Title
Market Channels and Value Added to Fish Landed at Monterey Bay Area Ports

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Introduction

Recent and pending federal marine management actions on the U.S. West Coast, from groundfish regulations to marine reserves and National Marine Sanctuary management plan revisions, have highlighted the critical need for socioeconomic information on marine resource uses and associated communities. The need for this information is both practical and legal. In practical terms, because resource users affect and are affected by management, socioeconomic information can be used to inform and enhance the effectiveness of management design, implementation and evaluation. In legal terms, the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, and amendments), the National Environmental Policy Act (NEPA), and the Regulatory Flexibility Act (RFA) require consideration of the "human dimensions" in the design and implementation of federal actions that affect the human and biophysical environments.

In central California, the site of three National Marine Sanctuaries (NMSs) and diverse federally- and state-managed fisheries, socioeconomic information to assess the impacts of management actions has been critically lacking. Among the types of information needed are qualitative and quantitative analyses of market channels through which value is added to the catch. These market channels are defined by the social and economic linkages among fishermen, receivers, processors and others, and are manifest in the spatial distribution of the quantity and value of fish products within and beyond the region.[1]

To address these information needs, we conducted a study of the production and distribution of fish products landed at the three main Monterey Bay area (MBA) ports: Moss Landing, Monterey and Santa Cruz. The overarching goal of the research was to help inform the assessment of potential social and economic impacts of fishery management and other measures and events. Specific objectives were: 1) to describe the spatial organization of processing activities for fish landed at Monterey Bay ports (i.e., Moss Landing, Monterey and Santa Cruz); and 2) to estimate value added in Monterey and Santa Cruz Counties to fish landed at Monterey Bay ports. This report provides a technical summary of the study background, followed by the methods, results and conclusions drawn.

Background

To evaluate the potential socioeconomic implications of marine management actions on coastal communities requires an understanding of use patterns both on the water and shoreside. The need for and relevance of this integrated information has been demonstrated, for example, in recent marine reserve efforts at the Channel Islands (Pomeroy and Hunter 2001, 2005; Leeworthy and Wiley 2002). Through a California Sea Grant-sponsored study, Co-PI Dalton and ecologist Dr. Stephen Ralston are investigating use patterns of groundfish trawlers in California (north of Point Conception) in an effort to predict how fishermen would respond to the implementation of marine reserves. However, consideration of the role played by ports and shoreside social and economic linkages to fishing communities and fish production facilities are beyond the scope of that study. Research by Pomeroy and colleagues (2001, 2002) has

[1] In this report we use "fish" to refer to all species of marine finfish and shellfish. Many "receivers" are often also the initial processors of landed fish, although in some cases, they receive fish on behalf of businesses that actually package or otherwise modify the landed catch. We use these terms and "fish buyer" interchangeably in most cases, and indicate clearly where the distinction between receivers and processors is important.

focused on these shoreside linkages in the California squid and coastal pelagic species (CPS) or "wetfish" fisheries.[2]

Economic analyses of fisheries have sought to understand these linkages, but generally have focused on and assumed that most economic activity following from the lading of fish at a particular port occurs within the same county. This approach makes analysis more tractable, and enables the use of much existing county level data on employment, income and business revenues. In particular, county-level data from IMPLAN[3], usually in the form of impact multipliers, are used widely. However, National Standard (NS) 8 of the Sustainable Fisheries Act (SFA) of 1996 requires the consideration of the impacts of fishery management actions on "fishing communities." The SFA Guidelines define fishing communities in spatial terms as discrete subcounty areas where fishery participants reside. In practice, agency and non-agency researchers have identified and delimited fishing communities in ways that account for the fact that in many cases, including Moss Landing, fishery participants reside in many places, yet work and identify with a particular fishing community.

Pomeroy and colleagues (2002) identified the Monterey Bay area as one of three regional centers of activity in the wetfish fishery. While Moss Landing was the most active port within the area, the fisheries' social, economic and market linkages within the region extended to Monterey and Salinas in Monterey County and Watsonville in Santa Cruz County. Much of the wetfish and squid catch undergoes limited processing before being exported outside the region or the country, although some local buyers have developed considerable processing capacity to produce a diversity of value-added products for human consumption and other uses. This diversity of value-added activities and products became apparent for fisheries more generally through a recent study of the commercial fishing industry at Moss Landing Harbor (Pomeroy and Dalton 2003). While Moss Landing is the site of much fish receiving involving fishermen and receivers, subsequent value-adding activity occurs in a wider region that crosses county boundaries. Moreover, fishing operations, fishermen, and fishery support businesses that play critical roles in the Moss Landing fishery are widely dispersed. Intra-regional linkages among fishing, receiving and processing activities have been identified in the central California commercial salmon troll fishery as well (Pomeroy 2002). Although salmon is perhaps the most popular species for off-the-boat sales, much of the fish landed at local ports is received by local and non-local buyers, and are transported primarily to regional restaurants, seafood markets and grocery stores for sale to consumers. These sales represent a final stage of value-added.

The fluidity and extensiveness of social and economic networks associated with fish production, as demonstrated above, suggest the impracticality of NS 8's place-based definition of fishing communities. To understand the potential and actual impacts of management actions on fishery participants and their communities requires knowledge about the geography of their networks of production. The work reported here is part of larger effort to develop this knowledge, and to compare the feasibility and accuracy of bottom-up (community-based) versus top-down (county-based) approaches to analyzing the impacts of management actions on fishing communities.[4]

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[2] The CPS or wetfish fishery targets anchovy, sardine and mackerel (all finfish) and squid. In this report, we differentiate between the CPS finfish species and squid because of key differences in value-added activity, markets and total economic value.

[3] IMPLAN is a regional input-output (I-O) model used to analyze regional industries and industry clusters using data collected from the U.S. Department of Commerce, U.S Bureau of Labor Statistics, and other state government agencies covering 528 Standard Industrial Categories (Forward Analytics 2005).

[4] It builds on a recently completed study of the direct economic value of the commercial fishing industry at Moss Landing Harbor, sponsored by the Monterey County Office of Economic Development. Two current studies complement the one reported here: Measuring Impacts on Fishing Communities: A Framework for Integrated Socioeconomic Assessment, funded by NOAA's Saltonstall-Kennedy Grant

Methods

To determine the market channels and value added to fish landed at MBA ports requires information on the spatial organization of economic exchanges that occur during receiving, processing, distribution and sales activities. To address the project goals and objectives, we used the combined approaches of fisheries anthropology and sociology (Pomeroy) and economics (Dalton), including archival data collection and ethnographic and survey fieldwork, followed by integrated analysis of the resulting data.

Data collection

We collected and reviewed archival data, which included qualitative and quantitative information from our previous research, reports and papers; agency reports and other gray literature; refereed literature; media reports and web-based information. From these materials we extracted descriptive information on fish receiving, processing and other value-adding activities in the MBA and more generally for the region's primary fisheries including groundfish, squid and wetfish, salmon and albacore, and crab. We analyzed "fish ticket" or "landings" data maintained by the Pacific States Marine Fisheries Commission (PSMFC) in the Pacific Fisheries Information Network (PacFIN) database to determine the approximate number of fish receivers, quantity and ex-vessel value of fish landed at each of the three major MBA ports. The PacFIN data include the weight, ex-vessel (i.e., landed) value and other information on fish and shellfish landed at California ports. We combined the results of these archival data collection and analysis efforts to generate a basic, preliminary description of fish receiving and handling activities within the region.

