COLLABORATIVE FISHERIES RESEARCH TO BUILD SOCIOECONOMIC ESSENTIAL FISHERY INFORMATION: A TEST CASE

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EXECUTIVE SUMMARY

Fisheries are integrated social-ecological systems, characterized by dynamic and complex interactions within and between the natural and human environments. California's 1998 Marine Management Life Act (MLMA) recognizes the role of people in fisheries, and the MLMA Master Plan calls for the inclusion of socioeconomic as well as ecological "essential fishery information" in fishery management plans. However, critical gaps in such information for virtually all fisheries hinder managers' ability to actively adapt and communities' ability to plan for the future.

This project begins to meet such information needs for the commercial fishery for California halibut, providing an example for other fisheries. We conducted a small collaborative fisheries research (CFR) project that engaged fishery participants, scientists and managers. Our goal was to produce sound social scientific understanding of the human dimensions of the fisheries system that is useful to the fishing, management, and scientific communities.

We used an iterative approach, integrating analyses of data from the state's California Fisheries Information System (CFIS), the literature, and knowledgeable fishery participants, managers and scientists to build understanding about the fishery's human system and its dynamics. The research focused on the period 2000-2012 to capture recent changes in the fishery and the larger fishery system, with events prior to and since also informing our efforts.

Key features of the commercial California halibut fishery

The commercial fishery for California halibut is small and complex in its own right, with important ties to other fisheries. Although it accounted for a small proportion of total statewide commercial fishery activity during the study period, on average, more than 20% of all California commercial fishery participants (fishermen, boats and buyers) landed or received California halibut.

The fishery consists of three gear groups, each with distinct practices and patterns but largely serving similar markets, with some key differences north and south of Point Conception. Costs and ease of entry and the extent of regulation vary by gear group, with hook-and-line being the most straightforward, gillnet more costly to enter and participate in, and trawl the most costly and complex to navigate.

The fishery serves domestic (mostly California) customers and consumers with culturally diverse tastes that affect demand, price and product forms. The live market for California halibut, which is supplied primarily by hook-and-line and trawl fishermen, grew through the 2000s, but then declined somewhat toward the end of the study period. Nonetheless, average ex-vessel (dockside) price per pound typically was 10 times the average price for all California-landed species, illustrating its role as a low volume, high price-per-pound fishery.

Most California halibut fishermen and buyers participate in multiple fisheries over the course of the year, with the particular mix and pattern contingent on resource availability, regulations, markets and others factors affecting each of those fisheries. Other fisheries they participate in include white seabass, salmon, groundfish, ridgeback shrimp and sea cucumber among others, with particular mixes differing by gear group and region.

Recent fishery trends: 2000-2012

For the period 2000-2012, landings peaked in 2004 at just over one million pounds with an ex-vessel value of $3.1 million, declined rapidly to 390,000 pounds worth more than $1.8 million in 2007. These measures have been more stable since then without a trend, averaging just over

400,000 pounds for the recent three years (2010-2012) of the period studied. Most activity (including 85% of landings) during the study occurred in three port areas: San Francisco, Santa Barbara and Los Angeles. The number of boats with California halibut landings declined steadily from 447 in 2003 to 264 in 2007, then increased thereafter to 374. The number of buyers statewide was somewhat more stable, decreasing from a high of 225 in 2002 to a low of 136 in 2007, increasing to 194 in 2008, and ranging between 161 and 180 through 2012. Activity in the fishery is seasonal, with a major peak on all measures in July, and a lesser peak in February.

Over the study period, activity among the three gear groups varied. Gillnet and trawl fishery activity declined through the mid to late 2000s and was somewhat less variable statewide thereafter. Activity in the hook-and-line fishery also dipped midway through the period, but then increased, especially in 2008 and 2009, when the commercial fishery for salmon was closed. The average age among gillnet and trawl fishermen increased steadily from 2000 to 2012, while remaining relatively stable among hook-and-line fishermen.

Average annual prices increased fairly steadily from a little less than $3 per pound in 2000 to about $5-6 in 2006, then declined to about $4-5 per pound through 2009, recovering somewhat over the next three years. Whereas average prices across gear groups were similar from 2000 through 2004, they began to diverge in 2004. From 2005 through 2009, prices for trawl- and gillnet-caught fish were similar. In 2010, the average annual price for trawl-caught fish caught up to that for hook-and-line-caught fish at just less than $6 per pound.

Key factors that have affected the fishery: 2000 – 2012

A range of economic, environmental and regulatory factors has affected activity in and the associated human system of the commercial California halibut fishery, with impacts varying within and across gear groups and places. Economically, changing markets has created new opportunities (e.g., through alternative or more direct marketing) for all gear groups, while competition with California halibut caught in Mexico and similar flatfish from various foreign sources has created challenges, especially for trawl and gillnet fishermen in southern California. Environmental variability and change continued to affect the distribution and catchability of California halibut, with differential effects on each gear group due to variations in where, when and how they fish. As a result, commercial fishermen often switched to other fisheries until the halibut are catchable.

Regulatory changes specific to California halibut and to other, related fisheries over the past three and a half decades, including several during the 13-year study period, have substantially limited fishing opportunities, especially for gillnet and trawl fishermen. Spatial closures in state and federal waters, in particular, have affected all fishery participants. By 2000, the gillnet fishery had been sharply curtailed, with fishing restricted to deeper offshore waters, where California halibut are much harder to catch. Management actions pursuant to the 2004 passage of SB 1459 have closed additional areas to fishing and imposed additional requirements (e.g., permits, observers) on trawl fishermen. And whereas actions taken to curtail the nearshore and salmon fisheries reportedly contributed to increased hook-and-line halibut fishery activity, federal groundfish fishery regulations have complicated trawlers' efforts to participate, in the California halibut fishery.

Summary

Fisheries are complex human systems; the commercial fishery for California halibut is no exception. As demonstrated here, a collaborative approach that uses mixed methods and engages individuals who are knowledgeable about the diverse aspects of the fishery affords information and insights that any one source or perspective would not afford. The work reported here also has afforded insights on how to carry out such work in the future, in a way that is both manageable and

productive. The CFIS data are an important piece of this work, but focusing on landings and ex-vessel value alone misses key aspects and dynamics of the fishery. Moreover, collaborating with fishery participants, scientists and managers to elicit and integrate their knowledge is essential to the appropriate and productive evaluation of the CFIS data and to building understanding of the diverse aspects of the commercial fishery for California halibut and its dynamics. The processes begun here and the insights afforded can and will be used to refine and distill particular information from this report and related work, to expand understanding of the human dimensions of the commercial fishery for California halibut and the state's larger fishery system.

ACKNOWLEDGEMENTS

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INTRODUCTION

Fisheries are increasingly recognized as integrated social-ecological systems, characterized by dynamic and complex interactions within and between the natural and human environments (Ostrom 2009). The "social" component of these systems includes the people, practices, institutions, and facilities involved, and their environmental, regulatory, economic, and social context. The 1998 California Marine Life Management Act (MLMA) (California Fish and Game Code Sections 7060-7090) requires the use of ecosystem-based management that integrates scientific understanding of the human and natural environments and the interactions between them. The California Ocean Protection Council further has pledged to "help establish ecologically and economically sustainable fisheries" in accordance with the MLMA (OPC 2006). According to the California Natural Resources Agency's Master Plan, however, "...socioeconomic information gaps still exist for the highest priority fisheries, and certain EFI [essential fishery information], such as socioeconomics, is almost entirely unavailable for most fisheries" (State of California Resources Agency 2001). Lacking sound scientific information on these human dimensions of marine resource use, it is difficult to evaluate outcomes and predict those that may occur under different management options, including the status quo (Pomeroy and Hunter 2007). This, in turn, hinders managers' ability to actively adapt and communities' ability to plan for the future.

Moreover, in 2008, the California Department of Fish and Game and the California Sea Grant Extension Program convened a workshop, "Managing Data-Poor Fisheries: Case Studies, Models and Solutions." Among the resulting suggestions was that DFG focus on the collection and analysis of social scientific data, including the development of collaborative relationships with the fishing and research communities to collect additional socioeconomic and biophysical data, that is, EFI (Starr et al. 2010).

Recently, social scientists have begun to measure social change in the context of fishery management (Gilden 2005; Pollnac et al. 2006; Jepson and Jacob 2007; Jacob and Jepson 2009; Hayes et al. 2011; Nenadovic et al. 2012). Social science tools and information are critically needed as a foundation for ecological and biological studies, as well as to better understand how changes in fisheries management affect the social aspects of fisheries systems.

Motivation for the study

In 2004, the California Legislature passed SB 1459, which closed state waters to bottom trawling, except in the previously designated California Halibut Trawl Grounds (CHTG), which cover about 200 square nautical miles in the Santa Barbara Channel region. In 2009, the California Fish and Game Commission further restricted the fishery, adopting requirements for "light touch" trawl gear for use in the CHTG (F&G Code Section 124 (b)(1) through (b)(5)). Pursuant to the implementation of SB 1459 in 2006, state officials notified fishermen in September 2006 that Monterey Bay's designation as state waters (determined by case law in the 1950s (Welles et al. 2005), but not enforced) would be enforced beginning October 1 of that year.[1] The enforcement of the Monterey Bay closure caught fishery participants by surprise, and led to debate between some sectors of the commercial fishing and the environmental NGO communities over the impacts of the fishery on the resource and habitat, the impacts of the closure on the fishing community, and ways to mitigate both of these.

In an effort to resolve this conflict, California State Assembly Member Monning's office helped establish the *Halibut Research Design Project* as a mechanism for bringing diverse interests together to discuss questions and concerns raised by the closure and options for mitigating its effects or finding an alternative that would allow fishing while protecting the resource and habitat. Although the group did not arrive at a long-term solution, the discussions revealed a number of research

questions and information needs including the need for information on the human dimensions of the fishery. Moreover, the state had identified the fishery for California halibut as a top priority for development of a fishery management plan, under the 1998 Marine Life Management Act (CDFG Marine Region 2001). In considering the foregoing, it became evident that a more holistic approach to the fishery was needed, one that considered the commercial fishery as a whole, including the other gear groups and its full geographic range.[2]

This project was developed to help meet the need for information about the human dimensions of the commercial fishery for California halibut, through a small collaborative fisheries research (CFR) effort that engaged fishery participants, scientists and managers. Our goal was to produce sound social scientific understanding of the human dimensions of the fisheries system that is useful to the fishing, management, and scientific communities. Our work was guided by the following objectives:

- determine and map the key features of the commercial California halibut fishery system;
- determine recent fishery trends by gear type, port, and other dimensions using existing data;
- identify key factors (e.g., changing environmental conditions, regulations, markets) that have affected those trends and features of the fishery; and
- develop a model of the socioeconomic structure of the fishery system to enable assessment of impacts of regulatory, environmental, economic, and other types of change.

Methods

We used an integrated, collaborative research process, adapted from previous work (Culver et al. 2007; Culver and Richards 2009; Pomeroy et al. 2010), that included archival research (focused on existing literature and available fisheries data, semi-structured interviews, and informational meetings to address our objectives. We assembled a team of knowledgeable halibut fishery participants representing different gear types and regions, California Department of Fish and Wildlife (CDFW) environmental scientists, Sea Grant Extension Program biologists and a social scientist, and an economist, who variously participated in project activities.

We extracted and analyzed fishery landings (Commercial Fisheries Information System, or CFIS) data for all participants in the California halibut commercial fishery for the period from 2000 to 2012.[3] We focused on this time period because it afforded sufficiently long-term context in which to place and interpret the impacts of recent events, with 2012 the most recent year for which comprehensive data were available). Information prior to 2000 also informed our analyses and provided historical context. Our analyses included exploring landings by weight and ex-vessel value, as well as patterns and trends in trips, vessels, buyers and prices, drawing on related state permit and vessel registration data. Based on these analyses, we identified spatial and temporal trends in the fishery, and developed non-confidential summaries for team member review. As part of this process, we grouped landings data by port areas consistent with CDFW's approach, and classified the landings by gear group and by species group (See Appendix 1). We combined fields provided in the original data set to analyze within and across these groups, which enabled us to look for relationships, for example, between port groups and gear types. While most of the data analysis was done using the R Project for Statistical Computing (R Core Team 2012), we used Excel (Microsoft Inc. 2011) to generate most of the graphics to share with fishery participants.

Using an iterative process, we worked with collaborating fishery participants, CDFW scientists and others to build understanding of the present day fishery as well as its history. We conducted initial

interviews to elicit collaborators' range of knowledge and experience related to the fishery, including key features of the fishery's human system, factors that have affected the fishery (i.e., how fishing is done, what it looks like today) and other relevant information. We then developed three sets of summary materials for collaborator review based on our landings data analyses, which addressed: 1) the spatial distribution of total California halibut fishery activity, 2) seasonality and mobility in the fishery, and 3) fishery activity by gear group within and across port groups (APPENDIX 2). We conducted additional interviews and meetings with collaborators to follow up on these materials and to collect further input on emergent questions.

To facilitate qualitative data analysis, we compiled and analyzed data derived from the literature, interviews and other sources using NVivo qualitative data analysis software (QSR International Pty Ltd. 2012). Using codes corresponding to the themes of interest, we coded these materials, then ran queries in NVivo to produce data summaries which are the basis for this report (Appendix 3).

Results from this study provide baseline socioeconomic EFI for the California halibut fishery. Further research steps are needed to enhance its utility for management and the community including: 1) incorporating the most recent available data (2013-2015); and 2) vetting the information more broadly with the fishing, scientific and management communities (i.e., beyond the project team). As such, this is a working document that provides the foundation for continuing research.

A PROFILE OF THE COMMERCIAL FISHERY FOR CALIFORNIA HALIBUT

The commercial fishery for California halibut *(Paralichthys californicus)* is comprised of three primary gear-based sectors or groups: 1) gillnet, 2) hook-and-line, and 3) trawl. The human systems associated with these gear groups have a number of commonalities but also some key differences including fishery participants, where and how they operate, infrastructure needs, and how they are affected by and respond to changing circumstances within and beyond the fishery itself. As such, we provide information about the fishery as a whole and by these three gear groups, as appropriate.

A Brief History of the Fishery

The history of the commercial fishery for California halibut *(Paralichthys californicus)* has been documented by others (Barsky 1990; Kramer et al. 2001; Schultze et al. 2011; Tanaka 2011).[4] We provide a brief overview of that history, highlighting events and circumstances most relevant to understanding how the fishery as a human system (integrated with the ecological system) has varied and changed over time, and how it functions today.

The fishery began in 1876, when paranzella nets (a trawl net towed between two vessels) first were used in San Francisco Bay to catch groundfish (i.e., bottom-dwelling finfish) and California halibut were caught incidentally. With the introduction of gillnets and trammel nets in the 1880s, the fishery expanded southward (Schultze et al. 2011), (Tanaka 2011). In the early 1900s, trawl fishermen began to target California halibut, particularly south of Point Conception (Jow 1990). By 1915, trawling had spread to the Monterey Bay area (Alliance of Communities for Sustainable Fisheries 2010), and by the 1930s, had become well established in the Santa Barbara area in particular (Kronman 2013).

Until about 1960, the majority (well over 50% and as much as 90% in some years) of commercial California halibut landings were concentrated south of Point Conception, from Santa Barbara to San Diego (Barsky 1990; Maunder et al. 2011). Facing competition with Mexican fishermen catching the same species, California fishermen focused increasingly on the Northern Channel Islands as well as the Ventura and Santa Barbara county coasts (Barsky 1990). By the mid 1970s, California halibut was considered depleted to 14% of historic levels in southern California (Maunder et al. 2011; Tanaka 2011). By the mid 1990s, landings north of Point Conception, primarily in the San Francisco and Monterey port areas, had increased to about 40% of the annual commercial halibut catch statewide (Maunder et al. 2011), even with the implementation of the 1990 Marine Resources Protection Act, which prohibited the use of gillnet gear in most state waters in the region. In 2000, 46% of the annual California halibut catch was landed north, and 54% was landed south, of Point Conception.

Between 1950 and 2012, landings varied between about 250,000 and 1.4 million pounds per year, with no clear trend overall (Figure 1). However, average annual prices have increased fairly steadily since about 1970, exceeding $2 per pound in 1987, $4 per pound in 2006, and about $5 per pound in 2012.

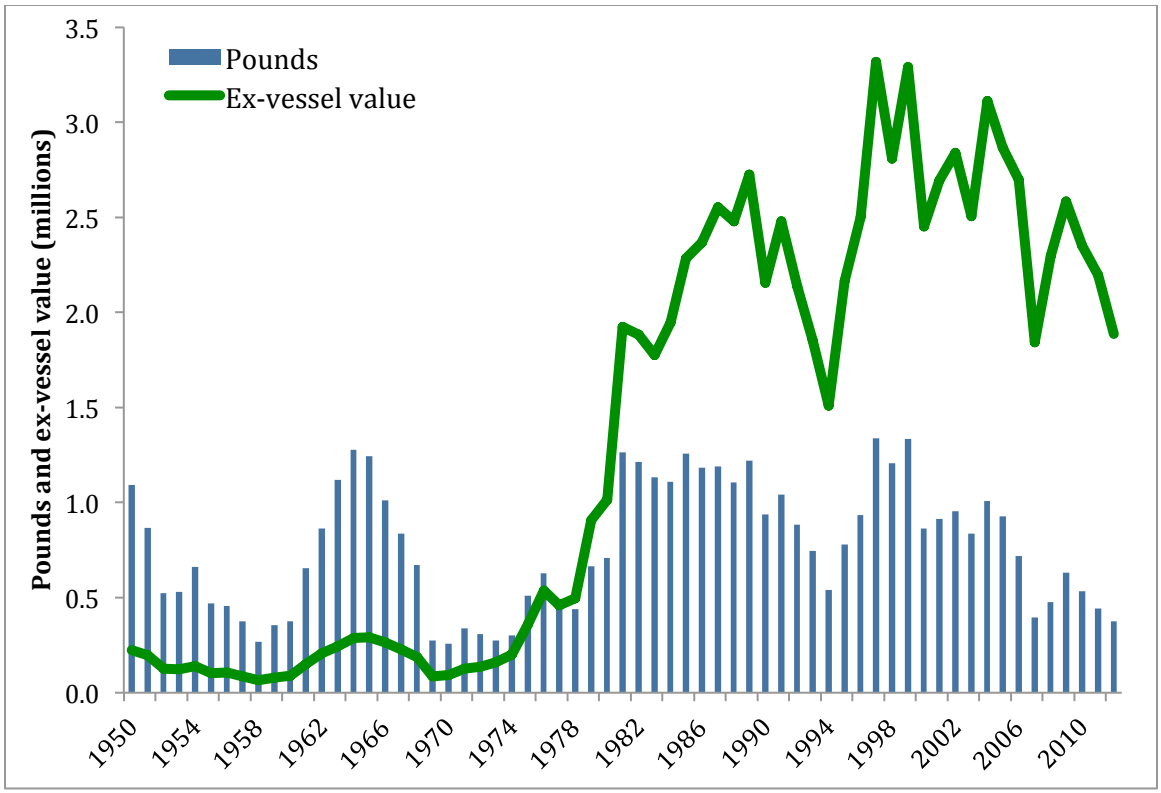

Figure 1. Statewide commercial landings (pounds and ex-vessel value) of California halibut, 1950-2012. (NMFS Annual Commercial Landings Statistics)

In recent years, the fishery has undergone considerable changes, following the implementation of new regulations primarily affecting the gillnet and trawl fisheries, emerging seafood marketing opportunities such as the live fish market, and challenges such as market competition from diverse sources of California halibut and other similar species which are treated as substitutes for California halibut from an increasingly globalized seafood system. Throughout, trawl and gillnet operations have accounted for the majority of the catch, with hook-and-line operations accounting for a considerably smaller portion of the catch.

The Present Day Fishery (2000-2012)

A fishery's human (socioeconomic) system consists of many interrelated components. These include the people (individuals, groups), their practices, the relationships that connect them, and the formal and informal rules that guide their actions, all in spatial, temporal, social and environmental context (Figure 2). Practices include how people fish, handle product, and interact with one another in the production and distribution of seafood – and in the supporting activities (i.e., providing needed goods and services) that enable fishing in the first place. Relationships include the social and economic networks among those in the fishery system, through which information, goods and services are exchanged – and impacts of change circulate. Figure 3 illustrates the key inputs, from a business perspective, into the seafood production process.

Figure 2. Components of a fishery's human system.

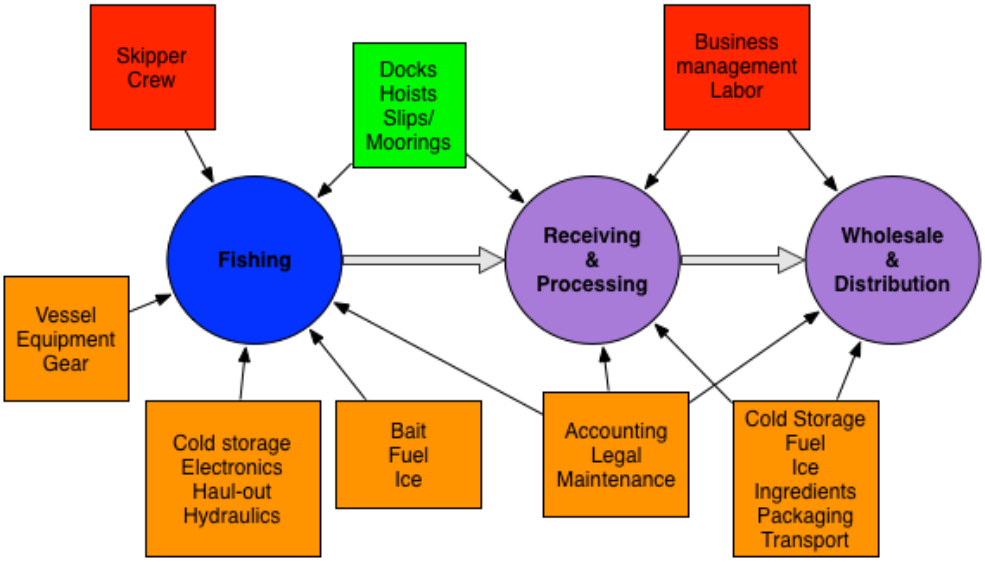

Figure 3. Economic inputs into the seafood production system.

Fishery participants

Participants in the commercial California halibut fishery include fishermen and buyers, who in turn depend on and interact with providers of supporting physical infrastructure (e.g., slips, moorings, hoists), goods (e.g., gear, equipment, groceries) and services (e.g., accounting, electrical, legal) along with resource management. We focus here on fishermen and buyers, using CFIS data and input from project participants.

Across gear groups and time periods, fishermen range widely in age (**Table 1**).[5] Notably, the average age among gillnet and trawl fishermen increased steadily from 2000 to 2012, while remaining relatively stable among hook-and-line fishermen. This reflects a general trend of reduced participation in the former two fisheries, with somewhat increased participation (including new entrants) in the latter.

Table 1. Age (mean and range) of commercial fishermen (licensees) with California halibut landings in 2000, 2006 and 2012. Overall data include two to three particpants each year whose primary gear group was other than gillnet, hook-andline or trawl. Data missing for some participants: 1 in 2000, 92 in 2006, and 138 in 2012. (CFIS data)

	2000			2006			2012		
Gear Group	**Mean**	**Range**	**N**	**Mean**	**Range**	**N**	**Mean**	**Range**	**N**
Gillnet	48	28-73	73	51	36-77	34	53	23-83	33
Hook-and-line	46	19-74	267	48	21-76	148	45	20-73	169
Trawl	46	19-78	97	51	30-79	32	56	32-74	22
Overall	46	19-78	440	49	21-79	216	48	20-83	228

Consistent with landings patterns and discussions with fishery participants, the greatest proportion (at least 40%) of California halibut fishermen reside in communities within the Santa Barbara, Los Angeles and San Francisco port groups (Table 2).[6] The Monterey and Morro Bay port groups follow, together accounting for 12-20% of licensees in the specified three years. While the proportion of licensees located in the Santa Barbara, San Diego and Monterey port groups was greater in 2012 compared to earlier years, it was lower in the other port groups, most notably Los Angeles and Morro Bay.

Table 2. Port group residence of commercial California halibut fishermen, 2000, 2006 and 2012. (CFIS data)

	2000	**2006**	**2012**
Port Group	n=441	n=308	n=366
Santa Barbara	15.2%	19%	18%
Los Angeles	15.0%	16%	12%
San Francisco	11.8%	11%	10%
Morro Bay	11.1%	6%	6%
Monterey	8.8%	6%	9%
San Diego	4.3%	5%	8%
Bodega Bay	3.9%	4%	2%
Other PGs and Inland	6.4%	3%	3%
Not Specified	20.9%	31%	32%

Residence patterns among licensees vary further by gear group and over time (Table 3). The proportion of gillnet fishermen residing in the Santa Barbara and Los Angeles (and to a lesser extent, San Diego) port groups has increased, while declining to near or actual zero in all other port groups. A similar pattern is evident among trawl fishermen, albeit with small (non-reportable) proportions remaining in other port group areas except for San Diego. Hook-and-line fishermen are distributed across a broader range of port group areas, with increasing proportions in the Santa Barbara and Monterey and San Diego port group areas, but declines in all other port group areas.

Table 3. Proportion of commercial California halibut fishermen (licensees) residing in port group counties, by port group and gear group, 2000, 2006 and 2012. (CFIS data) Blank indicates zero; • indicates data not reported to ensure confidentiality.

	2000			2006			2012		
	Gillnet	**Line**	**Trawl**	**Gillnet**	**Line**	**Trawl**	**Gillnet**	**Line**	**Trawl**
Port Group	n=73	n=268	n=97	n=35	n=223	n=48	n=33	n=296	n=30
Santa Barbara	21%	10%	24%	31%	15%	25%	36%	15%	37%
Los Angeles	27%	14%	9%	34%	15%	10%	39%	8%	13%
San Francisco		17%	6%		13%	13%		12%	•
Monterey	12%	7%	10%		7%	6%		11%	•
Morro Bay	15%	11%	8%		6%	10%	•	7%	•
San Diego	15%	3%		26%	2%		21%	7%	
Bodega Bay		5%	3%	•	4%			2%	•
Other PGs and Inland	•	8%	6%	•	5%			3%	•
Not Specified	8%	24%	33%	•	34%	35%		35%	27%

Fishing operations and practices

Gillnet fishery

The gillnet fishery for California halibut primarily uses set gillnet gear. Set gillnet fishermen most commonly use monofilament nets that are 10 to 12 feet high in sections that are 100 to 300 fathoms (600 to 1,800 feet) long. Set gillnets for California halibut have a minimum mesh size of 8.5 inches. Fishermen are allowed to fish set gillnets up to 1,000 or 1,500 fathoms in length depending on the area fished, and may divide this length into several smaller nets set at different locations. Fishermen typically set their nets to "soak" overnight, then pull (to collect the catch) and reset them for another soak, although some fishermen may soak them for two or more days, depending on fishing conditions, the practicality of returning the next day, and other considerations. Although some gillnet fishermen make day trips to set and pull gear, they typically make two- to five-day trips. Gillnet fishermen typically fish alone, but those who operate larger vessels or take longer trips may carry one or two deckhands.

Hook-and-line fishery

Hook-and-line fishermen targeting California halibut use a variety of gear types and configurations such as troll and pole-and-line gear.[7] The type of hook-and-line gear used differs among regions due to local environmental and fishing conditions, regulations, markets and demand, type of fishing vessel, other fisheries pursued (concurrently or serially, as part of an annual round), and fishermen's experience and preferences. For example, within San Francisco Bay, fishermen use rod-and-reel gear, typically with four lines and two hooks per line, flashers (which mimic movement of halibut prey) and live or fresh bait. Outside the bay, fishermen may drift or troll using "wireline" gear, which typically consists of two rods, one on each side of the boat, with 30 baited hooks attached to each rod. Some fishermen use "bounceball" gear, trolling slowly while moving the gear vertically so that a small (1- to 2-lb) sinker bounces off the bottom, attracting the bottom-dwelling halibut.

A diversity of people and operations participate in the hook-and-line fishery. Vessels range in size and functionality from small skiffs to larger multi-purpose (multi-fishery) vessels. Hook-and-line fishermen often fish alone, but may carry a crewman to assist them and/or two fishermen may fish from the same vessel, each landing his own catch and reporting on a separate fish ticket.

Trawl fishery

Trawling is prohibited in state waters, with the exception of the California Halibut Trawl Grounds off of Santa Barbara and Ventura counties, where a California Halibut Trawl Vessel Permit has been required since 2006. In 2009, the Commission adopted regulations requiring the use of "light-touch" trawl gear in the CHTG. This type of trawl gear has a lighter net and cod end, shorter head and foot ropes, no rollers or bobbins, and lighter doors than traditional trawl gear (typically 250-350 pounds rather than about 700 pounds) (Sunada et al. 2008; Wick et al. 2014). The net typically is towed just above the bottom, and may have thin chains that lightly touch the bottom, with mudlines to help guide halibut into the net. Traditional bottom-trawl nets, which only may be used in federal waters, have footropes that are from 50 to 180 feet in length, with an average of 90 feet (Frimodig et al. 2008). Trawlers typically tow from 45 minutes to an hour in the CHTG, but may tow for up to 9 hours when fishing in federal waters.

Crew size varies depending on the purpose of the trip, the particular gear used and the region. Among the light-touch trawl operations, most of which operate primarily in southern California, trawl captains typically work with one crewman. Fishermen using traditional bottom trawl gear may fish with one to two additional crew.

Infrastructure needs and uses

As with most fisheries, California halibut fishery participants' needs for fishery support infrastructure – facilities, goods and services – vary within and across gear groups. This information can be used to design and evaluate management actions while minimizing unintended consequences and to better enable fishery participants and associated port communities to adapt to change. All operations require certain types of services to support safe, efficient and effective operations at sea and dockside. These include a place to load gear and provisions, a place to unload the catch, a place to tie up or otherwise store their vessel, and fuel, whether gasoline or diesel. The particulars of these needs vary within and among gear groups. Typically, gillnetters, trawlers and larger hook-and-line gear vessels require docks for loading gear and equipment and unloading the catch, and slips or moorings to tie up. They also require other goods and services (e.g., hydraulics) to support the more complex gear, equipment and/or their vessels. Hook-and-line fishing can be done from smaller vessels, including skiffs and kayaks, which can be trailered among launch locations at harbors and at smaller, less developed sites along the coast. Across gear groups, some operations require ice to maintain their catch fresh on board while others (or the same operations at different times, depending on their intended market) may use live wells or totes equipped with aeration devices to keep the catch alive for that market.

Catch disposition and distribution

Fishermen land their catch fresh (dead) or alive, depending on the gear used, port area, and product destination. For the period 2000 through 2012, the proportion of the catch that was landed live averaged 21%, declining to 18% in more recent years (2010-2012), perhaps reflecting the reduction in live fish marketing opportunities noted by study participants. However, live landings varied considerably, with a low of 15% in 2005, 2009 and 2012 and a high of 37% in 2007, when total landings dropped to about 390,000 pounds, their second lowest for the period examined. Across gear groups, an average of 19% of the catch was sold live in 2000, 2006 and 2012. The proportion of the catch sold live by gear group was 29% for gillnet, 24% for hook-and-line and 13% for trawl gear. The "other" gear group, including traps and diving, sold 43% of its catch live.

First receivers of the catch include traditional stationary dockside buyers, mobile buyers who travel among ports to purchase the catch from fishermen, and fishermen who handle their own and perhaps others' catch, offloading it at the docks and delivering it to customers. Most of the catch,

whether fresh or live, remains in California, reaching consumers via restaurants, grocery stores and other markets, with little to no processing (Figure 4). In addition to retail sales of whole fish, fillets and steaks, California halibut sold within the state also have been popular as live fish in the Korean community (especially in the Los Angeles area), as sushi/sashimi favored by the Japanese community, and in cooked forms from fish and chips to steaks and fillets at "fine dining" restaurants.

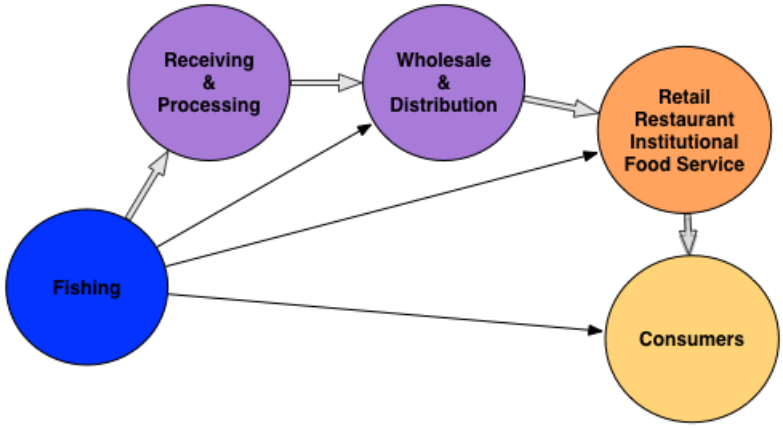

Figure 4. Seafood pathways in the commercial California halibut fishery.

In recent years, hook-and-line fishermen, along with some gillnetters and trawlers, increasingly have sold a portion (seldom all) of their catch directly to restaurants and retailers, with some also selling a portion of their catch directly to consumers via off-the-boat sales, farmers' and fishermen's markets, and community supported fisheries marketing arrangements.[8]

Price per pound is dependent on a number of factors, including the nature of the market, the quality of the catch, its condition (i.e., whether live or dead), and the presence of competing species (see Factors discussion below). Across all gear types and fish conditions (live, fresh/dead), average annual unit price (price per pound) increased fairly steadily until 2009, then declined notably, recovering somewhat over the next three years (Figure 5). Moreover, that recovery of average prices for California halibut caught using hook-and-line and trawl gear was stronger than for gillnet-caught fish. A similar pattern is evident at the port group level. However, fishery participants and others reported considerable intra-annual variation in prices (Figure 6).

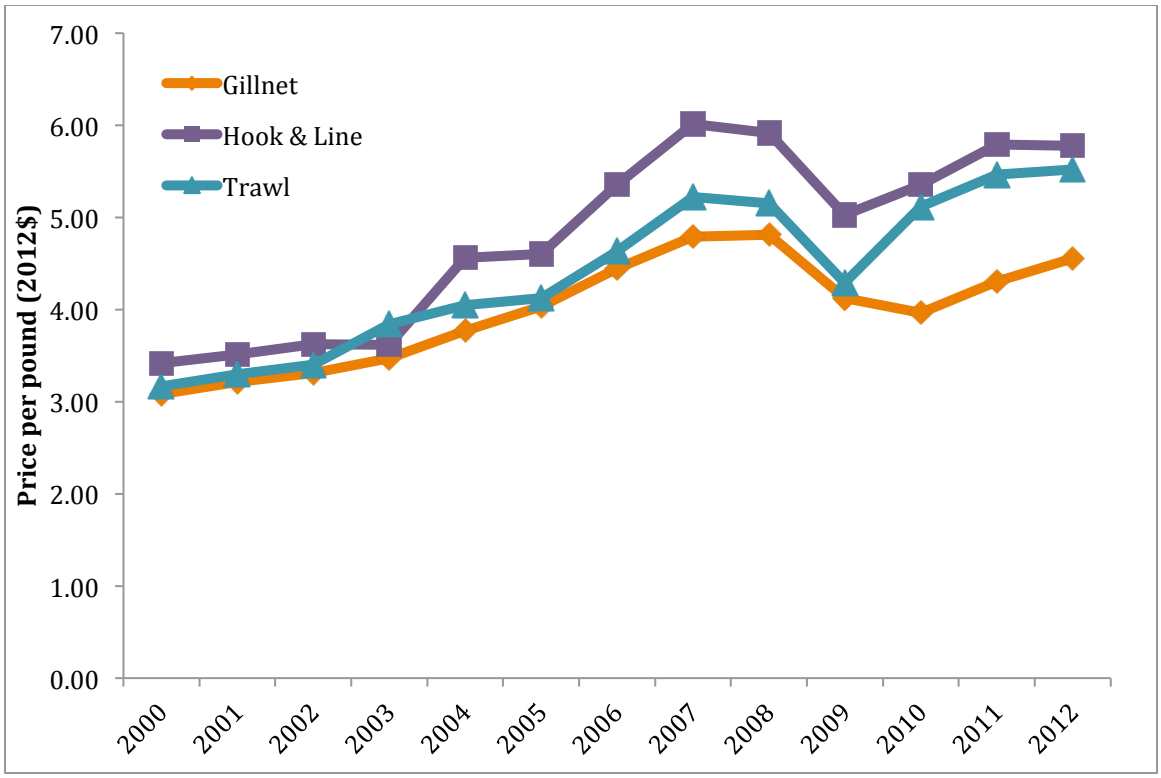

Figure 5. Average annual price per pound for California halibut, by gear group, 2000-2012. (CFIS data)

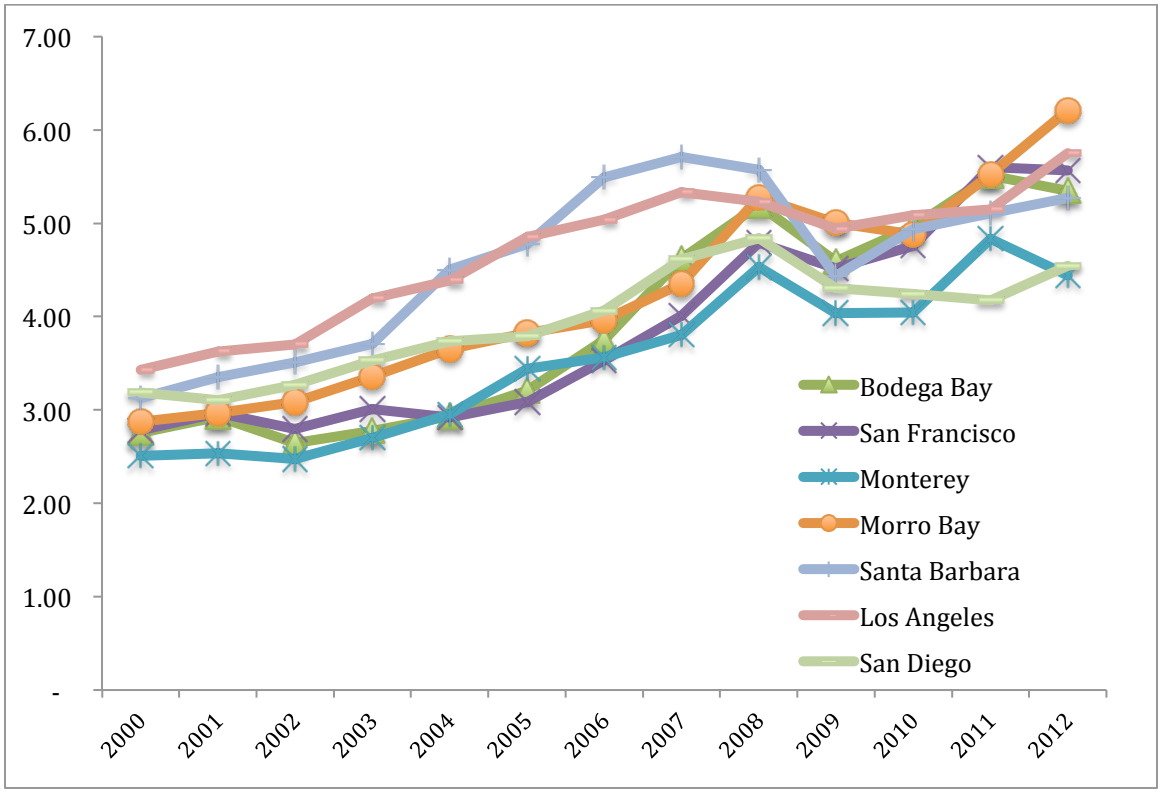

Figure 6. Average annual price per pound for California halibut, by port group, 2000-2012. (CFIS data)

Governance of the Fishery[9]

Prior to 2004, the California Legislature had primary rule-making authority for the commercial fishery for California halibut (Schultze et al. 2011). However, SB 1459 delegated that authority to the California Fish and Game Commission (Commission).[10] The CDFW implements fishery management measures as determined by the Commission and consistent with federal regulations (e.g., those specified in the Pacific Coast Groundfish Fishery Management Plan (FMP)) (Table 4). Although many management measures are used to govern the fishery, only the minimum size specification (22") is common across gear groups and locations.

Table 4. Summary of California halibut fishery management authority and measures by gear group.

