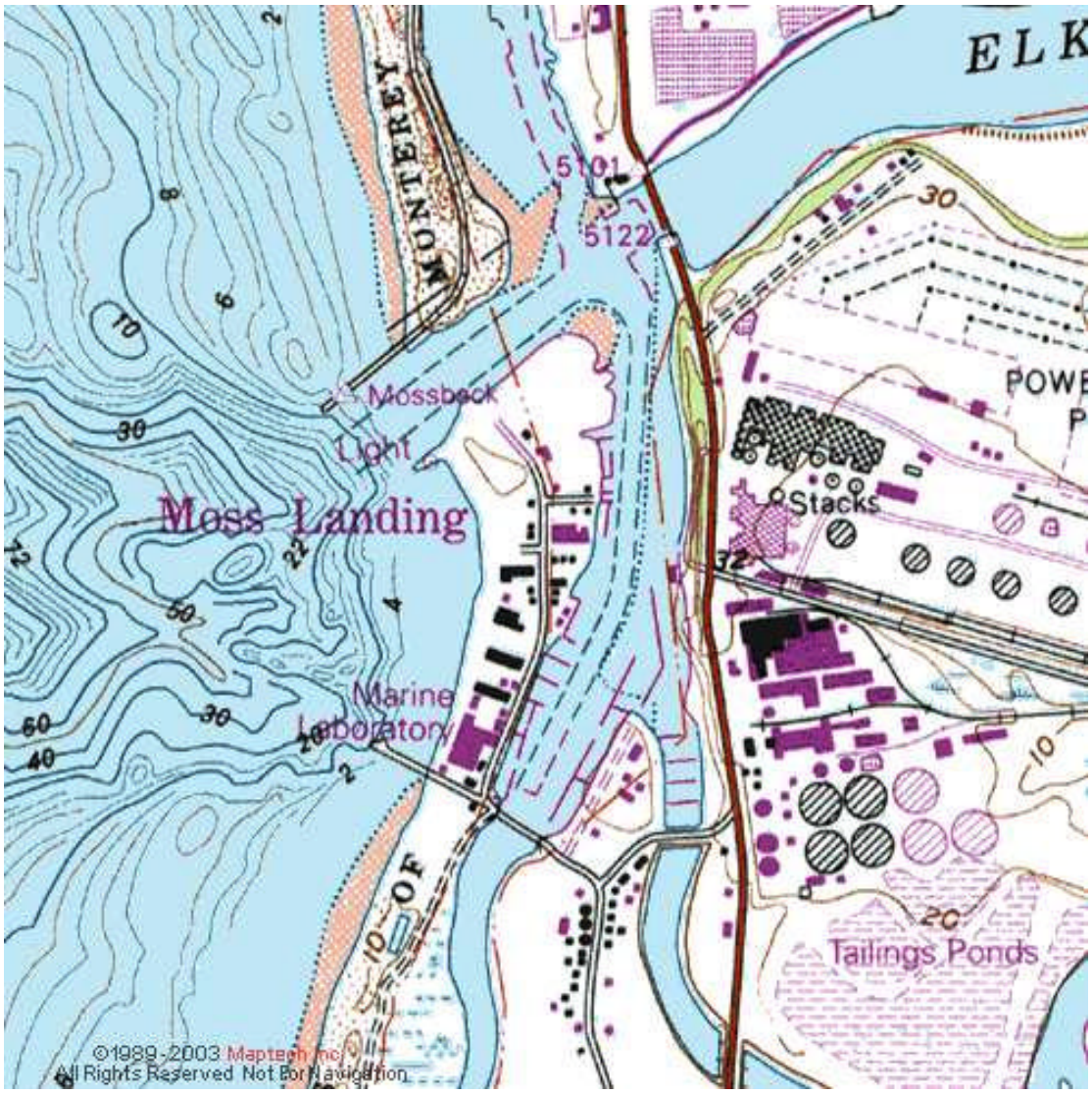


Figure 2-1. Map of Moss Landing Harbor. (Source: Mapserver.com 2003)

has been the site of many antique dealerships for several decades (Woodward 1983). More recently, it has become a center for tourism with the growth of recreational boating, sport fishing, whale watching and other nature tourism activities.

Although Moss Landing Harbor and the surrounding community have undergone considerable changes in recent years three sectors - commercial fishing, research, and recreation and tourism – remain the core of its economy. At times, there are tensions, differences of opinion and other issues among members of these groups, yet they share many needs, interests and concerns. This report focuses on the commercial fishing industry. In subsequent work, we will incorporate these other sectors, and document those commonalities and interdependencies, which are key to each sector and to the Moss Landing community as a whole.

The Community

Although it is an independent district of the state, Moss Landing Harbor is situated within the larger context of Moss Landing, an unincorporated, census-designated place (CDP) in North Monterey County. A complete treatment of the larger Moss Landing community is beyond the scope of this project, but the following background is provided to give readers a better sense of that local context. We will build upon this basic understanding in a new project that was recently funded by NOAA's Saltonstall-Kennedy Grant program.

In contrast to other North County communities (i.e., Aromas, Castroville, Elkhorn, Las Lomas, Pajaro and Prunedale), Moss Landing's economy is based on coastal dependent industry (Monterey County 2001). In addition to commercial fishing, Moss Landing hosts marine research, recreation and tourism, and antique businesses. (See Appendix B, Table B-2 for a list of Moss Landing businesses.) These entities are variously located in the North Harbor area, in South Harbor on the Island and mainland, in town, and at the south end of Moss Landing.

The North Harbor area is in transition, with two new restaurants and a fish market under construction to replace two restaurants formerly at the site. The North Harbor is also the site of a yacht club and a kayak business. The Island hosts most of the commercial fishing-related businesses, including seven resident fish buyers and eight fishery-support businesses. A seafood market and restaurant and the Monterey Bay Aquarium Research Institute (MBARI) are also located on the Island. The Moss Landing Harbor District Office is located across the Sandholt Bridge on the mainland side of South Harbor, along with a dry storage facility it operates and an independent sport fishing business. In the center of town are two restaurants, a bar and a coffee house, an RV park, most of the 20 or so antique shops, the post office, and the school district office. The Duke Energy plant and the former Kaiser Refractories are located across Highway 1 east of South Harbor. The new Moss Landing Marine Laboratories facility, the cemetery, more antique stores and restaurants, and a liquor/convenience store are located at the south end of Moss Landing.

Moss Landing is also the site of a residential community. Most of its estimated 135 housing units are in Moss Landing Heights, located south of Moss Landing Harbor near Potrero Road, with a few others scattered among the commercial development in the heart of Moss Landing and on the Island (Jefferson Associates 1980, US Census 2000). The 2000 US Census estimated the Moss Landing CDP population at 300 persons, of which 259 were at least 16 years old, and 208 were employed (Census Bureau 2000). Residents' median age in 2000 was 36.4 years. Occupational statistics indicate that 30% of residents are in management, professional and related occupations, 49% are in service, sales and office occupations, 10% work in farming, fishing and forestry, and 11% work in production, transportation and material

moving. Median household income and mean household earnings were, respectively, $66,442 and $54,074, while mean per capita income was $28,005, in 2000.

SECTION 3: THE MAJOR MOSS LANDING COMMERCIAL FISHERIES AND THEIR MANAGEMENT

Overview

Monterey Bay has been the site of diverse commercial fisheries since the mid 1800s. Its primary fisheries have included albacore, groundfish, salmon, sardine and squid, among others, developed and carried out by Anglo, Chinese, Italian, Japanese, Portuguese and Vietnamese fishermen and buyers. Initially, the gear used in these fisheries ranged from various hook-and-line configurations to lantern seines, lampara nets and the paranzella, a trawl net used by paired vessels (Dewees and Price 1983, Starr et al. 1998).

Prior to the 1930s, only small-scale fishing was conducted at Moss Landing, as whaling and shipping dominated its activities up to that point (Scofield 1954). As the sardine fishery grew through the 1930s, however, so did interest in developing the port of Moss Landing. In 1935, a "cannery boom" prompted the construction of jetties and dredging of the harbor entrance "so that fishing boats could enter the slough and have protected water for unloading at the canneries" (Scofield 1954: 92). In the mid 1940s, the California Legislature created the Moss Landing Harbor District, and work proceeded on the harbor channel and the development of sardine canneries and reduction plants on the Island, along with shipbuilding and repair yards, and other support services (Francis 1997). Scofield (1957) reports that by 1952, there were eight canneries and reduction plants, with 30 to 40 purse seiners, occasional trawlers, dozens of small salmon and albacore trollers and a few setline boats. Others report live bait operations as well. When the Monterey Bay sardine fishery collapsed in 1952, however, many purse seiners went south to San Pedro, only to have the fishery there collapse a few years later (McEvoy 1986). The smaller seiners that remained in the Monterey Bay area continued to fish for sardine, even though it was scarce. Many also shifted some of their effort to squid and other "wetfish" species (i.e., anchovy, mackerel) and herring.

The Monterey Bay area commercial fishing industry began to rebound in the 1960s, focusing especially on salmon, squid and Dungeness crab (Starr et al.1998). These regional trends were consistent with technological changes in California fisheries elsewhere, and included the development and adoption of nylon nets, power blocks, hydraulic pullers and improved navigation and communication equipment (Pomeroy et al. 2002).

Federal Fishery Management

The passage of the Magnuson Fishery Conservation and Management Act (Magnuson Act) in 1976 signaled a change in fishery management for the Monterey Bay area as well as the nation. It established the US Fishery Conservation Zone (FCZ) [declared the US Exclusive Economic Zone (EEZ) in 1983] that extended US fishery conservation and management authority in territorial waters from 12 out to 200 miles from the coast. The Magnuson Act also established eight regional fishery management councils, each responsible for developing fishery management plans (FMPs). The Pacific Fishery Management Council (PFMC) has federal fishery management authority for California, Oregon and Washington fisheries outside state waters (i.e., from 3 to 200 miles offshore).

The Magnuson Act effectively "Americanized" US fisheries (Cicin-Sain and Knecht 2000), with catch by foreign fleets in the EEZ dropping to zero by 1992 (Buck 1995). However, the drop was more than matched by a rapid expansion of the US domestic fleet, encouraged by government provision of technical and financial assistance to the industry. The late 1970s were a time of phenomenal growth in US and Monterey Bay area fisheries, including those for salmon and

albacore, groundfish and, to a lesser extent, squid. From 1977 on, total US fish harvest increased by more than 300% to a peak of 6.6 billion pounds annually by 1986 (Buck 1995), but then declined to 3.2 billion pounds by 2001 (NMFS 2003).

The 1996 Sustainable Fisheries Act (SFA) amended and reauthorized the Magnuson Act. The SFA amendments include new provisions for fishery management and conservation by the National Marine Fisheries Service (NMFS). National Standard 1(a) of the SFA requires that fishery management prevent overfishing while maintaining, on a continuing basis, optimum yield (OY). Optimum yield is the amount of fish that will achieve the maximum sustainable yield (MSY), as reduced by relevant economic, social, or ecological factors (NOAA 1997).[3] The standard explicitly links determination of OY to a harvest control rule that is expected to attain MSY for each stock, which is the largest long-term average catch. In cases where stocks fall outside the range of normal adjustments to reach MSY, National Standard 1(d) describes overfishing thresholds based on spawning stock biomass. A stock is considered overfished if current stock biomass is less than 25% of the virgin biomass. West Coast fishery managers recently used this standard to determine that several groundfish species including bocaccio, a species important to the Moss Landing groundfish fishery, are overfished.

State Fishery Management

Historically, the California State Legislature held lead management policy-making authority for commercial fisheries in state waters. It passed relevant legislation that the Department of Fish and Game (DFG) then implemented. The passage of the Marine Life Management Act (MLMA) in 1998, however, transferred that authority to the California Fish and Game Commission (Commission) for those fisheries not yet actively managed by the state. The MLMA also fundamentally restructured fishery management, modeling it largely after the federal fishery management plan (FMP) process.

The MLMA also included the Nearshore Fishery Management Act (NFMA), which established minimum sizes for several nearshore rockfish and associated species, and mandated that this fishery be the first (along with white seabass) to be managed under the MLMA's new procedures. In August 2002, the Commission adopted the Nearshore FMP, and in December 2002, it adopted a restricted access program for the fishery, effective April 1, 2003. The Nearshore FMP notwithstanding, the nearshore fishery is also constrained by regulations in the federal Groundfish FMP. The State has formally requested that the PFMC transfer its authority to California for some nearshore species that are currently managed under the federal Groundfish FMP.

A second major element of California's commercial fishery (and broader ocean) management policy is the Marine Life Protection Act (MLPA) of 1999. The MLPA directs the DFG to develop of a network of marine protected areas (MPAs) to support the Act's goals. After an initial unsuccessful attempt to establish a statewide network of MPAs, DFG has established seven regional working groups, including one in the Monterey Bay area, to work through the process.

Major Moss Landing Commercial Fisheries

In an effort to better understand the commercial fishing industry at Moss Landing Harbor, we focus on four of its major fisheries: 1) coastal pelagic species (CPS), 2) groundfish, 3) salmon,

[3] In the case of an overfished fishery, OY has been defined as the amount of fish that will provide for rebuilding a stock to a level that will support its MSY (NOAA 1997).

and 4) highly migratory species (HMS). Fisheries for other species such as Dungeness crab and spot prawn are discussed briefly as well. For each fishery, we describe the species targeted, the gear used, the locations and seasons fished, how the catch is received, processed and distributed, and how the fishery is managed.

The Coastal Pelagic Species Fishery

The coastal pelagic species (CPS) fishery focuses on five species: northern anchovy, jack and Pacific mackerel, and Pacific sardine and California market squid. Together these species are traditionally known as “wetfish” because they were packed “wet” (or raw) in cans, then cooked (Leet et al. 1992).

Fishing for wetfish commonly entails the use of purse seine gear that uses a drum or a power block to help retrieve the net, and a fish pump to transfer the catch from the net to the hold.[4] Most fishing occurs at night, and targets schools of CPS finfish or spawning aggregations of squid. Seiners typically make two to four sets a night of several tons each, either to reach a market-imposed limit or to fill the boat if no limit is in effect. [Wetfish purse seiners have an average capacity of about 60 short tons (Pomeroy et al. 2002).] When fishing for squid, seiners are usually assisted by smaller "light boats" that are equipped with high intensity lights (limited to 30,000 watts per vessel) to locate and/or attract the animals to the surface. After a night’s fishing, the vessel returns to port to deliver the catch to receivers. Most receiving stations consist of a docking facility with a shore-based pump that is used to transfer the fish from the vessel hold to a weighing bin with a scale. Once the fish is weighed, it is transferred to totes, which dockside laborers pack with ice. The loaded totes are then transferred by forklift to a truck for transport to the processing plant.

Except for World War II, when the federal government managed the wetfish fishery to maximize production, the State of California has had primary management authority for the sardine, mackerel and squid fisheries (Pomeroy et al. 2002). Since the 1960s, state regulation has included quotas on sardine, mackerel and anchovy. In 1970 and 1974, respectively, moratoria were placed on the mackerel and sardine fisheries. When the mackerel moratorium was lifted in 1977, the fishery was managed under a quota, with portions allocated to the state's northern region (north of San Simeon to the Oregon border) and to its southern region (south of San Simeon to the US-Mexico border). The directed fishery for sardine was re-opened in 1986 under a similar quota system. The state also managed the anchovy fishery through the mid 1970s, when it became subject to federal management under the Northern Anchovy FMP.

Over time, squid fishing has been regulated by the state with legislative measures that restrict the use of lights to attract squid, limit days or times when fishing is allowed, and for several years, prohibited the use of purse seines in Monterey Bay. The growth of the squid fishery especially since the early 1990s has prompted increased management. In 1997, the California Legislature passed SB 364, which instituted a $2,500 permit for catcher vessels and light boats, and a 3-year moratorium on entry into the fishery. SB 364 also mandated a study (funded by permit fees) of the resource and the fishery to inform the development of a squid fishery management plan. In the interim, the California Fish and Game Commission has adopted regulations that extend the Monterey Bay area weekend closure statewide, require light shields

[4] The details vary among operations. For example, whereas power blocks are used with purse seines, they are not used with drum seines. Brail and lampara net gear also have been used in the fishery by bait and smaller operations. In addition, brails are sometimes used to transfer squid from the net to the vessel hold.

and limit squid attracting lights to 30,000 watts per vessel. A draft management plan was released in May 2002, but following initial review is undergoing substantial modification. A revised Squid FMP is due for release in July 2003 (Sweetnam, pers. comm.).

In 1998, Amendment 8 to the Northern Anchovy FMP assigned sardine, jack and Pacific mackerel and squid to the same management unit as anchovy, and renamed the plan the Coastal Pelagic Species (CPS) FMP. Under the CPS FMP, sardine and Pacific mackerel are “actively managed” by the PFMC and subject to annual harvest limits based on annual biomass estimates. Anchovy, jack mackerel and squid are "monitored" species not subject to federal harvest limits, but potentially subject to other forms of federal as well as state management. In 1999, the PFMC adopted a limited entry program for the CPS finfish fishery south of Point Arena, California, effective January 1, 2000.

Taking into consideration the wetfish species’ sensitivity to changing environmental conditions the PFMC implemented an environmentally driven harvest control rule in order to achieve OY in the fishery. The harvest control rule monitors average sea surface temperature to detect changes in climate known as regime shifts or the Pacific Decadal Oscillation (Mantua et al 1997). Recently, the climate regime has been favorable to sardine, so much so that part of southern California’s sardine allocation has gone unused. The PFMC is considering changes to the allocation of sardine between the southern and northern management areas to more fully utilize the resource.

A subsequent amendment to the federal CPS FMP proposed a harvest control rule for attaining MSY for squid. Establishing MSY levels for squid raises technical issues for fishery scientists because of the species' unique biology and reproductive vigor. Like sardine, squid are especially sensitive to changes in ocean conditions. In particular, the absence of squid from their usual spawning (and fishing) grounds is highly correlated with El Niño events, as occurred in 1997-1998.

Moss Landing and the CPS Fishery

Monterey Bay is the historic center of the fishery, which is carried out statewide by fleets centered in central and southern California. The Monterey Bay fleet primarily targets sardine, anchovy and squid. Both sardine and anchovy are schooling fish, and are found in fishable aggregations along the coast, usually within state waters. Monterey Bay CPS fishermen tend to fish within a few miles of port and within Monterey Bay, although they have ranged further up and down the coast to fish squid in recent years (Pomeroy and FitzSimmons 2001). Sardine and anchovy are available most of the year. The Monterey Bay area squid season usually runs from late spring through early fall.

Moss Landing is one of the two major CPS landing ports in the Monterey Bay area; the other is Monterey. Moss Landing currently supports four wetfish receiving operations, with a fifth coming online within the next few months at the renovated Santa Cruz Cannery building. Most wetfish landed at Moss Landing are transported by truck to processing plants in nearby Watsonville and Salinas. One buyer at Moss Landing does some processing on site. Approximately 20 purse seiners deliver wetfish to Moss Landing. About 10 of these tie up there, while most of the others tie up at Monterey. When squid are particularly abundant, as occurred in 2002, several additional purse seiners that usually participate only in the southern California wetfish fishery fish Monterey Bay. Most of these deliver at Moss Landing.

While most of the wetfish landed at Moss Landing is frozen and exported for secondary processing, human consumption, bait and animal feed, some is locally and nationally distributed to secondary processors as well as wholesale and retail outlets (Pomeroy et al. 2002). In the mid 1990s, one local processor built a large canning facility in anticipation of new fishing and market opportunities for sardine. This facility also produces "individual quick-frozen" sardine, and other products from wetfish. Other Moss Landing processors produce "value added" products such as tubes, tentacles and breaded squid.

The Groundfish Fishery

The groundfish fishery consists of a suite of flatfish, roundfish, rockfish and other species targeted by fishermen using trawl, trap and a variety of hook-and-line gears. The fishery is jointly managed by state and federal authorities, and has come under increasing regulation over the past several years. State regulation of the groundfish fishery began in 1953 with the passage of a state law that banned trawling for rockfish in state waters. Through the 1980s, California groundfish regulation focused on gill and trammel nets which also had been used to catch some groundfish species. Through a series of laws and regulations, the use of gill and trammel nets has been increasingly limited in state waters. In 1994, they were banned in waters a) within three nautical miles of the mainland coast and off any manmade breakwater, from Point Arguello to the Mexican border, b) less than 35 fathoms between Point Fermin and Newport Harbor's south jetty, and c) less than 70 fathoms or within one mile (whichever is less) around the Channel Islands, pursuant to the 1990 Marine Resources Protection Act [MRPA Sec 2(d) and 3(a)].

State groundfish management increased in the mid 1990s with the passage of laws limiting the number of lines and hooks used by set, vertical and other hook-and-line fishermen. In 1998, finfish trap regulations were implemented that limited where, when and how many traps could be deployed per vessel. Also in 1998, the Nearshore Fishery Management Act (FMA), within the landmark Marine Life Management Act, was passed. The Nearshore FMA established minimum sizes for several species of rockfish, cabezon and lingcod, established a nearshore fishery permit, and required DFG to develop the California Nearshore FMP.

At the federal level, groundfish management began in earnest in 1982, following rapid expansion of the groundfish fishery throughout the West Coast. In that year, the Secretary of Commerce approved the PFMC's Groundfish FMP. The Groundfish FMP focused initially on widow rockfish and hake, both targets of the midwater trawl fishery. Over the next decade, additional species were added to the actively managed species list, and allowable catches and quotas were established.

In 1994, the PFMC instituted a limited entry program for the groundfish fishery. Trawl, trap and longline fishermen who had participated in the fishery could qualify for a limited entry permit. The majority of the allowable catch was allocated to the limited entry fishery while a considerably smaller allocation was set aside for the open access fishery. (The first year, limited entry fishermen were allocated 80,000 pounds while open access fishermen were allocated 10,000 pounds of groundfish per month.)

At present, the PFMC groundfish FMP covers more than 80 species, assigned to several distinct management categories. In recent years, the PFMC has managed the fishery primarily with bimonthly trip limits set to prevent fishing mortality from exceeding OY. Despite increasingly stringent management measures, however, several species included in the Groundfish FMP are considered overfished as defined by standards of the SFA. In January 2000, the Secretary of

Commerce declared the West Coast groundfish fishery a federal disaster. The ongoing contraction of West Coast groundfish stocks has followed decades of poor recruitment and production, perhaps due to the same ocean conditions considered favorable for sardines, during a period of rapid growth in fishing effort. SFA standards require that overfished species be rebuilt to levels associated with MSY. The rebuilding plans specify rigid limits on allowable catch, including bycatch from all sources, for each overfished species in order to meet rebuilding goals.

In Summer 2002, faced with dire news from the most recent stock assessments, the PFMC concluded that catch limits alone would not allow the groundfish fishery to remain open. A system of trip limits and depth-based area closures was devised to manage groundfish in 2003. The strategy is to exclude fishing effort in those depth zones inhabited by overfished species such as bocaccio. Near Moss Landing, depth-based restrictions have been implemented as part of the new Rockfish Conservation Area. The PFMC recently voted to use new observer-based discard rates for the remainder of in-season management for 2003. As a result, the Rockfish Conservation Area has increased in size, and trip limits may become even more constraining.

Moss Landing and the Groundfish Fishery

Moss Landing and other Monterey Bay fishermen target many species of groundfish. Whereas bottom trawls target flatfish and most rockfish species, midwater trawls target schooling species such as widow rockfish and Pacific hake (Starr et al. 1998). Bottom trawls are the more common of the two main types of trawl gear used in the Monterey Bay area, and account for the majority of groundfish landings in the region. Bottom trawls are used on vessels that range from 55 to 85 feet in length (Starr et al. 1998). Trawl gear configurations vary by the species targeted and the area fished. (See Starr et al. 1998 for a detailed description.) Traps or pots are used in the groundfish fishery to target sablefish (blackcod) and nearshore rockfish species, especially for the live fish fishery. Traps usually are deployed from smaller vessels that range in length from about 20 to 50 feet. Moss Landing fishermen use several types of hook-and-line gear including rod and reel, horizontal setline or longline, vertical longline and sticks[5] to target rockfish, lingcod and cabezon. Sticks in particular are used primarily in the nearshore live fish fishery.

Groundfish fishing takes place year round out of Moss Landing, subject to weather, regulatory constraints, species availability, the size and seaworthiness of the fishing operation, and local receiving and processing capacity.

Four resident fish buyers including one live fish receiver regularly receive groundfish at Moss Landing. Evidence suggests that on occasion, several non-resident buyers receive groundfish there as well. Two of the resident operations receive a wide range of groundfish species from trawl, trap and hook-and-line fishermen. The "dead" catch is unloaded using a hoist and totes or crates, then packed into iced boxes and loaded into trucks. These trucks deliver the catch to processing and packing facilities in Salinas, Watsonville, Santa Cruz and elsewhere for processing, packing and distribution locally, throughout the U.S, and internationally.

[5] Stick gear consists of a three- to four-foot piece of pvc pipe with several hooks attached to a leader that runs the length of the stick. One end of the stick is attached to a line that is tied to a float. The baited stick is deployed in rocky nearshore areas to catch gopher rockfish, cabezon and other nearshore species.

Most live fish are unloaded at Moss Landing directly from the boats into aerated saltwater tanks, although a few fishermen unload at Monterey and truck their catch to a buyer at Moss Landing. The live fish is then trucked to markets in San Mateo County and the San Francisco Bay area where it is distributed to restaurants, grocery stores and other retail outlets for sale primarily to the Asian American public.

The Highly Migratory Species Fishery

As defined by the PFM, highly migratory species (HMS) are "fish that move great distances in the ocean to feed or reproduce" (PFMC 2003a). The HMS group includes tunas, sharks, swordfish, and some other species such as dorado (mahi-mahi). The PFMC lists seven commercial gear types used to catch these species. Among Moss Landing fishermen, however, the most common species-gear combinations are albacore troll, and shark and swordfish gillnet.

The California albacore troll fishery starts in mid July, picks up substantially through August, September and into October, then tapers off through December. The location and magnitude of the fishery vary considerably from year to year depending on oceanic conditions, which strongly influence the migratory patterns of the fish. Albacore vessels range in length from 16 to over 100 feet in length, with most at least 25 feet long (PFMC 2003b). The Draft HMS FMP further distinguishes between smaller vessels (<40 feet) that tend to stay within the 200-mile US EEZ, and larger vessels that fish both within and beyond the EEZ. Smaller albacore trollers make 1- to 14-day trips, while wider ranging vessels may make trips of one to three months. In 1999, central California albacore troll vessels averaged 39 feet in length, and included a mix of these two types of operations (PFMC 2003b). Albacore trollers are equipped to bleed and freeze their catch using chilled brine, blast or plate freezing, or ice (PFMC 2003b).

The shark and swordfish drift gillnet fishery developed in the late 1970s. Shark and swordfish drift gillnet vessels range from 18 to 85 feet, and average 44.6 feet in length (PFMC 2003b). Fishing trips typically range from 5 to 15 days, but the length and timing of trips is a function of resource availability, market price, weather, fishing vessel range and other factors (PFMC 2003b). Fishing off California (limited to outside 150 miles offshore) occurs primarily between August 15 and December 31 (PFMC 2003b). Longline gear is also used in swordfish fishing by larger vessels that make trips as long as 30 days, and fish outside the EEZ. Many of these vessels deliver to other California ports as well as Moss Landing. As with albacore, the catch may be iced, chilled with brine spray, or blast frozen (PFMC 2003b). Most of the HMS catch (albacore included) is unloaded and sold in the fresh fish market to restaurants and local groceries (PFMC 2003b).

Whereas the albacore troll fishery has not been intensively managed (although logbooks are required), the drift gillnet fishery for shark and swordfish has been managed extensively. In 1980, state legislation established a limited entry permit system, required logbooks and observers, and imposed gear restrictions in the fishery (PFMC 2003b). As of 1999, there were 139 California drift gillnet limited entry shark/swordfish permits (PFMC 2003b). The fishery has also been governed by time and area closures, including a May 1 through August 14 closure within 75 miles of the California coast to reduce pressure on thresher shark, and a December 15 through January 31 closure within 25 miles of the coast to protect gray whales (PFMC 2003b). In 1997, the federal (marine mammal) Take Reduction Program required all drift gillnet fishermen to use pingers[6] on their nets, set the net at least 36 ft below the surface, and attend annual "skipper workshops" to help address marine mammal interactions in the fishery (PFMC

[6] Pingers are acoustic devices used to deter birds and marine mammals from fishing gear.

2003b). Since 2001, the area between Point Conception and 45°N (between Point Lookout and Newport, Oregon) has been closed to drift gillnet fishing between August 15 and October 31 to reduce leatherback sea turtle impacts (PFMC 2003b). More recently, various federal interim final rules have been adopted to limit the swordfish and shark drift gillnet fishery at certain times of the year and under certain conditions to protect loggerhead turtles.

In 2001, the PFMC proposed to develop a FMP for the HMS fishery, one of the last open access fisheries on the US West Coast. The PFMC adopted a control date of March 9, 2000 before which fishermen must have participated in the fishery in order to qualify for a limited entry permit, should a limited entry program be adopted at a later date. In October 2002, the PFMC adopted the HMS FMP that outlines its plans for management of the fishery to address the requirements of the Sustainable Fisheries Act. At its March 2003 meeting, the PFMC voted to delay submission of the FMP to the Secretary of Commerce for approval.

Moss Landing and the HMS Fishery

Over the past two decades, Moss Landing has been one of the top five albacore ports in California (PFMC 2003b). The catch of all HMS species is unloaded by hoist from the boats, and packed into iced totes for delivery to local and regional processors, restaurants and retailers. Historically, albacore was canned as white meat tuna, but this has become more problematic since the relocation of most canneries along the US West Coast to Samoa and other South Pacific locations, Ecuador, Puerto Rico and Thailand starting in the early 1980s. Some of the catch landed at Moss Landing is sold directly to the public by at least three local fishermen. Other fishermen sell their catch directly or through Moss Landing receivers to local groceries.

The Salmon Troll Fishery

The California commercial salmon troll fishery targets chinook salmon primarily north of Point Conception with hook-and-line (i.e., troll) gear. Salmon troll operations vary, most notably in distinctions among part- and full-timers, and day- and multi-day trippers. Salmon trollers define part-timers as those who fish for salmon for part or all of a given salmon season and engage in other non-fishing income-generating activities during the rest of the year, or who are retired from a non-fishing occupation (Pomeroy 2002a). Full-timers are those who fish for salmon exclusively or as part of an annual round of fishing activities (e.g., albacore, crab, rockfish fishing), with little or no non-fishing work. Part-timers tend to be day-trippers, heading out early in the morning for a day of fishing, then returning to port in the evening to deliver their fish. Full-timers tend to be multi-day trippers, whose trips usually range from three to five days (Pomeroy 2002a).

Salmon trollers market their fish in a variety of ways. They may sell it (gutted and iced) directly to the public at the dock or a farmer's market, or to an intermediary such as a fish receiver, restaurant, grocery or other retail outlet. Four resident fish buyers receive salmon from fishermen at Moss Landing. Most of the catch is unloaded by hoist from the trollers, loaded into iced totes, and transported to local and regional fresh fish markets and groceries. At least three Moss Landing skippers regularly sell salmon off the boat directly to the public.

The timing and spatial distribution of the fishery is governed both by the migratory patterns of the fish and by regulations designed to protect threatened and endangered runs of salmon species and insure adequate escapement for reproduction (PFMC 1999). In recent years, the fishery has been open from May 1 through September 30, although not all areas are open throughout this period each year. The number of fishing days per season is lowest in the

northern part of the state, and increases with movement south to the US - Mexico border. Commercial troll-caught salmon landings reflect this variability, with most landings concentrated in the San Francisco and Moss Landing port areas.

The salmon fishery is subject to federal fishery management authority under the PFMC's Salmon Fishery Management Plan. The PFMC implemented a limited entry permit system in 1982. Regulation is driven by the goals of "[limiting] impacts on Klamath River fall chinook while maximizing harvests of Sacramento River fall chinook" (PFMC 1999:IV-1) and meeting the "jeopardy standard" for Sacramento River winter run chinook (PFMC 2000c).[7] Since 1994, concerns for Klamath Management Zone (KMZ) salmon stocks have resulted in very limited and at times closed seasons for the commercial salmon troll fishery north of Point Arena, from Fort Bragg to Crescent City. This, in turn, has constrained activity by Moss Landing fishermen in those areas, but has concentrated fishing activity in the Monterey Bay area fishery and at Moss Landing. In addition to time and area closures, restrictions include area quotas, a minimum size limit of 26 inches, a limit of six lines per vessel, and a requirement that barbless hooks be used.

Other Moss Landing Fisheries

In addition to the major fisheries described above, several other fisheries play an important role in Moss Landing fishermen's and buyers' annual rounds of activity. Among these fisheries are Dungeness crab, California halibut and spot prawn, which we describe briefly below.

Dungeness Crab

The fishery for Dungeness crab is concentrated in the Crescent City area, but extends from Avila to the Oregon border (Dewees pers. comm.). Fishermen use circular steel traps deployed from multipurpose vessels, many of which also participate in the salmon and albacore, and perhaps shark and swordfish fisheries. Hankin and Warner (2001) recently estimated that 75% of the catch is marketed fresh (live) through local and regional markets and restaurants, while 25% is picked and vacuum packed for sale in retail outlets.

The State of California manages the Dungeness crab fishery through a limited entry system established in 1995. As of March 2000, 604 resident and 70 non-resident limited entry permits were assigned to fishermen (Hankin and Warner 2001). In 2001, the state issued 588 resident and 66 non-resident Dungeness crab vessel permits (DFG 2003). The state further manages the fishery through sex, size and season regulations by area. Only male crabs may be kept, and they must be at least 6.5 inches across the carapace (back). The central California season, which affects fishermen at Moss Landing, runs from the second Tuesday of November through June 30. Hankin and Warner (2001) characterize the fishery as "fully exploited".

California Halibut

California halibut is a flatfish species targeted by trawl, set gillnet and trammel net, and hook and line fishermen including salmon trollers (Kramer et al. 2001). The fishery is concentrated between Bodega Bay and southern California. Although the central California fishery occurs primarily in the San Francisco Bay area, considerable activity occurs at Moss Landing.

[7] The jeopardy standard of the Endangered Species Act requires that management be conducted in a way that does not "reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, number, or distribution of that species" (50 C.F.R. § 402.02).

The state has primary management authority for the halibut fishery, although the PFMC manages it indirectly through bycatch quotas for federally managed fisheries including salmon and groundfish. Commercial halibut fishing is limited by a 22-inch minimum size, and by trawl and gillnet restrictions on both net mesh size and where fishing is allowed. Trawling for halibut is prohibited in state waters, and gillnet fishing is now restricted to outside the 60-fathom depth contour along most of the California coast. Halibut are found most commonly between about 15 and 60 fathoms (Kramer et al. 2001), so that hook-and-line gear which do not face these depth restrictions have accounted for increasing shares of total landings, while gillnetting for halibut out of Moss Landing has ceased.

Spot Prawn

The spot prawn fishery originated in the Monterey Bay area in the 1930s. It remained a minor fishery statewide until the early 1970s, when it grew, especially in southern California (Larson 2001). In recent years, both trawl and trap fishermen have targeted this fishery. In 2000, about 54 trawlers participated in the fishery coastwide, including the Monterey Bay area. These vessels average 47 feet in length (range = 28-85 feet), and use shrimp nets and rollers (Larson 2001). The spot prawn trap fleet operates from Monterey Bay to southern California. In 2000, the Monterey Bay fleet consisted of about six vessels that ranged from 30 to 60 feet in length (Larson 2001). Traps are made of steel or plastic, and usually are set in strings of several traps at depths of 100 to 150 fathoms (Larson 2001). With the advent of the southern California live fish market in the late 1980s, the trap fishery in that area grew. Landings in the northern California trawl fishery (including the Monterey Bay area), in particular, have grown over the past decade. Trawl as well as trap vessels supply the market for live fish, with 95% of the 2000 catch allocated to this use (Larson 2001).