To identify and sample the population of MBA fish receivers for field data collection, we sought permission to use the fully disaggregated, confidential landings data. These data are the only comprehensive source from which to identify the population of fish receivers. Because permission to use the data was not forthcoming initially, we had to use an alternative approach that combined review of our previous research and archival sources, discussions with industry contacts and others knowledgeable of fish receiving and handling in the area, and interviews with the Santa Cruz, Moss Landing and Monterey harbormasters to develop a sampling frame of MBA fish receivers.[5]

To collect primary data, we conducted semi-structured interviews with harbormasters and a survey of fish receivers. Through the harbormaster interviews, we collected descriptive information on fish receiving and handling activities at each harbor, recent changes and trends in these activities, and descriptions of and contact information for fish receivers who operate at those harbors.

To collect data from receivers, we developed an introductory letter to receivers asking them to participate, a structured interview to be conducted in person or by telephone, and expenditure, asset and fish production worksheets to be completed by the receiver following the interview. The interview included questions about the business's history, employment and facilities by location, operations with particular attention to Monterey Bay area fisheries, top customers, and primary sources for goods and services. Goods and services include equipment and supplies for fish receiving and processing, office supplies, financial services, and government offices for licenses and permits. The worksheets requested dollar estimates of fixed and variable expenditures on goods and services, year-end asset values, and fish commodities produced and sold during 2003. We circulated drafts of these materials among colleagues

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Program, and Calibrating Sample Input-Output Data to Port Level Summaries with PacFIN Data, funded by the Pacific States Marine Fisheries Commission's EFIN Program.

[5] We used data from an interview conducted with the Moss Landing harbormaster for our recently completed study of the commercial fishing industry at Moss Landing Harbor (Pomeroy and Dalton 2003).

for review, conducted a limited field test, finalized the data collection materials, and then administered the survey. We entered the survey data into an Excel database, then checked and cleaned the data before proceeding with our analysis.

Because our primary goal was to estimate the value added to the catch, we used an opportunistic sampling strategy targeting the most active MBA receivers known to us in order to account for as much of the ex-vessel value of MBA landings as possible. This approach was also the most practical, given the incomplete information on the MBA receiver population, the lack of access to up-to-date landings data, and the limited resources available for this work. Shortly before the project ended, we received the 1998-2003 landings data through a contract with the PSMFC. Given the project's short timeline and resources remaining, we were unable to conduct additional receiver interviews. However, to inform our value-added analysis, we conducted a brief survey of the local customers (or "fish vendors"[6]) identified by survey respondents to collect wholesale and retail sales price per pound of the most common MBA species identified in our receiver survey and landings data analysis. We then used the updated landings data to generate a more up-to-date description of landings patterns, by species group, at the three Monterey Bay ports and to evaluate our sample. (See Appendix A for further information on this part of our PacFIN data analysis.)

We conducted 11 receiver interviews, and received 4 useable worksheets. Our interviews accounted for 73% of the ex-vessel value of fish landed at the three MBA ports in 2003, but only 12% of receivers that year. The more limited worksheet returns accounted for 65.7% of the 2003 MBA receipts, and just less than 5% of the 92 MBA receivers that year. Although the sample accounts for a large proportion of the landings by ex-vessel value, it is not representative of the population, as indicated by a comparison of landings receipts for the sample and the population. For the 12 species for which we had the most comprehensive data (of 134 landed at MBA ports), the proportion of MBA receipts that surveyed receivers accounted for ranged widely from about 1% to 53% in 2003, and 2% to 41% (for Dungeness crab and Northern anchovy in both cases) for the 1998-2003 period.

Analysis

To map the spatial distribution of fish receiving, processing and distribution within the MBA area and estimate the value added (VA) to fish landed at the three MBA ports, we developed a methodology that combined data collected in our survey of fish receivers, and their customers, with data on California landings and ex-vessel revenues from the PacFIN database.

To analyze the spatial relationships among vessels, processors, customers, and providers of goods and services, we developed a relational database using ArcView Geographical Information System (GIS) software. (Figure 1 shows a sample map and data layers.) Our analysis has four spatial components that depict the market channels of fish landed at MBA ports: port of landing, processor location, customer location, and the location of providers of goods and services. Each of these stages of VA activity is described below. We then combined the landings and survey worksheet data to calculate a series of indices (defined in Table 1) to reflect the price per pound of commonly caught species at each of three stages in the production chain: landing (ex-vessel), initial processing (ex-processor), and subsequent wholesaling or retailing (ex-vendor).

[6] "Fish vendors" include a variety of businesses that add value to the product they purchase from fish receivers. They may be the first to actually process - package or otherwise modify - the fish landed by fishermen and received by receivers, or they may add value to the product through secondary processing, wholesaling, distribution, retail sales and/or restaurant sales.

Figure 1. The Relational GIS Database with Information from the Processor Survey Linked to PacFIN Landings and Ex-Vessel Revenues. The GIS database includes seventeen tables that are linked by relationships among vessels, receivers, their customers, and providers of goods and services.