	Management Authority		**Management Measures**				
Gear Group	State	Federal	Limited entry	Quotas	Time/area closures	Species size rules	Gear restrictions
Gillnet	✓	✓*	✓		✓	✓	✓
Hook-and-line	✓				✓	✓	✓
Trawl	✓	✓*	✓	✓*	✓	✓	✓

** Federal authority for the gillnet fishery pertains primarily to interactions with threatened and endangered species. Federal authority for the trawl fishery pertains to the limited entry groundfish trawl fishery, in which incidental take of California halibut is limited to 150 pounds per trip.*

Gillnet fishery

The state manages the gillnet fishery for California halibut using gear specifications and area closures (Table 4). Set gillnets used to catch California halibut are required to have a minimum mesh size of 8.5 inches (216 mm). Gillnets and trammel nets are prohibited north of Point Reyes, in state waters along the coast south of Point Conception, and within one mile of shore or 70 fathoms (whichever is less) around the Channel Islands. In 2000, the gillnet fishery was closed in waters less than 60 fathoms from Point Reyes to Point Arguello; this closure became permanent in 2002 (Schultze et al. 2011). Given the relatively shallow depth distribution of California halibut, these regulations effectively restrict the gillnet fishery to southern California, where it is further restricted by area closures (e.g., state and federal MPAs, federal Rockfish Conservation Areas (RCAs).

Hook-and-line fishery

The state also has primary management authority for the hook-and-line fishery for California halibut, with gear specifications pertaining to hook-and-line fishing for other species (e.g., salmon, nearshore rockfish), as well as to the maximum number of hooks and lines which may be used. In addition, some MPAs prohibit fishing for California halibut (among other species) in federal and/or state waters.

Trawl fishery

The trawl fishery for California halibut is managed by CDFW using gear specifications and time and area closures. Trawling in the 200-nautical square mile California Halibut Trawl Grounds (CHTG)[11] requires a California halibut trawl vessel permit (required in federal as well as state waters if targeting California halibut) and the use "light-touch" trawl gear. In addition, the CHTG are closed seasonally, from March 15 through June 15. Although the fishery is not directly (or "actively") managed by the federal Pacific Fishery Management Council, it is subject to additional restrictions

related to the federal Pacific Coast Groundfish Fishery Management Plan. Specifically, such trawlers may not have more than 500 pounds of other species on board while fishing the CHTG, and must participate in the West Coast Groundfish Observer Program.[12] The restriction on the amount of other species they may have on board when trawling for California halibut has become more nuanced with the implementation of catch shares for 29 groundfish species in the federal limited entry groundfish trawl fishery. (See Factors discussion below.)

Fishery Activity (2000-2012)

In this section, we describe fishing patterns and trends within the commercial fishery for California halibut for the period 2000-2012. To put the fishery in some perspective, based on long-term (2000-12) and recent short-term (2010-12) average landings and ex-vessel (dockside) value, the commercial fishery for California halibut accounts for a small proportion (0.1-0.2%) of state fishery activity as defined by landings (Table 5). By other measures, however, the fishery has played a larger role, accounting for 7.8-9.8% of trips, with 17.7-18.9% of boats and 29-30.3% of buyers handling California halibut.[13] Whereas California halibut landings, value and trips account for a slightly smaller proportion of activity in recent years, the proportion of boats and buyers has increased slightly. In addition, California halibut is a high-value species, with average annual dockside prices (around $5/lb) about 10 times the average dockside price for all species (around $0.50/lb), making it a valuable part of individual fishing businesses.[14]

Table 5. Comparison of fishery activity for California halibut (CHL) and all California fisheries (All CA) averaged over the long-term (2000-12) and the recent short-term (2010-12). CHL = California halibut; All CA = all species combined. (CFIS data)

	2000-12			2010-12		
	CHL	**All CA**	**CHL/All**	**CHL**	**All CA**	**CHL/All**
Landings (lbs, millions)	0.69	375	0.2%	0.4	399	0.1%
Ex-vessel value (2012$, millions)	2.8	162	1.8%	2.2	212	1.0%
Boats	345	1,952	17.7%	332	1,754	18.9%
Buyers	157	542	29.0%	138	455	30.3%
Trips	5,664	58,054	9.8%	4,139	52,892	7.8%
Price ($/lb, 2012$)	4.91	0.44		5.34	0.54	

Fishery Activity Statewide

For the period 2000-2012, an annual average of 345 boats landed about 690,000 pounds (averaging 2,006 pounds per vessel) of California halibut with an ex-vessel (dockside) value of $2.8 million. An average of 157 dockside buyers ("first receivers"), some of them also fishermen themselves, received the catch at the docks. The number of boats with landings of California halibut was highest in 2001, with 448, and lowest in 2007, at 264 boats (Figure 7). The number of buyers peaked at 225 in 2002 and reached a low of 136 buyers in 2007. Landings peaked in 2004 at just over one million pounds with an ex-vessel value of $3.1 million, declined rapidly to 390,000 pounds worth more than $1.8 million in 2007, have been more stable since without a trend, and have averaged just over 400,000 pounds for the most recent three-year period (2010-2012).

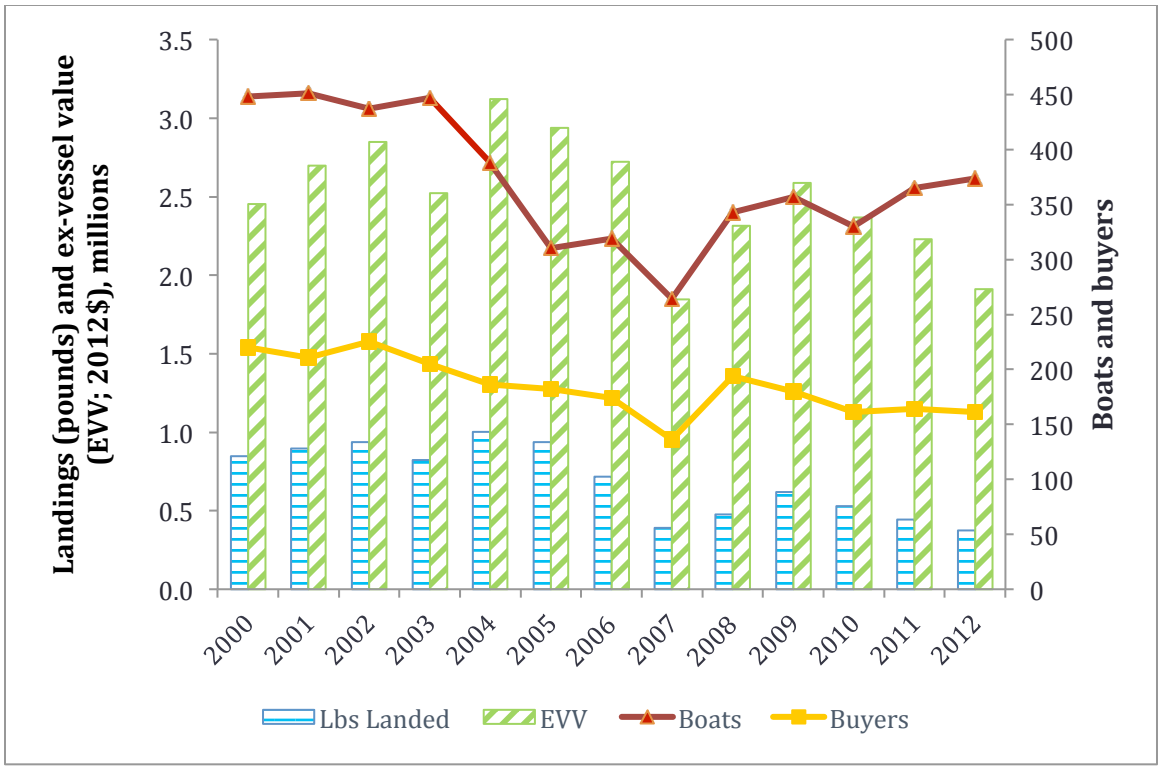

Figure 7: Statewide California halibut fishery activity, 2000-2012. (CFIS data)

In 2012 (the most recent year for which comprehensive data were available), 364 fishermen in 374 boats landed just over 375,000 pounds of California halibut at California ports. The catch was received by 161 buyers (including some fishermen handling their own catch), and had an ex-vessel (dockside) value of $1.9 million (Figure 7).

Activity in the fishery varies over the course of the year, with landings typically peaking in July and, to a lesser extent, in February, as a function of resource availability, seasonal openings and closures (e.g., the mid March through mid June closure of the CHTG), and opportunities in other fisheries that are part of a fisherman's "annual round" or "portfolio" (Figure 9). This seasonal pattern is most pronouced in the San Francisco, Santa Barbara and Monterey port groups (APPENDIX 2). The seasonal pattern in terms of active boats (i.e., those landing California halibut in a given year) is different from that for landings, peaking in the summer months when fishing conditions (e.g., weather) are better for the broader range of vessels, including typically smaller hook-and-line boats (Figure 9).

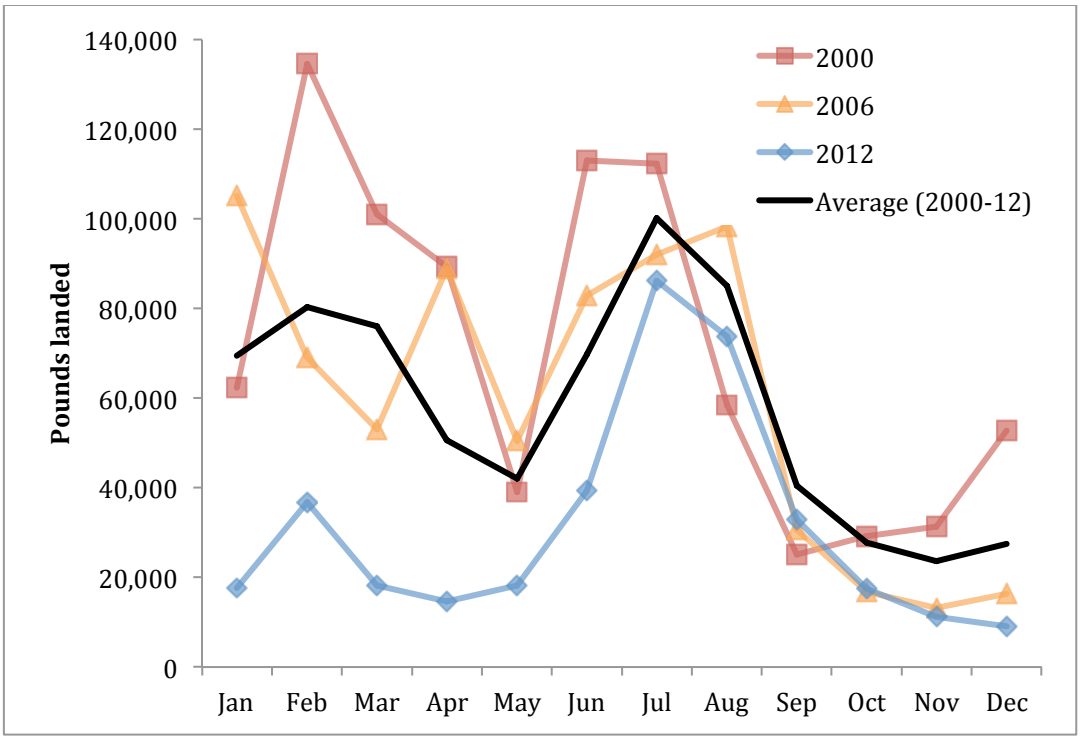

Figure 8. Seasonality of landings (pounds) in the California halibut fishery, statewide, 2000, 2006, 2012, and 2000-2012 average. (CFIS data)

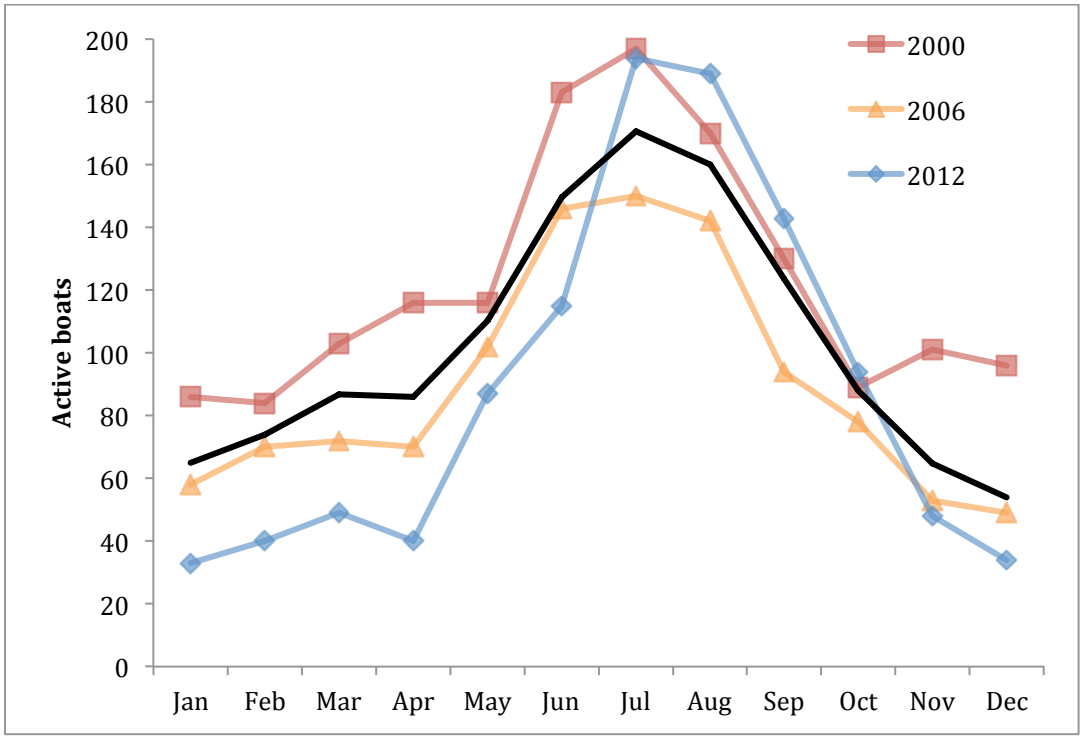

Figure 9: Seasonality of vessel activity in the California halibut fishery, statewide, 2000, 2006, 2012, and 2000-2012 average. (CFIS data)

Fishery Activity by Port Group

Activity in the fishery (measured as the number of boats with landings) varies within and across port groups, as a function of resource availability and accessibility (e.g., due to oceanographic and weather conditions), regulations, and other fishing opportunities. For the most part, however, few fishermen move among port groups. Overall, at least 92% of fishing operations landed California halibut at ports within a single port groups in 2000, 2006 and 2012 (APPENDIX 2). Trawlers were more likely than other fishery participants to deliver their catch to multiple port groups in a given year with 85-88% landing their catch in a single port area, and 12-15% landing in at least two port areas. The pattern and particular mix of port groups with trawl landings of California halibut, however, varied markedly among the three years. By contrast, 95-98% of hook-and-line fishermen and 91-93% of gillnet fishermen delivered their catch at a single port group in those three years. The proportion of hook-and-line fishermen with landings in the Monterey port group only increased steadily, more than doubling between 2000 and 2012, while declining by nearly half for the Los Angeles port group. Among gillnetters, the proportion of boats with California halibut landings in the Morro Bay port group decreased substantially (from 13% to 3%), while increasing steadily in the Los Angeles port group (from 26% to 35%) and varied widely in the San Diego port group.

Most activity (including 85% of landings) during the period 2000-2012 occurred in three port areas: San Francisco, Santa Barbara and Los Angeles, with some activity in other port areas from Fort Bragg to San Diego (Figure 10, Figure 11, APPENDIX 2).

Figure 10. Relative distribution of California halibut landings among California Port Groups, 2000-2012. (CFIS data)

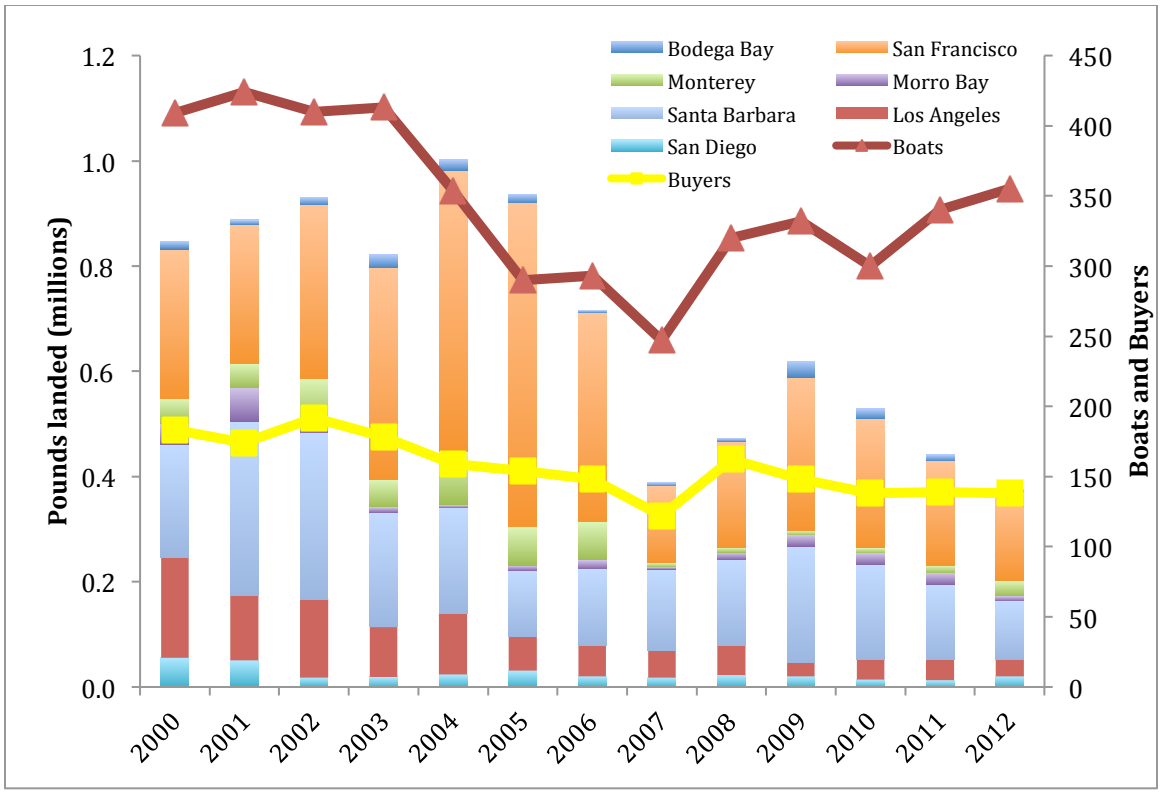

Figure 11: Pounds landed by port group and statewide number of participants in the commercial California halibut fishery, all gear, 2000–2012 (CFIS data)

Fishery Activity by Gear Group

The human systems associated with the three halibut fishery gear groups (gillnet, hook-and-line, trawl) have a number of commonalities but also some key differences including fishery participants, where and how they operate, infrastructure needs, and how they are affected by and respond to changing circumstances within and beyond the fishery itself. These differences play out in fishery activity as captured in the landings data (See Factors discussion below.) Activity by gear group varied over the study period statewide (see figures and tables below) and by port group (Appendix 2). For the period 2000-2012, trawl gear accounted for 55% and 52%, respectively, of landings and ex-vessel value, with gillnets accounted for 24% of both measures, and hook-and-line gear accounted for 24% and 21%, respectively, of landings and ex-vessel value. The breakdown for 2012 is similar (Figure 12).

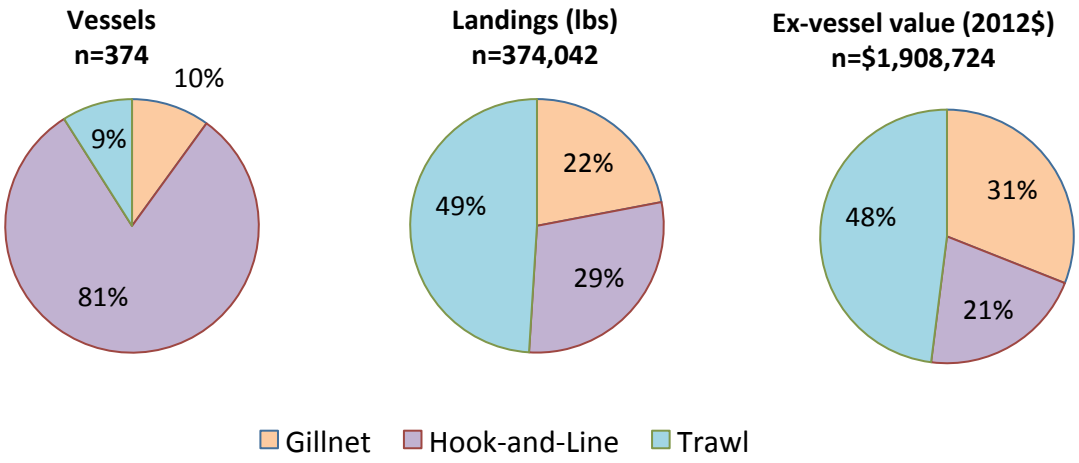

Figure 12. Landings, ex-vessel value, and number of boats active in the California halibut fishery, 2012. (CFIS data)

Gillnet fishery

Gillnet fishery activity declined overall, with the biggest differences noted for landings (-45%) and ex-vessel value (-41%) between short- and long-term activity during the 13-year period analyzed (Figure 13, Table 6). The average number of active boats declined by only 24% between the two time periods, but there was a substantial decrease in boats from 85 in 2000 to 40 in 2006, and a smaller decline to 36 boats in 2012. The difference in the number of buyers (-12%) was less dramatic, as many buyers rely on multiple species and can more readily find alternative sources or substitutes for a given species more readily than a fisherman can. Despite the general downward trend in the fishery, price increased to $4.81 per pound in 2008, dropped briefly, then increased somewhat to $4.56 per pound in 2012 (Figure 5).

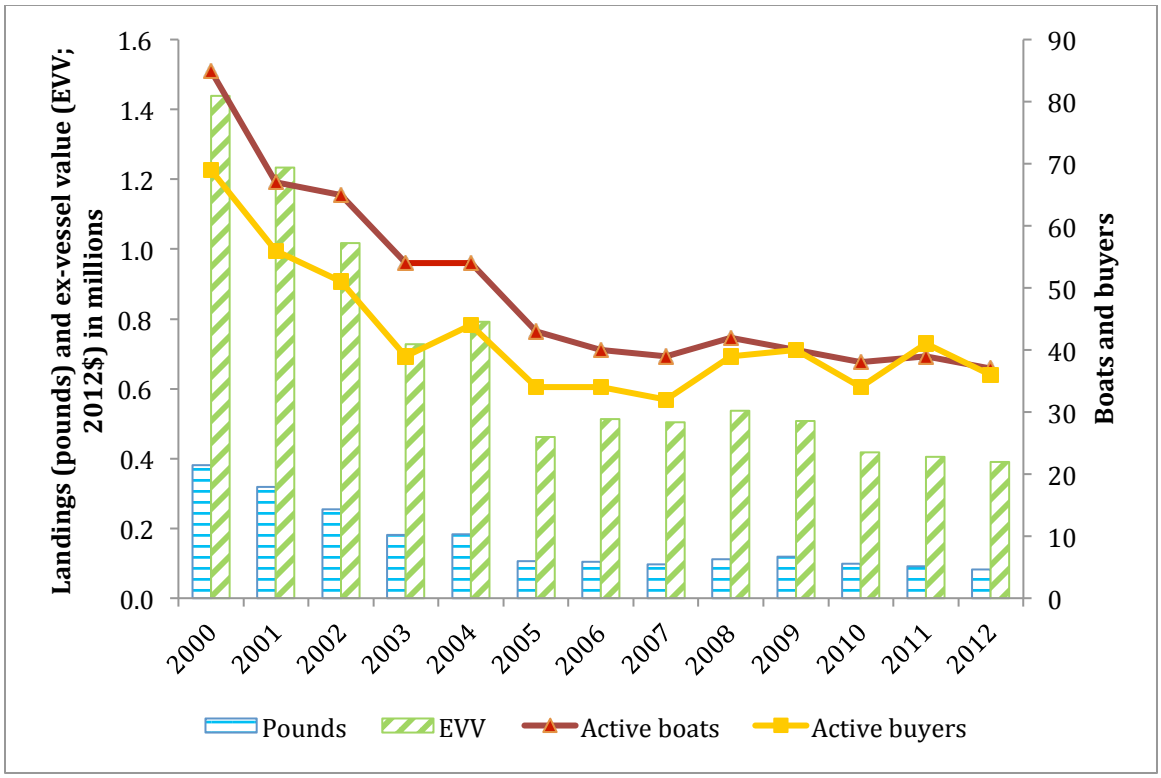

Figure 13. Statewide California halibut commercial *gillnet* fishery activity, 2000-2012. (CFIS data)

Table 6. Summary measures of fishery activity for the statewide California halibut commercial *gillnet* fishery, 2000-2012. (CFIS data)

	Long-term average 2000-2012	Recent average 2010-2012	Percent difference
Landings (lbs)	163,939	90,905	-45%
Ex-vessel value (2012$)	688,288	404,325	-41%
Boats	49	38	-23%
Buyers	42	37	-12%
Trips	1,735	1,041	-40%
Price ($/lb, 2012$)	4.51	4.60	2%

Hook-and-line fishery

The commercial hook-and-line fishery for California halibut experienced different patterns in activity than the gillnet and trawl fisheries (Figure 14, Table 7). Average annual landings and trips over the short term were only somewhat lower (8-15%) than over the longer term, while prices were somewhat higher (8%). Landings and ex-vessel value varied year-to-year during the period, peaking at about 220,000 pounds in 2003 and about $940,000 in 2008, then declined slightly thereafter to about 110,000 pounds with an ex-vessel value of about $600,000 in 2012. Participation peaked at 319 boats in 2001, then dropped through 2007, and increased again to 302 in 2012. The number of buyers has followed a similar, if less pronounced, pattern, peaking at 154 buyers in 2002 and declining to 109 in 2012. The increase in landings from 2000 through 2003 occurred as the nearshore rockfish fishery became increasingly constrained by catch limits and institution of a Nearshore Fishery Permit in 1999 to begin to reduce the number of participants in

that fishery, followed by the adoption of a regional restricted access program as part of the 2002 Nearshore FMP that substantially curtailed the number of nearshore fishery participants. The uptick in all measures from 2007 to 2008 is attributed in large part to the 2008 (and 2009) commercial salmon season closure and associated with increased price per pound.

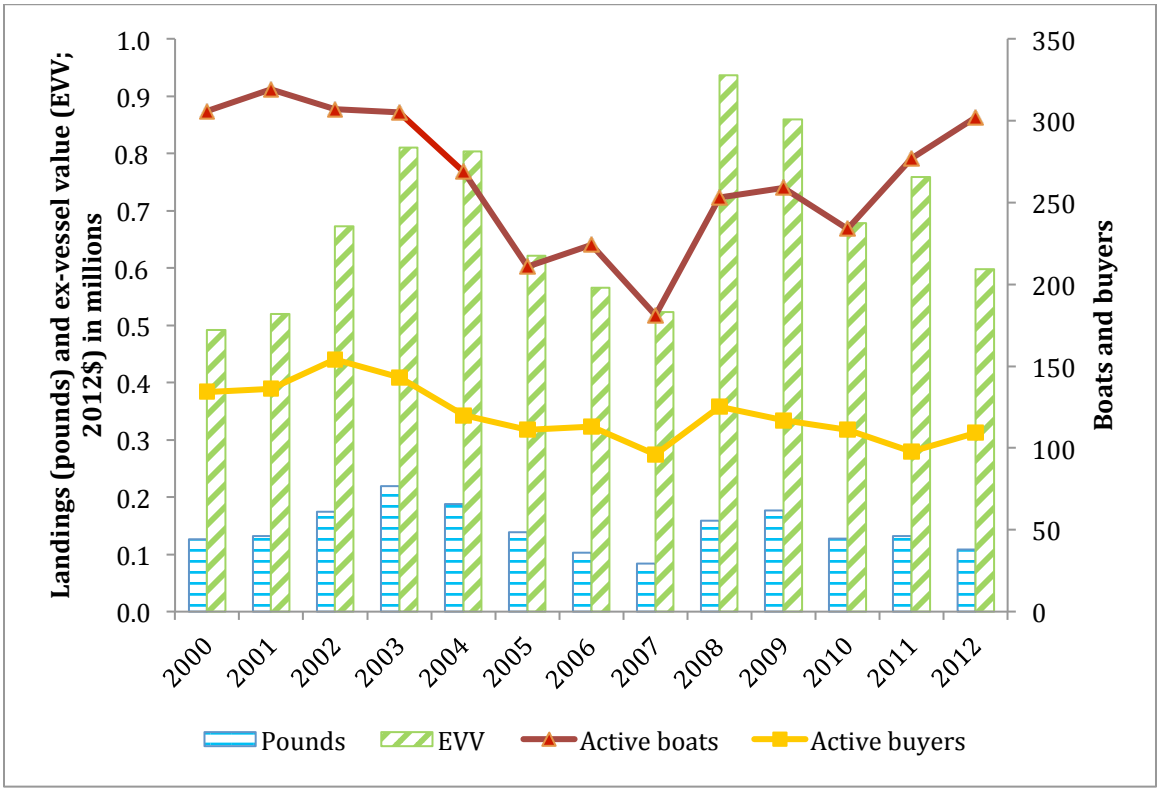

Figure 14. Statewide California halibut commercial *hook-and-line* fishery activity, 2000-2012. (CFIS data)

Table 7. Summary measures of fishery activity for the statewide California halibut commercial *hook-and-line* fishery, 2000-2012. (CFIS data)

	Long-term average 2000-2012	Recent average 2010-2012	Percent difference
Landings (lbs)	143,919	122,790	-15%
Ex-vessel value (2012 $)	679,882	678,392	0%
Boats	265	271	2%
Buyers	121	106	-12%
Trips	2,171	1,995	-8%
Price ($/lb, 2012$)	5.34	5.75	8%

Trawl fishery

Overall, recent short-term activity in the trawl fishery was lower than activity over the longer term, most notably for landings, boats and trips (Figure 15, Table 8). Landings and ex-vessel value increased early in the 13-year period, then dropped substantially from 2006 to 2007, stabilizing from 2008 onward at around 300,000 pounds per year with an ex-vessel value of about $1 million per year through 2012. Ex-vessel value was somewhat lower in recent years, despite higher ex-vessel prices (+12%) in the near term compare to the long term. Participation in the fishery

dropped substantially between 2000 and 2007, most notably from 90 boats in 2003 to 61 boats in 2004, attributed in part to the federal groundfish trawl buyback and related measures. Participation dropped further to 34 boats by 2007 following the 2005 Central Coast trawl buyback by The Nature Conservancy (with some effort being redirected into the hook-and-line fishery) and the implementation of SB 1459. In subsequent years, participation was more consistent, with 30 to 40 trawlers landings California halibut annually.

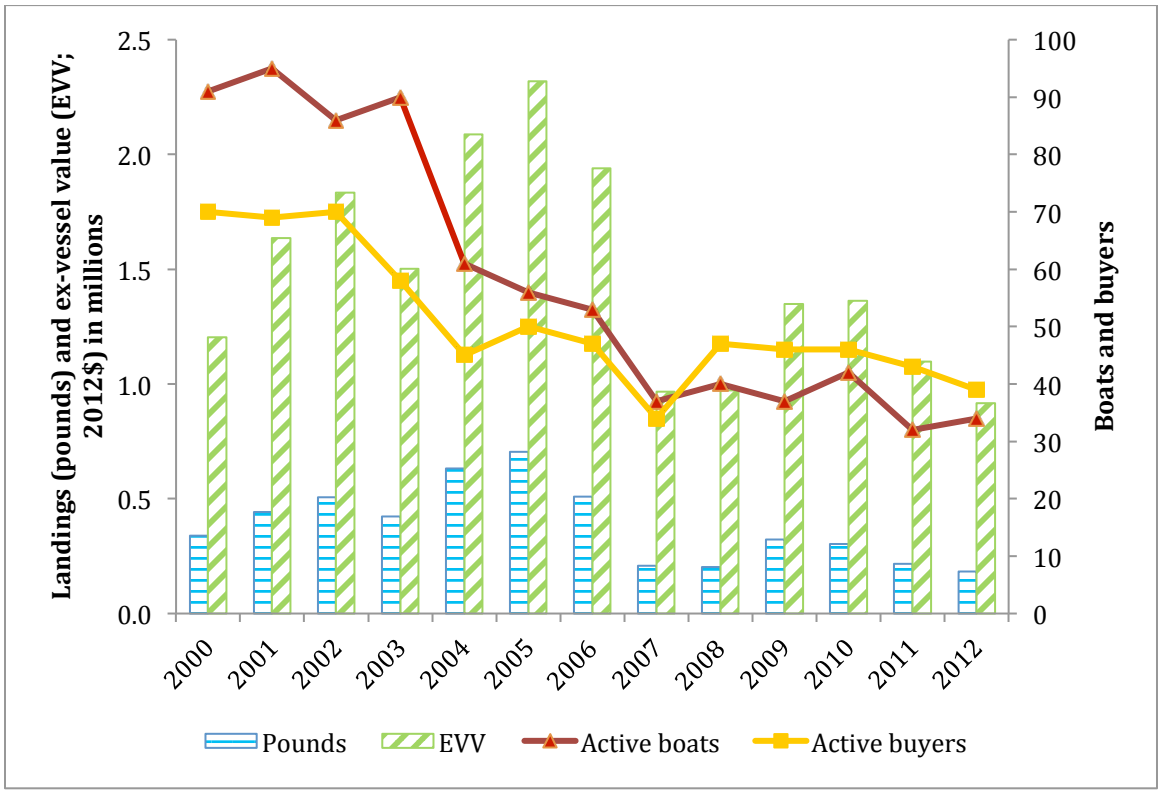

Figure 15. Statewide California halibut commercial *trawl* fishery activity, 2000-2012. (CFIS data)

Table 8. Summary measures of fishery activity for the statewide California halibut commercial *trawl* fishery, 2000-2012. (CFIS data)

	Long term average 2000-2012	Recent average 2010-2012	Percent difference
Landings (lbs)	383,976	234,145	-39%
Ex-vessel value (2012 $)	1,475,666	1,125,122	-24%
Boats	58	36	-38%
Buyers	51	43	-16%
Trips	1,731	1,069	-38%
Price ($/lb, 2012$)	4.89	5.46	12%

Factors Affecting the Fishery

A range of economic, environmental and regulatory factors affect the commercial fishery for California halibut. In some cases, these factors affect the fishery statewide and across gear groups; in others, they are more specific to one or more port groups and/or gear groups. Moreover, interactions among factors can affect the fishery in ways that any single factor may not. The following are some highlights based on our work to date that provide insights into the human dimensions of the fishery system and can be used to inform evaluation of management and other questions that may arise in the future.

Economic

Based on interviews with the project participants, we identified several economic factors that have affected fishery participation by fishermen and buyers including:

- Fixed and operating costs – permits, fuel, infrastructure
- California halibut's role in fishing and livelihood
- Supply – limited access, resource availability
- Demand – foreign competition, live fish, local food movement

Fixed and operating costs have affected all gear groups within the fishery, some more so than others. Hook-and-line operations typically have the lowest fixed and operating costs, followed by gillnet and trawl operations. These costs can vary considerably within a given gear group, depending, for example, on the size of the vessel and area fished (which affect fuel use and cost), the specific gear configuration (e.g., troll versus rod-and-reel, traditional bottom-trawl versus light-touch trawl). The costs of entry into the fishery vary markedly, with the hook-and-line fishery being the most economically (and practically) accessible; the fishery is open access, with no special permits required, and the investment in a boat, equipment and gear is relatively low (typically less than $10,000 by one estimate). The low cost of entry together with the relatively high price for the fish (whether fresh or live) has enabled increased participation by individuals who fish commercially part time, relying on other income for their livelihood.[15] By contrast, entry and sustained participation in the gillnet or trawl sectors of the fishery is more costly, given the higher cost of purchasing and maintaining gear, equipment and vessels and the additional permits required. (Permit costs include agency fees and, to the extent permits are transferable, the purchase or lease price.)

Study participants from all gear groups cited increasing fuel costs as an economic factor impacting their fishing activity. For gillnet and trawl fishermen these costs are related to traveling further from shore to areas where fishing is permitted. Among trawlers, high fuel prices also have discouraged travel to other port group areas where the fishing is reported to be good, something they would have done in the past. Fuel costs have contributed to decisions by some hook-and-line fishermen to fish together (two fishermen, one boat), as well as trailering their boats rather than paying slip or mooring fees. Trawlers and gillnetters cited slip fees, which vary widely by port. Trawlers also noted the increasing costs of hauling out for vessel maintenance. Gillnetters and trawlers also cited increased costs related to regulatory actions as a major factor affecting their business such as Vessel Monitoring Systems required for set gillnet operations (initial unit cost and a monthly service fee) and fees associated with the new onboard observer requirements (associated with the West Coast Groundfish Observer Program). The costs of supporting crew also factor into decision-making, with captains increasingly opting to fish alone or with fewer crew, which study participants noted has had negative implications for safety, especially for those who now fish further from the coast.

Fishermen from each gear group provided a rough idea of the minimum amount of California halibut catch that would generate sufficient revenue to cover costs and provide income for themselves (and crew). (Especially in the gillnet and trawl fisheries, multiple marketable species often are caught during, and contribute to earnings for, a trip.) Estimates are very rough, but begin at about 30-40 pounds of California halibut for hook-and-line, 50 pounds for gillnet, and 200 pounds for trawl gear. However, the number, size and condition (live/dead) of the fish matters, with some buyers grading the catch and paying accordingly. More generally, and critically important, California halibut is not a stand-alone fishery as some other California fisheries arguably are (e.g., salmon, crab). Across gear groups, analyses of species mixes for trips that included California halibut indicate that multiple species groups were landed as well on some trips. An estimated 14-32% of hook-and-line trips across three sample years (2000, 2006 and 2012) included landings of other species. About 67-72% of such gillnet trip and 64-78% of such trawl trips included landings of other species as well. Moreover, most fishermen and buyers rely on a mix of species and fisheries (including fisheries using different gear types) over the course of the year.

Similarly, buyers and processors incur costs that vary depending on where and how the product is received and handled, and whether and how it is stored, processed, packaged and distributed. These activities require different types and levels of inputs such as physical infrastructure and utilities, and labor, equipment and supplies. Whereas some buyers have dockside receiving stations, others do not, instead using trucks to collect the catch at the docks (via public hoists or other buyers' offloading stations), or relying on fishermen to bring the catch to them at their handling facilities. Some buyers are itinerant, traveling among ports to buy the catch from fishermen and delivering it to restaurants and retailers in various parts of the state (and to a limited extent in Nevada). Among more mobile buyers, especially, the costs of transportation have become a key consideration in view of reduced fishing opportunities for trawl and gillnet fishermen.

Supply and demand vary, in turn affecting the number of sales and prices paid to fishermen and buyers for California halibut. Supply varies widely due to the availability of and access to the resource per se, which in turn are affected by environmental and regulatory conditions (see below). Historically, there has been ample market for the catch. However, inconsistent supply has become an issue in some cases, contributing to the loss of local and regional markets, as occurred for some fishery participants following gillnet restrictions in the 1990s and early 2000s and subsequent trawl closures following the passage of SB 1459.

Across gear groups, fishery participants noted that the amount of halibut they land affects their decisions whether to sell to a buyer at the docks, an offsite buyer, or directly to consumers. For example, one trawler noted that if he brought in a relatively small load (e.g., 200 pounds), he would sell to a smaller buyer who could distribute the product quickly to local or regional customers; with a larger load, he would sell to a larger buyer who was better equipped to offload and sell larger quantities of fish.

Sources and types of demand differ by region and have changed as a result of several factors. The demand for live California halibut has been stronger in southern California (especially in the Los Angeles area) compared to northern California, especially from the Korean, and to a lesser extent the Chinese community, reflecting differences in cultural preferences for the product. However, in recent years, competition with overseas product - live cultured fish that is similar (as viewed by most consumers) but genetically unrelated to California halibut and more consistently available - has increased, reducing sales of California halibut through that southern California market. Conversely, the demand for live seafood in the San Francisco Bay area historically has not included

California halibut, but a small, limited market has emerged recently. At the same time, growing demand for fresh, locally caught seafood in the state's urban centers from San Francisco to San Diego has afforded enhanced opportunities for fishermen and wholesalers selling fresh California halibut.

With California halibut as one species among many that fishermen catch as part of their "annual round" or "portfolio," changing demand and prices for any of those species can affect participant effort and supply. In the early to mid 2000s, for example, Monterey Bay area trawlers turned to California halibut in response to limited fishing opportunities for other species (e.g., thornyheads) and demand from live fish buyers serving the San Francisco Bay area Chinese market. However, the Chinese market for California halibut reportedly collapsed in the fall of 2004, and as one fishery participant noted, "It's nice to have the live market, but you can't count on it for the long term." In southern California, high demand and strong prices for invertebrate species (e.g., shrimp, sea cucumber) together with spatial and temporal constraints on trawling for California halibut have resulted in those fishermen focusing more consistently on those invertebrate species, which are more readily available.

