Economic Data Collection Program

Mothership Report (2009-2014)

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October 5, 2016

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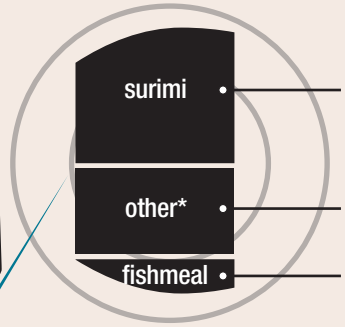
2014 Economic Data Collection (EDC)

West Coast Groundfish Trawl Catch Share Program

MOTHERSHIP

PACIFIC WHITING FLEET-WIDE PRODUCTION SUMMARY



11.2K mt (56%)
$28.5M, $2550/mt

6.9K mt (34%)
$12.8M, $1870/mt

2.0K mt (10%)
$5.0M, $2570/mt

All products:
20.0K mt
$46.4M, $2320/mt

*other includes: minced, fillets, fish oil, headed and gutted, and round, combined for confidentiality.

product recovery rate

ECONOMIC SUMMARY*

Vessel Average
$9.3M revenue
$6.6M variable costs
$2.7M variable cost net revenue
$2.0M fixed costs
$0.7M total cost net revenue

$39.9K variable cost net revenue per day

Fleet-wide Totals
5 vessels
$46.4M revenue
$13.5M variable cost net revenue
$3.3M total cost net revenue

ALASKA PARTICIPATION

WC vessels: 5
Total fleet-wide trips to Alaska: 20
Total purchases in Alaska: 182K mt

WC DELIVERY PORTS

of vessels offloading in each port

- Bellingham (3)
- Seattle* (2)

*(*all motherships report Seattle as their home port)*

Annual production per vessel: 4.0K mt

FISHERY PARTICIPATION

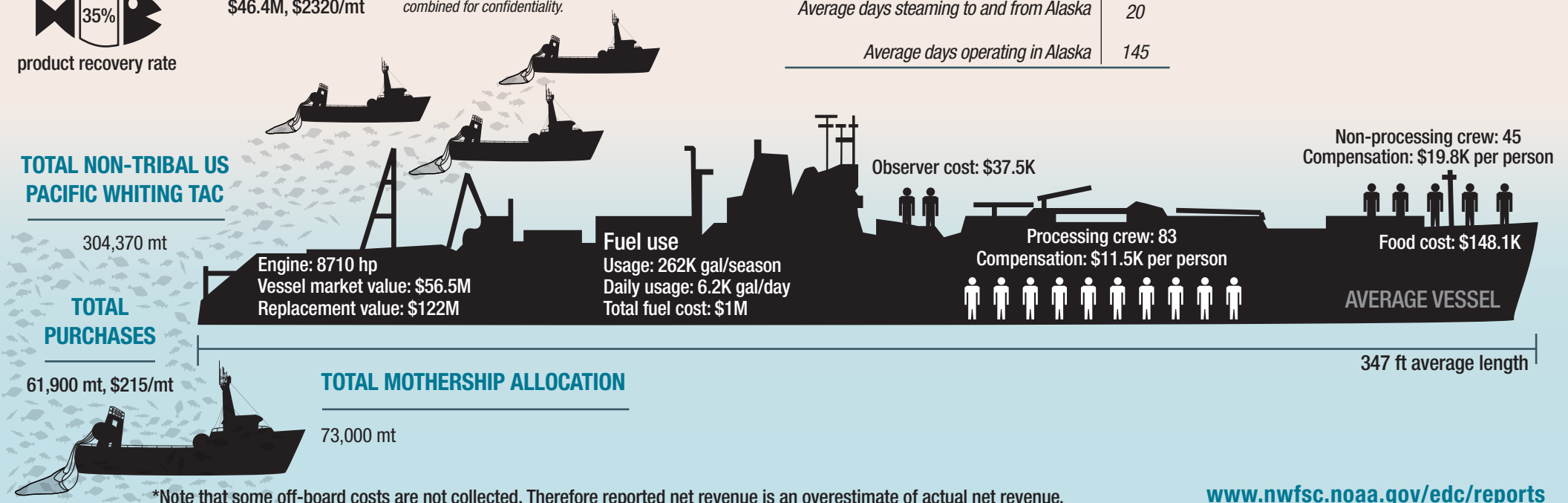
	Days at Sea
Average days processing and steaming on the West Coast	*59*
Average days steaming to and from Alaska	*20*
Average days operating in Alaska	*145*

TOTAL NON-TRIBAL US PACIFIC WHITING TAC

304,370 mt

TOTAL PURCHASES

61,900 mt, $215/mt



TOTAL MOTHERSHIP ALLOCATION

73,000 mt

*Note that some off-board costs are not collected. Therefore reported net revenue is an overestimate of actual net revenue.

www.nwfsc.noaa.gov/edc/reports

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Mothership Sector: 2014 Highlights[1]

In 2014, five motherships owned by four companies processed Pacific whiting on the West Coast.

- The mothership fleet generated $42 million in income and supported 926 jobs from purchases of Pacific whiting caught in the catch share program.
- The fleet spent 25% of its time operating in the West Coast whiting fishery. Otherwise, they were operating in Alaska or steaming between the West Coast and Alaska.
- West Coast motherships delivered to two ports: Blaine/Bellingham and Seattle. All five motherships list Seattle as their homeport.
- Each mothership employed an average of 83 processing and 45 non-processing crewmembers that were compensated approximately $11,500 and $19,800 per year, respectively. Average compensation for processing and non-processing crewmembers has grown by 104% and 73%, respectively, compared to the pre-catch share baseline period (2009 and 2010).
- The fleet's price paid to catcher vessels for fish purchases has increased from $198 per metric ton in pre-catch share years to $215 per metric ton in 2014.
- The average revenue for all product types was $2,320 per metric ton in 2014.
- Surimi comprised the largest portion of revenue, with an average production value of $2,550 per metric ton in 2014.
- Fishmeal had an average production value of $2,570 per metric ton in 2014, a 58% increase compared to the baseline.
- Vessels generated an average revenue of $9.28 million and spent about $8.63 million in fixed and variable costs, leading to a total cost net revenue of approximately $651,000 per vessel for the year, representing a 3 fold increase from baseline conditions in 2009 and 2010.
- Motherships earned a total cost net revenue of $121 per metric ton produced in 2014, a 37% increase from baseline conditions in 2009 and 2010.

[1] Values reported in inflation adjusted 2014 dollars. The pre-catch share baseline period is defined as the years 2009 and 2010.

Report Contents

Mothership Sector: Highlights **2**

Acknowledgments **5**

Report Introduction **6**

Overview **9**

Report **20**

List of Tables **23**

List of Figures **24**

1 Mothership Data Summaries **25**

1 Introduction 25

2 Vessel Participation on the West Coast and in Alaska 28

3 Delivery Ports 29

4 Vessel Physical Characteristics 30

5 Vessel Fuel Use and Crew Size 31

6 West Coast and Alaska Round Weight 32

7 Revenue 35

8 Costs 39

2 Mothership Data Analysis **46**

9 Cost Disaggregation 46

10 Net Revenue and Economic Profit 50

11 Economic Performance: Cost, Revenue, Net Revenue, Markup, and Product Recovery Rates 54

Acknowledgments

The Economic Data Collection (EDC) Program and EDC Reports reflect collaboration and coordination of individuals across the West Coast. There are numerous people to thank for their contributions to this effort.

We would like to acknowledge the efforts of all the Northwest Fisheries Science Center (NWFSC) economists who provided a wide range of input into survey design, implementation, and analysis. The group worked together in an effort to distribute high quality data in a timely fashion. A special thanks to Todd Lee, Abigail Harley, and Lily Hsueh for assistance in the development of these reports. We thank Su Kim of the NWFSC Scientific Communications Office for producing the infographics in these reports.

We appreciate the efforts of the Northwest Regional Office for support in the EDC Program development, outreach, and communication efforts. The Permit Office staff was particularly instrumental in ensuring compliance with the mandatory participation requirements.

The Northwest Division of the Office of Law Enforcement (OLE) and the National Oceanic and Atmospheric Administration (NOAA) Office of General Council helped extensively with many aspects of the EDC Program development and enforcement. They continue to collaborate with the EDC Program to ensure compliance. We thank the NWFSC Scientific Data Management staff for building the administrative tracking system and database, and the NWFSC Fishery Resource Analysis and Monitoring data team for continued support.

We thank PacFIN and AKFIN staff for providing access to important landings, permit, and vessel data. The staff at ODFW, WDFW, and CDFW also contributed with data used for the fielding of the baseline data collection. Other data and assistance with data interpretation were provided by the At-sea Hake Observer Program and the West Coast Observer Program.

We thank the Pacific Fishery Management Council and advisory bodies for their valuable comments on the EDC reports and data.

Finally, we thank the members of the West Coast fishing industry who met with us to discuss the development and implementation of data collection processes. We appreciate the time and effort of each participant that will continue to help improve the program in the coming years.

Report Introduction

About the Report

The US West Coast groundfish fishery takes place off the coasts of Washington, Oregon and California, and is comprised of over 90 different species of fish. The fish are harvested both commercially and recreationally. The commercial fishery has four components: limited entry with a trawl endorsement, limited entry with a fixed gear endorsement, open access, and tribal. In January 2011, the West Coast Limited Entry Groundfish Trawl fishery transitioned to the West Coast Groundfish Trawl Catch Share Program. The catch share program consists of cooperatives for the at-sea mothership (including catcher vessels and motherships) and catcher-processor fleets, and an individual fishing quota (IFQ) program for the shorebased trawl fleet.[2] The Economic Data Collection (EDC) Program is a mandatory component of the West Coast Groundfish Trawl Catch Share Program, collecting information annually from all catch share participants: catcher-processors, catcher vessels, motherships, first receivers, and shorebased processors. The EDC information is used to monitor the economic effects of the catch share program, and consists of data on operating costs, revenues, and vessel and processing facility characteristics.

This report summarizes information collected from the West Coast mothership fleet. The EDC reports are also produced for the other sectors, and currently cover the years 2009 to 2014. The 2009 and 2010 data were collected in 2011 to provide a baseline of pre-catch share information. There is a one-year lag in collecting the EDC data to allow companies to close their accounting books. Thus, 2014 data were collected from May to September 2015. The EDC reports are updated annually to disseminate the data collected and provide background, analysis, and context to support the interpretation of the data. The reports are also expected to serve as a catalyst for feedback on the data collected and its analysis. It is envisioned that the scope of these reports will expand, and the methods used will be refined with each publication.

The report is composed of three major sections. The first section, Mothership Overview (beginning on page 9), is an in-depth summary that contains descriptive analyses of the mothership fleet focusing on activities during 2014. The second section, Mothership Data Summaries (beginning on page 25), provides tables of all of the data collected from 2009 to 2014, with a detailed discussion of the methods used to collect and analyze the data. The third section, Mothership Data Analysis (beginning on page 46), contains information about cost disaggregation and calculations of net revenue and economic performance. The data that form the basis for this report are confidential and must be aggregated so that individual responses are protected. In cases where there are not enough observations to protect confidentiality, the data are either not shown, or are combined with broader groups of data. More information about EDC Program administration and fielding of the surveys, the EDC forms, data quality

[2] Information about the West Coast Groundfish Trawl Catch Share Program is available online at http://www.westcoast.fisheries.noaa.gov/fisheries/groundfish_catch_shares/.

controls and quality checks, data processing, and safeguarding confidential information can be found in the EDC Administration and Operations Report.[3]

Background - Economic Data Collection and West Coast Groundfish Trawl Catch Share Program

The economic benefits of the West Coast groundfish trawl fishery and the distribution of these benefits are expected to change under the West Coast groundfish trawl catch share program. To monitor these changes, the Pacific Fishery Management Council (PFMC) proposed the implementation of the mandatory collection of economic data. Using data collected from industry participants, the EDC Program monitors whether the goals of the catch share program have been met.

Many of the PFMC's goals for the catch share program are economic in nature. These goals include: provide for a viable, profitable, and efficient groundfish fishery; increase operational flexibility; minimize adverse effects from an IFQ program on fishing communities and other fisheries to the extent practical; promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry; provide quality product for the consumer; and, increase safety in the fishery.

The EDC program is also intended to help meet the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 2007 requirement to determine whether a catch share program is meeting its goals, and whether there are any necessary modifications of the program to meet those goals. The MSA requires a formal review 5 years after the implementation of a catch share program to which the EDC Program will make a valuable contribution.

Monitoring the economic effects of a catch share program requires a variety of economic data and analyses. The primary effects of a catch share program can be captured in two broad types of economic analysis: 1) economic performance measures, and 2) regional economic impact analysis. Both of these require information on the costs and earnings of harvesters and processors.

Economic performance measures include: costs, earnings, and profitability (net revenue); economic efficiency; capacity measures; economic stability; net benefits to society; distribution of economic net benefits; product quality; functioning of the quota market; incentives to reduce bycatch; market power; and, spillover effects in other fisheries. Some of these measures are presented in this report, while others will require more specific and involved analysis using EDC data.

Regional economic impact analysis measures the effects of the program on regional economies. The catch share program will likely affect different regional economies in different ways. Regional economic modeling involves tracking the expenditures of all businesses, households, and institutions within a given geographic region to arrive at the effects on income and employment. On the Pacific coast, the

[3] For more information about the EDC Program and the West Coast Groundfish Trawl Catch Share Program, please see the Economic Data Collection Program, Administration and Operations Report available at the EDC website: http://www.nwfsc.noaa.gov/edc.

Northwest Fishery Science Center's IO-PAC model[4] is used to estimate regional economic impacts using data from both the EDC survey forms and the voluntary cost earnings survey as model inputs.[5]

[4] Leonard, J., and P. Watson. 2011. Description of the input-output model for Pacific Coast fisheries. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-111, 64 p.

[5] For more information on cost earnings survey data collection process, see the Administration and Operations Report Draft Report for PFMC Review (May 2016).

OVERVIEW

Management Context

In January 2011, the West Coast Limited Entry Groundfish Trawl fishery transitioned to the West Coast Groundfish Trawl Catch Share Program, consisting of an individual fishing quota (IFQ) program for the shorebased trawl fleet and cooperatives for the mothership and catcher-processor fleets. This report focuses on mothership vessels, which process fish delivered at sea by catcher vessels. The at-sea Pacific whiting fishery also includes catcher-processors, which are vessels that both catch fish and process them on-board. In 2014, the mothership fleet generated $42 million in income and supported 926 jobs from purchases of Pacific whiting caught in the catch share program.[1]

The domestic Pacific whiting fishery grew rapidly in the 1990s after the United States banned foreign vessels from processing Pacific whiting harvested off the West Coast. With the development of more efficient processes to transform Pacific whiting into surimi (a product popular in Asia), and certification from the Marine Stewardship Council (MSC)[2] in 2009, demand in the international market has continued to rise, and the Pacific whiting fishery has subsequently transformed into one of the largest fisheries by volume in the United States.