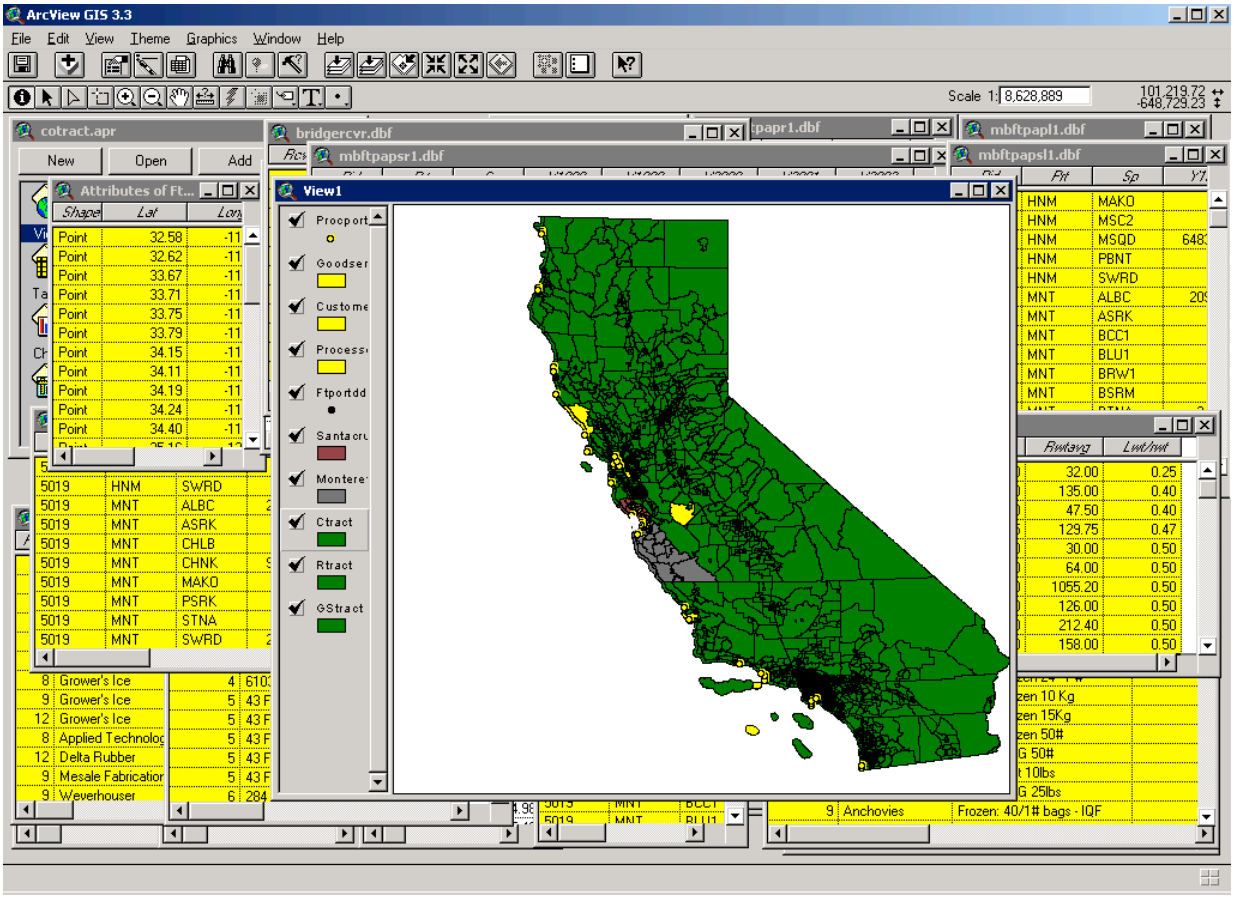

Table 1. Terms Used to Define Value Added by Stage of Production (/ = divided by).

Variable	Description	Definition
VPI	Vessel Price Index	Ex-Vessel Revenues / Landed Weight
PPI	Processor Price Index	Ex-Processor Revenues / Ex-Processor Weight
CPI	Customer Price Index	Average Market Price
VWI	Vessel Weight Index	Landed Weight / Round Weight
PWI	Processor Weight Index	Ex-Processor Weight / Landed Weight
CWI	Customer Weight Index	Final Product Weight / Landed Weight
UVAP	Unit Value Added by Processors	PPI / PWI – VPI
UVAC	Unit Value Added by Customers	CPI / CWI – PPI
TVAP	Total Value Added by Processors	(Landed Weight) x (UVAP)
TVAC	Total Value Added by Customers	(Landed Weight) x (UVAC)
TVA	Total Value Added	TVAP + TVAC

First Stage of Value-Added: Vessel Landings

The first stage of production occurs at sea when fishermen catch fish (or crab or squid). This production is reported on the fish tickets by weight and the amount (in dollars) paid to the fisherman by the receiver when the fish are delivered to port. Round weight is the total weight of the catch; landed (or ex-vessel) weight may differ if the fish has been gutted or bled at sea, but otherwise equals round weight. We calculated a landed weight index (VWI) to represent the ratio of landed weight to round weight for each vessel landing. We used landed weight as the physical quantity of fish that receivers used as an input, and assumed that expenditures by processors are equal to ex-vessel revenues received by the vessel. We aggregated landings and ex-vessel revenues of individual vessels, by species or species group, for each processor. (See Appendix B for a list of species and species groups.) We then calculated an index of ex-vessel prices (VPI) as Ex-Vessel Revenues divided by Landed Weight for each receiver.

Second Stage of Value-Added: Processing

The second stage of production occurs at the receiver's processing facility, identified by an address provided by the receiver. We determined the outputs of this stage of production, "ex-processor weight" and "ex-processor revenue" from the weight of fish commodities and the revenues from the sales of these commodities, by species or species group, as reported by survey respondents. We then calculated ex-processor weight index (PWI) as total ex-processor weight divided by total ex-vessel (landed) weight, and ex-processor price index (PPI) as total ex-processor divided by total ex-processor weight.

Third Stage of Value-Added: Processors' Customers

The third stage of value-added (and the last in our analysis) occurs at the location of the customers of survey respondents. These customers or vendors include restaurants as well as seafood markets and grocery stores. In a few cases, respondents reported end consumers (e.g., at a market or restaurant) as their top customers. However, because prices for fish products sold at restaurants usually reflect many other inputs (of goods and services, and perhaps a mix of different fish species), it is difficult, if not impossible, to determine the actual VA for a given unit of fish. To avoid this confounding factor, we used

only market prices provided by the subset of MBA fish vendors that sell fish by the pound (fresh or frozen) as a final product.

We used market prices as of June 2005 collected during on-site visits (e.g., to retail markets), brief phone interviews, and website reviews to calculate the customer price index (CPI) as the average price per pound for each species or species group.[7] We also calculated a customer weight index (CWI) as the weight of the customer's final product divided by the weight of the whole fish.[8] We converted fillet prices into price per pound for whole fish using yield factors derived from Skinner (1996). We applied this converted value to the weight of whole fish purchased by vendors from processors, so that this value includes any mark-up or value-added for the labor and other inputs used to process the fish.

Comparing Stages of Value-Added

To enable direct comparison of the value added indices for each stage of production, VPI, PPI and CPI, we used the weight indices, PWI and CWI, to convert them to like units. We then defined two types of unit-value-added (UVA), one for VA by processors (UVAP=PPI-VPI) and one for VA by their customers (UVAC=CPI-PPI).[9] Finally, we calculated total value added for processors (TVAP) as the product of landed weight (*vwt*) and UVAP, and total value added for customers (TVAC) as the product of *vwt* and UVAC, and total value added (TVA) as the sum of TVAP and TVAC.

Survey and Worksheet Data Caveats for Estimating Value-Added

Some of the receiver and customer data posed particular challenges for analysis. For example, some types of expenditures, such as ice or purchases of fish, are variable costs that are directly related to a processor's scale of production in a given year. However most expenditures including leases, mortgages, insurance, and licenses and fees do not vary directly with the scale of production in a single year. Therefore, constructing VA estimates using expenditures reported for a single year is not straightforward.[10]

A second set of complications arose with the customer data reported by our sample of receivers. We asked receivers to identify their top five customers in 2003, but for reasons of practicality and confidentiality, did not request additional information such as total purchases by each customer. The 11 surveyed receivers identified 41 customers, 18 of which were located in Monterey County or Santa Cruz County. Most other customers are located in California, several in the San Francisco Bay area, but Los Angeles and San Diego are also represented. Two customers are located in Seattle, one in Japan, and one in China. No attempt was made to contact customers outside of Monterey County or Santa Cruz County. Relationships between the 11 processors and 18 customers located in Monterey County or Santa Cruz County are intricate. For example, seven customers deal with two survey respondents. Another complication is that three processors in the survey retail fish at their location, and two of these are identified by another processor as among its top five customers.

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[7] Using current prices to proxy market conditions in 2003 is not ideal, but necessary given the expedited approach.

[8] For most finfish (e.g., groundfish, salmon), the final product was a fillet. Although some finfish species such as anchovy, mackerel and sardine, as well crab and squid, are frequently sold whole.