Environmental

California halibut typically inhabit sandy bottom areas, but their availability to the fishery varies considerably over time and space in response to oceanographic conditions and other factors (e.g., (Barsky 1990) (Jow 1990) (CDFG Marine Region 1995, 2002; Reilly et al. 2011)). Previous stock assessment studies have determined that stocks north of Point Conception are healthier than those south of Point Conception (Maunder et al. 2011), noting the role of habitat, oceanographic conditions and other factors in recruitment success.

Fishery participants likewise noted the variable availability of the resource over space and time. Across gear groups, fishermen characterized the availability of California halibut as patchy and often unpredictable, citing day-to-day weather and ocean conditions as well as seasonal conditions as factors that influence fishing activity and production. For example, California halibut are thought to move offshore to deeper water in late Fall in central California. Fishermen described a diversity of indicators (e.g., moon phase, bait availability) and strategies they and others use to find and catch California halibut. This often was related to how the behavior of California halibut affects its catchability by gear type: the fish need to be biting to be caught by hook-and-line, swimming to be caught by gillnet, and on or near the bottom to be caught by trawl. Further, spatial restrictions on fishing together with vessel and gear practicalities can put the fish out of reach for some fishermen/gear groups. When this happens they often switch to other fisheries until the halibut are catchable.

Management

Management actions (especially regulations) affecting the commercial fishery for California halibut include those that are specific to the fishery and/or the gear used (which usually can be used to catch other species) and those that affect other directly or indirectly associated fisheries. Spatial closures in particular affected all fishery participants. Regulation of other fisheries had differential effects on gear groups. Whereas actions taken to curtail the nearshore and salmon fisheries reportedly contributed to increased activity in the hook-and-line fishery for California halibut, groundfish fishery regulations complicated some trawlers' efforts to participate in the California halibut fishery. These factors and effects are best understood by considering each gear group involved in the California halibut commercial fishery in turn, and the particular fishery mixes common to each. Nonetheless, a number of management actions were identified as key factors affecting the fishery during the period 2000-2012.

Gillnet fishery
Over the past several decades, the use of gillnet gear has been increasingly constrained, with regulations prescribing gear configurations and timing and location of use. By 2000, the fishery had been sharply curtailed in state waters, such that it has virtually ended north of Point Conception and has been very limited to the south, with logbook and observer requirements and extensive spatial restrictions. The spatial closures, in particular, have limited gillnet operations to a relatively small area where their gear is less effective for catching Californian halibut than in other areas that previously were open to fishing.

Hook-and-line fishery
Few regulations directly affected the hook-and-line fishery for California halibut, per se. More salient for the hook-and-line fishery is the management of other species commonly caught using the same gear. The most notable example from the 2000-2012 period is the closure of the commercial salmon fishery in 2008 and 2009. Whereas some fishermen commonly catch salmon and California halibut on the same trip, participation and catches of California halibut clearly increased during this time – and continued even after the salmon fishery reopened in 2010. Another example cited by hook-and-line fishery participants is the Rockfish Conservation Areas, the establishment of which has led to crowding in some areas that remain open. Likewise, the implementation of MPAs between 2007 and 2012, pursuant to the state's Marine Life Protection Act, closed an estimated 14% of state waters with potential California halibut habitat, primarily affecting the hook-and-line fishery.

Trawl fishery
The trawl fishery for California halibut (and for all other species) has been the subject of extensive management activity throughout California since the early 1900s, with recent years no exception. As noted earlier, several actions have affected participation in the fishery.

In 2004, SB 1459 closed state waters to bottom trawling (for all species), with the exception of the CHTG, and established criteria for the CHTG to remain open and for new areas to be opened to bottom trawling. Ultimately, this resulted in the closure of some of the previously established CTHG and closure of Monterey Bay with enforcement of its decades-earlier designation as state waters. A series of changes in the federal groundfish fishery, including the implementation of catch shares for 29 groundfish species in 2011, resulted in a particularly complex set of rules that affect where, when and how trawlers can fish not only for groundfish, but also for California halibut, making it more difficult to participate in both fisheries concurrently.

Future of the fishery
The fishery for California halibut is complex in its own right and as part of the larger fishery system in which it is embedded within and beyond California. The fishery contributes to the livelihood of its participants, to the communities, ports and businesses that provide supporting facilities, goods and services, and to consumers, primarily in California. Within and across gear groups, the fishery faces challenges, some of which are outlined in the factors noted above. At the same time, the fishery affords opportunities to complement or supplement activity in other fisheries, supporting fisheries and fishing communities as a whole. For example, the hook-and-line fishery for California halibut is one of the few open access commercial fisheries in the state. The foregoing discussion illustrates the complexities of the fishery, the issues that confront it, and the role these and other factors may play in future decisions by fishery participants, ports and other support providers, and resource managers.

Process: Generating and using socioeconomic EFI

The foregoing provides highlights of our efforts to document and describe the human system associated with the commercial fishery for California halibut. It has been developed (and continues to develop) through an iterative process of analyzing available data, eliciting the input of knowledgeable fishery participants, scientists and managers, and integrating information to build understanding about the fishery and its dynamics. The process also has afforded insights on how to carry out such work in the future, in a way that is both manageable and productive. Future efforts to apply this process will enhance the availability of socioeconomic EFI for this and other fisheries.

ENDNOTES

[1] Also pursuant to SB 1459, additional portions of the CHTG were closed in 2005, with one additional area closed in 2008, because they were determined to not meet the criteria established in SB 1459. As of 2016, about 75% of the original CHTG remains open.
[2] The recreational fishery for California halibut also bears consideration in its own right and because of the various ways it interacts with the commercial fishery, but was beyond the scope of this small grant project.
[3] More recent data were not provided prior to the end date of this project, but are important for further understanding the impacts of management decisions on the socioeconomic aspects of the California halibut fishery.
[4] California Fish and Game Fish Bulletin 174 (Haugen 1990) provides a thorough description of the fishery through the late 1980s.
[5] The CFIS data include licensees' date of birth for most fishery participants. Commercial fishing licensees were assigned to the gear group with which they landed the largest proportion of their California halibut landings in that year. Less than 1% of participants had California halibut landings using more than one gear group in a given year. Analogous data are not available for buyers.
[6] As indicated by the "Not Specified" category in Table 2 and Table 3, CFIS data on licensees' address are incomplete. Also, we did not assign those with an inland county address to a particular port group.
[7] See the Discover California Commercial Fisheries website for more information on gear types.
[8] See the Market Your Catch website for information on seafood alternative marketing approaches.
[9] This profile focuses on management most relevant to this profile, which primarily addresses the period from 2000 to 2012. See fishery Schultze et al. (2011) for a complete regulatory history of the
[10] Although SB 1459 focused on the trawl fishery, it also "granted authority over other types of gear targeting the same species as the bottom trawl fisheries" including California halibut (CDFW 2014).
[11] In 1971, the California Legislature restricted trawling for California halibut to designated "California Halibut Trawl Grounds" (CHTG), defined as the area adjacent to Santa Barbara and Ventura Counties (from Point Arguello to Point Mugu) at least one nautical mile from shore and no greater than 25 fathoms deep (Frimodig et al. 2008), (Kronman 2013). Over time, the CHTG have been amended.
[12] Following implementation of the catch share program in the federal limited entry groundfish trawl fishery in 2011, all such trawlers are required to carry an observer on every trip; "open access" vessels (i.e., those that do not have a federal groundfish limited entry permit) are selected, using stratified random sampling, to carry an observer for a two-month period each year (https://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/halibut_trawl.cfm, accessed 4/12/16).
[13] Counts of boats, buyers and trips include all trips (defined as a unique vessel-date combination) where at least one California halibut was landed. Boats are a proxy for commercial fishing captains, although two or more individuals fishing from the same boat each may land his own catch. Buyers include some fishermen handling their own (and perhaps others') catch.
[14] Ex-vessel prices for California landings vary widely across species. In many cases, the unit price ($/lb) was recorded on fish tickets as $0.00, making analysis of prices difficult. Of the California halibut landings records examined, 1% had a unit price of $0.00, while 3% of the landings records for other species did. As unit price is dependent on species, gear, condition, size, port, date and other factors, unit price for these landings could be imputed after categorizing the landings by all these factors. In our calculations to compare unit prices, we omitted all such 0 values.
[15] This situation constitutes an opportunity, but also has been a source of tension among some fishery participants.

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APPENDIX 1: CALIFORNIA FISHERIES INFORMATION SYSTEM DATA HANDLING AND ANALYSIS

The California Department of Fish and Wildlife (CDFW) provided original landings data for the project in comma-separated value files (flat files) of fish tickets, vessels, buyers and licenses. CDFW also provided a key explaining the contents of each field in each file. Due to the large number of records, we used the R language for statistical computing to evaluate the file contents.

The initial analysis involved examining the values in the fields of each file, comparing the contents to the intended uses, identifying records with missing values or values that appeared confusing, and consulting with CDFW to better understand and resolve issues. For each field, we recommended a remedy to allow us to progress with the data analysis, and spoke to CDFW data managers to ensure the proposed remedy would not introduce inconsistencies into the data. The initial data were not modified, but we made a copy of each file and added fields to assist in our analysis.

To simplify data visualization, we classified each landing by port group, species group and gear group. Port groups were based on the CDFW groupings, species groups were based on genus, species and which species are managed together, and gears were classified by type into the groups gillnet, hook-and-line, trawl, and other. We further coded port groups to list them in order from north to south. We also added combination fields to make it easy to graph, for example, vessels active each year, or the price paid for fish caught with each gear type. We used Microsoft Excel to produce most graphs.

In three cycles, we provided sets of graphical representations of the data to collaborators, and asked them to tell us what they saw in the data, and to explain changes or suggest causes, where they could. With each iteration, we received new questions from our collaborators, and returned to the data to find answers to their questions. Collaborators' questions also raised additional questions for us to explore. In retrospect, we could speed up this process by asking collaborators and principal investigators to make a list of all their questions at the outset, and configure the dataset to answer all the questions provided before sending out the initial set of graphics. We expect we would still have additional questions and associated investigation after each review, but could reduce the amount of data analysis required between steps.

APPENDIX 2: FISHERIES DATA SUMMARIES FOR COLLABORATOR REVIEW

Set 1: Overview of commercial fishery activity for California halibut, 2000-2012

Questions to guide your review

1. Where the charts show noticeable changes in fishery activity (in landings, value, active boats or active buyers), what caused that to happen? Examples of causes might include: climate or weather conditions, availability of California halibut or other species, changes in market conditions or regulations, or anything else that could affect fishing activity.

2. How, if at all, did these events or changes affect how fishing, receiving, and distribution work in the California halibut fishery?

3. Have there been any substantial events or changes in the fishery that are not clearly indicated in the data as presented?

4. After reviewing the charts in this package, do you have questions about the recent history of the fishery that we might be able to answer by exploring the data further?

5. What additional information do you think we should gather to better understand how the fishery works?

6. Whom (beside yourself!) do you consider to be knowledgeable about the fishery?

Set 1: California halibut commercial fishery activity, 2000-2012

For the charts that follow, please note:
All data shown represent the activity of at least three boats and three buyers.
Ex-vessel value is abbreviated as EVV.
The left-hand vertical axis (labeled as "pounds," "ex-vessel value" or both) shows values for the ***bars*** on each chart.
The right-hand vertical axis (labeled as "boats and buyers") shows values for the ***lines*** on each chart.
Port groups and associated primary ports* include:

Eureka**
- Crescent City
- Trinidad
- Eureka/Fields Landing
- Shelter Cove

Fort Bragg**
- Fort Bragg/Noyo Harbor
- Albion
- Point Arena

Bodega Bay
- Bodega Bay
- Bolinas

San Francisco
- Sausalito
- Richmond
- Oakland
- San Francisco
- Princeton-Half Moon

Monterey
- Santa Cruz
- Moss Landing
- Monterey

Morro Bay
- Morro Bay
- Avila/Port San Luis

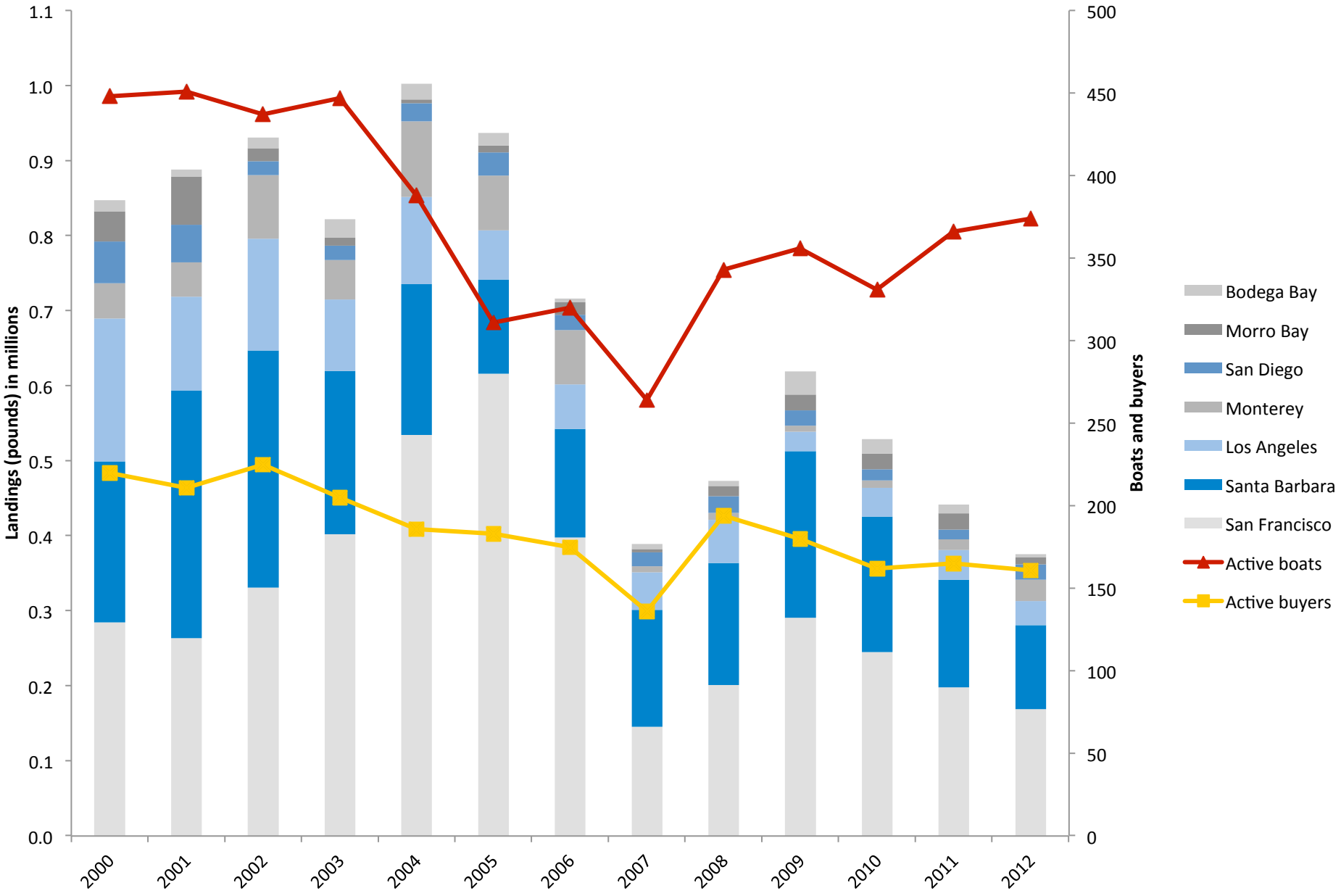
Santa Barbara
- Santa Barbara
- Oxnard/Channel Islands Harbor
- Ventura
- Port Hueneme

Port of Los Angeles
- Redondo Beach
- Los Angeles
- San Pedro
- Terminal Island
- Long Beach
- Huntington Beach
- Newport Beach
- Dana Point

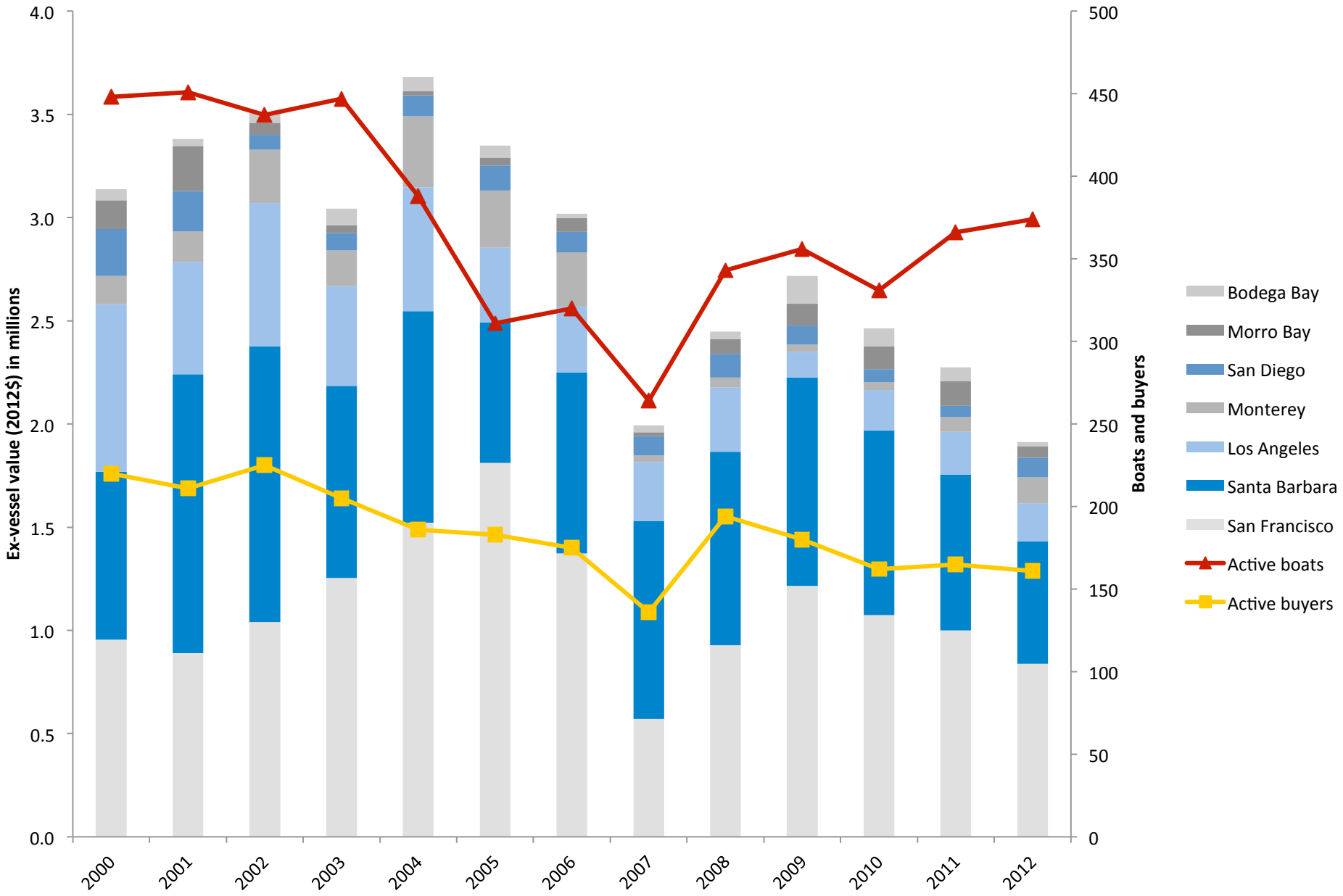
San Diego
- Mission Bay
- San Diego

***** Each port group also includes several other smaller ports and landings sites.
****** Eureka port group and Fort Bragg port group data not presented to ensure confidentiality.

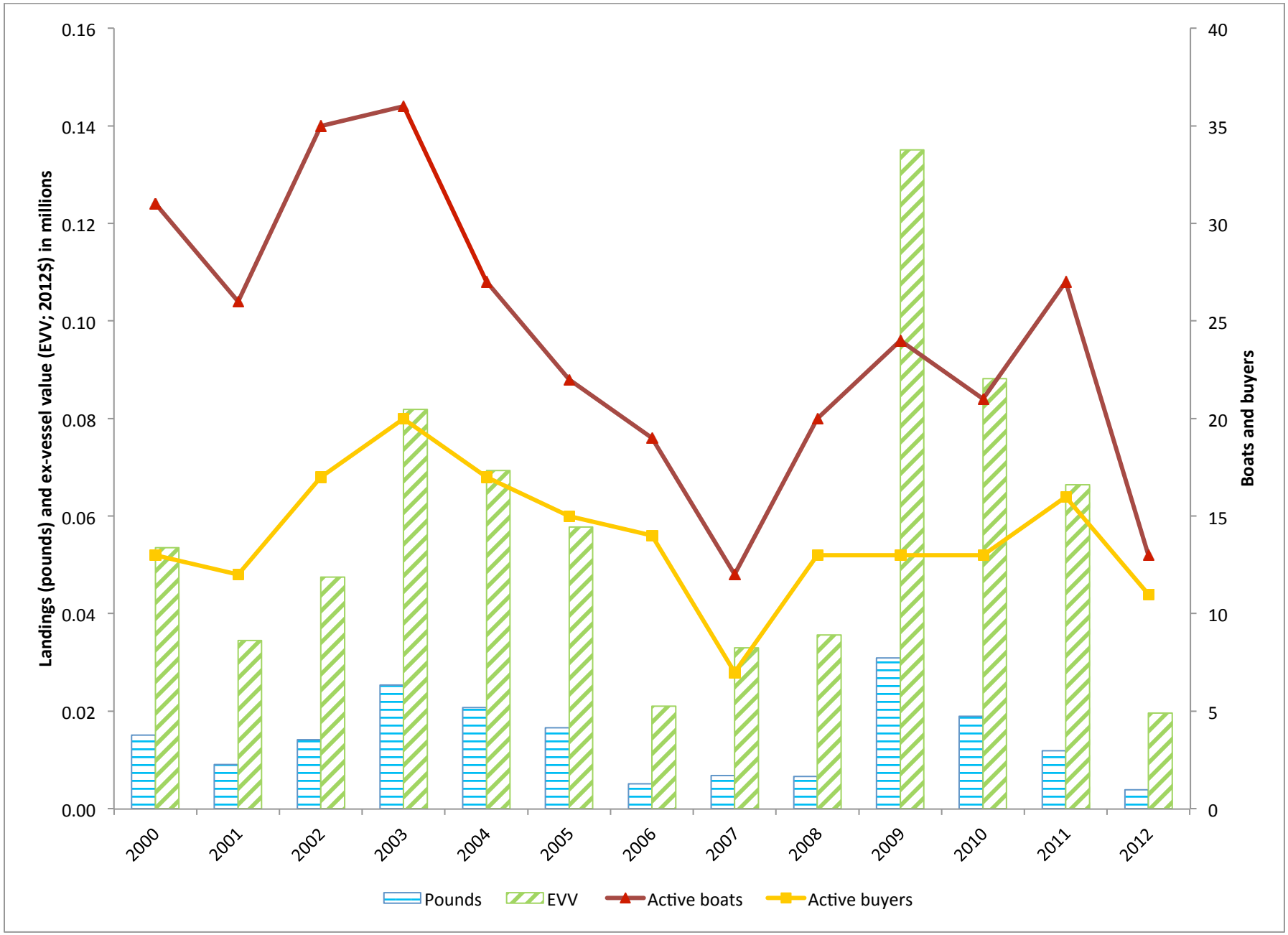
Pounds landed by port group, with statewide number of active boats and buyers in the California halibut fishery, 2000-2012



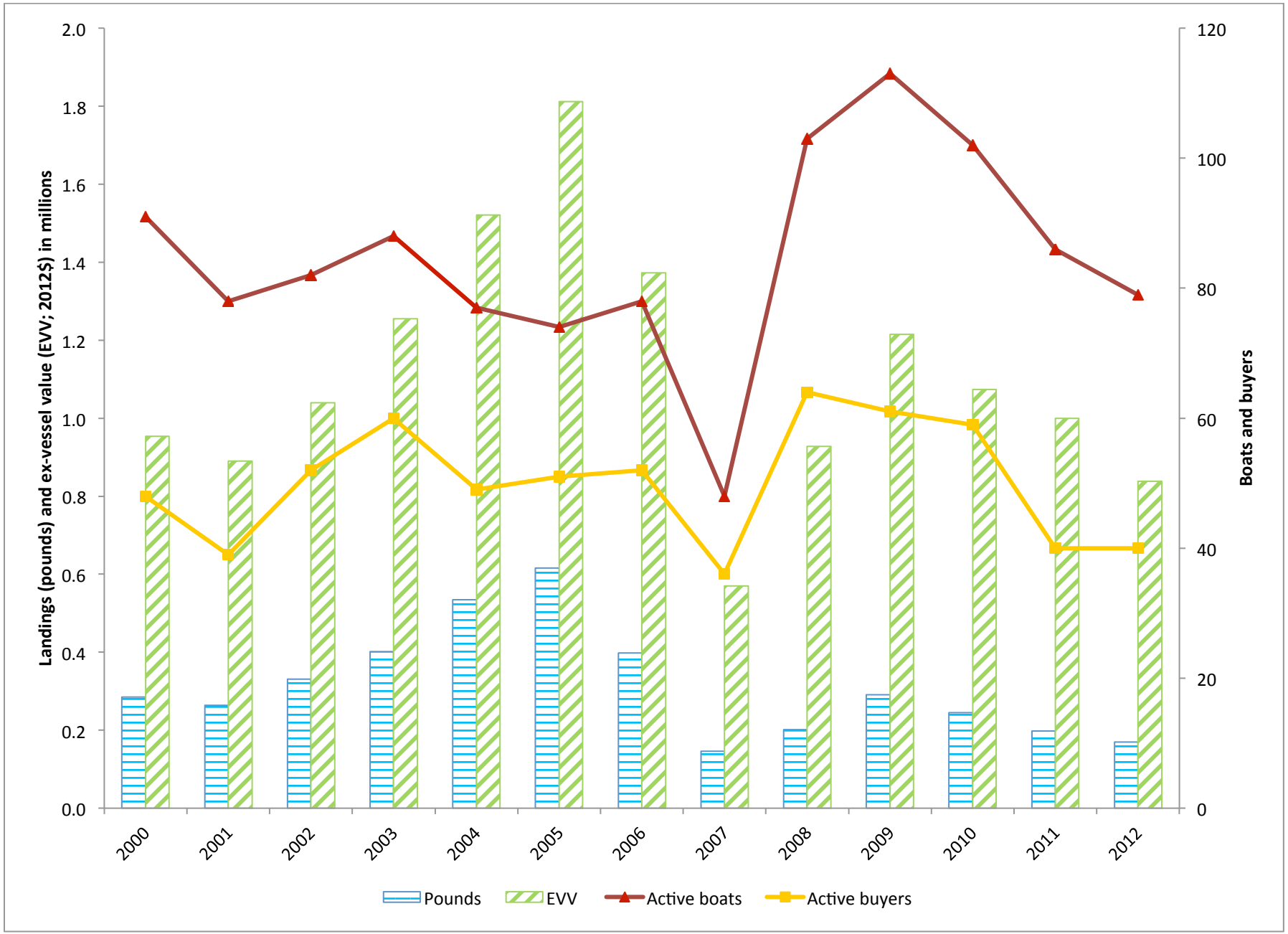
Ex-vessel value by port group, with statewide number of active boats and buyers in the California halibut fishery, 2000-2012



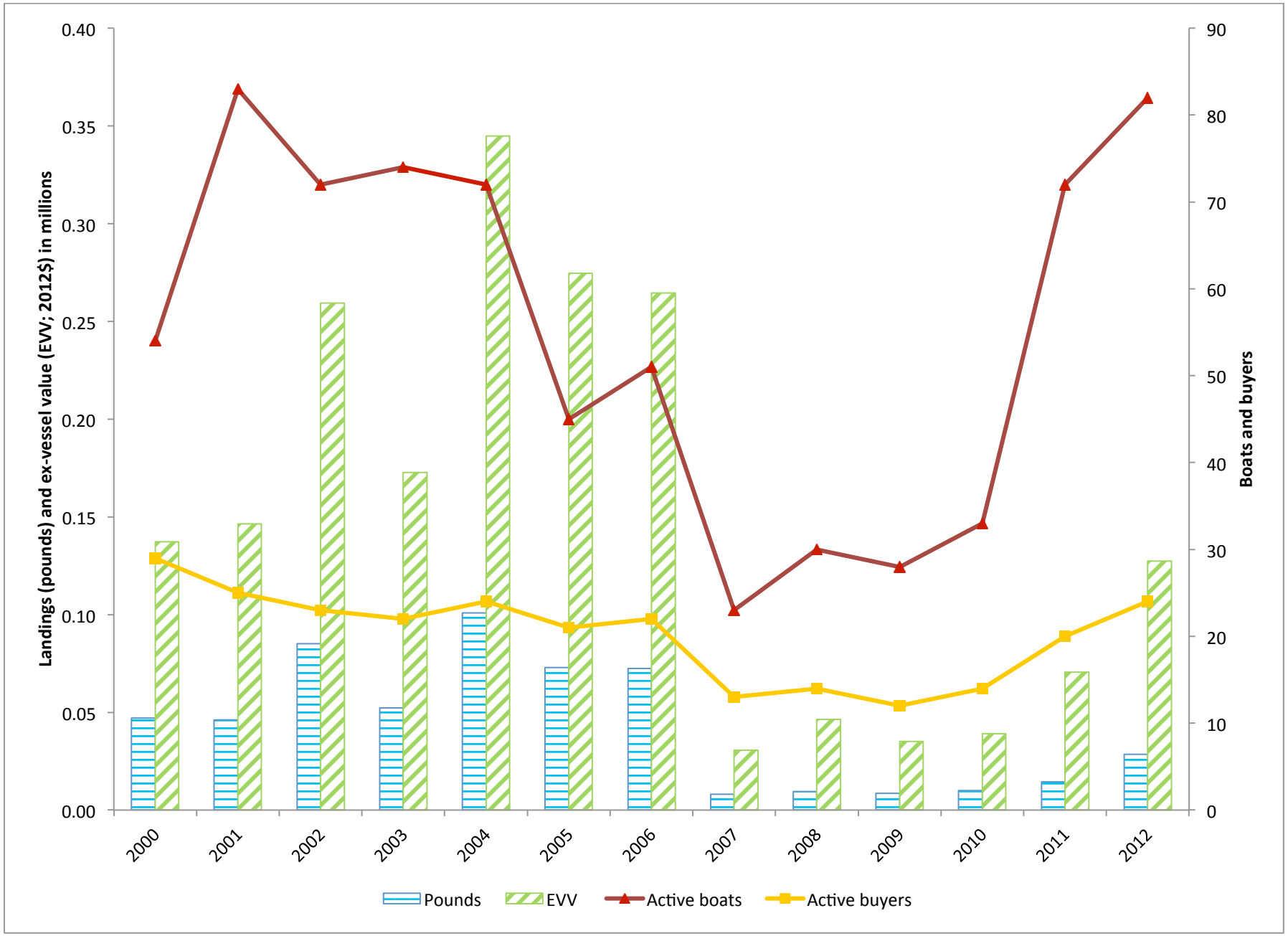
Bodega Bay port group: California halibut commercial fishery activity, 2000-2012



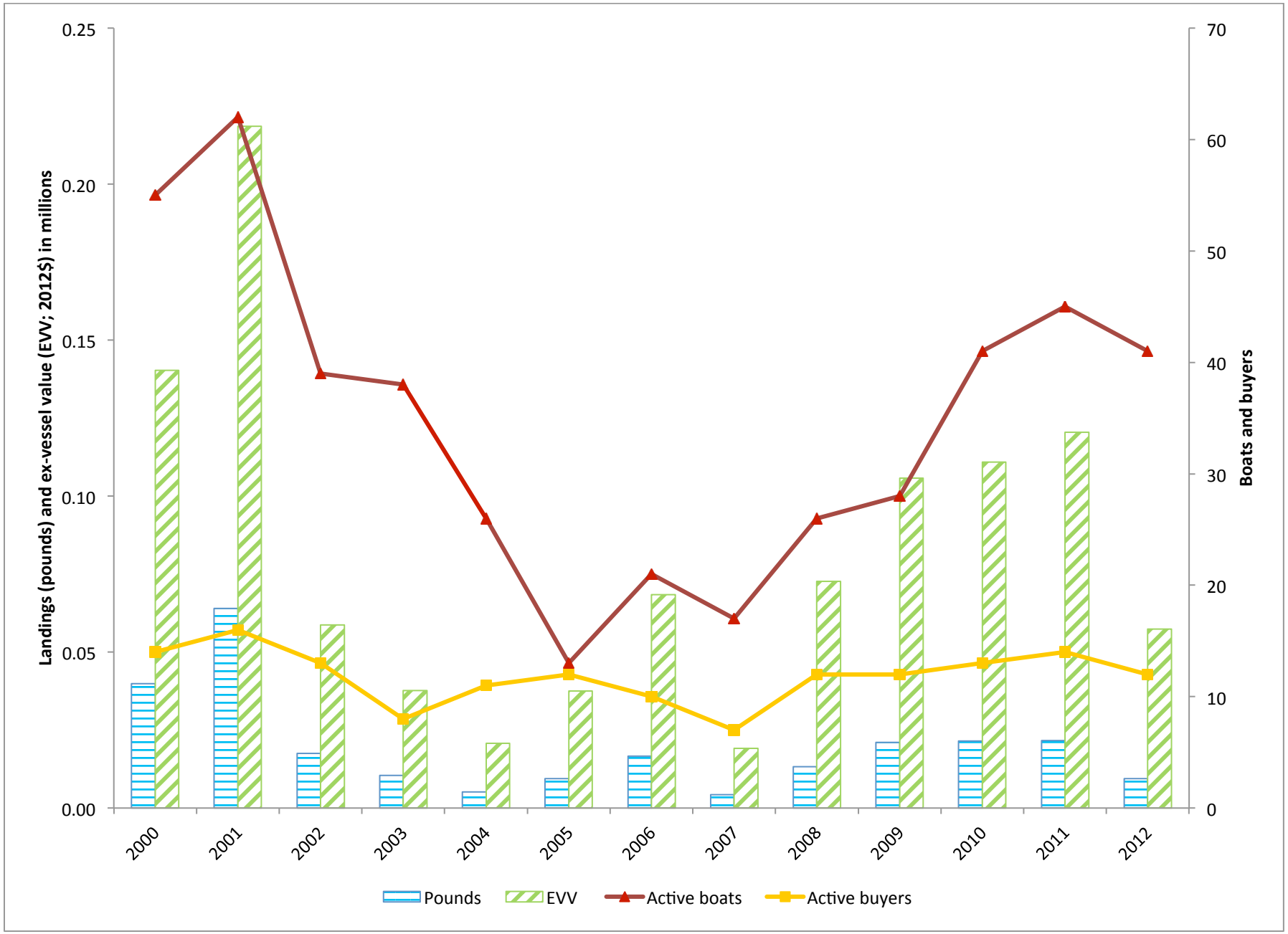
San Francisco port group: California halibut commercial fishery activity, 2000-2012



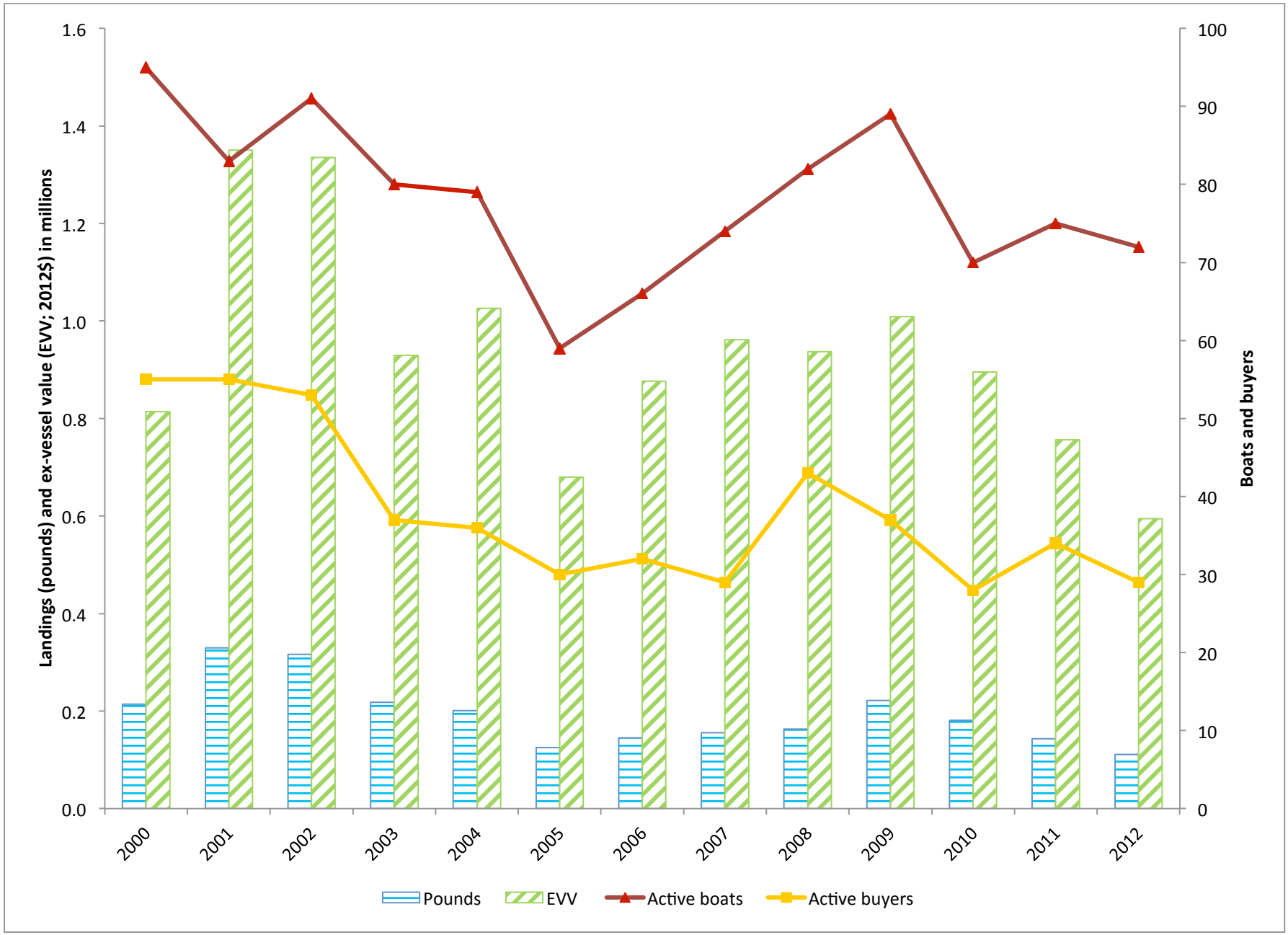
Monterey port group: California halibut commercial fishery activity, 2000-2012