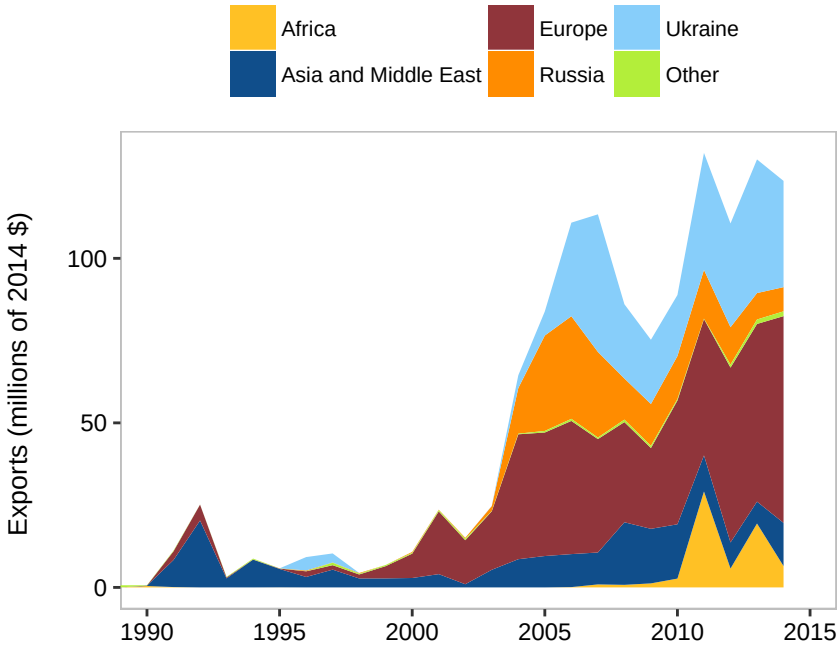

Figure 1: Total exports of fresh and frozen Pacific whiting (including mothership, catcher-processor, and shoreside production) from the U.S by recipient region (millions of 2014 $).

[1] Values calculated using the NWFSC IO-PAC model (Leonard, J., and P. Watson. 2011. Description of the input-output model for Pacific Coast fisheries. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-111, 64 p.)

[2] The MSC certification indicates that the West Coast Pacific whiting fishery has met the standard for "good management practices to safeguard jobs, secure fish stocks for the future and to help to protect the marine environment". This certification has opened new markets, largely in the European Union, for Pacific whiting.

In 2014, nearly 62,000 metric tons of Pacific whiting worth more than $100 million were exported from the United States[3] (Figure 1). Since 2000, most of these exports went to the European Union, followed by Russia and Ukraine. In 2014, Russia implemented trade sanctions against Europe and the United States, which could lead to declining demand for whiting exports. To date, it is unknown when these sanctions will be lifted.

The Pacific Fishery Management Council and National Marine Fisheries Service (NMFS) are responsible for managing the U.S. fishery for the coastal stock of Pacific whiting through a bilateral agreement between the United States and Canada, known as the Pacific Whiting Treaty. The United States and Canada signed an agreement in 2003 (which became law in 2007) that allocates a set percentage of the harvest quota to American and Canadian harvesters. The United States is allocated 73.88% and Canada the remaining 26.12%. Managers mainly use annual harvest quotas to regulate the coast-wide catch of Pacific whiting. Regulations prohibit processing at sea south of the Oregon-California border.

Once the total allowable catch of Pacific whiting has been determined and the tribal sector's share has been apportioned, the remaining U.S. proportion is then allocated between the catcher-processor, mothership, and shoreside sectors. The mothership sector is allocated 24% while the catcher-processor and shoreside sectors are allocated 34% and 42%, respectively. Near the end of the season, NMFS often redistributes unfished tribal allocations among the three commercial sectors.[4]

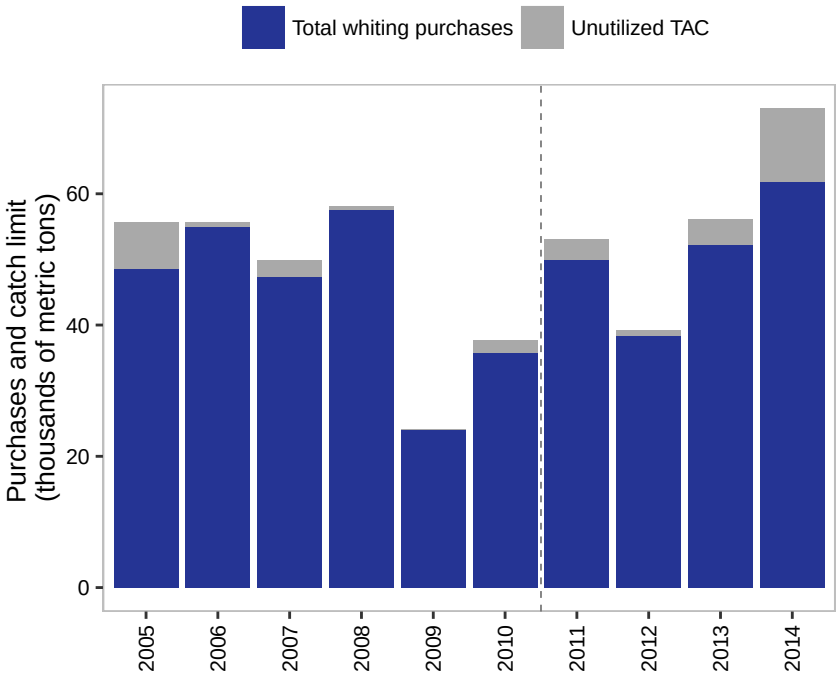

Figure 2: Mothership sector Pacific whiting catch limits, including any reapportionments among sectors that may have occurred during the season, and total purchases indicating unutilized portion of total allowable catch (thousands of metric tons). Dashed line represents the beginning of the catch share program.

Because of high variability in recruitment and other sources of uncertainty in the stock assessments, catch limits have varied substantially during the EDC data collections from 2009–2014.[5] Af-

[3] NMFS Science and Technology Commercial Fisheries Statistics, http://www.st.nmfs.noaa.gov/commercial-fisheries/foreign-trade/index.

[4] Notably, in 2008, catcher-processors received 6,000 metric tons of surplus mothership Pacific whiting. For allocation and season catch summaries going back through 2005, see http://www.westcoast.fisheries.noaa.gov/fisheries/management/whiting/whiting_reports_and_rulemakings.html.

[5] http://www.pcouncil.org/groundfish/stock-assessments/by-species/pacific-whiting-hake/.

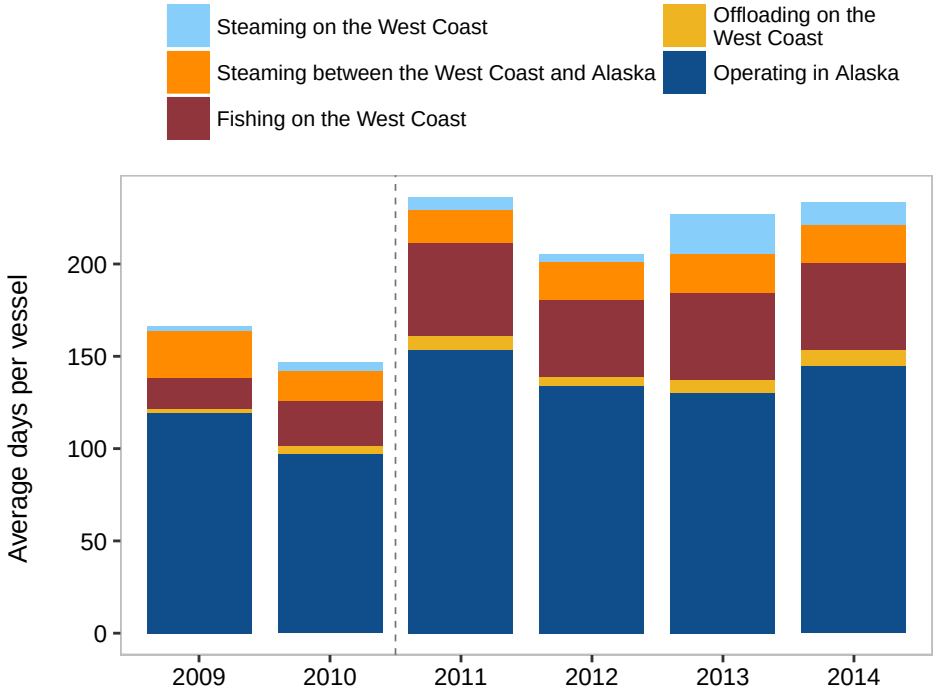

Figure 3: Average number of days spent in each activity per mothership vessel. Dashed line represents the beginning of the catch share program.

ter several seasons of large Pacific whiting harvests from 2005–2008, managers lowered the catch limit substantially in 2009, but have raised it every year since with the exception of 2012 (Figure 2).

In 2014, the mothership sector received an allocation of 73,000 metric tons of Pacific whiting; about 16,900 metric tons more than the allocation in 2013, and about 33,800 metric tons more than the allocation in 2012 (see Mothership Data Summaries, Table 6.1). Since 2009, the mothership fleet has caught 93-97% of its annual catch with the exception of 2014 when only 85% was caught. On average, mothership vessels received 12,400 metric tons of Pacific whiting from catcher vessels in 2014.

In addition to receiving an allocation of Pacific whiting quota, the mothership sector is also allocated quota for bycatch. In 2014, the mothership sector was allocated 7.2 metric tons of Pacific ocean perch, 120 metric tons of widow rockfish, 9.3 metric tons of dark blotched rockfish, and 5.4 metric tons of canary rockfish.[6] In 2014, motherships received about five prohibited and protected fish per every 100 metric tons of Pacific whiting from catcher vessels.[7] This included mostly Chinook salmon, but also chum salmon, coho salmon, Pacific halibut, and eulachon. Major non-prohibited bycatch species include widow rockfish, minor slope rockfish complex species, spiny dogfish, and squid. The bycatch rate in the mothership sector decreased by 11% between the pre-catch share period and 2014.

NOAA Fisheries has mandatory rebuilding plans that limit bycatch for species that are designated "overfished". There are two rockfish species that remain designated as overfished as of 2014: Pacific

[6] Biennial Specifications and Management Measures; Inseason Adjustments, http://www.gpo.gov/fdsys/pkg/FR-2014-11-20/pdf/2014-27489.pdf.

[7] 2014 Pacific whiting fishery summary: http://www.westcoast.fisheries.noaa.gov/publications/fishery_management/groundfish/whiting/2014-summary.pdf.

ocean perch and darkblotched rockfish. In 2011, widow rockfish was taken off the overfished list.[8] As a result, the annual catch limit for widow rockfish was raised starting in 2013. Similarly, canary rockfish was taken off the overfished list in 2015,[9] and the coast-wide annual catch limit will likely be increased for both widow rockfish and canary rockfish starting in 2017.

The flexibility introduced by the catch share program allows for the use of new bycatch reduction strategies. Both the catch share provision and the mothership catcher vessels' cooperative charter state that reducing bycatch is a primary goal under the trawl catch share program. Several measures have been voluntarily agreed upon by the catcher vessel cooperative members, including the designation of bycatch "hotspots" and a prohibition on night fishing that is broader than what is required by regulation.

Mothership Sector Description

In 2014, four different companies owned the seven vessels with active permits in the West Coast mothership sector, and of these, five motherships participated in the fishery. These motherships process Pacific whiting (*Merluccius productus*), also known as Pacific hake, on the West Coast. The average length of mothership vessels participating on the West Coast is approximately 372 feet. Their main engines have 8,710 horsepower, on average, and a fuel capacity of about 437,000 gallons.

The mothership fleet purchased approximately 11% of all commercially harvested fish on the West Coast (including crab and shrimp), 23% of Pacific whiting, and 22% of all Groundfish Trawl Catch Share Program fish.

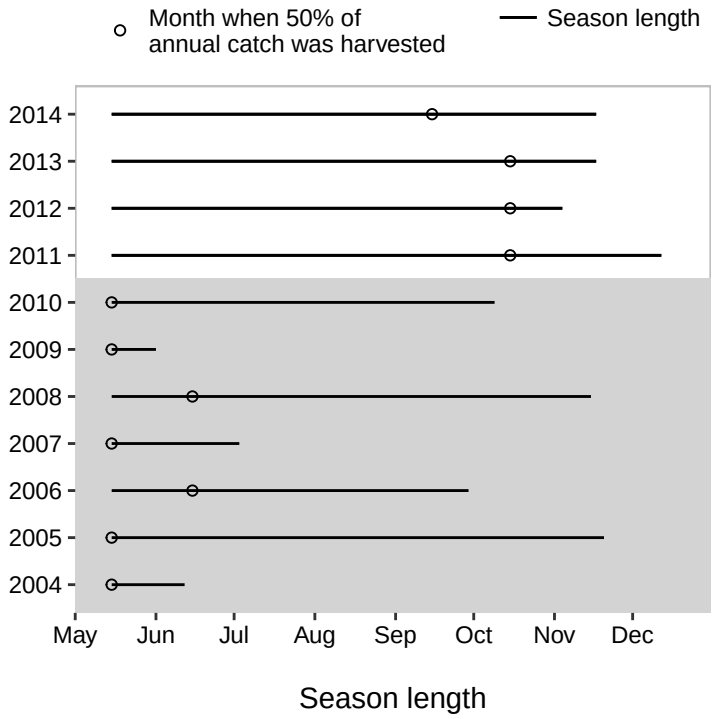

Figure 4: Season length for the mothership whiting fishery from 2004 through 2014, with horizontal lines representing when the first and last whiting was caught each year. The open circle represents the month when half of the cumulative annual catch was caught. The shaded region represents the seven years prior to the implementation of the catch share program.

[8] http://www.pcouncil.org/wp-content/uploads/Widow_2011_Assessment.pdf.

[9] NMFS 2015. Status of canary rockfish in the CA current in 2015: http://www.pcouncil.org/wp-content/uploads/2015/05/D8_Att1_Canary_2015_FULL-E-Only_JUN2015BB.pdf.

Two types of vessels participate in the Pacific whiting mothership sector: traditional motherships that also act as a mothership in Alaska, and catcher-processor vessels that only act as a mothership on the West Coast. Both types of vessels spend the majority of their time in the Alaska pollock fishery in the Bering Sea and Aleutian Islands (Figure 3). The mothership vessels that participated in the West Coast whiting fishery after the implementation of the catch share program have reported a decrease in Alaska pounds, and an increase in days in Alaska. Changes in Alaska operations likely reflect changes in regulations and annual catch limits in the Alaska pollock fishery, along with the shift to catch shares on the West Coast.

In 2014, mothership vessels spent the majority of their time (62%) processing Alaska pollock in the Bering Sea and Aleutian Islands off Alaska, otherwise they were operating on the West Coast or steaming between the West Coast and Alaska. In 2014, the average mothership spent 59 days processing fish and steaming along the West Coast and 20 days steaming between the West Coast and Alaska (See Mothership Data Summaries, Table 2.1 for more information on fleet activity). The fleet as a whole took 20 one-way trips to and from Alaska in 2014. West Coast motherships deliver Pacific whiting primarily to two ports in Washington State: Blaine/Bellingham and Seattle. All of the motherships that participated in the West Coast whiting fishery list Seattle as their homeport.