[9] The conversion factor for UVAP is (*pwt/vwt*), and the factor for UVAC is (*cwt/vwt*).

[10] The data on expenditures that we collected from processors will be used in the SK project mentioned above, but these data do not play a direct role in the VA estimates described in this document, which are based on revenues and market prices.

Results

Landings of Fish and Shellfish at Monterey Bay Area Ports

Over 130 species of finfish and shellfish with an ex-vessel value of more than $58 million (unadjusted) were received at the three primary MBA ports and other smaller landings sites combined between 1998 and 2003. The primary species or species groups received were: CPS finfish and squid, groundfish, salmon, albacore and crab. Other species landed included shark and swordfish, among others. The configuration of species and species groups landed at each MBA port varies over time and in comparison to the other ports. For example, Santa Cruz is known primarily for its salmon, albacore and crab landings, as well as some groundfish, but little if any no CPS finfish or squid. In contrast, Moss Landing is the primary site for landing the latter species, as well as groundfish, salmon, albacore, crab and other species caught in more distant fisheries (e.g., swordfish). Monterey has some CPS and squid receiving infrastructure, but receives much less now as deliveries have shifted to Moss Landing. Monterey also receives some groundfish and salmon.

Total receipts for the MBA ranged from $7.4 million in 1998 (an El Niño year) to about $12 million in 2003. The number of receivers active (i.e., that received fish) at the three ports combined ranged from 94 in 2003 to 125 in 2000. The average ex-vessel value of the fish they purchased from fishermen ranged from a few dollars to more than $4.5 million per year. Average ex-vessel value received per year falls at the lower end of this range, but nearly doubled from just under $68,000 in 1998 to over $125,000 in 2002 and 2003. Overall, it appears that receiving activity is becoming more consolidated, with fewer receivers and increasing total receipts over the six-year period. This may be due in large part to growing constraints on the groundfish fishery, and concomitant losses of vessels and buyers, along with increasing activity in the wetfish and squid fisheries which require specialized receiving and processing capacity and well-developed markets, which a few long-time MBA receivers already have in place.

Fish receiving activity varied among the three ports during this period as well. Moss Landing has consistently been the most active port, with an average of 61 active receivers per year, and a range from 45 in 2002 to 71 in 2000. Santa Cruz averaged about 30% fewer active receivers (39) and Monterey averaged fewer than half (27) as many compared to Moss Landing. The number of receivers at Santa Cruz has varied over time, but the proportion of the landed value of MBA fish that they accounted for declined from over 12% in 1998 and 1999 to about 4.5% in 2002 and 2003. The number of receivers at Monterey has varied between 22 and 32, while the proportion of MBA landings value has varied between about 19% in 2000 and 31% in 1998. The number of receivers at Moss Landing ranged from 45 in 2002 to 71 in 2000, and appears to have declined, while revenues have increased in absolute and relative terms. Landings there accounted for 69% of the ex-vessel value of MBA landings, on average, between 1998 and 2003.

Fish Receiving, Processing and Distribution Operations in the Monterey Bay Area

There is a considerable diversity of fish receiving, processing and distribution operations in the MBA. Although very late access to the confidential landings data precluded more complete data collection from these operations, our archival, interview and survey data afford some general insights into these activities overall, and more detailed information on our sample of receivers.

The types of fish receivers in the MBA range from fishermen who are licensed to land their own and perhaps others' catch and market it to consumers (e.g., via farmer's markets and off-the-boat sales) to "processors" that may own fishing vessels, receiving stations, processing facilities and fish markets. The types of connections among fishing, receiving, processing, distribution and retail sales are a largely function of the species involved. Some species such as crab, salmon and albacore are relatively consumer-

ready and high value from the time they are landed, and are amenable to off-the-boat sales and small scale receiving, followed by little if any actual processing. Off-the-boat sales of these and some other species are most common at Santa Cruz Harbor, followed by Moss Landing and Monterey. In addition, a number of receivers have transient operations, where they meet fishermen at public hoists to unload the catch, then deliver it to processors, retailers or consumers. Line-caught groundfish, halibut and other species are also often handled this way. Receiving and processing for larger volume fisheries, such as groundfish trawl and CPS finfish and squid, as well as larger fish such as shark and swordfish require more equipment and infrastructure. As a result, few fishermen land (or receive) their own catch, relying instead usually on stationary buyers at receiving stations along the coast. Whereas some of these receiving stations operate independently and under contract to processors, others are owned or leased and operated by vertically integrated receivers/processors. These businesses engage in some combination of receiving, transporting, processing and packaging, distribution and wholesaling, exporting and restaurant service or retailing.

Our 11 survey respondents represent some of this variability in types of receiving and value adding operation. All but one first handled fish in the MBA. They have been in business as fish buyers an average of 32 years (range 5-68 years). As of the survey (2004), five (46%) reported their headquarters in Santa Cruz County, three (27%) in Monterey County, one in Santa Clara County (9%), and one (9%) out of state. Five (46%) reported a second business related to the fish receiving and processing business we interviewed them about. (Two of these were separate businesses; three were integrated.) Most had some degree of vertical integration, with the business engaging in processing, distribution and export and/or retail as well as receiving and in some cases fishing.

The surveyed receivers handle an average of four MBA species (range = 1-8). Receivers most commonly handled salmon (73%) and groundfish (64%), followed by crab and albacore (55%), and halibut and squid (46%). One receiver each reported handling swordfish and shark. Salmon was reported as the most important fishery in 2003 and over time by 46% of respondents, followed by squid (27% in 2003, 18% over time), and crab (18% in 2003 and over time) and groundfish (18% over time).

There are a variety of fish receiving arrangements within the Monterey Bay area and statewide, as reflected by our sample. Whereas some operate a permanent receiving station at one or more ports within and side the MBA, others rely on public hoists or contracts with established receivers. In addition, some receive deliveries directly from fishermen at inland locations. Of the receivers we surveyed, one (9%) reported owning one or more receiving stations, five (45%) reported leasing one or more receiving stations, and two (18%) reported contract arrangements for receiving stations in California. Three (27%) reported that they owned, leased or contracted receiving stations in Washington or Alaska. Very little processing occurs at the harbors, although this is changing somewhat with infrastructure developments at Moss Landing and perhaps Monterey.

Once the catch is landed, it may be sold off the boat, trucked to an inland processing site, or delivered to or picked up by a distributor, restaurateur or retailer. Fish buyers also own, lease or contract several types of facilities to support their fish processing, distribution and marketing. These include processing and packing plants that usually have some cold storage capacity as well as separate cold storage (which also serves agricultural business in the MBA), and in some cases food service and retail market establishments. Among the receivers we surveyed, two (18%) reported owning, and four (36%) reported leasing their primary (post-receiving station) processing facility in California. Three (27%) respondents reported multiple processing and packing sites. Nine reported using ice facilities (7 owned, 2 used by other arrangement), which ranged from ice makers that fit in a home garage to small industrial ice makers. Three (27%) respondents reported leasing cold storage facilities in addition to their primary processing facility. Almost half (45%) had live shellfish or finfish facilities, primarily for Dungeness crab, but in a few cases for rockfish and other finfish species. Finally, just over half of those we surveyed

(55%) reported operating a retail market or restaurant, with one (9%) of these owned and the other five (45%) in leased buildings.