Like Dungeness crab and California halibut, spot prawn is managed by the State of California. In the early 1990s, regulations focused primarily on the southern California fishery. Larson (2001) reports that following technological changes in the fishery and a precipitous decline in landings in 1999, fishermen requested further regulation and a limited entry program for the fishery. In 2000, the Fish and Game Commission adopted a May to August trap fishery closure north of Point Conception, and limited traps to 300 per vessel during the rest of the year. In addition, regulations required bycatch reduction devices in the trawl fishery, and an industry-funded observer program for trap and trawl components of the fishery in northern and southern California. In 2002, the Commission approved a limited entry program for the fishery. In February 2003, the Commission adopted regulations prohibiting the use of trawl nets to take spot prawn, effective April 1, 2003.

SECTION 4: TRENDS AND RECENT EXPERIENCE

In this section we focus on trends and experience in the commercial fishing industry at Moss Landing. We take both a long view, exploring trends in the fisheries over the past two decades (1981-2001), as well as a shorter view of recent trends and experience. We examine trends in the number of active vessels, pounds landed and ex-vessel revenue, by species group and gear group, statewide and at Moss Landing.

The discussion that follows is based on our analysis of California commercial fish landings data from the Pacific Fisheries Information Network (PacFIN) database for 1981 through 2001, and data collected through our archival, ethnographic and survey research for this and related projects. The PacFIN data include a record of "fish tickets" completed upon the delivery of fish by commercial fishing boats at California ports. The fish ticket data include information on the species, gear, port of delivery, and pounds and ex-vessel value landed. We began by analyzing all of the California fish ticket data to determine statewide trends in numbers of participants, and landings (in pounds and ex-vessel value) overall, and by species and gear group, by port. We then selected the data for all vessels that made at least one landing at Moss Landing between 1981 and 2001. This data represents the population of commercial fishing vessels that have delivered to Moss Landing during that time. As the survey data reported in the next section illustrate, many of these vessels land at other California (and some non-California) ports as well. The landings of these vessels at other California ports (as well as Moss Landing) are captured in the statewide (CA) data. Moreover, most fishing vessels participate in fisheries that cut across the species and gear categories used. As a result, landings and revenue per vessel at Moss Landing or for particular species or gear groups represent only a portion of such vessels' overall activities, landings and revenue.

To make the analyses and their interpretation more tractable, we grouped the species, gear and port data. We used five major species groups, and a sixth catchall group, linked closely to the major fisheries described in the Overview of Major Moss Landing Fisheries above. ***Coastal pelagic species*** (CPS) includes anchovy, mackerel, sardine and squid; ***groundfish*** includes flatfish, roundfish and some rockfish species targeted primarily by the trawl fleet; ***open access rockfish*** includes dozens of rockfish species, cabezon, lingcod and some other species targeted by the open access fleet; ***highly migratory species*** (HMS) is comprised of albacore and other tunas, shark and swordfish; ***salmon*** consists of chinook salmon; and ***other species*** comprises several species including crab, halibut and spot prawn. We grouped gear into seven categories: ***gillnet***, ***line***, ***pot***, ***seine***, ***trawl***, ***troll*** and ***other***. We aggregated port data into port area groups for all ports except the three main Monterey Bay ports of Moss Landing (ML), Monterey (MN) and Santa Cruz (SC). Port area groups include (from north to south): Crescent City (CC), Eureka (ER), Ft. Bragg (FB), Bodega Bay (BB), San Francisco (SF), other Monterey Bay area ports (OM), Morro Bay (MB), Santa Barbara/Ventura/Port Hueneme (SB/V/PH), Los Angeles (LA), San Diego (SD) and other California ports (OC). (See Appendix B, Figure B-1 for a map of California ports, and Tables B-3, B-4 and B-5 for detailed lists of gears, ports and species in each group.)

The following should be noted about counts of fishery participants and revenues. Because landings data are reported for fishing vessels rather than skippers or crew, they only enable the assessment of trends for active fishing vessels, not for fishermen per se. Some skippers own more than one boat; others are non-owner operators. License statistics compiled by the Department of Fish and Game can be used to count the number of individuals who purchased commercial operator (skipper) and crew licenses, but not to determine how many of those individuals actually fished commercially in a given year. In addition, revenues represent ***ex-***

vessel values paid by the buyer to the fishing operation only, and are not an indication of skipper or crew earnings, nor do they account for the full economic value of the commercial fishing sector or industry.

Vessels, Pounds landed and Ex-vessel Revenues Overall

The number of participants in California's commercial fishing industry has changed considerably since 1981 (Table 4-1). The number of vessels has dropped by 65% over the 21-year period. The rapid decline from 6,908 to 4,813 active vessels between 1981 and 1985 was likely a result of the implementation of limited entry in the salmon fishery in 1982 and the 1982-83 El Niño which affected the availability of some species (e.g., squid) and access to the fishing grounds more generally. Although there was a small increase in the number of active vessels through the late 1980s, the decline resumed in 1990, and continued fairly steadily through 2001. The number of vessels landing fish at Moss Landing also dropped over the 21-year period, although somewhat less than the number statewide. Whereas the decline in number of active vessels statewide has been fairly consistent, it has been more variable at Moss Landing. The number of vessels peaked at 658 in 1983, and then declined to fewer than 400 through 1992. Since then, the number of active vessels has varied considerably from a low of 270 in 1994 to a high of 429 in 1997, and varying around 300 vessels most years since then. The decline in fishery participants can be attributed to several factors, including additional limits on entry in other fisheries, declining allowable catches and prices, and increasing costs.

Landings at California ports dropped by 44% between 1981 and 2001 overall, from a high of nearly 800 million pounds to just under 450 million pounds, the 21-year mean. Since 1984, landings have varied between about 250 and 500 million pounds, except in 2000 when they reached 550 million pounds. Whereas pounds of fish landed at California ports overall has declined markedly, landings at Moss landing have more than doubled since 1981, peaking at over 56 million pounds in 2001. Moreover, the recent trend of increases in pounds landed since 1993 (except for 1998 when squid disappeared during the height of the El Niño) contrasts notably with the steady decline in pounds landed through the 1980s, and the highly variable landings of the early 1990s at Moss Landing.

Ex-vessel revenues statewide and by port area have also declined considerably over the 21-year period (Table 4-1). Statewide ex-vessel revenue declined from over $633 million in 1981 to $107.7 million in 2001, a drop of 83%. Most of the decline occurred in the early 1980s, especially as tuna canneries in southern California shifted their operations overseas. Ex-vessel revenues continued to decline through the mid 1990s, but at a slower pace. These declines were offset some by brief increases in revenue from 1993 to 1996, but have shown a general downward trend since then. The trend in ex-vessel revenue at Moss Landing has been similar to the statewide pattern, with two notable exceptions. In both 1983 and 1997, ex-vessel revenues at Moss Landing increased while statewide ex-vessel revenues declined relative to the previous year. The substantial drop in ex-vessel revenues from 1997 to 1998 both at Moss Landing and statewide may be attributed largely to the decline in squid landings associated with the 1997-1998 El Niño.

Table 4-1. Number of commercial fishing vessels, pounds landed and ex-vessel revenues (2000 $) statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	6,908	609	791,642,788	22,159,789	633,062,266	12,313,102
1982	6,592	509	697,906,863	17,757,180	466,568,994	8,333,182
1983	5,834	658	523,057,441	14,289,116	357,021,742	9,401,702
1984	5,179	504	447,621,572	15,455,320	290,396,063	5,623,489
1985	4,813	414	358,347,985	10,739,963	222,184,215	5,588,809
1986	4,853	388	416,644,990	14,028,666	223,810,348	6,427,727
1987	4,720	364	442,768,378	12,182,539	231,842,893	6,271,304
1988	4,815	336	495,426,441	8,308,253	263,362,194	6,740,869
1989	4,887	313	487,011,755	7,777,539	209,081,675	4,639,098
1990	4,606	353	395,576,000	10,335,626	198,484,946	4,922,171
1991	4,394	347	371,532,870	8,153,696	181,110,297	4,241,101
1992	3,877	325	299,190,245	11,399,091	165,786,794	4,111,856
1993	3,658	409	320,023,732	7,785,961	160,579,018	5,041,556
1994	3,643	270	330,597,377	14,443,964	177,779,138	5,709,860
1995	3,435	368	425,518,808	13,533,457	186,210,253	7,770,609
1996	3,321	405	461,714,667	24,979,143	206,719,438	9,373,169
1997	3,206	429	492,358,754	44,775,711	191,332,344	11,467,420
1998	2,741	289	284,135,907	27,435,438	116,292,824	4,356,495
1999	2,812	307	472,016,292	40,509,741	149,810,196	6,314,941
2000	2,669	355	550,273,906	50,361,086	135,904,342	7,304,370
2001	2,393	294	443,643,596	56,039,191	107,685,858	6,726,859

Trends in Vessels, Pounds Landed and Ex-Vessel Revenues by Species Group

The following tables show summary statistics of salmon, CPS, groundfish, open access rockfish, HMS, and other species for landings statewide (CA) and at Moss Landing (ML), from 1981 through 2001. The data for each species group are presented in sets of two tables. The first table shows 1) the number of vessels that landed, 2) total pounds landed, and 3) total ex-vessel revenues in year 2000 dollars for the species group. The second table shows 1) the average price per pound, calculated as total ex-vessel revenues divided by total pounds landed ($/lb.), 2) average pounds landed per vessel, defined as total pounds landed divided by total number of vessels, and 3) average ex-vessel revenues per vessel, defined as total revenues divided by total number of vessels for each year.

Salmon

In California as a whole, the number of vessels landing salmon steadily declined from more than 4,000 in 1981 to fewer than 700 by 1998 (Table 4-2). Pounds landed were unusually high around 1988, but otherwise have fluctuated around about 4 million pounds for the state. The situation for Moss Landing is similar to the state for the number of vessels, but there has been an erratic upward trend in salmon landings at Moss Landing. For example, salmon landings more than doubled from 1990 levels to more than 1 million pounds landed in 1997 and 2000.

Table 4-2. Vessels, pounds landed and ex-vessel revenues for salmon landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	4,039	349	5,498,781	310,580	31,534,894	1,798,020
1982	3,950	432	7,362,335	659,926	37,650,753	3,433,859
1983	3,131	361	2,116,357	315,880	8,101,094	1,233,266
1984	2,540	299	2,604,733	211,203	12,739,903	1,063,044
1985	2,308	265	4,500,298	199,027	19,933,918	926,409
1986	2,573	271	7,400,968	473,492	23,603,901	1,600,966
1987	2,437	222	9,051,766	275,447	35,575,256	1,127,520
1988	2,567	250	14,436,253	797,663	54,936,047	3,028,652
1989	2,535	250	5,587,063	420,094	18,499,782	1,418,729
1990	2,103	281	4,124,738	451,095	15,397,382	1,691,892
1991	1,743	248	3,239,412	275,685	11,070,314	937,626
1992	1,083	224	1,632,371	180,328	5,672,309	619,706
1993	1,243	309	2,541,343	352,934	7,241,275	1,001,438
1994	1,025	177	3,105,641	401,866	7,902,500	998,191
1995	1,179	246	6,645,719	1,214,235	13,573,709	2,305,318
1996	990	259	4,118,543	1,145,463	7,154,753	1,774,419
1997	839	224	5,287,399	1,311,856	8,152,637	1,696,825
1998	669	153	1,847,328	214,104	3,306,565	311,843
1999	670	157	3,843,887	661,899	7,705,089	1,132,259
2000	762	240	5,135,719	1,132,612	10,306,939	1,949,578
2001	699	152	2,396,103	211,171	4,926,809	442,893

Real ex-vessel revenues for salmon show a similar pattern to landings for the state. Ex-vessel revenues at Moss Landing exhibit major inter-annual fluctuations, but the overall trend is downward. For example, revenues at Moss Landing were greater than $2 million in 1995 and less than $500,000 in 2001.

This situation of increasing landings and decreasing revenues likely occurred as a result of supply and demand interactions, with prices falling in response to the increased supply of fish on the market, including farmed salmon. The data for real ex-vessel prices show a drop in ex-vessel prices for salmon from 1981 through 2001 of more than 60% both for the state and at Moss Landing (Table 4-3). This drop followed salmon prices that ranged from $2.50 to $4.00 per pounds between 1973 and 1976.

Average pounds landed of salmon per vessel have fluctuated widely but exhibit an upward trend that is correlated with downward trends in the number of vessels operating in California and at Moss Landing. Of particular interest, observed trends in pounds landed and in number of vessels seem to approximately balance downward trends in ex-vessel prices. In this case, average ex-vessel revenues exhibit boom and bust cycles, varying by more than 300% from the mean in some years, and fluctuate around $9,000 per vessel for the state, and around $4,000 at Moss Landing. These cycles are influenced not only by the local availability of salmon, but also by interactions with supply and price of farmed salmon from sources within and outside the US.

Table 4-3. Prices, pounds landed and revenues per vessel for salmon landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	5.73	5.79	1,361	890	7,808	5,152
1982	5.11	5.20	1,864	1,528	9,532	7,949
1983	3.83	3.90	676	875	2,587	3,416
1984	4.89	5.03	1,025	706	5,016	3,555
1985	4.43	4.65	1,950	751	8,637	3,496
1986	3.19	3.38	2,876	1,747	9,174	5,908
1987	3.93	4.09	3,714	1,241	14,598	5,079
1988	3.81	3.80	5,624	3,191	21,401	12,115
1989	3.31	3.38	2,204	1,680	7,298	5,675
1990	3.73	3.75	1,961	1,605	7,322	6,021
1991	3.42	3.40	1,859	1,112	6,351	3,781
1992	3.47	3.44	1,507	805	5,238	2,767
1993	2.85	2.84	2,045	1,142	5,826	3,241
1994	2.54	2.48	3,030	2,270	7,710	5,640
1995	2.04	1.90	5,637	4,936	11,513	9,371
1996	1.74	1.55	4,160	4,423	7,227	6,851
1997	1.54	1.29	6,302	5,857	9,717	7,575
1998	1.79	1.46	2,761	1,399	4,943	2,038
1999	2.00	1.71	5,737	4,216	11,500	7,212
2000	2.01	1.72	6,740	4,719	13,526	8,123
2001	2.06	2.10	3,428	1,389	7,048	2,914

Coastal Pelagic Species

The CPS fleet lands large volumes of market squid and Pacific sardine, which dominate the fishery, plus mackerel and northern anchovy (Table 4-4). The number of vessels landing CPS species in California declined steadily from nearly 900 vessels in 1981 to about 300 in 2001. The decline at Moss Landing during this period was about half, from 42 vessels to 20. Inter-annual variation in numbers of CPS vessels with landings at Moss Landing is greater than for the state as a whole.

CPS landings have increased for both California and Moss Landing. However, CPS landings exhibit dramatic boom and bust cycles, attributed largely to climate fluctuations such as El Niño events. The increase in landings at Moss Landing during the 1990s is remarkable, from around 5 million pounds in 1990 to more than 50 million pounds in 2001. In large part, this increase is due to the recovery of the California sardine fishery, particularly in Monterey Bay. Real ex-vessel revenues for CPS species have fluctuated around $40 million for the state. At Moss Landing, these revenues have grown in the past decade but have fluctuated widely from less than $500,000 in the late 1980s to more than $3 million in 1997 and 2001.

Like salmon, the increase in CPS landings has corresponded to a decrease in real ex-vessel prices statewide and at Moss Landing (Table 4-5). Ex-vessel prices for California as a whole appear to be greater, on average, than at Moss Landing in any given year, possibly reflecting the high volume of CPS species landed at Moss Landing. Unlike salmon, however, the

downward trend in ex-vessel prices for CPS species is not enough to offset the upward trend in pounds landed, and thus creates a downward trend in ex-vessel revenues per vessel.

Table 4-4. Vessels, pounds landed and ex-vessel revenues of CPS landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Landings		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	876	42	297,532,401	13,673,700	53,280,873	1,852,319
1982	855	25	275,015,521	9,834,582	53,695,239	1,383,139
1983	824	34	144,567,961	2,059,151	44,208,261	387,790
1984	757	39	133,447,138	7,784,589	21,532,056	605,451
1985	796	39	142,282,966	3,726,209	31,381,840	652,702
1986	711	46	184,582,589	6,087,199	30,256,493	779,646
1987	736	27	187,384,078	4,418,234	25,624,558	538,336
1988	773	16	230,331,837	1,825,813	30,514,276	205,915
1989	760	14	246,844,607	2,043,038	30,261,693	238,179
1990	724	28	185,503,790	4,957,936	27,060,519	425,428
1991	551	21	198,662,036	4,280,594	30,101,081	411,013
1992	718	42	128,632,721	6,517,940	22,838,575	525,459
1993	517	45	171,820,780	3,009,502	20,926,997	503,328
1994	457	23	186,307,238	10,439,414	26,169,569	1,802,834
1995	442	25	280,951,770	6,948,869	43,263,861	569,351
1996	483	24	297,256,963	18,022,573	50,599,240	1,809,000
1997	520	27	326,834,258	37,140,767	48,999,414	3,462,016
1998	388	16	158,096,103	23,604,869	9,654,601	764,425
1999	370	15	370,030,922	35,924,437	44,284,444	1,290,218
2000	415	28	463,192,406	46,246,061	39,981,778	2,750,295
2001	313	20	374,996,811	52,196,945	30,191,602	3,284,157

Following the recovery of Pacific sardine, the per vessel average number of pounds landed of CPS species has increased rapidly during the 1990s both for the state and at Moss Landing. For the state, pounds landed per vessel increased from about 250,000 to almost 1.2 million pounds per vessel. The increase was even greater at Moss Landing, from less than 200,000 to about 2.6 million pounds per vessel.

Average ex-vessel revenue per vessel from CPS species also increased after 1990. For the state, the increase was from less than $40,000 per vessel to almost $100,000. As with average pounds landed per vessel, the increase in this measure at Moss Landing is even more impressive, from about $15,000 to more than $100,000 per vessel.

Table 4-5. Prices, and average landings and revenues per vessel for CPS landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.18	0.14	339,649	325,564	60,823	44,103
1982	0.20	0.14	321,656	393,383	62,801	55,326
1983	0.31	0.19	175,447	60,563	53,651	11,406
1984	0.16	0.08	176,284	199,605	28,444	15,524
1985	0.22	0.18	178,747	95,544	39,424	16,736
1986	0.16	0.13	259,610	132,330	42,555	16,949
1987	0.14	0.12	254,598	163,638	34,816	19,938
1988	0.13	0.11	297,971	114,113	39,475	12,870
1989	0.12	0.12	324,796	145,931	39,818	17,013
1990	0.15	0.09	256,221	177,069	37,376	15,194
1991	0.15	0.10	360,548	203,838	54,630	19,572
1992	0.18	0.08	179,154	155,189	31,809	12,511
1993	0.12	0.17	332,342	66,878	40,478	11,185
1994	0.14	0.17	407,674	453,888	57,264	78,384
1995	0.15	0.08	635,637	277,955	97,882	22,774
1996	0.17	0.10	615,439	750,941	104,760	75,375
1997	0.15	0.09	628,527	1,375,584	94,230	128,223
1998	0.06	0.03	407,464	1,475,304	24,883	47,777
1999	0.12	0.04	1,000,084	2,394,962	119,688	86,015
2000	0.09	0.06	1,116,126	1,651,645	96,342	98,225
2001	0.08	0.06	1,198,073	2,609,847	96,459	164,208

Groundfish

The groundfish category includes species caught by multiple gear types, but is strongly influenced by the limited entry groundfish trawl fleet. Trawlers' target species include the Dover sole-thornyhead-sablefish (DTS) complex, slope and shelf species such as widow rockfish, and several flatfish species including petrale sole and English sole. (We excluded California halibut from the groundfish category because it is not actively managed under the federal Groundfish FMP.)

The number of vessels landing groundfish in California declined somewhat from 1983 to 1997, but declined more quickly after that due largely to restrictive controls on fishing to protect overfished groundfish stocks (Table 4-6). Effects of recent regulations are even more striking at Moss Landing where the number of vessels that land groundfish gradually increased through 1996, but has declined sharply since that time.

Since 1982, groundfish landings in California have declined steadily, from more than 70 million pounds to less than 30 million pounds. The decline at Moss Landing has been more gradual, with peaks of activity in 1982 and 1995 of about 4 million pounds per year, to less than 2 million pounds in 2001. The situation will become worse next year due to even stricter groundfish regulations, including depth based area restrictions such as the Rockfish Conservation Area.

Except for peaks in 1982 and 1995 of about $40 and $30 million respectively, real ex-vessel revenues for groundfish have declined steadily in California to about $12 million in 2001. On the other hand, except for the boom around 1995 when revenues peaked at more than $3 million, groundfish revenues at Moss Landing have been relatively stable, fluctuating between $1.0 million and $1.5 million per year.

Table 4-6. Vessels, pounds landed and ex-vessel revenues for groundfish landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	1,474	51	63,509,455	2,507,669	30,683,030	1,220,607
1982	1,665	78	87,641,949	3,831,640	39,074,054	1,654,593
1983	1,171	93	56,344,242	3,914,635	25,156,992	1,642,388
1984	1,059	60	55,808,353	3,567,695	22,532,754	1,381,778
1985	1,062	59	65,535,005	2,798,898	28,033,828	1,205,988
1986	1,177	81	63,350,750	2,972,805	28,163,655	1,228,098
1987	1,361	63	62,981,698	2,819,571	27,265,118	1,229,497
1988	1,315	59	62,550,873	2,351,189	24,487,845	1,118,761
1989	1,410	49	65,864,613	1,843,851	25,672,258	887,519
1990	1,462	57	57,506,787	1,367,149	22,874,232	715,469
1991	1,378	71	59,430,967	1,644,568	23,715,547	912,000
1992	1,391	93	61,442,346	3,255,525	26,060,365	1,551,297
1993	1,175	74	48,192,567	2,557,484	20,498,410	1,176,342
1994	1,142	66	41,641,844	2,626,015	21,415,937	1,448,670
1995	1,144	97	50,589,727	3,889,901	31,093,763	3,098,619
1996	1,158	117	47,455,741	2,718,074	30,704,773	2,902,413
1997	1,167	98	50,746,625	2,053,232	26,764,010	2,243,804
1998	862	76	35,756,987	1,495,211	14,893,911	1,044,580
1999	848	93	25,742,178	1,702,925	14,546,725	1,392,204
2000	726	75	30,863,822	1,856,195	15,144,367	1,612,250
2001	650	67	20,348,805	1,682,445	11,913,439	1,381,722

Real ex-vessel prices for groundfish have increased, on average, since 1981 with a peak of more than $0.60 per pound for California, and more than $1.00 per pound at Moss Landing (Table 4-7). While statewide ex-vessel prices increased by perhaps a third between 1981 and 2001, average groundfish prices have doubled at Moss Landing during that time. In fact, real ex-vessel prices for many groundfish species were relatively stable from 1981 through 2001. An exception was Dover sole, which experienced increases in ex-vessel prices during the 1990s.

As expected, average pounds landed of groundfish per vessel has declined steadily since 1982 for California, and at Moss Landing except for the period between 1990 and 1995. For California, landings per vessel have declined from around 50,000 to less than 40,000 pounds per vessel. The decline has been more dramatic at Moss Landing, from 50,000 to less than 25,000 pounds per vessel.

Average ex-vessel revenues from landings of groundfish, on the other hand, have fluctuated but do not show a significant trend up or down. For California, real revenues per vessel have fluctuated around $20,000, with peaks in 1985 and 1995 of more than $25,000 and a low in 1990 of about $15,000. Average ex-vessel revenues per vessel at Moss Landing also fluctuated

around $20,000. Peak average revenues at Moss Landing in 1995 were greater than $30,000 per vessel, and less than $15,000 in 1990 and 1998.

Table 4-7. Prices, average pounds landed and revenues per vessel for groundfish landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.48	0.49	43,086	49,170	20,816	23,933
1982	0.45	0.43	52,638	49,124	23,468	21,213
1983	0.45	0.42	48,116	42,093	21,483	17,660
1984	0.40	0.39	52,699	59,462	21,277	23,030
1985	0.43	0.43	61,709	47,439	26,397	20,440
1986	0.44	0.41	53,824	36,701	23,928	15,162
1987	0.43	0.44	46,276	44,755	20,033	19,516
1988	0.39	0.48	47,567	39,851	18,622	18,962
1989	0.39	0.48	46,712	37,630	18,207	18,113
1990	0.40	0.52	39,334	23,985	15,646	12,552
1991	0.40	0.55	43,128	23,163	17,210	12,845
1992	0.42	0.48	44,171	35,006	18,735	16,681
1993	0.43	0.46	41,015	34,561	17,445	15,897
1994	0.51	0.55	36,464	39,788	18,753	21,950
1995	0.61	0.8	44,222	40,102	27,180	31,945
1996	0.65	1.07	40,981	23,231	26,515	24,807
1997	0.53	1.09	43,485	20,951	22,934	22,896
1998	0.42	0.70	41,481	19,674	17,278	13,744
1999	0.57	0.82	30,356	18,311	17,154	14,970
2000	0.49	0.87	42,512	24,749	20,860	21,497
2001	0.59	0.82	31,306	25,111	18,328	20,623

Open Access Rockfish

The open access (OA) rockfish category has data for almost ninety species, most of the genus Sebastes. These species are usually caught in nearshore areas within a few miles of the coast and are often subject to both state and federal regulations. Several of the nearshore species have recently become subject to the state's limited access program under the Nearshore FMP. In general, little is known about the biological status of most rockfish and related species. Fishery scientists are particularly concerned about cabezon, which will undergo a stock assessment for the first time in 2004.

For California, the number of vessels reporting landings of OA rockfish species steadily declined from around 3,000 vessels in 1981 to fewer than 800 in 2001 (Table 4-8). The situation at Moss Landing, however, was different with a relatively modest downward trend in the number of vessels from more than 150 to about 100 vessels. The peak years for Moss Landing were 1982 with more than 200 vessels and 1992 with 170 vessels landing. At the other extreme, 75 vessels landed OA rockfish at Moss Landing in 1994.

For California, landings of OA rockfish species have declined steadily since 1990, from about 23.5 million to under 2.5 million pounds in 2001. Landings at Moss Landing have followed an

erratic decline from just over 3.5 million pounds in 1983 to nearly 300,000 pounds in 2001, punctuated by landings of more than 2 million pounds in 1996.

Real ex-vessel revenues for California open access rockfish landings also declined, from almost $15 million dollars in 1990 to less than $4 million in 2001. At Moss Landing, ex-vessel revenues fluctuated between $1 million and $1.6 million per year during the 1980s and fell to between $200,000 and $500,000 per year in the 1990s.

Table 4-8. Vessels, pounds landed and ex-vessel revenues for open access rockfish landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	2,862	140	28,380,006	2,234,114	14,970,778	931,922
1982	2,961	153	21,943,355	2,199,876	13,213,703	972,372
1983	2,391	207	23,988,167	3,591,793	12,990,163	1,526,378
1984	2,082	141	26,532,354	2,361,789	13,704,756	976,258
1985	1,909	95	21,950,907	2,054,467	13,256,586	991,746
1986	1,979	118	20,808,337	2,898,808	12,994,093	1,420,681
1987	2,129	108	21,681,666	2,413,968	12,419,015	1,110,668
1988	2,007	86	20,208,401	1,658,304	10,849,872	765,693
1989	2,209	79	22,274,530	2,024,597	12,802,938	896,510
1990	2,198	116	23,563,314	2,086,411	13,351,745	994,804
1991	1,991	99	18,682,735	1,472,757	11,804,270	739,405
1992	1,847	170	14,770,270	961,671	9,851,892	477,601
1993	1,564	95	13,156,461	914,215	9,167,172	498,035
1994	1,478	75	11,297,915	372,435	7,920,945	257,285
1995	1,393	106	10,839,790	671,201	8,042,606	296,387
1996	1,399	109	12,394,529	2,065,108	8,783,163	473,884
1997	1,356	85	11,342,063	1,138,155	7,488,589	310,692
1998	1,158	107	12,055,087	1,247,810	7,947,987	488,395
1999	1,106	99	3,902,712	452,830	4,329,842	218,245
2000	1,030	97	2,380,937	327,094	4,079,740	212,023
2001	793	87	2,469,437	426,860	3,754,229	253,700

For California, real ex-vessel prices for the OA rockfish group were remarkably stable at about $0.60 per pound through 1996 when prices increased to about $0.70 per pound (Table 4-9). At Moss Landing, ex-vessel prices increased gradually from just over $0.40 to $0.70 per pound in 1992, followed by swings between $0.20 and $0.60 per pound through 2001.

Average landings per vessel in California declined gradually from a peak of more than 12,000 pounds in 1985 to more than 10,000 in 1998. Average landings per vessel fell sharply from this level to around 3,000 pounds in 2001, due in part to landings limits for several species.

For California, average ex-vessel revenues peaked in 1985 and 1998 at about $7,000 per vessel. At other times, average annual revenues per vessel have fluctuated from peak levels to less than $4,000. Average ex-vessel revenues at Moss Landing peaked in 1986 at more than $12,000 per vessel, and declined after 1990 to just under $3,000 per vessel in 1992. Between 1992 and 2001, average revenues per vessel at Moss Landing fluctuated between about $2,000 and $5,000.

Table 4-9. Prices, average pounds landed and revenues per vessel for open access rockfish landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.53	0.42	9,916	15,958	5,231	6,657
1982	0.60	0.44	7,411	14,378	4,463	6,355
1983	0.54	0.42	10,033	17,352	5,433	7,374
1984	0.52	0.41	12,744	16,750	6,583	6,924
1985	0.60	0.48	11,499	21,626	6,944	10,439
1986	0.62	0.49	10,515	24,566	6,566	12,040
1987	0.57	0.46	10,184	22,352	5,833	10,284
1988	0.54	0.46	10,069	19,283	5,406	8,903
1989	0.57	0.44	10,084	25,628	5,796	11,348
1990	0.57	0.48	10,720	17,986	6,075	8,576
1991	0.63	0.50	9,384	14,876	5,929	7,469
1992	0.67	0.50	7,997	5,657	5,334	2,809
1993	0.70	0.54	8,412	9,623	5,861	5,242
1994	0.70	0.69	7,644	4,966	5,359	3,430
1995	0.74	0.44	7,782	6,332	5,774	2,796
1996	0.71	0.23	8,860	18,946	6,278	4,348
1997	0.66	0.27	8,364	13,390	5,523	3,655
1998	0.66	0.39	10,410	11,662	6,864	4,564
1999	1.11	0.48	3,529	4,574	3,915	2,204
2000	1.71	0.65	2,312	3,372	3,961	2,186
2001	1.52	0.59	3,114	4,906	4,734	2,916

Highly Migratory Species

The Highly Migratory Species (HMS) FMP includes tunas, swordfish and sharks. HMS species landed at Moss Landing include leopard, mako, soupfin and thresher sharks; albacore, bluefin and skipjack tunas; and swordfish. After a boom during the 1980s, the number of vessels landing HMS species appears to have stabilized at around 750 vessels in California, with between 50 and 100 landing at Moss Landing in a given year (Table 4-10).

Landings of HMS species declined steadily through the 1980s. For California, landings went from a high of more than 325 million pounds in 1981 to a little over 20 million pounds by 1990. After that, California landings climbed back to about 45 million pounds but were less than 15 million pounds in 2001. The pattern at Moss Landing is similar, reaching a low near 200,000 pounds in 1990 and then increasing dramatically to more than 2.7 million pounds in 1997. The trends at Moss Landing for HMS species appear to be more positive than for the state as a whole.

Ex-vessel revenues from landings of HMS species declined sharply between 1981 and 1990. For California, total ex-vessel revenues dropped from more than $450 million in 1981 to $30 million in 1990, and fluctuated between $35 million in 1995 to less than $17 million in 2001. At Moss Landing, ex-vessel revenues went from a high of more than $6 million dollars in 1981 to a little more than $400,000 in 1990. Ex-vessel revenues at Moss Landing climbed back to around $3 million in 1997 but fell back to about $1 million in 2001.

Table 4-10. Vessels, pounds landed and ex-vessel revenues for HMS landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	2,168	304	325,157,018	3,263,139	425,087,669	6,239,797
1982	1,627	85	251,190,888	409,223	264,660,922	524,751
1983	2,220	396	246,126,880	3,849,702	217,570,595	4,325,958
1984	1,780	207	183,766,480	1,278,865	168,539,060	1,303,427
1985	1,542	170	70,934,780	1,544,882	78,530,663	1,499,981
1986	1,227	116	75,181,212	1,102,809	67,270,941	1,112,265
1987	1,163	138	74,862,578	1,307,148	66,191,848	1,795,341
1988	923	76	71,432,790	680,765	68,456,613	1,101,677
1989	905	62	56,857,027	299,061	49,763,278	609,079
1990	803	47	31,311,184	233,690	29,967,632	416,616
1991	669	63	21,837,282	260,871	21,318,073	992,823
1992	884	79	21,602,580	357,235	22,704,563	795,618
1993	783	101	27,300,000	818,137	28,746,371	1,622,120
1994	813	58	28,594,408	422,852	31,440,137	749,925
1995	633	57	28,383,142	624,971	20,940,409	1,217,128
1996	724	72	44,053,147	774,803	34,908,821	1,836,578
1997	1,020	181	39,619,139	2,712,249	29,619,557	3,121,246
1998	806	77	37,994,907	534,551	26,372,565	1,055,684
1999	772	85	28,080,040	1,476,480	26,440,703	1,786,084
2000	675	59	14,039,180	688,600	19,377,074	642,232
2001	752	82	12,790,128	1,370,886	16,668,274	1,120,519

For California, average landings of HMS species per vessel declined from more than 140,000 pounds in 1981 to less than 25,000 pounds in 1990 (Table 4-11). Average landings for the state increased to more than 60,000 pounds per vessel in 1995, but dropped below 20,000 pounds in 2001. At Moss Landing, the decline in average pounds landed was relatively modest, falling from about 11,000 to about 4,000 pounds per vessel. Following 1990, except for 1998, average landings at Moss Landing steadily increased to almost 17,000 pounds per vessel in 2001.

Whereas average HMS landings per vessel statewide have declined by about 90% (from nearly 50 million to 17 million pounds), they have increased by 56% at Moss Landing (from about 10 million to nearly 17 million pounds) since the early 1980s. The inter-annual patterns in HMS landings also differ notably between the state as a whole and Moss Landing in particular. Statewide, HMS landings dropped by almost 70% between 1981 and 1985, increased some through 1988, and then dropped again through 1992. They then increased through 1996, but have dropped fairly steadily since 1998 to a low of 17 million pounds in 2001. Following declines through the early 1990s at Moss landing, landings increased, and since 1995 have been well above the 21-year mean of 9.1 million pounds, except for 1998 when they dipped below 7 million pounds.

Average ex-vessel revenues per vessel for HMS species quickly declined in California from almost $200,000 in 1981 to less than $40,000 in 1990. Since then, average ex-vessel revenues in California have fluctuated between $20,000 and $50,000 per vessel. Average revenues from HMS landings at Moss Landing have increased from the low value approaching $6,000 per

vessel in 1982 to values of more than $20,000 during some years, and more than $25,000 in 1996.

Table 4-11. Prices, average pounds landed and revenues for HMS landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	1.31	1.91	149,980	10,734	196,074	20,526
1982	1.05	1.28	154,389	4,814	162,668	6,174
1983	0.88	1.12	110,868	9,721	98,005	10,924
1984	0.92	1.02	103,240	6,178	94,685	6,297
1985	1.11	0.97	46,002	9,088	50,928	8,823
1986	0.89	1.01	61,272	9,507	54,826	9,588
1987	0.88	1.37	64,370	9,472	56,915	13,010
1988	0.96	1.62	77,392	8,957	74,168	14,496
1989	0.88	2.04	62,825	4,824	54,987	9,824
1990	0.96	1.78	38,993	4,972	37,320	8,864
1991	0.98	3.81	32,642	4,141	31,866	15,759
1992	1.05	2.23	24,437	4,522	25,684	10,071
1993	1.05	1.98	34,866	8,100	36,713	16,061
1994	1.10	1.77	35,171	7,291	38,672	12,930
1995	0.74	1.95	44,839	10,964	33,081	21,353
1996	0.79	2.37	60,847	10,761	48,217	25,508
1997	0.75	1.15	38,842	14,985	29,039	17,244
1998	0.69	1.97	47,140	6,942	32,720	13,710
1999	0.94	1.21	36,373	17,370	34,250	21,013
2000	1.38	0.93	20,799	11,671	28,707	10,885
2001	1.30	0.82	17,008	16,718	22,165	13,665

Other Species

The other species category includes 32 species, several of which are important to Moss Landing including California halibut, Dungeness crab and spot prawn. For California, the number of vessels that reported landings of the other species was relatively stable before 1995, fluctuating between about 1,600 and 1,900 (Table 4-12). After that, the number of vessels declined to just fewer than 1,300 in 2001. The number of vessels landing other species at Moss Landing increased from around 40 vessels in 1981 to about 80 in 2001. The peak occurred in 1997, when 96 vessels landed other species at Moss Landing. Landings for both California and at Moss Landing exhibit upward trends, with relatively large fluctuations, and peaks in 1997 of more than 35 million and 400,000, pounds respectively.