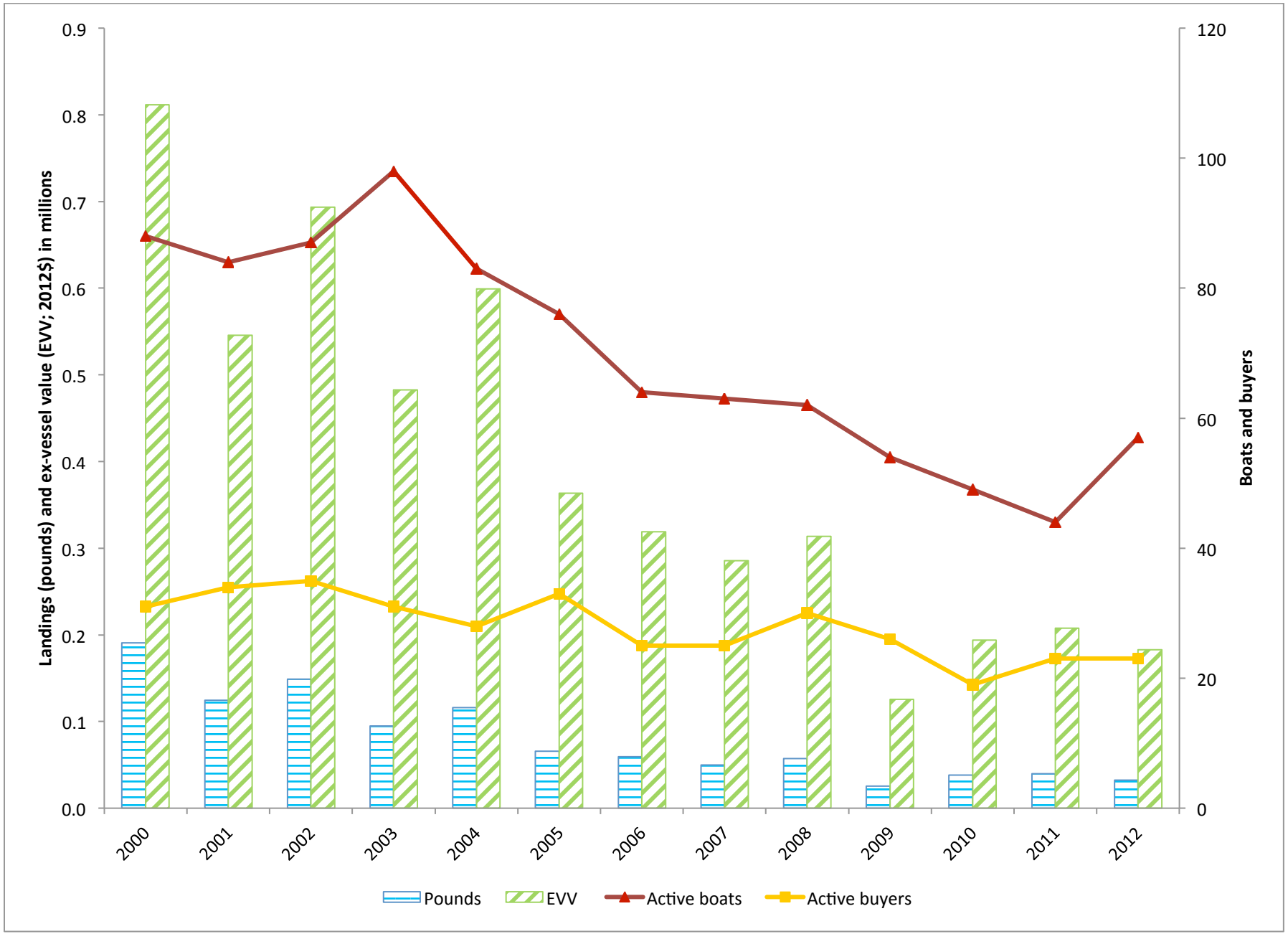
Morro Bay port group: California halibut commercial fishery activity, 2000-2012



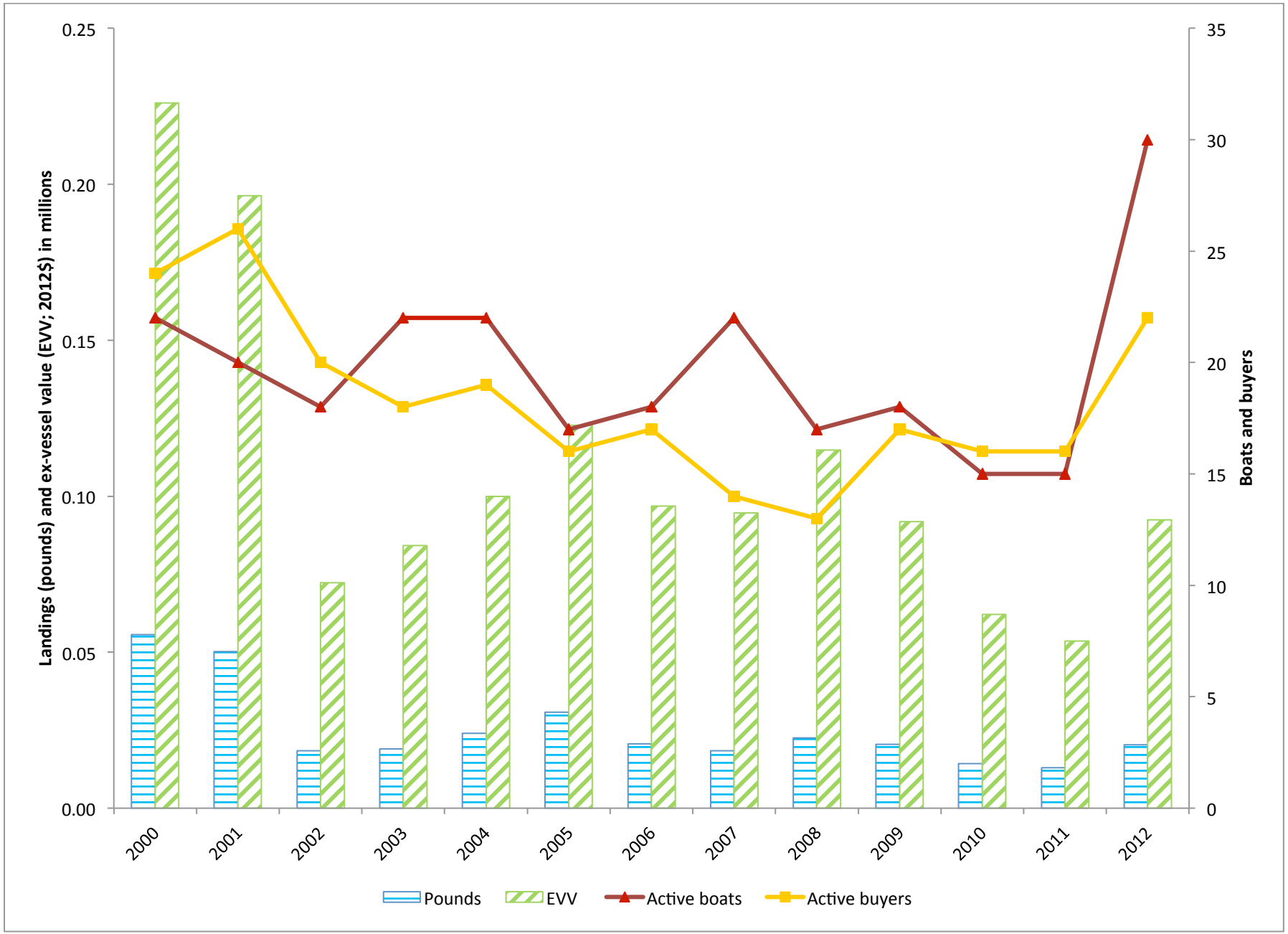
Santa Barbara port group: California halibut commercial fishery activity, 2000-2012



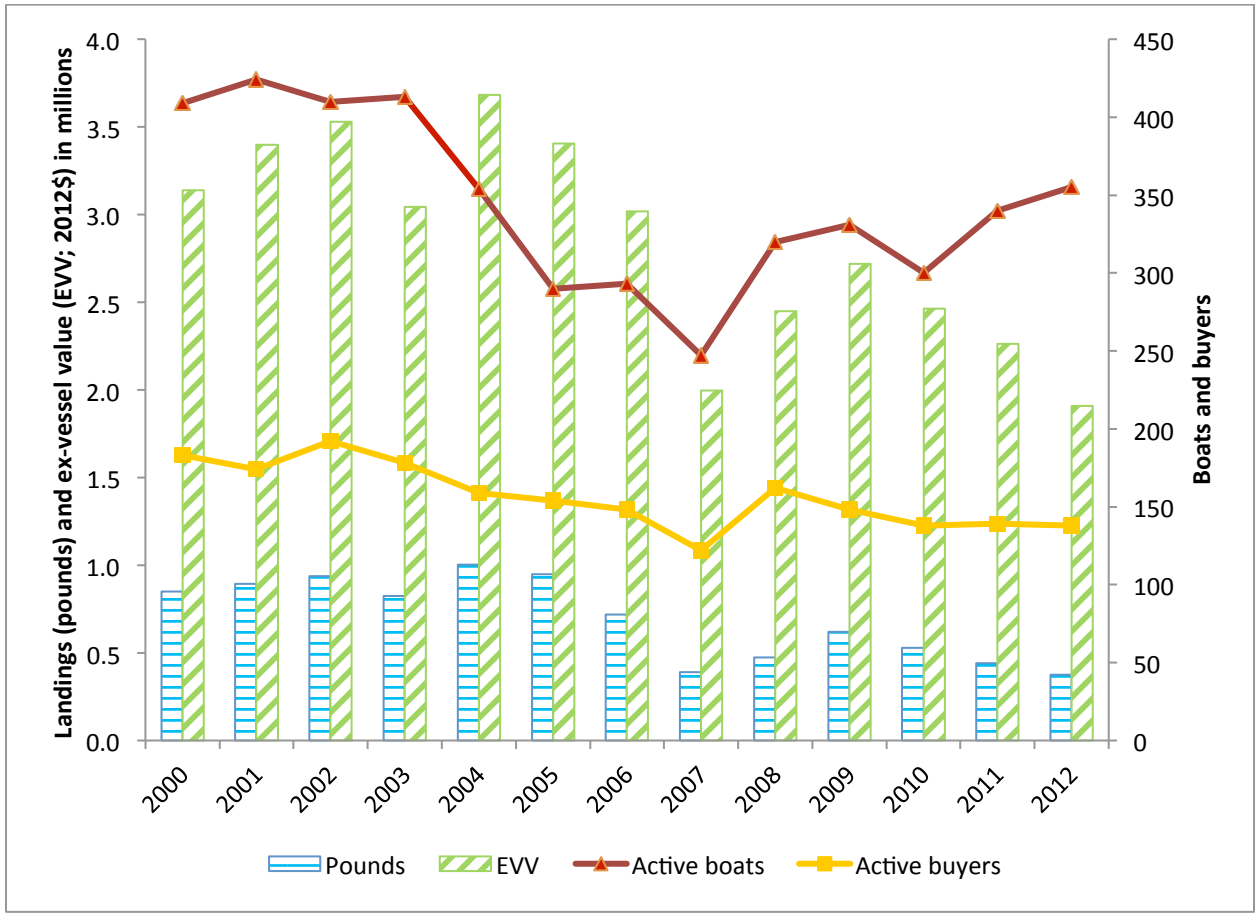
Los Angeles port group: California halibut commercial fishery activity, 2000-2012



San Diego port group: California halibut commercial fishery activity, 2000-2012

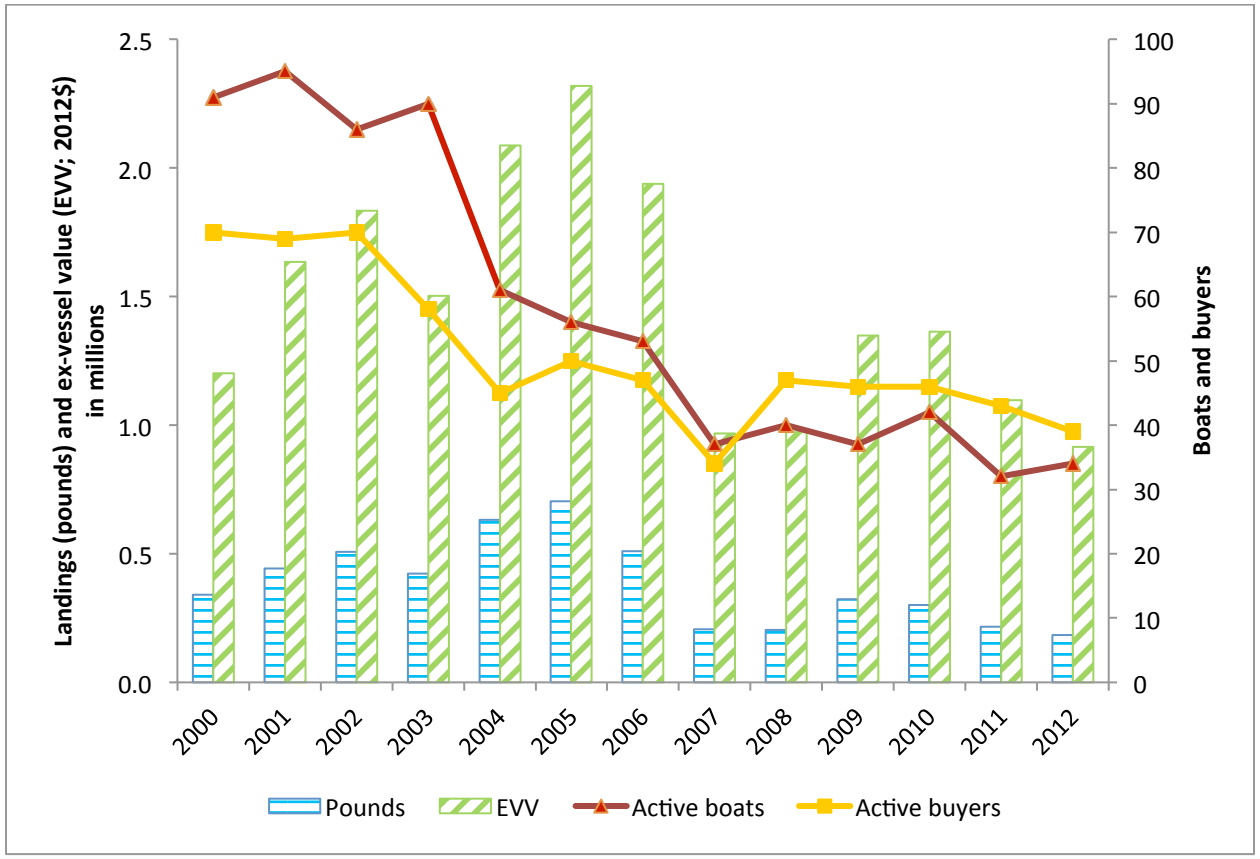


All gear types combined: California halibut commercial fishery activity, 2000-2012



	Long term average 2000-2012	Recent average 2010-2012	Percent difference	High year(s) (amount)	Low year(s) (amount)
Landings (lbs)	692,662	448,664	-35%	2004 (1,002,632)	2012 (375,278)
Ex-vessel value (2012 $)	2,847,225	2,211,322	-22%	2004 (3,681,542)	2012 (1,906,991)
Boats	345	332	-4%	2001 (424)	2007 (247)
Buyers	157	138	-12%	2002 (192)	2007 (122)
Trips	5,664	4,139	-27%	2002 (8,189)	2012 (3,633)
Price ($/lb, 2012$)	4.91	5.34	9%	2007 (5.70)	2000 (4.05)

Trawl gear: California halibut commercial fishery activity, 2000-2012

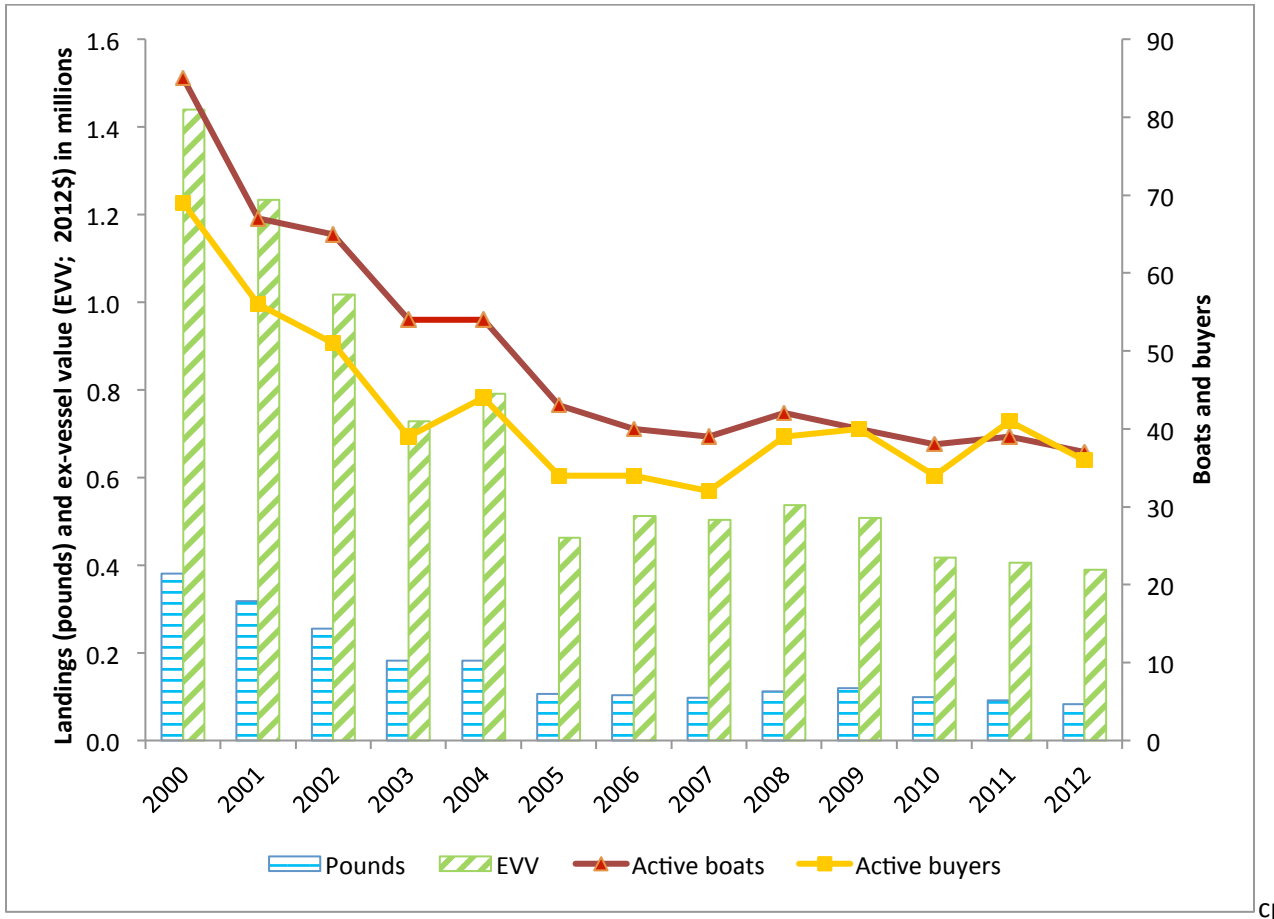


	Long term average 2000-2012	Recent average 2010-2012	Percent difference	High year(s) (amount)	Low year(s) (amount)
Landings (lbs)	383,976	234,145	-39%	2005 (703,660)	2012 (183,172)
Ex-vessel value (2012 $)	1,475,666	1,125,122	-24%	2005 (2,319,518)	2012 (915,634)
Boats	58	36	-38%	2001 (95)	2011 (32)
Buyers	51	43	-16%	2000 (70)	2007 (34)
Trips	1,731	1,069	-38%	2002 (2,707)	2012 (752)
Price ($/lb, 2012$)	4.89	5.46	12%	2007 (5.62)	2000 (4.04)

Line gear: California halibut commercial fishery activity, 2000-2012

	Long term average 2000-2012	Recent average 2010-2012	Percent difference	High year(s) (amount)	Low year(s) (amount)
Landings (lbs)	143,919	122,790	-15%	2003 (219,258)	2007 (84,103)
Ex-vessel value (2012 $)	679,882	678,392	0%	2008 (936,114)	2000 (492,042)
Boats	265	271	2%	2001 (319)	2007 (181)
Buyers	121	106	-12%	2002 (154)	2007 (96)
Trips	2,171	1,995	-8%	2002 (2,765)	2007 (1,454)
Price ($/lb, 2012$)	5.34	5.75	8%	2007 (6.48)	2000 (4.36)

Gillnet gear: California halibut commercial fishery activity, 2000-2012



cpomeroy

	Long term average 2000-2012	Recent average 2010-2012	Percent difference	High year(s) (amount)	Low year(s) (amount)
Landings (lbs)	163,939	90,905	-45%	2000 (380,971)	2012 (82,560)
Ex-vessel value (2012 $)	688,288	404,325	-41%	2000 (1,439,592)	2012 (389,487)
Boats	49	38	-23%	2000 (85)	2012 (37)
Buyers	42	37	-12%	2000 (69)	2007 (32)
Trips	1,735	1,041	-40%	2000 (3,630)	2012 (968)
Price ($/lb, 2012$)	4.51	4.60	2%	2007 (5.17)	2000 (3.94)

Set 2: Seasonality and mobility in the commercial California halibut fishery, 2000-2012

Please consider the questions below for the enclosed charts and tables, keeping in mind:

- *environmental conditions*, e.g., weather, climate, availability of prey (feed)
- *fishery conditions*, e.g., availability of California halibut and of other species
- *economic conditions*, e.g., availability of buyers, prices (for California halibut and for other species), fuel costs
- *regulatory conditions*, e.g., rules allowing or limiting access to California halibut and/or other species or to particular fishing grounds
- *technological, social or other factors,* e.g., availability of/access to port infrastructure, changes in consumer preferences, which might affect fishermen's and buyers' decisions to participate in the commercial fishery for California halibut

Seasonality: The pounds landed and the number of boats in the commercial California halibut fishery varies from month to month and from year to year, by port group, and by gear type. (See graphs on pages 2-12.)

1. Do the patterns of activity shown make sense given your understanding of the fishery? If not, how are they different from what you would expect?

2. What do you think caused *month-to-month* differences in activity for the years shown?

3. What do you think caused differences *among years* in the month-to-month patterns shown?

4. What do you think caused the differences among *port groups* across the sample years shown?

5. What do you think caused the differences among *gear types* across the sample years shown?

6. Why are the patterns of active boats and landings different from each other in some cases? (See, for example, February 2000 on the statewide chart on p.2.)

Mobility: The enclosed mobility tables show the port groups and port group combinations where commercial fishermen delivered their California halibut catch in 2000, 2006 and 2012. (See tables on pages 13-16.) Most boats landed California halibut at only one port group (and usually at a single port), while a small percentage of boats landed their catch at some combination of port groups. In 2006, a slightly greater percentage of boats landed their catch at multiple port groups, compared to 2000 and 2012.

1. Does the distribution of activity make sense given your understanding of the fishery? If not, how are they different from what you would expect?

2. Why do most boats deliver their catch to a single port group?

3. For those boats that deliver their California halibut catch to more than one port group:
   a. How, if at all, are those boats different from other boats in the fishery?

   b. Why do those boats deliver to more than one port group?

   c. Why would a fisherman decide to unload at a port (group) other than his home port (group)?

4. What do you think caused the differences across the port groups, gear types and years shown?

5. What characteristics of particular ports (or port groups) or other factors are important to California halibut fishermen and/or buyers?

Set 2: California halibut commercial fishery activity, 2000-2012

For the charts and tables that follow, please note:
All seasonality data shown represent the activity of at least three boats.
Port groups and associated primary ports* include:

Eureka**
- Crescent City
- Trinidad
- Eureka/Fields Landing
- Shelter Cove

Fort Bragg**
- Fort Bragg/Noyo Harbor
- Albion
- Point Arena

Bodega Bay
- Bodega Bay
- Bolinas

San Francisco
- Sausalito
- Richmond
- Oakland
- San Francisco
- Princeton-Half Moon

Monterey
- Santa Cruz
- Moss Landing
- Monterey

Morro Bay
- Morro Bay
- Avila/Port San Luis

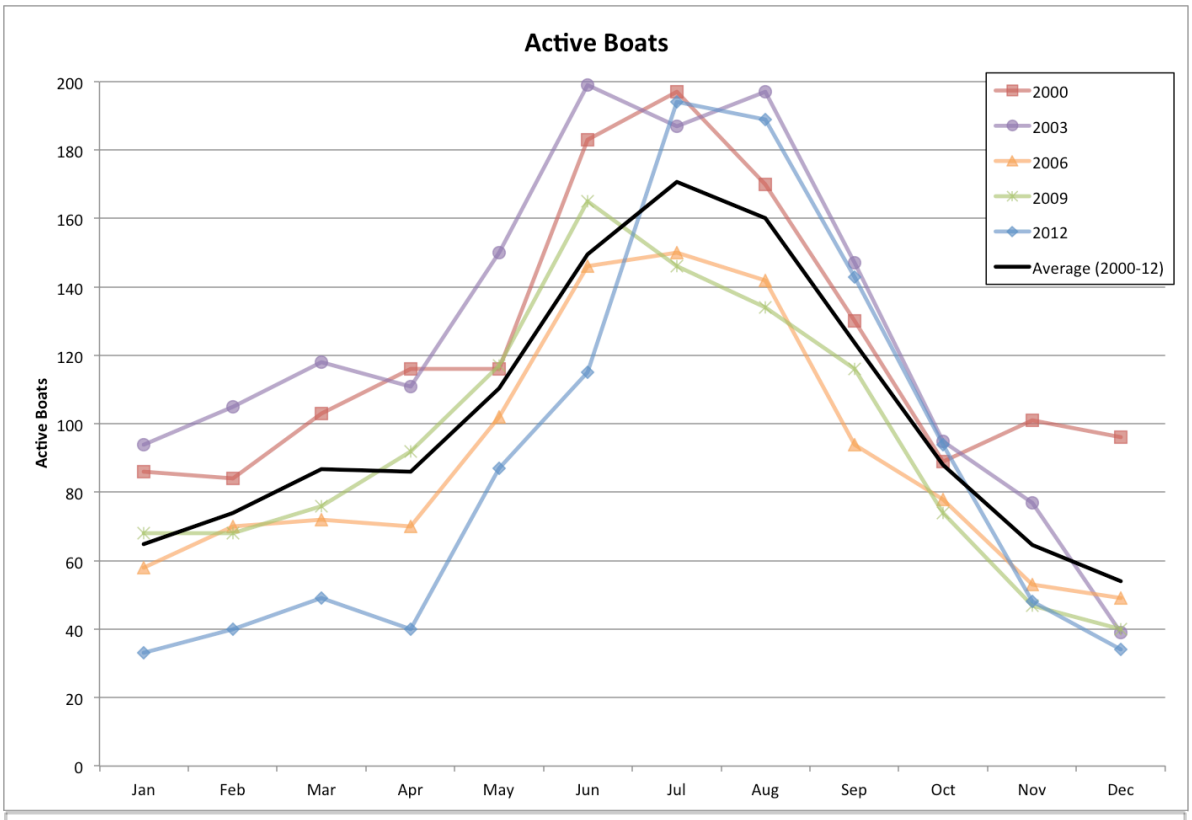
Santa Barbara
- Santa Barbara
- Oxnard/Channel Islands Harbor
- Ventura
- Port Hueneme

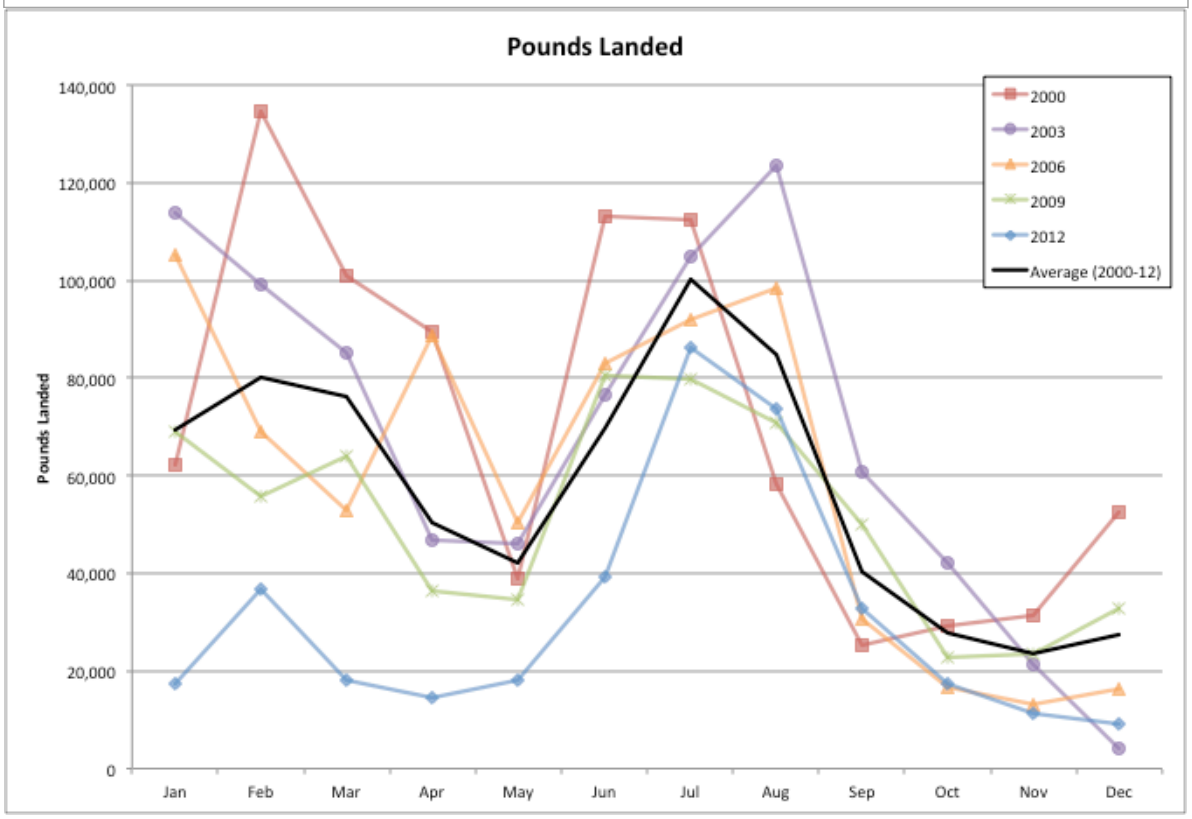
Los Angeles
- Redondo Beach
- Los Angeles
- San Pedro
- Terminal Island
- Long Beach
- Huntington Beach
- Newport Beach
- Dana Point

San Diego
- Mission Bay
- San Diego

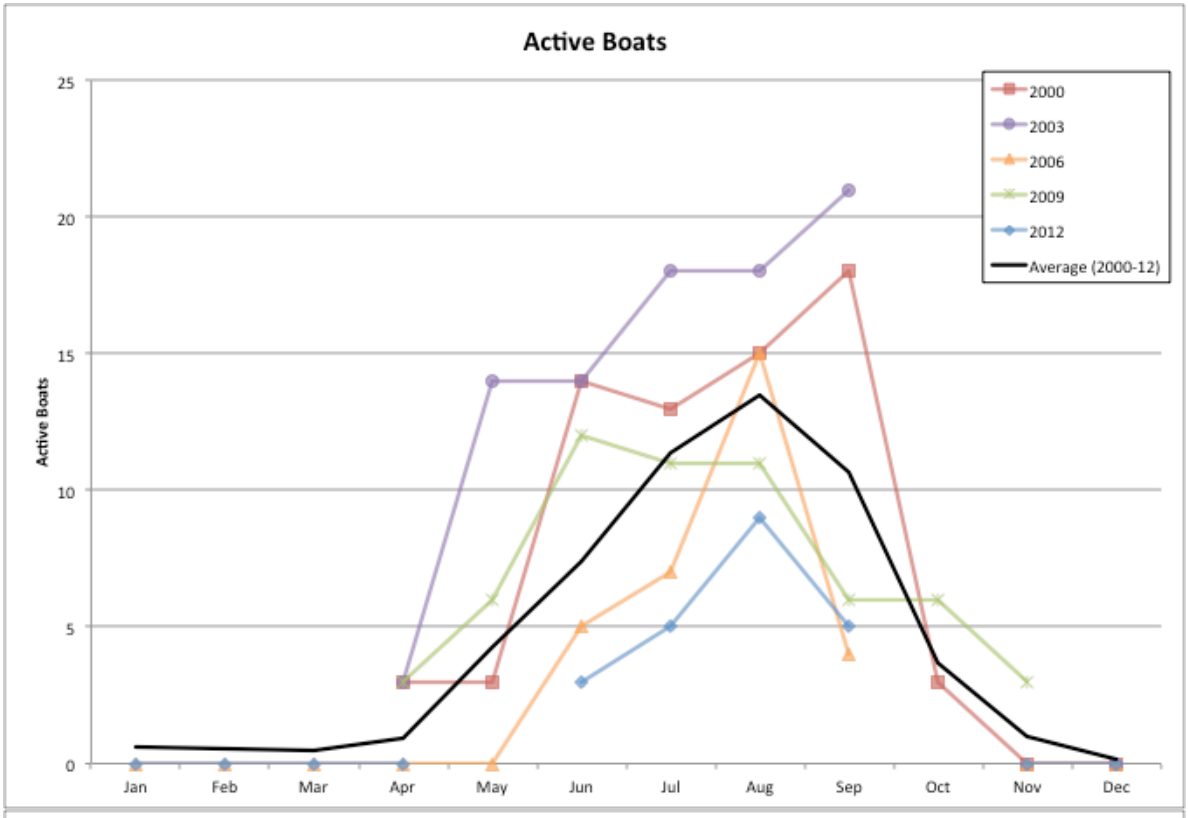
***** Port groups also include other smaller ports and landing sites.
****** Eureka port group and Fort Bragg port group data not presented to ensure confidentiality.

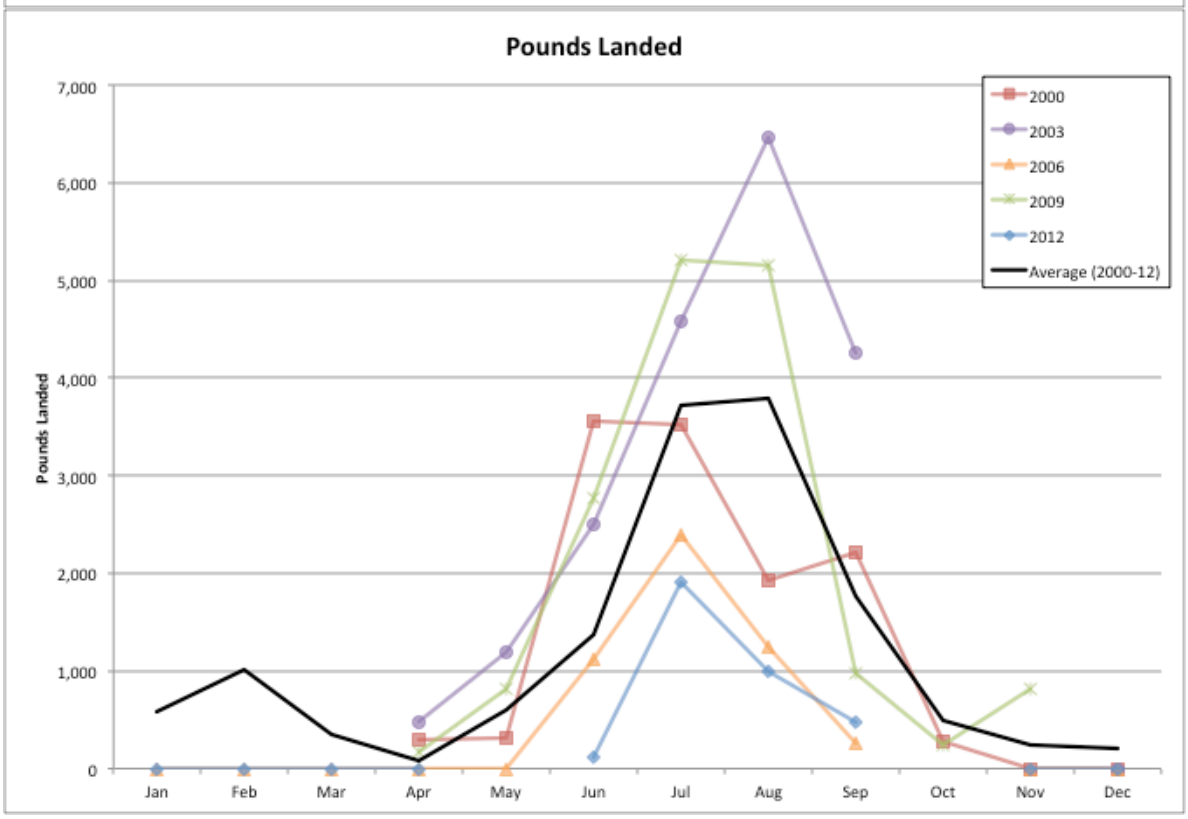
Seasonality in the Statewide California Halibut Fishery





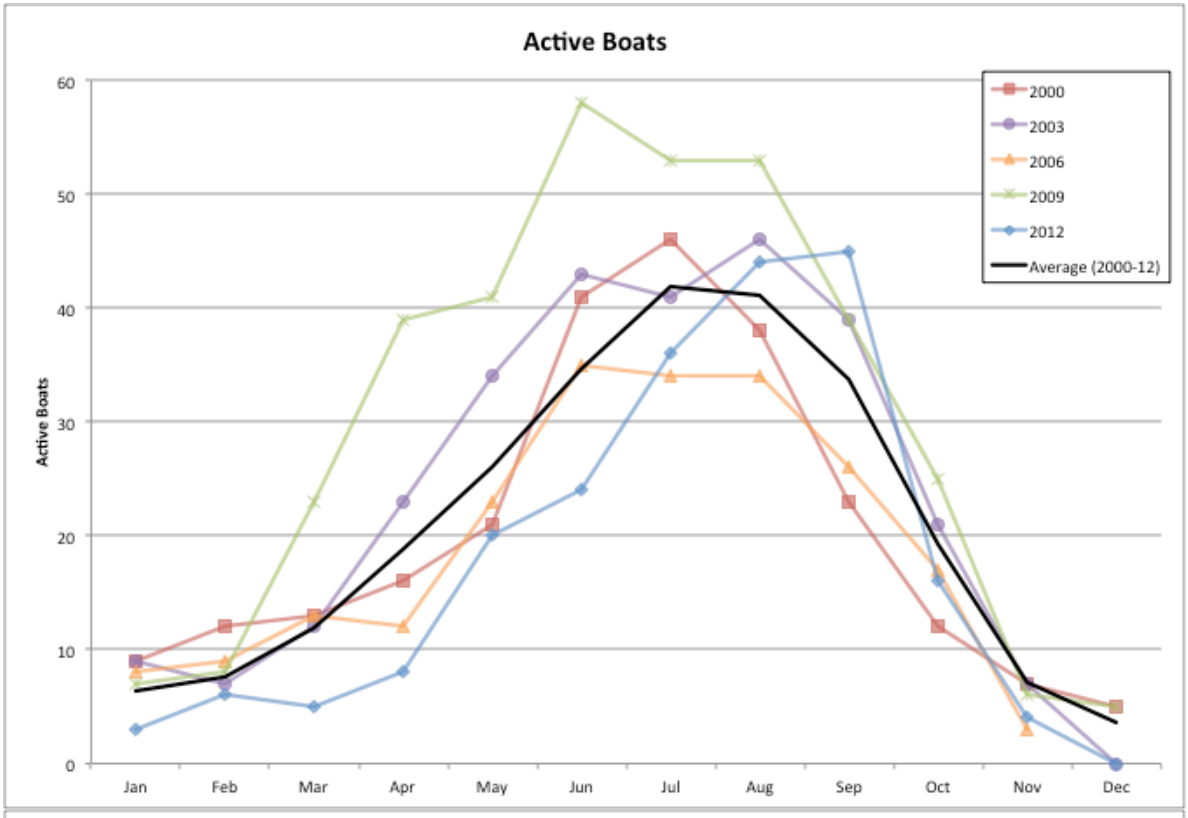
Seasonality in the California Halibut Fishery: Bodega Bay Port Group*

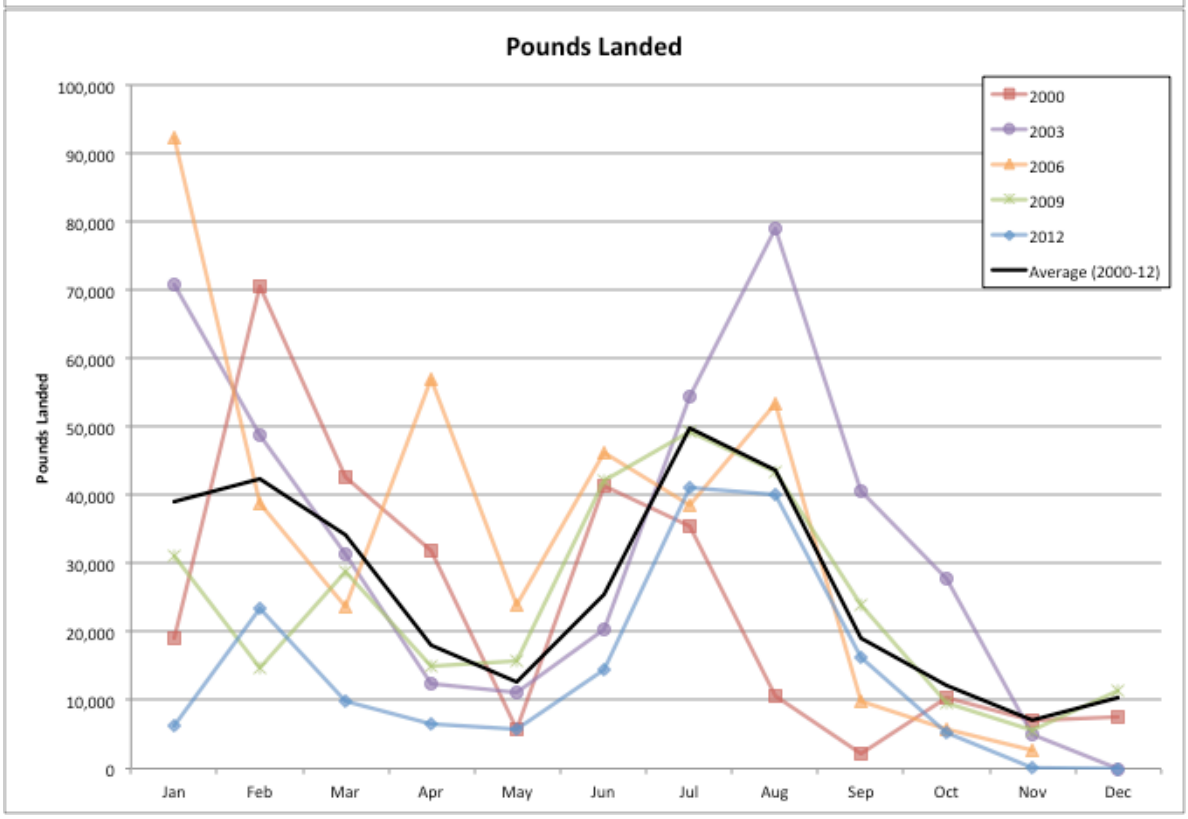




*Data are not reported for certain months to ensure confidentiality.