Employment to run and maintain these facilities and operations for the receivers we surveyed ranged widely from 1 to 463, and averaged 72 full time equivalents (FTEs), although these numbers belie the seasonality of fishing and related employment. Most of these employees reside in the MBA.

Market Channels and Value Added to Fish Landed at Monterey Bay Area Ports

Figures 2-7 display spatial information from the GIS developed from our interviews and the landings data. Figure 2 shows the range of ports throughout California at which MBA receivers were active between 1998 and 2003. Figure 3 indicates the census tract location of the surveyed receivers' headquarters. Figure 4 depicts the census tract locations of customers identified by respondents. While many customers are located in Monterey County or Santa Cruz County, a group of customers are concentrated in the San Francisco Bay area. Customers not shown in Figure 4 are located further in Seattle, Los Angeles, and overseas in China, Japan and European countries. Figure 5 shows the census tract location of individuals and businesses that provided goods and services to the surveyed receivers.

Figure 2. Location of California Ports (in yellow) Where Surveyed Processors Received Fish in 2003.

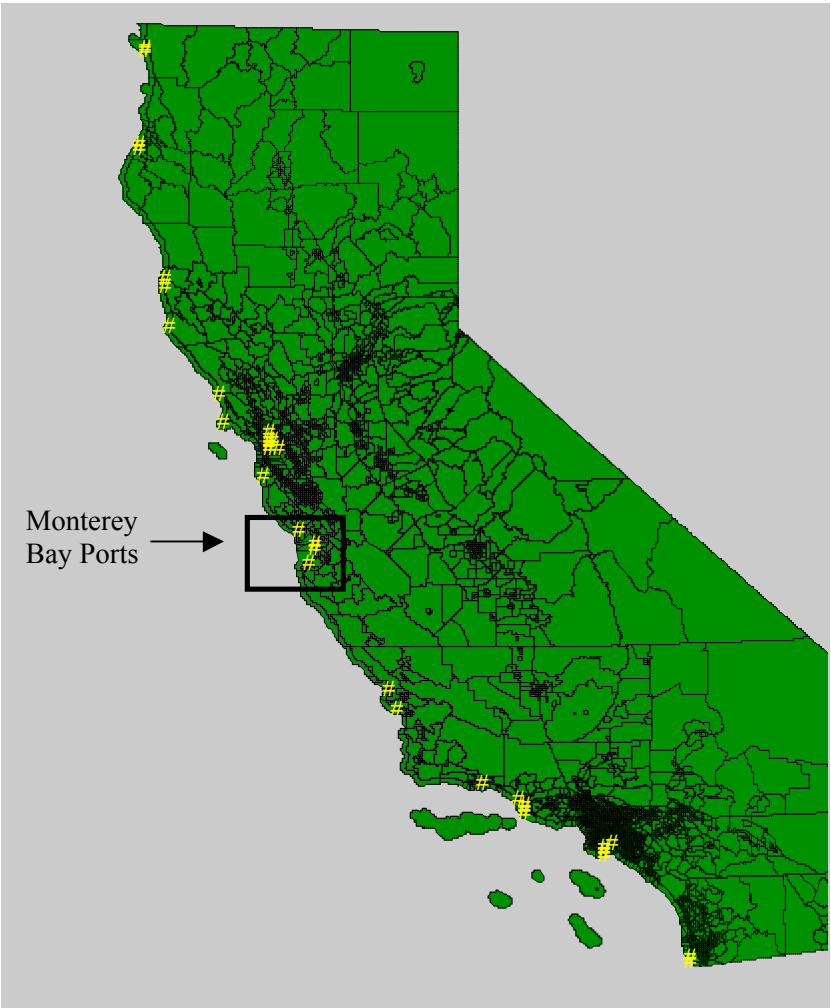


Figure 3. Location of Surveyed Processors, by 1990 Census Tract (in yellow). Monterey County tracts are shown in grey; Santa Cruz County tracts are shown in brown (CRZ=Santa Cruz, MOS=Moss Landing, MNT=Monterey, OCM = Other Santa Cruz and Monterey County Ports).

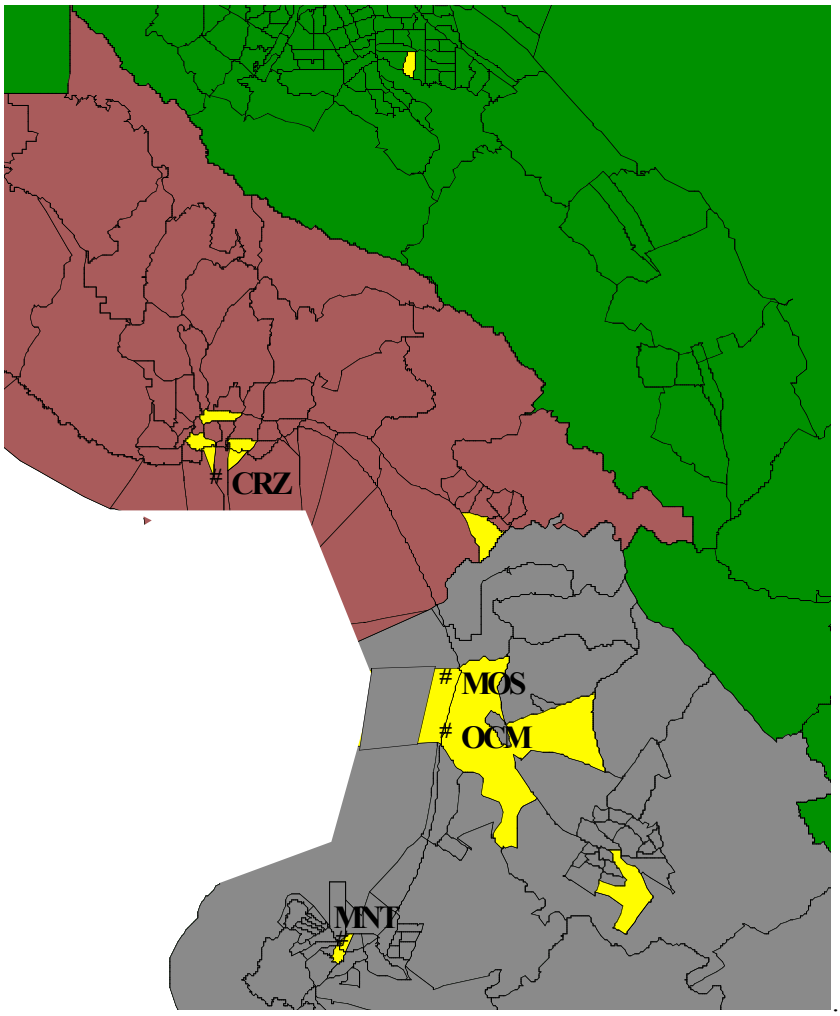


Figure 4. Location of Surveyed Processors' Top Five Customers by 1990 Census Tract (in yellow). Customer locations in Los Angeles, Seattle, Japan, China and Europe are not shown. (Because the CalSIL GIS file does not show San Francisco Bay, San Francisco and Port Reyes are identified in the figure for orientation.)