Total ex-vessel revenues for the other species fluctuated between $25 million and $40 million between 1981 and 1997, but declined steadily after that. On the other hand, ex-vessel revenues peaked at nearly $700,000 in 1998 before returning to what appear to be more normal levels, around $100,000 per year.

It is difficult to interpret ex-vessel revenues for the other species category, as relatively high value species such as crabs and prawns receive the greatest weight in the calculation of average prices for this category. For California, ex-vessel prices appear to have declined

gradually, from a peak of over $2 per pound in 1983 to around $1.50 in 2001 (Table 4-13). Ex-vessel prices for other species landed at Moss Landing, on the other hand, appear to have an upward trend before 1996, when prices reached more than $2.50 per pound, before falling to the average value for California of $1.50.

Table 4-12. Vessels, pounds landed and ex-vessel revenues for other species landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	1,722	41	22,670,975	158,622	39,355,454	95,300
1982	1,843	48	19,284,560	94,005	31,062,076	69,163
1983	1,730	65	12,625,326	132,104	25,955,611	100,983
1984	1,746	71	13,552,178	103,811	25,759,921	186,677
1985	1,689	84	17,545,685	134,109	28,561,228	132,572
1986	1,698	79	21,867,863	122,582	34,177,308	86,318
1987	1,673	59	22,476,381	205,570	31,356,062	119,101
1988	1,745	42	29,004,929	155,118	34,617,463	99,848
1989	1,822	52	25,949,923	174,442	26,824,985	121,818
1990	1,809	57	26,197,044	169,198	38,036,398	113,230
1991	1,893	83	22,241,380	189,883	27,879,255	200,448
1992	1,807	78	33,071,219	121,502	30,903,595	137,928
1993	1,665	79	25,619,891	130,109	30,450,928	238,831
1994	1,770	61	32,521,092	179,496	42,410,014	451,334
1995	1,636	80	23,156,663	176,263	32,889,853	280,335
1996	1,697	93	32,538,440	219,184	41,269,309	573,225
1997	1,625	96	36,284,943	417,180	42,257,797	631,398
1998	1,543	86	22,143,249	326,412	37,435,411	687,168
1999	1,478	78	23,193,539	291,170	33,416,216	495,932
2000	1,403	65	18,274,389	110,524	27,530,432	137,993
2001	1,291	72	15,322,516	150,884	22,319,603	243,867

Average landings per vessel also appear to exhibit an upward trend for California, going from just over 13,000 pounds in 1981 to more than 22,000 pounds in 1997. Average landings do not appear to trend up or down, but values fluctuate between around 1,500 and almost 4,500 pounds per vessel.

Average ex-vessel revenues per vessel for landings of other species exhibit upward trends for California and Moss Landing. For California, average annual ex-vessel revenues per vessel increased from around $15,000 between 1982 and 1991 to more than $25,000 per vessel in 1997, before returning to values more typical of those before the peak. Moss Landing exhibited similar trends but at a lower level. Average ex-vessel revenues per vessel at Moss Landing went from around $1,000 in 1986 to about $8,000 in 1998, and then fell to values similar to those before the peak.

Table 4-13. Prices, average pounds landed and revenues for landings of other species statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Prices		Pounds Landed/Vessel		Revenue/Vessel	
Year	CA	ML	CA	ML	CA	ML
1981	1.74	0.60	13,165	3,869	22,855	2,324
1982	1.61	0.74	10,464	1,958	16,854	1,441
1983	2.06	0.76	7,298	2,032	15,003	1,554
1984	1.90	1.80	7,762	1,462	14,754	2,629
1985	1.63	0.99	10,388	1,597	16,910	1,578
1986	1.56	0.70	12,879	1,552	20,128	1,093
1987	1.40	0.58	13,435	3,484	18,742	2,019
1988	1.19	0.64	16,622	3,693	19,838	2,377
1989	1.03	0.70	14,243	3,355	14,723	2,343
1990	1.45	0.67	14,482	2,968	21,026	1,986
1991	1.25	1.06	11,749	2,288	14,728	2,415
1992	0.93	1.14	18,302	1,558	17,102	1,768
1993	1.19	1.84	15,387	1,647	18,289	3,023
1994	1.30	2.51	18,374	2,943	23,960	7,399
1995	1.42	1.59	14,154	2,203	20,104	3,504
1996	1.27	2.62	19,174	2,357	24,319	6,164
1997	1.16	1.51	22,329	4,346	26,005	6,577
1998	1.69	2.11	14,351	3,795	24,261	7,990
1999	1.44	1.70	15,693	3,733	22,609	6,358
2000	1.51	1.25	13,025	1,700	19,623	2,123
2001	1.46	1.62	11,869	2,096	17,289	3,387

Trends in Vessels, Pounds Landed and Ex-Vessel Revenues by Gear Group

Gillnet Gear

The gillnet gear group includes gill and trammel nets, and set and drift gillnets that historically have targeted a variety of species, from white seabass to rockfish to shark. Since 1981, the number of vessels with gillnet landings statewide has declined by about 70% overall, although that number peaked at 978 in 1986 before declining steadily to 268 in 2001 (Table 4-14). At Moss Landing, the pattern has been similar, although the overall decline has been greater (nearly 85%), from 44 vessels in 1981 to 7 vessels in 2001. Relative to numbers of vessels statewide, the number of vessels with gillnet landings at Moss Landing has averaged about 6.3% of the statewide count, varying from 2.6% in 2001 to nearly 12% in 1993. The declines local and the statewide likely reflect increasing limitations on the use of gill and trammel nets in state waters, except for the San Francisco Bay herring fishery.

Pounds landed statewide using gillnet gear have fluctuated, but declined by just over 50% during the 21-year period. Landings peaked at 30.3 million pounds in 1987, a near peak year for participation in the fishery, but declined to a low of 8.1 million pounds in 2001. Landings at Moss Landing have been highly variable, corresponding less to the number of vessels than is the case with the statewide data. Landings have ranged from 16,392 pounds in 2000 to over 2.4 million pounds in 1990. Gillnet landings (in pounds) have accounted for an average of 5% of state landings per year, and ranged from 0.2% to 10.9% of the state total.

Table 4-14. Vessels, pounds landed and ex-vessel revenues for gillnet gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	844	44	17,449,426	270,245	26,261,677	174,960
1982	809	26	26,366,798	462,155	37,504,198	271,970
1983	807	47	20,495,137	1,485,920	35,015,841	661,915
1984	691	25	12,338,321	60,373	24,086,314	134,028
1985	937	37	25,163,953	677,514	34,388,441	566,023
1986	978	58	28,821,341	886,705	30,938,710	620,141
1987	923	64	30,299,120	1,745,119	28,211,537	1,036,800
1988	870	44	27,753,510	1,434,587	22,652,053	766,036
1989	827	44	25,709,736	2,158,812	22,430,803	1,322,378
1990	688	42	21,990,673	2,400,257	23,527,946	1,331,697
1991	627	65	20,265,630	1,503,652	23,162,233	1,584,704
1992	552	47	17,239,581	1,584,075	21,287,075	1,200,510
1993	476	56	13,800,002	1,125,200	15,726,050	1,493,177
1994	403	34	9,721,660	654,322	12,365,892	720,172
1995	372	35	12,503,518	813,021	17,577,583	1,179,684
1996	382	37	15,147,677	493,309	25,008,917	1,558,338
1997	379	34	18,193,054	550,009	18,019,044	1,204,470
1998	298	28	5,811,300	604,647	7,511,812	1,068,940
1999	317	19	8,138,510	82,815	8,034,295	190,149
2000	319	9	10,375,184	16,392	8,303,789	29,552
2001	268	7	8,100,329	16,716	6,969,887	29,744

Over the 21-year period, gillnet landings in California have averaged nearly $21.4 million in ex-vessel revenue, and ranged from just under $7 million in 2001 to $34.9 million in 1985. Ex-vessel revenues of gillnet landings at Moss Landing have averaged about $816,000 per year, and were greater than $1 million most years from 1988 to 1998, but dropped precipitously to just under $30,000 per year in 2000 and 2001. As a proportion of statewide revenues from gillnet landings, landings at Moss Landing have varied from well under 1% in the early 1980s and since 2000, to peaks of 9.5% in 1993 and 14.2% in 1998.

At the state level, price per pound for gillnet-caught fish has varied somewhat from $0.80 to $1.95, with an annual average of $1.26 per pound for the 21-year period (Table 4-15). Prices appear to drop with increases in landings until 2000 and 2001. The reduced landings, however, were not matched by higher prices. As with other measures, prices at Moss Landing do not closely track those at the state level. Moss Landing prices have ranged widely from a low of $0.55 in 1990 to a high of $3.16 in 1996.

Average gillnet landings per vessel at Moss Landing have varied much more widely than those statewide. Whereas the former has ranged from 17,800 to 48,000 pounds, the latter has ranged from 1,821 to 33,704 pounds per vessel. More striking is the fact that statewide landings per vessel have fluctuated closely about the mean in recent years, while the figures for Moss Landing have dropped to as low as 10% of the mean.

Revenues per vessel show a similar contrast between the statewide and Moss Landing situations. Statewide, ex-vessel revenues per vessel for gillnet landings averaged $35,468 and

ranged from a low of $26,000 in 2001 to a high of $65,468 in 1996. Revenues per vessel at Moss Landing have been considerably lower, ranging from $3,284 to $42,117, with an average of $20,000 for the 21-year period. Whereas revenues per vessel statewide have varied moderately around the mean, those at Moss Landing increased from just under $4,000 in 1981 to over $42,000 in 1996 before beginning a drop to recent lows.

Table 4-15. Prices, average pounds landed and revenues for gillnet landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	1.51	0.65	20,675	6,142	31,116	3,976
1982	1.42	0.59	32,592	17,775	46,359	10,460
1983	1.71	0.45	25,397	31,615	43,390	14,083
1984	1.95	2.22	17,856	2,415	34,857	5,361
1985	1.37	0.84	26,856	18,311	36,701	15,298
1986	1.07	0.70	29,470	15,288	31,635	10,692
1987	0.93	0.59	32,827	27,267	30,565	16,200
1988	0.82	0.53	31,901	32,604	26,037	17,410
1989	0.87	0.61	31,088	49,064	27,123	30,054
1990	1.07	0.55	31,963	57,149	34,198	31,707
1991	1.14	1.05	32,322	23,133	36,941	24,380
1992	1.23	0.76	31,231	33,704	38,564	25,543
1993	1.14	1.33	28,992	20,093	33,038	26,664
1994	1.27	1.10	24,123	19,245	30,685	21,182
1995	1.41	1.45	33,612	23,229	47,252	33,705
1996	1.65	3.16	39,654	13,333	65,468	42,117
1997	0.99	2.19	48,003	16,177	47,544	35,426
1998	1.29	1.77	19,501	21,595	25,207	38,176
1999	0.99	2.30	25,674	4,359	25,345	10,008
2000	0.80	1.80	32,524	1,821	26,031	3,284
2001	0.86	1.78	30,225	2,388	26,007	4,249

Line Gear

Line gear includes a wide variety of gear types and configurations, from single or double hook-and-line to longline (but excluding troll gear), and is used to target a wide range of species from nearshore rockfish to swordfish.

The number of vessels reporting landings with line gear has varied considerably over time at both the state and local levels (Table 4-16). Some of this variation may be due to reporting errors in the mid 1980s. At the state level, the number of vessels using line gear dropped dramatically from over 400 vessels in 1981 and 1982 to 13 in 1987. The number of vessels with line gear landings grew in the early 1990s, reaching a peak of 712 vessels in 1996, but has declined since to 419 in 2001, though still above the 21-year mean. At Moss Landing, the number of vessels with line gear landings has shown a similar trend on a smaller scale. The PacFIN data show few vessels with line gear landings through the 1980s, then a rapid increase to a peak of 96 vessels in 1996, followed by a drop to 46 vessels in 2001, also well above the mean of 25 for 1981 through 2001.

Table 4-16. Vessels, pounds landed and ex-vessel revenues for line gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).						
	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	439	15	3,029,749	22,919	2,570,389	20,784
1982	459	25	2,933,624	112,513	2,505,005	81,226
1983	227	7	623,095	36,128	554,411	34,125
1984	95	3	306,278	2,620	426,987	2,173
1985	53	1	215,659	42	200,588	58
1986	19	1	28,831	3,020	42,171	4,362
1987	13	0	20,596	0	23,825	0
1988	22	1	290,620	24,310	474,460	11,126
1989	20	0	107,314	0	130,066	0
1990	71	1	715,160	3,251	787,584	1,928
1991	249	15	3,595,994	109,240	3,556,103	80,535
1992	319	16	4,546,775	161,884	3,777,397	96,396
1993	224	6	2,147,374	19,225	1,983,677	12,100
1994	430	13	5,248,769	104,987	9,130,264	91,301
1995	542	61	5,896,478	1,107,842	8,615,883	1,327,569
1996	712	96	8,632,754	3,124,294	11,942,869	2,403,464
1997	709	76	7,727,547	2,040,845	12,030,487	2,036,542
1998	528	43	4,604,537	758,578	6,999,334	505,690
1999	548	55	5,502,668	1,144,583	11,241,178	1,398,699
2000	494	47	6,167,254	1,085,099	13,767,496	1,019,552
2001	419	46	5,228,854	681,042	11,684,985	779,269

Landings with line gear follow the pattern of vessel participation at the state level, ranging from a low of 20,596 pounds in 1987 to a high of 8.6 million pounds in 1996. At Moss Landing, landings are less clearly linked to participation levels. For example, while 15 vessels landed nearly 23,000 pounds of fish in 1981, 25 vessels landed five times as much fish in 1982.

Ex-vessel revenues from line-caught fish landed statewide dropped considerably through 1987 along with participation, increased but varied greatly in the early 1990s, then increased notably again starting in 1994. Except for 1998, annual ex-vessel revenues from statewide line gear landings have exceeded $11 million since 1996, well above the $4.8 million annual average. At Moss Landing, ex-vessel revenues fluctuated well under $100,000 per year until 1995, when they jumped to over $1.3 million. They nearly doubled the following year, dropped by about 75% in 1998, and have since varied around $1 million, still well above the 21-year average of $471,757. The substantial landings and ex-vessel revenues of the late 1990s to the present are due, in part, to the growth of the live fish fishery, where prices for some species live are five or more times the price for dead fish. (The trend also may be due to changes in landings reporting procedures and practices in the mid 1990s.) Some of this growth may be tempered by recent groundfish and nearshore fishery management regulations, which increasingly limit participation as well as catch in the fishery.

Price per pound of line gear landings statewide averaged close to $1 until 1994, when they jumped to $1.74 (Table 4-17). Prices then were about $1.50 per pound until 1999, when they rose to over $2, peaking at $2.23 per pound in 2000 and 2001. At Moss Landing, prices occasionally exceeded those at the state level in the early 1980s, but have been well below

them since 1988. Since then prices per pound for line-caught fish have fluctuated between $0.59 in 1990 and $1.22 in 1999. Since then, prices have varied, but has remained above the 21-year mean for Moss Landing, and below the mean for the state.

Table 4-17. Prices, average pounds landed and revenues for line gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.85	0.91	6,901	1,528	5,855	1,386
1982	0.85	0.72	6,391	4,501	5,458	3,249
1983	0.89	0.94	2,745	5,161	2,442	4,875
1984	1.39	0.83	3,224	873	4,495	724
1985	0.93	1.38	4,069	42	3,785	58
1986	1.46	1.44	1,517	3,020	2,220	4,362
1987	1.16	0.00	1,584	0	1,833	0
1988	1.63	0.46	13,210	24,310	21,566	11,126
1989	1.21	0.00	5,366	0	6,503	0
1990	1.10	0.59	10,073	3,251	11,093	1,928
1991	0.99	0.74	14,442	7,283	14,282	5,369
1992	0.83	0.60	14,253	10,118	11,841	6,025
1993	0.92	0.63	9,586	3,204	8,856	2,017
1994	1.74	0.87	12,206	8,076	21,233	7,023
1995	1.46	1.20	10,879	18,161	15,896	21,763
1996	1.38	0.77	12,125	32,545	16,774	25,036
1997	1.56	1.00	10,899	26,853	16,968	26,797
1998	1.52	0.67	8,721	17,641	13,256	11,760
1999	2.04	1.22	10,041	20,811	20,513	25,431
2000	2.23	0.94	12,484	23,087	27,869	21,693
2001	2.23	1.14	12,479	14,805	27,888	16,941

Statewide, landings per vessel have varied widely from about 1,500 pounds in 1986 to over 14,000 pounds in 1991 and 1992. Landings per vessel have since averaged well over 10,000 pounds per year, about 3 times greater than the average for 1981 through 1987. Line gear landings per vessel at Moss Landing were well below 6,000 pounds through the 1980s (except for 1988 when they exceeded 24,000 pounds), but have increased since then. They peaked at over 30,000 pounds per vessel in 1996, fluctuated over the next few years, then dropped to just under 15,000 pounds per vessel in 2001.

Revenues per vessel for fish caught using line gear have increased at Moss Landing as well as statewide since the early 1980s. Over the 21-year period, they increased nearly five-fold at the state level, and nearly eight-fold at Moss Landing. Statewide, revenues per vessel varied around $5,000 through the 1980s except 1988, when they jumped to over $21,000. They varied through the 1990s as well, although at a much higher level (around $15,000) until 1998, and over $20,000 since 1999. A similar pattern has occurred at Moss Landing, with revenues per vessel varying well below $10,000 through 1994 (except for 1988). Line gear revenues per vessel at Moss Landing jumped by 300% between 1994 and 1995, and have since averaged over $20,000 per year, with lows in 1998 and 2001. The greater ex-vessel revenue at Moss Landing compared to the state as a whole may be due in large part to the growth of the live fish fishery in the Monterey Bay area, which began in earnest in the mid 1990s.

Pot gear

Pot gear comprises traps as well as pots that are used to catch crab, prawn, deepwater sablefish and other finfish species, including fish for the live market. The number of vessels landing fish caught with pot gear statewide averaged 1,022 for the 21-year period, remaining fairly constant through 1997, then dropping to 776 in 2001 (Table 4-18). The pattern at Moss Landing has been more variable, with a range of 4 to 27 vessels, an average of 15, and no clear trend in the number of vessels over time.

Table 4-18. Vessels, pounds landed and ex-vessel revenues for pot gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	1,022	6	17,579,031	73,622	29,131,058	33,685
1982	1,035	4	16,405,581	3,999	27,390,329	9,984
1983	1,015	14	12,981,020	154,048	24,629,273	77,767
1984	1,019	22	9,615,598	106,301	21,652,505	164,054
1985	989	14	10,293,329	80,757	22,507,209	83,284
1986	983	7	11,953,469	228,467	25,574,269	159,675
1987	1,004	9	9,851,129	254,608	19,994,070	127,718
1988	1,105	19	15,658,499	471,564	28,019,387	269,435
1989	1,105	14	12,603,819	177,867	21,498,866	112,542
1990	1,080	14	18,577,430	591,973	33,998,538	333,539
1991	1,142	22	8,038,755	178,998	18,797,165	172,679
1992	1,143	26	11,871,647	50,236	22,575,819	85,358
1993	1,041	15	15,065,925	37,921	26,204,401	47,793
1994	1,124	17	15,980,510	73,076	30,835,046	120,486
1995	1,029	15	12,358,445	69,031	26,949,627	149,760
1996	1,093	16	15,491,191	33,225	31,457,482	76,379
1997	1,011	10	13,395,170	30,926	33,886,757	108,894
1998	974	27	13,688,716	84,883	32,003,161	319,693
1999	928	21	11,040,026	31,865	25,825,067	132,605
2000	854	15	9,429,067	13,774	23,724,902	49,746
2001	776	15	6,685,703	142,665	19,556,357	85,210

Statewide, landings declined from 17.6 million pounds in 1981 to 6.7 million pounds in 2001, with occasional variations in this pattern. Landings at Moss Landing by vessels using pot gear have varied over time, with peaks in 1988 and 1990, and lows in 1982 and 2000. Landings in 2001, however, were above the 21-year mean at 142,665 pounds.

Ex-vessel revenues have varied statewide, peaking at nearly $34 million in 1990 and 1997, and dropping below $20 million in 1988, 1990 and 2001. Ex-vessel revenues at Moss Landing have been much more variable, with peaks at over $300,000 in 1990 and 1998, and a low of just under $10,000 in 1982.

Prices for pot-caught fish are higher than those for several other gear types, averaging $2.09 per pound statewide for the 21-year period (Table 4-19). Prices for pot-caught fish statewide increased steadily starting in 1992 to a high of $2.93 in 2001. Prices have been more variable at

Moss Landing, ranging from a low of $0.46 in 1981 to a high of $4.16 in 1999. Still, prices for pot-caught fish at Moss Landing increased after 1989, although they dropped to $0.60 in 2001.

Table 4-19. Prices, average pounds landed and revenues for pot gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	1.66	0.46	17,201	12,270	28,504	5,614
1982	1.67	2.50	15,851	1,000	26,464	2,496
1983	1.90	0.50	12,789	11,003	24,265	5,555
1984	2.25	1.54	9,436	4,832	21,249	7,457
1985	2.19	1.03	10,408	5,768	22,758	5,949
1986	2.14	0.70	12,160	32,638	26,017	22,811
1987	2.03	0.50	9,812	28,290	19,914	14,191
1988	1.79	0.57	14,171	24,819	25,357	14,181
1989	1.71	0.63	11,406	12,705	19,456	8,039
1990	1.83	0.56	17,201	42,284	31,480	23,824
1991	2.34	0.96	7,039	8,136	16,460	7,849
1992	1.90	1.70	10,386	1,932	19,751	3,283
1993	1.74	1.26	14,473	2,528	25,172	3,186
1994	1.93	1.65	14,218	4,299	27,433	7,087
1995	2.18	2.17	12,010	4,602	26,190	9,984
1996	2.03	2.30	14,173	2,077	28,781	4,774
1997	2.53	3.52	13,249	3,093	33,518	10,889
1998	2.34	3.77	14,054	3,144	32,857	11,840
1999	2.34	4.16	11,897	1,517	27,829	6,315
2000	2.52	3.61	11,041	918	27,781	3,316
2001	2.93	0.60	8,616	9,511	25,201	5,681

Although pot-caught landings per vessel statewide were considerably higher than the mean (12,455 pounds) in 1981 and 1982, it is difficult to detect a long-term trend in the years since then. Landings per vessel were greater than the 21-year mean most years through the 1990s, but have declined since 1998. Landings at Moss Landing show a different pattern, with relatively high landings per vessel through 1990 when they peaked at over 42,000 pounds. Landings per vessel then declined to a low of 918 pounds in 2000, but then jumped to 9,511 pounds in 2001.

Except for a few years when ex-vessel revenue per vessel dropped below $20,000, statewide figures for pot gear has remained strong, varying little around the $25,000 mean. Revenue per vessel at Moss Landing has been much more variable, ranging from about $3,000 in 1982, 1992, 1993 and 2000, to over $20,000 in 1986 and 1990. Revenue per vessel declined from a short-term high of nearly $12,000 to just over $3,300 in 2000, but rose to nearly $5,600 in 2001.

Seine Gear

Seine gear include purse seines and drum seines, which are used primarily by coastal pelagic species (CPS) or “wetfish” fishermen to target northern anchovy, Pacific and jack mackerel, Pacific sardine and squid. Several seiners that land at Moss Landing also participate in the southern California wetfish fishery, and account for a considerable proportion of those landings as well (Pomeroy et al. 2002). Many seiners, primarily those based at San Pedro, also target

tunas. Seiners also include larger “super seiners” that target tunas and other migratory species, although much of that fishery moved offshore with the closure of tuna canneries in San Pedro and San Diego in the late 1970s and early 1980s.

The initial decline in all of the CPS measures in Table 4-20 was due primarily to the closure of tuna canneries in southern California. Statewide, the number of vessels with seine gear landings declined from a high of 294 in 1981 to 128 in 2001. Since 1984, the number of vessels has varied between 124 and 175. At present, limited entry in the sardine fishery and a moratorium on entry into the squid fishery have capped the number of seine vessels operating in California. The pattern at Moss Landing has been more variable, ranging between 3 and 21 active vessels, respectively, in 1989 and 2000, and averaging 13 vessels. The small number of active seiners through the 1980s reflects the ban on the use of purse seine gear in parts of Monterey Bay until 1989. It may also be a function of the relatively limited fishing opportunities for seine gear during that time due to the sardine closure until 1986.

Table 4-20. Vessels, pounds landed and ex-vessel revenues for seine gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	294	25	577,724,871	13,639,176	414,270,720	1,827,591
1982	282	15	484,477,328	9,776,636	268,104,621	1,298,233
1983	234	7	292,023,990	556,378	176,684,006	100,215
1984	168	9	250,552,148	2,912,467	128,147,460	205,121
1985	163	7	161,446,948	2,309,512	50,932,476	217,690
1986	151	9	206,899,965	5,322,975	55,514,391	650,403
1987	175	13	212,704,018	3,790,716	55,419,293	478,472
1988	172	8	260,935,094	1,312,798	68,393,734	163,583
1989	176	3	259,539,852	1,908,674	51,727,609	218,362
1990	133	13	193,014,226	4,235,382	32,606,666	356,317
1991	134	14	148,069,970	3,505,162	22,025,993	354,977
1992	129	13	116,135,854	6,441,941	17,138,569	517,204
1993	124	12	161,080,109	2,996,356	21,379,618	499,817
1994	153	13	184,780,537	10,400,067	29,849,031	1,796,081
1995	153	14	285,372,070	6,946,886	41,743,485	567,113
1996	173	18	311,740,164	17,940,952	44,937,168	1,807,694
1997	173	20	340,364,527	37,123,685	49,886,657	3,460,123
1998	133	11	182,496,936	23,603,234	21,997,768	764,127
1999	157	17	375,163,102	36,140,554	46,585,843	1,662,997
2000	155	21	455,459,936	45,407,196	38,688,183	2,715,689
2001	128	17	366,769,600	52,153,271	27,603,181	3,394,555

The seine fishery is a high volume fishery, with vessels commonly catching 30 tons per trip, and an average vessel capacity of about 55 to 60 tons (Pomeroy et al. 2002). Statewide seine gear landings have varied greatly, reflecting environmental sensitivity and variability, demand and regulation of several species (especially sardine and squid) targeted by seiners. Landings declined from 1981 through 1985, 1988 through 1992, and again in 1998, but increased from 1985 through 1988, from 1992 through 1997, and in 1999 and 2000. These variations are closely correlated with the 1982-83, 1992-93, and 1997-98 El Niño events. Seine landings at Moss Landing also varied through the mid 1990s, seldom exceeding 20 million pounds. Since

1996, however, they have increased due to growth in the squid and sardine fisheries, to a high of 52 million pounds in 2001.

At the same time, however, statewide ex-vessel revenues from seine landings have declined, from $414 million in 1981 to $27.6 million in 2001. This trend reflects the declining importance of tuna in the fishery. In contrast, ex-vessel revenues at Moss Landing have increased over the last several years. From 1983 through 1993, revenues range from $100,000 to just over $650,000. Since 1994, however, ex-vessel revenues have ranged from over $1.6 million to $3.4 million, except for the warm water years of 1995 and 1998.

Seine landings' price per pound declined from a high of $0.72 in 1981 to a low of $0.08 in 2001 (Table 4-21). Some of this decrease can be attributed to the shift from higher value tuna species to lower value wetfish species. Prices dropped steadily from 1981 through 1990, then stagnated for several years at about $0.15 per pound. The price trend at Moss Landing has also been downward from $0.13 per pound in 1981 to $0.07 per pound in 2001, but with periodic price increases in the 1980s and 1990s. Prices at Moss Landing increased slightly from $0.03 per pound in 1998 to $0.07 in 2001. The discrepancy may be due in large part to the persistence of a small fishery for tuna and the greater availability of mackerel as well as squid in southern California, whereas Monterey Bay area fisheries rely more on lower priced sardine and to a lesser extent, even less valuable anchovy.

Table 4-21. Prices, average pounds landed and revenues for seine gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.72	0.13	1,965,051	545,567	1,409,084	73,104
1982	0.55	0.13	1,718,005	651,776	950,726	86,549
1983	0.61	0.18	1,247,966	79,483	755,060	14,316
1984	0.51	0.07	1,491,382	323,607	762,783	22,791
1985	0.32	0.09	990,472	329,930	312,469	31,099
1986	0.27	0.12	1,370,198	591,442	367,645	72,267
1987	0.26	0.13	1,215,452	291,594	316,682	36,806
1988	0.26	0.12	1,517,065	164,100	397,638	20,448
1989	0.20	0.11	1,474,658	636,225	293,907	72,787
1990	0.17	0.08	1,451,235	325,799	245,163	27,409
1991	0.15	0.10	1,105,000	250,369	164,373	25,355
1992	0.15	0.08	900,278	495,534	132,857	39,785
1993	0.13	0.17	1,299,033	249,696	172,416	41,651
1994	0.16	0.17	1,207,716	800,005	195,092	138,160
1995	0.15	0.08	1,865,177	496,206	272,833	40,508
1996	0.14	0.10	1,801,966	996,720	259,752	100,427
1997	0.15	0.09	1,967,425	1,856,184	288,362	173,006
1998	0.12	0.03	1,372,157	2,145,749	165,397	69,466
1999	0.12	0.05	2,389,574	2,125,915	296,725	97,823
2000	0.08	0.06	2,938,451	2,162,247	249,601	129,319
2001	0.08	0.07	2,865,388	3,067,839	215,650	199,680

Seine landings per vessel at the state level varied between about 1 and 2 million pounds through 1998, then increased to nearly 2.9 million pounds in 2001. Landings at Moss Landing show a similar pattern, averaging less than 1 million pounds per vessel through 1996. They increased significantly thereafter, reaching more than 3 million pounds per vessel in 2001.

While statewide revenues per vessel have declined for seine gear landings, at Moss Landing they have been more variable and in recent years have increased. Statewide, revenues per vessel have averaged $391,629, but have been below that mean since 1989. At Moss Landing, however, revenues per vessel have increased overall, and have exceeded the 21-year mean ($72,036) 6 of the past 8 years, reaching nearly $200,000 in 2001.

Trawl Gear

There are many different types of trawls that fall into the general trawl gear category, although bottom trawls are the dominant trawl gear in the Moss Landing area and statewide. Trawl gear is used to target a wide variety of groundfish species, including roundfish, flatfish, rockfish, prawn and shrimp, and catches some other species as well.

The number of trawl vessels that landed fish in California has varied over the 21-year period, peaking at 471 in 1989 and declining to 226 in 2001 (Table 4-22). The number of vessels landing at Moss Landing has also varied, but peaked in 1995 at 32 from a low of 11 in 1981 and 1990. That number has declined since, however, to 18 vessels in 2001.

Table 4-22. Vessels, pounds landed and ex-vessel revenues for trawl gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	247	11	84,859,191	4,497,804	44,537,373	1,986,291
1982	275	20	102,654,719	5,956,683	47,503,999	2,494,689
1983	261	20	73,499,951	5,547,118	34,868,678	2,300,410
1984	282	23	76,804,609	5,650,111	34,047,756	2,213,273
1985	269	27	81,463,024	4,152,283	37,200,924	1,770,285
1986	299	17	69,372,405	3,612,143	33,563,866	1,404,397
1987	364	22	80,138,897	2,953,540	40,045,373	1,276,602
1988	409	16	74,122,578	2,780,963	32,592,321	1,272,268
1989	471	15	88,710,450	2,415,140	37,244,758	1,114,859
1990	376	11	75,185,076	978,626	32,237,624	487,842
1991	415	16	74,211,348	1,269,410	33,451,521	644,112
1992	314	19	77,789,513	1,486,853	33,357,165	683,522
1993	268	24	58,821,594	2,268,775	26,424,449	1,073,002
1994	345	27	57,506,310	2,256,412	33,028,865	1,490,647
1995	347	32	60,891,409	2,924,097	38,029,707	1,819,941
1996	317	25	64,016,975	1,669,058	40,682,772	1,304,125
1997	299	31	73,784,256	1,351,091	36,525,953	936,877
1998	292	27	49,011,936	1,933,624	24,465,791	1,138,140
1999	307	30	36,547,511	1,346,324	21,968,469	882,919
2000	261	19	37,175,927	1,377,955	18,976,224	791,085
2001	226	18	27,603,104	1,335,993	15,269,770	802,693

Trawl landings statewide have varied over the long term, but show a general decline from 102.7 million pounds in 1982 to 27.6 million pounds in 2001. Landings at Moss Landing have also declined, from nearly 6 million pounds in 1982 to less than 1 million pounds in 1990. Landings at Moss Landing then increased to over 2.9 million pounds in 1995, before declining to about 1.3 million pounds in 2001, due largely to increasingly stringent catch limits on many species.

Statewide, ex-vessel revenues from trawl landings were in the $40 million range several years - 1981, 1982, 1987, and 1995. Over the long term, however, they have declined to $15.3 million in 2001. Ex-vessel revenues at Moss Landing have varied as well, though somewhat less dramatically. They reached a high of $2.5 million in 1982, dipped below $500,000 in 1990, rose for some years, then declined to about $800,000 in 2000 and 2001.

Price per pound for trawl-caught fish increased slightly for landings both statewide and at Moss Landing over the 21-year period (Table 4-23). At the state level, price per pound varied from $0.43 in 1990 to $0.64 in 1996. In 2001, the average price was $0.55 per pound, $0.05 above the mean. Moss Landing prices ranged somewhat more widely, from $0.39 in 1984 and 1986 to $0.78 in 1996. In 2001, the mean price per pound was $0.60, above both the state price and the 21-year Moss Landing mean of $0.52.

Table 4-23. Prices, average pounds landed and revenues for trawl gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.52	0.44	343,559	408,891	180,313	180,572
1982	0.46	0.42	373,290	297,834	172,742	124,734
1983	0.47	0.41	281,609	277,356	133,596	115,021
1984	0.44	0.39	272,357	245,657	120,737	96,229
1985	0.46	0.43	302,837	153,788	138,293	65,566
1986	0.48	0.39	232,015	212,479	112,254	82,612
1987	0.50	0.43	220,162	134,252	110,015	58,027
1988	0.44	0.46	181,229	173,810	79,688	79,517
1989	0.42	0.46	188,345	161,009	79,076	74,324
1990	0.43	0.50	199,960	88,966	85,738	44,349
1991	0.45	0.51	178,823	79,338	80,606	40,257
1992	0.43	0.46	247,737	78,255	106,233	35,975
1993	0.45	0.47	219,484	94,532	98,599	44,708
1994	0.57	0.66	166,685	83,571	95,736	55,209
1995	0.62	0.62	175,480	91,378	109,596	56,873
1996	0.64	0.78	201,946	66,762	128,337	52,165
1997	0.50	0.69	246,770	43,584	122,160	30,222
1998	0.50	0.59	167,849	71,616	83,787	42,153
1999	0.60	0.66	119,047	44,877	71,559	29,431
2000	0.51	0.57	142,437	72,524	72,706	41,636
2001	0.55	0.60	122,138	74,222	67,565	44,594

Average landings per vessel statewide have declined from nearly 400,000 pounds in the early 1980s to just over 122,000 pounds in 2001. Interestingly, landings per vessel at Moss Landing were greater than those statewide in 1981, but have been lower than statewide landings per

vessel since then. In recent years, they have ranged from about 43,000 to nearly 75,000 pounds per vessel.