The catch share program provides increased operational flexibility to both motherships and catcher vessels, demonstrated through changes in season length (Figure 4). The length of the season (the number of days from the first to the last haul) fluctuated during the years before catch shares, often relative to changes in the catch limit. Under current regulations, motherships can begin processing at sea on May 15. The mothership fleet had processed at least half of their annual quota by the end of May for five out of the seven years leading up to the implementation of catch shares. By comparison, processing continued into October in years after the implementation of catch shares (Figure 4), again indicating that the cooperative framework may give trawl vessels and motherships more operational flexibility.

Economic Indicators

The EDC Program tracks economic indicators by compiling information submitted by participants about expenses and revenue and how those figures change over time. All values reported here in the Overview section are inflation adjusted 2014 dollars. Pre-catch share data for the 2009 and 2010 operating years were submitted in 2011 and have been averaged to calculate "baseline" conditions within the fishery to which subsequent years of data can be compared.

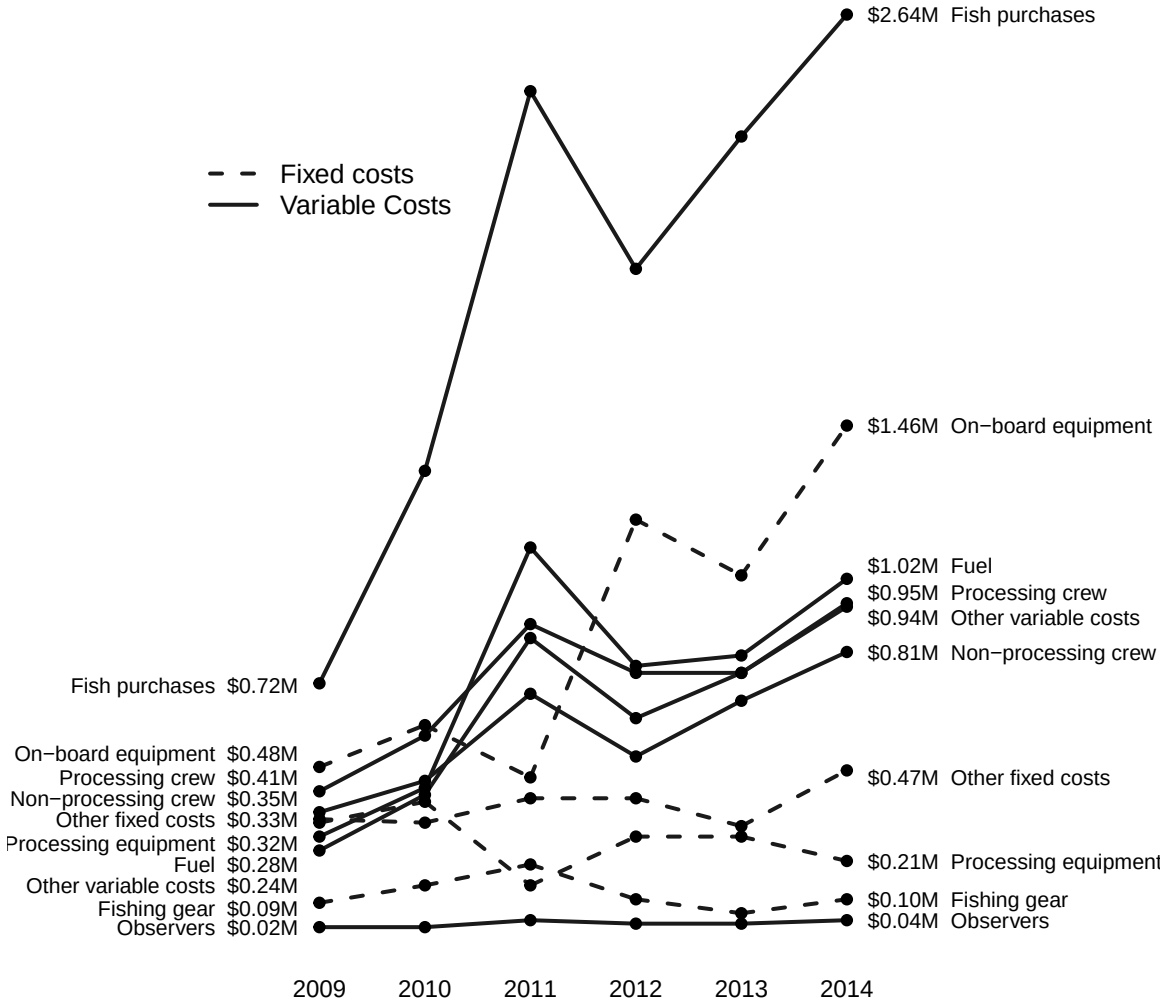

Figure 5: Average fixed (dashed line) and variable costs (solid line) per vessel (millions of 2014 $).

Variable Costs

Mothership vessel costs are separated into two categories: variable costs and fixed costs. Variable costs comprise the majority of a vessel's total expenditures and include fish purchases, fuel, crew compensation, food, additives, packaging and materials, and observer coverage. Variable costs vary with the level of fishery participation and averaged $6.58 million per vessel in 2014 (see Mothership Data Summaries, Table 8.1).

Pacific whiting purchases constituted the largest portion of variable costs ($2.64 million), followed by fuel and lubrication ($1.02 million), processing crew compensation ($955,000), and non-processing crew compensation ($813,000). Overall expenditures on fish purchases have increased substantially since 2009 (Figure 5) due to significant increases in catch limits (Figure 2) that allow for a higher catch volume. The fleet's average price paid per metric ton of fish purchased from catcher vessels has ranged from $198 during the pre-catch share period to a peak of $252 in 2012. The price was $215 in 2014.

Crewmembers include line workers, fishmeal crew, quality control, technicians, cleanup, factory managers, combis, and mechanics who work on processing equipment. During the baseline years, motherships employed an average of 88 processing crew and 34 non-processing crew, which changed to 83 and 45 by 2014, respectively. In 2014, motherships compensated processing crewmembers $11,500, a 104% increase compared to the baseline period. Likewise, annual compensation per non-processing crewmember was $19,800 in 2014, a 73% increase compared to baseline conditions.

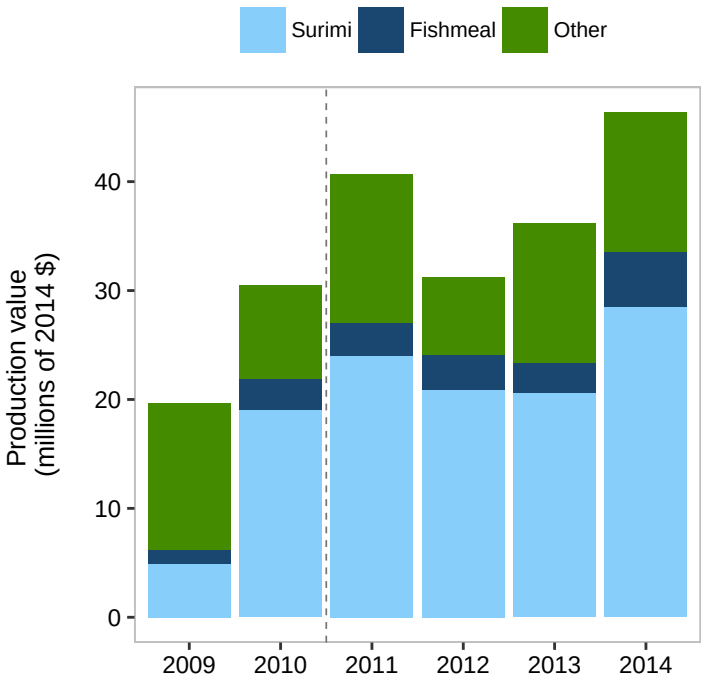

Figure 6: Fleet-wide production value by product type (millions of 2014 $). Other includes fillets, fish oil, headed and gutted, minced, and round, and are combined to protect confidential data. Dashed line represents the beginning of the catch share program.

Average daily fuel use while processing and steaming on the West Coast and in Alaska was 6,160 gallons per day in 2014, decreasing by 5% from baseline conditions. Fuel and lubrication comprise one of the largest cost categories for the fleet on the West Coast, with total costs varying significantly with fuel prices. The Pacific States Marine Fisheries Commission tracks historical marine fuel prices, which in Washington State increased from $1.92 in March 2009 to a high of $4.10 per gallon in 2012, ranging from $3.15 to $3.80 during 2014.[10] Therefore, while daily fuel use has decreased slightly, the average fuel expenses reported by motherships on the West Coast have increased by 3 fold compared to baseline conditions.

Observer coverage on motherships dates back to the Fishery Conservation and Management Act of 1976. Mothership vessels, like the rest of the processing fleet, have continued to have two observers on board while operating in the West Coast Pacific whiting fishery after the implementation of the catch share program. Observer coverage for motherships cost an average of $37,500 per vessel for the 2014 year.

The Magnuson-Stevens Act requires that NMFS compute and collect cost recovery fees from participants of limited access privilege programs, such as catch shares, to recover additional government costs attributable to the private sector use of a public resource. Cost recovery fees were implemented for the West Coast groundfish fishery in 2014 and are calculated yearly, not to exceed 3% of ex-vessel value. Unlike catcher-processors, fees for the Mothership Coop Program sector are paid by catcher vessels that deliver the fish.[11]

[10] PSMFC 2015. West Coast and AK Marine Fuel Prices Annual Report, http://www.psmfc.org/efin/docs/2014FuelPriceReport.pdf.

[11] For more information on cost recovery fees, see the Compliance Guide at http://www.westcoast.fisheries.noaa.gov/

Fixed Costs

Mothership vessel fixed costs include capitalized expenditures and expenses on vessel and on-board equipment, fishing gear for catcher vessels, and processing equipment. In general, these do not vary with fishing effort as much as variable costs.[12] Average annual expenditures on vessel and on-board equipment, fishing gear, and processing equipment has averaged $899,000 since 2009. In 2014, the average West Coast portion of other fixed costs amounted to $292,000, similar to baseline conditions.

Revenue

Participants report three sources of revenue: the total value received for processed product, earnings from quota leasing, and any other sources of revenue. This report summarizes the total production value and average values by product type, per vessel, per day, and per metric ton produced (See Mothership Data Summaries Tables 7.2, 11.1, 11.2, and 11.2 for more detailed information).

The average production value of all Pacific whiting products was about $9.28 million per vessel (representing a 118% increase from baseline conditions) and $2,320 per metric ton in 2014. Surimi, with an average production value of $2,550 per metric ton in 2014, comprised the largest portion of production revenue (Figure 6) and production weight (Figure 7). Fishmeal had an average production value of $2,570 per metric ton in 2014, representing 58% growth compared to baseline conditions (Figure 8). The "Other" category includes fillets, fish oil, fish sold in the round, or headed and gutted fish, and fluctuates in volume and value from year to year, as shown in Figures 6 and 7.

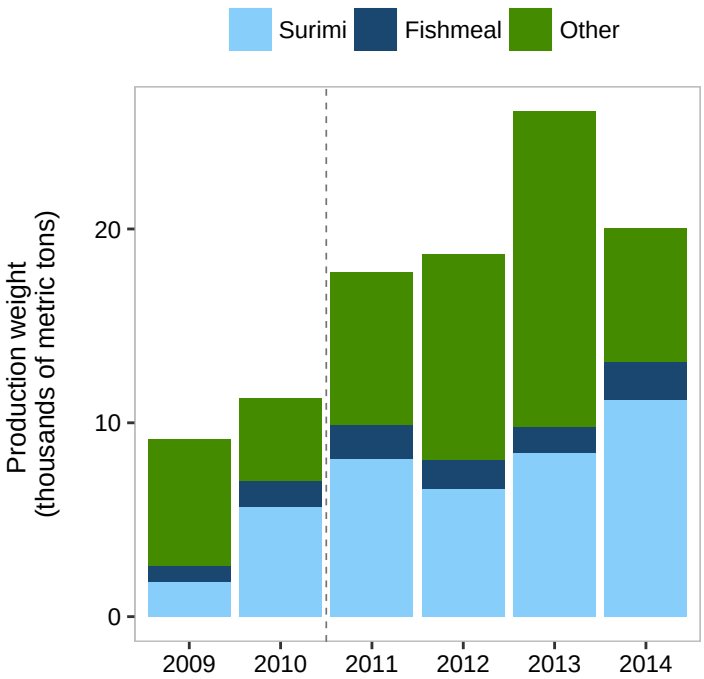

Figure 7: Fleet-wide production weight by product type (thousands of metric tons). Other includes fillets, fish oil, headed and gutted, minced, and round, and are combined to protect confidential data. Dashed line represents the beginning of the catch share program.

The product markup (total value of production divided by total cost of fish purchased) decreased from 4.57 to 3.51 during 2009-2014 as the average production value remained constant but purchase prices increased. The product recovery rate (total weight of production divided by total weight of fish purchased) was 0.33 in 2014, ranging from 0.27 to 0.50 since 2009.

publications/fishery_management/groundfish/public_notices/cost-recovery-compliance-guide.pdf.

[12] All of the average fixed costs collected, and the breakout for fixed costs on the West Coast, are reported in Mothership Data Summaries Section 8.2.

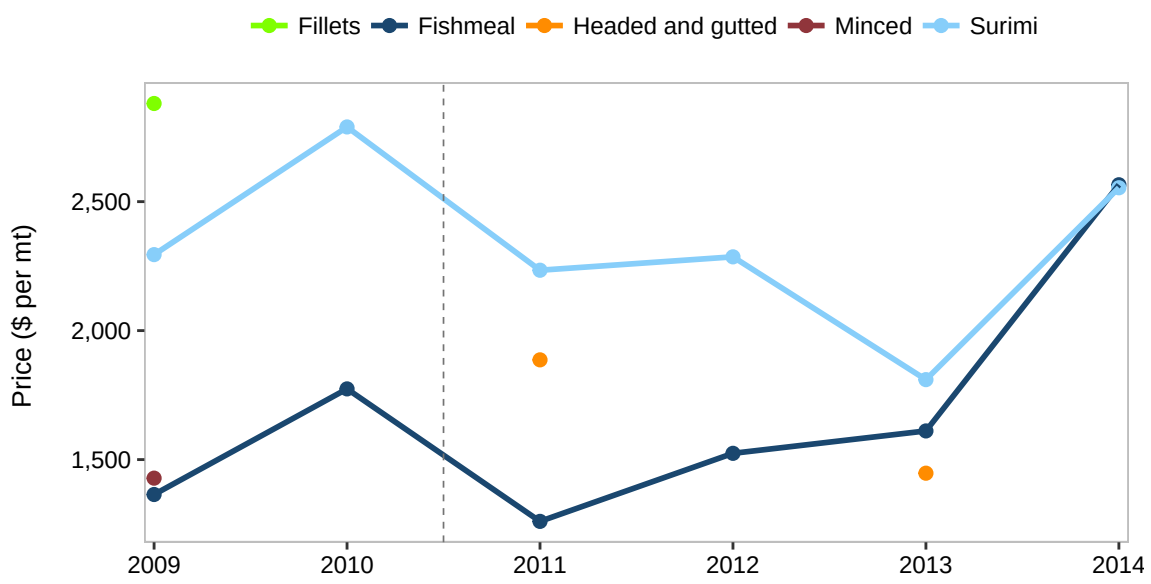

Figure 8: Average price by product type (2014 $). Some values suppressed to protect confidential information. Product types such as minced, fillets, and fish oil delineated here were combined in Figures 6 and 7. Dashed line represents the beginning of the catch share program.