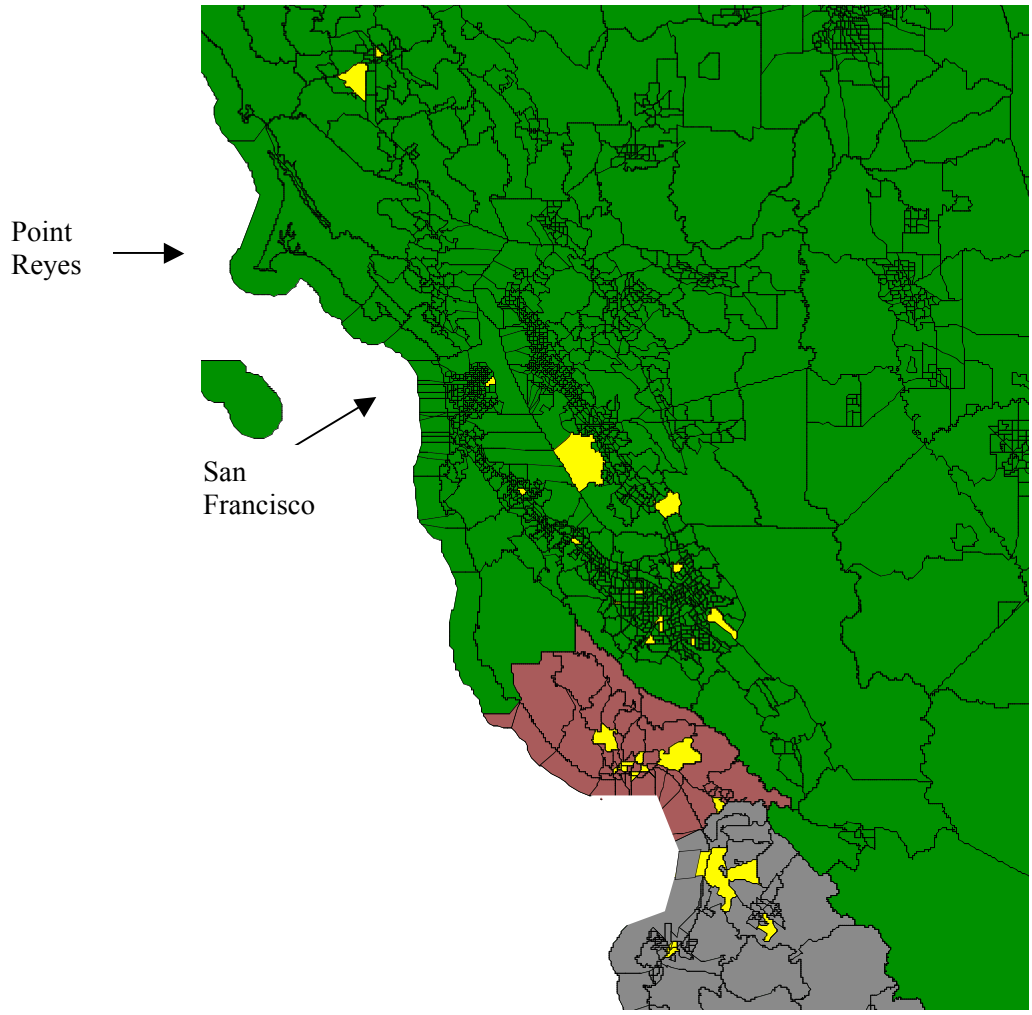
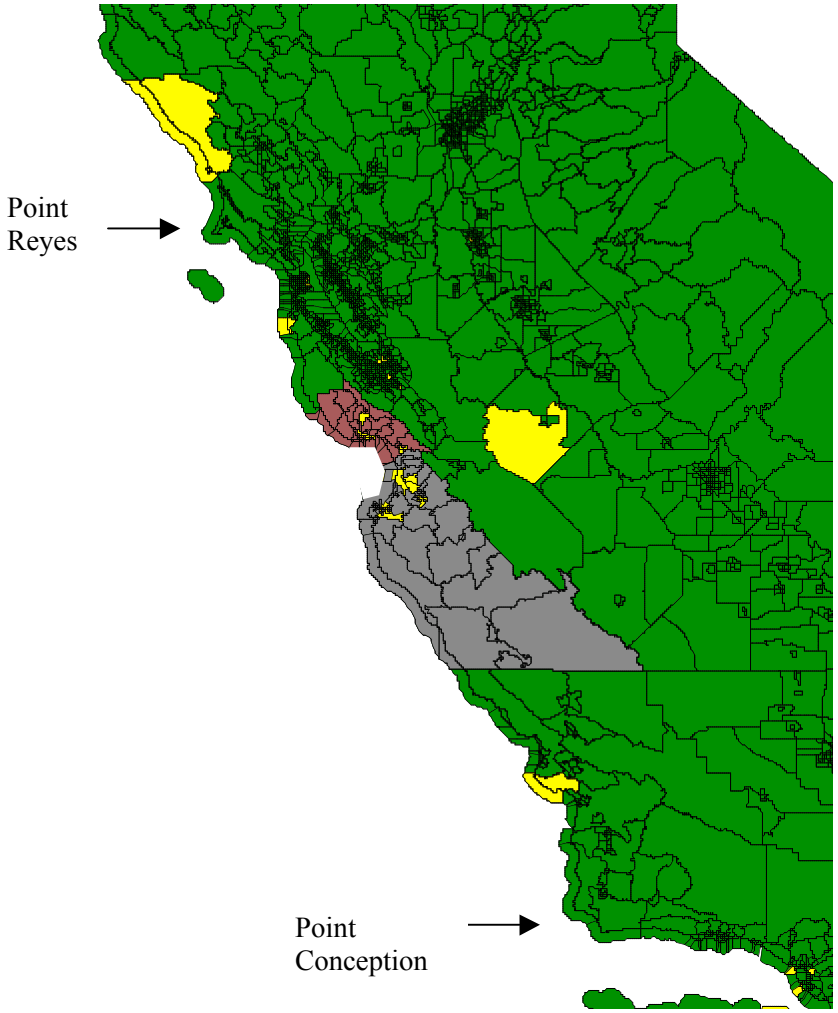


Figure 5. Location of Providers of Goods and Services to Surveyed Processors, by 1990 Census Tract (in yellow). Point Reyes and Point Conception are identified in the Figure for orientation.



The next set of figures and tables presents the results of our analysis of value-added for landings at Monterey Bay ports. Figure 6 summarizes data from PacFIN fish tickets to show the distribution of ex-vessel revenues among processors that were active at Monterey Bay ports between 1998 and 2003. While Figure 2 shows that the set of ports where these processors were active was large, Figure 6 demonstrates that their level of activity (in terms of ex-vessel value of receipts) at ports outside the MBA was modest. The level of activity at Moss Landing is greater than that of all the other California ports combined.

Figure 6: Average Ex-Vessel Revenues for Processors Active at Monterey Bay Ports. Santa Cruz (N=111), Monterey (N=77), Moss Landing (N=179), Other M/SC Counties (N=22), Other California Ports (N=175).