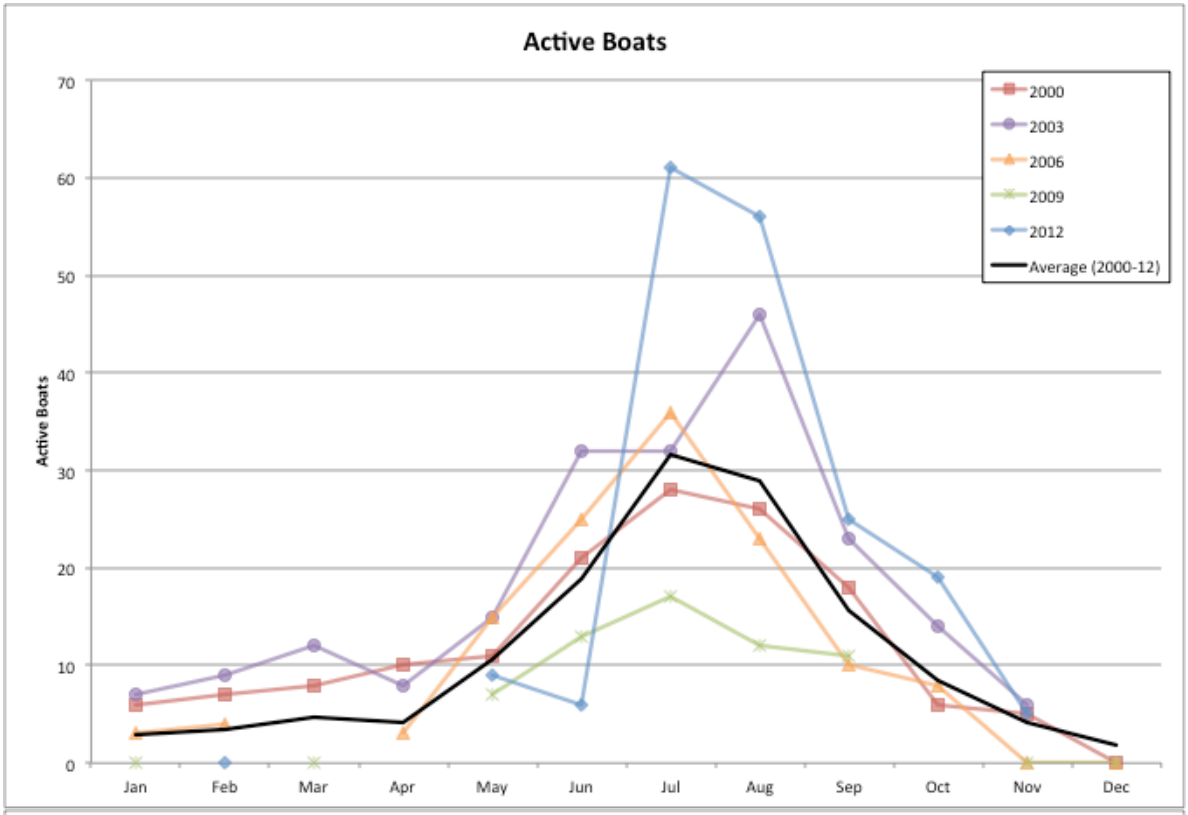
Seasonality in the California Halibut Fishery: San Francisco Port Group*

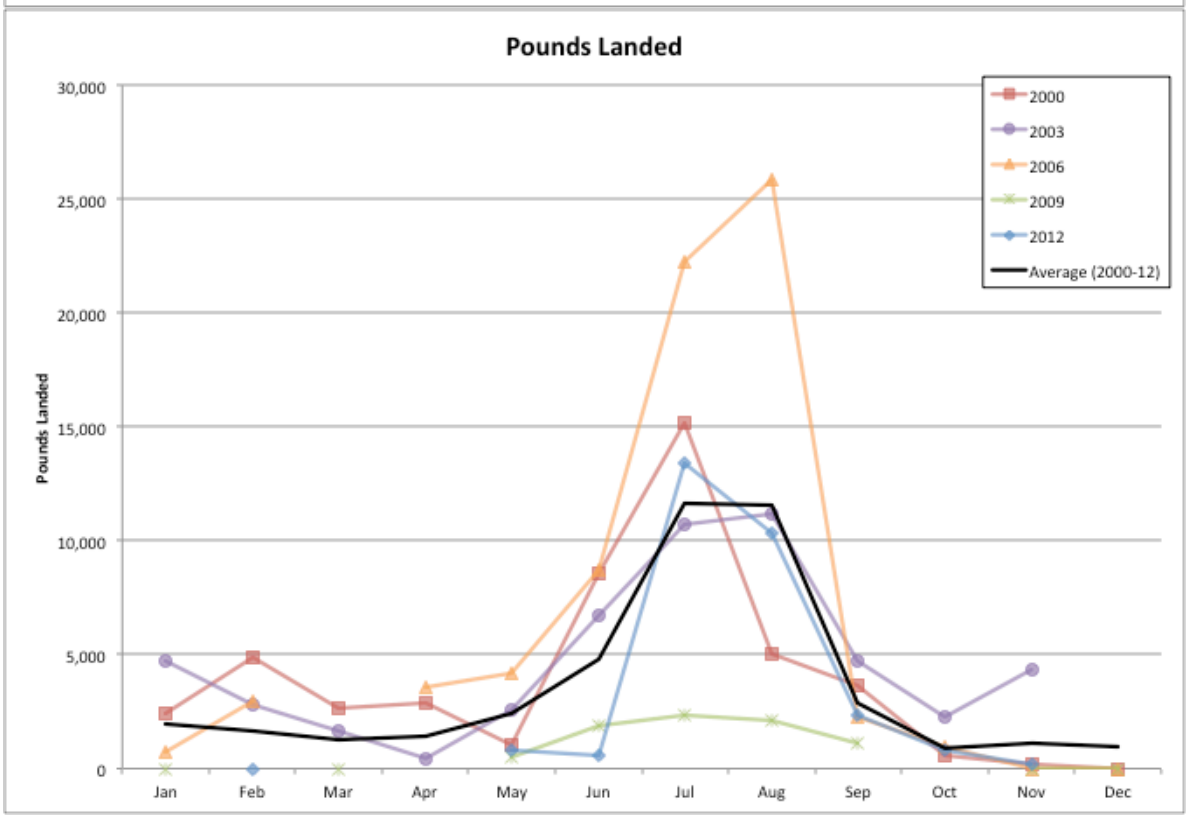




*Data are not reported for certain months to ensure confidentiality.

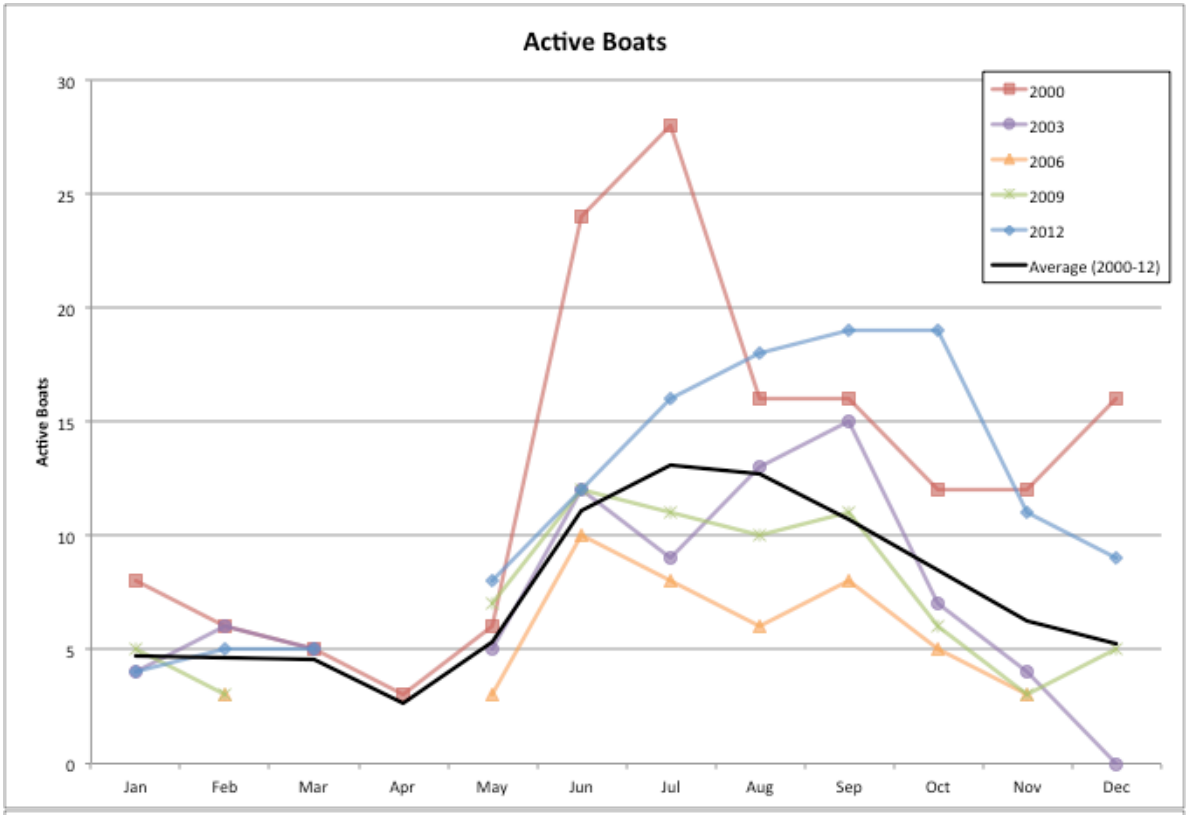
Seasonality in the California Halibut Fishery: Monterey Port Group*

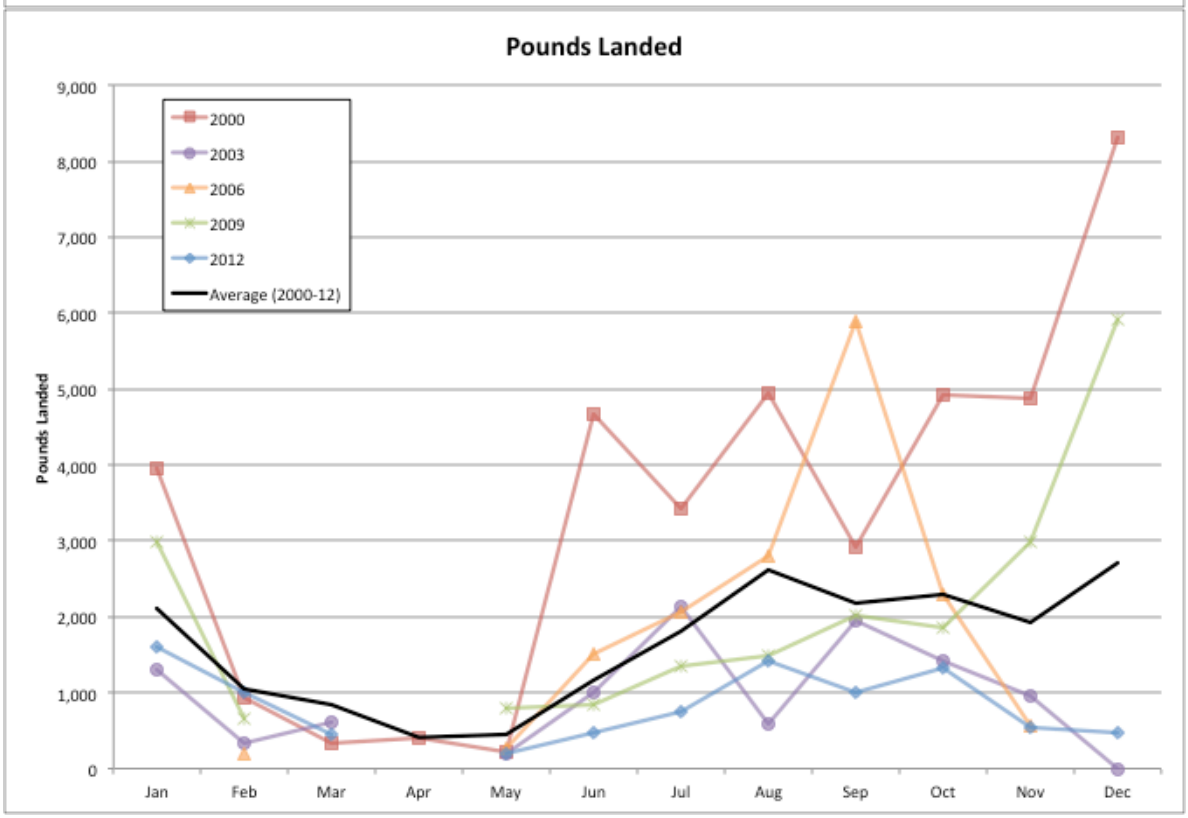




*Data are not reported for certain months to ensure confidentiality.

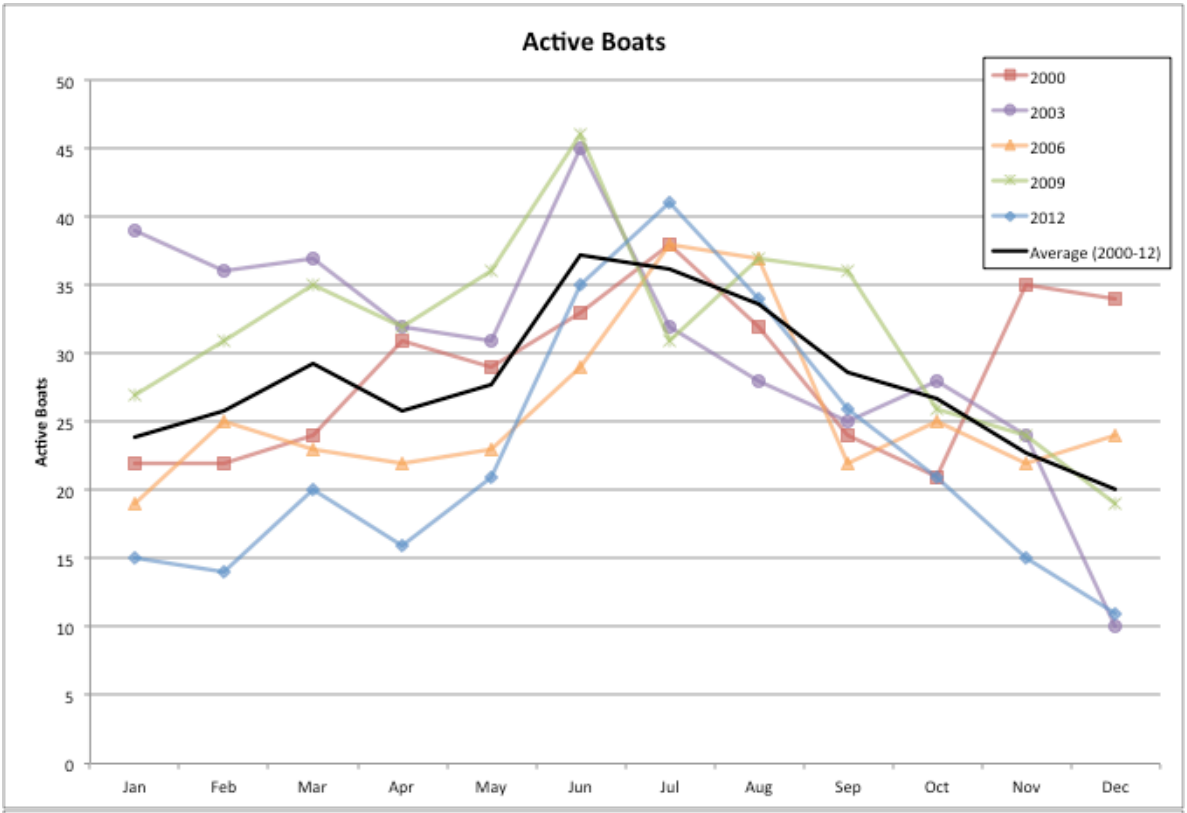
Seasonality in the California Halibut Fishery: Morro Bay Port Group*

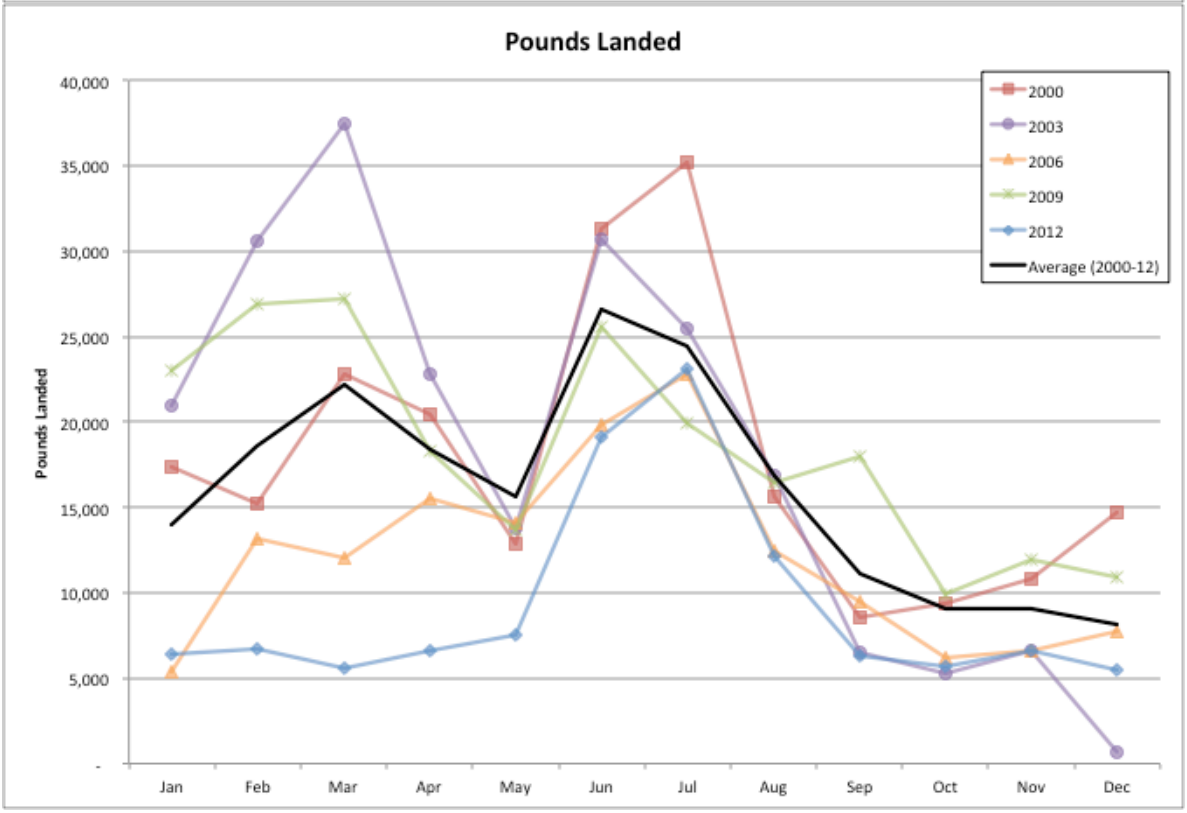




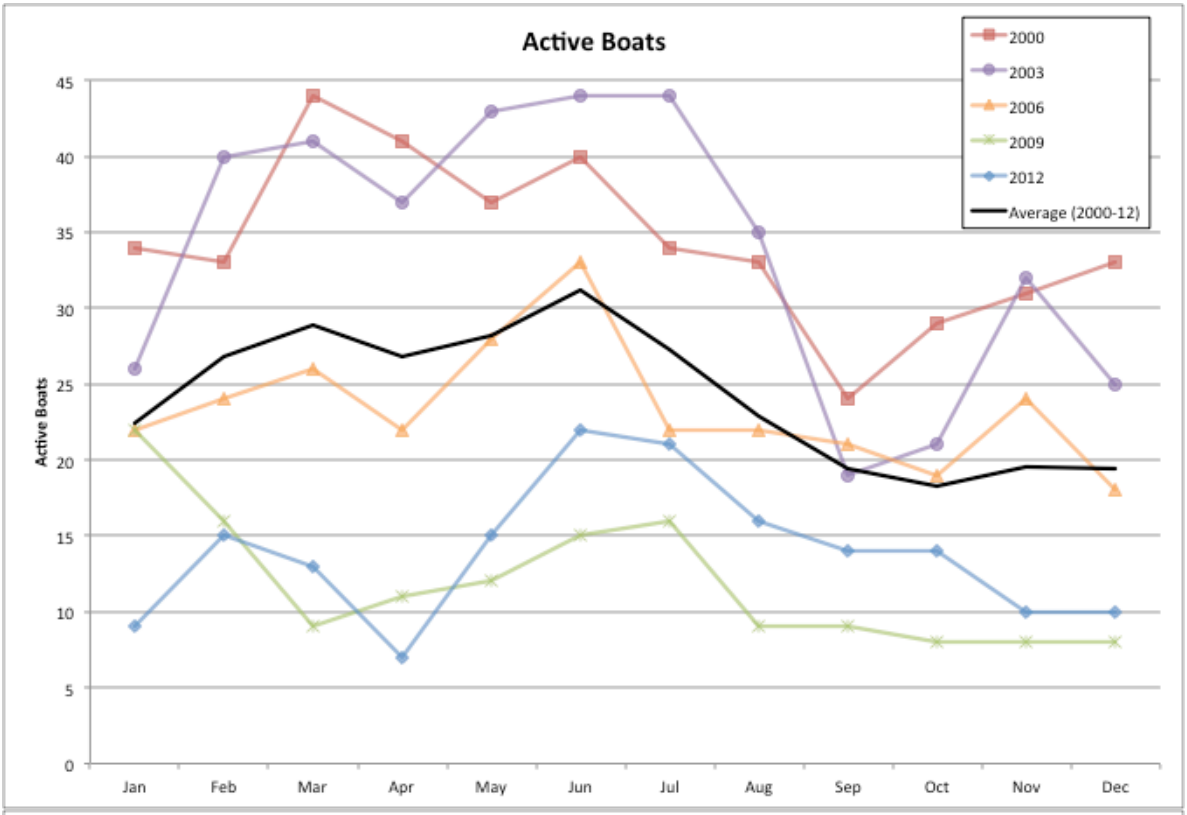
*Data are not reported for certain months to ensure confidentiality.

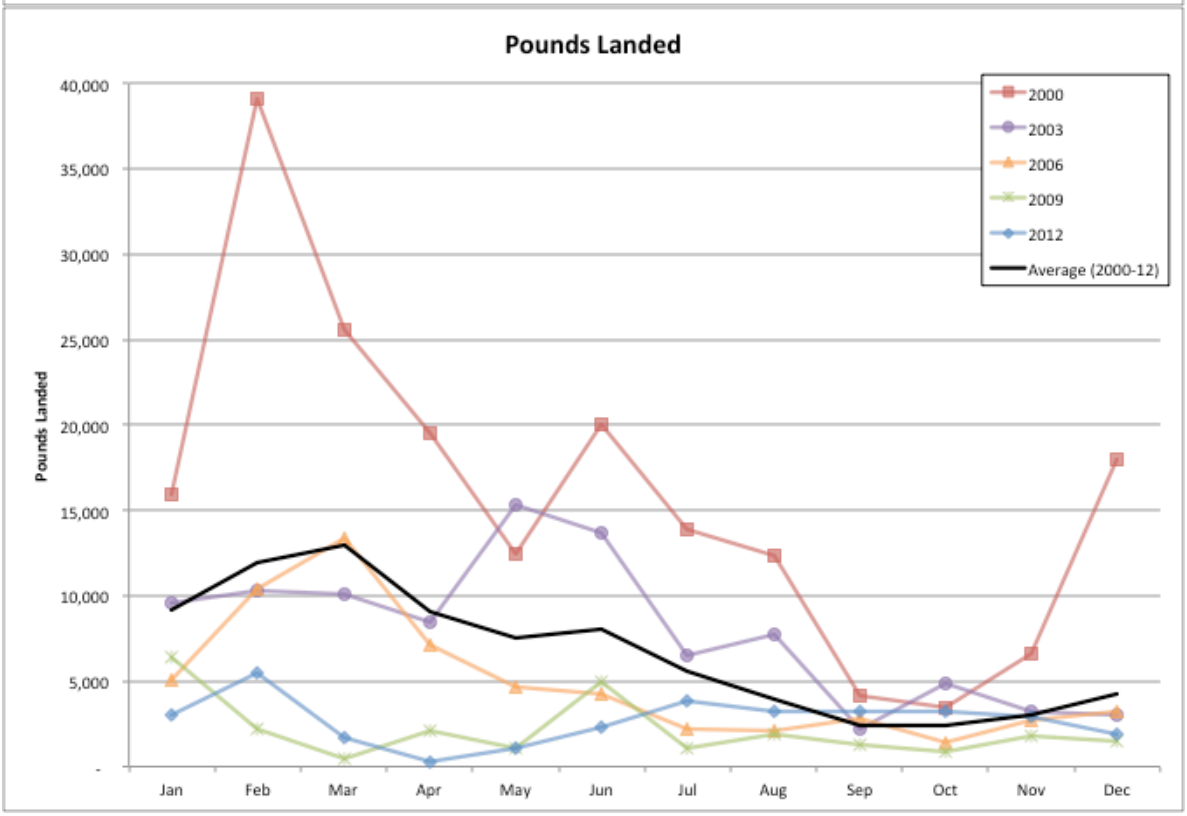
Seasonality in the California Halibut Fishery: Santa Barbara Port Group



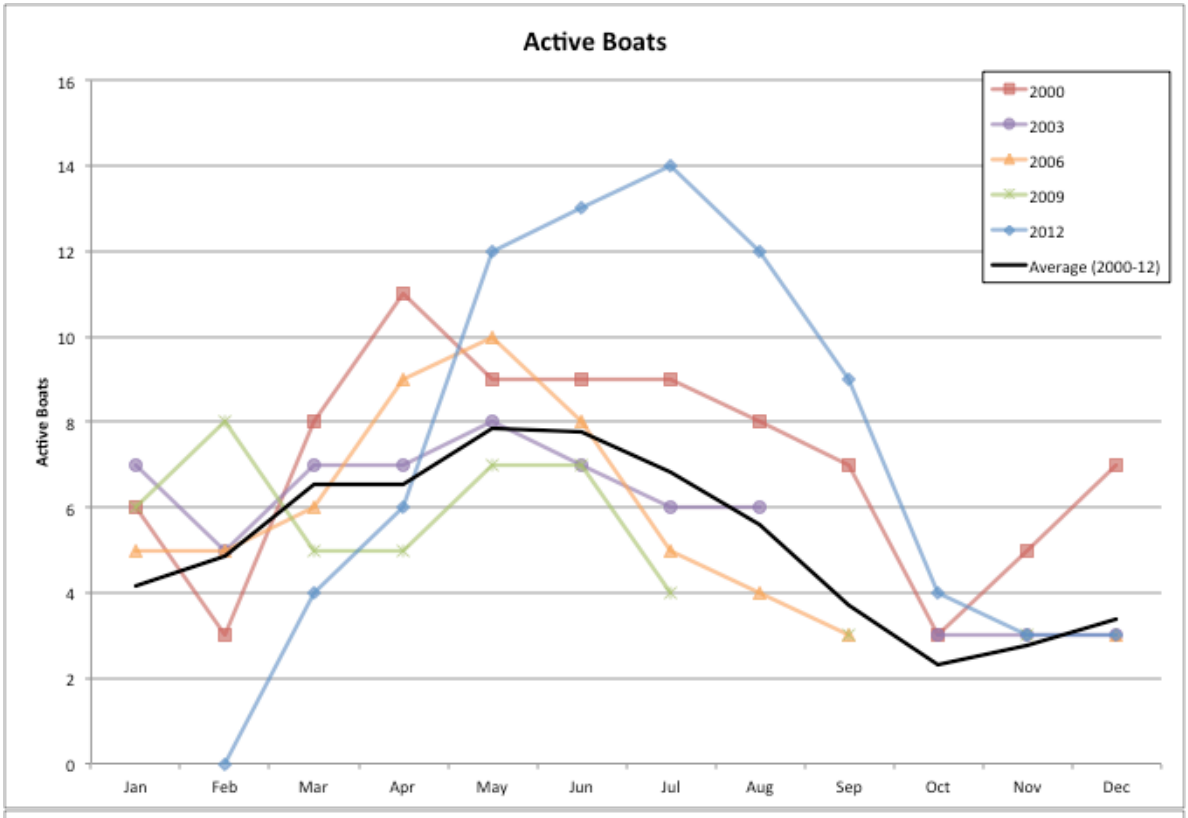


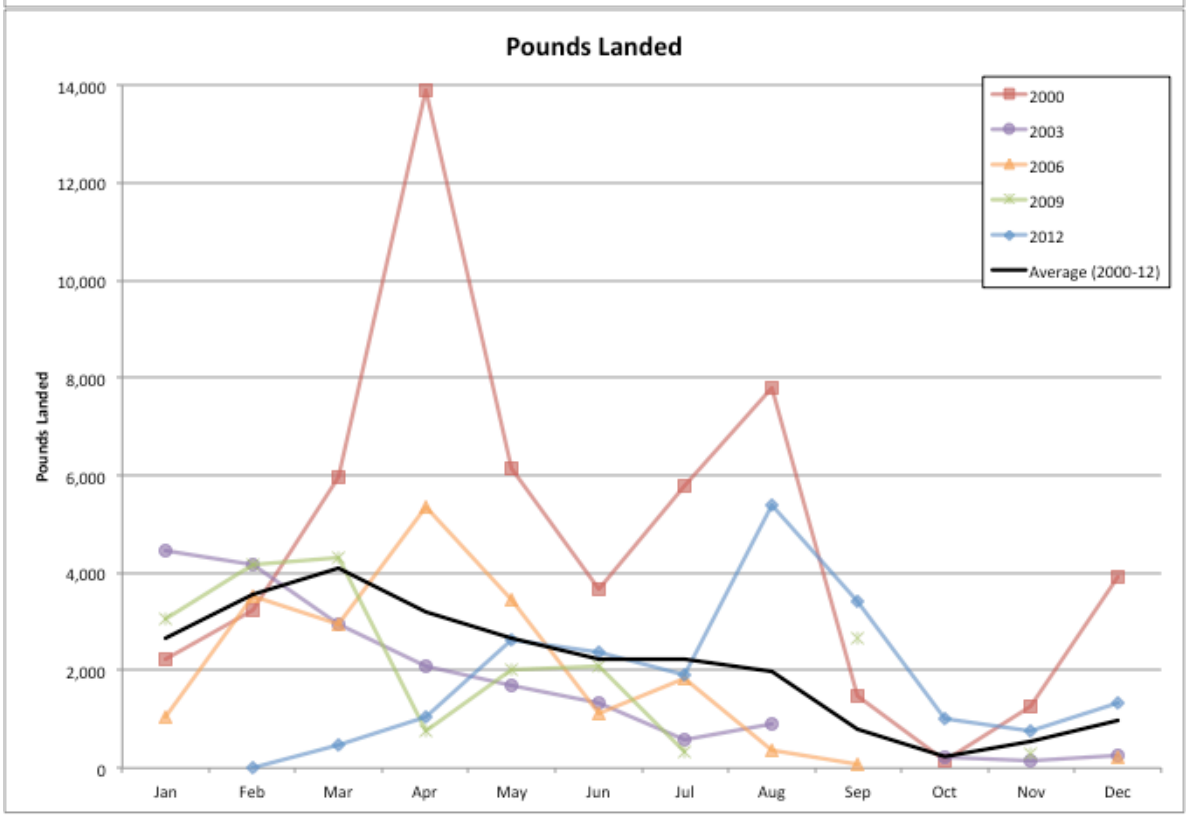
Seasonality in the California Halibut Fishery: Los Angeles Port Group





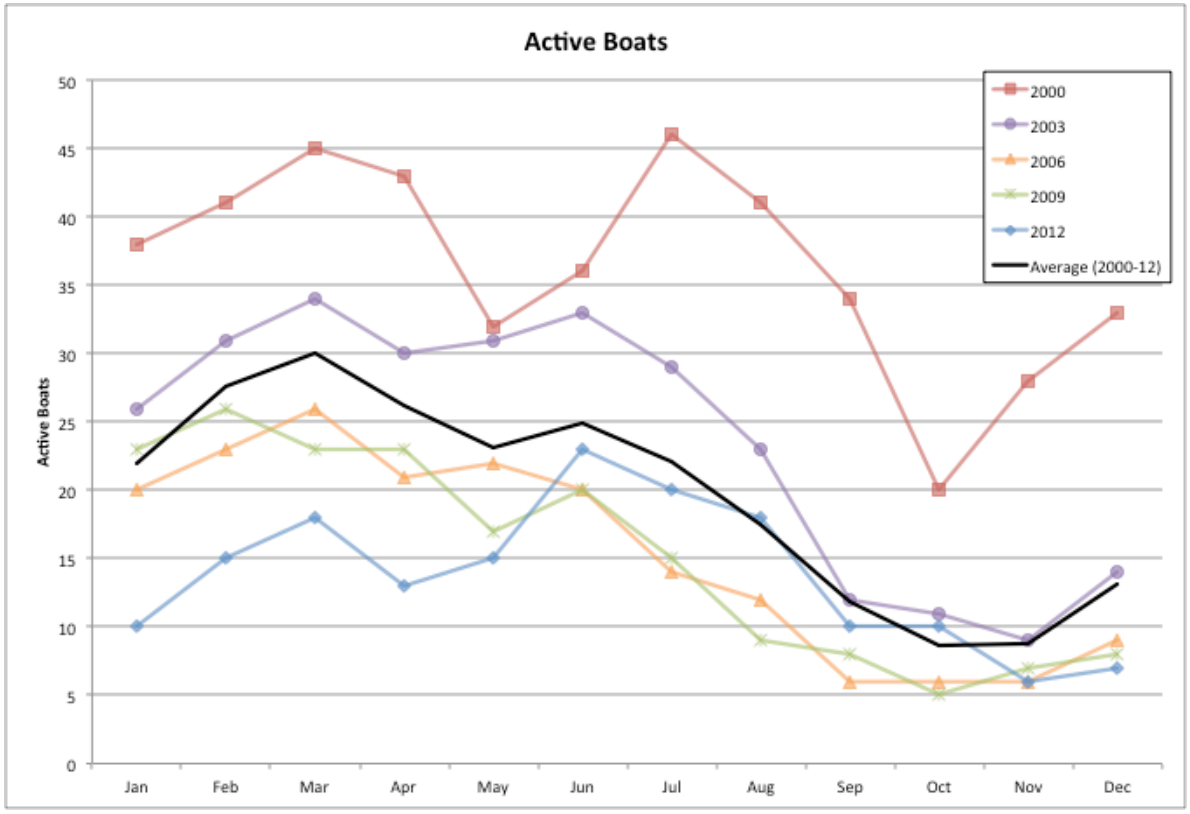
Seasonality in the California Halibut Fishery: San Diego Port Group*

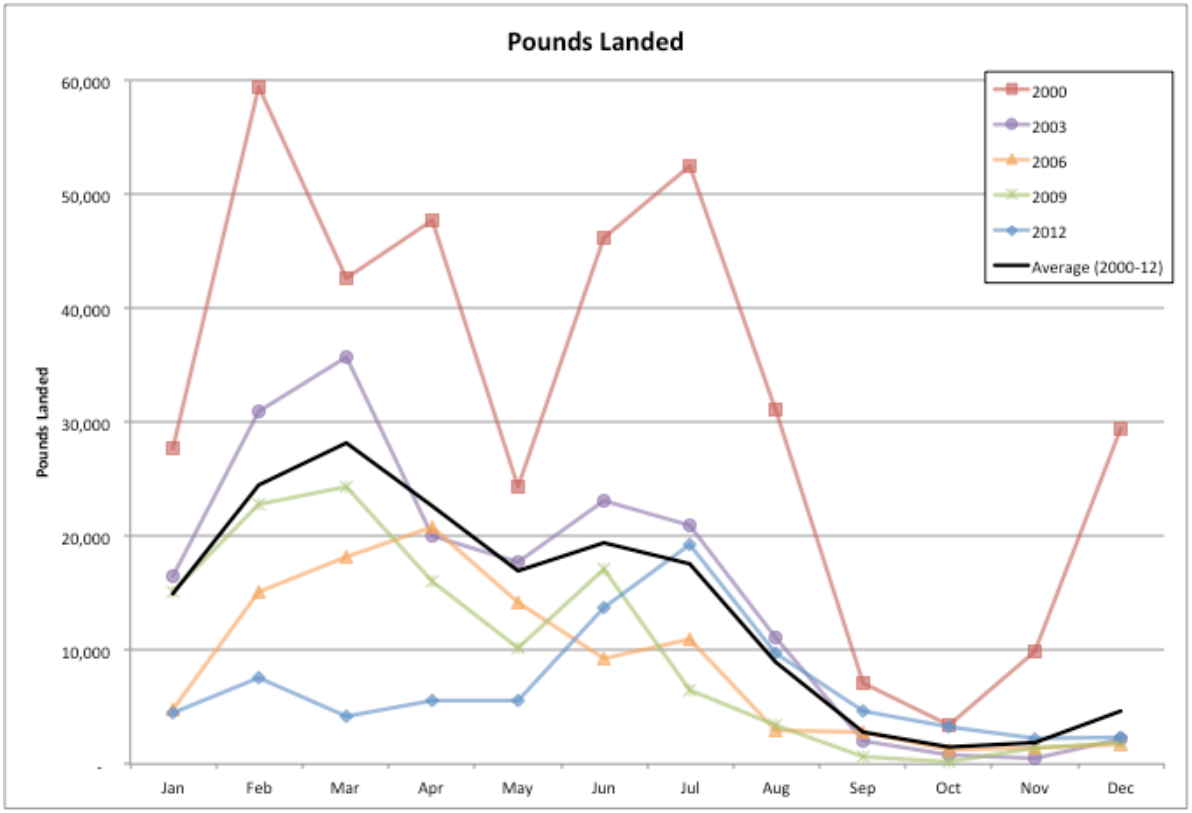




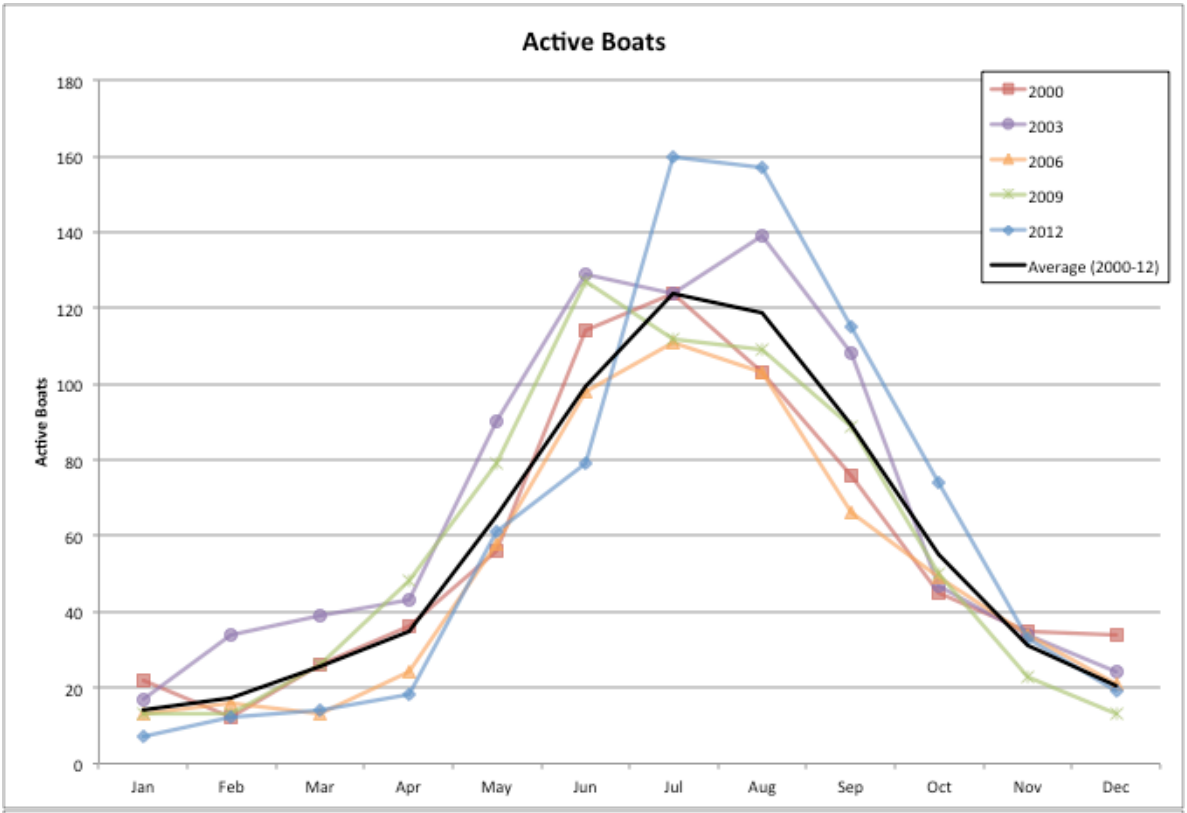
*Data are not reported for certain months to ensure confidentiality.