Net Revenue

The EDC Program measures the net economic benefits of the catch share program by reporting two types of net revenue. The first is variable cost net revenue, which is revenue minus variable costs. The second is total cost net revenue, which is revenue minus both variable and fixed costs.[13] To provide a complete picture of the changes that have occurred, net revenue is presented at two scales. Figure 9 shows the total fleet-wide net revenue for the fishery, while Figure 10 shows net revenue for the average vessel. Both figures only include revenues and costs associated with the West Coast catch share program. It is important to note that the EDC forms aim to capture only costs that are directly related to vessel fishing operations, and not costs that are related to activities or equipment off the vessel. Therefore, the net revenue reported here is an overestimate of the true net revenue.[14]

In 2014, motherships generated a total fleet-wide revenue of $46.4 million and spent about $43.1 million in fixed and variable costs, leading to a total cost net revenue of approximately $3.25 million for the year (Figure 9). From baseline conditions in 2009 and 2010, the fleet has experienced increasing variable costs, with costs being highest in 2011 and 2014. However, revenue has kept pace with these increasing costs, having grown by 85% from baseline conditions to 2014. As a result, total cost net revenue (revenue minus all costs) has increased by 2 fold compared to baseline years, though was highest in 2011 when fixed costs were lowest.

In terms of revenue per vessel, motherships generated an average revenue of $9.28 million and spent

[13] See Figure 5 for a description of which costs are considered variable costs and which costs are considered fixed costs.

[14] See Mothership Data Summaries Section 8: Costs and Section 10: Net Revenue and Economic Profit for a more complete discussion of variable costs, fixed costs, and the calculation of net revenue.

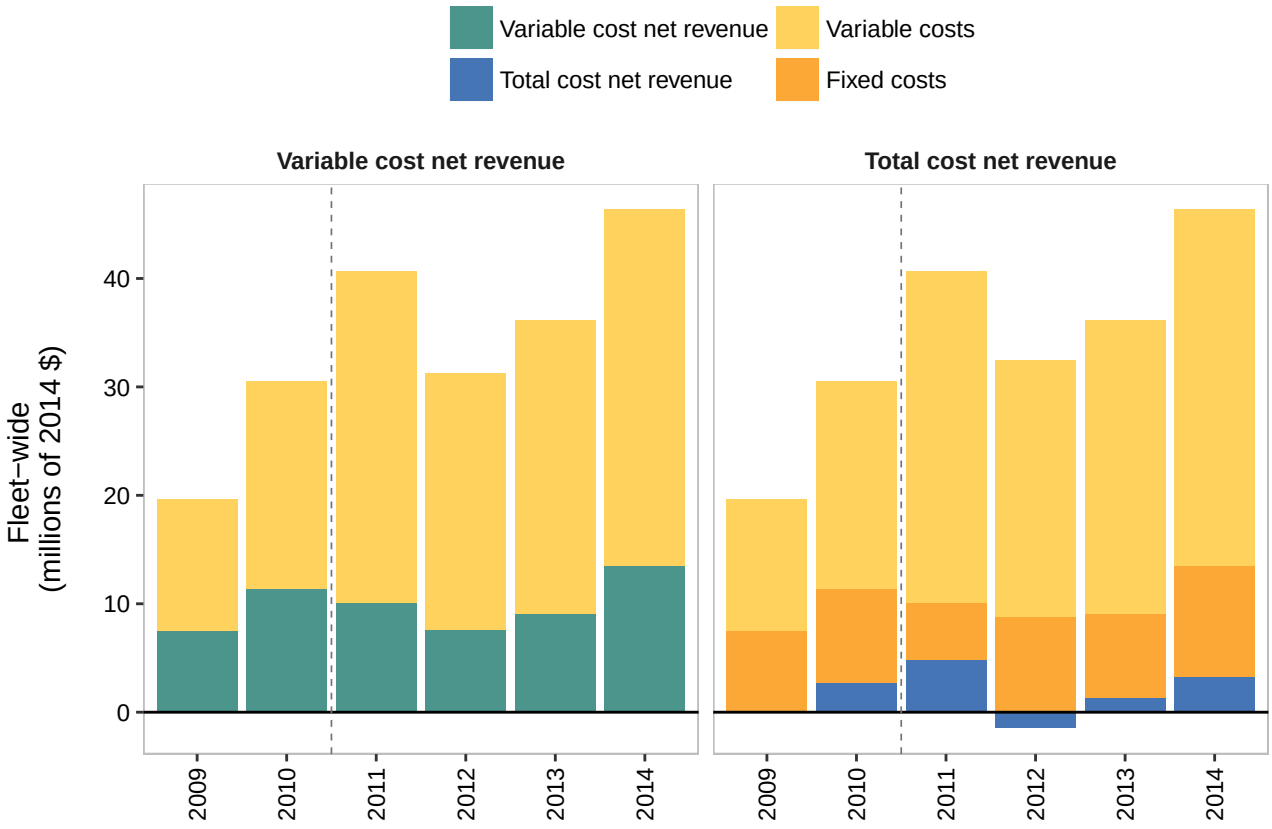

Figure 9: Fleet-wide variable cost net revenue (revenue minus variable costs) (left) and fleet-wide total cost net revenue (revenue minus variable costs and fixed costs) (right) (millions of 2014 $). Dashed line represents the beginning of the catch share program.

about $8.63 million in fixed and variable costs, leading to a total cost net revenue of approximately $651,000 per vessel for the year (Figure 10), representing a 3 fold increase from baseline conditions.

Many of the above patterns in costs and revenue are also evident in daily and production values. Daily production value per vessel was $154,000 in 2014. Motherships earned a total cost net revenue per metric ton produced of $121 in 2014, a 37% increase from baseline conditions (see Mothership Data Summaries, Table 11.2).

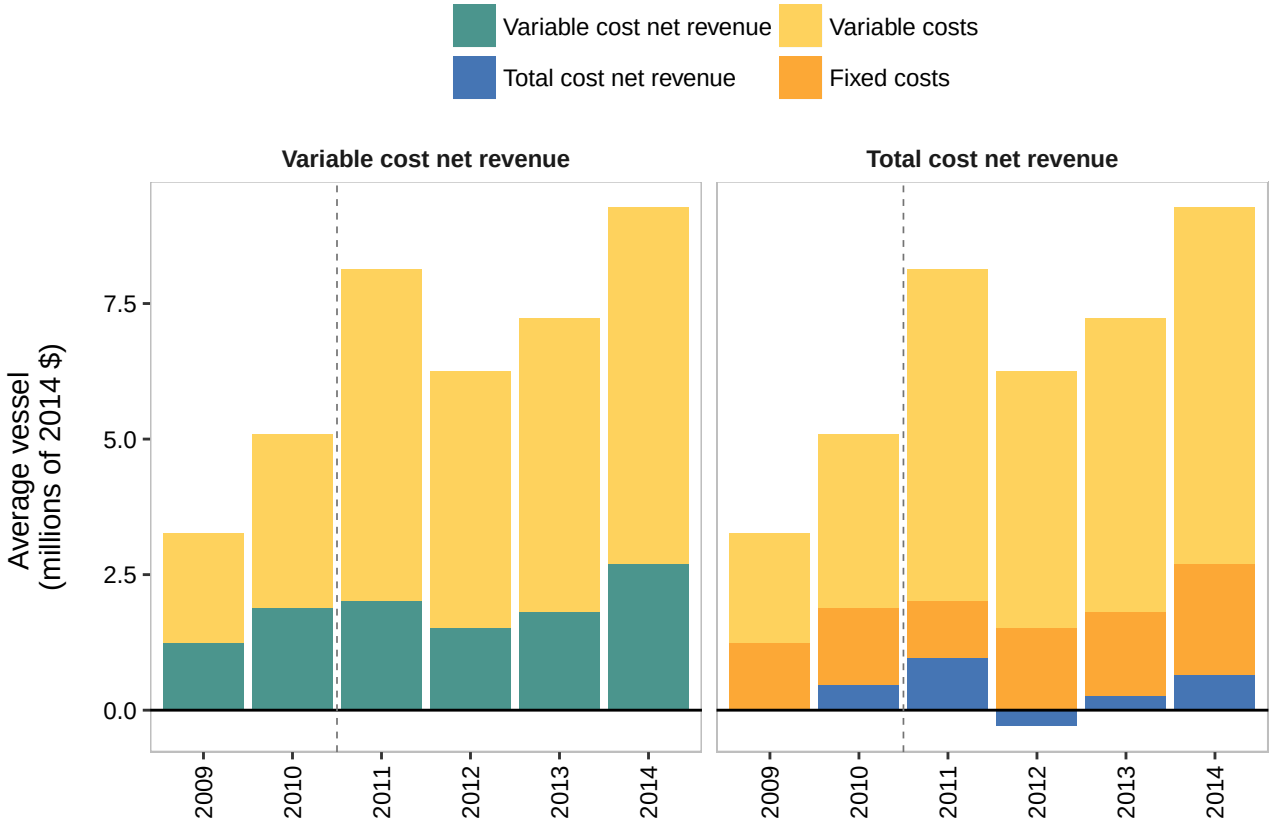

Figure 10: Average variable cost net revenue (revenue minus variable costs) (left) and average total cost net revenue (revenue minus variable costs and fixed costs) (right) (millions of 2014 $). Dashed line represents the beginning of the catch share program.

Mothership Report

MOTHERSHIP REPORT

Contents

Mothership Sector: Highlights **2**

Acknowledgments **5**

Report Introduction **6**

Overview **9**

Report **20**

List of Tables **23**

List of Figures **24**

1 Mothership Data Summaries **25**

1 Introduction 25
1.1 Background 25
1.2 Understanding the report 26
1.3 Purpose of the report 27
1.4 Mothership form administration 27
2 Vessel Participation on the West Coast and in Alaska 28
3 Delivery Ports 29
4 Vessel Physical Characteristics 30
5 Vessel Fuel Use and Crew Size 31
5.1 Fuel use 31
5.2 Crew size 31
6 West Coast and Alaska Round Weight 32

7 Revenue . . . 35
8 Costs . . . 39
8.1 Variable costs . . . 40
8.2 Fixed costs . . . 40
8.3 Quota and permit costs . . . 45

2 Mothership Data Analysis **46**
9 Cost Disaggregation . . . 46
9.1 West Coast portion of fixed costs . . . 47
9.2 Summary of West Coast portion of costs . . . 48
10 Net Revenue and Economic Profit . . . 50
10.1 Net revenue . . . 51
11 Economic Performance: Cost, Revenue, Net Revenue, Markup, and Product Recovery Rates . . . 54

List of Tables

2.1 Average days at sea. 29
2.2 Average number of trips to Alaska 29
2.3 Number of vessels that processed fish on the West Coast and in Alaska. 29
3.1 Delivery ports. 30
4.1 Vessel characteristics. 30
4.2 Number of vessels hauled out 31
5.1 Average daily fuel use. 31
5.2 Annual fuel use. 31
5.3 Average crew size. 32
5.4 Average number of individuals employed. 32
6.1 Mothership sector allocation, West Coast whiting purchases, and total purchases. . . . 33
7.1 Whiting production weight 35
7.2 Whiting production value. 37
8.1 Variable expenses. 41
8.2 Fish purchased and received. 42
8.3 Capitalized expenditures on gear and equipment 43
8.4 Expenses on gear and equipment 44
8.5 Other fixed expenses. 45
8.6 Depreciation. 45

9.1 West Coast portion of fixed costs on gear and equipment 47
9.2 West Coast costs on insurance, moorage, and leasing. 47
9.3 Summary of West Coast portion of costs. 48
10.1 West Coast variable cost and total cost net revenue. 53
11.1 Revenue, costs, and net revenue per day. 54
11.2 Revenue, costs, and net revenue per metric ton produced. 54
11.3 Net revenue per metric ton purchased. 55
11.4 Markup rate. 55
11.5 Product recovery rate. 56

List of Figures

1 Whiting exports . . . 9
2 Sector TAC and utilization . . . 10
3 Days at sea by activity . . . 11
4 Fishery season length . . . 12
5 Average costs per vessel . . . 14
6 Fleet-wide production value . . . 15
7 Fleet-wide production weight . . . 16
8 Price by product type . . . 17
9 Fleet-wide net revenue . . . 18
10 Average vessel net revenue . . . 19

11 Average annual purchases on the West Coast and Alaska . . . 34
12 Production weight. . . . 36
13 Production value by product type and year. . . . 38

14 Average costs by category on the West Coast. . . . 49
15 Net revenue explanation . . . 51
16 Average vessel revenue, costs, and net revenue . . . 53

Mothership Data Summaries

1 Introduction

1.1 Background

The US West Coast groundfish fishery takes place off the coasts of Washington, Oregon and California, and is comprised of over 90 different species of fish. The fish are harvested both commercially and recreationally. The commercial fishery has four components: limited entry with a trawl endorsement, limited entry with a fixed gear endorsement, open access, and tribal. In January 2011, the West Coast Limited Entry Groundfish Trawl fishery transitioned to the West Coast Groundfish Trawl Catch Share Program. The catch share program consists of cooperatives for the at-sea mothership (including catcher vessels and motherships) and catcher-processor fleets, and an individual fishing quota (IFQ) program for the shorebased trawl fleet.[1]

The Economic Data Collection (EDC) program[2] was implemented as part of new regulations to monitor the economic effects of the catch share program. Annual economic data submissions are required from all fishery participants: catcher vessels, motherships, catcher-processors, and first receivers and shorebased processors §50 CFR 660.114. Baseline, pre-catch share data were submitted in 2011 for the 2009 and 2010 operating years, and data for each annual report update were collected in the following calendar year (*e.g.* the most recent 2014 data submitted for this updated report were collected in 2015).

The EDC Program has enhanced the quantity and quality of economic information available for analysis, and for the management of the West Coast groundfish trawl fishery. While costs and earnings data are available for shorebased catcher vessels starting in 2004,[3] this is the first data collection from the mothership fleet. This report summarizes the 2009-2014 EDC mothership survey data, and with its

[1] Information about the West Coast Groundfish Trawl Catch Share Program is available online at http://www.westcoast.fisheries.noaa.gov/fisheries/groundfish_catch_shares/.

[2] Additional information on the EDC Program, including the EDC data collection forms can be found at http://www.nwfsc.noaa.gov/edc.

[3] Lian, C.E. 2010. West Coast limited entry groundfish trawl cost earnings survey protocols and results for 2004. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-107, 35 p.

companion reports covering the other sectors, is the third in the series of reports. Northwest Fisheries Science Center economists will expand and refine the scope and methods used with each new publication.

1.2 Understanding the report

The data provided in the summary tables throughout the report are for all vessels that fished on the West Coast during the survey year, unless otherwise noted. Unlike the Overview section, all numbers reported in the Data Summaries are generated from the raw responses received from participants and, therefore, are in nominal dollars.