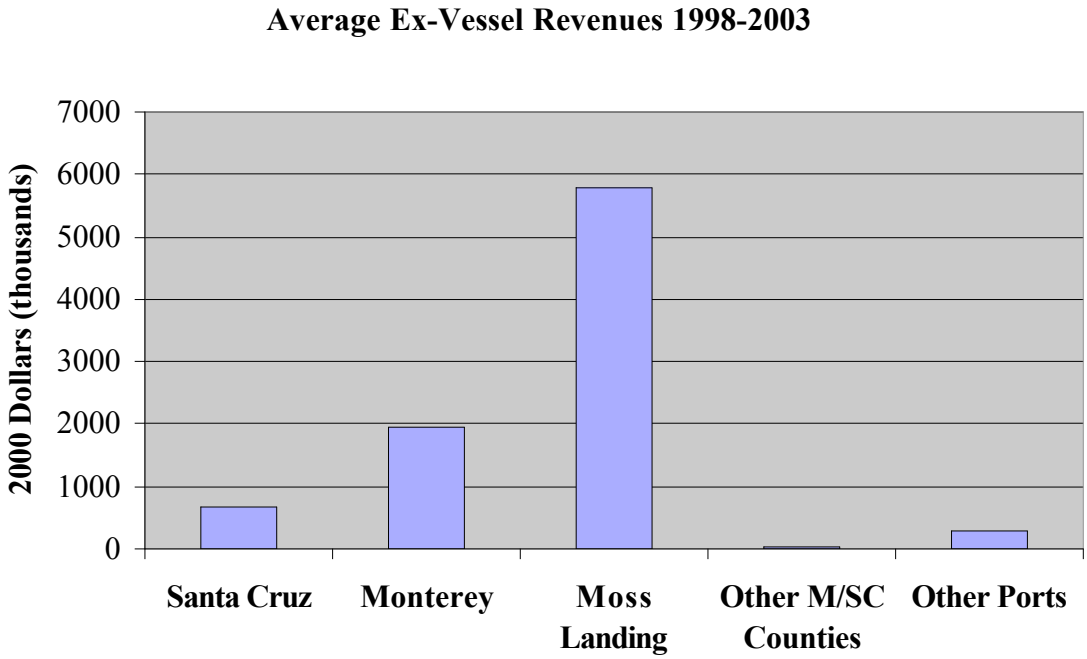


Table 2 lists the market categories for different types of fish and their associated price indices for processors and seafood vendors, and indicates the number (N) of respondents or other sources of information that were used to calculate the price indices. Only two of the eleven processors surveyed provided product and sales data in sufficient detail to allow us to compute an ex-processor price in terms of pounds of whole fish. As a result, the data presented in the column for ex-processor prices are sparse. To compensate for this shortcoming, we used recent price data collected from eight MBA seafood vendors identified as top customers by the receivers we surveyed.

Table 2: Ex-Vessel, Ex-Processor, and Ex-Vendor Prices at Monterey Bay Ports. All values expressed in 2000 US dollars per pound of whole or landed fish. Values with N<3 are not presented to protect confidentiality.

	Ex-Vessel	Ex-Processor	N	Yield Factor	Ex-Vendor	N
Albacore	0.62		1	0.5	4.76	6
Anchovy	0.05		1	1.0		2
Salmon	1.63		1	0.6	5.01	7
Crab	1.89		1	1.0	4.66	4
English Sole	0.46		1	0.7		1
Halibut	2.30		1	0.7	6.27	7
Lingcod	1.26		2	0.6	3.38	5
Mackerel	0.13		1	1.0		1
Petrale Sole	0.81		2	0.7	6.24	6
Sablefish	1.07		1	0.7	3.62	3
Sardine	0.03	0.54	3	1.0		0
Squid	0.23	0.98	3	0.7	1.60	4

Current prices for processors and their customers in Table 2 are converted into 2000 real dollars using the producer price index for unprocessed finfish from Bureau of Labor Statistics (http://www.bls.gov). This particular index was used to be consistent with the deflator used for PacFIN data. Ex-vessel prices are total ex-vessel revenues from PacFIN data for Monterey Bay ports divided by total landings of each species. Ex-processor prices are total revenues divided by total product for two surveyed processors, and the current wholesale price for a third processor. The average of these values is presented in Table 2 to give a sample size N=3 for prices of sardine and squid. Prices for seafood vendors are the average of values obtained from surveyed receivers' customers that are located in Monterey County or Santa Cruz County.

Ex-vessel prices (i.e., the value added by fishing operations) are lowest for CPS finfish and squid ($0.03-$0.23 per pound), and highest for salmon, crab and halibut ($1.63-$3.30 per pound). Groundfish and albacore fall in the middle range, with prices ranging from $0.24 to $1.26 per pound. This range of prices reflects the nature of the fisheries, including the gear used, markets and consumers targeted. CPS finfish and squid are high volume fisheries, with much of the product frozen in large bulk units (e.g., 50 lb blocks) and exported to Asia and Europe for further processing and consumption. A small portion of the product, especially squid and sardine, is more extensively processed in the MBA for particular domestic and international markets. (See Pomeroy et al. 2002.) Most of the groundfish accounted for in this project (and in the region's landings) is trawl-caught and sold dead. The prices above likely do not reflect the higher prices plaid to fishermen and vendors for live fish, which are usually caught using hook-and-line or trap gear. Crab, salmon and halibut are smaller volume fisheries that serve stronger local and regional markets, especially for fresh caught product.

Table 2 also reflects the value added by processing and post-processing sales. Ex-vendor prices for albacore, squid and Petrale sole represent the largest increase in value - seven-fold or more - among the species analyzed. Sablefish and salmon follow, reflecting a five-fold increase in value over the ex-vessel (landed) value of the catch. Halibut, lingcod and crab reflect less post-processing value added, with prices between 2.5 and 2.7 times ex-vessel prices.

Table 3 presents landings, revenue estimates, and value-added, separated into three stages of production: ex-vessel, ex-processor, and ex-vendor. Landings and ex-vessel revenues are the total landed weight and ex-vessel value derived from PacFIN data for the population of fish receivers that were active at MBA ports in 2003. Ex-processor revenues are the product of landings and the corresponding ex-processor price in Table 2. At this stage, value-added (VA) is the difference of ex-processor and ex-vessel revenues. Only sardine and squid have a large enough sample to permit showing ex-processor revenues. The ex-processor revenues for species in Table 2, except sardine and squid, are reported as an aggregate, labeled “Anonymous” to insure respondents' confidentiality. Ex-processor revenues for this category are calculated by multiplying landings with the prices that are missing in Table 2 (also to insure confidentiality). For the final stage of production, revenues of seafood vendors are estimated by multiplying landings with the corresponding ex-vendor price in Table 2. Recall this ex-vendor price has been converted into terms of whole fish, and includes the value-added associated with labor and other inputs used to prepare fillets and other final products. The “Anonymous” category for ex-vendor revenues consists of revenues calculated using landings in Table 3 multiplied by the ex-vendor prices we have for anchovy, English sole, and mackerel, which are not presented in Table 2 because of the small sample size (N<3). Value-added by vendors is relative to ex-processor revenues. Therefore, the “Anonymous” component of VA for vendors contains all species in Table 3 except sardine (which does not have a vendor price) and squid to be consistent with the “Anonymous” VA category for processors.