State and Moss Landing revenues per vessel were nearly the same in 1981, over $180,000. Both generally declined thereafter, although they have increased periodically. Statewide revenues per vessel declined from over $128,000 in 1996 to $67,565 in 2001. At Moss Landing, ex-vessel revenues per vessel have varied more, dropping to $29,000 in 1999, but increasing since then to nearly $45,000 in 2001.

Troll Gear

Troll gear is used primarily to catch salmon and albacore, and occasionally halibut and some other species, for delivery to California ports. The number of vessels that reported landings of troll-caught fish in California declined steadily from 5,593 to 1,498 between 1981 and 2001 (Table 4-24). The number of troll vessels with landings at Moss Landing has also declined from 536 in 1981 to 252 in 2001, although the pattern has been more variable.

Table 4-24. Vessels, pounds landed and ex-vessel revenues for troll gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	5,593	536	40,797,841	3,503,076	89,334,932	7,890,915
1982	5,202	451	28,866,460	1,061,025	62,315,495	3,911,521
1983	4,059	368	20,868,202	349,994	25,851,123	1,272,814
1984	3,502	309	25,053,239	246,488	36,144,801	1,134,301
1985	3,212	282	22,234,378	683,488	36,383,200	1,332,748
1986	3,315	287	20,839,952	1,214,923	35,215,156	2,189,176
1987	3,238	247	22,628,078	899,678	47,150,875	1,774,225
1988	3,354	265	27,437,524	825,089	66,194,073	3,052,840
1989	3,412	259	21,065,779	601,209	31,955,131	1,583,603
1990	3,122	295	15,229,549	702,896	26,569,335	1,949,810
1991	2,813	279	13,625,130	624,279	21,291,087	1,200,075
1992	2,273	258	13,987,459	668,055	17,885,098	1,067,502
1993	2,255	336	16,274,206	1,164,780	22,587,952	1,767,007
1994	2,154	204	19,670,063	916,055	23,259,764	1,478,039
1995	2,073	283	15,278,366	1,666,663	20,058,960	2,710,083
1996	1,975	319	20,201,011	1,649,569	23,959,016	2,206,941
1997	1,910	349	15,617,379	3,662,361	17,705,527	3,716,897
1998	1,559	215	15,129,478	439,898	12,686,269	554,462
1999	1,580	237	17,131,903	1,763,600	20,402,475	2,047,571
2000	1,599	311	11,035,568	2,115,041	16,592,680	2,672,754
2001	1,498	252	10,092,640	1,709,504	12,562,421	1,635,389

California troll landings (in pounds) declined by about 75% between 1982 and 2001 from nearly 41 million to just over 10 million pounds, but the pattern is irregular. Landings declined at Moss Landing as well, but less dramatically, and with greater variation. Landings peaks at Moss Landing occurred at over 3.5 million pounds in 1981 and again in 1996, and have varied between 1.7 and 2.1 million pounds in recent years. Most years, landings at Moss Landing range between 10 and 20% of the statewide totals.

Declines in ex-vessel revenues have been more dramatic at the state and local levels, due to a combination of declining prices and landings. Statewide, ex-vessel revenues were nearly $90 million in 1981, and despite periodic increases, declined to $12.6 million by 2001. The decline in ex-vessel revenues at Moss Landing was most apparent from 1981 through 1992. After that, however, ex-vessel revenues increased to over $3.8 million in 1997, and have varied between $500,000 and $2.7 million since then.

For troll landings, price per pound has declined both statewide and at Moss Landing (Table 4-25). At the state level, price peaked at $2.41 per pound in 1988, then dropped steadily until it reached $0.84 in 1998. Prices increased in 1999 and 2000, then declined again to $1.24 per pound. The long-term average price for troll-caught fish has been higher at Moss Landing compared to the state as a hole ($2.11 v. $1.52). Price per pound at Moss Landing varied between $1.80 and $4.60 between 1981 and 1990, but dropped fairly steadily from a high of $3.70 in 1988 to a low of $0.96 in 2001.

Table 4-25. Prices, average pounds landed and revenues for troll gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	**CA**	**ML**	**CA**	**ML**	**CA**	**ML**
1981	2.19	2.25	7,294	6,536	15,973	14,722
1982	2.16	3.69	5,549	2,353	11,979	8,673
1983	1.24	3.64	5,141	951	6,369	3,459
1984	1.44	4.60	7,154	798	10,321	3,671
1985	1.64	1.95	6,922	2,424	11,327	4,726
1986	1.69	1.80	6,287	4,233	10,623	7,628
1987	2.08	1.97	6,988	3,642	14,562	7,183
1988	2.41	3.70	8,181	3,114	19,736	11,520
1989	1.52	2.63	6,174	2,321	9,366	6,114
1990	1.74	2.77	4,878	2,383	8,510	6,610
1991	1.56	1.92	4,844	2,238	7,569	4,301
1992	1.28	1.60	6,154	2,589	7,869	4,138
1993	1.39	1.52	7,217	3,467	10,017	5,259
1994	1.18	1.61	9,132	4,490	10,798	7,245
1995	1.31	1.63	7,370	5,889	9,676	9,576
1996	1.19	1.34	10,228	5,171	12,131	6,918
1997	1.13	1.01	8,177	10,494	9,270	10,650
1998	0.84	1.26	9,705	2,046	8,137	2,579
1999	1.19	1.16	10,843	7,441	12,913	8,640
2000	1.50	1.26	6,902	6,801	10,377	8,594
2001	1.24	0.96	6,737	6,784	8,386	6,490

Trolling, a type of hook-and-line fishing, is a low volume enterprise. Participants include part-time and full-time fishermen, who make single and multi-day (and in some cases, multi-week) trips. Statewide, landings per vessel have varied considerably over time from about 4,800 pounds in the early 1990s to over 10,800 pounds in 1999. Landings per vessel at Moss Landing have been more variable, ranging from 798 pounds in 1984 to nearly 10,500 pounds in 1997. Recent average landings per vessel of more than 6,700 pounds have been well above the mean (4,103 pounds) at Moss Landing.

Revenues per vessel from troll-caught fish have varied markedly at both the state and local levels over time. Over the long term they have declined. Statewide, revenues per vessel were nearly $16,000 in 1981, peaked at $19,736 in 1988, and although they have varied from year to year thereafter, declined to $8,386 in 2001. At Moss Landing, troll revenues per vessel declined from $14,722 in 1981 to $6,490 in 2001, with occasional increases, most notably in 1988, 1995 and 1997.

Other Gear

The number of vessels with landings for other gear (e.g., dredge, unspecified gear) in California peaked at 3,138 in 1983, and declined steadily thereafter to 325 vessels in 2001 (Table 4-26). A parallel pattern is evident at Moss Landing, where the number of vessels peaked at 486 in 1983, then declined to 0 in 2001.

Table 4-26. Vessels, pounds landed and ex-vessel revenues for other gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Vessels		Pounds landed		Revenues	
Year	CA	ML	CA	ML	CA	ML
1981	1,104	14	50,202,679	152,947	26,956,118	378,876
1982	1,256	31	36,202,353	384,169	21,245,345	265,558
1983	3,138	486	102,566,046	6,159,530	59,418,412	4,954,456
1984	2,845	289	72,951,379	6,476,960	45,890,240	1,770,540
1985	2,307	188	57,530,694	2,836,367	40,571,378	1,618,721
1986	2,185	165	78,729,027	2,760,433	42,961,784	1,399,574
1987	2,032	157	87,126,540	2,538,878	40,997,921	1,577,488
1988	1,741	102	89,228,616	1,458,942	45,036,167	1,205,581
1989	1,786	58	79,274,805	515,837	44,094,442	287,352
1990	1,746	71	70,863,886	1,423,241	48,757,254	461,039
1991	1,529	52	103,726,043	962,955	58,826,196	204,019
1992	1,546	77	57,619,416	1,006,047	49,765,673	461,364
1993	1,051	35	52,834,522	173,704	46,272,872	148,659
1994	1,017	3	37,689,528	39,045	39,310,273	13,134
1995	882	7	33,218,522	5,917	33,235,030	16,460
1996	597	9	26,484,895	68,736	28,731,214	16,229
1997	518	3	23,276,821	16,794	23,277,918	3,616
1998	484	3	13,393,004	10,574	10,628,690	5,444
1999	428	0	18,492,572	0	15,752,868	0
2000	411	12	20,630,970	345,629	15,851,066	25,992
2001	325	0	19,163,366	0	14,039,258	0

Landings made by vessels with other gear also peaked in 1983, and again in 1991, at over 100 million pounds statewide. 1983 and 1984 were peak years for other gear landings at Moss Landing, with more than 6 million pounds landed each of those years. Statewide, landings by vessels that used other gear generally ranged above 70,000 pounds per year most years through 1991, but have dropped since then to around 20,000 pounds in the latter 1990s and more recently. At Moss Landing, landings varied between 1 and 6 million pounds most years through 1992, but were much lower through the 1990s, except for 2000, when they jumped to almost 350,000 pounds.

Ex-vessel revenues for landings with other gear have varied since 1981, with a low of about $10.6 million in 1998 to a high of $59.4 million in 1983, following the pattern in ex-vessel landings. Ex-vessel revenues of other gear landings at Moss Landing also have followed the landings pattern there, peaking at nearly $5 million in 1983, and declining most years since then, until they jumped to nearly $26,000 in 2000.

Price per pound for other gear landings at the state level has varied between $0.47 and $1.08 (Table 4-27). Prices ranged between about $0.50 and $0.90 per pound through 1993, then increased to $1 or more for 1994 through 1997 before declining to $0.73 per pound in 2001. Moss Landing prices for fish caught using other gear have been lower, on average, although they peaked at well over $2 per pound in 1981 and 1995.

Landings per vessel statewide averaged 41,510 pounds over the 21-year period, with a low of 24,900 in 1985 and a high of 67,839 pounds in 1991. In 2001, other gear landings per vessel statewide were about 60,000 pounds, nearly 50% greater than the 21-year average. With few exceptions, landings per vessel at Moss Landing ranged between 10,000 and 16,000 pounds through the 1980s, but have varied considerably since with peaks over 20,000 pounds in 1990 and 2000, and no landings in 1999 or 2001.

Statewide, revenues per vessel with other gear have varied throughout, but have increased in general since the 1980s to over $44,000 in 1997 and 2001, well over the $30,330 mean for the 21-year period. In contrast, revenues per vessel at Moss Landing have declined from more than $11,800 to just over $2,100.

Table 4-27. Prices, average pounds landed and revenues for other gear landings statewide (CA) and at Moss Landing (ML), 1981-2001 (PacFIN data).

	Price per pound		Pounds Landed/Vessel		Revenues/vessel	
Year	CA	ML	CA	ML	CA	ML
1981	0.54	2.48	45,473	10,925	24,417	27,063
1982	0.59	0.69	28,824	12,393	16,915	8,566
1983	0.58	0.80	32,685	12,674	18,935	10,194
1984	0.63	0.27	25,642	22,412	16,130	6,126
1985	0.71	0.57	24,937	15,087	17,586	8,610
1986	0.55	0.51	36,032	16,730	19,662	8,482
1987	0.47	0.62	42,877	16,171	20,176	10,048
1988	0.50	0.83	51,251	14,303	25,868	11,819
1989	0.56	0.56	44,387	8,894	24,689	4,954
1990	0.69	0.32	40,586	20,046	27,925	6,494
1991	0.57	0.21	67,839	18,518	38,474	3,923
1992	0.86	0.46	37,270	13,066	32,190	5,992
1993	0.88	0.86	50,271	4,963	44,027	4,247
1994	1.04	0.34	37,060	13,015	38,653	4,378
1995	1.00	2.78	37,663	845	37,681	2,351
1996	1.08	0.24	44,363	7,637	48,126	1,803
1997	1.00	0.22	44,936	5,598	44,938	1,205
1998	0.79	0.51	27,672	3,525	21,960	1,815
1999	0.85	0.00	43,207	0	36,806	0
2000	0.77	0.08	50,197	28,802	38,567	2,166
2001	0.73	0.00	58,964	0	43,198	0

SECTION 5: SOCIO-ECONOMIC PROFILE OF THE MOSS LANDING COMMERCIAL FISHING INDUSTRY

In this section, we provide socio-economic profiles of three sets of participants in the Moss Landing commercial fishing industry: fishermen, fish buyers and fishery-support businesses. The socio-economic profiles consist of information on these groups' and their members' experience, patterns of activity, operations, social and economic networks and interdependencies, economics and (for the fishermen only) demographics.

The information reported here is based on surveys conducted with samples from each group complemented by ethnographic fieldwork carried out from March 2002 through January 2003. (See Appendix A for a detailed description of the methods used and the representativeness of the samples.) Combining the depth afforded by ethnography with the breadth of a survey generates more reliable and valid information than either method alone (Yin 1989). Both methods, however, require considerable time and effort identifying, locating and securing the participation of respondents. Whereas non-interview surveys require little project staff time (but still require respondent time and effort), survey and ethnographic interviews can last from 30 minutes to several hours.

We surveyed 38 commercial fishing captains using two methods, a take-home survey distributed with the help of fishing industry members, and an in-person survey interview. Because of the large population of skippers (N = about 300), we sampled the population using snowball techniques (McCall and Simmons 1969).[8] Skipper survey topics included fishing history and experience; fishing operation and patterns; issues, needs and concerns regarding commercial fishing in general and at Moss Landing harbor; fishing expenses and revenues; and demographics.

Although we attempted to census resident populations of fish buyers (N=7) and fishery-support businesses (N=8), we were only able to survey samples of each. We conducted in-person interviews with four (57%) of the resident fish buyers and three (37.5%) resident providers of goods and services at Moss Landing Harbor. For these surveys, we collected data on business history and experience; business operations; issues, needs and concerns regarding commercial fishing in general and at Moss Landing Harbor; and expenses and revenues.

Ethnographic fieldwork entailed participant observation of fishing-related activities at Moss Landing Harbor, and informal and semi-structured interviews with fishermen, receivers, fishery-support business operators and harbor staff. This fieldwork augmented the surveys, providing in-depth information on aspects of the commercial fishing industry at Moss Landing and essential contextual data for interpreting the surveys.

Fishermen

Demographics

To complement the fishery-specific information presented below, we sought demographic information on the skippers surveyed. This information included respondents' age, other work experience, and selected household characteristics (Table 5-1). The average age (as of

[8] Snowball sampling is a method of nonprobability sampling used in field research, especially in cases where the population is not well defined, its members are difficult to locate, and they may be sensitive or reluctant to participate in the research without assurance from their peers. The population of Moss Landing skippers met all of these conditions.

December 2002) of the skippers surveyed was 51.7 years (range = 36-80 years). Fishermen often commented that fishermen as a group were older than used to be the case, and attributed this to fewer young people entering the fisheries because of uncertain and in some cases negative economic and regulatory conditions. The average household size reported was three people, including two adults and one child.

Table 5-1. Demographics of surveyed skippers (N=37).		
	Mean	**Range**
Age	51.7	36-80
Adults in household	2.2	1-7
Children in household	0.7	0-4
Household size	3.0	1-8

Although over 80% of survey respondents reported Moss Landing as their homeport, only 8 (21.6%) reside there. Another 26 (70.3%) live elsewhere in the Monterey Bay area, 4 in Santa Cruz County and 21 in Monterey County (Table 5-2). Two (2.7%) respondents reside in Oregon.

Table 5-2. Surveyed skippers' state and county of residence (N=37).		
	Freq.	**%**
California		
Santa Clara	1	2.7
Santa Cruz	4	10.8
Monterey	29	78.4
Los Angeles	1	2.7
Oregon		
Clatsop	1	2.7
Josephine	1	2.7

Thirty-one (83.8%) of 37 respondents reported full-time commercial fishing as their primary occupation. The five respondents who reported a primary occupation other than fishing included a fish broker and a stainless steel fabricator (both directly related to the commercial fishing industry), a fuel dock worker, a biologist and a teacher. Four of these characterized themselves as part-time fishermen; the fifth said he was a retired fisherman. Of the eight respondents who reported working outside fishing in the past or presently, six did so in land-based jobs such as construction and metal work, while two had found work on the water, including one who had worked for a local research institution.

Fishing History and Experience

Fishing history and experience includes how, where and when skippers became commercial fishermen, whom they learned from, and the fisheries in which they have participated. Over half of the fishermen surveyed (21, or 58.3%) started fishing as children, and 75% reported learning how to fish from a family member, be it father, grandfather or another relative. Ten (27%) of the skippers surveyed started fishing in the Monterey Bay area, nine (24.3%) started fishing in Vietnam and all but two of the others (i.e., 18.5%) started fishing elsewhere in California. The most common first gear among those we surveyed was gillnet (11 or 40.7%), followed by salmon / albacore troll gear (6 or 22.5%).

Skippers' fishing experience (as of December 2002) ranged from 6 to 53 years, and averaged 27 years (Table 5-3). Respondents had fished an average of 18.5 years from Moss Landing. Most (81.6%) reported Moss Landing as their homeport, while the remainder reported Monterey, illustrating the close tie between these two Monterey Bay area ports. (One fisherman who reported Moss Landing as his homeport has since returned to his previous homeport in Oregon.)

Table 5-3. Surveyed skippers' experience.

	N	Mean	Range
Year first fished	36	1975	1949-1996
Years fished from ML	34	18.5	3-53
Number of ports fishes from	38	3.4	1-7
Number of vessels owned	31	1.3	1-4
Number of fishery permits	37	2.7	1-6

Most have fished out of other ports as well over the years (mean = 3.4, range = 1-7). Apart from Moss Landing, the most common areas respondents reported fishing out of were San Francisco (40.5%), Half Moon Bay (31.5%), Monterey (29.7%) and Alaska ports (27.0%) (Table 5-4). Fishermen ranged even more widely, reporting fishing out of ports from as far south as San Diego and venturing as far west as the Western Pacific.

Table 5-4. Locations, from north to south, that surveyed skippers fish during the year (N=37).

	Freq.	%
Alaska	10	27.0
Washington	4	10.8
Oregon	9	24.3
Fort Bragg	3	8.1
Bodega Bay	4	10.8
San Francisco	15	40.5
Half Moon Bay/Princeton	13	35.1
Santa Cruz	6	16.2
Moss Landing	37	100.0
Monterey	11	29.7
Morro Bay	6	16.2
Port San Luis/Avila	1	2.7
Ventura/Channel Islands/Port Hueneme	4	10.8
San Pedro/Terminal Island	5	13.5
San Diego	2	5.4
Outside US	3	8.1

Table 5-5 illustrates surveyed skippers' fishing patterns for 2001, including species-gear configurations and general area fished. It illustrates the diversity of fisheries engaged in by Moss Landing fishermen as part of their annual round of activities. A few ideal types, based on annual rounds of particular configurations of fisheries, characterize most fishing operations at Moss Landing. For example, many salmon trollers also fish for albacore and perhaps crab. Many purse seiners target CPS (i.e., sardine, squid and anchovy) locally, squid in southern

California and perhaps sardine in Oregon or Washington, complemented by San Francisco Bay herring and Alaska salmon.

Table 5-5. Surveyed skippers' 2001 fishing patterns (N=38).

	Monterey Bay		Other CA		OR		WA		AK		Outside US	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Salmon troll	23	60.5	17	44.7	1	2.6						
Albacore troll	20	52.6	18	47.4	5	13.2	3	7.9			2	5.3
Blackcod longline	14	36.8	12	31.6								
Live fish trap/stick/longline	13	34.2	13	34.2	1	2.6						
Groundfish trawl	7	18.4	6	15.8	1	2.6						
Halibut gillnet/troll	5	13.1										
CPS purse seine	4	10.5	3	7.9	1	2.6	1	2.6				
Crab/finfish trap	4	10.5										
Swordfish/shark longline/driftnet	2	5.3	2	5.3								
Spot prawn/shrimp trawl	1	2.6	1	2.6								
Herring gillnet[a]			4	10.5								
Salmon gillnet[b]									8	21.1		

[a] San Francisco Bay; [b] Alaska

Fishing Operations

Closely related to fishing patterns are the characteristics of the fishing operation, including vessel characteristics, gear and other equipment, fishing permits and licenses, and people involved. Respondents operate diverse types of fishing vessel with a range of gear and other equipment. Thirty-one (81.6%) of those surveyed own their vessel; the remainder (nearly 20%) are non-owner operators. Five (13.2%) of the skippers surveyed own multiple vessels. Although they usually hire other skippers to run their other vessels, they may run the vessels themselves, as occurs in the summer salmon fishery in Alaska. In a few cases, a skipper may be non-owner operator of a vessel in a distant fishery such as Alaska salmon.

For their primary fishing vessel (the one they operate most frequently), we asked skippers to provide information on vessel characteristics (Table 5-6). These vessels averaged 44.1 feet in length, 22.9 net tons, and 19.6 tons capacity. Vessels ranged in age from 3 to 87 years, and averaged 37 years. Vessel hull types were fairly evenly distributed among fiberglass (34.2%), wood (31.6%) and steel (28.9%). Typically, the oldest vessels have wood hulls, those built in the 1970s and 1980s have steel hulls, and those built most recently have fiberglass or steel hulls. Respondents reported having run their primary vessel an average of 12.4 years, and owning it an average of 11.8 years.

We sought information on the equipment carried on respondents' vessels, both to inform our estimation of the industry's direct economic value, and to provide a better sense of the characteristics and complexity of Moss Landing fishing operations and the investment in them. We requested information on the following equipment categories: fish-finding and navigation equipment, communications and information management equipment, fish catching equipment (excluding gear, see below), safety equipment, and other equipment (e.g., water makers) (Table

5-7). Several types of navigation and communication equipment such as fathometers, radar, GPS and two-way radios were common to most fishing operations. Several types of fish catching equipment such as reels, power blocks, winches and refrigeration were less common, as these are needed in some fisheries but not in others. Long distance fishery equipment such as satellite phones and image receiving equipment is least common, used primarily by highly migratory species fishermen. (See Appendix B, Table B-6 for a list of equipment commonly used in the major Moss Landing fisheries.)

Table 5-6. Selected characteristics of respondents' primary fishing vessels.

	N	Mean	Range
Year built	35	1963	1915-1999
Length (ft)	38	44.1	22-88
Net tons	27	22.9	2-100
Capacity (tons)	37	19.6	0-150
Years running the vessel	5	12.4	6-22

Table 5-7. Number and proportion of surveyed skippers that carry specific types of equipment (N=38).

	Freq.	%
Communication		
Two-way radio/CB	38	100
Cell phone	34	89.5
Desktop/laptop computer	5	13.2
Fax machine[a]	3	8.1
INMARSAT	3	7.9
Satellite phone	1	2.6
Single side band radio[a]	1	2.7
Fishing		
Winch	19	50
Fish pump	15	39.5
Reel	15	39.5
Temperature gauge[b]	15	57.7
Refrigeration	14	36.8
Sonar	11	28.9
Drum	10	26.3
Power block	7	18.4
Seine skiff	6	15.8
Fish-finding and navigation		
Fathometer	37	97.4
GPS	35	92.1
Radar	35	92.1
Plotter	33	86.8
Auto pilot[b]	19	73.1
Direction finder[a]	19	51.4
Other navigation and fish-finding equipment	5	13.2

[a] N=37, [b] N=26

The number and variety of gear used also characterizes and demonstrates skippers' investments in their fishing operation. Respondents identified 19 different gear types they had (Table 5-8). The most common gear used by respondents was salmon troll gear, followed by albacore troll, and longline, reported by 71.1%, 60.5% and 47.4%, respectively, of the 38 respondents. Skippers reported using or having ready to use an average of 3.3 gear types.

Table 5-8. Gear used/possessed by surveyed skippers (N=38).

	Freq.	%
Salmon troll	27	71.1
Albacore troll	23	60.5
Longline	18	47.4
Stick	11	28.9
Bottom trawl	8	21.1
Vertical longline	7	18.4
Gillnet	6	15.8
Trap/pot	6	15.8
Hook & line	4	10.5
Halibut troll	3	7.9
Purse seine	3	7.9
Driftnet	2	5.3
Lampara	2	5.3
Brail	1	2.6
Dinglebar	1	2.6
Fly gear	1	2.6
Harpoon	1	2.6
Midwater trawl	1	2.6
Shrimp hopper/net	1	2.6

Increasingly critical to fishing operations is access to and possession of fishing registrations, licenses and permits. While some items, such as the squid catcher vessel and light boat permits are issued to the fishing vessel, others such as the California nearshore fishery permit are issued to individuals. In addition, whereas some permits are transferable, others are not, or they have strict limitations on transferability. Twenty-nine items, including three vessel registrations, seven fishing licenses and nineteen fishery permits were specified by at least one respondent (Table 5-9). In addition to the required California commercial operator's (skipper's) license and commercial fishing vessel registration, the most commonly held licenses and permits were the California salmon troll limited entry permit, the California nearshore fishery limited entry permit, and the Federal groundfish limited entry permit. On average, respondents had 1.4 registrations, 1.6 licenses and 2.4 permits (Table 5-10). All but two skippers owned rather than leased their permits in 1999, 2000 and 2001. (See Appendix B, Table B-7 for a list of common fishing registrations, licenses and permits and their fees for 1999 through 2001.)

In addition to the vessel, equipment, gear and licenses, the people involved, the skipper and crew, define a fishing operation. Crew sizes vary notably among types of fishing operations. Many small troll and line fishing operations run with no crew, or perhaps one additional person. Larger troll and highly migratory species operations run with one to three crewmembers in addition to the skipper. Purse seine operations for CPS finfish and squid have the largest crew sizes, ranging from three to six plus the skipper. Skippers reported crew sizes (not counting themselves) ranging from 0 to 6 persons (mean = 1.3). More than half (57.9%) reported having

family currently involved in fishing, including seven (18.4%) who reported that at least one family member fishes with them.

Table 5-9. Number of surveyed skippers holding specific licenses, registrations, and permits (N=37).

	Freq.	%
CA commercial operator[a]	36	100.0
CA vessel registration[b]	35	100.0
CA skiff registration[a]	11	30.5
CA commercial crew[a]	8	22.2
CA fishermen's retail[a]	5	13.8
AK commercial operator[a]	4	11.1
AK vessel registration[a]	3	8.3
CA receiver[a]	2	5.5
OR commercial operator[a]	2	5.5
AK commercial crew[b]	1	2.8
CA salmon troll LE	26	70.3
CA nearshore	13	35.1
San Francisco Bay (CA) herring gillnet	5	13.5
CA general trap	4	10.8
CA Dungeness crab	3	8.1
CA general gill /trammel net	3	8.1
CA golden, spot, ridgeback prawn trawl	3	8.1
CA squid light boat	3	8.1
CA squid vessel	3	8.1
CA swordfish/shark[a]	2	5.5
CA anchovy/sardine live bait permit	1	2.7
CA northern pink shrimp trawl	1	2.7
OR albacore landing permit	2	5.4
OR salmon and albacore landing permit	1	2.7
WA albacore landing permit	1	2.7
WA groundfish landing permit	1	2.7
AK Bristol Bay salmon permit	3	8.1
Federal groundfish limited entry permit	9	24.3
Federal CPS permit	3	7.9

[a] N = 36; [b] N = 35

Table 5-10. Number and types of registrations, license and permits held by surveyed skippers.			
	N	**Mean**	**Range**
Fishing licenses	35	1.6	1-4
Vessel registrations	35	1.4	1-3
Fishing permits	37	2.5	1-6

Family involvement was also evident in other roles played by family members. For example, several respondents reported fishing with family members in the past and family members who currently fish on their own. Nine skippers (24.3%) reported that their wife/partner or another family member does the bookkeeping for the fishing operation. Also related to family involvement is the question of whether the fishing operation is a family business. Fourteen of 37 respondents (37.8%) overall, and 14 (63.6%) of those with family involved in some aspect of fishing, characterized their fishing operation as a family business.

Beyond the fish catching aspects of the operation itself are the handling and sale of the catch. Respondents were asked how they sold their catch: to a fish buyer at Moss Landing or elsewhere, to a restaurant or grocery store, and/or directly to the public; and the percentage of their catch they sold to each of these in 1999, 2000 and 2001. Most of those surveyed sold their catch primarily to a buyer at Moss Landing all three years (Tables 5-11 and 5-12). These patterns varied little of over the three-year period. When fishing more than a few hours transit from Moss Landing, most fishermen typically deliver at other ports along the coast to minimize lost fishing time and get their product to market as soon (and in as good condition) as possible. If their Moss Landing buyer has a receiving station or other receiving arrangement at those sites, fishermen deliver to them there. Otherwise, they deliver to an alternative buyer at those locations. As discussed in the fish buyers section below, many fish buyers receive fish at multiple California (and some out-of-state) ports. (See Table 5-16.)

Table 5-11. Number and proportion of surveyed skippers who sold their catch through various outlets, 1999-2001 (N=32).									
	1999			**2000**			**2001**		
	N	**Freq.**	**%**	**N**	**Freq.**	**%**	**N**	**Freq.**	**%**
Buyer at Moss Landing	26	24	92.3	26	24	92.3	28	26	92.9
Buyer elsewhere	26	14	53.8	26	14	53.8	28	16	57.1
Public	31	1	3.2	31	1	3.2	34	1	2.9

Table 5-12. Percent of catch sold via various outlets 1999-2001 (N=32).									
	1999			**2000**			**2001**		
	N	**Mean**	**Range**	**N**	**Mean**	**Range**	**N**	**Mean**	**Range**
Buyer at Moss Landing	26	66.7	0-100	26	65.6	0-100	28	64.0	0-100
Buyer outside Moss Landing	26	27.1	0-100	26	28.0	0-100	28	33.4	0-100
Public	31	1.9	0-60	31	2.1	0-65	34	2.2	0-75

Economics of Fishing Operations

We collected diverse data on the economics of respondents' fishing operations, including investment, expense and revenue data. We began with investment data, including vessel, equipment, gear and license costs and estimated current values (Table 5-13). Skippers reported an average vessel purchase price of $119,217, and an average replacement cost of $382,095. (These purchases were made over several decades, and prices are unadjusted for inflation.) Although this discrepancy was not surprising, skippers reported an average re-sale value of only $162,455. Several commented that few people are interested in buying a commercial fishing vessel, in large part due to increasing regulatory constraints, and both economic and regulatory uncertainty.

Table 5-13. Purchase price, re-sale value and estimated replacement costs for surveyed skippers' primary vessel, equipment and gear.

	N	Mean	Range
Vessel			
Vessel purchase price ($)	23	119,217	6,000-1,200,000
Vessel re-sale value ($)	33	162,455	6,000-1,200,000
Vessel replacement cost ($)	21	382,095	40,000-3,000,000
Equipment replacement cost			
Materials ($)	31	41,399	3,125-250,000
Skipper's time (hours)	9	1,501	1-5,000
Others' time helping (hours)	12	2,083	0-15,000
Gear replacement cost			
Materials ($)	33	26,312	250-220,000
Skipper's time (hours)	9	1,445	0-7,000
Others' time helping (hours)	10	689	0-2,000

Although equipment and gear are commonly not re-sold, making it difficult to estimate re-sale value, several respondents estimated replacement values for these items (Table 5-12). Mean replacement value for equipment was $41,399, but ranged widely from $3,125 to $250,000. The wide range of values reflects the diversity of fishing operations in terms of both size or scale and type, as well as the variety of equipment configurations. The lower ranges for these figures represent hook-and-line operations, while the upper ranges represent trawlers, seiners and some of the larger, farther-ranging multi-species operations. It should be noted that these costs, like those for gear and vessels, do not reflect the full value of these items. In addition to the costs of materials and paid labor, the skipper's and crew's time, and the time and assistance of friends and colleagues are often invested in these items. Most fishermen were not able to offer a quantitative estimate of these inputs, but noted that they varied considerably among types of fishing operations. About 25% of respondents, however, provided rough estimates, shown in Table 5-13.

Fishermen also provided data on recent costs and revenues associated with their fishing operations to inform our estimation of the direct economic value of the commercial fishing industry at Moss Landing provided in Section 6 of this report. Table 5-14 provides a partial list of average annual expenditures for 1999 through 2001 on several items required for a fishing operation. These figures reflect the responses of the 18 respondents who provided sufficient

data for analysis. Because the expenditure data are from a limited subset of the 38 skippers surveyed, they may not fully represent the fleet as a whole in terms of types of operation, total expenditures, and their allocation among categories and across locations. (See Appendix A for a detailed discussion of the sample and this subset, and their representativeness. We will improve on this data in subsequent work.) Moss Landing-based groundfish line and trawl, and salmon troll fishing operations are well represented in the data, whereas HMS line and gillnet and CPS purse seine operations are underrepresented. HMS and CPS fishing operations tend to be larger and more labor and cost-intensive than the other types of operations. In addition, they are typically more wide-ranging than other types of fishing operations that deliver to Moss Landing, and therefore have higher cost for items such as fuel, maintenance and groceries.

The figures shown within expenditure categories and across locations reflect the availability of goods and services as well as the nature of the fishing operation. The most readily available and commonly purchased items at Moss Landing include bait, fuel, ice, maintenance and repair services and salt. In addition, fishing operations that overnight at the harbor incur slip fees (whether as transient or assigned berth holders). In addition, some gear and groceries are available locally. These items are also available in the larger Monterey Bay area. Additional expenditures that are likely to be paid elsewhere in the Monterey Bay area include crew and vessel payments and accounting, legal, insurance and fishing license fees. These additional expenditures also or alternatively may be paid outside the Monterey Bay area, especially in the case of non-resident fishermen.

Table 5-14. Surveyed skippers' annual average expenditures by category and location, 1999-2001 (unadjusted $, N=21).

		Location			
Category	**Code**	**ML**	**M/SC**	**OM**	**Total**
Accounting	AC	2,100	3,524	907	6,532
Association	AS	-	-	100	100
Bait	BA	24,961	21,879	6,477	53,318
Crew Payment	CR	20,780	7,000	4,770	32,550
Fuel	FU	52,500	40,890	57,417	150,807
Gear	GE	34,144	42,150	26,922	103,217
Groceries	GR	10,800	14,800	2,600	28,200
Ice	IC	16,430	1,829	1,923	20,182
Insurance	IN	1,864	10,893	38,513	51,269
License	LC	26,200	139	4,102	30,441
Lodging	LO	100	-	150	250
Maintenance	MA	16,936	36,827	82,642	136,405
Other Expenses	OE	2,914	474	571	3,959
Salt	SA	700	-	-	700
Slip	SL	24,091	18,372	14,540	57,003
Vessel Payment	VE	3,850	8,033	33,917	45,800
Total	Total	238,369	206,810	275,553	720,732

ML = Moss Landing, M/SC = elsewhere in Monterey or Santa Cruz Counties,
OM = Outside the 2-county area.

Based on our understanding of the possible types, amounts and locations of fishing operation expenditures during the year, the expenditures reported in Table 5-14 appear reasonable for some categories such as accounting, bait and ice. They appear low at Moss Landing and overall for fuel, and license and slip fees. Gear expenditures, which also include purchases of

equipment such as seine skiffs, safety gear, net reels and GPS units, also appear low, although they may be consistent with the character of the subsample. Note, however, that many types of gear and equipment are “big ticket” items that are purchased once every several years. For example, a seine skiff or net can cost from $30,000 to $70,000 (Pomeroy et al. 2002). Moreover, given recent trends in some fisheries and uncertainties affecting the industry overall, some fishermen have deferred these items for the past few years. Grocery expenditures at Moss Landing appear too high, given the lack of a bona fide grocery store there.

For 1999 through 2001, an average of about 80% of respondents' household income came from fishing, with the remaining 20% coming from other work, a spouse/partner’s work, and in a few cases, other investments and sources (Table 5-15). Respondents were more reluctant to report their gross income from fishing. For those who did, however, it ranged widely within years, up to $250,000 in 1999. Note that the subset of the sample that reported gross income from fishing, however, primarily represents smaller scale troll and other line gear operations. Larger line gear and gillnet, as well as purse seiners, are not well represented in this subsample. These skippers tend to have higher gross revenues, accompanied by higher operating costs.[9]

Table 5-15. Gross income and percent of household income from commercial fishing, 1999-2001 (unadjusted $).