All data submitted via the EDC Program are confidential under 402(b) of the Magnuson-Stevens Act (16 U.S.C. 1801, et seq.) and under NOAA Administrative Order 216-100.[4] In order to protect these data, a rule of three and a rule of 90-10 are implemented. The rule of three requires a response from at least three companies in order to show a summary statistic. The 90-10 rule requires that no single company's value comprise over 90 percent of the value displayed. In the case of the West Coast whiting mothership fishery, there are only four companies. The tables show a '***' for data points where there are less than three companies reporting the information, and/or where one company's responses account for greater than 90 percent of the average value. Zeroes are shown if all entities report zeroes. More information about how confidential data are protected in the EDC Program can be found in the Administration and Operations Report. Simple means are reported for statistics that denote the performance of an average entity (i.e., net revenue) while weighted means are reported for statistics that describe characteristics of the fishery (i.e., ex-vessel prices, markup, recovery rates, etc.). Additionally, "—" is used to denote fields where the question was not asked on the form in that survey year.

In order to track and assess the variation of data submitted by participants across any given variable or statistic, these reports include the coefficient of variation (CV) of the mean. The stacked dots included in the data tables provide information about the coefficient of variation (CV) of the mean. We use the following scoring:

- $\cdot$ represents $CV < 0.5$,
- $\vdots$ represents $0.5 \leq CV < 1.0$,
- $\vdots$ represents $1.0 \leq CV < 2.0$, and
- $\vdots$ represents $2.0 \leq CV$. For 2009-2014, none of the CVs exceeded 2.83.

Although participants are identified on a calendar year basis, survey forms are completed using information based on their fiscal year. The fiscal year can span more than one calendar year, but, to date, there is no vessel where the fiscal year spans more than one whiting season.

The EDC survey form has not changed significantly since the baseline 2009-2010 data collection. One change to the forms from 2009-2010 to the present pertained to offload locations, with "Tacoma"

[4] For more information about form administration, please see Administration and Operations Report.

substituted for "Westport, Hoquiam" in response to input on the 2009 and 2010 surveys. In 2012, a space was added for participants to provide the total round weight harvested in the West Coast fisheries in addition to that harvested in Alaska/Other, in order to validate the external data source that was used to calculate revenue from West Coast whiting. In 2013, a new question was added, "Provide the total number of individuals who worked for you". Respondents provide the total number of processing crew and the total number of non-processing crew. These data provide us with an upper bound of the total number of people employed by the sector.

1.3 Purpose of the report

This report, like the other four EDC reports,[5] has multiple objectives. The first is to provide basic economic data summaries that can be used for a variety of purposes associated with fishery management. Since much of the data collected are confidential under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) of 2007, the data are summarized as averages or totals for each question on the EDC forms. Thus summarized, the reports make the data available to the public for both research and informational purposes.

The second objective is to provide information about the performance of the catch share program. This includes information that can be used to monitor whether and to what degree the goals of the program are being met. These reports will serve as the basis for the 5-year review of the catch share program that is mandated in the MSA, as well as the NOAA Fisheries National Catch Shares Performance Indicators.

Third, the reports serve as the basis for economic models that are used as part of the Pacific Fishery Management Council's (PFMC) biennial specification process for groundfish management. These models include the IO-PAC model,[6] as well as estimates of revenue, costs, and net revenue.

Lastly, and perhaps most importantly, the data reports are expected to serve as a catalyst for feedback on the data and their analysis.

1.4 Mothership form administration

Completion of EDC forms is mandatory for participants in the catch share program. Survey participants are identified using contact information provided by the Northwest Regional Permit Office. The regula-

[5] In addition to the mothership report, there are four companion reports:

- Economic Data Collection Program, Administration and Operations Report (Oct 2016)
- Economic Data Collection Program, Catcher-Processor Report, 2009-2014 (Oct 2016)
- Economic Data Collection Program, Catcher Vessel Report, 2009-2014 (Oct 2016)
- Economic Data Collection Program, First Receiver and Shorebased Processor Report, 2009-2014 (Oct 2016)

[6] Leonard, J., and P. Watson. 2011. Description of the input-output model for Pacific Coast fisheries. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-111, 64 p.

tions for defining who is required to complete an EDC form differs between the baseline data collection (2009 and 2010) and all annual/ongoing data collections for 2011 onward. For the baseline period, all owners, lessees, and charterers of a mothership vessel that received whiting in 2009 or 2010 as recorded in NMFS' NORPAC database §660.114(b)(3)(i) were required to complete an EDC form. For 2011 and beyond, all owners, lessees, and charterers of a mothership vessel registered to a mothership permit at any time are required to complete an EDC form §660.114(b)(3)(ii). For permit owners, a mothership permit application will not be considered complete until the required EDC form for that permit owner is submitted, as specified at §660.25(b)(4)(i). For a vessel owner, participation in the groundfish fishery (including, but not limited to, changes in vessel registration) will not be authorized until the required EDC form for that owner for that vessel is submitted, as specified, in part, at §660.25(b)(4)(v). For a vessel lessee or charterer, participation in the groundfish fishery will not be authorized until the required EDC form for their operation of that vessel is submitted.

A calendar year is used to determine which vessels meet the criteria. For example, in 2015, data were collected from all owners, lessees, and charters of a mothership registered to a limited entry trawl permit during 2014. The forms are fielded on this schedule in order to allow participants the time necessary to complete their taxes, which may contain information required on the EDC forms.

If a form has missing information, or the information provided on the form is believed to be incorrect, EDC Program staff attempt to contact the participant to correct the information. On occasion, the participant cannot be reached or the participant cannot provide the missing information. In these cases, the missing or inaccurate data are treated on a case-by-case basis during analysis as documented in the Administration and Operations Report. Data are validated and verified with external data sources whenever possible. These data sources include the Northwest Regional Permit Office and the At-Sea Hake Observer (A-SHOP) program.

2 Vessel Participation on the West Coast and in Alaska

The mothership fleet participates in fisheries on the West Coast and Alaska. Table 2.1 provides the average days at sea by activity listed. Participants are instructed to count partial days as full days when recording days at sea on the forms. Table 2.2 presents the average number of one-way trips vessels made steaming between Alaska and the West Coast that year. Table 2.3 presents the number of vessels that processed fish within the catch share program on the West Coast and Alaska. The number of participating vessels has been five since the implementation of the catch share program.

Table 2.1: Average days at sea. Average days at sea by activity on the West Coast and in Alaska for mothership vessels (N = number of vessels with non-zero, non-NA responses).

Description	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Processing on the West Coast	17	6	24	6	51	5	42	5	47	5	47	5
Offloading on the West Coast	2	6	4	6	7	5	5	5	7	5	9	5
Steaming on the West Coast	3	6	4	6	7	5	4	5	21	5	12	5
Steaming between West Coast and Alaska	25	6	20	5	18	5	20	5	22	5	20	5
Operating in Alaska	119	6	117	5	153	5	134	5	130	5	145	5

Table 2.2: Average number of trips to Alaska. Mean number of one-way trips between the West Coast and Alaska (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
One-way trips to Alaska	3.7	6	3.6	5	4.0	5	3.6	5	3.6	5	4.0	5

Table 2.3: Number of vessels that processed fish on the West Coast and in Alaska. Number of vessels that processed fish on the West Coast and in Alaska since the beginning of data collection.

Location	2009	2010	2011	2012	2013	2014
Alaska	6	5	5	5	5	5
West Coast	6	6	5	5	5	5

3 Delivery Ports

Participants report the percentage of all West Coast whiting products offloaded from the mothership vessel at each major West Coast port. Table 3.1 lists the number of vessels delivering to each port. Some vessels delivered to more than one port in a given year.

Table 3.1: Delivery ports. Total number of vessels that offloaded in each port. Some vessels delivered to multiple ports in the same year.

Location	2009	2010	2011	2012	2013	2014
Astoria	0	0	1	0	0	0
At-sea	0	0	0	0	0	0
Blaine/Bellingham	1	3	3	3	3	1
Coos Bay	0	0	0	0	0	0
Port Angeles	0	0	0	0	0	0
Seattle	5	5	2	2	3	4
Tacoma	—	0	0	0	0	0
Westport	0	0	—	—	—	—
Other	0	0	0	0	0	0

4 Vessel Physical Characteristics

Survey participants provide basic information about the vessel and its physical characteristics, including market value, replacement value, vessel length, horsepower of main engines, and fuel capacity from the most recent marine survey (Table 4.1). Marine surveys are done on a regular basis and are often required for insurance, financing, and other purposes.

Table 4.1: Vessel characteristics. Average market value (millions of $), replacement value (millions of $), vessel length (feet), horsepower of main engines (thousands), and fuel capacity (thousands of gallons) (N = number of EDC vessels with non-zero, non-NA responses).

Vessel characteristic	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Market value	54.5˙	4	54.5˙	4	42.8˙	4	46.0˙	4	46.0˙	4	56.5˙	4
Replacement value	107.5˙	4	107.5˙	4	86.2˙	4	87.5˙	4	100.0˙	4	122.0˙	4
Vessel length	360˙	6	360˙	6	304˙	5	304˙	5	304˙	5	372˙	5
Horsepower	8.5˙	6	8.5˙	6	5.2˙	5	5.2˙	5	4.8˙	5	8.7˙	5
Fuel capacity	397.7˙	6	397.7˙	6	247.3˙	5	243.7˙	5	243.7˙	5	437.1˙	5

Participants also provide information about whether the vessel was hauled out at any point during the year, which provides context that may be used to explain major costs associated with vessel repair and maintenance. Since 2009, a large proportion of all active fishing vessels have been hauled out in a given year (Table 4.2).

Table 4.2: Number of vessels hauled out. Number (N) and percentage (%) of vessels that were hauled out during the year.

Haul out	2009		2010		2011		2012		2013		2014	
	N	%	N	%	N	%	N	%	N	%	N	%
YES	3	50%	1	17%	2	29%	3	43%	3	50%	2	33%
NO	3	50%	5	83%	5	71%	4	57%	3	50%	4	67%

5 Vessel Fuel Use and Crew Size

5.1 Fuel use

Participants provide information about average fuel use per day and total fuel use per year when engaged in fishing activities on the West Coast (Tables 5.1 and 5.2). The total annual fuel usage by vessels during the survey year in the West Coast whiting fishery excludes fuel used for steaming between the West Coast and Alaska.

Table 5.1: Average daily fuel use. Average daily fuel use (thousands of gallons) while steaming and processing in the West Coast whiting fishery and steaming between the West Coast and Alaska (N = number of vessels with non-zero, non-NA responses).

Activity	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Processing and steaming on West Coast	6.5˙	6	6.5˙	6	5.1˙	5	5.9˙	5	5.5˙	5	6.2˙	5
Steaming between West Coast and Alaska	6.7:	6	6.5:	6	3.8˙	5	5.0˙	5	4.9˙	5	6.5:	5

Table 5.2: Annual fuel use. Average total fuel use (thousands of gallons) (N = number of vessels with non-zero, non-NA responses).

Activity	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Total bunker fuel	***	***	***	***	***	***	***	***	***	***	***	***
Total diesel	118.1˙	6	135.7˙	6	278.6:	5	217.0:	5	211.7:	5	261.8˙	5
Total fish oil	***	***	***	***	***	***	***	***	***	***	***	***

5.2 Crew size

Participants provide the number of processing and non-processing crewmembers on board at any one time when the vessel was operating in the West Coast whiting fishery during the year (Table 5.3).

In 2013, the EDC form was revised to also collect the total number of individuals employed annually (Table 5.4). The total number of individuals employed across all vessels serves as an upper bound of the total number of individuals employed in the fishery. Processing crew includes line workers, fishmeal crew, quality control, technicians, cleanup, factory managers, combis, and mechanics who work on processing equipment. Non-processing crew includes the captain, deckhands, wheelhouse, galley, and engineers.

Table 5.3: Average crew size. Average number of non-processing and processing crew positions per vessel (N = number of EDC vessels with non-zero, non-NA responses).

Crew Type	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Non-processing	35.2˙	6	33.0˙	6	34.0˙	5	32.2˙	5	31.2˙	5	45.4˙	5
Processing	90.3˙	6	85.2˙	6	66.0˙	5	71.8˙	5	68.6˙	5	83.0˙	5

Table 5.4: Average number of individuals employed. Average total number of individuals employed in non-processing and processing crew positions throughout the year (N = number of EDC vessels with non-zero, non-NA responses).

Crew Type	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Non-processing crew	—	—	—	—	—	—	—	—	34.4˙	5	53.0˙	5
Processing crew	—	—	—	—	—	—	—	—	85.8˙	5	113.0˙	5

6 West Coast and Alaska Round Weight

To document and track the volume of fish harvested and purchased during the year, participants are asked to provide the total round weight of all fish processed on the vessel in all fisheries, including the West Coast and Alaska. This information is then combined with the annual whiting fish purchases on the West Coast provided by the A-SHOP through the Pacific Fisheries Information Network (PacFIN) database (Table 6.1).

Table 6.1: Mothership sector allocation, West Coast whiting purchases, and total purchases. Final whiting allocation for the West Coast mothership whiting sector, total West Coast whiting purchases (excluding tribal purchases), and total weight of all purchases (West Coast, Alaska, and tribal) (thousands of metric tons) (N = number of vessels with non-zero, non-NA responses).

Description	2009		2010		2011		2012		2013		2014	
	Total	N	Total	N	Total	N	Total	N	Total	N	Total	N
Whiting allocation	24.0		37.7		53.0		39.2		56.2		73.0	
West Coast whiting purchases	23.5	6	41.8	6	52.7	5	37.5	5	52.1	5	61.5	5
West Coast and Alaska harvest and purchases	203.5	6	212.6	6	166.1	5	187.7	5	171.2	5	243.3	5

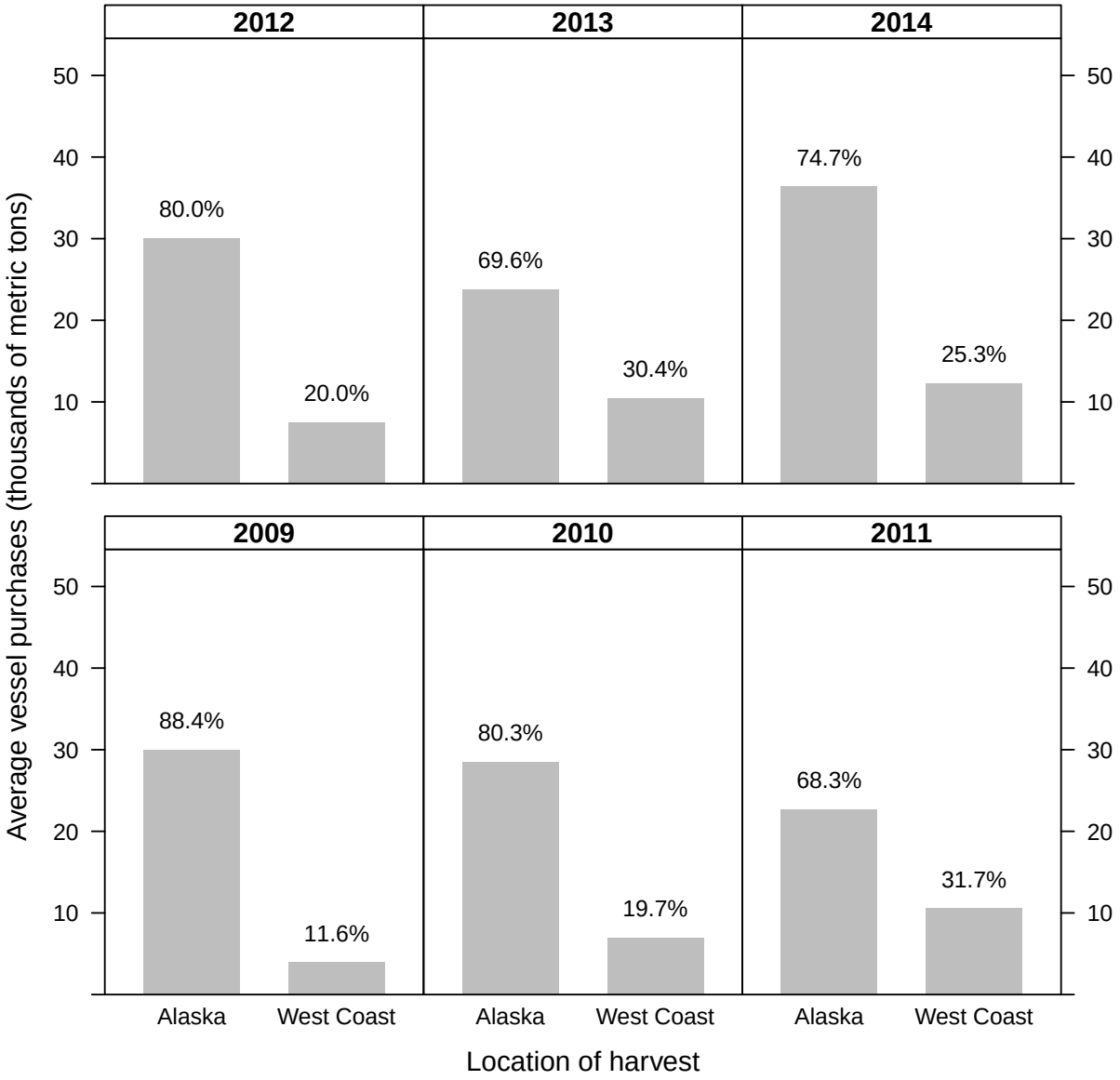

Figure 11: Average annual purchases on the West Coast and Alaska. Average annual purchases (thousands of metric tons) from 2009 to 2014 on the West Coast and in Alaska. Percentages above each bar indicate the portion of the total purchases in that fishery.