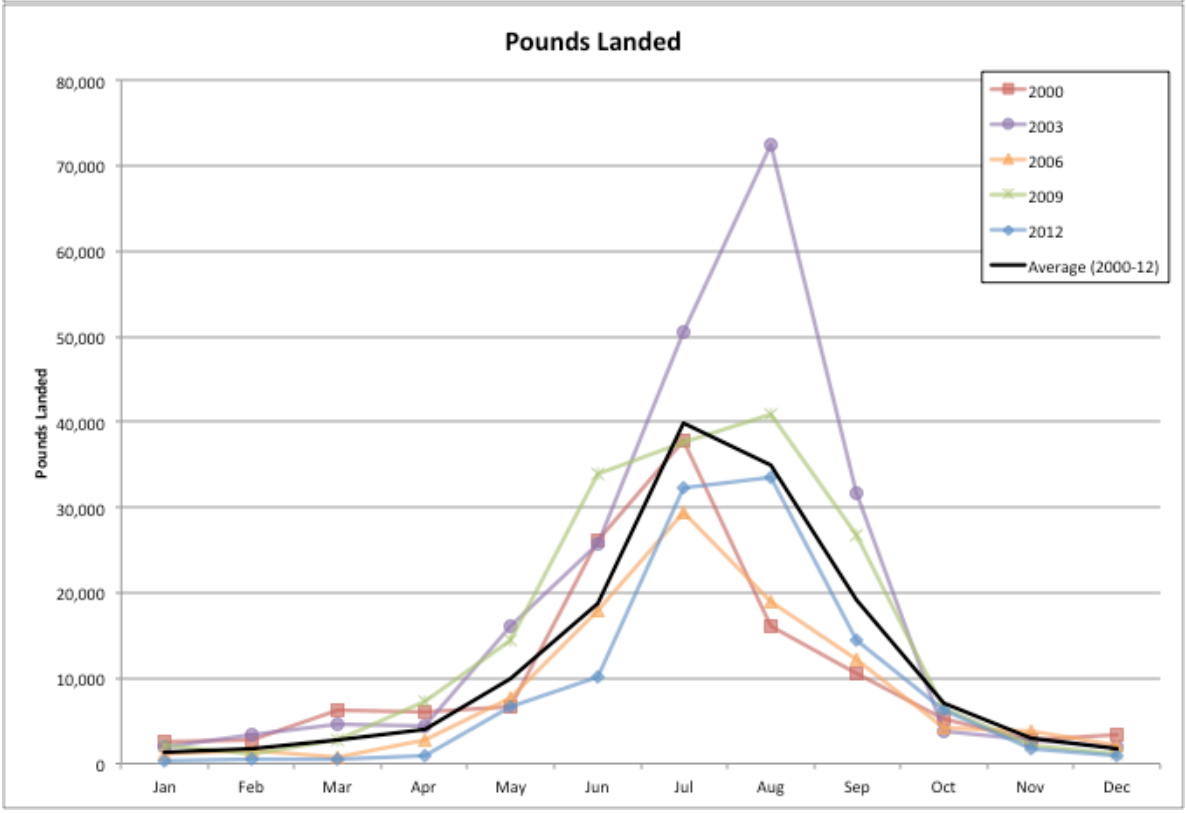
Seasonality in the California Halibut Fishery: Gillnet Gear



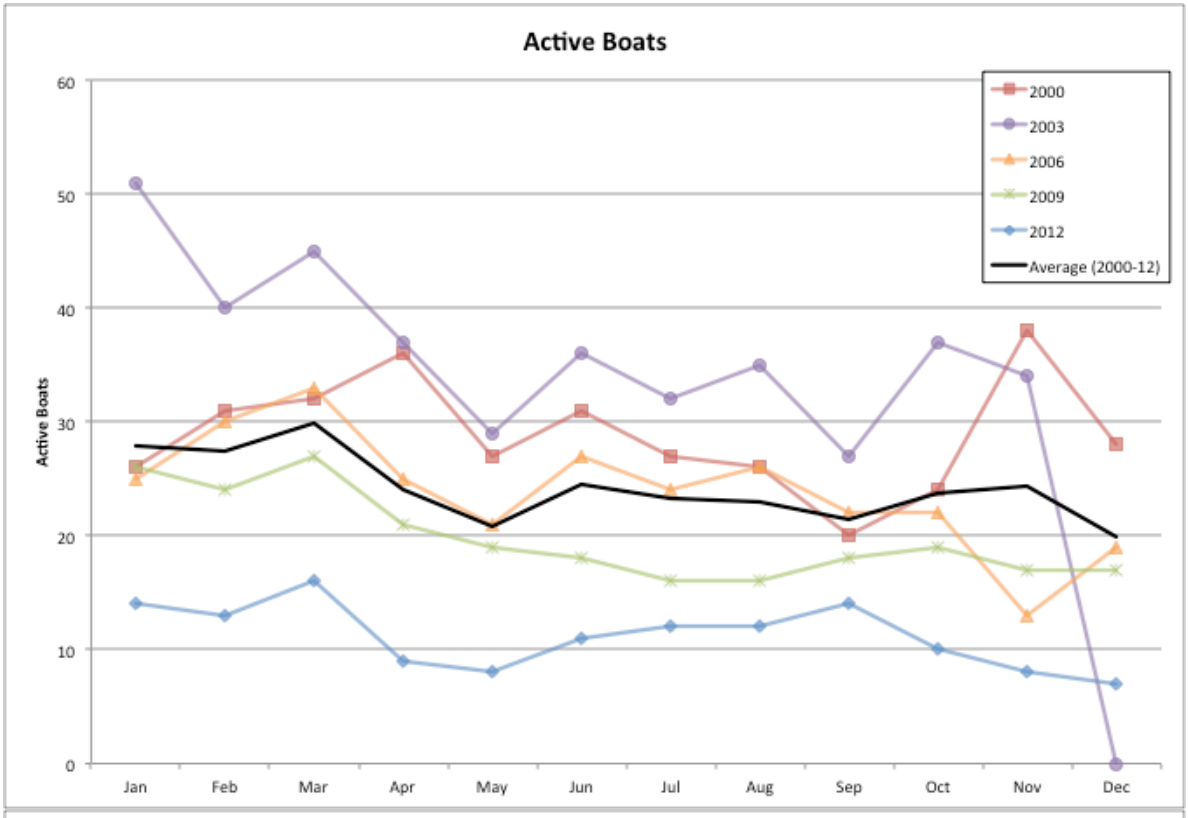


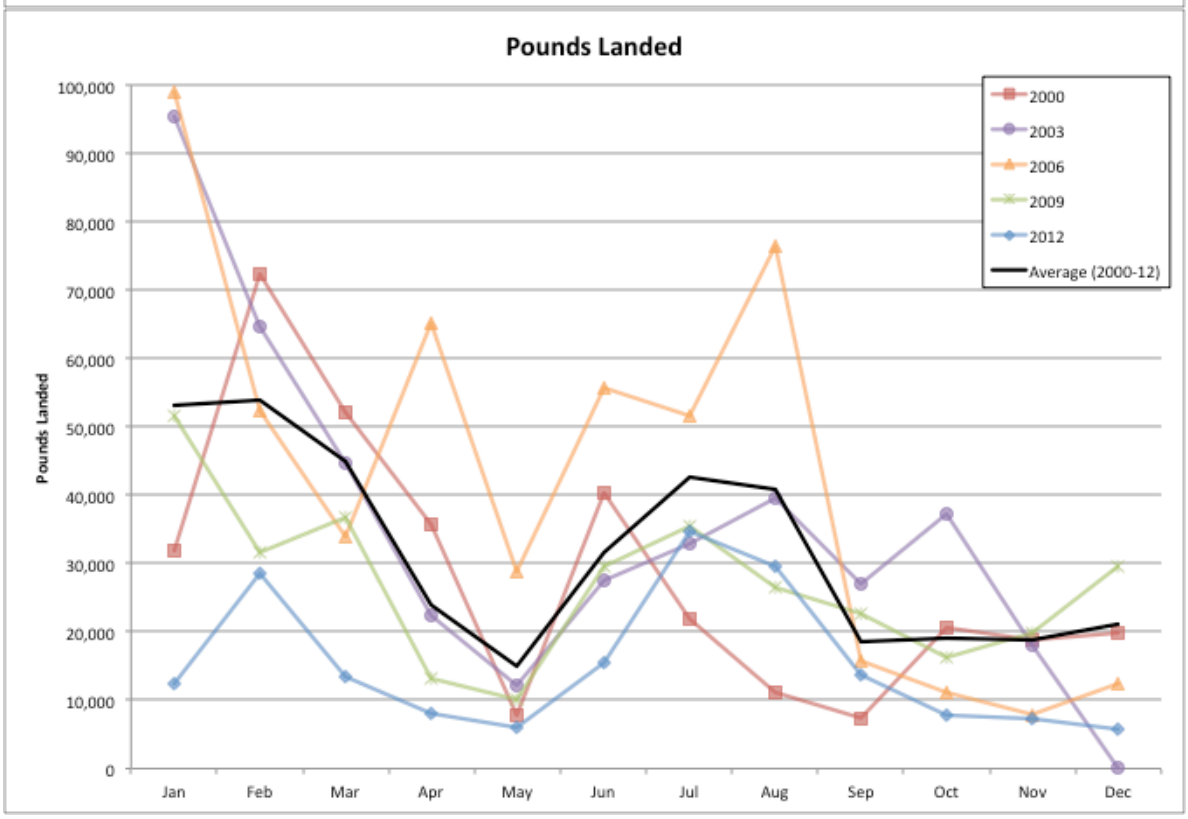
Seasonality in the California Halibut Fishery: Hook & Line Gear





Seasonality in the California Halibut Fishery: Trawl Gear





Percent of Boats with CHL Landings at One or More Port Groups: 3 Main Gear Types, Combined

	Percent of Boats Per Year		
	2000	**2006**	**2012**
1 Port Group	***93%***	***95%***	***94%***
Eureka	2%	1%	
Bodega Bay	5%	5%	2%
San Francisco	19%	23%	19%
Monterey	11%	14%	21%
Morro Bay	11%	6%	9%
Santa Barbara	20%	21%	20%
Los Angeles	20%	20%	15%
San Diego	4%	5%	7%
2 Port Groups	***7%***	***3%***	***6%***
Fort Bragg, Santa Barbara		~0%	
Bodega Bay, San Francisco	1%	1%	1%
Bodega Bay, Monterey		~0%	
Bodega Bay, Morro Bay			~0%
San Francisco, Monterey	~0%	~0%	1%
San Francisco, Morro Bay	1%		1%
Monterey, Morro Bay	1%		~0%
Monterey, Santa Barbara	1%		~0%
Morro Bay, Santa Barbara	~0%	~0%	1%
Santa Barbara, Los Angeles	2%	1%	1%
Los Angeles, San Diego	1%		1%
3 Port Groups		***1%***	
San Francisco, Monterey, Santa Barbara		~0%	
San Francisco, Monterey, Los Angeles		~0%	
Santa Barbara, Los Angeles, San Diego		~0%	
4 Port Groups	***~0%***	***~0%***	
Eureka, Fort Bragg, Bodega Bay, San Francisco	~0%		
San Francisco, Monterey, Morro Bay, Santa Barbara		~0%	
5 Port Groups		***1%***	
San Francisco, Monterey, Morro Bay, Santa Barbara, Los Angeles		1%	
Number of boats with at least one landing of CHL	**482**	**317**	**373**

Note: Blank cells indicate no activity, while ~0% indicates <0.5% of boats. Discrepancies between sums and totals shown are due to rounding.

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Percent of Boats with CHL Landings at One or More Port Groups: Gillnet Gear

	Percent of Boats Per Year		
	2000	**2006**	**2012**
1 Port Group	***91%***	***93%***	***92%***
San Francisco	1%	3%	
Monterey	8%	3%	3%
Morro Bay	13%		3%
Santa Barbara	32%	33%	35%
Los Angeles	26%	33%	35%
San Diego	11%	23%	16%
2 Port Groups	***9%***	***5%***	***8%***
Monterey, Santa Barbara	1%		
Morro Bay, Santa Barbara		3%	3%
Santa Barbara, Los Angeles	1%	3%	3%
Los Angeles, San Diego	7%		3%
3 Port Groups		***3%***	
Santa Barbara, Los Angeles, San Diego		3%	
Number of boats with at least one landing of CHL	**85**	**40**	**37**

Note: Blank cells indicate no activity, while ~0% indicates <0.5% of boats. Discrepancies between sums and totals shown are due to rounding.

Percent of Boats with CHL Landings in One or More Port Groups: Line Gear

	Percent of Boats Per Year		
	2000	**2006**	**2012**
1 Port Group	***95%***	***98%***	***95%***
Eureka	~0%	1%	
Bodega Bay	8%	7%	3%
San Francisco	23%	25%	21%
Monterey	12%	18%	25%
Morro Bay	12%	7%	10%
Santa Barbara	15%	17%	16%
Los Angeles	21%	20%	12%
San Diego	4%	3%	7%
2 Port Groups	***4%***	***2%***	***5%***
Bodega Bay, San Francisco	1%	1%	1%
Bodega Bay, Monterey		~0%	
Bodega Bay, Morro Bay			~0%
San Francisco, Monterey			1%
San Francisco, Morro Bay			1%
Monterey, Morro Bay	1%		~0%
Monterey, Santa Barbara	1%		~0%
Morro Bay, Santa Barbara	1%		1%
Santa Barbara, Los Angeles	1%	1%	~0%
Los Angeles, San Diego			1%
4 Port Groups	***~0%***		
Eureka, Fort Bragg, Bodega Bay, San Francisco	~0%		
Number of boats with at least one landing of CHL	**306**	**224**	**302**

Note: Blank cells indicate no activity, while ~0% indicates <0.5% of boats. Discrepancies between sums and totals shown are due to rounding.

Percent of Boats with CHL Landings in One or More Port Groups: Trawl Gear

	Percent of Boats Per Year		
	2000	**2006**	**2012**
1 Port Group	***85%***	***87%***	***88%***
Eureka	10%		
San Francisco	21%	28%	21%
Monterey	8%	8%	
Morro Bay	5%	6%	6%
Santa Barbara	29%	32%	41%
Los Angeles	11%	13%	21%
San Diego	1%		
2 Port Groups	***15%***	***4%***	***12%***
Fort Bragg, Santa Barbara		2%	
Bodega Bay, San Francisco			3%
San Francisco, Monterey	1%	2%	
San Francisco, Morro Bay	3%		6%
Monterey, Santa Barbara	2%		
Santa Barbara, Los Angeles	9%		
Los Angeles, San Diego			3%
3 Port Groups		***4%***	
San Francisco, Monterey, Santa Barbara		2%	
San Francisco, Monterey, Los Angeles		2%	
4 Port Groups		***2%***	
San Francisco, Monterey, Morro Bay, Santa Barbara		2%	
5 Port Groups		***4%***	
San Francisco, Monterey, Morro Bay, Santa Barbara, Los Angeles		4%	
Number of boats with at least one landing of CHL	**91**	**53**	**34**

Note: Blank cells indicate no activity, while ~0% indicates <0.5% of boats. Discrepancies between sums and totals shown are due to rounding.

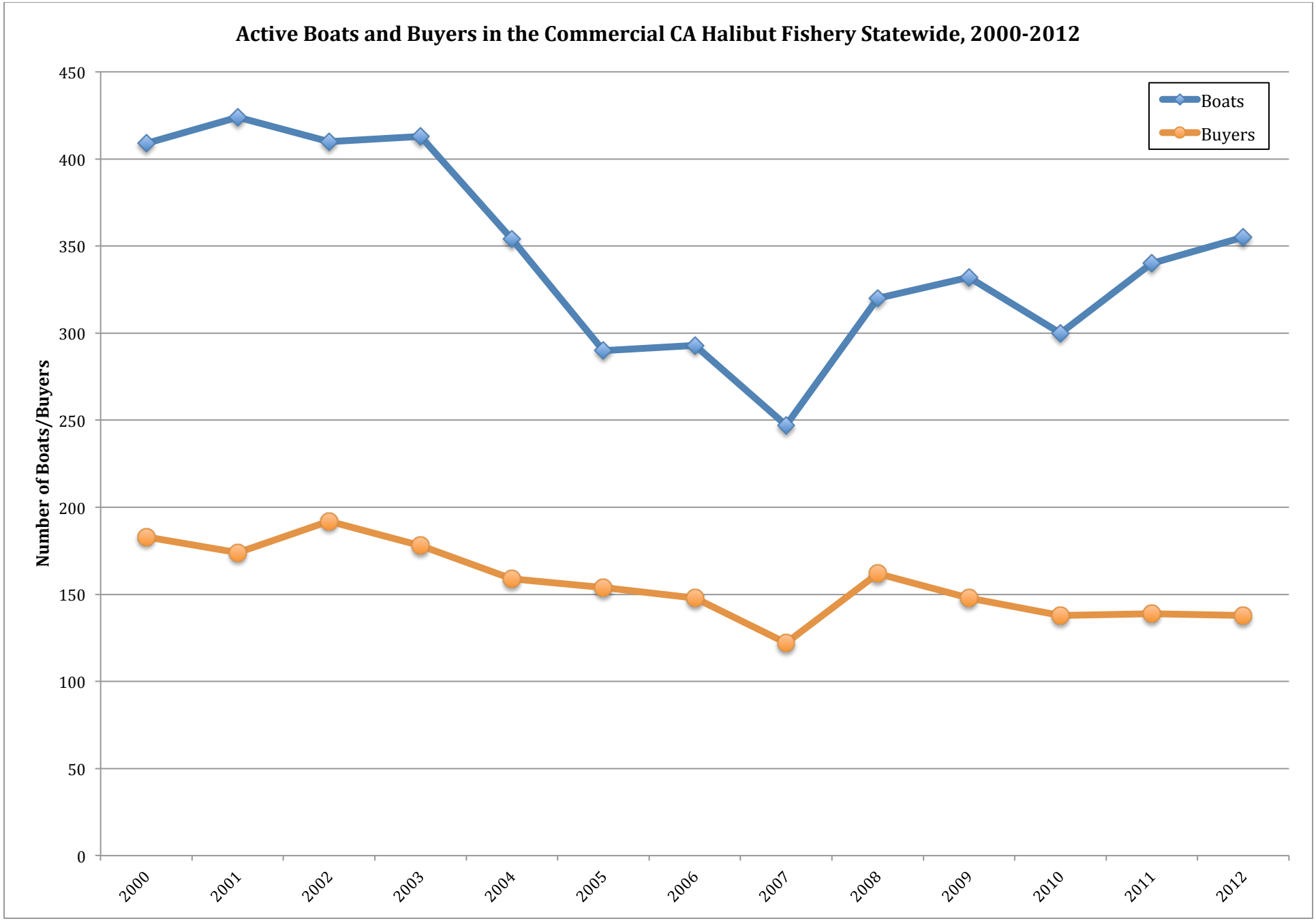
Set 3: California halibut commercial fishery activity, 2000-2012

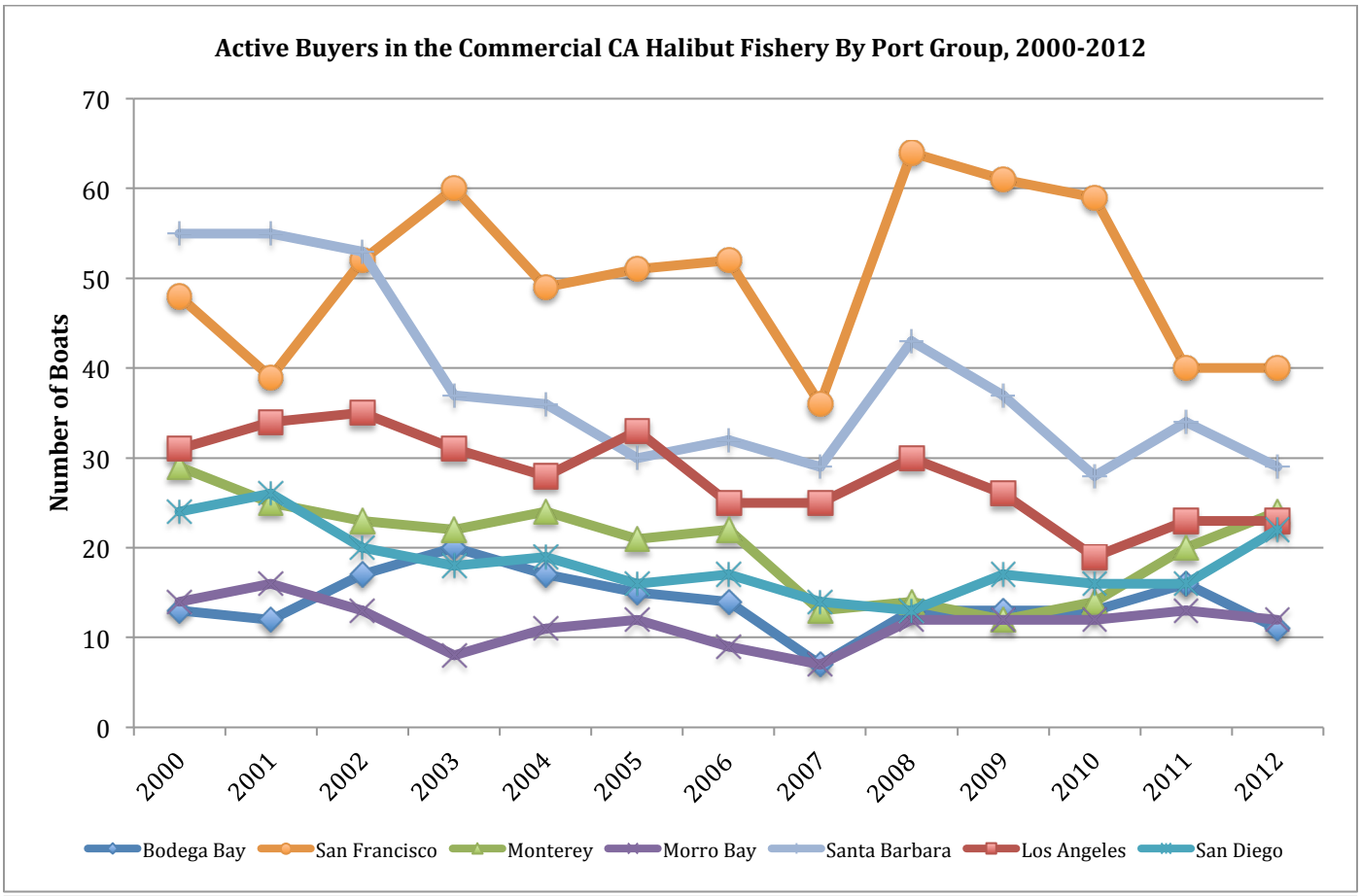
Questions to guide your review

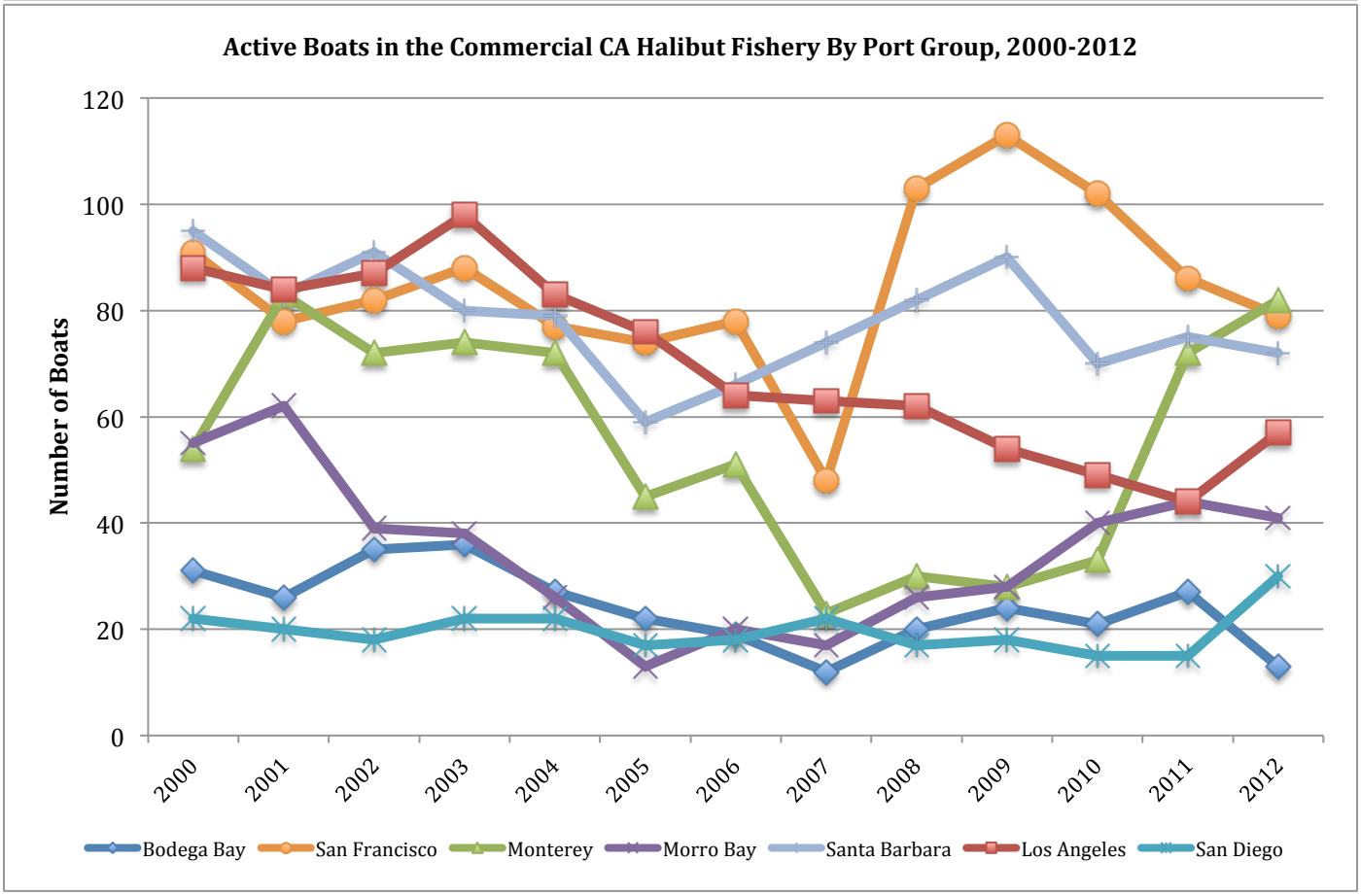
1. Where the charts show noticeable changes in fishery activity (in landings, value, active boats or active buyers), what caused that to happen? Examples of causes might include: climate or weather conditions, availability of California halibut or other species, changes in market conditions or regulations, or anything else that could affect fishing activity.

2. How, if at all, did these events or changes affect how fishing, receiving, and distribution work in the California halibut fishery?

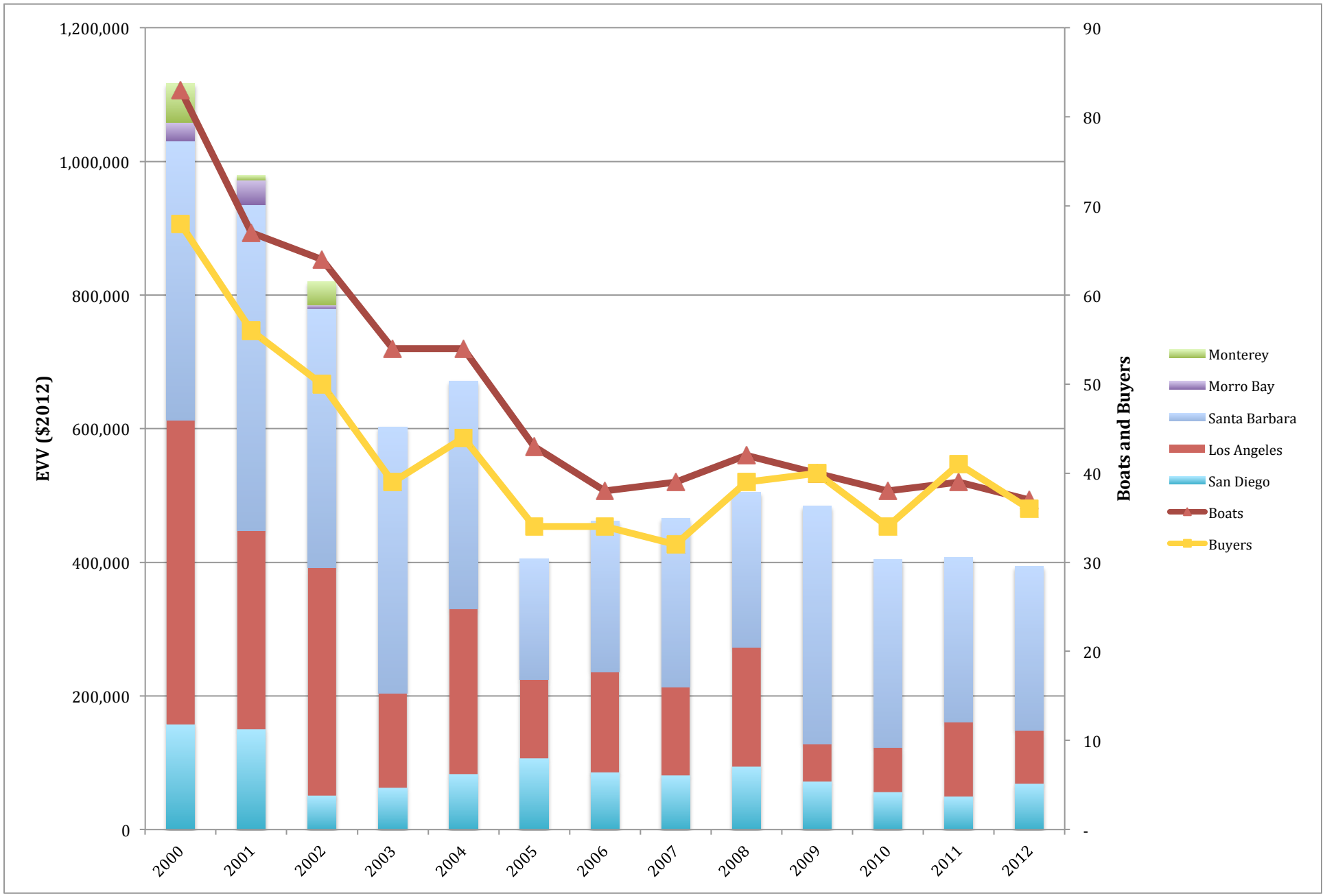
3. Have there been any important events or changes in the fishery that are not clearly indicated in the data as presented?


Active Boats and Buyers in the Commercial CA Halibut Fishery Statewide, 2000-2012
Number of Boats/Buyers
450
400
350
300
250
200
150
100
50
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Boats
Buyers


Active Buyers in the Commercial CA Halibut Fishery By Port Group, 2000-2012
Number of Boats
70
60
50
40
30
20
10
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Bodega Bay
San Francisco
Monterey
Morro Bay
Santa Barbara
Los Angeles
San Diego

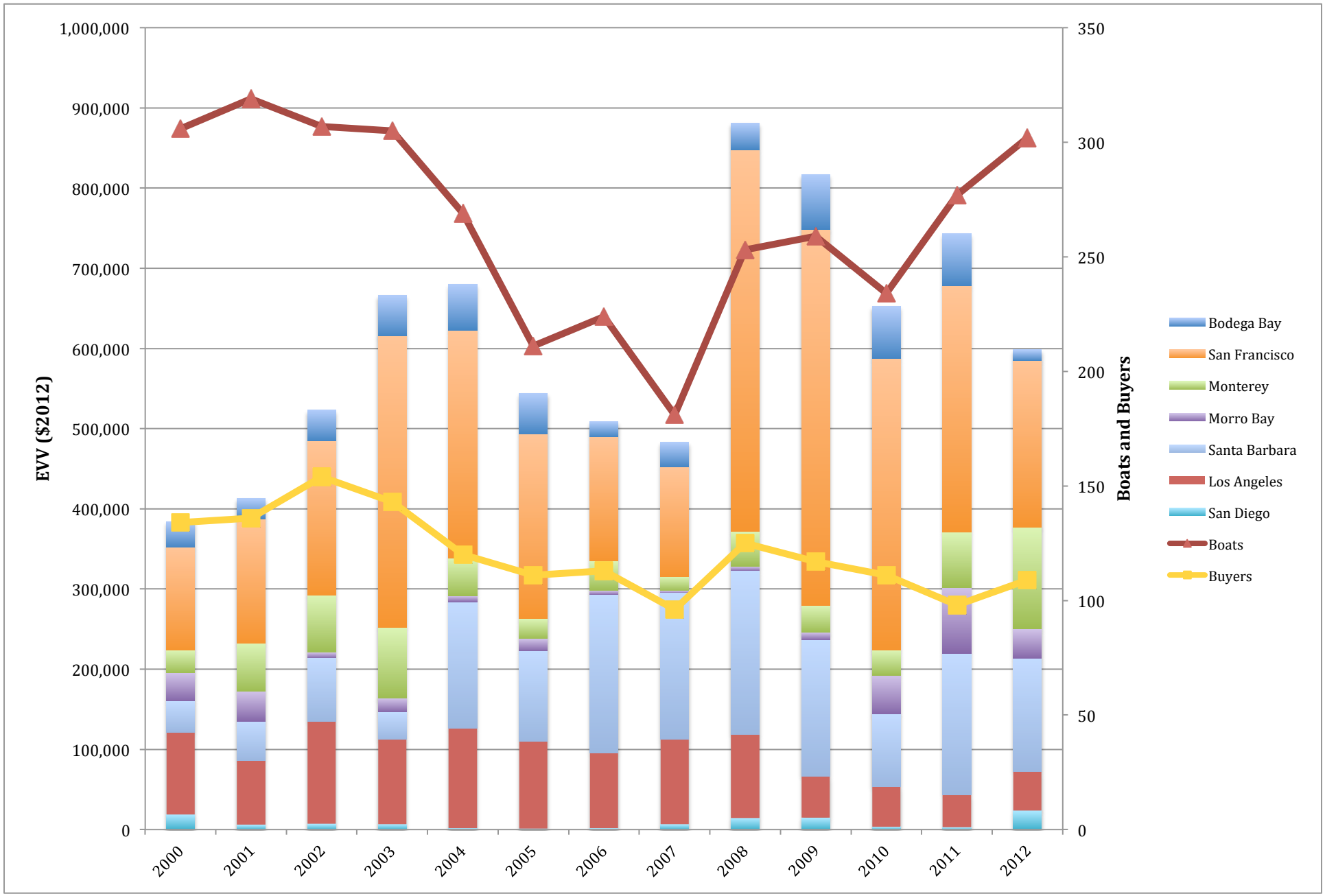

Active Boats in the Commercial CA Halibut Fishery By Port Group, 2000-2012
Number of Boats
120
100
80
60
40
20
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Bodega Bay
San Francisco
Monterey
Morro Bay
Santa Barbara
Los Angeles
San Diego

Ex-Vessel Value by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Gillnet Gear

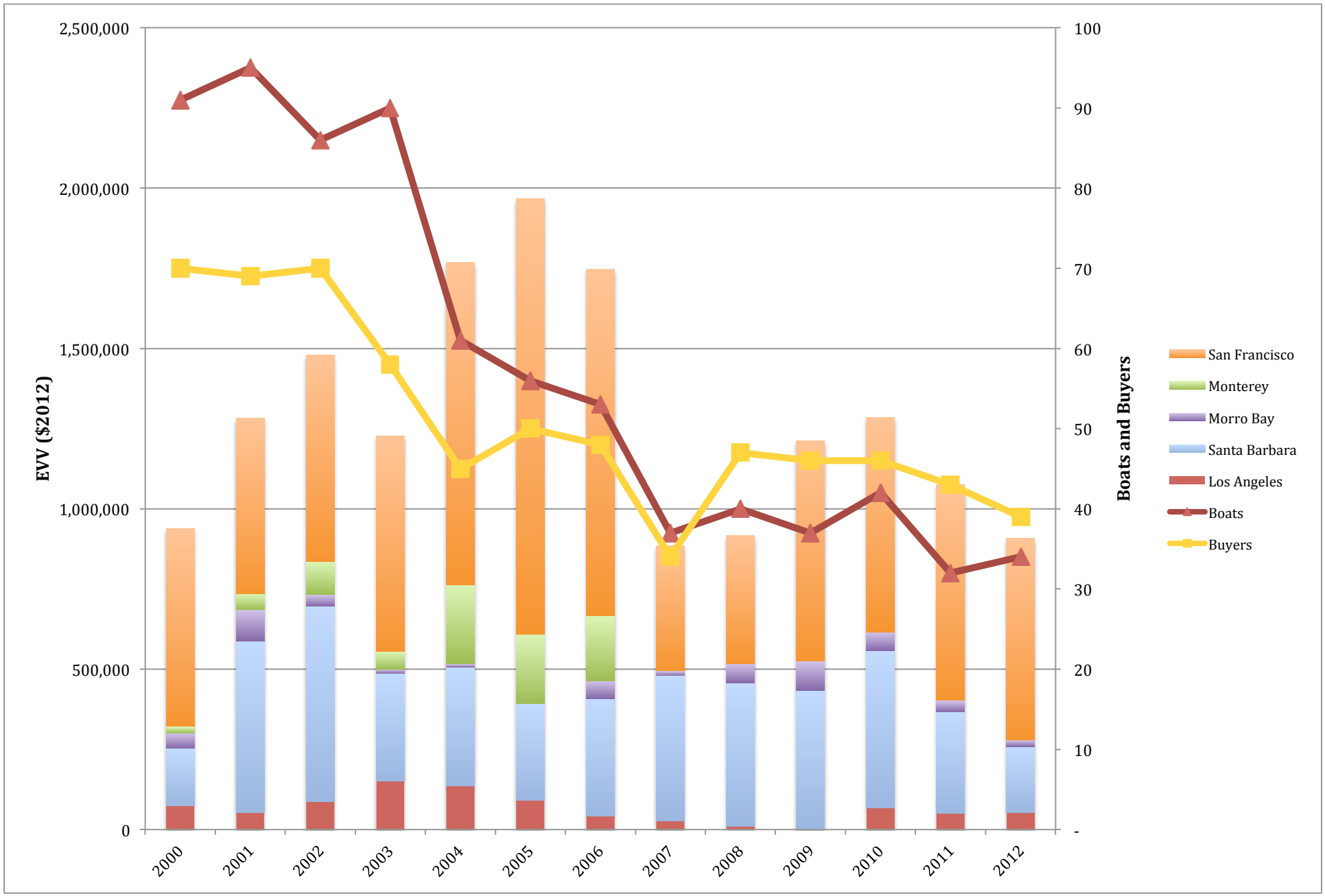


*Some data are not reported to ensure confidentiality.