	1999			2000			2001		
	N	**Mean**	**Range**	**N**	**Mean**	**Range**	**N**	**Mean**	**Range**
Gross fishing revenues	15	76,635	8,400-250,000	17	61,932	7,660-200,000	20	60,429	0-200,000
Percent of household income	35	81.7	0-100	35	80.0	0-100	34	79.8	4-100

Commercial Fish Buyers

Dozens of non-resident and seven resident fish buyers buy fish from commercial fishermen at Moss Landing.[10] Non-resident fish buyers receive fish directly or indirectly through another receiver at Moss Landing. Non-resident and resident fish buyers alike are active at ports throughout the state. Between 1999 and 2001, an average of 60 buyers per year received fish at Moss Landing (Table 5-16). (See Appendix B, Figure B-1 for a map of California ports.) Of these, many also received fish at other port areas throughout the state, using an adaptive strategy much like that of the mobile fishermen described above. The most common ports at which resident and non-resident Moss Landing buyers received fish were San Francisco, Moro Bay, Santa Barbara/Ventura/Port Hueneme, and Bodega Bay. Very few received fish at the state's more southerly and northerly ports.

[9] We will work with these and a broader set of operations and skippers in subsequent projects in an effort to refine these estimates of expenses and revenues.

[10] This estimate of receivers is based on an analysis of PacFIN data, for which we grouped receivers with similar license numbers. Specifically, following the California licensing system, receivers with multiple receiving licenses (e.g., for receiving at Moss Landing and at Monterey) have license numbers that differ only in the last one or two digits of their eight-digit id numbers. We therefore aggregated receiver data by combining data for those entities with license numbers that differed only by the last two digits. It is still possible to overestimate the number of receiving firms, as some receivers have multiple receiving licenses with distinctly different license numbers.

Table 5-16. Average annual number of Moss Landing receivers that also received fish at other California ports 1999-2001 (PacFIN data).			
	Received fish at ML		
Port/port area	**No**	**Yes**	**Port total**
Moss Landing (ML)	-	60	60
San Francisco (SF)	157	20	177
Morro Bay (MB)	55	17	72
Santa Barbara/Ventura/Port Hueneme (SB/V/PH)	143	15	158
Bodega Bay (BB)	67	15	82
Santa Cruz (SC)	27	12	39
Northern California (Crescent City and Eureka, NC)	79	10	89
Monterey (MN)	18	10	28
Los Angeles (LA)	130	8	139
Fort Bragg (FB)	54	8	62
San Diego (SD)	71	6	77
Other California ports (OC)	13	2	14
Other Monterey Bay area ports (OM)	4	2	6
Total	818	185	1,003

Note: Aggregations are for port areas except for the three major Monterey Bay area ports.

Our research focused on Moss Landing's resident fish buyers, which account for the majority of commercial fish receipts for the port. We gathered data through interviews, ethnographic observation, the study of archival sources, and Pomeroy's previous research on the salmon and wetfish fisheries (Pomeroy 2002a, Pomeroy et al. 2002). We conducted structured survey interviews with four of the resident fish buyers, and ethnographic interviews with two other resident fish buyers.

Resident Fish Buyers at Moss Landing

The resident fish buyers at Moss Landing may be roughly categorized as follows: one live fish buyer, three wetfish (CPS) receiver/processors, and three multi-species buyers. They include a mix of relative newcomers and long-established businesses. All are headquartered in the Monterey Bay area, and have been involved in the fishing industry for well over a decade, including one business that has operated for more than 60 years.

The resident live fish buyer's operation is wholly contained at Moss Landing. Although it first began operations at Moss Landing in 1997, it recently moved into new quarters in the Santa Cruz Cannery building, which it leases from the Harbor. This buyer has employed as many as five people, but due to recent cutbacks in the groundfish fishery and especially the nearshore fishery, currently employs two people. Following the recent completion of K-dock (adjacent to the Cannery building), it now receives deliveries from live fish fishermen there. The catch is held in aerated tanks until the buyer accumulates a load to deliver to a buyer in the San Jose / San Francisco Bay area.

The CPS buyers buy some groundfish, salmon and other species as well as CPS finfish and squid. These three wetfish buyers have large-scale operations that include a range of activities from receiving to exporting and importing fish. Each employs more than 80 permanent, full-time staff, and up to 500 additional part-time and seasonal workers at its locations Moss Landing and other locations combined. Two have their headquarters in Salinas, while one is based at

Monterey. They receive squid and, on occasion, sardine at Port Hueneme, and have sardine receiving operations in Oregon and Washington. They truck most of the catch from southern California as well as Monterey Bay area ports to processing facilities in the Monterey Bay area. Each of these firms produces particular specialty wetfish products in addition to frozen blocks that are shipped overseas for further processing (Pomeroy et al. 2002). These CPS receivers also do some processing of other species (e.g., groundfish) and distribution to regional secondary processors and fresh fish markets.

Moss Landing is the primary central coast receiving location for these buyers. One CPS buyer has owned and operated receiving facilities at Moss Landing including a small building that serves as an office, a fish pump, a hoist and loading docks, as well as the land on which these are located since 1988. A second CPS buyer has a similar set-up at Moss Landing. Both of these buyers receive groundfish and other species as well as CPS at Moss Landing. The third major CPS buyer has received CPS and small amounts of other species at Moss Landing since 1998, primarily through another receiver. It has leased space in the new Santa Cruz Cannery Building at K-dock, where it is preparing to receive and do limited processing of CPS.

Among the three multi-species buyers, one is primarily a receiver on behalf of some resident and many non-resident buyers for CPS, groundfish, HMS, salmon, and other species. On occasion, this receiver also brokers fresh fish regionally. It employs three individuals full-time, and up to seven part-time/seasonal workers to assist with unloading, packing fish into totes, and loading totes into trucks. Its operations are centered on a single dock, which it has leased from MBARI since 1992. Its facilities include a wetfish pump and three hoists, and an ice-chipping machine that processes 300-pound blocks of ice.

The second and third multi-species buyers purchase a variety of fish from a small number of local fishermen. Both do some on-site processing and packing at their Moss Landing facilities. They sell the product in their own local and regional retail markets and restaurants, and distribute some to retail businesses in the region. The older of the two operations has been at Moss Landing since the 1970s, and employs about 40 staff locally. The other buyer has been involved in the fishing industry since about 1975, and in the post-harvest sector since 1982, but only recently started operations at Moss Landing space in the Santa Cruz Cannery Building leased from the harbor. At present, it employs 36 people full-time and 2 to 15 additional people seasonally. This includes two people at its Moss Landing receiving and processing facility. This number will increase when the buyer opens a seafood restaurant and market at Moss Landing's North Harbor later this year.

Moss Landing Fish Buyers' Expenditures

Fish buyers purchase a wide range of goods and services locally, regionally and more widely to support their fish buying and related activities. The magnitude and location of these expenditures depends on where they operate and the additional fish production activities in which they are involved. Table 5-17 presents summary data for the three surveyed fish buyers that provided expenditure data for 1999 through 2001, which we used to estimate the direct economic value of the commercial fishing industry at Moss Landing. Expenditures made in the larger Monterey and Santa Cruz County area and outside the area are aggregated to insure the confidentiality of individual buyers' data. Although the total for each category are accurate, the allocation of expenditures across locations may have errors. Some expenditures appear to be attributed to Moss Landing, when they are more likely to have been made elsewhere. This is the case for financial and legal services, insurance, taxes and licenses, which are not readily available or payable at Moss Landing. In addition, based on our understanding of the fisheries

and these three businesses, their aggregate expenditures for licenses, vessel payments and purchases, and slip fees may be under-reported. We will seek to augment and refine this data in subsequent work.

Table 5-17. Average annual expenditures of sampled fish buyers by location, 1999-2001 (N=3).

Category	Code	ML	Outside ML	Total
Building and Equipment	BE	32,349	286,376	318,725
Financial and Legal Service	FL	13,271	78,579	91,851
Fuel	FU	2,080	91,142	93,222
Ice	IC	2,173	168,785	170,958
Insurance	IN	6,304	614,720	621,024
License	LC	5,180	0	5,180
Other Expenses	OE	150	2,018,427	2,018,577
Payroll	PA	27,252	4,202,644	4,229,896
Service	SE	31,898	379,555	411,453
Slip or berth	SL	5,735	0	5,735
Supplies	SU	19,847	2,505,856	2,525,703
Taxes	TX	3,438	198,731	202,169
Utilities	UT	3,433	604,622	608,055
Vessel payments and purchases	VE	17,009	400,000	417,009
Fish Purchases	FP	1,420,322	9,885,536	11,305,858

Common fish buyer expenditures at Moss Landing are fish purchases, slip fees, fuel (for vessels), ice and local payroll. Not surprisingly, however, the majority of fish buyers' expenditures are made outside Moss Landing. Several items essential to a fish buyer's operation such as fish receiving equipment and packing supplies are not available at Moss Landing. In addition, some buyers have receiving, processing, packaging and marketing facilities offsite, most commonly in Monterey and Salinas. They take advantage of the greater number and diversity of goods and services offered in these commercial centers. Salinas, in particular, is an important source of goods and services for fish buyers, who require many the inputs also required for agricultural operations.

Fishery-Support Businesses

The operations and maintenance of commercial fishing vessels and receiving stations depend upon the provision of particular goods and services. Fishermen and buyers depend upon, and in turn contribute to, the economic well-being of the businesses that provide those goods and services.

As Moss Landing Harbor grew through the 1960s and 1970s, there was a proliferation not only of commercial fish businesses, but also of support businesses. A 1980 report identified nine sites of fishery-support businesses including marine repair and storage facilities, a boat broker, a fuel dock, a marine electronics specialist, and two marine supply stores (Jefferson Associates 1980).

Although there have been some noticeable changes, 23 years later, Moss Landing still hosts several fishery-support businesses. These include a fuel dock that has a small marine supply and general store, a boatyard that also sells marine supply items, a marine covers/upholstery

shop, electrical, diesel, hydraulic, metalwork and other service providers and a dry storage facility. In addition to these businesses that play a direct role in the maintenance and operation of commercial fishing operations, fishermen and staff of fish receiving operations frequent Moss Landing restaurants, including one on the Island and several on the mainland. (See Appendix B, Table B-2 for a list of Moss Landing businesses.) In addition, many other businesses in the larger Monterey Bay area and beyond support and depend on the commercial fishing industry.[11] The following provides a description of some of the support businesses at Moss Landing, based on in-depth interviews with three of the nine businesses identified, and other ethnographic fieldwork and archival research conducted for this study.

Many of the fishery-support businesses at Moss Landing have been serving the commercial fishing industry for at least two decades. All of these businesses are based at Moss Landing, and are locally- and in most cases family-owned. Chief among these are the fuel dock, the boatyard and several specialty businesses housed on the boatyard's property. In addition to these, a new metalwork shop opened in the Santa Cruz Cannery Building in late 2002.

The fuel dock was started in the mid 1950s by the current owner's parents, and at that time included boat sales and supplies. Since 1975, it has specialized as a fuel dock and small marine supply store, with about 80% of its business attributed to the commercial fishing industry. In addition to the owner, it has one full-time and two part-time employees. The business owns and operates a fuel dock, a store, tanks and piping, a few slips it leases to fishermen and others, and some on-land storage space for sailboats. Its fuel and oil sales to commercial fishing and other vessel operators constitute about 75% of its business. Sales of fishing gear and equipment including hooks, line and safety equipment, along with snacks and other small items, account for the remaining 25% of its business. The staff regularly orders items for fishermen and other customers, placing orders with about 50 vendors located as nearby as Hollister and as far away as Canada. In addition to providing these goods and fueling services to the commercial fishing and larger boating community, this business also leases some freezer space to local fishermen, and has provided oil pump out service to boaters for over 50 years.

The boatyard had been in business several years when the current owner's family bought it (including the land) around 1970. The boatyard employs five people, and has a travel lift, boat storage including storage containers, a small machine fabrication shop and a few slips. It also has a marine supply shop that sells marine paint and other supplies especially related to boat work. It offers services such as high-pressure washes, painting of vessel hulls, welding, electronics repair and service, and installation and repair of various parts and zincs (to prevent corrosion of steel hulls, fittings, bolts and screws). The boatyard has made some key changes in its services over the past several years that are relevant to the commercial fishing industry. It stopped offering sandblasting services because of the high cost of compliance with environmental regulations. The boatyard provides space, air, water and electricity, and has increasingly allowed fishermen to do more of their own work to reduce their costs. The owner estimates that historically an average of 70 to 80% of its annual business came from the commercial fishing industry, but that figure declined to 65% in 2000 and about 50% in 2001.

The specialty businesses housed at the boatyard include a painting and woodwork shop, a diesel maintenance and repair business and a marine covers shop. Although the former two are more recent arrivals [other similar businesses used to be at Moss Landing (Jefferson Associates 1980)], the marine covers shop has operated since at least the mid 1970s. It has two full-time

[11] Documenting these businesses' role in and dependence on the commercial fishing industry at Moss Landing was beyond the scope of this study, but is part of subsequent work.

employees and occasional part-time help to produce and repair two major types of goods for the commercial fishing industry: interior items and items related directly to fishing. Interior items include bunk and bench cushions, covers and curtains. Fishing-related items include instrument, freezer and wire covers; rain gear; tuna chutes; salmon drags; and fish hold liners.[12] While the business sells most of these items to customers at Moss Landing, it also has orders from fishermen, aquaria and produce companies elsewhere in the US and overseas. A smaller proportion of this business's revenue comes from commercial fishing compared to the boatyard and the fuel dock. That figure declined from about 25 to 35% in 1999 to about 18% in 2001.

Moss Landing Fishery Support Businesses' Expenditures

Average annual expenditures reported by the three fishery-support business owners surveyed are reported in Table 5-18, and are used in Section 6 to estimate the direct economic value of the commercial fishing industry at Moss Landing. We aggregated data on expenditures made in the larger Monterey and Santa Cruz County area and outside the area to insure the confidentiality of individual businesses' data. Although the total amounts reported are believed to be comprehensive and accurate, their allocation across locations is less certain. For example, auto, insurance, license, tax and utility payments are most likely made outside, rather than at, Moss Landing. However, other items such as maintenance appear to be well accounted for in terms of both amount and location of expenditure. As with the skipper and fish buyer data, we will seek to refine and augment these data in subsequent work.

Table 5-18. Average annual expenditures by fishery-related businesses (N=3).

Category	Code	ML	Outside ML	Total
Auto	AU	5,691	2,994	8,685
Buildings and Equipment	BE	27,470	36,867	64,336
Financial and Legal Services	FL	1,676	8,652	10,328
Insurance	IN	35,662	55,152	90,814
Licenses	LC	854	0	854
Maintenance Services	MA	8,923	20	8,943
Other Expenses	OE	0	20,072	20,072
Payroll	PA	79,681	106,231	185,911
Services	SE	0	576	576
Supplies	SU	2,726	107,267	109,994
Tax	TX	33,588	64,976	98,563
Utilities	UT	14,923	17,367	32,290
Equipment	EQ	3,549	11,403	14,952

Fishery-support businesses' expenditures have considerable overlap with but also differ in important ways from those of fish buyers. Fishery-support businesses do not have fish purchases or vessel payments (although these would not be unheard of), but do have higher auto costs. In addition, the goods and equipment they require differ from those of fish buyers. Although they tap into the region's agricultural economy for some goods and services, and suppliers of general business supplies in nearby Monterey and Salinas, they use vendors outside the region for some goods and services including, notably, equipment related to vessel

[12] Salmon drags and tuna chutes, also called sea anchors, are cone shaped canvas devices with openings at both ends. They are used to slow a vessel's drift when fishing for salmon or tuna, or when the vessel is in water too deep to anchor.

maintenance and repair. Another interesting feature of fishery-support businesses was their access to and use of local mechanical, electrical and other technical expertise for maintenance.

SECTION 6: DIRECT ECONOMIC VALUE OF COMMERCIAL FISHING AT MOSS LANDING

Input-output (IO) tables, based on economic information from the survey and interview data collected at Moss Landing, are used to estimate the direct economic value of commercial fishing at Moss Landing Harbor. The estimate of direct economic value includes three industries and operating expenses for the Moss Landing Harbor District. The three industries are commercial fishing operations, fish buyers, and fishery-related businesses that provide fuel and other inputs for fishing operations.

In IO analysis, specific assumptions are made to ensure aggregation or adding-up conditions for the data. The most restrictive assumption in IO analysis is that data for different firms or producers in an industry may be added together. In other words, costs are linear, which allows data on expenditures by different firms to be added together so that averages of the expenditure shares may be calculated for the industry. The assumption of linear costs is standard in IO analysis and is used, for example, by the Bureau of Economic Analysis in producing their benchmark IO tables from the National Income and Product Accounts.

Expenditure Shares and Ex-Vessel Revenues

The sample data on different types of expenditures at Moss Landing in Tables 5-14, 5-17, and 5-18 are used to calculate average expenditure shares for different inputs that are purchased at Moss Landing by commercial fishermen, fish buyers and fishery-related businesses.

Total real ex-vessel revenues ($2000) at Moss Landing from 1999 through 2001 for the sample of skippers represented by Table 5-14 were computed from PacFIN data, and the sample average for this period is $1.7 million per year. Average expenditures for fishing operations represented in the sample are well below the average for revenues, and we refer to the difference as gross profits. Note that important costs, including expenditures at other locations on gear and other essential inputs that are not available at Moss Landing, are included in the definition of gross profits.

Total real ex-vessel revenues ($2000) for all vessels at Moss Landing from 1999 through 2001 were also computed from PacFIN data, and averaged $6.8 million per year. This value provides an important link between fishing operations and fish buyers. We estimate total expenditures on different inputs by all fishing operations at Moss Landing by scaling our estimates of expenditure shares and gross profits from the sample of operations in Table 5-14 by the $6.8 million per year ex-vessel revenue figure.

Total ex-vessel revenues at Moss Landing also represent payments by fish buyers to commercial fishermen. We use this fact to scale expenditure shares at Moss Landing for the sample of fish buyers in Table 5-17. Total ex-vessel revenues are divided into fish purchased by fishermen (bait) and fish purchased by fish buyers for further processing. The expenditure shares calculated from Table 5-17 are scaled so that total fish purchases by the fish buyers is equal to ex-vessel revenues less bait expenditures by fishermen.

The sample of fishery-related businesses is small (N=3), but represents about 40% of the fishery-related businesses at the harbor, and is believed to be representative of the population of fishery-related businesses at Moss Landing. We use expenditures at Moss Landing from Table 5-18 as conservative or lower bound estimates of total expenditures by all fishery-related businesses at the harbor.

Input-Output Tables

We use an IO table to present estimates of expenditures at Moss Landing for the three industries on different inputs, payments to labor and capital, and gross profits (Table 6-1). Columns in the table represent industries, and rows show expenditures on the different inputs used by each industry.

Inputs are aggregated by categories. For example, fish purchased by fishermen includes bait. Utilities include water and electricity. Supplies is a general category that includes a range of items from salt to office supplies. Financial and legal includes advertising as well as legal and accounting costs. Service refers to general contract services such as maintenance and computer support. Equipment used by fishermen includes fishing gear. Additional detail on these categories is provided in Appendix A.

The gross economic value of each industry presented in Table 6-1 is the sum of all expenditures on inputs plus gross profits. Where information on revenues is limited or unavailable, as in the case of fish buyers and fishery-related businesses, the sum of expenditures provides a lower bound on the true gross economic value of that industry.

Table 6-1. Annual average inputs and outputs of commercial fishing at Moss Landing, 1999-2001 (year 2000 dollars, x 1,000).

Category	Code	Fishing operations	Fish Buyers	Fishery-Related Businesses	Total
Fish Purchased	FP	98.5	6,683.6	0.0	6,782.1
Fuel	FU	207.1	9.8	0.0	216.9
Utility	UT	0.0	16.2	14.9	31.1
Ice	IC	64.8	10.2	0.0	75.1
Supplies	SU	45.4	93.4	2.7	141.5
Financial/Legal	FL	8.3	62.4	1.7	72.4
Insurance	IN	7.4	29.7	35.7	72.7
Maintenance	MA	66.8	0.0	8.9	75.7
Service	SE	0.0	150.1	0.0	150.1
Other Expense	OE	11.9	0.7	0.0	12.6
Auto	AU	0.0	0.0	5.7	5.7
Building/Equipment	BE	0.0	152.2	27.5	179.7
Equipment	EQ	134.7	0.0	3.5	138.3
Slip Fees	SL	95.1	27.0	0.0	122.0
Vessel Payment	VE	15.2	80.0	0.0	95.2
Payroll	PA	82.0	128.2	79.7	289.9
Gross Profit	GP	5,841.5	0.0	0.0	5,841.5
License	LC	103.4	24.4	0.9	128.6
Tax	TX	0.0	16.2	33.6	49.8
Total		***6,782.1***	***7,484.1***	***214.7***	***14,480.9***

Goods and services provided by Moss Landing Harbor are an inseparable feature of commercial fishing at Moss Landing. The annual costs of harbor operations are given in Table 6-2. These costs are included in the estimate of commercial fishing's direct economic value, even though other groups such as recreational fishermen use the harbor. To account for different types of users, a plausible adjustment in future work could be to, for example, scale the

total value in Table 6-2 by the percentage of berths occupied by commercial fishing vessels. However, the public goods nature of the harbor makes assigning value to a particular user group tricky.

Table 6-2. Annual Moss Landing Harbor expenditures, 1999-2001 (year 2000 dollars, x 1,000).

Category	**Code**	***Expenditure***
General and administrative	FL	690.2
Maintenance	MA	281.0
Operations	SE	2,666.8
Capital and depreciation	BE	3,225.4
Suppliers and employees	PA	3,227.7
Total		***10,091.1***

Estimates of Economic Value

The direct economic value of commercial fishing at Moss Landing is estimated by the sum of gross economic values for the three industries, shown in the bottom row of Table 6-1, plus the sum of operating expenses for the Harbor in Table 6-2. By an accounting identity, the sum of gross economic values is equal to the sum of expenditures on all inputs, profits and taxes, and these values appear in the last column of Table 6-1. Based on values in Tables 6-1 and 6-2, the direct value of commercial fishing at Moss Landing is estimated to be $25 million per year.

Since it adds the gross dollar value reported for commercial fishermen to fish purchases by fish buyers in Table 6-1, our estimate of direct economic value double counts the value of ex-vessel revenues. A net measure of economic value that avoids double counting may be more informative than our estimate of direct value. One measure of the net economic value of commercial fishing at Moss Landing is estimated by total expenditures of fish buyers, fishery-related businesses, and the Harbor, which equals $18 million per year. Fishermen's expenditures on bait could also be added to this estimate.

These estimates of commercial fishing's economic value at Moss Landing are based only on producer data for expenditures and revenues. A more complete estimate of the market value of the fishery would include indirect values from the final goods that use fish landed at Moss Landing as inputs, for example local restaurants or as bait in the recreational fishery. Figure 6-1 shows a typical case with demand and supply of fish landed at Moss Landing. The market price and quantity occur at P and Q. Producer surplus in the figure is total profits obtained at Moss Landing by commercial fishermen, buyers, and related businesses. Note that data in Table 6-1 provide information on profits only for fishermen, and therefore underestimate producer surplus in the Figure 6-1. Total costs in the figure are estimated by the total expenditures in Tables 6-1 and 6-2.

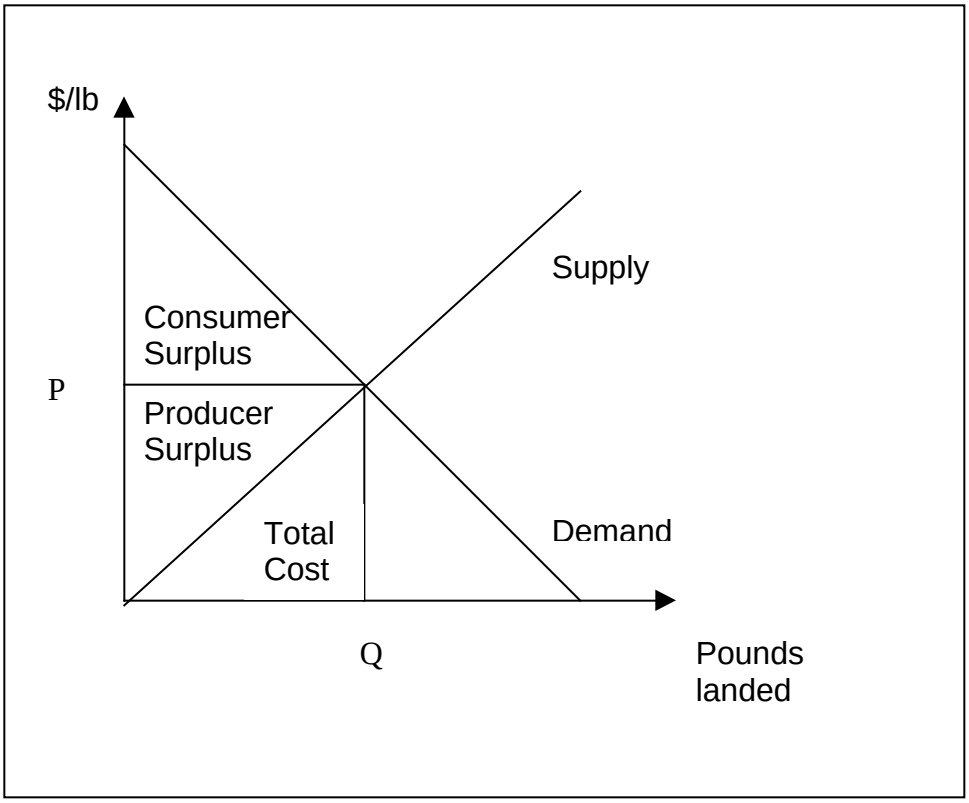


Figure 6-1. Market equilibrium and economic value.

SECTION 7: COMPARISON OF MOSS LANDING, SANTA CRUZ AND MONTEREY HARBORS

The harbors of Santa Cruz, Moss Landing and Monterey mark the northern, eastern and southern edges, respectively, of Monterey Bay. Each has long played a role in the commercial fishing industry, as well as the larger community. In this section, we provide a general description of each harbor and describe its key fishery-related features. Given the focus of this study, the description of Moss Landing Harbor is more comprehensive than that for Monterey and Santa Cruz, although more detailed descriptions of these harbors are being developed through subsequent research. We then provide a comparison of the recent trends in commercial fishing activities at the three harbors. The descriptive information reported here is based on data provided by historical and other relevant documents, harbor web sites and harbor management. The comparative analysis employs PacFIN data, and is informed by these sources as well.

Moss Landing Harbor

The Moss Landing Harbor District is a political subdivision of the State, which is governed by a Harbor Commission with five members elected by local residents. The Harbor Commission sets policy for Harbor management; the Harbor Office is responsible for implementing that policy and day-to-day operations. Although the Harbor's staff size has fluctuated over time, as of this writing, the harbor employs 10 individuals including a harbor manager/master, an assistant harbormaster, and other administrative and maintenance staff. In addition, the harbor engages outside contractors for legal, end-of-year accounting and some other services.

The commercial fishing industry has played a prominent role at Moss Landing Harbor since its establishment in 1947. The Harbor has supported multiple, diverse fisheries, the relative importance of which has varied over time with changes in environmental, social and economic and regulatory conditions. At present, Moss Landing Harbor hosts seven resident commercial fish receivers, about 125 resident and 175 non-resident commercial fishing vessels, and over a half dozen businesses that provide goods and services to the commercial fishing industry.

The Harbor provides a number of goods and services to the commercial fishing industry, as well as other harbor users (Table 7-1). Primary items provided to the industry are berthing for commercial fishing vessels and associated amenities. Of the approximately 743 berths at the harbor, some 455 (Superior Court 2002) are located in South Harbor, where commercial fishing activity is concentrated. (The harbor has no moorings.) In assigning berths, the harbor distinguishes among commercial fishing vessels, other commercial vessels and pleasure craft. It also differentiates between assigned and transient berths and occupants. Berthing fees are based on vessel length, vessel type and duration of occupancy. Because Moss Landing is a commercial port, commercial fishing vessels that demonstrate at least $5,000 in commercial fishing revenues for the year are given a discount on berthing fees. Occupancy rates vary considerably throughout the year, especially because of the seasonality of several fisheries in the Monterey Bay area and in other areas fished by Moss Landing fishermen. However, priority is given to commercial fishing vessels. As of this writing, there are about 100 vessels on the Harbor’s berth waiting list, but none are commercial vessels.

Table 7-1. Features and amenities at Moss Landing, Monterey and Santa Cruz Harbors directly related to the commercial fishing industry.			
	Moss Landing	**Monterey**	**Santa Cruz**
Number of berths	743	413	950
Number of dry slips	0	45-50	280
Number of moorings	0	180-185	0
Bilge pump-out facility	X	X	X
Dock power	X	X	X
Dock water	X	X	X
Dredge yard			X
Dry storage	X	X	X (3)
Hoists	X (2)	X (2)	X (3)
Launch ramp	X	X (2)	X
Laundry	X	X (1)	
Oil pump-out station	X	X	X (5)
Oil recycling facility	X	X	X
Other buildings	Cannery Building	Maintenance shop	X (11)
Outdoor storage lot	X		
Parking lot	X	X	X
Pier		X	
Restrooms	X (3)	X (2)	X (11)
Sewage pump-out		X	X
Shower facility	X	X	X (8)
Trash disposal	X	X	X
Number of fish buying stations	6	6	1
Fishery support businesses			
Bait shop		X	X
Boat repair yard	X	X	X
Canvas shop	X		X
Fish market			X
Fuel dock	X	X	X
Grocery store			X
Marine hydraulics	X		X
Marine electrician	X		X
Marine supply store	X	X	X

Note: Numbers in parentheses indicate number of units of a given item, provided for amenities only.

In addition, the Harbor provides several services that are essential to the operation of the commercial fishing industry. These include the provision of utilities such as water, electricity, and sewage and trash disposal, towing and related services. Most importantly, perhaps, the harbor is responsible for insuring that it is adequately dredged so that fishing and other vessels can navigate in the harbor, and do so safely. Dredging has been an expensive and problematic issue, especially since the determination that sediment and dredge spoils are contaminated with DDT and other toxins (some of which have not been used in decades, but which persist in local sediment) from nearby agricultural lands (Woolfolk 1996, Weinstein 1999).

The Harbor also provides goods and services through the acquisition of grants and loans to support projects related to the commercial fishing industry and other harbor users. Of particular note are recent improvements to the Harbor, including the renovation of the Santa Cruz Cannery Building, which now houses three fish buyers and a metalwork shop. K-dock, adjacent to the Cannery Building, which suffered substantial damage in the 1989 Loma Prieta earthquake, has also been renovated. It includes a loading dock with a small truck turn-around area, two pumps and a hoist that are owned and operated by Cannery Building fish businesses, and a public hoist and workspace where fishermen can tie up, load, unload and work on gear. Further improvements include plans to construct a 2-lane bridge to replace the hard-traveled and often dangerous one-lane Sandholt Bridge that connects the Island to the mainland. In addition, while most activity and infrastructure related to the commercial fishing industry is concentrated in the South Harbor area, development of a seafood retail and restaurant facility is planned for North Harbor.

Monterey Harbor

Although Monterey Harbor's history dates back to the early 17th century, the development of the present day commercial fishing industry and related facilities began in the latter 19th century. Among the early fisheries that operated at the Harbor, and stimulated its growth were the salmon, sardine and squid fisheries. In 1916, the City of Monterey purchased the original wharf (known as Fisherman' Wharf") from the Pacific Coast Steamship Company, largely to better provide for the needs of the growing sardine industry as well as the existing freight business there (Monterey Harbor 2003).

The City has regularly expanded harbor infrastructure since first acquiring Fisherman's Wharf in 1916. In 1926, a second wharf, Municipal Wharf II, was completed. With the collapse of the sardine fishery after World War II, Fisherman's Wharf shifted focus to accommodate growing tourism in the area, while Wharf II became the focus of commercial fishing activity. Additional development continued through the 1960s and 1970s. A marina with 367 berths was completed in 1960, with 29 berths added in 1975. Bulkheads, launch ramps and others facilities were added as well. In late 1996, further improvements were completed as part of a $5 million Marina Reconstruction Project (Monterey Harbor 2003).

The Harbor falls under the jurisdiction of the City of Monterey, which provides guidance to the Harbormaster and 11 additional permanent, full-time staff, who mange the Harbor's day-to-day operations including marine operations, maintenance and security.

Monterey Harbor provides a range of goods and services to the commercial fishing industry (and other harbor users) (Table 7-1). The Monterey Municipal Marina has 413 slips, 6 end ties, 180 to 185 moorings, and an open anchorage where additional vessels may anchor for up to 30 days in any 6-month period. (A mooring license is required from the City.) Berthing fees differ for permanent and transient use, and the summer and winter seasons (Monterey Harbor 2003). The Harbor also has 45 to 50 dry storage spaces, which are managed by the Monterey Peninsula Yacht Club. Harbor amenities and services also include electricity, water, pump-out stations, two public launch ramps, two public hoists, restroom, shower and laundry facilities, trash disposal, recycling and parking. The wharf also includes a parking area where fishermen can mend nets.

As of this writing, Monterey Harbor is used by seven resident wholesale fish companies, 140 commercial fishing vessels, and several providers of goods and services. The seafood

wholesalers that operate on the wharf include four multi-species buyers, two operations that focus primarily on wetfish, and one live fish buyer. Commercial fishing vessels include wetfish seiners and squid light boats, salmon trollers, groundfish trawlers and a few hook-and-line, longline and trap vessels that target rockfish, halibut and other species. Two marine supply businesses, two boatyards and a fuel dock that serve the industry are located at the harbor as well.

Santa Cruz Harbor

The Santa Cruz Port District was created pursuant to a County election in 1950, to "provide and manage small craft harbor facilities in Santa Cruz County" (Santa Cruz Port District 2003), to operate as a regional facility for "recreation, commercial fishing and as a harbor of refuge" (Santa Cruz County Grand Jury 2002: 7-11). The harbor was not built, however, until after the 1958 passage of federal legislation that authorized the Santa Cruz Small Craft Harbor and Beach Erosion Project (Santa Cruz Harbor 2003). Construction of the South Harbor was completed in 1964; the construction of the North Harbor was completed in 1973. The Port District comprises the City of Santa Cruz and most of Live Oak and Pasatiempo.

Like the Moss Landing Harbor District, the Santa Cruz Port District is an independent Special District of the State of California. It is governed by a Port Commission whose five members are elected to four-year terms by residents of the Port District. The Port District Commission sets Port District policy and oversees its operation. The Commission hires the Port Director, who oversees the day-to-day operations at the harbor. The Harbor has 23 full-time and 20 to 25 part-time employees who manage the harbor, do is accounting, conduct maintenance including annual dredging, and provide security and other goods and services to harbor users (Santa Cruz Port District).

The commercial fishing industry has had a relatively small but consistent presence at the Santa Cruz Harbor. The Harbor is homeport to 45 commercial fishing operations, 10 of which sell at least some of their catch directly to the public off the boat. The commercial fleet consists primarily of salmon trollers, along with a smaller number of crab, albacore, halibut and rockfish fishing operations. The Harbor hosts one resident full service, multi-species fish buyer and two fresh fish retail markets (Table 7-1). In addition, three to four other buyers regularly purchase fish from boats at Santa Cruz Harbor. Fishery-support businesses based at the harbor include a boatyard, electrical, hydraulic and metal work services, a marine covers shop and a marine supply store. A marine surveyor and a small grocery store are located a block from the harbor.