7 Revenue

Participants submit three types of revenue: revenue from production of seafood products, revenue from sale or lease of West Coast whiting mothership permits, and revenue from lease or bareboat charter of the vessel. All vessels that processed fish on the West Coast reported production revenue, but there were no vessels that reported revenue from permits or lease/charter. It is possible that vessels may have made end-of-season informal arrangements regarding leftover quota; however, the EDC survey does not capture this type of transfer.

Tables 7.1 and 7.2 provide summary information about annual production in the mothership West Coast whiting sector. Participants provide total weight and value of production by major product categories. These values include any post-season adjustments for products produced during the survey year. Not included in the production value are any additional payments received to cover shipping, handling, or storage costs associated with the sale beyond the free-on-board (buyer assumes responsibility and liability for the product and pays shipping costs) port of discharge. The revenue only includes West Coast activities.

Table 7.1: Whiting production weight. Average whiting production weight (metric tons) per vessel (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Fillets	398	4	***	***	***	***	***	***	307	3	***	***
Fish oil		0		0	***	***	***	***	***	***	***	***
Fishmeal	166	5	278	5	437	4	372	4	344	4	390	5
Headed and gutted	***	***	***	***	902	3	***	***	1,860	3	***	***
Minced	309	4	522	3	547	4	653	3	***	***	***	***
Roe		0		0		0		0	***	***		0
Round	***	***		0	***	***	***	***	***	***		0
Stomachs		0		0		0		0		0		0
Surimi	358	5	940	6	2,040	4	1,647	4	2,108	4	2,235	5
Other	***	***		0		0		0		0		0
Average total weight	1,528	6	1,883	6	3,552	5	3,739	5	5,212	5	4,002	5

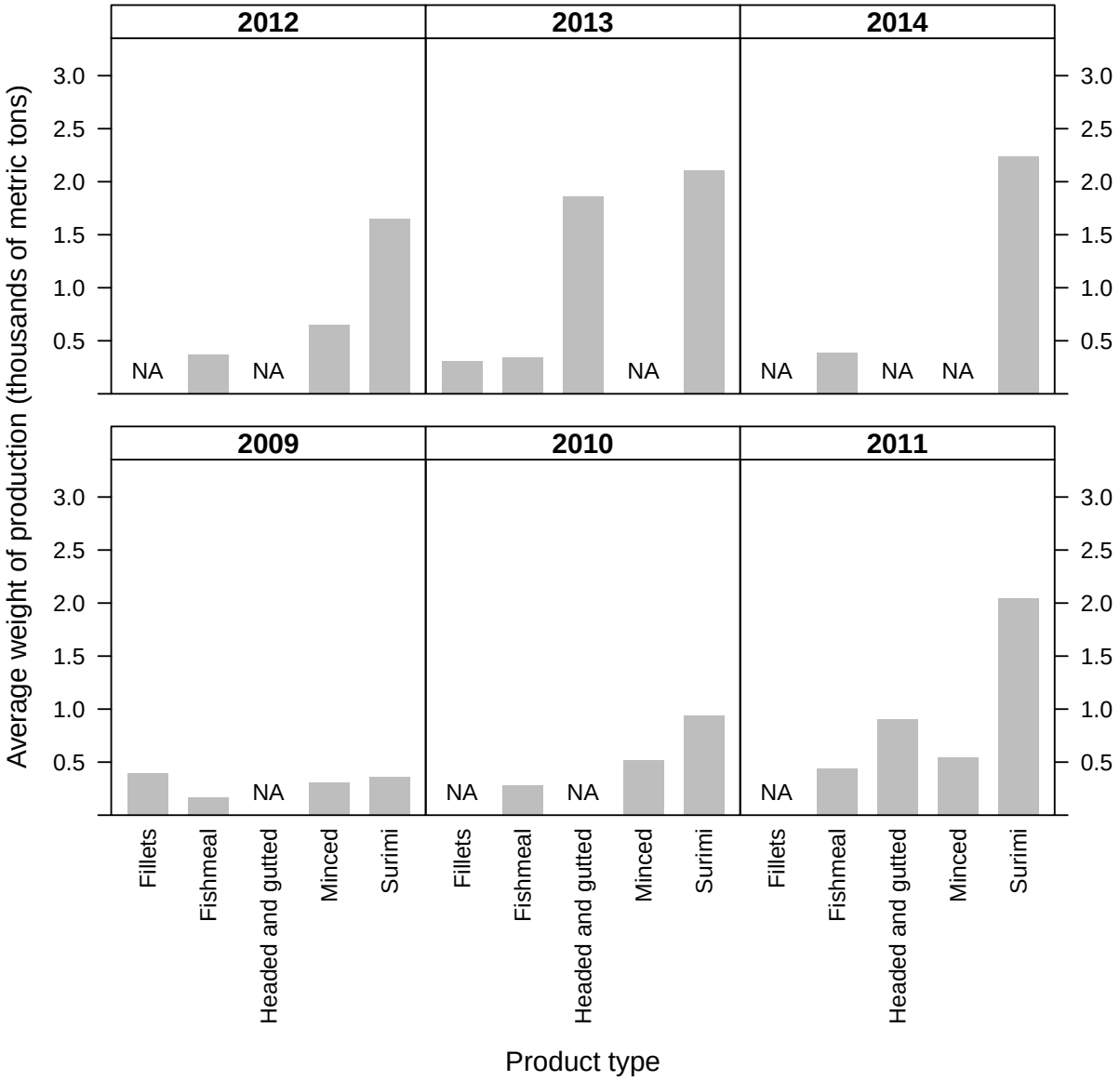

Figure 12: Production weight. Average whiting production weight by product type and year, excluding categories where no vessel reported production weight in any years. "NA" is shown where data are confidential.

Table 7.2: Whiting production value. Average production value (thousands of $) of whiting product types (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Fillets	$1,241	4	***	***	***	***	***	***	$903	3	***	***
Fish oil		0		0	***	***	***	***	***	***	***	***
Fishmeal	$236	5	$545	5	$708	4	$795	4	$659	4	$999	5
Headed and gutted	***	***	***	***	$1,617	3	***	***	$2,649	3	***	***
Minced	$588	4	$1,083	3	$865	4	$921	3	***	***	***	***
Roe		0		0		0		0	***	***		0
Round (unprocessed)	***	***		0	***	***	***	***	***	***		0
Stomachs		0		0		0		0		0		0
Surimi	$900	5	$2,949	6	$5,717	4	$5,046	4	$5,079	4	$5,708	5
Other	***	***		0		0		0		0		0
Other species		0		0		0		0		0		0
Average total value	$3,008	6	$4,738	6	$7,726	5	$6,054	5	$7,111	5	$9,277	5

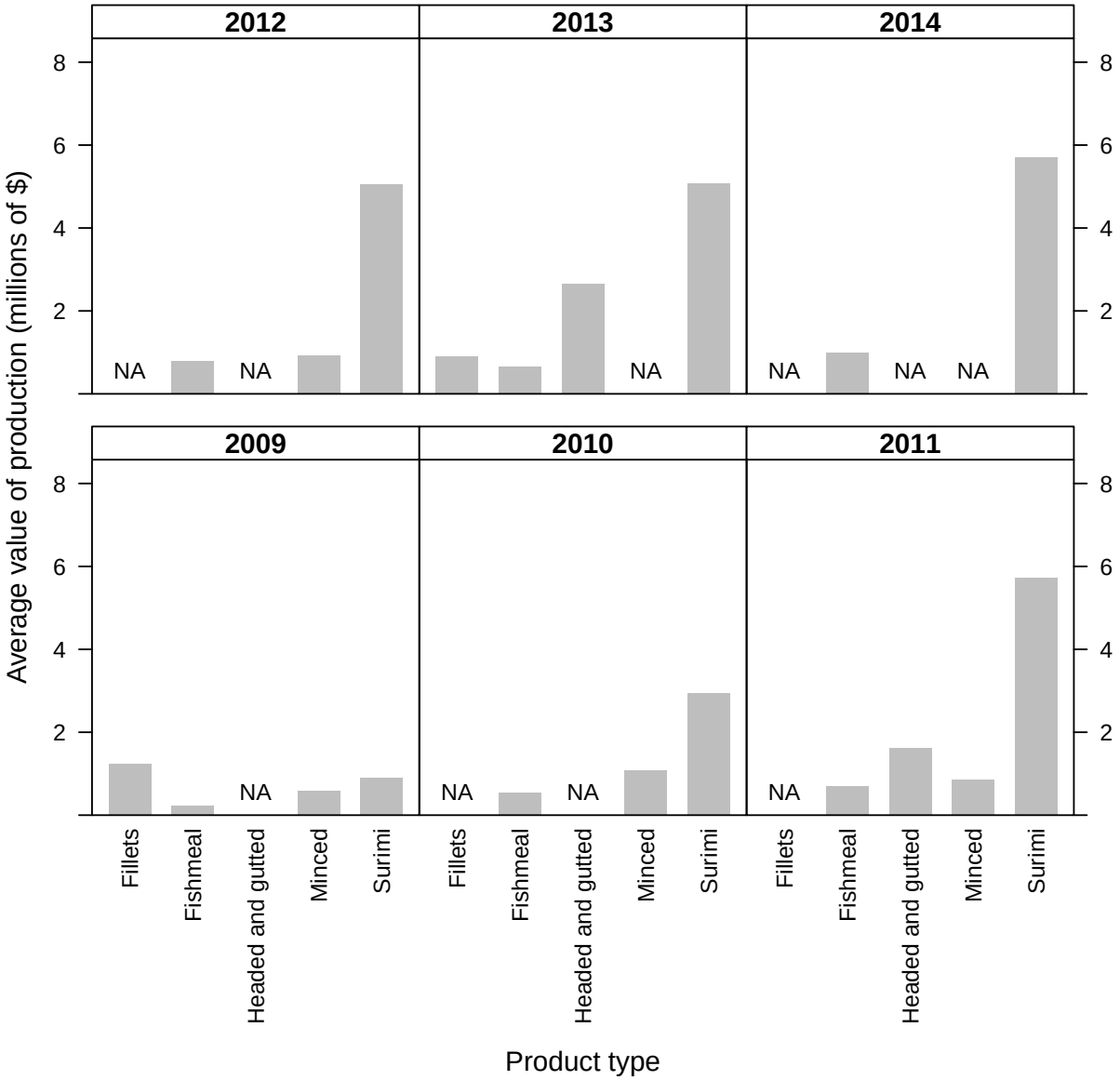

Figure 13: Production value by product type and year. Average whiting production value by product type and year, excluding categories where no vessel reported production values in any years. "NA" is shown where data are confidential.

8 Costs

This section describes the cost data that are collected by the EDC Program for the purpose of documenting variable costs, fixed costs, and total costs.

For EDC Program analyses, costs are divided into two categories: variable costs and fixed costs. Variable costs vary with the level of fishery participation, and generally include items such as fuel and crew compensation. Fixed costs do not vary as directly with the level of fishery participation, and generally include items such as vessel capital improvements. The designation of a cost as variable or fixed depends on many factors, including the relevant time horizon and use of the data. While some costs would clearly be considered fixed (e.g., the purchase of a new engine), others are more difficult to categorize. For the purposes of this report, the costs listed in Tables 8.1 and 8.2 to be variable and those costs listed in Tables 8.3, 8.4, 8.5, 9.1, and 9.2 to be fixed. The EDC Program will continue to refine the categorization of these costs.

Fishery participants provide both "capitalized expenditures" and "expenses" for vessel improvements and maintenance, fishing gear, and processing equipment because certain costs may be treated for tax accounting purposes as either capitalized or expensed. Capitalized expenditures are depreciated over a number of years whereas expensed items are fully deducted as a cost for the year in which they are incurred. In an effort to reduce the reporting burden and potential for errors, these data are collected as they are reported in the businesses' accounting systems.

In order to conduct economic analyses of specific fisheries, it is important to have costs broken out by fishery, i.e. West Coast whiting versus processing in Alaska. It may be feasible for participants to delineate costs at the fishery level for some items, but not for the majority of expenses. During the development of the EDC survey form, a key issue was the determination of which costs could reasonably be broken out by fishery. Each cost item is assigned to one or more categories based on how they are commonly tracked by industry members: 1) used in West Coast fisheries only (West Coast Only); 2) used on the West Coast and in other fisheries (Shared); and 3) used in all fisheries (All) regardless of whether they are used on the West Coast.

Finally, there are a variety of costs that are associated with operating a mothership that are not requested on the form because it is difficult to determine the share of the costs associated with the vessel. These costs include items that can be used for activities other than processing, or are too difficult to allocate to a particular vessel in a multi-vessel company. These expenses include office space, pickup trucks, storage of equipment, professional fees, and marketing. In general, the EDC survey attempts to capture costs that are directly related to vessel maintenance and processing operations, and not costs that are related to activities or equipment off the vessel. For these reasons, the aggregated costs presented here (variable costs, fixed costs, and total costs) underestimate the true costs of operating a business.

8.1 Variable costs

Where possible, data were collected for costs incurred while participating in only West Coast fisheries. Unlike fixed costs, variable costs are directly related to processing operations, and therefore can be more easily differentiated for activities on the West Coast versus other activities. Table 8.1 summarizes variable costs on the West Coast and Table 8.2 summarizes expenses on fish purchases.