We estimated total ex-vendor revenue for these 12 species at over $60 million for 2003, reflecting $35.6 million in value added by receiver/processors and $24 million in value added by vendors. Squid had the highest estimated total ex-vendor value, at nearly $49 million in 2003. This reflects about $23 million in

value added by processors and $19 million in value added by vendors, in addition to fishing operations' initial value added of $7 million. Ex-vendor value added is more than three times that for the other 11 species in this analysis. The estimated total ex-vendor value for species after squid included well over $2 million for sablefish, salmon and albacore. Dungeness crab, Petrale sole, halibut and lingcod followed with estimated ex-vendor values ranging from $57,000 to about $330,000. Rankings for the other species listed are not reported to insure confidentiality.

Table 3. Revenues and Value-Added for Vessels, Processors, and Seafood Vendors from Landings at Monterey Bay Ports. Landings are given in pounds. Revenues and value-added (VA) are expressed in 2000 U.S. dollars. Ex-processor and ex-vendor revenues in cases with N<3 (from Table 2) are aggregated in a summary "Anonymous" category.

	Landings	Ex-Vessel	Ex-Processor	VA	Ex-Vendor	VA
Albacore	473,375	295,679			2,251,558	
Anchovy	1,555,834	73,718				
Salmon	475,760	775,628			2,383,667	
Crab	163,033	308,628			759,823	
English Sole	21,610	9,928				
Halibut	52,278	120,276			327,822	
Lingcod	16,808	21,237			56,785	
Mackerel	45,770	6,012				
Petrale Sole	53,388	43,143			333,402	
Sablefish	664,877	711,597			2,404,985	
Sardine	17,432,494	600,012	9,465,890	8,865,878		
Squid	30,691,176	7,123,877	30,027,304	22,903,427	48,964,168	18,936,864
Anonymous			6,212,596	3,846,750	2,918,876	5,167,538
Total		10,089,733	45,705,790	35,616,056	60,401,087	24,104,402

Discussion

This report describes an economic framework for estimating value-added (VA) for three stages of production: ex-vessel, ex-processor, and ex-vendor. We used data from the Pacific Fisheries Information Network to estimate landings, ex-vessel revenues, and ex-vessel prices for fish landed at ports in Monterey County or Santa Cruz County. We conducted a survey of processors in these counties to estimate VA at the ex-processor level. We used information from the survey of processors to contact several seafood vendors in Monterey County and Santa Cruz County to estimate VA at the ex-vendor level. Results from the survey of processors have four spatial components, and we used a GIS analysis to show (i) ports in California where processors active at Monterey Bay ports also receive fish, (ii) locations of processors in our survey, (iii) locations of businesses that provided goods and services to the processors in our survey, and (iv) the location of customers that purchased fish, crab, or squid from the processors in our survey.

The GIS analysis shows that processors active at Monterey Bay ports purchased fish along the entire coast of California, but most activity was at Moss Landing, followed by Monterey, and then Santa Cruz. Only a small fraction of purchases occurred at other ports. The GIS analysis also shows that processors in our survey are located close to Monterey Bay, and are thus concentrated in a few locations within Monterey County or Santa Cruz County. The businesses that purchased fish from, or provided goods and services to, processors in our survey are located throughout California, with most of these businesses near

Monterey Bay or San Francisco Bay. Customers of the processors in our survey are also located in Washington State, Japan, and China.

The VA estimates for processors suffer from small sample size, and the survey data gave VA estimates for only two species of the more than twelve identified in the survey. However, the survey data identified forty-two customers of the processors, including several that operate as seafood vendors in Monterey Country and Santa Cruz County. We contacted these vendors and obtained prices to augment the meager survey returns. To derive estimates of ex-vendor revenues, we simply multiplied landings at Monterey Bay ports by an average of prices, adjusted using an appropriate yield factor, obtained from the seafood vendors that we contacted. This procedure has some serious shortcomings. First, prices obtained from the vendors are current and may not represent conditions in 2003, the year used for both ex-vessel and ex-processor revenues. Second, the procedure assumes implicitly that vendors in Monterey County or Santa Cruz County purchase all landings of species except sardine and squid, or that prices obtained from these vendors are representative outside these counties. Data from the survey reject the former, identifying many customers in the area of San Francisco Bay. Therefore, the VA estimates presented above are based on the assumption that prices from a select group of seafood vendors in Monterey County and Santa Cruz County are representative of market conditions near, and north of, Monterey Bay. This working hypothesis could be tested with a survey of seafood vendors around San Francisco Bay, an important market identified by our spatial analysis.

However to estimate spatial flows of income within or between counties, additional information is needed from processors or vendors on purchases of fish, crab, and squid. The survey of processors described above did not ask for information about amounts sold to each customer, which would have been a difficult task on the survey worksheet. As it was, only a few of the worksheets that were returned by processors had enough detail to estimate value-added. Our judgment is that a larger and more comprehensive survey of seafood vendors in the counties around Monterey Bay and San Francisco Bay is needed to complete the value-added estimates presented above. Including counties near Morro Bay in the survey of seafood vendors would be useful. The survey of seafood vendors should be designed to collect information about where vendors purchase fish in California, and elsewhere, and the amounts purchased from each source. A database of seafood vendors would complement the GIS work in this report and improve the framework developed above for analyzing the spatial flows of income associated with fish and other species that are landed at ports in California.

Limitations

Our results illustrate the spatial organization of processing activities for fish landed at the major MBA ports, and provide an estimate of the value added in Monterey and Santa Cruz Counties to fish landed at those ports. There are several limitations to this work. First, because we did not receive the confidential landings data until six weeks before the project end date (even with the requested NCTE), we had to engage in opportunistic sampling of MBA receivers based on our previous research, which had focused on selected fisheries (e.g., wetfish) and receivers with a permanent presence (e.g., receiving station, processing plant) at the Moss Landing, and to a lesser extent, Santa Cruz and Monterey. While these receivers account for the majority of landings, they represent only a small fraction of all businesses that received fish at MBA ports. Second, whereas we were able to collect considerable and high quality (qualitative) data on locations of receivers, customers and goods and service providers, we were less successful in obtaining quantitative data on actual production and distribution (with four notable exceptions). We attribute this largely to the level of detail in the information request to receivers, which for some respondents proved burdensome, impractical (because such data could not readily be derived from receivers' books), or highly sensitive (e.g., due to competition for customers). Third, the resulting data limited our ability to fully and accurately estimate (quantitatively) the value added within and outside the two-county MBA to fish landed at MBA ports. In particular, we were unable to collect data on the

proportion of MBA-landed fish that remained within the two-county area versus that that was exported outside the area. In addition, our estimate of value added is informed only by June 2005 retail market prices, which may be different from prices for 2003 in general, and which otherwise fluctuate considerably. Moreover, our ex-vendor estimates exclude value added, for example, when fish are sold as part of a prepared meal at a restaurant. To address these two caveats would have required a significantly more comprehensive survey of these customers, and was beyond the scope of the project. Therefore, results from the study in general and the value-added analysis in particular should be interpreted with care.

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