The harbor provides many goods and services and has made several improvements over the past few years that are useful to the commercial fishing industry. These include electricity, water, trash disposal, recycling and sewage disposal, oil recycling and dump stations, a dry storage lot and parking (Table 7-1). Among recent capital improvements at the harbor are an ice production plant, a new lighthouse and an oil reclamation facility. In addition, and in contrast to Moss Landing and Monterey Harbors, Santa Cruz owns and maintains a dredging vessel to help address substantial annual dredging needs. According to harbormaster Brian Foss, Santa Cruz harbor is the only harbor in California that is financially responsible for its own dredging, which it finances with user fees. Berthing at the harbor includes 950 wet slips (split between south and north harbor), 280 dry-berths and 150 small boat racks. Of the harbor's approximately 1,090 vessels that use these spaces, 15% are commercial fishing vessels, 35% are pleasure powerboats, and 50% are pleasure sailboats (Santa Cruz Port District). About 1,200 vessels are on the waiting list for slips.

Comparison of Fishing Landing Activity at the Three Harbors

To further inform our comparison among the three Monterey Bay Harbors, we explored the PacFIN landings data for each of the three ports for the 21-year period, 1981-2001 (Table 7-2). (Recall that these data primarily show vessel activity, which is only one aspect of commercial fishing activity at a harbor.) The number of vessels landing fish at all three harbors has declined by about half. The number of vessels that landed fish at Santa Cruz harbor ranged from 130 in 1999 to 376 in 1989, and varied around 150 between 1998 and 2001. The number of vessels with landings at Moss Landing ranged from 270 in 1994 to 658 in 1983, and has varied around 300 in recent years. The number of vessels landing at Monterey ranged from 99 in 1999 to 414 in 1983 (an El Niño year), and was just over 130 in 2000 and 2001. Throughout the period, Moss Landing had the greatest number of commercial fishing vessels with landings, except for 1987 and 1989, when Monterey and Santa Cruz, respectively, had more vessels delivering fish.

Table 7-2. Commercial fishing activity as indicated by number of vessels, pounds landed and ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (M), 1981-2001 (PacFIN data).

	Vessels			Pounds landed			Revenue		
	SC	ML	M	SC	ML	M	SC	ML	M
1981	324	609	384	361,971	22,159,789	33,895,654	1,195,861	12,313,102	12,051,498
1982	338	509	354	360,122	17,757,180	31,944,246	1,329,199	8,333,182	9,571,116
1983	290	658	414	264,465	14,289,116	17,926,802	725,667	9,401,702	6,317,424
1984	264	504	362	321,996	15,455,320	30,446,634	783,443	5,623,489	6,306,800
1985	279	414	340	477,064	10,739,963	18,371,958	1,014,805	5,588,809	7,158,845
1986	240	388	331	443,514	14,028,666	17,646,208	1,131,490	6,427,727	6,398,183
1987	195	364	394	480,934	12,182,539	16,406,239	1,385,991	6,271,304	6,174,716
1988	305	336	299	1,636,019	8,308,253	14,377,590	4,101,370	6,740,869	5,681,256
1989	376	313	329	4,467,910	7,777,539	17,260,419	2,687,150	4,639,098	6,267,800
1990	327	353	331	4,473,995	10,335,626	22,770,298	3,033,657	4,922,171	5,143,378
1991	257	347	332	2,910,607	8,153,696	19,329,158	1,644,694	4,241,101	4,657,478
1992	211	325	243	1,133,950	11,399,091	17,586,054	1,030,637	4,111,856	3,280,593
1993	185	409	214	768,061	7,785,961	17,160,185	1,073,821	5,041,556	3,994,290
1994	163	270	187	1,059,883	14,443,964	28,897,303	1,282,546	5,709,860	7,289,843
1995	225	368	185	1,817,353	13,533,457	18,673,803	2,070,484	7,770,609	5,142,770
1996	240	405	170	1,783,546	24,979,143	24,765,417	2,019,014	9,373,169	5,170,948
1997	189	429	178	1,908,442	44,775,711	30,571,499	1,801,273	11,467,420	5,609,536
1998	146	289	126	1,119,657	27,435,438	6,831,356	934,275	4,356,495	2,425,567
1999	130	307	99	970,722	40,509,741	5,671,335	1,174,551	6,314,941	1,893,661
2000	166	355	139	705,778	50,361,086	10,806,334	1,109,786	7,304,370	2,441,274
2001	145	294	134	370,006	56,039,191	7,437,031	558,390	6,726,859	1,789,282

Aggregate landings patterns over time have varied across the three ports. At Santa Cruz, less than 500,000 pounds of fish were landed in the early 1980s. In both 1988 and 1989, this figure increased three-fold, held for another year, and then fluctuated downward to a low of 370,006 pounds in 2001. Landings at Monterey have varied widely, from nearly 33.9 million pounds in 1981 to 6.8 million pounds in 2000. Although 1997 was a peak year, with 30.6 million pounds of fish landed, landings have been relatively low since then at about 7 million pounds per year. In

contrast to Santa Cruz and Monterey, landings have increased at Moss Landing over the long term, and especially since 1998. In 2001, they reached over 56 million pounds. Ex-vessel revenues (and prices) have declined, although the trends have varied, among the three ports. Ex-vessel revenues at Santa Cruz have been much lower compared to those at Monterey and Moss Landing, ranging between about $560,000 in 2001 and $4.1 million in 1988, and have shown a more gradual decline, with intermittent increases in the late 1980s and mid 1990s. Ex-vessel revenues at Monterey and Moss Landing were similar in 1981 (a peak year for both harbors) and 1982. At Monterey, however, they declined fairly steadily through the early 1990s, rose briefly in 1994, and declined thereafter to $1.8 million in 2001. Ex-vessel revenues at Moss Landing also declined through the 1980s and into the early 1990s, but then increase in the mid 1990s. Ex-vessel revenues reached a short-term high of $11.5 million in 1997, and have fluctuated around $7 million per year more recently. Thus, although commercial fishing activity in the Monterey Bay area has declined over the past two decades, Moss Landing is the most active commercial fishing port in the area, as indicated by vessels, landings and revenues.

To better understand the general trends at and among the three Monterey Bay area ports, we examined the changing composition of the catch and gear types at each port. Whereas for some fisheries and gear groups the trends across the three harbors were similar, there were some cases where they were not. We highlight examples of these differences below.

Shifts in the CPS and groundfish limited entry fisheries are the most notable. In the CPS fishery, Monterey was the primary port for vessels, landings and revenues through 1989, followed by Moss Landing and Santa Cruz (Figure 7-1). In 1990, however, and again in 1992, the landings data indicate that the number of vessels landing CPS at Santa Cruz was greater than at the other two ports. Since 1993, however, Monterey and Moss Landing have had similar numbers of vessels with CPS landings, and more vessels than at Santa Cruz. Nonetheless, Monterey was the top CPS landings port in the area until 1996, when Moss Landing became the dominant port for landings. Ex-vessel revenues for CPS were greatest at Monterey until 1995, but were matched and then exceeded by revenues at Moss Landing in 1996 and the years following.

For the groundfish group (i.e., primarily slope and shelf species, targeted by trawl and other gears), the inter-harbor dynamics have been even more variable (Figure 7-2). (See Appendix B, Table B-5 for species groups.) Monterey had the greatest number of vessels with groundfish landings in 1981 and 1982, and 1984 through 1988. Moss Landing matched Monterey on this measure in 1994, and has exceeded it since, although the number of active vessels has declined since 1999. The number of vessels landing groundfish at Santa Cruz has varied widely, matching the number at Moss Landing in 1981 and again in 1987, and surpassing both Moss Landing and Monterey in 1989 and 1992. Groundfish landings patterns are quite different. Landings have consistently been the lowest at Santa Cruz. Landings at Monterey were the greatest in 1981 and 1982, but then dropped well below landings at Moss Landing until 1996. Monterey outranked both Moss Landing and Santa Cruz on this measure until 1998, when Moss Landing again had the most pounds landed in the Monterey Bay area. Groundfish revenue patterns matched landings patterns through 1995. In 1996, however, revenues were greater with less fish landed at Moss Landing than they were at Monterey.

Figure 7-1. Commercial fishing activity for coastal pelagic species (CPS) in terms of a) number of vessels, b) landings (pounds) and c) ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (MN), 1981-2001 (PacFIN data).

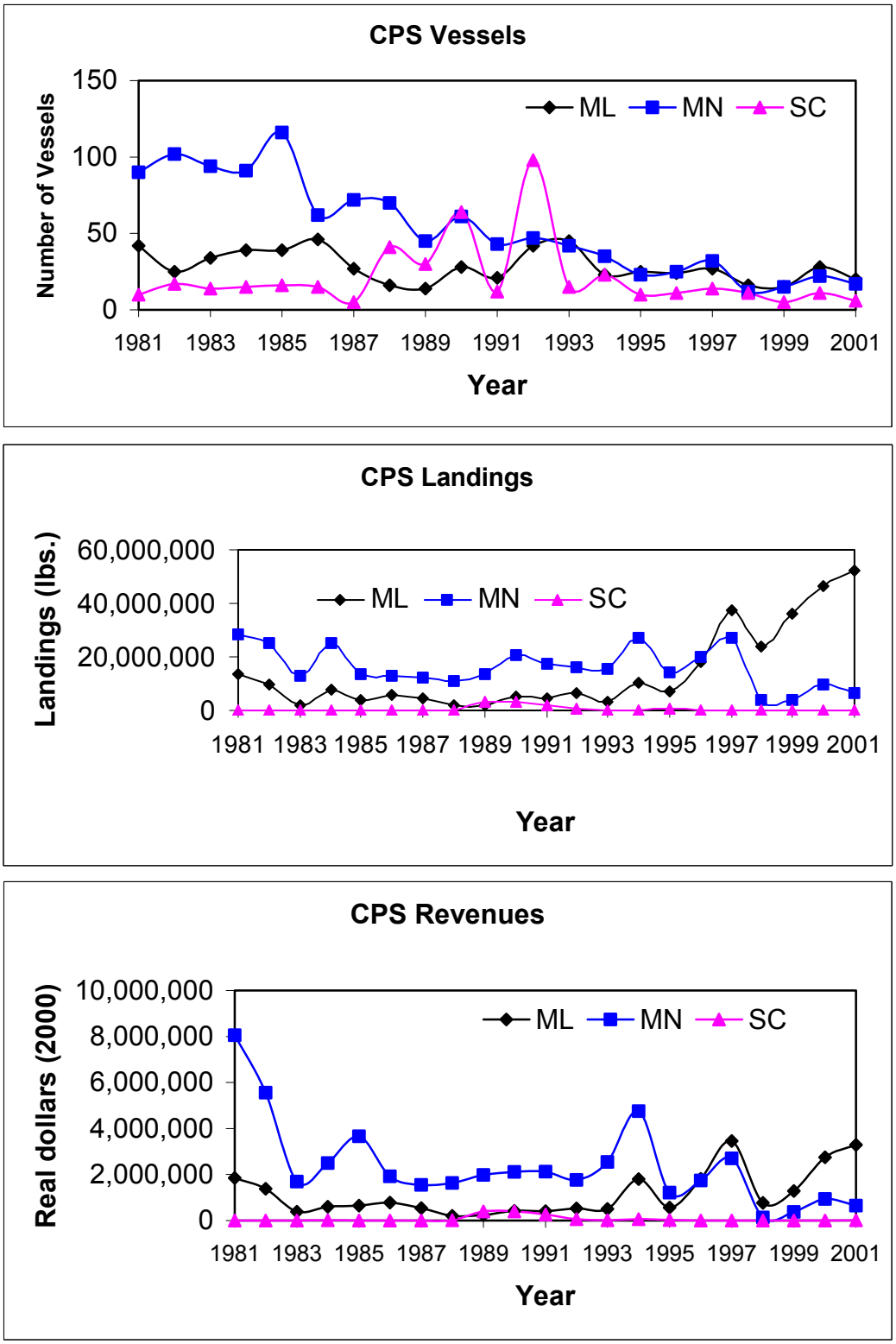
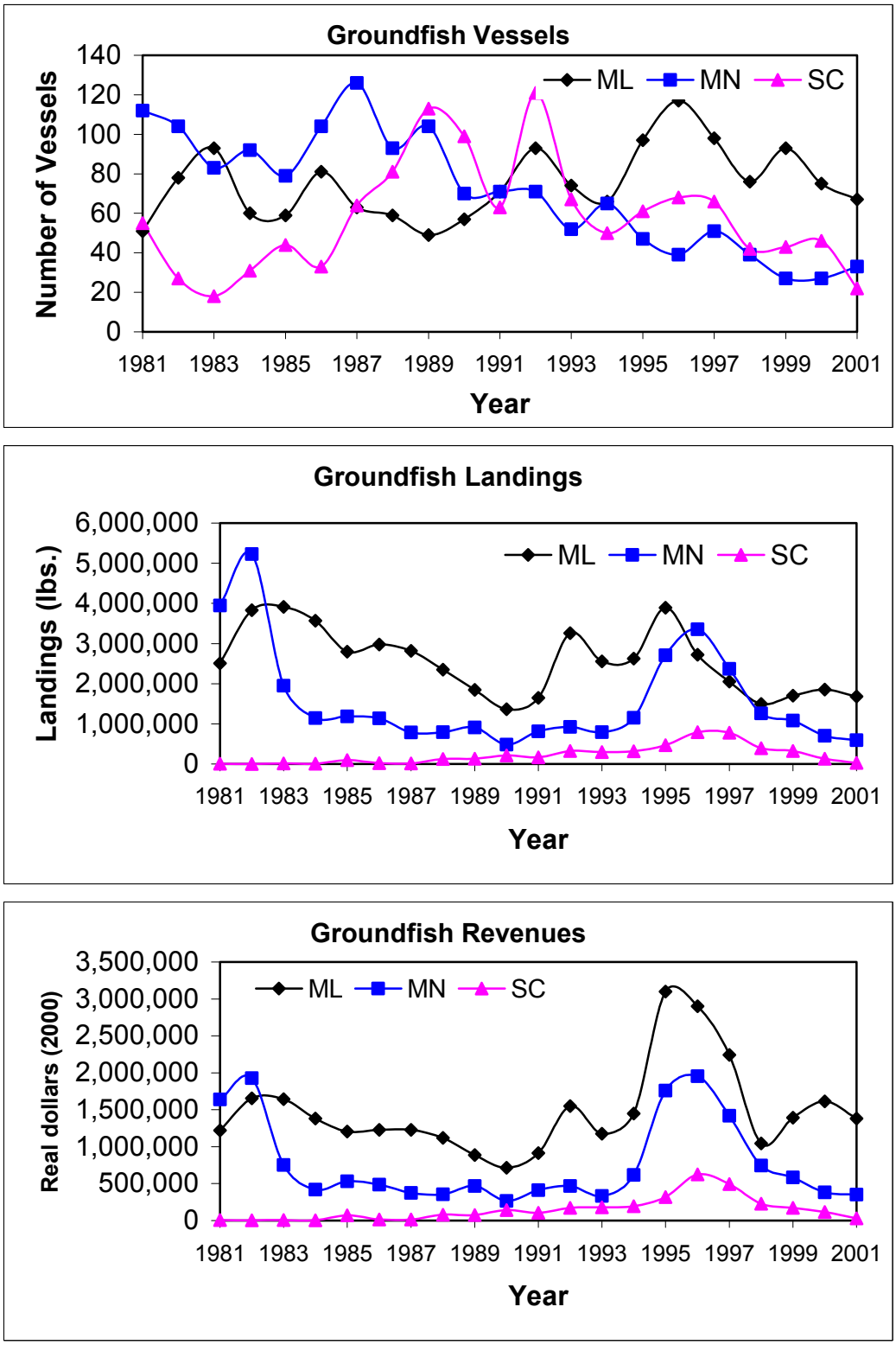


Figure 7-2. Commercial fishing activity for groundfish in terms of number of vessels, landings (pounds) and ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (MN), 1981-2001 (PacFIN data).



SECTION 8: EMERGING ISSUES AND NEEDS

A key feature of our assessment of the socio-economics of the commercial fishing industry at Moss Landing Harbor is the identification of emerging issues and needs. We have addressed this topic in part in previous sections of this report. In this section, we present study participants' views on 1) the advantages and disadvantages of Moss Landing Harbor as a commercial fishing port, 2) issues and concerns of the industry and related businesses, and 3) needs and suggestions of ways the Monterey County Office of Economic Development (OED) could enhance the economic viability of the commercial fishing industry at Moss Landing.

The information presented is based primarily on survey questions posed to study participants, and is presented by topic separately for fishermen, fish buyers, fishery-support business operators, and harbor personnel. It is important to note that most questions were asked using an open-ended format to avoid the potential survey research pitfall of leading respondents or artificially limiting their response choices. A potential drawback of the open-ended question approach, however, is that respondents may provide answers that extend beyond the specific focus of the study. These responses are nonetheless germane in that they provide insights into participants' perceptions, opinions and ideas, which can be used to better understand their behavior and address misperceptions, misinformation and miscommunication. The information below reflects, in part, differences in perceptions, opinions and understanding, especially between fishermen and fishery-support businesses on the one hand, and Harbor personnel on the other. More importantly, however, there is considerable common ground among these diverse groups. That common ground is the focus of our final discussion and recommendations in Section 9 of the report.

Advantages and Disadvantages of Moss Landing Harbor

When asked about the advantages and disadvantages of Moss Landing as a commercial fishing harbor, fishermen, fish buyers, operators of related businesses, and Harbor personnel pointed out several features, some of which are not readily apparent to observers outside the industry.

Fishermen

Many fishermen highlighted the harbor's proximity to fishing grounds for a variety of species. As one fisherman explained:

> It's because the deep water is so close to the shore. There's only one other place - Patagonia - where there are these giant, deep underwater canyons so close to shore. They come up against the continental shelf and create habitat. It's what made this a really great place to fish.

They also see advantages in the harbor's proximity to markets (i.e., fish buyers) and to providers of goods and services, both in Moss Landing and in nearby Castroville, Marina, Salinas, Seaside, and Watsonville. For example, many buy supplies from an auto supply store in Castroville, and groceries for their fishing trips in Watsonville.

Many also described the safety and navigability advantages of Moss Landing. Moss Landing has been described as the most protected harbor in the region, where "you can tie your boat up with a shoe string". Even more important to fishermen is safe entry and exit. Fishermen frequently remarked on the lack of surge at the harbor entrance, a feature that has been noted by other observers as well (Crampton 1994). This is due largely to the harbor's location just east

of the steep Monterey Submarine Canyon. Finally, many study participants commented on the less tangible but nonetheless valuable social and cultural features of Moss Landing that attracted them. They noted that Moss Landing historically was clearly oriented toward and supportive of commercial fishing. Some felt that this sense of community persists, while others felt that the dynamic has changed, especially with the growth of marine research and tourism businesses.

Although the advantages of Moss Landing Harbor outweighed the disadvantages for most of the skippers surveyed, all but one respondent noted at least one disadvantage (Table 8-2). The disadvantage most frequently cited by fishermen was competition with other harbor users, most notably the research community. This was related to their sense that the Harbor's identity as a commercial fishing port has diminished, while its identity as a research center has grown. A second disadvantage cited by surveyed and other interviewed fishermen was a sense of poor harbor management and relations vis à vis the commercial fishing community. They cited the Harbor Board's recent decisions to raise berthing fees, charge a flat fee for dock utility use, and construct an RV park on a former storage lot as examples of management decisions they felt illustrated this problem. As noted below, however, these decisions have been driven by the Harbor's limited access to financial resources to make much-needed infrastructure improvements such as dock maintenance and dredging. The dredging problem is a particular issue for those who operate and tie up in the inner reaches of South Harbor. Finally, the Harbor's monthly meetings and other formal communications notwithstanding, some fishermen said they wished that Harbor management staff would "make the rounds" (walk the docks) from time to time to engage in informal communication with harbor users.

Table 8-1. Advantages of Moss Landing Harbor cited by surveyed skippers (N=38).

	Freq.	%
Close to home	20	53
Location of/access to buyer(s)	20	53
Good Infrastructure/facilities	15	40
Safe	10	26
Affordable	6	16
Close to fishing grounds	5	13
Supportive of commercial fishing	4	11

Table 8-2. Disadvantages of Moss Landing Harbor cited by surveyed commercial fishing captains (N=38).

	Freq.	%
User group competition	8	21.1
Harbor management, relations, politics	7	18.4
Loss of/limited markets	6	15.8
Harbor infrastructure needs	5	13.2
Limited goods and services (high cost, inconvenience)	4	10.5
Distance from fishing grounds	3	7.9
Dredging situation	3	7.9
Other	4	10.5
No real disadvantages	1	2.6
No response	5	13.2

Respondents noted two important economic disadvantages of Moss Landing as a commercial fishing port: loss of and/or limited markets for their fish, and limited providers of goods and services. The first issue is of particular concern to salmon and albacore fishermen. Several of them recall the situation years ago when prices were better overall, and the presence of several buyers meant competition among buyers for fish (and thus better prices for fishermen), rather than competition among fishermen for buyers (and further dampened prices). The second issue focuses especially on fuel and marine supplies. Fishermen said they felt that the small number of local providers had translated into higher prices for the goods available at the harbor. This points to the challenges of matching supply and demand, especially in an environment of uncertainty. Under present conditions, it is not clear that there is sufficient demand to support additional providers of some of the goods and services already available at Moss Landing. More generally, some fishermen noted the inconvenience of having to travel elsewhere in the Monterey Bay area and beyond to find some goods and services.

Fish Buyers

Buyers noted several advantages of Moss Landing Harbor to their businesses and the commercial fishing industry as a whole. Like the fishermen, several noted the harbor's central location relative to Monterey Bay area fishing grounds for several key species, and its relative safety (e.g., low surge, accessibility), especially compared to Santa Cruz and Monterey Harbors. Some noted the infrastructure, local support businesses, and easier access for trucks (compared especially to Monterey Harbor). One commented on the newly renovated K-dock and Santa Cruz Cannery building, including the good unloading set-up, as well as the nearby marine store and fuel dock as useful resources. One buyer characterized Moss Landing as "one of the best harbors on the West Coast".

These advantages notwithstanding, buyers also noted some disadvantages of the harbor. Three types of problem were noted: infrastructure (even as some buyers noted recent improvements), Harbor management, and the Harbor's changing character. In terms of infrastructure problems, some buyers commented on the limited space available for commercial fishing operations, especially given the renewed activity in some fisheries such as sardine. They also cited the need for more storage space for commercial fishing gear and equipment, and the replacement of the one-lane Sandholt Bridge that connects the Island to the mainland. Regarding Harbor management, one buyer was dismayed at the increase in berthing fees given the recent further cutbacks in the groundfish fishery. The buyer added that this action suggested that the Harbor Commission was not "up to speed" on fishery management issues. (See p.79 for discussion of the berthing fees issue from the Harbor manager's perspective.) In commenting on the changing nature of the harbor, some buyers highlighted the growing presence of the research community, and a reduced sense of Moss Landing as a community especially focused on commercial fishing.

Fishery-Support Businesses

The advantages identified by fishery-support business operators differed somewhat from those identified by other interviewees. They appreciated the central land-based location of Moss Landing relative to transportation networks and vendors elsewhere in the region, the relative ease of operating a business in a less crowded, unincorporated area, and the commercial orientation of the port. As one business owner said, "that's good for us, because working boats need our goods and services".

The disadvantages they identified had more in common with those identified by others. For example, one cited the lack of - and critical need for - a maintenance dredging program as at Santa Cruz Harbor. They also commented variously on the negative aspects of harbor politics and management and the loss of local fishery-related businesses. They also discussed the increased congestion on the Island and resultant parking and other problems, which they attributed to the establishment of the Monterey Bay Aquarium Research Institute (MBARI) and increased tourism.

Harbor Personnel

Harbor personnel cited many of the same practical advantages noted by fishermen, fish buyers and fishery-support businesses operators such as its central location relative to Monterey Bay fishing grounds, safe and easy access, and protection from weather conditions. They also noted that Moss Landing's berthing and other use fees have historically been below market rate, and are low compared to Santa Cruz and Monterey Harbors, as recently illustrated in a Monterey County Grand Jury report (Monterey County Grand Jury 2002). A recent contract with the state Department of Boating and Waterways (DBW) to support removal and demolition of abandoned vessels, however, requires that the Harbor District charge fair market value for its slips and services. In response, the Harbor began charging annual increases based on the consumer price index in order to comply with the DBW requirement. Nonetheless, commercial fishing vessels continue to receive a discount on berthing fees.

In addition, Harbor personnel highlighted several recent and pending improvements that benefit the commercial fishing industry. Chief among these are the recently completed Santa Cruz Cannery Building renovation and the reconstruction of K-dock and its fish receiving and workspace amenities. In addition, the Harbor has garnered scarce funds for dredging, keeping the harbor open continuously since 1998 (in contrast to Santa Cruz Harbor which has faced closures despite its best efforts at maintenance dredging). Looking to the future, the Harbor is working to improve and make available additional dry storage space. Although some in the commercial fishing industry acknowledged and discussed items such as the Cannery Building and K-dock improvements, they did not note these other recent and pending improvements. And whereas some acknowledged dredging efforts and relatively low berthing fees, most of those who raised these general issues did not.

Harbor personnel also cited disadvantages of the harbor for commercial fishermen such as the need for new (or better maintained) docks and a maintenance dredging program. However, they also noted the constraints to making such "big ticket" improvements. According to the Harbormaster, a recent feasibility study on replacing all the docks in the Harbor with utilities, lighting and other amenities in compliance with state and federal regulations estimated the cost at $10 million.

The Harbor's limited resource base is a disadvantage directly related to these issues. Sources of harbor revenue are limited by its small population base, which generates only $175,000 per year, and limited property and other potential income generating sources. As a result, it depends on berthing fees for nearly 75% of its revenue (Monterey County Grand Jury 2002). Although the Grand Jury recommended that the Harbor raise berthing fees, Harbor staff noted that large increase in fees are impractical under current conditions for some fisheries. It also advised the Harbor to remove abandoned vessels to open more slips to potential occupants, although this is complicated by high legal, permitting and waste disposal costs. Moreover, because the Harbor is an independent district, and is remote from a major population center, it

cannot access or leverage resources in ways that more urban harbors and ports can. To adapt to these circumstances, the Harbor has cut its staff to 10, and is investigating more cost-effective ways to address infrastructure, dredging and other management needs. In addition, the opening of new fish receiving and processing facilities at the Cannery Building, the public dock and hoist in South Harbor, and the planned North Harbor restaurants and fish market, along with the recently opened RV park, are expected to generate much-needed lease and use revenues to help address these infrastructure problems and better support the Harbor's operations.

Issues and Concerns

Fishermen

We asked skippers to identify key issues they face in fishing in general and at Moss Landing, and their concerns and needs as commercial fishermen operating at Moss Landing. When asked to identify the most important issues facing them as commercial fishermen, respondents offered a diversity of specific issues that fell into four broad categories: resource management, economics, pinniped-fishery interactions, and a catchall category, other.

The most important issues facing respondents, as commercial fishermen, are resource management-related, as indicated by 77.8% of respondents (Table 8-3). Most fishermen who cited this type of issue were concerned about management ***outcomes***, that is, laws and regulations that increasingly constrain how, when, where and how much they can fish. Among the specific items noted were reduced quotas and fishery closures in the federal groundfish and nearshore fisheries. A common concern across fisheries was the prospect of networks of reserves through the state's MLPA process, the Monterey Bay National Marine Sanctuary Management Plan Review, and the PFMC.[13] Although none of these processes has been completed yet, some Moss Landing fishermen are affected by the recently established Channel Islands marine reserves. Others see the PFMC's closure of the continental shelf (60 to 150 or 250 fathoms, depending on location), effective January 1, 2003, as the equivalent of a marine reserve (for the affected fisheries).

Table 8-3. Issues cited by survey respondents (N=36)

	Freq.	%
Management	28	77.8
Economics	15	41.7
Other	8	22.2
Pinniped-fishery interactions	4	11.1

Note: Some respondents identified more than one issue, so totals are greater than the number of respondents.

[13] Recently, several of the National Marine Sanctuaries (NMSs), including the MBNMS, have demonstrated an interest in fishery management (NOAA 2003). Language in the National Marine Sanctuaries Act claims some fishery regulation and management authority for the sanctuaries (e.g., Sec. 304), even though primary federal fishery management authority resides with NMFS. Both NMFS and the National Ocean Service, under which the NMSs are administered, are housed within the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce.

Fishermen also cited resource management ***process*** issues, from the actual decision-making process to the development and implementation of management measures. Through both surveys and informal conversations with Moss Landing fishermen, we learned of their frustration with fishery management science, inattention to fishermen's knowledge and experience as a complement to scientific data, and the weak communication among scientists, policy-makers, fishermen and others. Some felt there was an imbalance of power in the management process following the increased involvement of environmental groups.

Fishermen also expressed dismay at the frequency of change in fishery management regulations, at times on short notice. In addition to the regulations being a constraint in themselves, these frequent changes pose critical challenges to planning and management of fishing operations, businesses and livelihoods. An example is the September 1, 2002 federal closure of the open access and limited entry fixed gear fishery for minor nearshore rockfish, which was announced only three days earlier, on August 29, 2002. (The limited entry trawl fishery for these species had been closed since July 1, 2002.)

Related to resource management and the practicalities of fishing per se was the issue, noted by salmon fishermen, of pinniped-fishery interactions. This issue has been a long-standing one in the Monterey Bay area, statewide and elsewhere along the West Coast. Fishermen are frustrated by the persistence of the problem on the water and inaction by resource managers to address it (Pomeroy 2002a).

Economic issues were cited by nearly half (41.7%) of those surveyed. Several fishermen expressed general concerns about increasing costs and declining prices. Some of the specifics noted were increased maintenance and operating costs, including increases in slip and related service fees [although these are lower at Moss Landing than at Monterey and Santa Cruz harbors (Monterey Grand Jury 2002)]. Fishermen linked declining prices to a number of sources. For salmon fishermen, it was competition with imported farmed salmon; for albacore fishermen, it was the movement of tuna canneries overseas and the resulting lack of domestic canners; and for fishermen as a whole, it was the reduced number of fish buyers, both locally and statewide. Decreasing quotas on groundfish species and similar limitations also were noted as an economic issue. Decreasing quotas result in less fish being landed, but have not led to higher prices paid to fishermen.

Fish Buyers

Fish buyers identified several issues and concerns similar or analogous to those expressed by the fishermen. They cited fishery management issues such as recent groundfish closures, reduced quotas for several species, and marine reserves as concerns or threats to the commercial fishing industry. Two buyers discussed the frequent regulatory changes in groundfish management, and the challenges this uncertainty and change pose to their businesses and the fishermen whose fish they buy. These fishery management issues have economic implications for their ability to meet operating costs and maintain the markets to which they sell. Buyers also cited other economic issues, most notably increasing costs of insurance and utilities. A non-anthropogenic source of concern cited by one buyer was El Niño, and the variability and uncertainty it creates, adding to these other challenges.

These challenges have affected fish buyers in diverse ways, although as one buyer put it, most indicated that these challenges have forced them to "work more efficiently". Two buyers reported employment effects, noting also the reduced income to fishermen. Three reported

changes in their operations: deferring purchase of new equipment; leasing rather than owning processing and storage facilities; and shifting operations to Mexico.

Fishery-Support Businesses

When asked to identify the issues facing the commercial fishing industry and how these were affecting their businesses, fishery-support business owners all identified recent regulations and their impacts on fishermen's ability to earn enough to require and be able to pay for their goods and services. As a result, one business noted carrying higher accounts receivable than previously, most of them from fishermen, while another has experienced markedly fewer orders for non-essential items. The combination of higher fuel prices and low fish prices several years ago led to declines in fuel purchases, which were further exacerbated by reductions in catch quotas. Fishermen could not catch more fish to make up for the growing difference between costs and revenues. This prompted the fuel dock to add its gear store and service. These businesses also noted increases in their own costs, especially for utilities, insurance, licenses and permits, and compliance with environmental regulations. In addition to these financial issues, fishery-support business operators discussed the diverse county, state and federal environmental permitting and other regulatory requirements they face in providing essential goods and services to the commercial fishing industry and other harbor users. Compliance with these requirements is costly in financial and temporal terms, and especially difficult when requirements from different agencies conflict with one another.

Fishery-support businesses also have concerns about harbor management as they affect the commercial fishing industry and, by extension, their businesses. In particular, they discussed recent increases in berthing and utility fees, noting that these have prompted some of their commercial fishing customers to move to other ports.

Harbor Personnel

Issues and concerns cited by harbor personnel had much in common with those cited by the other three groups in this study. Increasing and rapidly changing fishery regulation was central to their concerns, as were growing constraints on the harbor's ability to meet fishing industry and other harbor user needs and interests in that regulatory and, by extension, economic, context. Harbor personnel also shared fishery-support businesses' concerns about the costs and other constraints placed on their operations by environmental regulations. As an example, increasing regulation in some fisheries has led to increased abandonment of boats in the harbor. To improve use conditions at the harbor and meet environmental regulations, the Harbor must dispose of those vessels. Yet such disposal is costly because it requires that the Harbor follow a complicated, time-consuming and expensive process for seizing, demolishing and disposing of abandoned vessels. A $40,000 DBW grant recently secured by the Harbor for this purpose paid for only four demolitions. More generally, the harbor's distance from relevant policy-making arenas and associated sources of political and financial support is a critical issue.

A second key issue is dredging, which is needed for basic maintenance every three years, and following severe weather and flood events such as the 1995 and 1998 floods. According to Harbormaster Horning, the Harbor dredged 178,000 cubic yards of material from 1998 to 2000, at a cost of more than $7 million (Monterey County Grand Jury 2002). The Harbor then had to apply for new permits to support regular maintenance dredging, which it did not receive until 2003. This process was expensive, with testing and dredging of 16,200 cubic yards costing $237,000, plus consultant and permit fees as well as considerable staff time.

In addition to the foregoing, the Harbor is also dealing with increasing demands on its time and resources by diverse users and issues. Harbor personnel discussed the multiple and diverse policy-making arenas and decisions they must keep track of and attend to, in addition to carrying out harbor management functions. Several county and state agencies require permits for a range of activities undertaken by the harbor. The Harbor also participates in working groups and other regional activities related to fishery and broader coastal management policy. Staff members regularly attend the MBNMS Sanctuary Advisory Council meeting, and participated in the Harbors and Dredge Disposal Working Group for the Sanctuary's Joint Management Plan Review process earlier this year. These activities are directed toward representing the Harbor, and its commercial, research and recreation and tourism constituents in these arenas. These demands on the Harbor, especially given recent staff cuts to address budgetary constraints, leave little time to "walk the docks", which members of the commercial fishing industry cited as a concern, although Harbor staff report they recently have made a concerted effort to address this concern. Finally, Harbor staff are concerned that many harbor users do not seem to be aware of their activities and efforts, despite monthly Harbor District meetings, staff reports and other formal mechanisms for communicating this information.

Needs and Suggestions for the Monterey County Office of Economic Development

Fishermen

We asked fishermen their opinion regarding the need for a number of improvements and programs at Moss Landing Harbor. The list of items was based on input from study participants and steering committee members. Respondents were asked if they felt the item was needed, and if so, whether that need was very or somewhat important (Table 8-4). In responding, most fishermen considered others' as well as their own interests and needs. The need for an ice plant was most consistently deemed important by respondents, followed by gear storage, and a fresh fish cleaning station. Whereas gear storage space is a more general need for fishermen, the other two items, which were rated as important by 50 to 58% of respondents, are most useful to those who land fresh fish such as salmon, albacore and halibut. The next cluster of items in terms of overall importance included another marine supply store, advertising of Moss Landing as a place to buy fresh fish, a fish marketing facility for those who currently sell to the public off their boats, a bait supplier and more parking for commercial fishing vessel crew. Again, some of these items such as parking and marine supply providers are of general interest, whereas others are particular to some fisheries.

Just under half agreed there is a need for cooperative research opportunities, although they were split on the level of importance. Respondents elaborated on this (as well as other items), with diverse comments. Some saw the economic benefits of cooperative research if it would put their fishing vessels and gear to use. Others saw it as a chance to better understand scientific research. Still others said it would enable them to guard against "bad science", a concern of many fishermen. Most importantly for some, participating in cooperative research was favored if it would give them a chance to contribute their knowledge, experience and expertise to the scientific effort. Few respondents felt there was a need for vehicle or foot traffic management, a dedicated meeting facility, or safety and technical training courses.