Fish purchases

Participants submit information detailing the purchase of whiting and "Other" fish during the year, which is presented along with a calculation of the average annual price per metric ton in Table 8.2. The average price for the season is calculated using the total reported revenue divided by the total reported purchase weight for each vessel for that survey year.

8.2 Fixed costs

Costs on vessel and on-board equipment, fishing gear, and processing equipment

Table 8.3 presents average annual capitalized expenditures. Survey participants are asked to provide capitalized expenditures for the survey year associated with the following categories:

- New and used vessel and on-board equipment: excludes processing equipment and fishing gear, includes all electronics, safety equipment, and machinery not used to process fish. Participants are asked to provide information for **All** fisheries regardless of where the vessel fished.
- Processing Equipment: excludes all equipment, machines, and buildings based primarily on shore, excludes any processing equipment that is not used at least partially in the West Coast whiting fishery, and includes on-board freezers, storage equipment, packing equipment, conveyors, and on-board cargo handling equipment. Participants are asked to separately report costs related to processing equipment **Shared** between the West Coast and other fisheries from those costs related to equipment used only on the **West Coast**.
- Fishing gear: Includes nets, cables, doors, and fishing machinery used in the West Coast whiting fishery, excludes any fishing gear that is not used at least partially in the West Coast whiting fishery. Participants are asked to separately report costs related to fishing gear **Shared** between the West Coast and other fisheries from those costs related to gear used only on the **West Coast**.

Participants are asked to separate capitalized expenditures and expenses on fishing gear and processing equipment used on the West Coast versus those expenses that are shared.

Table 8.1: Variable expenses. Average variable expenses on the West Coast for motherships (thousands of $) (N = number of vessels with non-zero, non-NA responses).

Expense Category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Communication	5.8˙	6	4.3:	6	15.7⁝	5	8.9⁝	5	11.7⁝	4	15.0:	4
Food	47.0:	5	48.0˙	6	127.5˙	5	136.3:	5	107.7:	5	148.1˙	5
Freight	***	***	***	***	***	***	38.1⁝	3	21.9⁝	5	24.3⁝	4
Fuel and lubrication	262.0˙	6	389.8˙	6	1,051.9:	5	749.8:	5	787.8:	5	1,019.4˙	5
Non-fish ingredients (additives)	29.8˙	5	148.9:	6	392.3⁝	4	245.1:	4	363.0:	4	384.8˙	5
Non-processing crew	326.0:	6	411.3:	6	651.6⁝	5	492.6:	5	657.1⁝	5	812.5:	5
Observers	15.7˙	6	17.0˙	6	36.7:	5	32.9˙	5	28.8:	5	37.5˙	5
Offloading	33.6:	6	30.7⁝	6	55.2⁝	5	29.2⁝	5	70.7:	4	89.3˙	5
On-board cargo/product insurance	12.3˙	5	11.7:	5	***	***	135.7:	5	146.5:	4	176.0:	5
Packing materials	86.6˙	6	97.4:	6	228.9˙	5	132.7:	5	152.3:	5	229.3:	5
Processing crew	375.7˙	6	534.5˙	6	842.7˙	5	725.9˙	5	736.3˙	5	954.6˙	5
Supplies	***	***	40.5⁝	4	47.2:	3	70.4:	3	118.2⁝	3	42.8:	3
Travel	18.2:	4	14.5:	4	33.4:	4	39.2˙	4	***	***	***	***
Pacific whiting purchases	658.4˙	6	1,237.4˙	6	2,296.5:	5	1,845.6:	5	2,255.6:	5	2,640.1˙	5
Non-whiting fish purchases		0		0		0		0		0		0
Average total variable costs	1,864.8˙	6	2,973.0˙	6	5,811.7:	5	4,582.3:	5	5,324.3:	5	6,581.4˙	5

Table 8.2: Fish purchased and received. Average purchase weight (metric tons), purchase cost ($), and weight received but not paid for of whiting and other species. (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Total weight of whiting purchased	4,037 ˙	5	6,225 ˙	5	9,057 ⁝	4	6,683 ⁝	4	10,045 ⁝	4	12,292 ˙	5
Total cost of whiting purchased	623,567 ˙	5	1,318,363 ˙	5	2,095,360 ⁝	4	1,631,569 ⁝	4	2,215,575 ⁝	4	2,640,064 ˙	5
Average annual whiting purchase price per mt	155 ˙	5	216 ˙	5	240 ˙	4	247 ˙	4	234 ˙	4	215 ˙	5
Total weight of other fish purchased		0		0		0		0		0		0
Total cost of other fish purchased		0		0		0		0		0		0
Total weight of whiting received but not paid for	105 ˙	3	***	***		0	***	***	***	***	***	***
Total weight of other fish received but not paid for	***	***	***	***		0		0	***	***		0

Table 8.3: Capitalized expenditures on gear and equipment. Average capitalized expenditures (thousands of $) on vessel and on-board equipment, fishing gear, and processing equipment (N = number of EDC vessels with non-zero, non-NA responses). Note that some expenditures were requested for (a) all fisheries the vessel participates in regardless of where the vessel fished (denoted by "All"), (b) West Coast whiting, Alaska, and other, denoted by "Shared") and (c) for West Coast fisheries only (Washington, Oregon, and California, denoted by "West Coast").

Expenditure category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Fishing gear (Shared)	$172 ⁝	5	***	***	$685 ⁝	3	$223 ⁝	3	***	***	$124 ⁝	4
Fishing gear (West Coast)	***	***	***	***		0		0		0	***	***
Processing equipment (Shared)	$1,990 ⁝	5	$931 ⁝	5	***	***	$651 ⁝	4	$947 ⁝	3	$588 ⁝	5
Processing equipment (West Coast)		0		0		0		0		0		0
Vessel and on-board equipment (All)	$1,640 ⁝	5	$1,600 ⁝	6	$798 ˙	5	$2,505 ⁝	5	$3,154 ⁝	5	***	***
Average total capitalized expenditures	$3,170 ⁝	6	$2,714 ⁝	6	$1,454 ˙	5	$3,160 ⁝	5	$3,863 ⁝	5	$3,460 ⁝	5

Table 8.4: Expenses on gear and equipment. Average expenses (thousands of $) on vessel and on-board equipment, fishing gear, and processing equipment (N = number of vessels with non-zero, non-NA responses). Note that some expenditures were requested for (a) all fisheries the vessel participates in regardless of where the vessel fished (denoted by "All"), (b) West Coast whiting, Alaska, and other, denoted by "Shared") and (c) for West Coast fisheries only (Washington, Oregon, and California, denoted by "WC").

Expense category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Fishing gear repair and maintenance (Shared)	285.5 :	4	***	***	163.4 :	5	193.7 :	5	151.6 :	4	151.6 :	4
Fishing gear repair and maintenance (West Coast)	***	***	***	***	***	***		0		0		0
Processing equipment (Shared)	402.9 :	4	355.2 :	5	302.9 :	5	631.5 :	5	389.4 :	4	472.9 :	4
Vessel and on-board equipment (All)	1,547.3 :	6	1,330.5 :	6	856.4 :	5	1,310.4 .	4	1,156.0 :	5	1,496.6 :	5
Average total expenses	2,028.6 .	6	1,834.7 :	6	1,353.6 :	5	1,873.5 .	5	1,588.9 :	5	1,996.2 :	5

Other fixed costs

Participants also provide information about other fixed costs and vessel depreciation, which is summarized in Tables 8.5 and 8.6.

Table 8.5: Other fixed expenses. Average fixed expenses (thousands of $) on all other categories in all fisheries (N = number of vessels with non-zero, non-NA responses).

Expense category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Co-op membership fees on the West Coast		0		0	***	***	***	***		0	***	***
Insurance	1,128˙	6	1,177˙	6	769⁝	5	597⁝	5	399˙	5	785⁝	5
Lease of vessel	***	***		0	***	***	***	***	***	***	***	***
Moorage	362˙	6	357˙	6	235⁝	5	267⁝	5	273⁝	5	286⁝	5
Average total fixed costs	1,662˙	6	1,534˙	6	1,012˙	5	870⁝	5	676˙	5	1,078˙	5

Table 8.6: Depreciation. Average depreciation (millions of $) taken during the survey year (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Depreciation	2.14˙	6	2.48˙	6	2.29⁝	5	2.49⁝	5	1.56⁝	5	2.32˙	5

8.3 Quota and permit costs

Participants submit information on quota and permit expenses. No vessels reported lease or purchase of permits; however, vessels may have made end-of-season informal arrangements regarding leftover quota. The EDC survey does not capture this type of transfer.

Mothership Data Analysis

To fully evaluate cost information and calculate net revenue for specific fisheries, Northwest Fisheries Science Center economists must do more than summarize data submitted by fishery participants. This section describes the methods used to calculate costs and net revenue for only West Coast fisheries.

9 Cost Disaggregation

As noted above, not all costs reported on the EDC forms are incurred while only participating in West Coast fisheries. For some costs, it may be feasible for participants to break out or track costs at the fishery level. However, for some costs this is not possible. Some cost categories on the EDC forms are only incurred while participating in West Coast fisheries, while others include costs incurred while operating in Alaska. Therefore, cost disaggregation was required to estimate total costs and total cost net revenue on the West Coast. As part of the EDC development process, NWFSC staff met with participants to determine what cost categories could be reported for only West Coast fisheries and which would could not, and therefore require further disaggregation.

To disaggregate the West Coast and Alaska costs, we allocate costs proportional to the weight of fish purchased or harvested in each fishery. We calculate the ratio of total West Coast Pacific whiting weight (for all years the vessel has supplied data) to the weight in all fisheries for the same time span:

$$\frac{\sum_y WT_n^{WestCoastMothership}}{\sum_y WT_n^{AllFisheries}}$$

where n is an individual vessel in a season, summed over all years, y, that the vessel has supplied EDC data. Thus, each vessel's ratio of costs being allocated to the West Coast is the same for all years. This method makes the proportion of costs allocated to the West Coast less sensitive to fluctuations in the TAC for the West Coast Pacific whiting and Alaska fisheries.

For vessels that participated in the tribal sector of the West Coast Pacific whiting fishery, West Coast costs, days at sea, fuel use, and production weight and value have been adjusted to reflect only non-tribal mothership sector activities as needed using a ratio of mothership pounds to all West Coast pounds.

9.1 West Coast portion of fixed costs

Based on the methods described above, information submitted by participants about fixed costs are disaggregated into West Coast-only values and presented in Tables 9.1 and 9.2.

Table 9.1: West Coast portion of fixed costs on gear and equipment. Capitalized expenditures and expenses (thousands of $) on vessel and on-board equipment, fishing gear, and processing equipment on the West Coast (N = number of vessels with non-zero, non-NA responses).

Cost Category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Fishing gear	100 :	5	***	***	189 :	5	97 :	5	55 :	5	102 :	4
Processing equipment	297 :	6	350 :	6	132 :	5	271 :	5	273 :	5	208 ·	5
Vessel and on-board equipment	442 ·	6	558 :	6	427 :	5	1,149 :	5	1,009 ·	5	1,461 :	5
Average total fixed costs	823 ·	6	1,042 :	6	749 :	5	1,517 :	5	1,337 ·	5	1,751 :	5

Table 9.2: West Coast costs on insurance, moorage, and leasing. Expenses on insurance, moorage, and leasing on the West Coast (thousands of $) (N = number of vessels with non-zero, non-NA responses).

West Coast Costs	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Insurance	193 ·	6	225 :	6	178 :	5	165 :	5	104 :	5	217 :	5
Lease of vessel	***	***		0	***	***	7 :	3	***	***	***	***
Moorage	65 :	6	67 :	6	62 :	5	71 :	5	86 :	5	72 :	5
Average total fixed costs	296 ·	6	292 :	6	245 :	5	240 :	5	191 :	5	294 :	5

9.2 Summary of West Coast portion of costs

Table 9.3: Summary of West Coast portion of costs. Average capitalized expenditures and expenses (thousands of $) on vessel and on-board equipment, fishing gear, and processing equipment, other fixed costs, and all variable costs on the West Coast (N = number of EDC vessels with non-zero, non-NA responses).

Cost category	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Total costs on vessel and on-board equipment, fishing gear, and processing equipment	$823˙	6	$1,042:	6	$749:	5	$1,517:	5	$1,337˙	5	$1,751⁝	5
Total other fixed costs	$296˙	6	$292:	6	$245:	5	$240:	5	$191:	5	$294:	5
Total variable costs	$1,865˙	6	$2,973˙	6	$5,812:	5	$4,582:	5	$5,324:	5	$6,581˙	5
Average total costs	$2,984˙	6	$4,306˙	6	$6,806:	5	$6,339:	5	$6,853:	5	$8,626˙	5

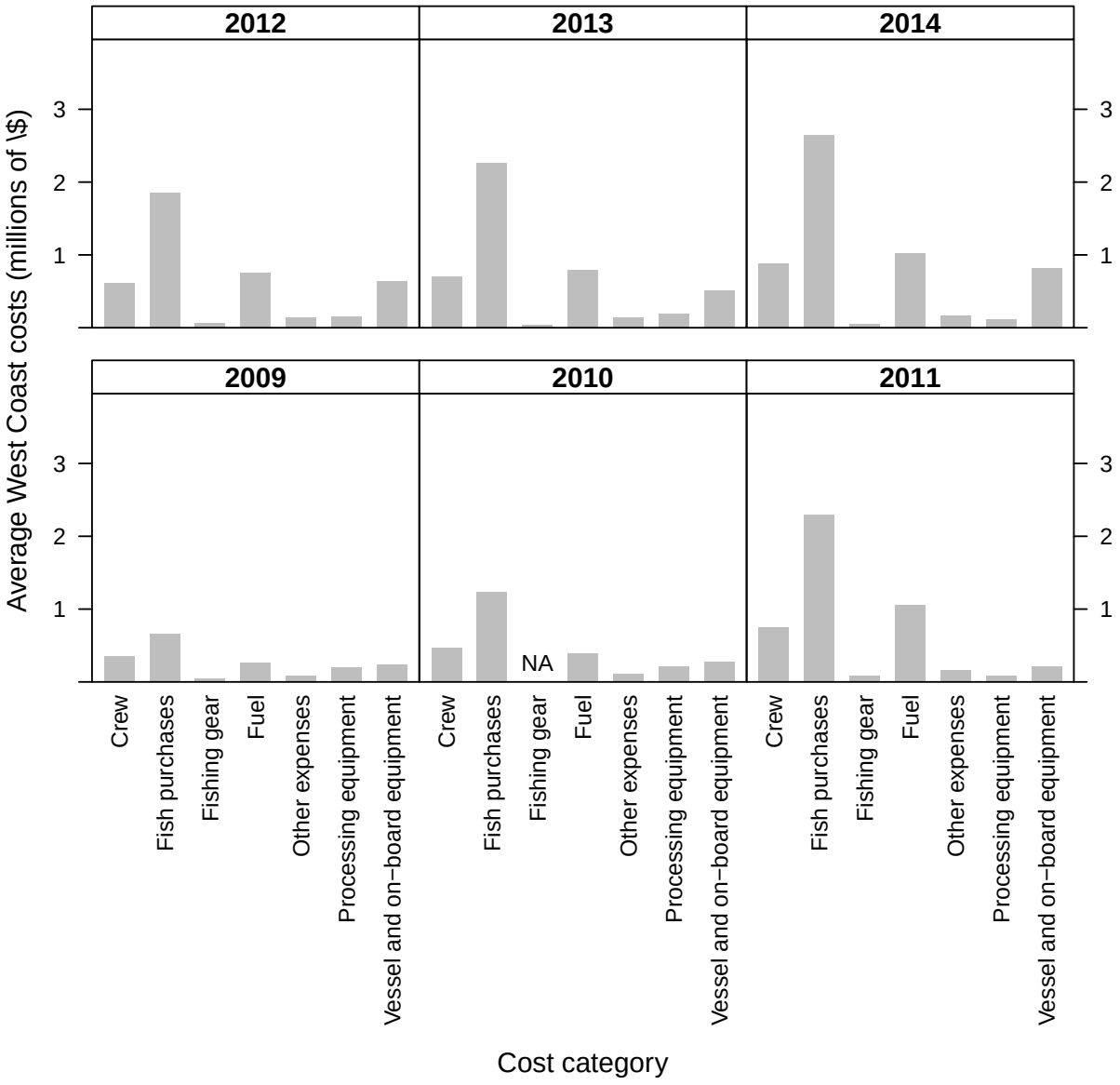

Figure 14: Average costs by category on the West Coast. Average costs by category on the West Coast including capitalized expenditures and annual expenses (millions of $). Crew includes both processing and non-processing crew expenses. The "Other" category includes expenses on additives, communication, fees, insurance, freight, moorage, observers, offloading, supplies, packing, travel, and Sea-State monitoring. "NA" is shown where data are confidential.