Ex-Vessel Value by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Hook & Line Gear

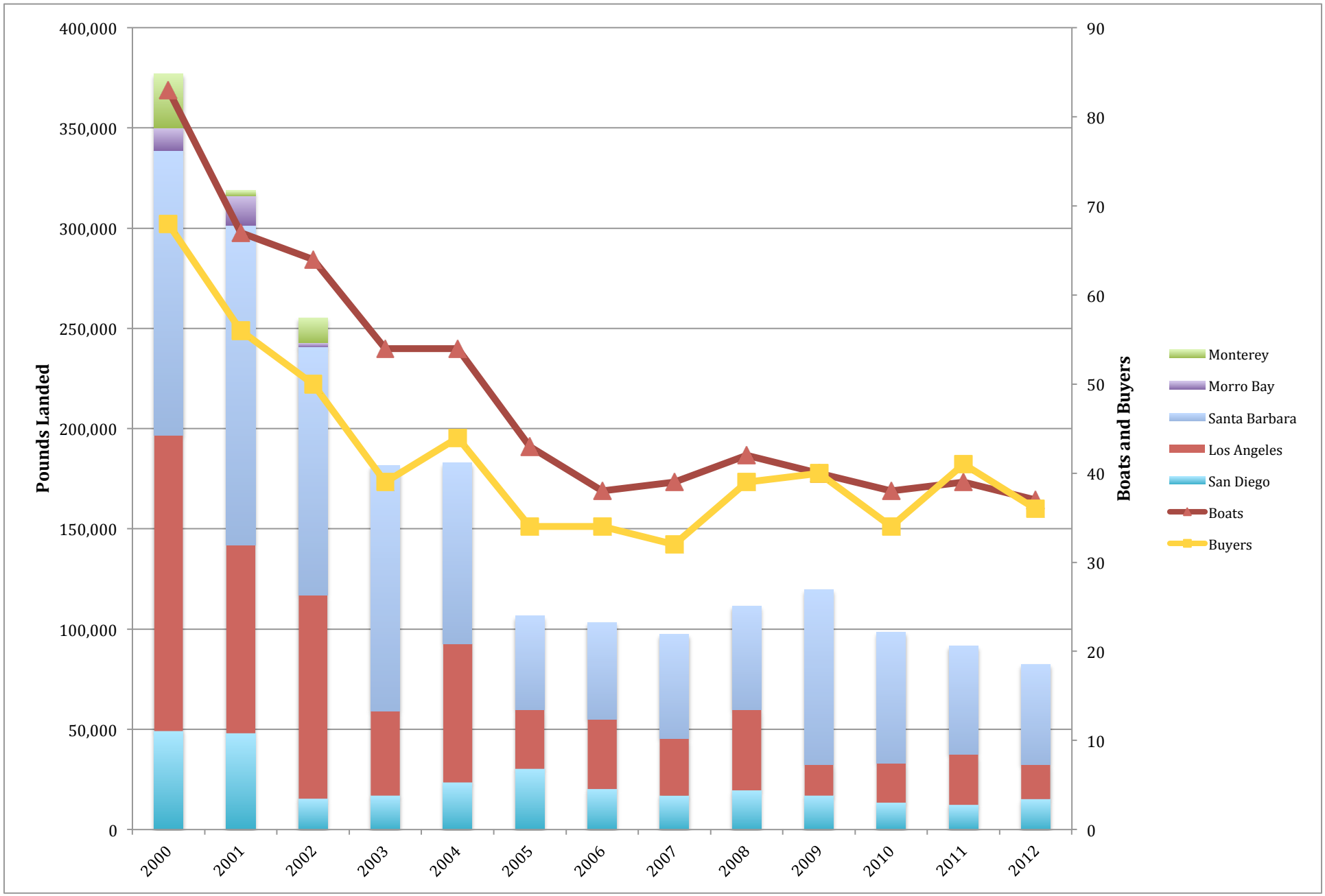


Ex-Vessel Value by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Trawl Gear



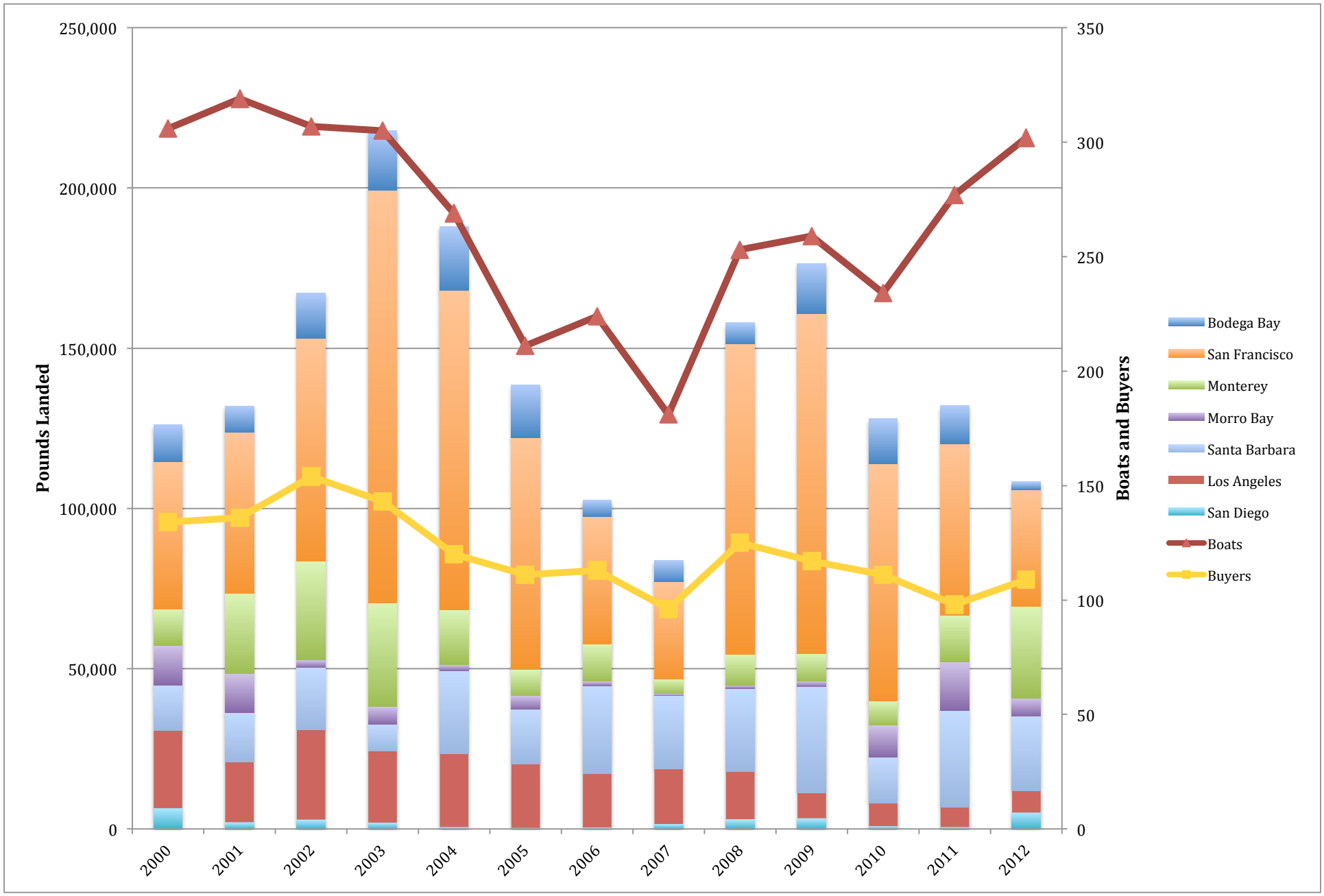
*Some data are not reported to ensure confidentiality.

Pounds Landed by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Gillnet Gear

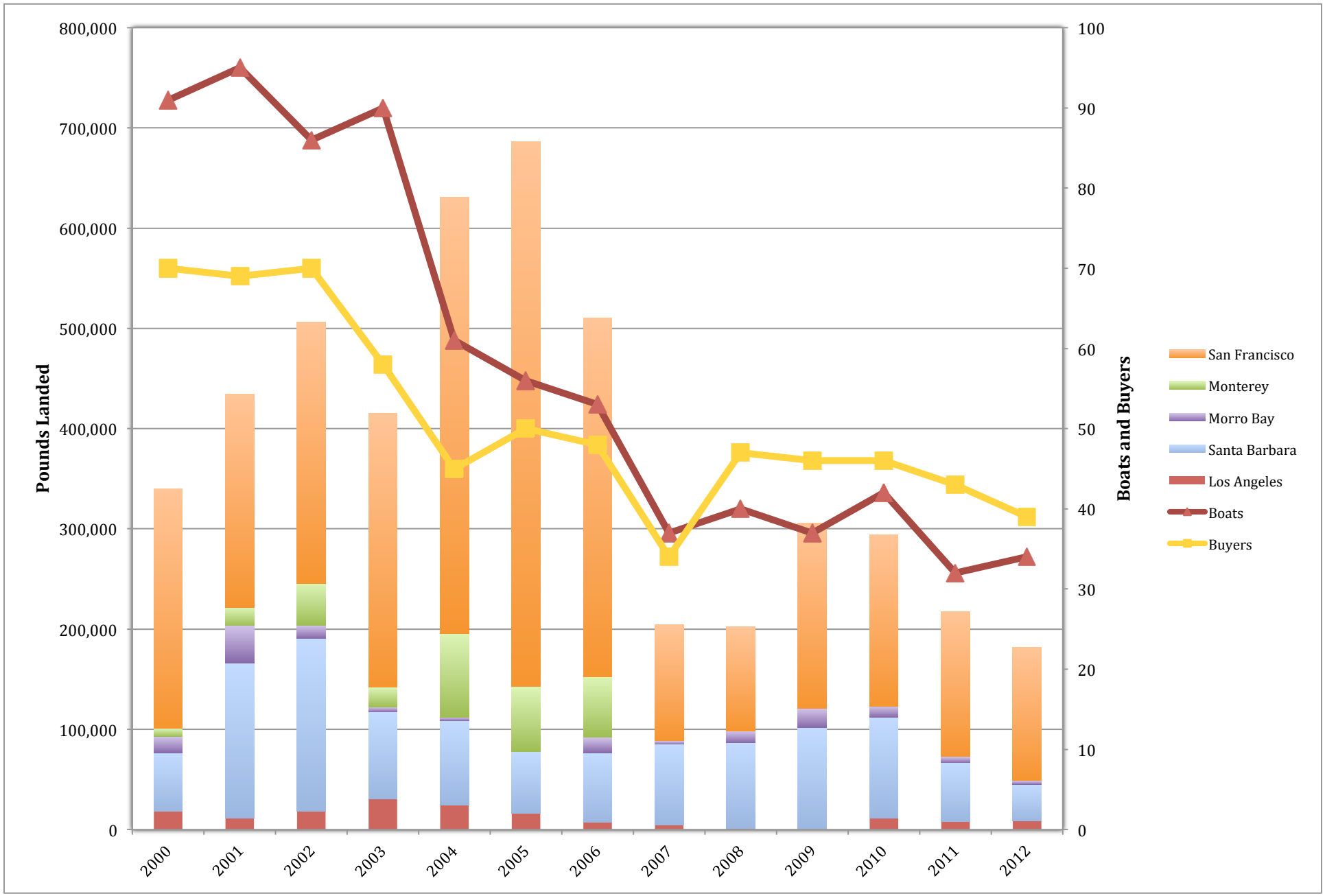


*Some data are not reported to ensure confidentiality.

Pounds Landed by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Hook & Line Gear

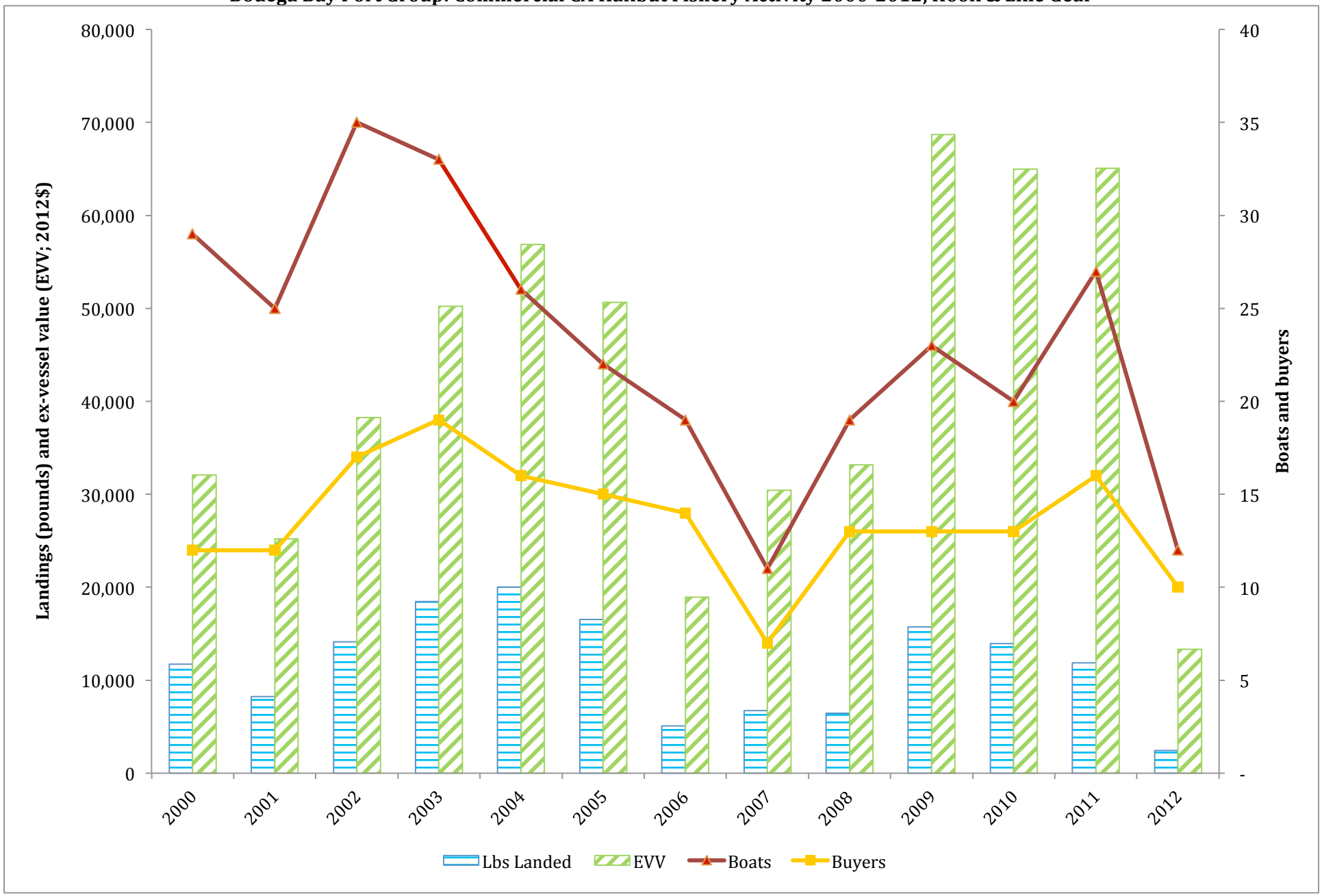


Pounds Landed by Port Group and Statewide Number of Participants in the Commercial CA Halibut Fishery, 2000-2012: Trawl Gear

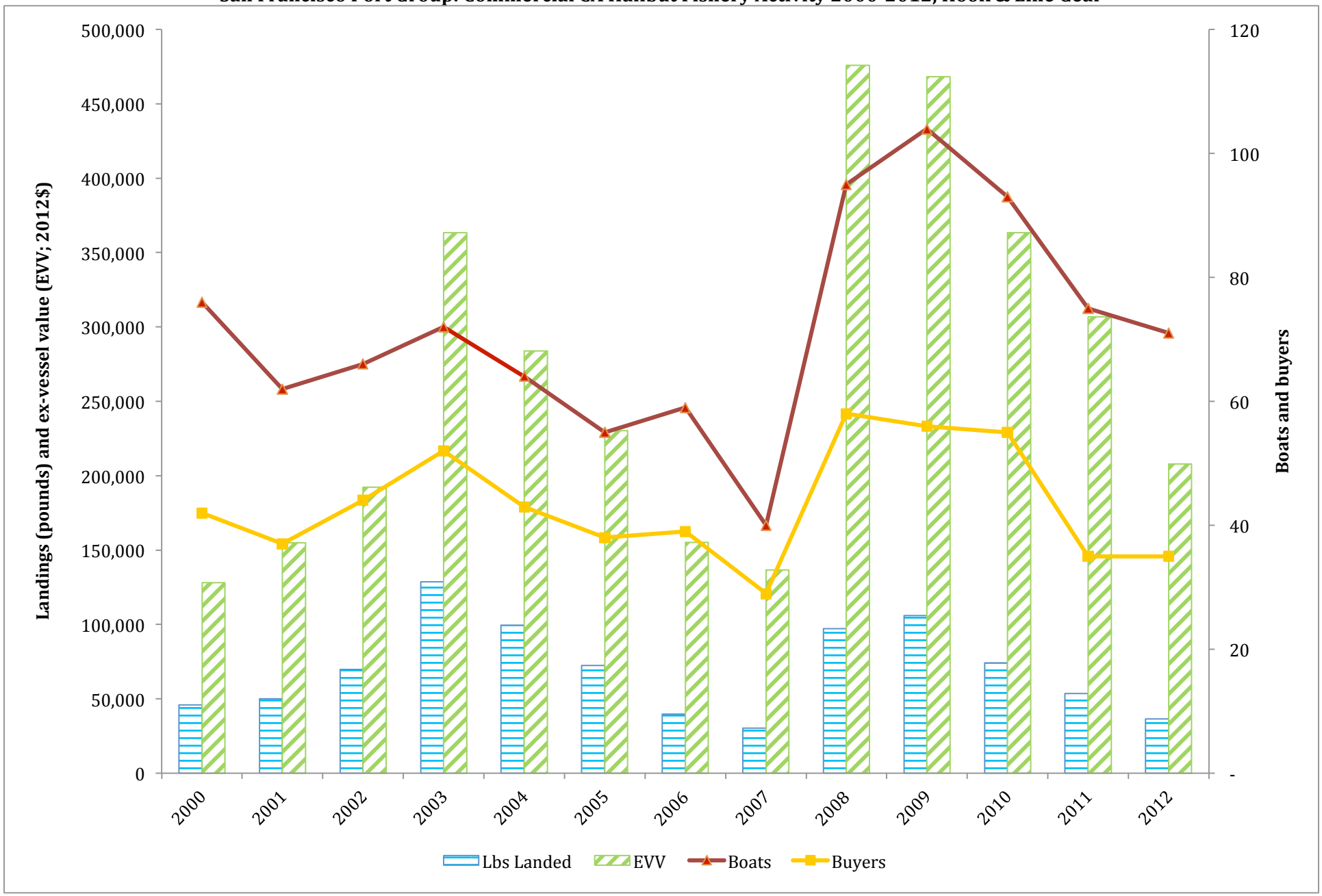


*Some data are not reported to ensure confidentiality.

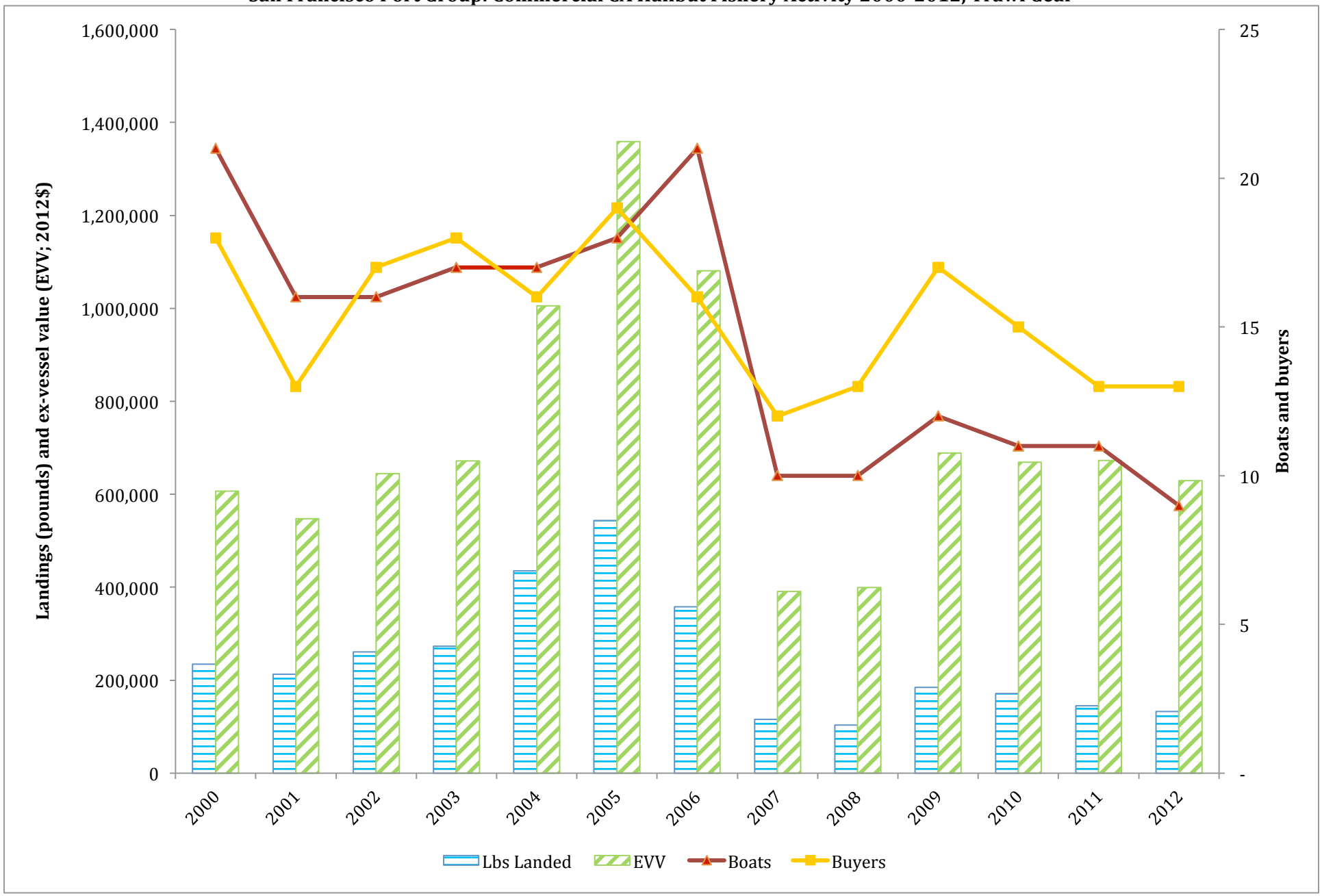
Bodega Bay Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear



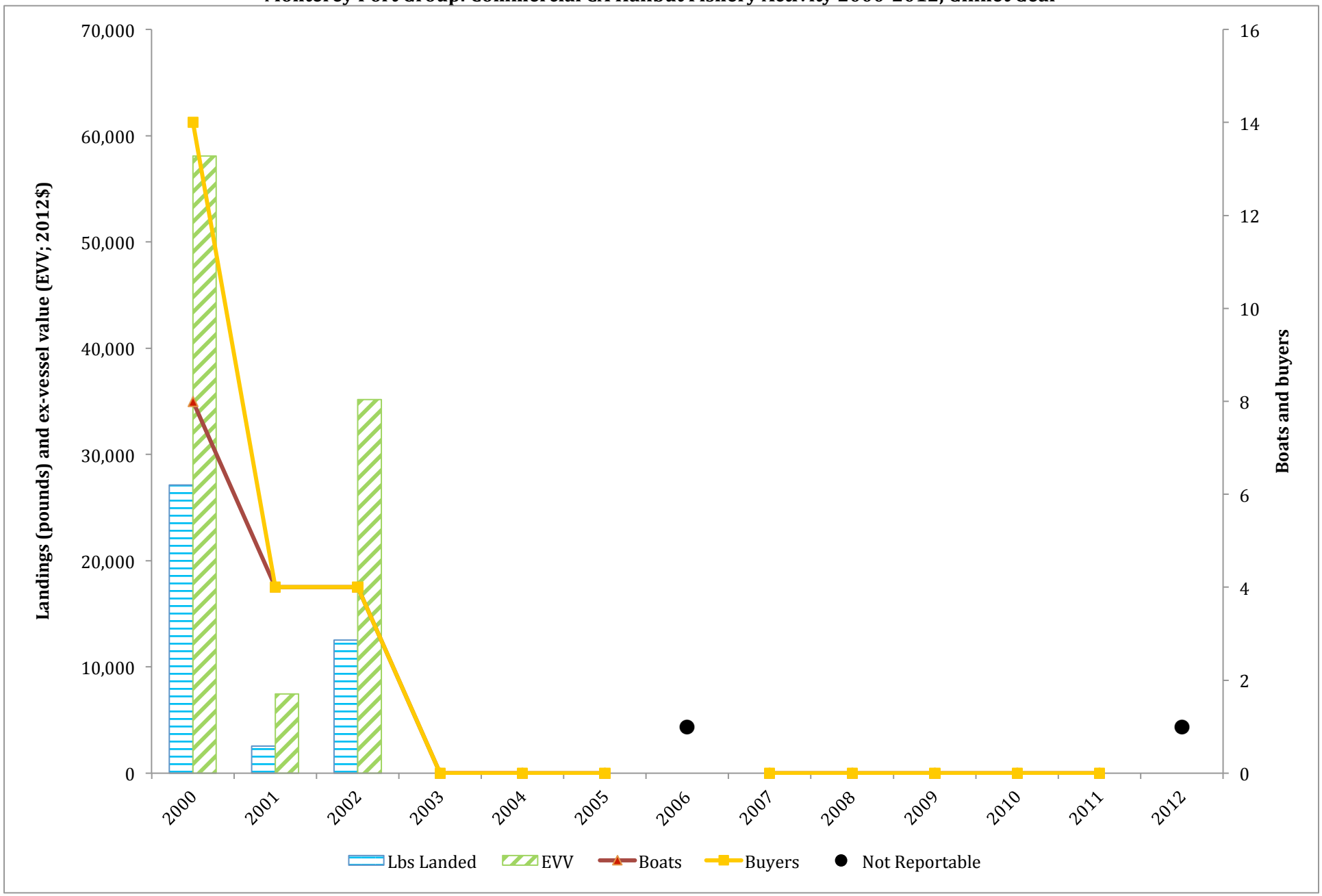
San Francisco Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear



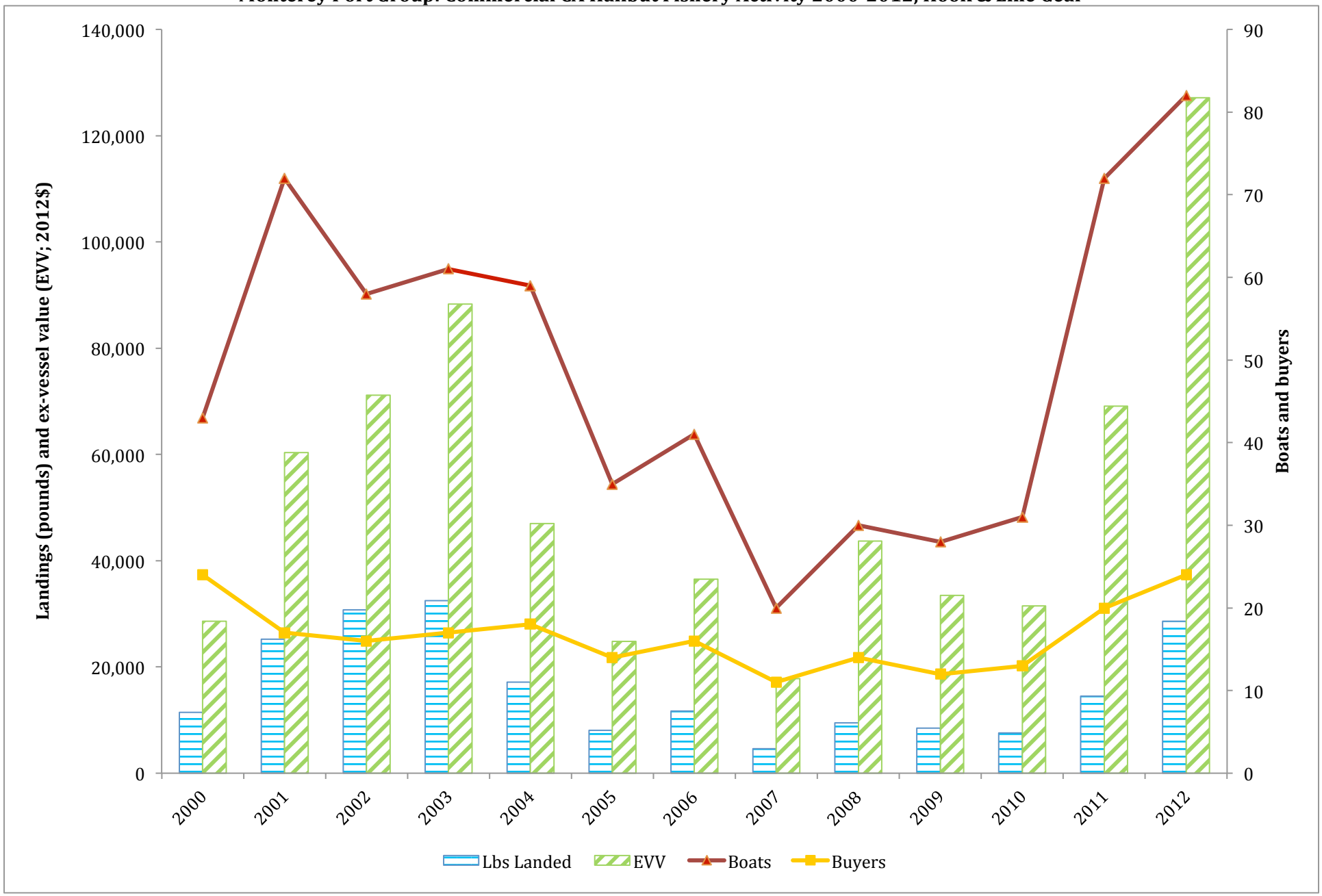
San Francisco Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Trawl Gear



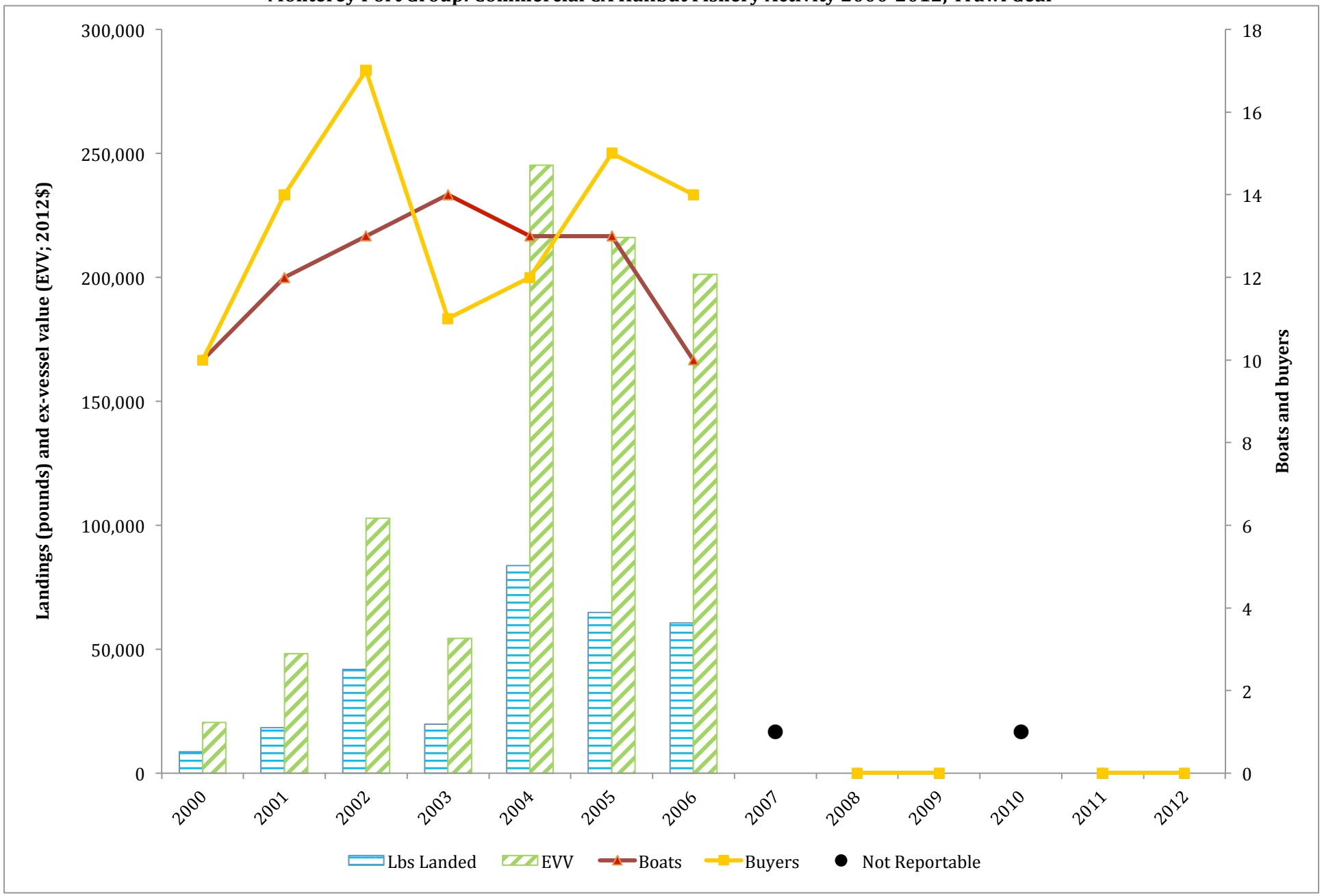
Monterey Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Gillnet Gear



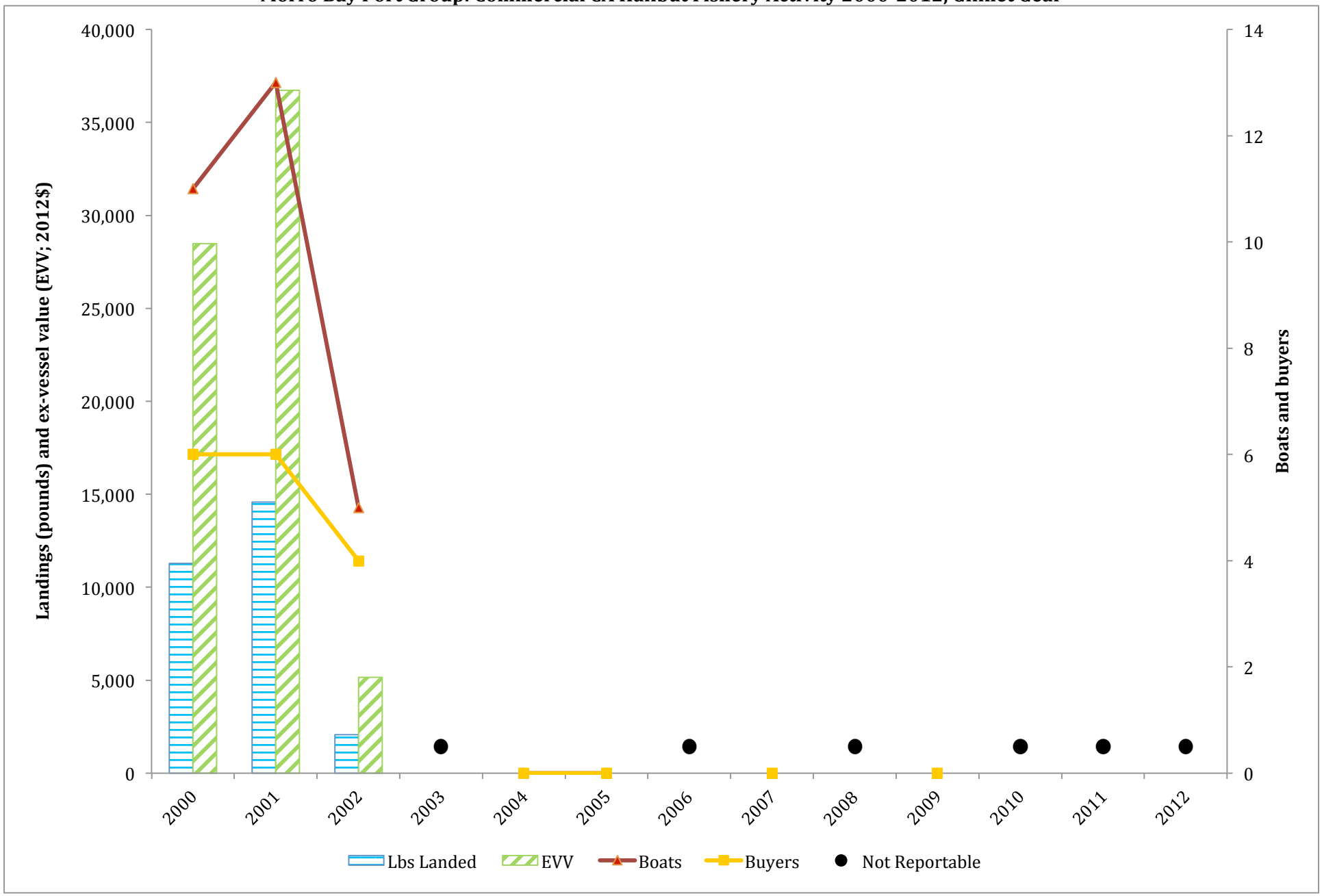
Monterey Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear



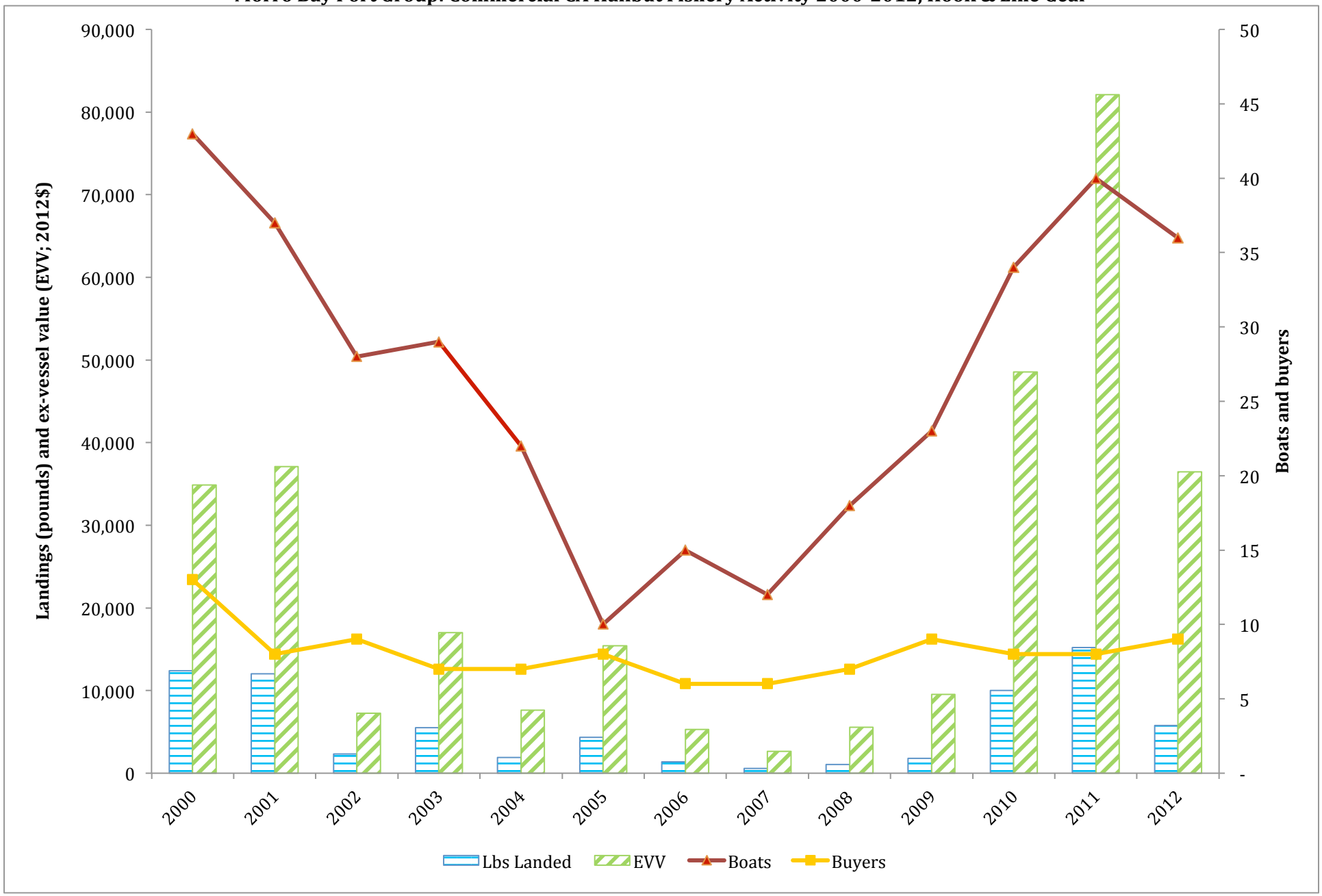
Monterey Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Trawl Gear