Table 8-4. Surveyed skippers' opinions regarding the need for improvements and programs at Moss Landing Harbor (reported as %; N=-38).					
	Very important	**Somewhat important**	**Not needed**	**Don't know/ no opinion**	**Not asked/ no response**
Ice plant	52.6	15.8	15.8	5.3	10.5
Cleaning station	47.4	13.2	13.2	15.8	10.5
Another marine supply store	42.1	15.8	28.9	0.0	13.2
Market facility	42.1	13.2	18.4	13.2	13.2
Parking	36.8	21.1	26.3	2.6	13.2
Workspace for gear	36.8	21.1	26.3	2.6	13.2
Advertising ML as a place to buy fish	36.8	18.4	21.1	10.5	13.2
Gear storage	28.9	34.2	13.2	13.2	10.5
Bait supplier	28.9	21.1	28.9	5.3	15.8
Cooperative research opportunities	26.3	21.1	26.3	13.2	13.2
Vehicle traffic management	18.4	26.3	31.6	10.5	13.2
Meeting facility	7.9	36.8	31.6	5.3	18.4
Safety and technical courses	7.9	34.2	39.5	5.3	13.2
Foot traffic management	5.3	23.7	47.4	10.5	13.2

We then asked skippers an open-ended question about the greatest needs of the commercial fishing industry at Moss Landing. We categorized their responses into three categories: harbor infrastructure, fishery management, and economic assistance (Table 8-5). The first category encompassed both the maintenance of existing infrastructure, most notably the docks, and the development of new or improved infrastructure, especially storage. Needs related to fishery management were focused especially on federal groundfish and state nearshore fishery management and marine reserves, but also addressed the management process, science, and the role of fishermen's knowledge. Needs included the rolling back of current regulations and the reconsideration or tabling of marine reserves as a management tool. Fishermen also felt there was a need for "more and better science" to inform fishery management. The need for economic assistance to the industry included several options, from vessel buybacks and retraining programs to low-interest loans and breaks on berthing and other fees, especially for those facing cutbacks in the groundfish fishery

Table 8-5. Moss Landing Harbor needs identified by surveyed skippers (N=27).		
	Freq.	**%**
Harbor infrastructure	12	44.4
Fishery management	10	37.0
Economic assistance to the industry	8	29.6

At the end of the survey, we asked respondents "What could the County do to assist the commercial fishing industry at Moss Landing Harbor?" The most frequently offered suggestion (31.5%) was that the County help the Harbor improve its commercial fishing facilities (Table 8-6). [The same number of respondents specified this as an overarching need, as well. (Table 8-5).] The next most frequently cited suggestion (28.9%) was that the County be more aware of and involved in fishery and broader management policy, and in particular, inform policy-makers in other arenas (i.e., the California Fish and Game Commission, the Pacific Fishery Management Council, and the Monterey Bay National Marine Sanctuary) of the social and

economic value of the commercial fishing industry, and the potential cumulative impacts of regulations on the industry, the community and the County.

Other suggestions were more directly economic, and to some extent overlap with the suggestion about improving harbor facilities. Eight respondents (21.1%) suggested that the OED facilitate economic assistance to the industry, primarily to help participants weather recent regulatory and economic downswings. Seven (18.4%) explicitly suggested that the OED help develop markets and marketing, through either direct assistance or by facilitating grants for those purposes. Nine respondents (33%) suggested that the OED provide economic assistance that would enable some fishery participants to leave the industry. This assistance took two forms: job retraining (13.2%) and a vessel buyback program (10.5%). The job retraining suggestion was made despite a recent federally funded program that offered retraining through county employment offices. This program, however, was problematic in that it was directed only toward groundfish fishermen, it provided a small stipend relative to local costs of living, and it was not advertised or tailored to meet some of the particular social and economic characteristics and needs of fishery participants. A federal vessel buyback program for groundfish trawlers has been discussed for some time, and was approved by President Bush as part of a federal spending bill in February 2003.

Fish Buyers

When asked about the need for particular infrastructure improvements and other programs at Moss Landing, three fish buyers cited the need for more commercial fishing equipment storage. Other improvements buyers felt were very or somewhat important were parking (as it limits truck maneuvering on the Island) and opportunities for cooperative research and/or interaction with location research institutions. Although three buyers noted the need for an ice plant, two also noted that it, along with several other items on the list, were more appropriate as private, rather than public (i.e., harbor) investments. When asked for additional suggestions of harbor improvements, buyers suggested that harbor personnel attend more meetings to keep up with the rapidly changing regulatory environment of fishery management. (Note, however, harbor efforts to do this noted on p.82.) Buyers also commented that the harbor should “get its projects completed”. This referred to the Cannery Building and K-dock, which experienced construction delays primarily related to permitting and other issues largely beyond the Harbor's control.

Table 8-6. Surveyed skippers' suggestions of ways the Monterey County Office of Economic Development could assist the Moss Landing Harbor commercial fishing industry (N=38).

	Freq.	%
Help the harbor improve facilities	12	31.5
Inform policy-makers about Moss Landing commercial fishing industry	11	28.9
Facilitate economic assistance	8	21.1
Help develop markets and marketing	7	18.4
Provide job retraining	5	13.2
Initiate a vessel buyback program	4	10.5

Finally, we asked buyers how the Monterey County Office of Economic Development (OED) could assist the commercial fishing industry at Moss Landing. One buyer noted that the fishermen and the buyers had to help themselves. Two others, however, suggested that the OED could help by: 1) financing an ice plant at Moss Landing; 2) facilitating small business

loans for infrastructure improvements and to help fishermen through downturns such as the groundfish disaster; 3) finding or providing funds to support fishery data collection and research by the community; and 4) providing work or re-training funds (more substantial than those currently available) to “help make sure we’re economically sustained”.

Fishery-Support Businesses

Fishery-support business owners were in agreement on the need for particular infrastructure improvements at Moss Landing, but disagreed on the need for other improvements. Most directly related to the viability of the fishing industry, they uniformly rated the need for a local facility where fishermen could sell their catch as very important, and the need for a (more substantial) gear storage facility as very or somewhat important. They also said the need for better parking and its management was very important, although this was more related to their own ability to do business. They were of mixed opinion on the need for an ice plant and for better management of foot and vehicle traffic.

They were also asked about the need for three types of programs: cooperative research, other interactions with local researchers, and safety and technical training. Two felt that providing opportunities for cooperative research and for other interactions such as regular discussions involving local fishermen and researchers were very important, while one was undecided or did not see the need. And while one felt that offering safety and technical training courses was very important, two did not.

Fishery-support business operators then identified several other improvements that they felt would enhance the viability of the commercial fishing industry and related businesses at Moss Landing. They noted the need to dredge the harbor regularly and better maintain the docks. They also suggested establishing a truck turn-around on the Island and limiting parking to one side of the street to facilitate fish unloading and related traffic.

When asked what Monterey County’s Office of Economic Development (OED) could do to assist or enhance the viability of the commercial fishing industry at Moss Landing, two fishery-support business owners suggested that it help establish a central marketing place or other mechanism for fishermen to be able to sell their catch directly to the public. One also suggested the County help establish a facility to break down and dispose of waste associated with abandoned vessels in the harbor, noting that this is a costly undertaking, but one that is needed and would be appreciated for its long-term environmental and other benefits. Other suggestions to the County were more oriented toward the larger community and included street sweeping, clean-up of the north end of Sandholt Road, and the addition of a park there for visitors who fish off the harbor channel jetty.

Harbor Personnel

Harbor personnel made several suggestions about ways in which the OED and the County more generally could assist the commercial fishing industry at Moss Landing Harbor. These suggestions focused especially on financial support to maintain and develop harbor infrastructure, and to assist fishermen. Harbor staff prefaced its suggestions with information about the considerable need for and costs of infrastructure maintenance and development, as well as the Harbor’s limited resources to support those activities. The Harbor suggested first that the OED provide financial support for maintenance dredging and dock maintenance and repair, if not outright replacement of work facilities. Other types of financial assistance for these

projects would be helpful as well, although harbor staff are reluctant to incur new debt, especially given its limited revenue base.

Harbor staff also suggested that the OED provide support programs and financial assistance to commercial fishermen and related business as needed. Specific suggestions included assistance to develop an insurance pool or otherwise assist fishermen with insurance for their vessels and themselves. Several fishermen noted that their vessels were un- or under-insured because of the high cost. For those with wood hull vessels, insurance is unavailable or even more prohibitively costly than for others. Harbor staff also suggested that the OED provide low interest loans to fishermen during the off season to offset slip fees and other fixed costs. Harbor staff suggested that these funds be provided directly to the harbor so as to eliminate collection costs and insure this much-needed source of revenue to the Harbor. This would help address the problem of delinquent berth fee payments, which costs the Harbor District more than $300,000 in lost revenue each year (Monterey County Grand Jury 2002).

Finally, although Harbor staff recognize the limited ability of the OED and the County to influence fishery and other environmental regulations, they suggested that the County could assist by speaking before relevant policy-makers on behalf of the Harbor and its users who are facing increasingly stringent and onerous restrictions, and associated economic challenges.

SECTION 9: CONCLUSIONS AND RECOMMENDATIONS

We conclude this report with a discussion of current and long-term issues that affect commercial fishing at Moss Landing. We use this discussion to motivate several suggestions and recommendations about how the Monterey County Office of Economic Development (OED) and other agencies might work with fishermen, business owners, and the Moss Landing Harbor District to support commercial fishing's long-run socio-economic viability at Moss Landing.

Our research shows that the commercial fishing industry at Moss Landing is facing several challenges. Although our research identified many relevant issues, we focus on those that are most amenable to assistance from Monterey County and the OED. These issues and concerns fall into three general categories:

- Regulatory constraints
- Short- and long-term economic challenges
- Infrastructure and maintenance needs

Regulatory Constraints

Commercial fishery participants, support business operators and Harbor personnel cited regulations as a critical and growing constraint to their operations in particular and to the vitality of the commercial fishing industry as a whole. These regulations pertain not only to fishing, but also to land-based aspects of commercial fishing, support business and Harbor operations.

State and federal groundfish fishery regulations and efforts to establish marine reserves were of most frequent and common concern to study participants. Groundfish regulations have become increasingly restrictive in terms of areas open to fishing as well as allowable catch. Moreover, frequent changes in the regulations have made it more difficult for fishermen and related businesses to plan and adapt in a timely and effective manner. An emergent issue of concern is the recent assertion of the National Marine Sanctuaries' authority to engage in fishery management (NOAA 2003). State and federal initiatives to establish marine reserves is a second fishery management concern. These include the state's Marine Life Protection Act process to establish a network of marine reserves in state waters, the Channel Islands Marine Reserve process (in both state and federal waters), and the Monterey Bay National Marine Sanctuary's consideration of marine reserves through its Joint Management Plan Review process. Marine reserves displace fishing effort, with on-the-water and potential shoreside consequences such as localized reduction in landings and attendant social and economic impacts (Pomeroy 2002b).

A related issue is the nature and use of science and other information to inform the management process. Recent acknowledgements by fishery scientists that previous assumptions made about West Coast groundfish stocks were inappropriate have fueled concerns about the science being used to inform fishery management. Because management decisions that affect fishermen's and buyers' (and support businesses' and the Harbor's) operations are based on these assumptions and findings, fishermen and others want to know more about the science, assist in its design and evaluation, and contribute their local ecological knowledge.[14] One mechanism for addressing fishermen's and others' concerns and interests is

[14] Local knowledge differs from scientific knowledge, as it tends to be highly localized and seasonal, and is based on ongoing daily experience rather than scientific research procedures. A growing body of evidence, however, has shown it to be a potentially valuable complement to

cooperative research that involves fishermen and (biological and social) scientists. There is growing interest in cooperative research, as demonstrated by the Pacific States Marine Fisheries Commission's West Coast Cooperative Research Grant Program.

Broader county, state and federal environmental regulations also pose challenges, especially to local providers of goods and services including the Harbor. These regulations, designed to protect coastal and marine environments and public health, increasingly affect dredging and other harbor maintenance, boatyard and fuel dock operations, and infrastructure development in the coastal zone. For example, dredging operations are subject to environmental regulations that require numerous permits and carefully controlled extraction and disposal of dredged material. This is especially problematic at Moss Landing, where sediment contaminated with long-banned DDT and other persistent toxins from upland agriculture flows and settles following frequent storm and flood events. Recently, the Harbor waited nearly three years for the necessary permits, at a cost of nearly $300,000, to enable continued maintenance dredging.

Similarly, multiple, complicated, and at times conflicting environmental and public health regulations increasingly challenge Moss Landing's boatyard and fuel dock operations. For example, the boatyard operator was recently told by County environmental and public health officials that fishermen who wish to work on their vessels under the "do it yourself" arrangement at the boatyard will soon be required to obtain a permit. In addition, they may soon be prohibited from scraping paint from vessel hulls on land. This is impractical because removing hull paint (necessary for vessel maintenance) over the water is prohibited. Such regulations are important for protecting the coastal environment and public health, yet compliance is often costly and at times difficult.

Recommendations

- ***Support the industry, related businesses, and the Harbor in local, state and federal policy-making arenas.***

- ***Develop an ombudsman program or other mechanism to coordinate the County's environmental initiatives and regulations that affect the industry and the Harbor, to eliminate redundancy, resolve conflicting mandates, and increase efficiency of permitting and related processes.***

- ***Establish a centralized, well-publicized and accessible information clearinghouse for relevant county, state and federal regulations.***

- ***Disseminate information on grant and loan programs to the Harbor directly, and to the fishing industry and related businesses through their social networks and communication channels.***

- ***Provide funds for cooperative research that involves fishermen (and their knowledge, skills, expertise and fishing vessels) and local scientists to augment and improve information on local fisheries and marine ecosystems.***

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traditional, scientific information, especially in natural resource conservation and management (e.g., Berkes 1998, Neis et al. 1999).

Short- and Long-term Economic Challenges

The economic vitality of the commercial fishing industry at Moss Landing depends on several factors including a healthy marine environment and fish stocks, fishery and environmental management that protects those resources while allowing for their use, and infrastructure that enables and promotes safe, cost-effective and productive operations. At present, the commercial fishing industry and support businesses face considerable short- and long-term economic challenges. In the short-term, revenues are not keeping pace with operating costs. For many fishermen (as well as others involved in the industry) costs for fuel, maintenance and repairs, licenses and insurance have increased, while revenues have stagnated or declined, as a function of cuts in allowable catches for some species and stagnant or declining prices for most species. The narrowed margin between revenues and costs has made it difficult for some to pay their slip fees, do basic vessel maintenance and in some cases, simply make a living from fishing. Reduced revenues from commercial fishing affect incomes of fish buyers, support businesses, and the Harbor, and in turn, reduces spending on other goods and services at Moss Landing.

These short-term economic problems also create tensions within the industry and with support businesses and the Harbor, as well as safety issues. For example, unpaid slip fees constitute lost operating revenues to the Harbor and further limit dock maintenance and repair. This in turn makes fishermen's work more difficult. The Harbor's limited revenue base affords few alternative sources of funds to offset these losses. For fish buyers, reduced landings affect their marketing outlets and strategies, which depend on a reliable flow of quality fish. Disruptions in that flow can lead to loss of markets for fish landed at Moss Landing, as has occurred for some groundfish buyers and occurred with squid in the 1997-98 El Niño (Mangel et al. 2002, Pomeroy et al 2002).

Following the Federal Groundfish Disaster, a federally sponsored re-training program (augmented with state funds) was made available to affected California groundfish fishermen. It offered a $1,000 to $1,500 monthly stipend to support fishermen who sought re-training in a field unrelated to fishing, and assistance with re-training placement. Information meetings were held at several California ports, including Moss Landing. Although this program held promise for eligible fishery participants, its effectiveness was limited by several factors. The program was not well publicized, and did not deal clearly with issues such as whether a fisherman could continue fishing while undergoing re-training (e.g., to meet the costs of living in the Monterey Bay area). In addition, the program was not designed to meet the particular needs and limitations of potential applicants. The program assumed applicants possessed the necessary skills, comfort and familiarity with land-based job search and employment practices. Yet these differ fundamentally from those associated with commercial fishing. Commercial fishermen have a broad set of skills associated with running and maintaining their fishing operations including navigation, information management, vessel gear and equipment maintenance (including hydraulics and electronics), and small business management. However, most lack formal training or employment to document these skills. Moreover, it is not always clear how these skills can be transferred to an alternative job. The mismatch between the program and potential applicants was even greater for the Vietnamese fishermen at Moss Landing because of language and other cultural factors.

More recently, a voluntary capacity reduction program for the West Coast groundfish fishery has been approved and partially funded by the federal government. A $10 million appropriation has been made, along with a $36 million reduction loan, which will be repaid over time by those who remain in the fishery. Complementary to this, the California State Assembly has approved and

the Senate is considering AB 1354, which would establish the Commercial Fisheries Capacity Reduction Account in the Fish and Game Preservation Fund. The bill would require the Fish and Game Commission to establish a capacity reduction fee on certain species of fish landed in California to fund the account. The funds would be used to repay loans made to California fishermen by the federal government under the buyback program. The success of these programs, however, depends on a viable and productive fishery and community.

Longer-term economic challenges follow from the persistence and accumulation of the short-term conditions noted above. Chief among these are access to fishery resources, and adequate and diversified sources of revenue to the Harbor to support its fishery-related (and other) infrastructure and operations. The former is of most critical long-term concern to fishermen and fish buyers, but also to fishery-support businesses and the Harbor, as it affects their revenues and operations as well.

Commercial fishery participants, businesses and the Harbor have developed strategies to adapt to most short-term environmental, economic and regulatory challenges. Fishermen, in particular, are accustomed to adapting to the variability and uncertainty that are characteristic of fisheries. Most pursue a diversified annual round of fisheries, and do their accounting across several years rather than by a single fishery or within a single year. Fish buyers also use adaptive strategies, diversifying the species, products and services they offer, and the markets they serve. Moss Landing's resident buyers have done this, each carving out a niche for itself. Fishery-support businesses have diversified their offerings, and the Harbor is developing more diversified sources of revenue to meet the interests and needs of its commercial fishing, research and recreation and tourism constituencies. Adapting to these challenges over the long-term, and to their cumulative effects, however, may require more resources than the community can muster alone. For example, the Harbor is developing a long-term (20-year) dredging plan, but under present conditions, lacks the financial resources to implement the plan, especially given the resources also needed to replace or otherwise improve docks and related infrastructure in order to support and insure continued use of the harbor.

Recommendations

- ***Provide or facilitate low-interest loans or lines of credit to the fishing industry to offset costs such as slip fees during the off-season or when severe restrictions on fishing are imposed.***

- ***Provide or facilitate the establishment of an insurance pool for commercial fishermen to help reduce their insurance costs and better insure their vessels.***

- ***Adjust or develop re-training programs to better meet fishery participants' background, skills, resources and needs.***

- ***Provide low-interest loans or grants to the commercial fishing industry, fishery-support businesses and the Harbor to address infrastructure needs to insure safe, efficient and economically productive operations.***

Infrastructure and Maintenance Needs

Infrastructure maintenance and development are critical, cross-cutting issues at Moss Landing. Among the most pressing needs related to existing infrastructure are dock maintenance, repair and improvement; maintenance and catastrophic event dredging; and South Harbor bulkhead

repair (or replacement). (Other needs such as dry storage space and an ice plant are being addressed.[15]) These infrastructure needs are basic to safe and efficient navigation and use of the harbor. Yet they are costly and require permitting and other supportive action by other agencies, may of which operate independently of the Harbor and the County. Complete dock replacement has been estimated at $10 million. Less expensive alternatives are being explored, but will still constitute a "big ticket" expense for the Harbor, which it cannot afford without substantially increasing fees, developing additional sources of revenue, or securing external assistance. Substantial fee increases are impractical, given current strains on fishing operations noted in this report. Bulkhead repair, which must be approved by the Army Corps of Engineers and the California Coastal Commission is needed to limit erosion overall and to better protect fishery-support businesses such as the boatyard, where facilities and operations are especially vulnerable to infill caused by nearby erosion. This problem has become acute for the boatyard, whose owner is considering closing the business. Our discussion at the meeting of the project's Steering Committee focused on the potential wide-ranging economic implications of losing this essential service for fishermen, related businesses and the Harbor.

Additional infrastructure developments could enhance the economic viability of the commercial fishing industry. At present, a small number of fishermen sell their catch to the public off their boats, docked in the harbor. While this has been productive, there are safety issues associated with people walking the docks, health department requirements that are sometimes difficult or costly for boat-based vendors to meet, and convenience issues for customers.

A broader infrastructure issue follows from concerns about the loss of fish processors and other providers of goods and services to the industry. In the mid 1970s, there were at least five resident processors. In recent years, that number dropped to one such fish processor, although the Santa Cruz Cannery Building now has two additional small processing operations. In discussing this infrastructure need, Steering Committee members noted that sewer and water were limiting factors for the establishment of new fish processing operations, as was the limited availability of real estate.

This discussion also addressed recent losses of support businesses (e.g., a large marine supply store) and needs for additional providers of goods and services. Bringing new businesses to Moss Landing, however, may pose further challenges to local industry and its economy. The viability of new and existing businesses depends on the magnitude and nature of industry activity. Revenues and expenditures by fishing operations at Moss Landing must first be sufficient to support existing businesses. Recent events and conditions in some fisheries such as groundfish suggest this may not be the case. Growth in other fisheries such as wetfish and the increasing concentration of Monterey Bay area fishing activity at Moss Landing, however, suggest that the potential for viability and vitality of existing businesses exists. It remains to be seen, however, whether additional businesses can be supported by this growth and concentration of activity.

[15] As this report goes to print, one of the fish buyers leasing space in the Santa Cruz Cannery Building and a Monterey Bay area ice company are working together to install an ice producing facility at the Cannery Building. According to the Habormaster, the Harbor will be involved as the permitting agency and/or reviewing the project pursuant to the terms of the fish buyer's lease.

Recommendations

- ***Work with the Harbor to identify and secure loans or grants to support dock replacement and, in the interim, dock maintenance and repair.***

- ***Provide low-interest loans or grants to support maintenance dredging.***

- ***Support Harbor efforts to gain Army Corps of Engineers, California Coastal Commission and other relevant agency support for dredging, bulkhead repair and other projects essential to safe navigation and efficient commerce at Moss Landing.***

- ***Provide low-interest loans or grants to support the development of a centralized fish market where fishermen can sell their catch directly to the public.***

- ***Provide assistance with permitting, locating a site for, and establishing such a market.***

- ***Work with the fishing community and associated businesses to further explore the need for and constraints to additional businesses to support the commercial fishing industry, determine the economic implications of such growth for both existing and prospective businesses, and develop incentives to retain existing businesses and attract new ones.***

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APPENDIX A: METHODOLOGICAL DETAIL

The information provided in this report is based upon research conducted at Moss Landing with support from the Monterey County Office of Economic Development (OED), complemented by the Co-PIs' previous and ongoing research. This appendix provides background on those complementary studies, followed by details on the methods used for the OED-sponsored study.

Previous work

Previous work by Pomeroy and colleagues includes five studies, briefly described here. Three of these studies focused on the squid and wetfish fisheries, and included: 1) a California Sea Grant-sponsored study with M. FitzSimmons focused on the changing socio-economic organization of the California market squid fishery, 2) a National Oceanic and Atmospheric Administration (NOAA)–sponsored study, assisted by Hunter, Los Huertos and others on the socio-economic impacts of potential marine reserves at the Channel Islands (which are of particular concern to squid fishermen and buyers at Moss Landing, among others), and 3) a California Seafood Council-sponsored study, with S. Hackett, of the statewide wetfish fishery, which produced a socio-economic profile and an estimate of value added by wetfish processing statewide. Methods used in these studies included archival, ethnographic and survey research. Archival research focused on the gray, refereed and trade literatures, and landings data from the Pacific States Marine Fisheries Commission's (PSMFC) Pacific Fisheries Information Network (PacFIN) database. Ethnographic research entailed observation of the fishery and related activities, and in-depth interviews with fishermen, receivers and processors, harbor personnel, operators of support services, resource managers and others knowledgeable of the industry. Surveys focused on fishermen and processors. A fourth study, sponsored by NMFS, examined the social and economic impacts of pinniped-fishery interactions on the central California salmon troll fleet. This work was more exploratory and qualitative, and entailed the use of archival, ethnographic and limited survey research with salmon troll skippers. The fifth study examined the primarily live fish skiff fishery at Big Creek, and also involved the combined use of archival and field research methods. Together, these studies afforded data on and understanding of the social, cultural and economic aspects of these fisheries, all of which play a role at Moss Landing. Moreover, they afforded the building of working relationships with fishery participants and a solid foundation for conducting the port-specific research at Moss Landing.

The Moss Landing Harbor (MLH) Study

For study reported here, we combined the approaches of fisheries sociology (Pomeroy) and economics (Dalton). We collected both archival and field data, and used qualitative and quantitative analyses. Archival data included landings data from the PSMFC's PacFIN database, Monterey County and other appropriate agency data, and gray and refereed literatures on Moss Landing, the commercial fishing industry and associated fisheries. We collected field data from fishermen, fish buyers and local providers of goods and services to the industry, including the Harbor. In addition to collecting data specific to MLH, we gathered information on the adjacent Monterey and Santa Cruz Harbors. We present methodological details below.

Data Collection

The trends analysis in this report was based on archival and field research directed toward: 1) describing and explaining trends in the major fisheries and overall at Moss Landing, and 2) describing fishery participants and related businesses. For the first of these, we primarily used

archival data analysis of PacFIN data. Interpretation of these trends was informed by our recent and ongoing research, investigation of fishery management documents, and field surveys, interviews and observation for this project.

For the socio-economic profile, we conducted extensive field research including ethnographic observation and interviews with fishery participants and others knowledgeable of the industry, and survey interviews with skippers, fish buyers and fishery-support business operators at Moss Landing. The interviews and surveys were designed by Pomeroy, with assistance from Dalton to insure coverage of the project's diverse data needs. Pomeroy conducted most of the ethnographic and survey research, with assistance from Vietnamese translator and interviewer Hue-Thanh Bergevin and research assistants Mark Gleason and Heather Kerkering.

Because we were unable to obtain a list of vessels with landings at Moss Landing, we used a two-pronged approach for the skipper survey. First, local fishery participants assisted us with the distribution of a written survey in late April 2002. Self-identification on this survey was voluntary, but most of the 11 respondents provided their name and contact information for follow up as needed. Because of the low response rate, however, we then conducted the survey as a face-to-face interview with skippers. We used snowball techniques for identifying respondents, and interviewed 27 skippers in late summer and fall 2002. Survey interviews lasted from about 40 minutes to nearly 3 hours (in cases where respondents provided additional historical and other contextual information on Moss Landing and its commercial fisheries).

The two surveys differed only in the approach to expense information. The written survey included the request for expense information within the instrument. For the survey interviews, we provided respondents with an expense and revenue worksheet, cover memo, and self-addressed stamped envelope so that they could review their records and complete the worksheet at their convenience following the interview. We did follow up with expense worksheet non-respondents by phone and in person to remind them about the worksheet, answer questions, and encourage them to complete it and return it to us as soon as possible. (Despite repeated attempts, we were unable to reach some respondents.)

In working with fish buyers, we targeted the seven that have permanent receiving operations at Moss Landing. Because we were unable to obtain a reliable list of transient fish buyers at Moss Landing, we were unable to collect data from them. (We hope to be able to identify and work with at least some of these buyers in subsequent research.) However, resident buyers account for the great majority of landings (by weight and value) at Moss Landing.

The approach to fish buyers and fishery-support businesses at Moss Landing was similar to the survey interview approach used with skippers. We developed a survey instrument for each of these groups. We sought information on their businesses' history and experience, operations, and opinions, concerns and needs at Moss Landing and in regard to commercial fishing more generally. We conducted the survey interview with four of the seven resident fish buyers, a less structured interview with a fifth buyer, and collected more limited information from the two other buyers. Three of Moss Landing's nine fishery-support business operators participated in survey interviews. These interviews lasted from about 45 minutes to nearly 3 hours. Also similar to the skipper survey interview, we provided fish buyers and fishery-support business operators with expense and revenue worksheets, and followed the same reminder procedure. Three respondents from each of the two groups completed these worksheets.

We used a semi-structured questionnaire together with a structured survey to collect data from the three Monterey Bay area harbors. Following initial contact with the three harbormasters, we

e-mailed them the two data collection instruments, then followed up to collect the data from them. The Monterey and Santa Cruz harbormasters provided their data by telephone interview and e-mail. The Moss Landing harbormaster provided written responses to the questionnaire, and several documents with data germane to the survey. Moss Landing's assistant harbormaster provided additional input in occasional semi-structured interviews at the harbor office.

Representativeness of the Samples

Based on input provided by knowledgeable industry members and Harbor personnel, we estimate the total resident and non-resident fleet to include about 300 fishing vessels, their skippers and crew. An estimated 109 to 132 vessels are home ported at Moss Landing. We surveyed a total of 38 commercial fishing skippers. Although we feel the sample of skippers is roughly representative of the population of Moss Landing skippers in terms of fishery configurations, it nonetheless has its limitations. For example, the sample likely over-represents resident fishermen and under-represents non-resident fishermen. This is due to several challenges facing the research team, including the timing of the research during the busy summer and fall fishing seasons, and the lack of a vessel and skipper list to facilitate timely identification and contact with skippers.

In addition, whereas response rates for most of the survey questions were high, some were considerably lower. In particular, questions about expenses and revenues are sensitive, and tend to elicit fewer responses than questions about fishing experience, operations and opinions. For the skipper survey, just under half (18) of the 38 respondents provided expense data. This subsample differs in important ways from both the sample and the population, in that it primarily represents smaller scale troll and other line gear operations. Larger line gear and gillnet, as well as purse seiners, are not well represented in this subsample. These skippers tend to have higher gross revenues, accompanied by higher operating costs. Moreover, while some respondents were particularly thorough in completing the worksheet, others were not. As a result, the expense estimates provided in Tables 5-14 and 6-1 may not fully or accurately reflect the actual expenses of the subsample, and by extension, the sample and the population.

We conducted structured interviews of four of the seven (57%) resident fish buyers at Moss Landing, and received expense and revenue data for three of them (43%). One buyer did not purchase fish at Moss Landing during part of the sample period (1999-2001). The sample appears to be representative of the diversity among Moss Landing fish buyers. We were unable, however, to identify and interview the dozens of non-resident fish buyers. Although the sample of fish buyers captures considerable diversity of fish buying operations, we caution against inferences about the population of non-resident buyers.

We interviewed three of the nine fishery-related business operators at Moss Landing. This sample represents one-third of the fishery-related businesses at the harbor. Based on our knowledge of the other businesses at the harbor, we believe it is representative of the population of fishery-support businesses there. As noted in Sections 5 and 6, however, some questions remain about the spatial allocation of expenditures as well as total revenues.

We will work with participants in the Moss Landing study and a broader set of fishery and support business operations in subsequent projects in an effort to obtain more complete and accurate estimates of expenses and revenues and their allocation across locations. These will enable us to improve our estimate of the direct economic value of the industry at Moss Landing, and will be essential to the estimation of indirect values associated with the fishery.

Data Management and Analysis

Ethnographic observations and interviews were transcribed. Resulting qualitative data were managed in Word, while most quantitative data were managed in Excel. Most of the skipper survey data were entered into Statistical Package for the Social Sciences (SPSS). Non-quantifiable qualitative data from the surveys were extracted and managed in text files. Expense and revenue data were entered into Excel to facilitate their use in Dalton's construction of the input-output tables and analysis of direct economic value. Fish buyer and fishery-support business interviews were transcribed, and quantitative data were entered into excel spreadsheets for basic qualitative ad quantitative analysis. Harbor questionnaire data were transcribed in a text document, and survey data were entered into an Excel database for comparative qualitative and quantitative analysis. Data were managed in password-protected files, and strict protocols were observed to insure confidentiality of study participant data.

Univariate and bivariate analyses of quantitative data were used to generate the descriptive statistics in this report. Qualitative data were analyzed using procedures outlined in Miles and Huberman (1984). We will conduct more complex analyses of the data in subsequent work.

For the input output (IO) analysis, we used expense and revenue data from the interviews and surveys conducted at Moss Landing from Spring 2002 through Winter 2003. Sample data for skippers were compiled and entered into a geographical information system (GIS). The GIS includes summary information from fish ticket data for California in the PacFIN database for all vessels that landed at Moss Landing between 1999 and 2001.

The raw data collected from skippers were incomplete across years. Respondents most often simply repeated their 2001 costs in 1999 and 2000. The approach taken in this report followed this pattern by substituting 2001 data for missing values in 1999 and 2000 to form three-year totals that we compared with 1999-2001 totals computed with data from PacFIN. The sample data provided by the three fish buyers and three fishery-support businesses were specific to each year, rather than repeated as with much of the skipper data.

The sample expense and revenue data were sorted into expenditure categories to construct an input-output (IO) table. The expenditure categories include fish purchased, energy and utilities, supplies and services, payroll, rent, buildings and equipment, vessel payments, licenses and taxes. This classification scheme distinguishes inputs related to energy, materials, capital, and labor. As described in the report, under certain assumptions, costs of these inputs may be interpreted as defining the gross economic value of an industry. Results in this report follow that interpretation.

Sample Cost Shares and PacFIN Benchmark

We used the interview and survey data from skippers to estimate cost shares for each of the expenditure categories for fishermen listed in Table A-1. Additional work is needed to estimate skipper income, an important category that does not appear in Table A-1. In this report, the difference between the scaled estimate of total expenditures for skippers and total ex-vessel revenues computed from PacFIN data was used as gross profits for fishermen. In this case, total costs of vessel operations including profits are identically equal to the total value of ex-vessel revenues.

Table A-1. Expenditure codes for skippers.	
Code	**Category**
AC	Accounting
AS	Association
BA	Bait
CR	Crew Payment
FU	Fuel
GE	Gear
GR	Groceries
IC	Ice
IN	Insurance
LC	License
LI	Light Boat
LO	Lodging
MA	Maintenance
OE	Other Expenses
PI	Pilot
SL	Slip
SA	Salt
VE	Vessel Payment

Cost shares were estimated for the sample of fish buyers using the expenditure categories listed in Table A-2. Moss Landing is only one of the multiple locations where fish buyers operate. Since this industry is also assumed to exhibit constant returns to scale, cost shares may be scaled by an appropriate factor to estimate the gross economic value of the industry. In this case, the appropriate factor depends on total purchases of fish at Moss Landing, which is equal to ex-vessel revenues from landings.

Table A-2. Expenditure codes for fish buyers.	
Code	Category
BE	Building and Equipment
FL	Financial and Legal Service
FP	Fish Purchases
FU	Fuel
IC	Ice
IN	Insurance
LC	License
OE	Other Expenses
PA	Payroll
SE	Service
SL	Slip or berth
SU	Supplies
TX	Taxes
UT	Utilities
VE	Vessel payments and purchases

The fishery-related businesses do not have an expenditure category that can be scaled to match PacFIN data for ex-vessel revenues (Table A-3)..In this case, cost shares were not used, and the gross value of this industry was estimated to be the sum of expenditures for the three fishery-related businesses in the sample. Because of the representativeness of this sample, the error from this assumption is expected to be small.

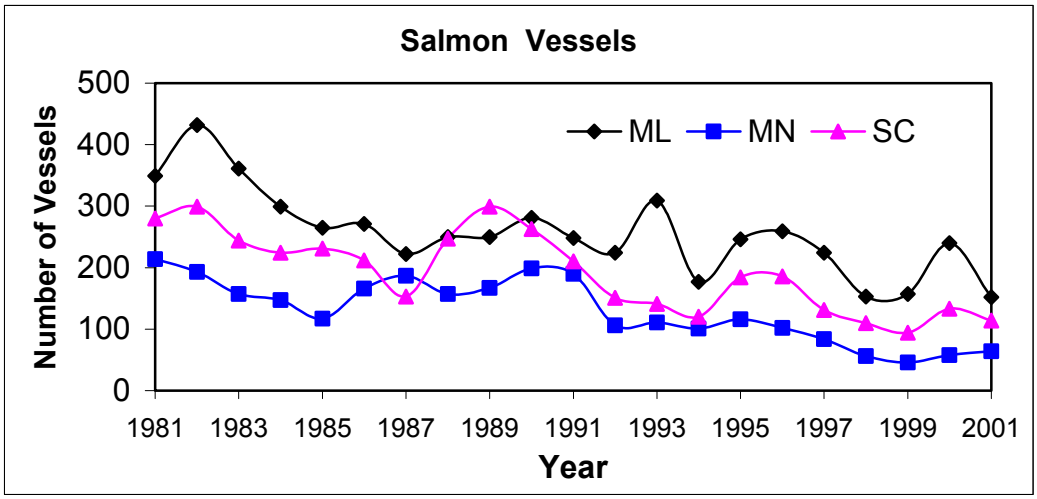
Table A-3. Expenditure codes for fishery-support businesses, including the Harbor.

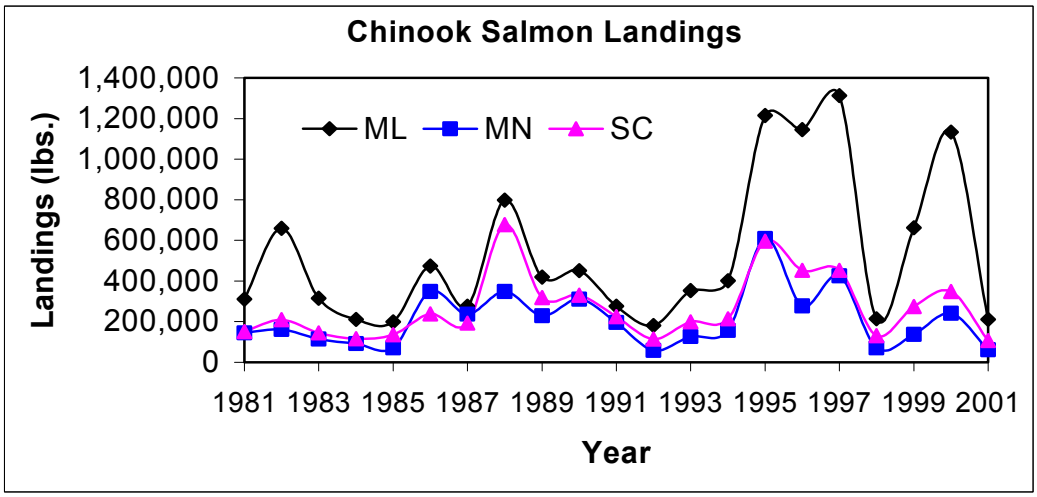
Code	Category
AU	Auto
BE	Buildings and Equipment
FL	Financial and Legal Services
IN	Insurance
LC	Licenses
MA	Maintenance Services
OE	Other Expenses
PA	Payroll
SE	Services
SU	Supplies
TX	Tax

APPENDIX B: SUPPLEMENTARY FIGURES AND TABLES

Figure B-1. California ports.

Figure B-2. Commercial fishing activity for salmon in terms of number of vessels, landings (pounds) and ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (MN), 1981-2001 (PacFIN data).





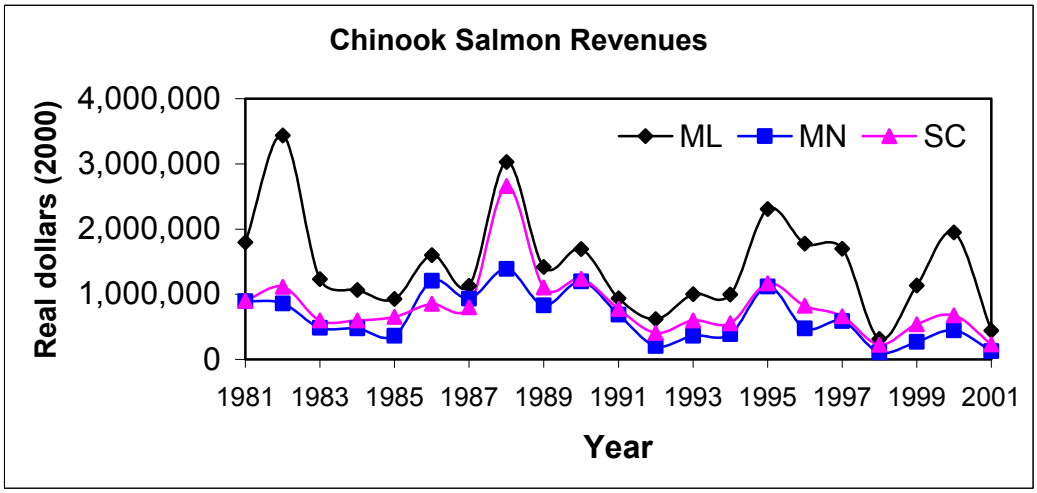


Figure B-3. Commercial fishing activity for the highly migratory species (HMS) in terms of number of vessels, landings (pounds) and ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (MN), 1981-2001 (PacFIN data).

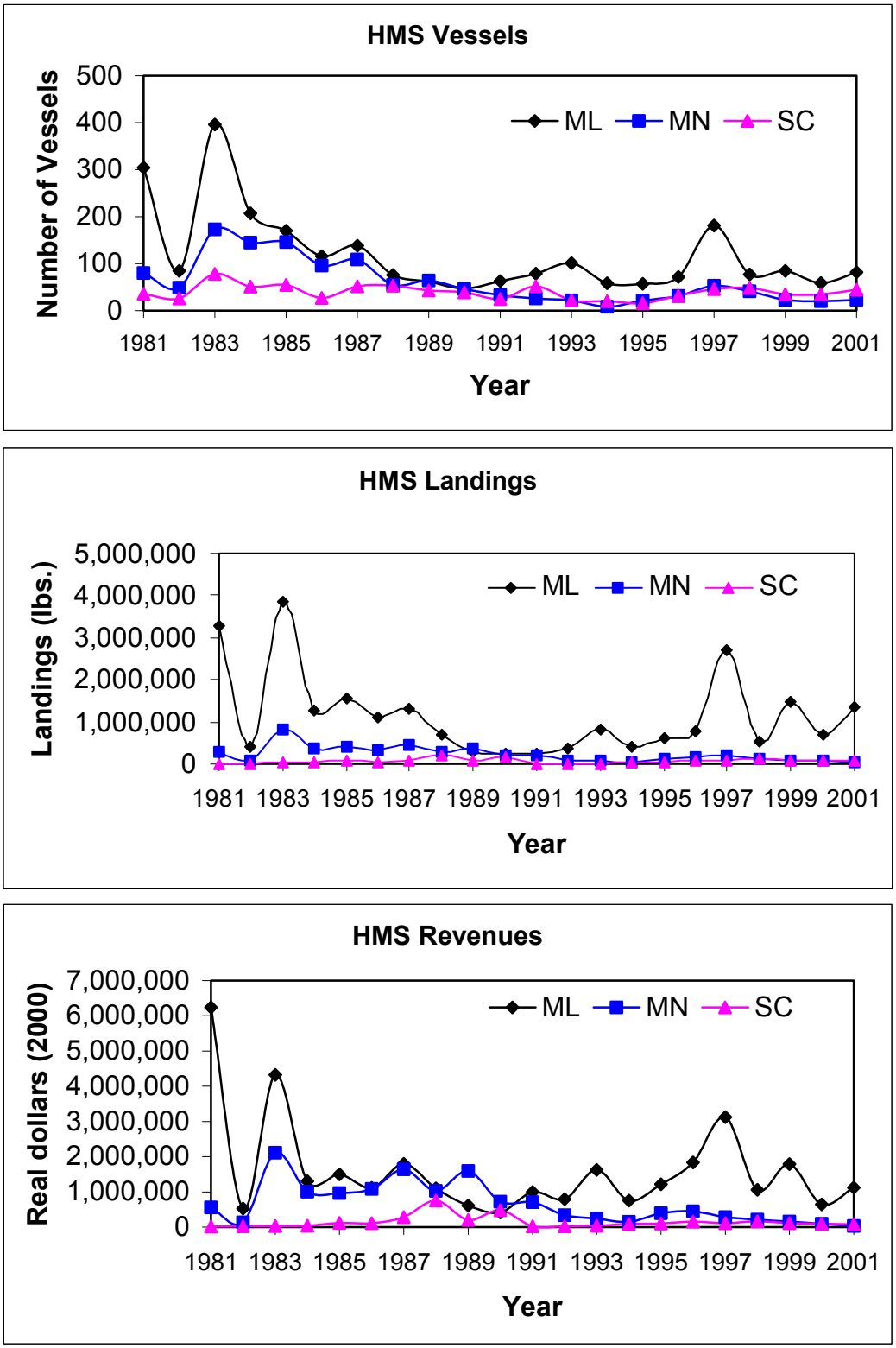
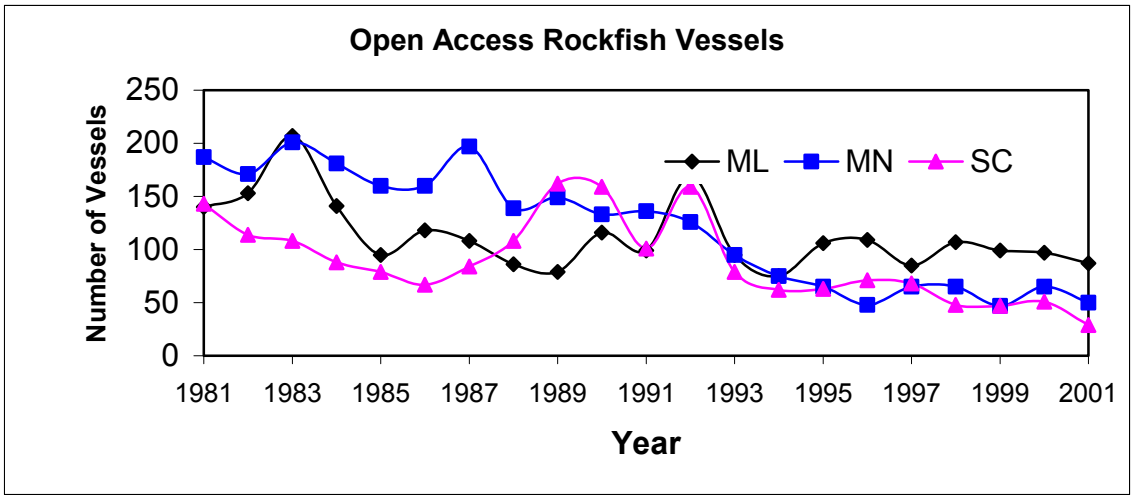
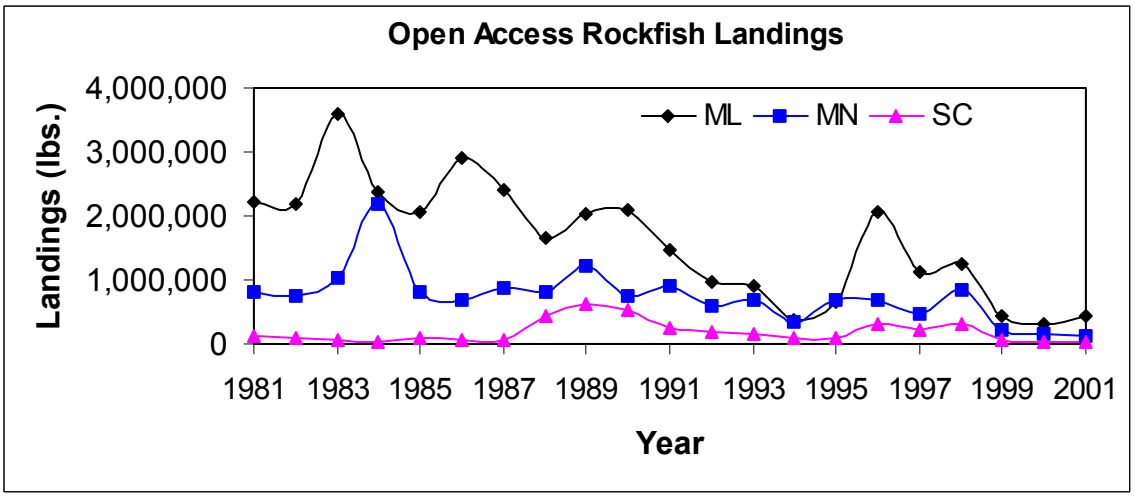


Figure B-4. Commercial fishing activity for the open access rockfish in terms of number of vessels, landings (pounds) and ex-vessel revenues (2000 $) at Santa Cruz (SC), Moss Landing (ML) and Monterey (MN), 1981-2001 (PacFIN data).





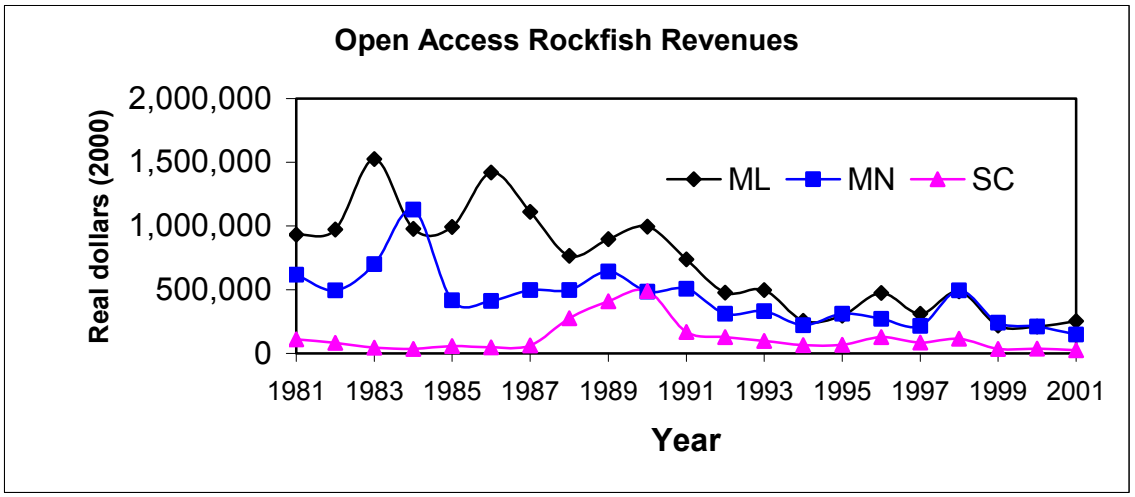


Table B-1. Timeline of key events related to the Moss Landing commercial fishing industry.	
1863	Commercial fishery for squid started by Chinese in Monterey Bay
1905	Lampara net introduced to Monterey Bay
1930	Lampara boats replaced by purse seine vessels
1935	Cannery boom prompts construction of jetties and dredging of channel
1947	Moss Landing Harbor District established
1952	Sardine collapse in Monterey Bay
1953	Trawling for rockfish prohibited in state waters
	Purse seine nets prohibited in Monterey Bay
1959	Squid attracting lights banned in Monterey Bay
1959	Puretic power block becomes widespread in purse seine fisheries
1967	Directed (non-bait) sardine fishery moratorium implemented
1970	Pacific mackerel moratorium implemented
1974	Sardine moratorium implemented
1976	Magnuson Fisheries Conservation and Management Act passed
1977	Pacific mackerel fishery re-opened (under quota system)
1978	Federal Northern Anchovy FMP implemented
	California Salmon Stamp program initiated
1980	California shark/swordfish drift gillnet limited entry implemented
	Moratorium on entry into California commercial salmon troll fishery
1982	Set gillnets restricted to 10 fathoms in state waters (<3 miles)
	Federal Groundfish FMP adopted
	California salmon troll limited entry implemented
1984	Set gillnets restricted to outside 15 fathoms in state waters
1986	Directed fishery for sardine opened
1988	Moratorium on squid attracting lights in most of Monterey Bay lifted
1989	Purse seines and squid attracting lights permitted throughout Monterey Bay
	Set gillnet fishery restricted to 20 fathoms in state waters
	Loma Prieta Earthquake
1990	California Marine Resource Protection Act (Proposition 132) “gillnet ban” passed
1991	Set gillnet fishery restricted to 30 fathoms in state waters
1994	Federal groundfish limited entry implemented
	State gillnet ban implemented
	Chinese market for squid opened
1995	California Dungeness crab limited entry implemented
1996	Re-authorization of MFCMA, passed as Sustainable Fisheries Act
1997	SB 364 Squid Fishery Management Bill passed
	Federal Marine Mammal Take Reduction Program established requiring pingers on shark/swordfish gillnets
1998	Marine Life Management Act passed in California,
	Northern Anchovy FMP amended to include all wetfish species, renamed the Coastal Pelagic Species (CPS) FMP
	Nearshore Fishery Management Act passed in California
	$2,500 catcher and light boat permits, 3-year moratorium on entry implemented in squid fishery
1999	Marine Life Protection Act passed in California,
	Sardine fishery declared recovered by state

Table B-1. Timeline (continued).	
	Mandatory logbooks and statewide weekend closures for the squid fishery implemented
	30,000 watt limit and light shields required for squid catcher and light boats
2000	West Coast groundfish declared federal disaster
	CPS Limited Entry implemented; management (except squid) shifted to PFMC
2002	Draft management plan released for squid, currently under substantial modification
	Highly Migratory Species (HMS) FMP adopted by PFMC
	Set gillnet fishery restricted to outside 60 fathoms from Pt. Reyes to Pt. Arguello
	Nearshore Fishery Management Plan adopted
	Limited entry for spot prawn trap fishery
2003	Rockfish Conservation Area established
	Federal groundfish buyback program approved in Congress
	Trawling for spot prawn prohibited in state waters

Table B-2. Businesses at Moss Landing.		
Emphasis	**Business Name**	**Location**
Antiques	Antiques, Etc.	Mainland
	Camelot By the Sea	Mainland
	Hamlin's Antiques	Mainland
	Il Nido	Mainland
	Martin and Company Antiques	Mainland
	Moss Landing Antique & Trading Co.	Mainland
	Moss Landing Station	Mainland
	Nonie's Collectibles	Mainland
	Old Post Office Antiques	Mainland
	Potter Palmer Antiques	Mainland
	Promenade Deck Antiques	Mainland
	Russian collectables	Mainland
	The Caboose N' Stuff	Mainland
	The Little Red Barn Antiques	Mainland
	Then and Now Antiques	Mainland
	Waltha's Place	Mainland
	Waterfront Antiques	Mainland
	Yesterday's Books	Mainland
	Zyanya Collectibles	Mainland
Fish buyers/processors/markets	BayFresh	Island
	Del Mar Seafoods	Island
	EMK, Inc.	Island
	Monterey Fish Co.	Island
	Phil's Fish Market	Island
	Sea Harvest	Island
	Solomon Live Fish	Island
Fishery-support businesses	Aquarius Boatworks	Island
	Custom Marine Covers	Island
	Dick Johnson (compass, electronics)	Island
	Gravelle's Boat Yard	Island
	Hof Electronics	Island
	Moss Landing Dry Storage	South Harbor
	Peninsula Diesel	Island
	Sanctuary Stainless	Island
	Woodward Marine	Island
Government/Public Sector/Other	Moss Landing Harbor District	Mainland
	Post Office	Mainland
	School District Office	Mainland
	Harbor Chapel Community Church	Mainland
Jewelers	Amadio Jewelers	Mainland
	Karthia Studios	Mainland
Lodging	Captain's Inn	Mainland
Marine research	California Sea Grant Marine Advisor	Mainland
	Monterey Bay Aquarium Research Institute	Island

Table B-2. Businesses at Moss Landing (continued).		
Emphasis	**Business Name**	**Location**
	Moss Landing Marine Laboratories	Mainland
	Monterey Canyon Research Vessels	Mainland
Other retail	Elkhorn Native Plant Nursery	Mainland
	J & S Surplus and Eagle Emblems	Mainland
	M and L Liquors	Mainland
Outdoor recreation/nature tourism	Captain's Inn Bed and Breakfast	Mainland
	Elkhorn Slough National Estuarine Research Reserve Visitor Center / Foundation	E of Harbor
	Elkhorn Slough Safari	S Harbor Mainland
	Elkhorn Yacht Club	N Harbor
	Kayak Connection	N Harbor
	Monterey Bay Kayaks	N Harbor
	Monterey Birding Adventures	S Harbor Mainland
	Moss Landing RV Park	S Harbor Mainland
	Moss Landing State Beach	N of N Harbor
	Salinas River State Beach	N of N Harbor
	Sanctuary Cruises	S Harbor Mainland
	Tom's Sportfishing	S Harbor Mainland
Professional Services	ABA Consultants	Mainland
	Al Munoz, CPA	Mainland
	Carole Kettman Girl Friday	Mainland
	Melanie Mayer Consulting	Mainland
	Moss Landing History and Heritage Center	Mainland
	North County Business Services	Mainland
	Oceanview Animal Cremation	Mainland
	Open Door Construction	Mainland
	Technique Mirage	Mainland
	Whale House	Mainland
Restaurants and Bars	April's Bear Flag	Island
	Artichoke Amore	Mainland
	Charlie Moss's	Mainland
	Haute Enchilada Art Café	Mainland
	Lighthouse Harbor Grill	Mainland
	Moss Landing Cafe	Mainland
	Moss Landing Jazz Club	Mainland
	Phil's Fishery Market & Eatery	Island
	Phil's Smoke Shack	Mainland
	Whole Enchilada	Mainland
Utilities	Duke Energy	E of Harbor

Source: Moss Landing Chamber of Commerce. www.monterey-bay.net/ml/businesses.html

Table B-3. Gear groups, names and PacFIN codes.		
Gear group	**Gear name**	**PacFIN Code**
Gillnet	Set net	STN
Gillnet	Trammel	TML
Gillnet	Gill net	GLN
Gillnet	Sunken gillnet	SGN
Line	All hook and line gear except troll	HKL
Line	Hand line	HDL
Line	Hook and line (recreational)	HLR
Line	Pole (commercial)	POL
Line	Setline	STL
Line	Drop line	DRL
Line	Longline or setline	LGL
Line	Other hook and line gear	OHL
Other	All dredge gear	DRG
Other	All net gear except trawl	NET
Other	All other miscellaneous gear	MSC
Other	Dip net	DPN
Other	Unknown or unspecified gear	USP
Other	Jig	JIG
Other	Other dredge gear	ODG
Other	Other known gear	OTH
Other	Other net gear	ONT
Other	Scallop dredge	SCD
Other		ALL ...
Pot	All pot and trap gear	POT
Pot	Crab and lobster pot	CLP
Pot	Crab pot	CPT
Pot	Fish pot	FPT
Pot	Lobster pot	LPT
Pot	Other pot gear	OPT
Pot	Prawn trap	PRW
Pot	Snail pot	SPT
Seine	Seine	SEN
Trawl	All shrimp trawls	TWS
Trawl	Beam trawl	BMT
Trawl	Bottom trawl	BTT
Trawl	Bottom trawl, catcher boat, foreign	CBF
Trawl	Bottom trawl, catcher boat, jv	CBJ
Trawl	Groundfish (otter) trawl	GFT
Trawl	Midwater trawl - catcher/processor	MPT
Trawl	Pair trawl	PRT
Trawl	Prawn trawl	PWT
Trawl	Shrimp trawl, double rigged	DST
Trawl	Shrimp trawl, single or double rig	SHT
Trawl	All trawls except shrimp trawls	TWL

Table B-3. Gear groups, names and PacFIN codes (continued).		
Gear group	**Gear name**	**PacFIN Code**
Trawl	Bottom trawl, large freezer trawler	LFZ
Trawl	Bottom trawl, small freezer trawler	SFZ
Trawl	Bottom trawl, surimi trawler	SRM
Trawl	Flatfish trawl	FFT
Trawl	Midwater trawl	MDT
Trawl	Other trawl gear	OTW
Trawl	River trawl	RVT
Trawl	Roller trawl	RLT
Trawl	Shrimp trawl, single rigged	SST
Troll	Hand troll	HTR
Troll	Power gurdy troll	PTR
Troll	All troll gear	TLS
Troll	Bottomfish troll	BTR
Troll	Troll	TRL

Table B-4. Port groups, ports and PacFIN codes (continued).		
Port Group	**Port**	**PacFIN Code**
BB	Bodega Bay	BDG
BB	Other Marin	OSM
BB	Point Reyes	RYS
BB	Tomales Bay	TML
CR	Crescent City	CRS
CR	Other Del Norte	ODN
ER	Eureka	ERK
ER	Fields Landing	FLN
ER	Other Humboldt	OHB
ER	Trinidad	TRN
FB	Albion	ALB
FB	Pt. Arena	ARE
FB	Fort Bragg	BRG
FB	Other Mendocino	OMD
LA	Dana Point	DNA
LA	Long Beach	LGB
LA	Newport Beach	NWB
LA	Other Los Angeles	OLA
LA	San Pedro	SP
LA	Terminal Island	TRM
LA	Wilmington	WLM
ML	Moss Landing	MOS
MN	Monterey	MNT
MR	Avila	AVL
MR	Morro Bay	MRO
MR	Other San Luis Obispo	OSL
OC	Other California	OCA
OM	Other Monterey Bay	OCM
SB	Port Hueneme	HNM
SB	Other Ventura	OBV
SB	Oxnard	OXN
SB	Santa Barbara	SB
SB	Ventura	VEN
SC	Santa Cruz	CRZ
SD	Oceanside	OCN
SD	Other San Diego	OSD
SD	San Diego	SD
SF	Alameda	ALM
SF	Berkeley	BKL
SF	Oakland	OAK
SF	Other SF	OSF
SF	Princeton	PRN
SF	Richmond	RCH
SF	San Francisco	SF
SF	Sausalito	SLT

Table B-5. Species groups, species and PacFIN codes.		
Species/Market Category	**Species**	**PacFIN Code**
Coastal Pelagic Species (CPS)	Chub Mackerel	CMCK
	Jack Mackerel	JMCK
	Market Squid	MSQD
	Northern Anchovy	NANC
	Pacific Herring	PHRG
	Pacific Sardine	PSDN
	Unsp. Mackerels	UMCK
Groundfish Species (GRD)	Arrowtooth Flounder	ARTH
	Bocaccio	BCC1
	Chilipepper	CLP1
	Canary Rockfish	CNR1
	Dover Sole	DOVR
	English Sole	EGLS
	Lingcod	LCOD
	Longspine Thornyhead	LSP1
	Petrale Sole	PTRL
	Pacific Whiting	PWHT
	Rex Sole	REX
	Sablefish	SABL
	Shortspine Thornyhead	SSP1
	Thornyheads	THDS
	Unsp. Slope Rockfish	USLP
	Widow Rockfish	WDW1
Highly Migratory Species (HMS)	Albacore Tuna	ALBC
	Pacific Angel Shark	ASRK
	Bluefin Tuna	BTNA
	Pacific Barracuda	CUDA
	Leopard Shark	LSRK
	Shortfin Mako Shark	MAKO
	Other Shark	OSRK
	Other Tuna	OTNA
	Pelagic Thresher Shark	PSRK
	Soupfin Shark	SSRK
	Skipjack Tuna	STNA
	Swordfish	SWRD
	Common Thresher Shark	TSRK
	Unsp. Shark	USRK
	Unsp. Tuna	UTNA
	Yellowfin Tuna	YTNA
Open Access Rockfish Species (OAR)	Aurora Rockfish	ARR1
	Blackgill Rockfish	BGL1
	Black Rockfish	BLK1
	Blue Rockfish	BLU1
	Bank Rockfish	BNK1
	Brown Rockfish	BRW1

Table B-5. Species groups, species and PacFIN codes (continued)		
Species/Market Category	**Species**	**PacFIN Code**
OAR (continued)	Black&Yellow Rockfish	BYL1
	Cabezon	CBZ1
	China Rockfish	CHN1
	Copper Rockfish	COP1
	Cowcod Rockfish	CWC1
	Darkblotched Rockfish	DBR1
	Flag Rockfish	FLG1
	Greenblotched Rockfish	GBL1
	Gopher Rockfish	GPH1
	Grenadiers	GRDR
	Grass Rockfish	GRS1
	Greenspotted Rockfish	GSP1
	Greenstriped Rockfish	GSR1
	Kelp Greenling	KGL1
	Kelp Rockfish	KLP1
	Olive Rockfish	OLV1
	Queenfish	QFSH
	Quillback Rockfish	QLB1
	Unsp. Bolina Rockfish	RCK2
	Unsp. Reds Rockfish	RCK4
	Unsp. Small Reds Rockfish	RCK5
	Unsp. Rosefish Rockfish	RCK6
	Unsp. Gopher Rockfish	RCK7
	Redbanded Rockfish	RDB1
	Rosy Rockfish	ROS1
	Rosethorn Rockfish	RST1
	Unsp. Sculpin	SCLP
	Splitnose Rockfish	SNS1
	Starry Rockfish	STR1
	Starry Flounder	STRY
	Swordspine Rockfish	SWS1
	Treefish	TRE1
	Unsp. Rockfish	URCK
	Unsp. Nearshore Rockfish	USHR
	Unsp. Shelf Rockfish	USLF
	Vermillion Rockfish	VRM1
	White Croaker	WCRK
	Yelloweye Rockfish	YEY1
Other Species (OTH)	California Halibut	CHLB
	Dungeness Crab	DCRB
	Spiny Dogfish	DSRK
	Monkeyface Eel	MEEL
	Miscellaneous Animals	MISC
	Miscellaneous Fish	MSC2
	Other Bass	OBAS
	Other Crab	OCRB

Table B-5. Species groups, species and PacFIN codes (continued).		
Species/Market Category	**Species**	**PacFIN Code**
OTH continued	Other Croaker	OCRK
	Octopus	OCTP
	Other Flatfish	OFLT
	Other Mollusks	OMSK
	Other Skates	OSKT
	Pacific Cod	PCOD
	Pacific Sanddab	PDB1
	Pink Shrimp	PSHP
	Rock Crab	RCRB
	Ridgeback Prawn	RPRW
	Rock Sole	RSOL
	California Sheephead	SHPD
	Unsp. Smelt	SMLT
	Spotted Prawn	SPRW
	Squarespot	SQR1
	Surfperch	SRFP
	Sand Sole	SSOL
	Unsp. Crab	UCRB
	Unsp. Sanddabs	UDAB
	Unsp. Echinoderms	UECH
	Unsp. Flatfish	UFLT
	Unsp. Sea Cucumber	USCU
	Unsp. Skate	USKT
	White Seabass	WBAS

Table B-6. Equipment used in Moss Landing fishing operations that are common to most fisheries, and specific to certain fisheries.						
	Most fisheries	**CPS**	**Groundfish**	**HMS**	**Salmon**	**Other fisheries**
Fish finding and navigation						
Radar	X					
Sonar	X					
Fathometer	X					
Plotter	X					
Direction finder	X					
Auto pilot	X					
Temperature gauge	X					
Global Positioning System (GPS)	x[a]					
Color fish finder/meter	X					
Compass	X					
Loran C	x[a]					
Communication						
Two-way radio/CB	X					
Cell phone	X					
Fax machine	X[b]					
Satellite phone			X[b]	X	X[b]	
Desktop/laptop computer	X[b]					
INMARSAT				X	X[b]	
Single side-band	X					
Fishing (excluding gear)						
Drum/net reel		X	X[b]			X[b]
Reel (longline)			X[b]	X[b]		
Power block		X				
Winch		X	X			X[b]
Fish pump		X				
Seine skiff		X				
Tuna/Salmon gurdies/pullers				X	X	
Crab block/pot puller			X[b]			X[b]
Block and tackle		X	X			X[b]
Cyncher		X				
Safety						
Standard equipment	X					
Equipment required outside state waters	X					
Other						
Auxiliary engine/generator	X					
Watermaker				X		
Skiff				X[b]	X[b]	X[b]
Squid lights		X				

[a] Loran is being replaced by GPS, although some vessels continue to use it
[b] Depends on an operation's particular gear and characteristics

Table B-7. Licenses, registrations, and permits and associated fees relevant to Moss Landing commercial fishing operations.			
Item	**1999**	**2000**	**2001**
CA resident crewmember license	50	50	50
CA resident operator license	90	90	90
CA non-resident commercial fishing license	150	150	150
CA resident crewmember upgrade license	40	40	40
CA resident vessel registration	200	200	200
CA non-resident vessel registration	400	400	400
CA commercial salmon stamp	85	110	248
CA junior commercial fish license	35	35	35
CA john doe salmon stamp	85	110	248
CA ocean enhancement stamp	25	25	25
CA salmon vessel permit	30	30	30
CA finfish trap permit	110	110	110
CA drift gillnet shark/swordfish permit	330	330	330
CA general gill/trammel net permit	330	330	330
CA resident herring gillnet	265	265	265
CA herring stamp	100	100	100
CA nearshore fishery permit	125	125	125
CA northern pink shrimp trawl (individual)	n/a	n/a	500
CA northern pink shrimp trawl (vessel-transferable)	n/a	n/a	1000
CA northern pink shrimp trawl (vessel-nontransferable)	n/a	n/a	500
CA spot prawn trap vessel permit, tier 1	n/a	n/a	n/a
CA spot prawn trap vessel permit, tier 2	n/a	n/a	n/a
CA squid light boat permit	2500	2500	400
CA market squid vessel permit	2500	2500	400
CA resident dungeness crab vessel	200	200	200
CA non-resident dungeness crab vessel	400	400	400
CA coonstripe shrimp vessel permit	n/a	n/a	n/a
CA fish landed outside state permit	15	15	15
CA golden, spot, & ridgeback prawn permit	30	30	30
CA southern pink shrimp trawl	n/a	n/a	30
CA swordfish permit	330	330	330
CA trap permit	35	35	35
CA junior commercial salmon stamp	43	55	124
CA pink shrimp permit (individual)	285	285	n/a
CA pink shrimp permit (vessel)	285	285	n/a
CA spot prawn observer fee (trap)	n/a	250	n/a
CA spot prawn observer fee <1,000lbs (trawl)	n/a	250	n/a
CA spot prawn observer fee 1,000-9,999lbs (trawl)	n/a	500	n/a
CA spot prawn observer fee >10,000lbs (trawl)	n/a	1000	n/a
OR resident commercial fishing license			
OR non-resident commercial fishing license			
OR commercial crewmember			
OR resident vessel registration			
OR non-resident vessel registration			

Table B-7. Licenses, registrations, and permits and associated fees relevant to Moss Landing commercial fishing operations.			
Item	**1999**	**2000**	**2001**
OR single delivery license			
OR albacore tuna landing license			
OR salmon troll permit			
AK Bristol Bay salmon vessel			
AK non-resident crewmember			
Federal Coastal Pelagic Species (CPS)* limited entry permit		60	0
Federal Groundfish limited entry permit			

APPENDIX C: PROJECT TEAM BIOGRAPHIES

Caroline Pomeroy is a natural resource sociologist with the Institute of Marine Sciences and a Lecturer in Ocean Sciences at the University of California, Santa Cruz. Her research focuses on the "human dimensions" of commercial fisheries in particular and marine policy more generally. Her research has included studies of the social and economic organization of the California squid and wetfish fisheries, the socio-economic impacts of pinniped interactions on California salmon trollers, cooperative management and collaborative data collection at Big Creek Marine Reserve in central California, and the human dimensions of marine reserves. In addition to the OED-sponsored study of the commercial fishing industry at Moss Landing, she is beginning work on a Sea Grant-sponsored study of market channels and value added to fish landed at Moss Landing, and a NOAA-sponsored study of the environmental, economic and regulatory impacts on the Moss Landing community as a whole. As a UCSC Ocean Sciences lecturer, she developed and teaches Introduction to Marine Policy

Michael Dalton is assistant professor in the Institute for Earth Systems Science and Policy, California State University Monterey Bay. Dalton earned his Ph.D. in economics from the University of Minnesota in 1995. Dalton's research currently includes projects with California Sea Grant, the National Marine Fisheries Service, NOAA's Saltonstall-Kennedy program, and the Environmental Protection Agency. The views expressed in this report do not necessarily reflect the views of these organizations. Research in these projects spans the socioeconomic analysis of Moss Landing and Monterey Bay fishing communities, bioeconomic and statistical modeling of California groundfish fisheries, and economic and demographic modeling of global energy use and carbon dioxide emissions.

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