Morro Bay Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Gillnet Gear

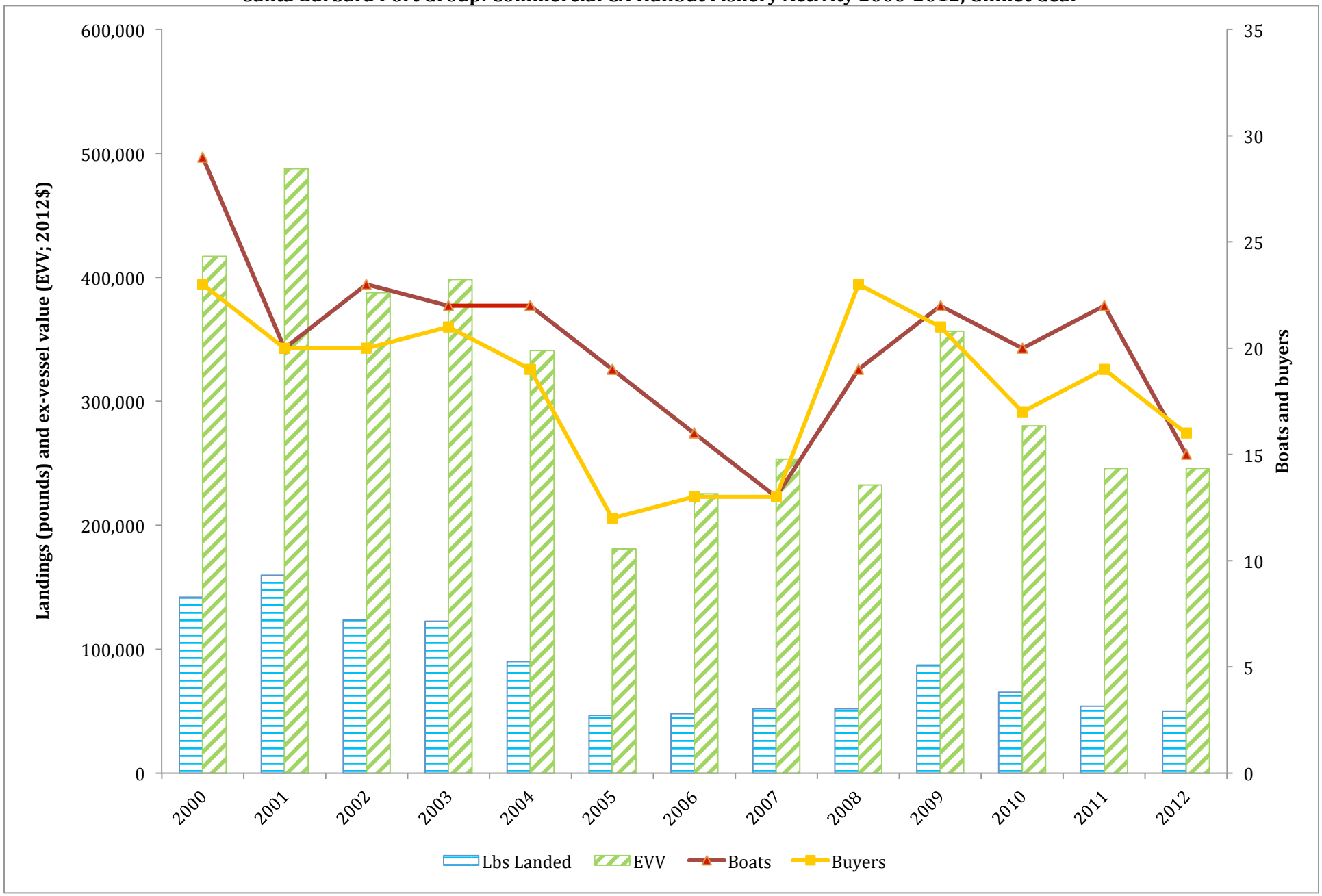


Morro Bay Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear

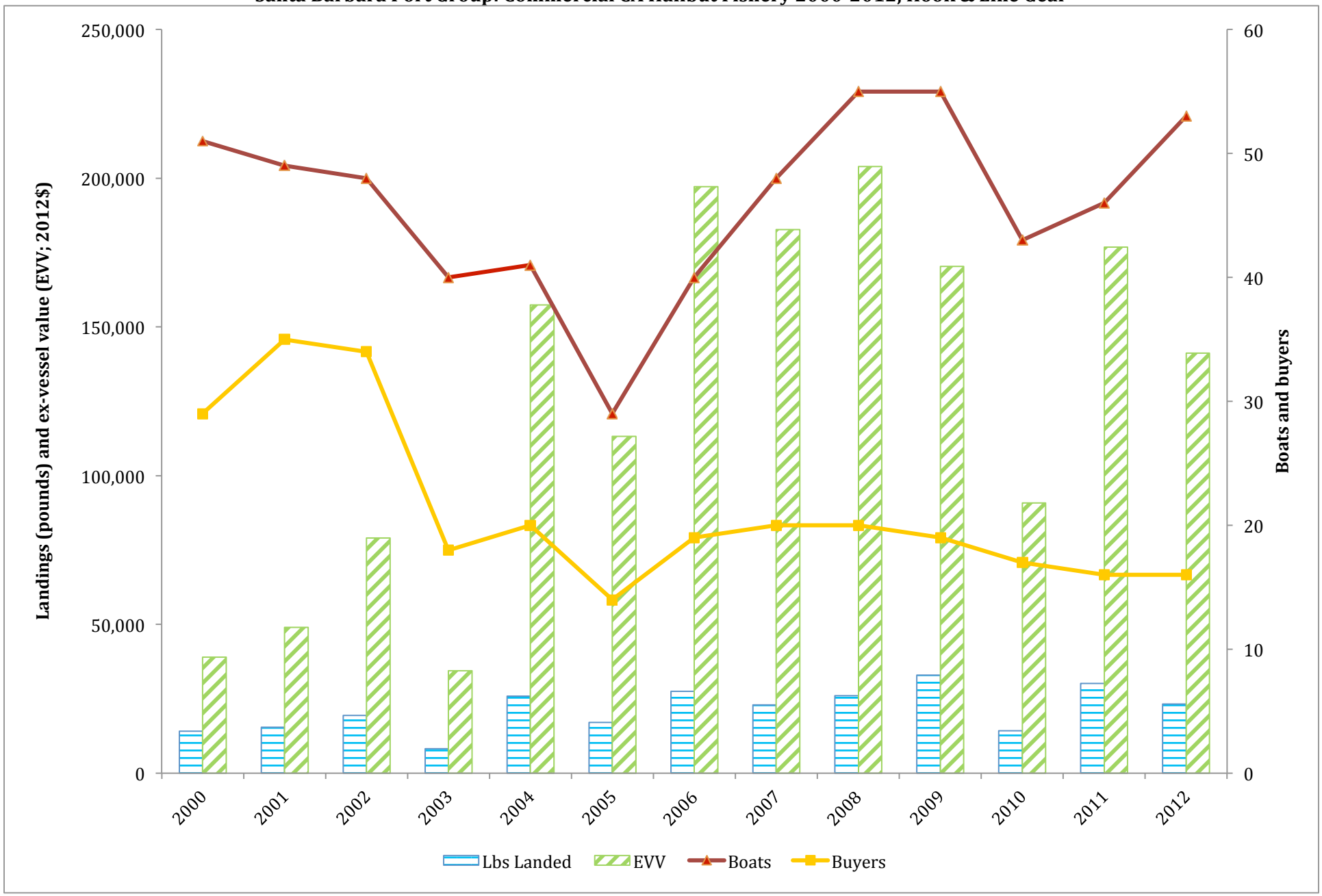


Morro Bay Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Trawl Gear

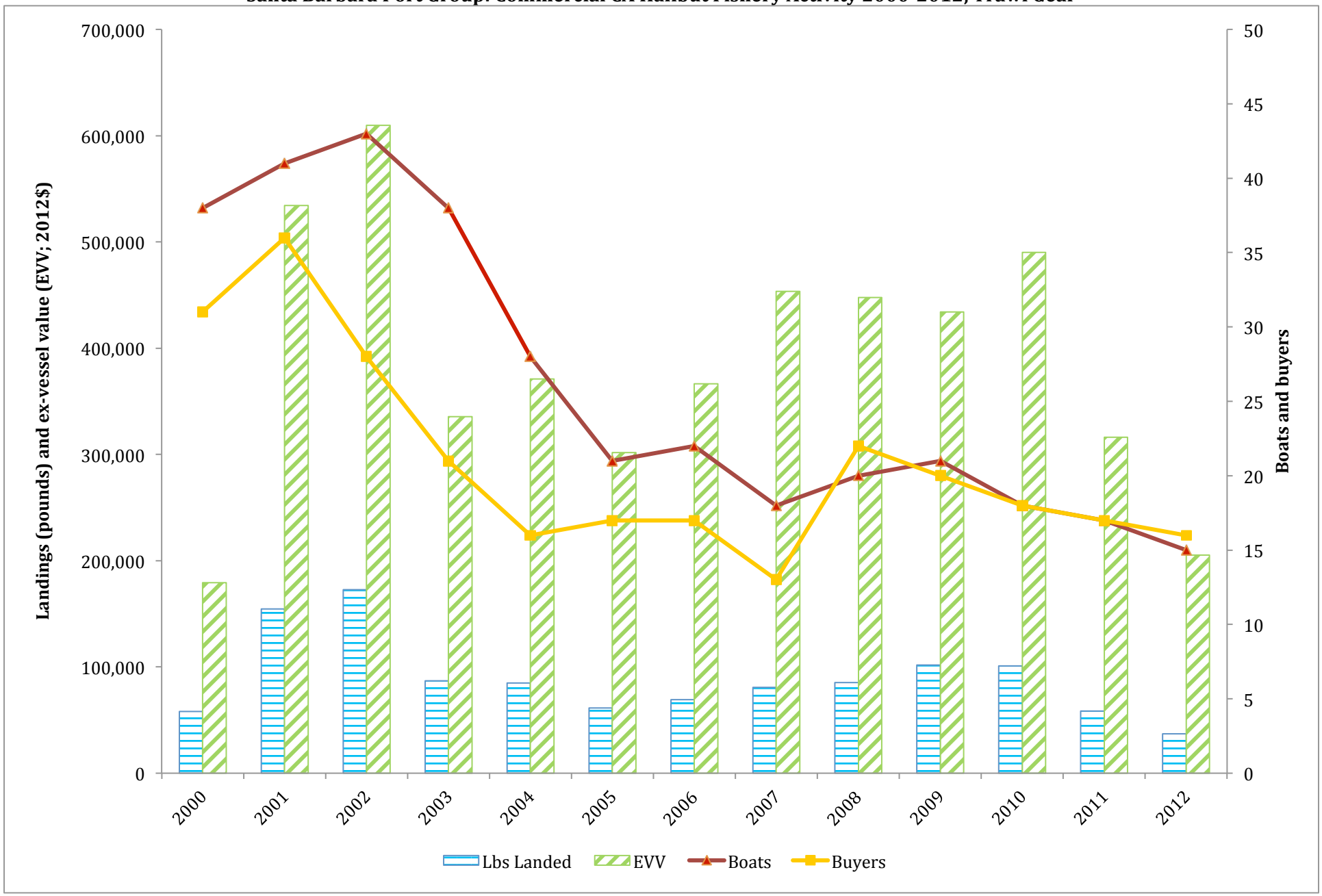
Santa Barbara Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Gillnet Gear



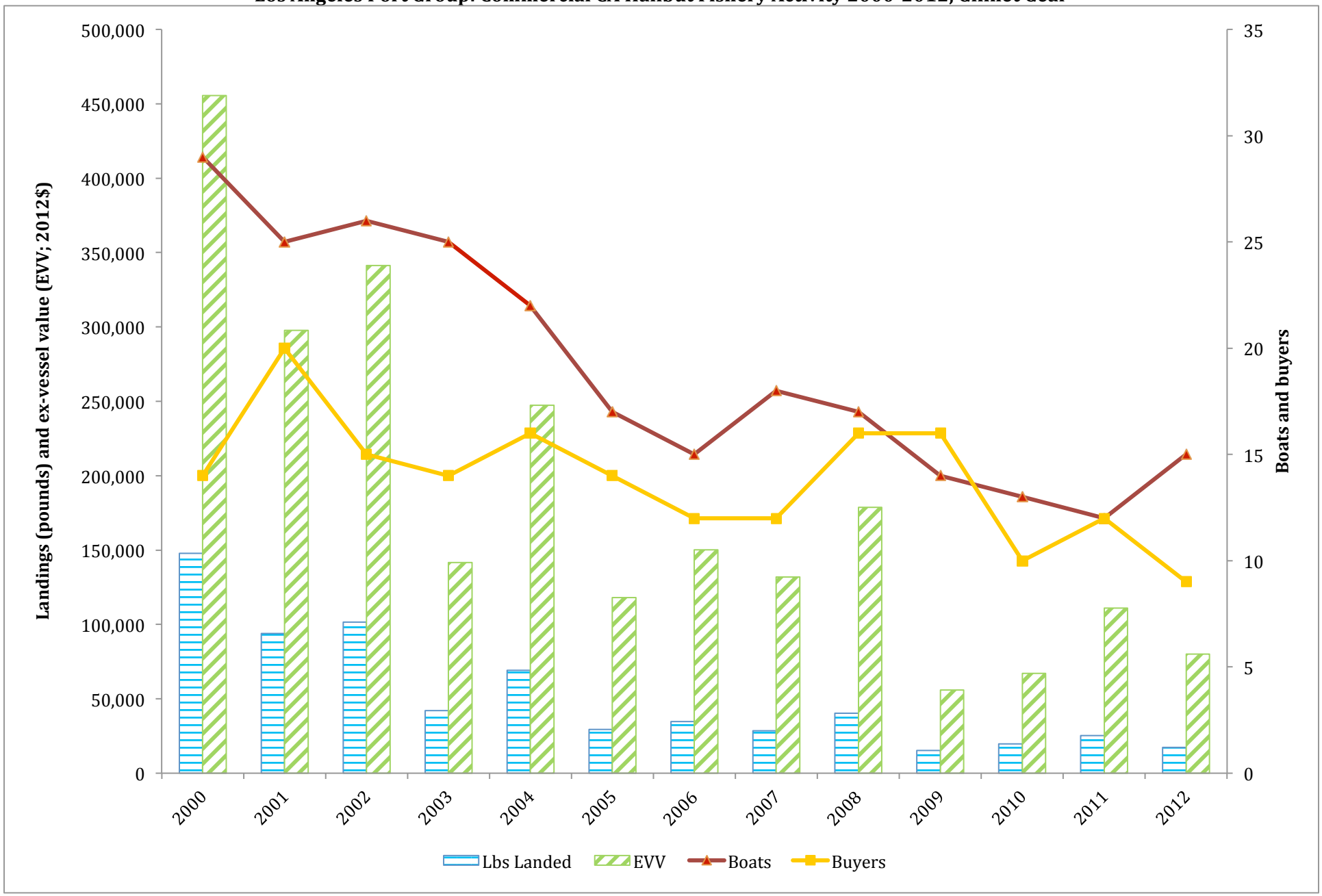
Santa Barbara Port Group: Commercial CA Halibut Fishery 2000-2012, Hook & Line Gear



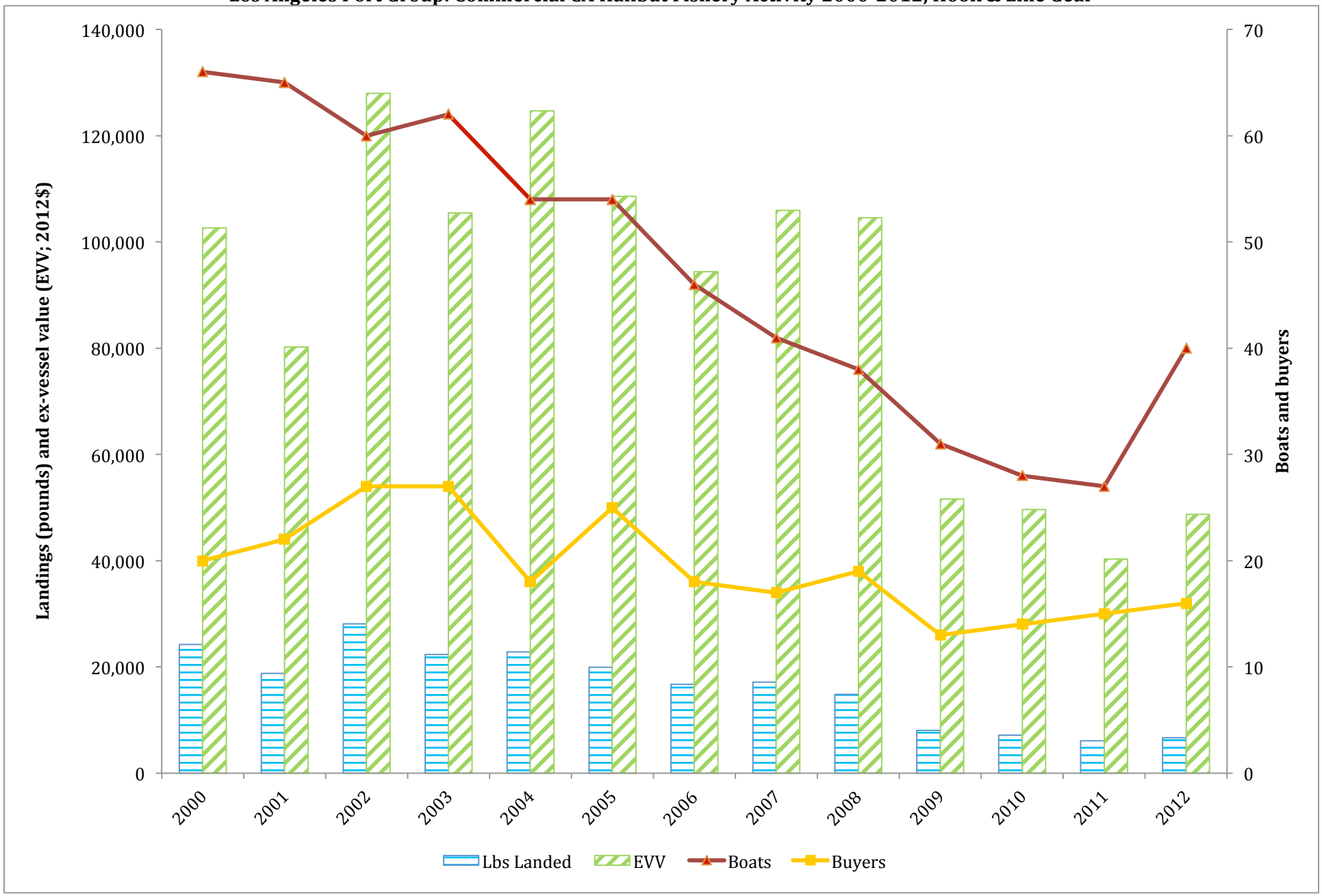
Santa Barbara Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Trawl Gear



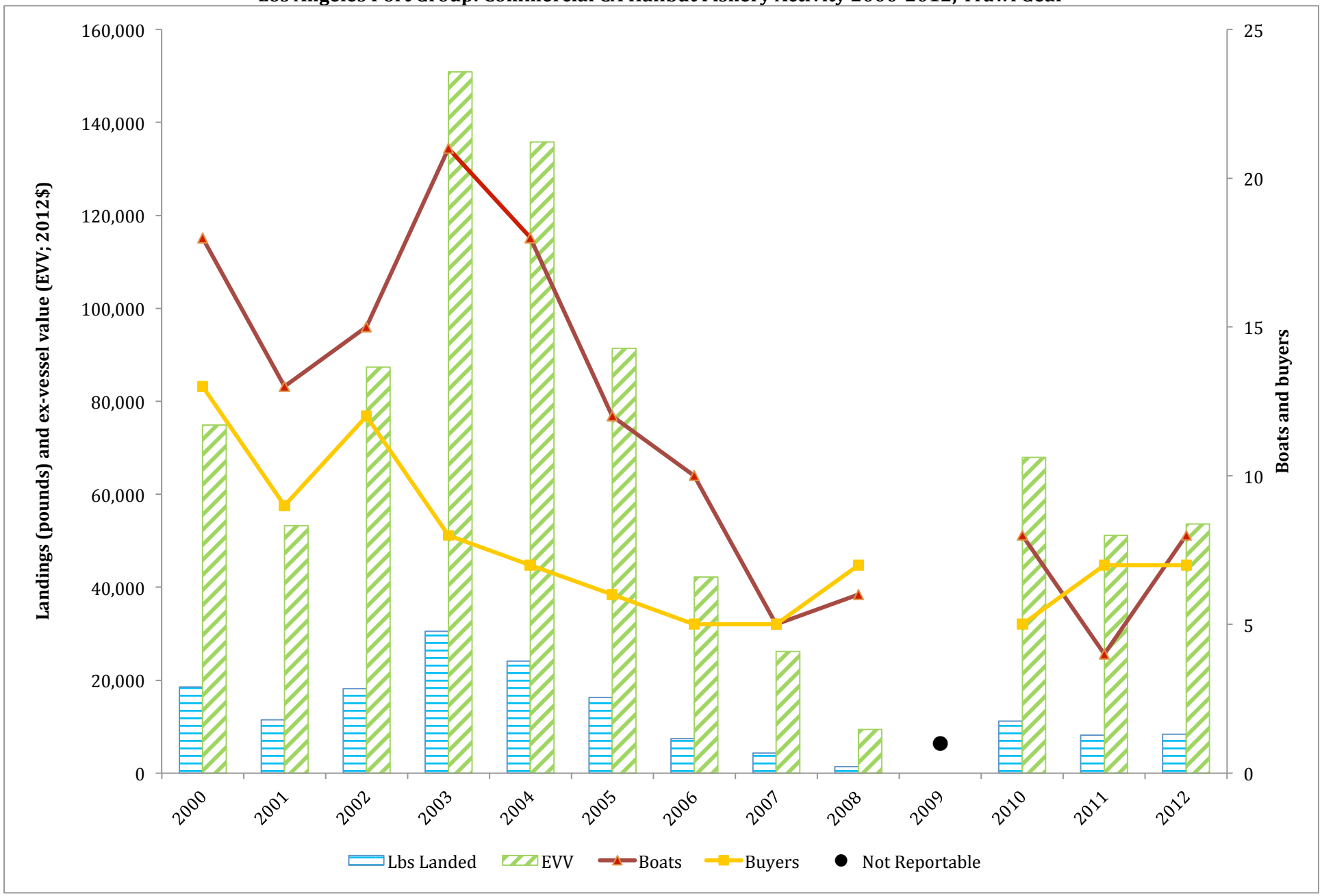
Los Angeles Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Gillnet Gear



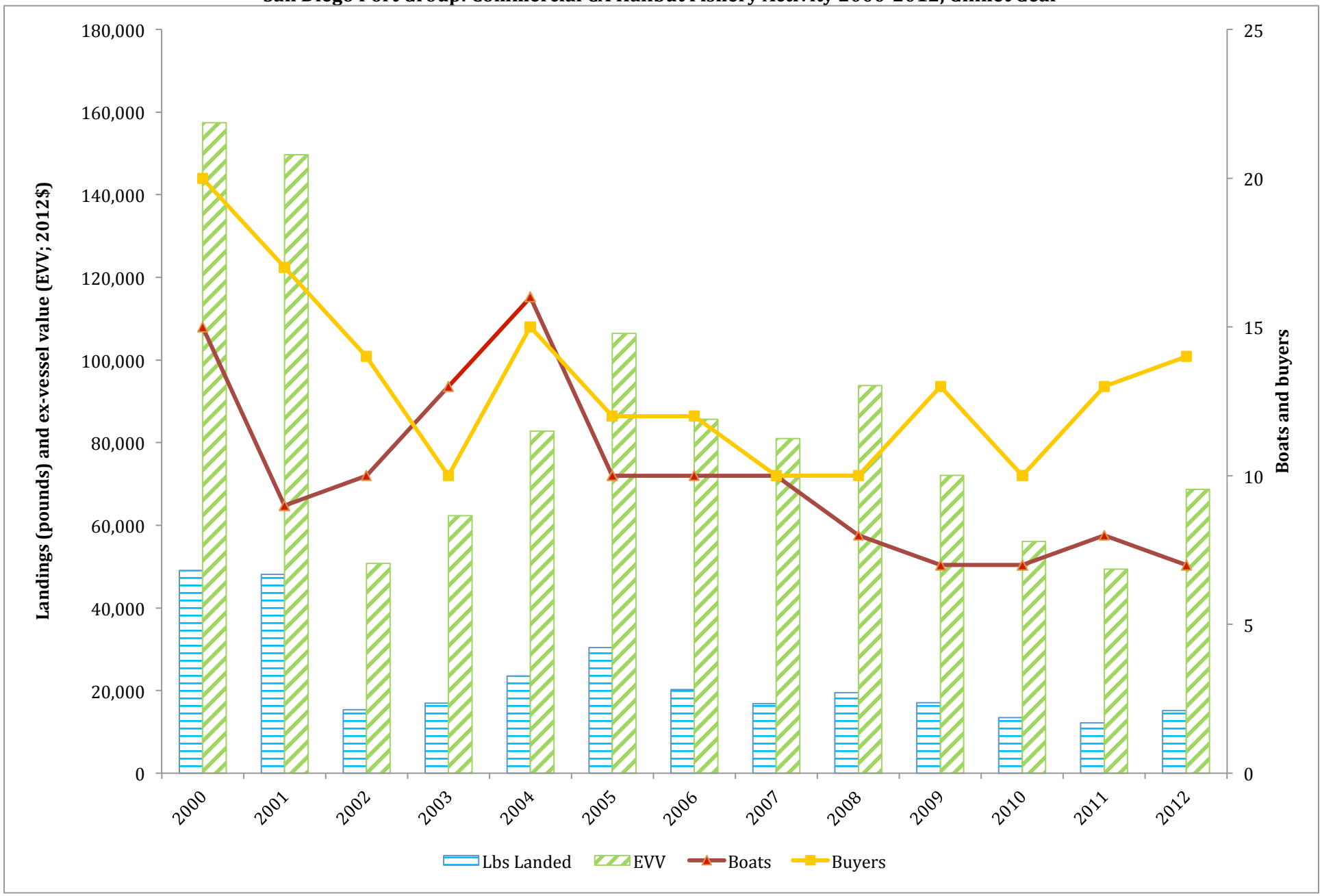
Los Angeles Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear



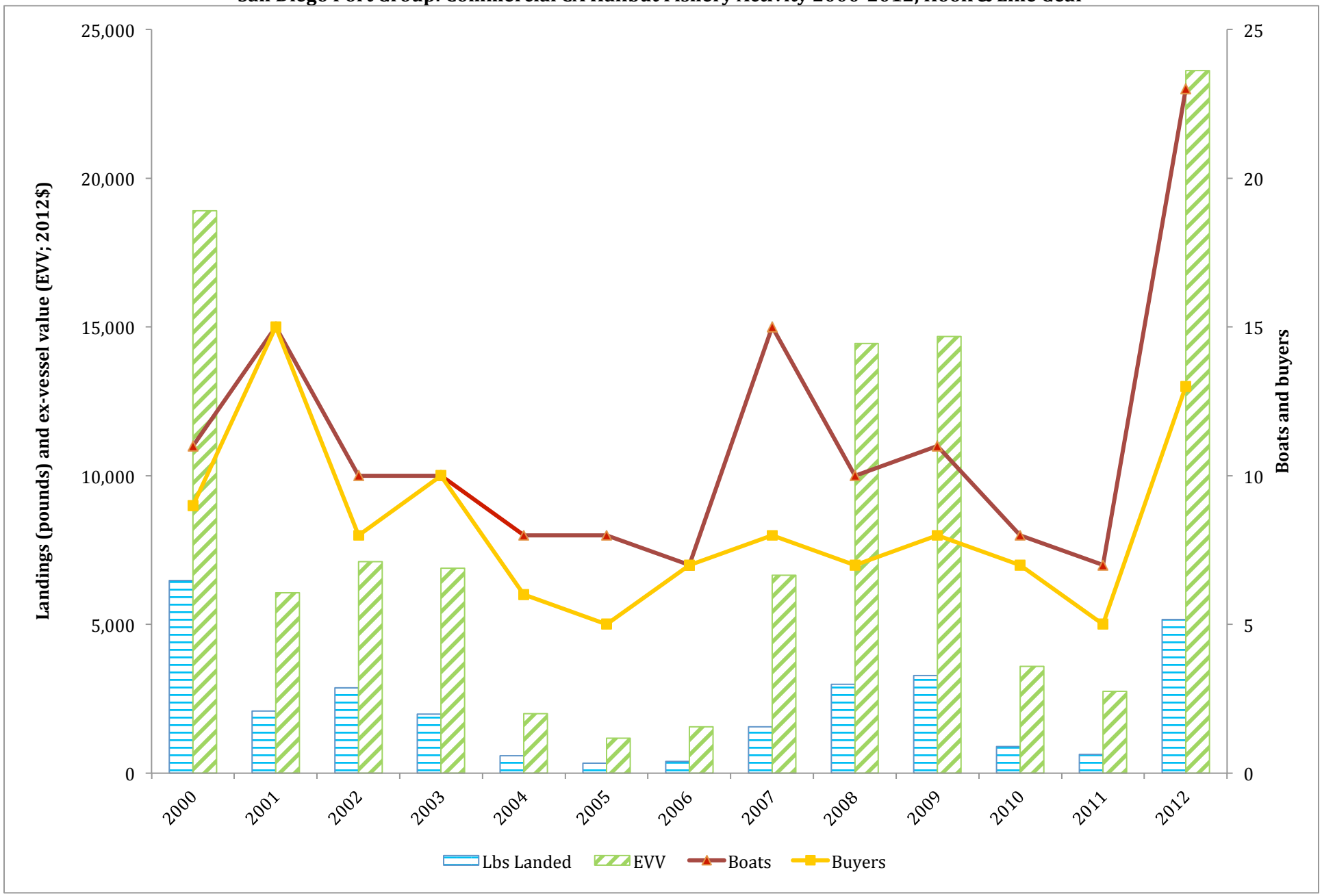
Los Angeles Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Trawl Gear



San Diego Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Gillnet Gear



San Diego Port Group: Commercial CA Halibut Fishery Activity 2000-2012, Hook & Line Gear



Set 3: California halibut commercial fishery activity, 2000-2012

Questions from California halibut fishery collaborators based on Set 1 materials

You and other project collaborators raised the following questions in response to the first set of CA halibut fishery charts. The questions are organized by topic; our answers, in italics, follow each question. Please contact us if you'd like to discuss.

Economic considerations

Q: What is the difference in value of live and dead halibut? Are some areas responsible for higher value due to live v. dead catch? Could you show the change in $/lb from 2000-2012? Why is the $/lb so low for gillnet gear?

A: We are doing an analysis to compare ex-vessel (dockside) price per pound for landings of live v. dead fish overall and by gear group and port group, over time.

Q: How have the types of halibut buyers changed over the time period? How many are brick-and-mortar stores compared to mobile buyers compared to restaurants?

A: We will discuss the different types of buyers in the profile, but the limited data available (and with some people playing multiple roles) makes it difficult to compare the numbers of each type of operation.

Q: How do imports of cultured (live) flounders from Korea or other Asian countries affect the market for CA halibut?

A: We have import/export data, have discussed this with some project participants, and are looking into this further.

Fishery features

Q: How many boats fish halibut as their primary/one of their primary fisheries? What does the 'core' fleet look like? What percentage of the fleet makes a single/few landings versus moderate to high number of landings?

A: We are characterizing these aspects of the fishery using the landings data and input from collaborators.

Q: Could you compare commercial landings with DFW data on party-boat catch? Do they correlate?

A: Study of the recreational fishery (CPFV, private boat, shore/bank) is beyond the scope of this project, but has come up in discussions and we will address it briefly in the profile.

Q: Does the number of boats determine landings (pounds and ex-vessel value (EVV)), or is it resource availability?

A: We are using statistics to look at relationships between number of boats and buyers v. tickets, pounds landed, and EVV. Without consistent, year-to-year data (e.g., from stock assessments), we can't include resource availability in the analysis.

Q: Where do the fish go after the buyer lands the fish (how many steps to the consumer)?

A: We are exploring this with collaborators and will discuss it in the profile.

Gear

Q: Are participants in the hook-and-line fleet more recreational (sport-commercial) with trailered vessels or commercial vessels switching gear from other fisheries?

A: We don't have the necessary data on recreational fishing activity to fully address this question, but are using the commercial landings data to characterize commercial fishery participants by their mix of commercial fisheries.

Q: Is there data on the troll fleet switching gear during the lean salmon years and closures between 2007 & 2010?

A: We will address this question as we analyze the fisheries mix of vessels with commercial California halibut landings.

Q: Were new gears introduced, or were existing gears modified?

A: Although all three major gear types have been used in the fishery for many years, fishermen have modified the gear and/or how it is used. We will describe these briefly in the profile.

Interactions with other fisheries

Q: Do imports of other flatfish species (e.g. from Mexico or Asia) contribute to the number of active buyers staying relatively steady over time compared to the number of active boats? Can imports be partitioned out of the analysis?

A: This has come up in many discussions with collaborators. We are looking at seafood import data, which are separate from the California fishery landings data. The boat and buyer data in the charts we have provided are based on landings of California halibut at California ports only.

Q: It would be interesting to compare the "Pounds Landed by Port Group" chart to salmon and white seabass landings, since they are higher value fish.

A: We are exploring the relationship between commercial landings for California halibut and other species.

Q: Is there a connection between the Pacific halibut catch in Alaska and the market demand for CA halibut?

A: Based on what we've learned so far, there may be a limited connection. We will explore this further.

Other

Q: Could you compare weather patterns over time?

A: We can't do this quantitatively, but we're looking at the ways weather, oceanographic conditions and resource availability affect fishery activity.

Q: Were there any health advisories issued by DHS at any point about halibut?

A: Yes. California's Office of Environmental Health hazard Assessment (OEHHA) has issued the following advisories along with safe eating guidelines:

1) for fish from Ventura to San Mateo point based on mercury or PCBs (updated 2009; see http://www.oehha.ca.gov/fish/so_cal/socal061709.html).

2) for Tomales Bay fish and shellfish based on mercury and PCBs (updated 2009; see http://oehha.ca.gov/fish/so_cal/tomales.html)

3) for San Francisco Bay fish and shellfish based on mercury and PCBs (updated 2011; see http://oehha.ca.gov/fish/nor_cal/2011sfbay.html)

Q: Are growing populations of seals and sea lions having an impact on the CA halibut catch, especially in regard to damage to vulnerable fish caught in all gear types?

A: The dynamics between seals/sea lions and California halibut have been mentioned and will be noted in the profile, but we are not looking at this specifically.

Q: Fleet demographics (their age, other species that are part of their fishing profile) would be useful. Demographic information on the LA commercial halibut fishing fleet may provide answers as to the decline in vessels.

A: We can provide general demographic information based on the CDFW data and our conversations with project collaborators. A demographic survey of the fleet and associated buyers is beyond the scope of this project, but could be done in a project that builds on the information from this effort.

Questions about specific charts

Q: How was there a drop in 'active' boats in 2004, but still higher landings? Those with few landings didn't fish halibut in 2004? [Ex-Vessel Value by Port Group]

A: The noted drop in active boats does follow the 2003 groundfish trawl buyback and other changes in related fisheries.

Q: What could possibly cause the number of boats in the San Francisco port group to double between 2007-2008?

A: We are discussing this and other variations in fishery activity with collaborators.

Q: What has happened to over half the gillnet boats that used to actively fish in the Santa Barbara port complex? Are they being sold? Rotting away in a slip not being used? Or are the boats shifting to other fisheries?

A: We are looking at the data to see what we can learn.

Spatial

Q: Could you break the graphs down by port and by gear within the port?

A: This set includes graphs by port group and by gear group within port group. Because this makes for many graphs, this packet contains the charts we believe are most relevant to you. Let us know if you would like to receive any other graphs from this set. We are not providing port-specific information to ensure confidentiality.

Q: Could you show the relative contributions from each port?

A: Please see the stacked bar charts from Set 1, pages 2 and 3. As noted above, we are not providing port-specific data to ensure confidentiality.

Q: Did live California halibut buyers travel from as far as LA and San Francisco to purchase MB/PSL halibut prior to 2002 (before the decline in landings)?

A: We are investigating this.

Q: Could you show changes in boats and buyers by location (with a line for each location)?

A: Yes. These charts are included in this packet.

Temporal

Q: How consistently do people participate in the fishery (from year to year)?

A: We are using the landings data to describe patterns of participation in the fishery (by gear group) from year to year. We also will look at relationships between major events and participation patterns.

Q: Could you show data going further back in time?

A: Kristine Barsky's 1990 article, History of the commercial California halibut fishery, provides landings data for 1916-1988; the NMFS commercial fisheries statistics website provides data for 1950-2013. If you'd like help accessing these data, please let us know.

Q: Is there seasonal variability in effort/catch/value? By month across years?

A: Yes. This has now been addressed. Please see Set 2 charts, pages 2-12.

APPENDIX 3: NVIVO NODES USED TO CODE QUALITATIVE DATA FOR THE PROJECT

The following nodes (or codes) were used to code and organize qualitative data from diverse sources including project interviews and meetings, literature and other materials. Segments of text in each source were selected and assigned one or more of the following codes. Queries based on coding (for single codes and combinations of codes), word/phrase searches and other criteria were used to develop queries. Results include the selected text, which is further reviewed and used as a foundation for building descriptions and explanations of features of the fishery.

Actors
Buyers and processors
Fishermen
Goods and services providers
Managers
Organizations
Retail
Scientists
Attitudes, perceptions, beliefs
Collaborative research
Cultural aspects of the fishery
Ethnicity of fishery participants
Fishery features
Annual round
Fishing costs
Fishing operations
Fishing practices
Products
Receiving, processing and distribution
Seasonality
Fishery history
Innovation
Fishery needs
Gear
Gillnet trammel net
Hook-and-line
Longline
Pots and traps
Trawl
Troll
Interaction among fisheries
Issues and concerns
Bycatch
Competition with other fisheries or products
Conflict
Habitat impacts
Stock condition
Knowledge

- Landings
- Management
- Other fisheries
  - Commercial Dungeness crab fishery
  - Commercial groundfish fishery
  - Commercial salmon fishery
  - Commercial shark fishery
  - Commercial white seabass fishery
  - Sport California halibut fishery
- Ports and port groups
  - Bodega Bay
    - Bodega Bay
    - Bolinas
  - Eureka
    - Crescent City
    - Eureka - Fields Landing
    - Shelter Cove
    - Trinidad
  - Fort Bragg
    - Albion
    - Fort Bragg - Noyo Harbor
    - Point Arena
  - Los Angeles
    - Dana Point
    - Huntington Beach
    - Long Beach
    - Los Angeles
    - Marina del Rey
    - Newport Beach
    - Redondo Beach
    - San Pedro
    - Terminal Island
  - Monterey
    - Monterey
    - Moss Landing
    - Santa Cruz
  - Morro Bay
    - Avila - Port San Luis
    - Morro Bay
  - Other CA places
  - San Diego
    - Mission Bay
    - Oceanside
    - San Diego
  - San Francisco
    - Oakland
    - Princeton-Half Moon
    - Richmond

- San Francisco
- Sausalito
- Santa Barbara
- Oxnard - Channel Islands Harbor
- Port Hueneme
- Santa Barbara
- Ventura

Price

Project Strategy and Ideas

- Set 1 Review Notes
- Set 2 Review Notes
- Set 3 Review Notes

Sources and types of change

- Economic factors
- Environmental factors
- Management factors
- Social factors
- Technological factors

Sources to investigate

Spatial dimensions

- Fishing location
- Geographic distribution of the fishery

Trends in fishery

Value or Importance

- Ecological value
- Economic value
- Social and cultural value