10 Net Revenue and Economic Profit

Net returns from operating a vessel are presented in this section. The level of net returns not only indicates whether a vessel is a viable ongoing business, but also the size of net benefit that is created from society's perspective. Two different measures of net returns are examined. They differ in the types of costs that are taken into account, and therefore, their interpretation and use. The first is a monetary, financial measure that attempts to track a vessel's net cash flow, which we call *net revenue*. It is calculated as revenue minus monetary costs. The only costs that are accounted for are those that are actually paid or associated with a financial transaction. The second measure attempts to track the broader economic performance of a vessel and includes all costs regardless of whether there is a financial transaction. Costs are measured by their true resource costs, which may or may not be equal to monetary outlays. This measure is called *economic profit*.[1] The distinction between the two measures is probably most easily understood through a few examples relevant to fisheries.

Labor costs for the net revenue measure are the total payments to the crew and captain. If work is performed that is not paid for, then it is not included as a cost. This commonly occurs in commercial fishing when the owner of a vessel is also the captain, but does not draw a captain's wage. In this case, the net revenue is higher than it would be if the captain drew a wage or hired a captain. In the end, the vessel owner-captain is not necessarily any worse off since s/he is the residual claimant to the net revenue. However, the net revenue would be higher than a comparable vessel that hired a captain.[2] Economic profit, on the other hand, accounts for the cost associated with an owner's time that is used as a captain. This is called an opportunity cost in the economics literature,[3] and is typically approximated by the wage of a comparably productive captain.[4]

A second example of the difference between net revenue and economic profit is the treatment of vessel capital costs. Again, net revenue only includes costs that are actually paid, which includes items such as vessel repair, maintenance, and upgrades. Economic profit would also include the opportunity cost of owning the vessel, a capital asset. By owning a vessel, the owner foregoes other investment opportunities that would provide a rate of return. This is called the opportunity cost of capital, and is typically approximated by the market rate of return associated with businesses of comparable risk, multiplied by the market value of the vessel.

Both net revenue and economic profit are useful measures for fishery management. Net revenue attempts to measure the annual financial well-being of vessel operations. It can be used to determine if there is a monetary gain or loss, or how changes in fishery management may affect the level of monetary gain or loss. Economic profit is a better indicator of the long-term viability of fishery operations since it includes

[1] Whitmarsh D., James C., Pickering H., Neiland A. 2000. The profitability of marine commercial fisheries: a review of economic information needs with particular reference to the UK. Marine Policy, Vol. 24(3), pp. 257-263.

[2] The same would also be true when a vessel owner does not receive a wage for work performed to repair or maintain gear or a vessel.

[3] Boardman, Anthony, David Greenberg, and Aidan Vining. Cost-Benefit Analysis: Concepts and Practice, Prentice Hall, NJ. 2000. pp. 31-32.

[4] A more accurate measure would be the owner-captain's most valued wage off the vessel.

all costs, and values the costs at their opportunity cost. It can be used to estimate whether there are incentives or disincentives to invest in capital, or enter and leave the fishery. It is also a better measure of the net benefit of the fishery to the nation.

Calculations of net revenue are included in this report. The cost categories used in net revenue, based on those reported in the EDC forms, are discussed below. Currently, calculations of economic profit are beyond the scope of the report. Economic profit relies on opportunity costs, which may be different from some of the costs reported on the EDC forms, so additional methods and analyses are required. The EDC Program economists will continue to work on developing measures of economic profit so that it may be included in future reports.

10.1 Net revenue

Net revenue is calculated two ways: using only variable costs, and using variable costs plus fixed costs (total costs).[5] The first calculation is called *variable cost net revenue*, while the second is called *total cost net revenue* (Figure 15). Variable cost net revenue is useful to examine changes in fishery operations that are not so great as to affect fixed costs. For example, the cost of processing an additional day, or processing an additional metric ton of fish, is better represented by only considering variable costs. Total cost net revenue is usually a better summary measure of financial gain or loss for an entire year, season, or fishery.

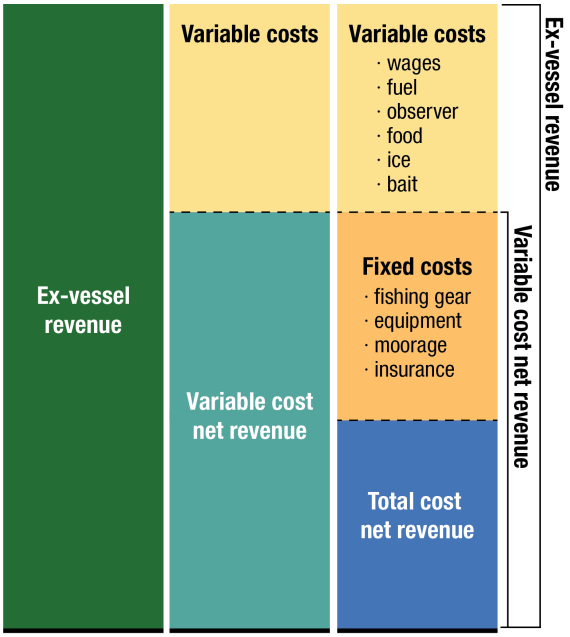

Figure 15: Composition and derivation of variable and total cost net revenue used in the EDC Program analysis of revenue, costs, and economic performance.

There are several caveats associated with the net revenue calculations in this report. As noted in Section 8, there are a variety of costs that are associated with running a vessel that are not requested by the EDC form because it is difficult to determine the share of the cost associated with the vessel. These costs include items that can be used for activities other than processing, or are too difficult to allocate to a particular vessel in a multi-vessel company. These expenses include office space, vehicles and transport trucks, storage of equipment, professional fees, and marketing. In general, the EDC forms attempt to capture only costs that are directly related to vessel maintenance and processing operations, and not

[5] See Section 8 for a more complete discussion of variable and fixed costs used in this report.

costs that are related to activities or equipment off the vessel. Therefore, the EDC calculated net revenue is an overestimate of the true net revenue. The difference is likely much greater for total cost net revenue than variable cost net revenue since most of the excluded costs are fixed costs.

Another caveat is that the EDC forms do not collect information about income taxes or financing costs. This has several implications. The first is that these costs are not included in the net revenue calculations. Therefore, net revenue is greater than it would be otherwise. The second is that in lieu of financing information (principal and interest payments), EDC total cost net revenue uses the total costs associated with vessel and gear purchases, repair, maintenance and improvements. For example, if a new engine is purchased, the total cost of the engine is used, even though the actual cash outlay, if it were financed, would only be the principal and interest payments made that year. It is likely that many larger capital costs, and perhaps some operating costs, are financed. This would mean that the actual cash outlays in a particular year for those items would be less than what is used in the EDC for the net revenue calculation. Over time, this may balance out to some degree because previously financed or purchased capital and equipment are also not included, except for the year in which they are purchased.[6] Moreover, total cost net revenue is expected to be representative of actual total cost net revenue only when averaged over many years and across vessels because relatively large capital costs occur periodically.

Net revenue for all West Coast fishing activities

Average net revenue is calculated for all activities on the West Coast. West Coast revenue only includes revenue from production of fish. The variable and fixed costs do not include costs related to acquiring limited entry permits, quota shares, or quota pounds.

$$\text{Variable cost net revenue} = \text{West Coast revenue} - \text{West Coast variable costs}$$

$$\text{Total cost net revenue} = \text{West Coast revenue} - (\text{West Coast variable costs} + \text{West Coast fixed costs})$$

[6] At best, it is just a partial balancing out because the interest payments are not accounted for in the EDC data.

Table 10.1: West Coast variable cost and total cost net revenue. Average total revenue, variable costs, variable cost net revenue, fixed costs, and total cost net revenue on the West Coast (millions of $) (N = number of vessels). Fixed costs include capitalized expenditures and expenses and other fixed costs (N = number of EDC vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Revenue	$3.01	6	$4.74	6	$7.73	5	$6.05	5	$7.12	5	$9.28	5
(Variable costs)	$1.86	6	$2.97	6	$5.81	5	$4.58	5	$5.32	5	$6.58	5
Variable Cost Net Revenue	**$1.14**	**6**	**$1.76**	**6**	**$1.91**	**5**	**$1.47**	**5**	**$1.79**	**5**	**$2.70**	**5**
(Fixed costs)	$1.12	6	$1.33	6	$0.99	5	$1.76	5	$1.53	5	$2.04	5
Total Cost Net Revenue	**$0.02**	**6**	**$0.43**	**6**	**$0.92**	**5**	**-$0.29**	**5**	**$0.26**	**5**	**$0.65**	**5**

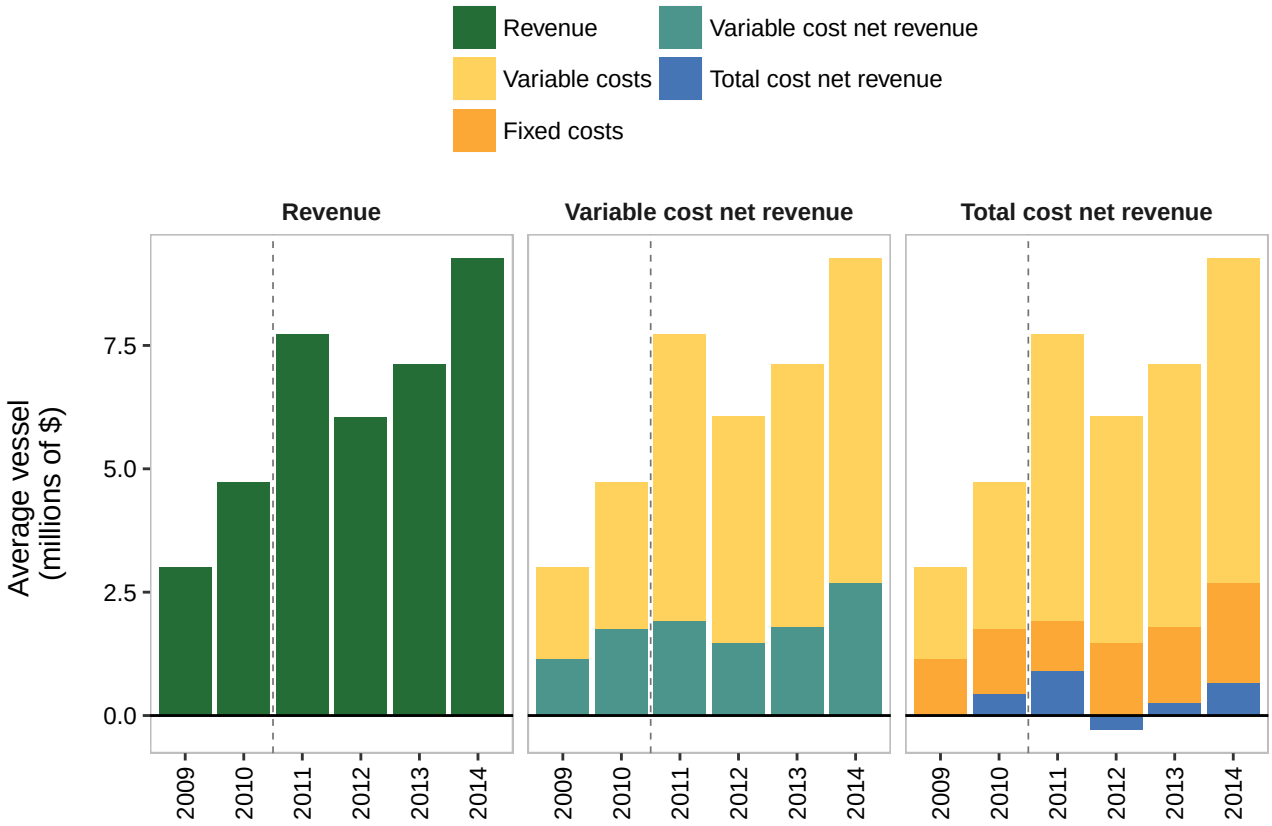

Figure 16: Average total reported revenue (left), average variable cost net revenue (revenue minus variable costs) (middle), and average total cost net revenue (revenue minus variable costs and fixed costs) (right) (millions of $). Dashed line represents the beginning of the catch share program.

11 Economic Performance: Cost, Revenue, Net Revenue, Markup, and Product Recovery Rates

Net revenue rates

Tables 11.1, 11.2, and 11.3 provide revenue, variable costs, variable cost net revenue, fixed costs, and total cost net revenue by days at sea (West Coast processing and steaming), metric ton of fish produced, and metric ton of fish purchased. Rates are calculated as vessel averages and thus reflect the operations of the average vessel and not the fleet as a whole.

Table 11.1: Revenue, costs, and net revenue per day. Mean revenue, variable costs, fixed costs, variable cost net revenue, and total cost net revenue per day (thousands of $).

Per Day	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Revenue	$152.3	6	$150.6	6	$110.0	5	$116.6	5	$127.4	5	$153.8	5
(Variable costs)	$93.9	6	$93.4	6	$86.4	5	$93.1	5	$93.0	5	$113.8	5
Variable cost net revenue	**$58.4**	**6**	**$57.2**	**6**	**$23.6**	**5**	**$23.5**	**5**	**$34.4**	**5**	**$39.9**	**5**
(Fixed costs)	$56.9	6	$43.3	6	$16.0	5	$35.1	5	$29.3	5	$32.5	5
Total cost net revenue	**$1.5**	**6**	**$13.8**	**6**	**$7.6**	**5**	**-$11.6**	**5**	**$5.1**	**5**	**$7.5**	**5**

Table 11.2: Revenue, costs, and net revenue per metric ton produced. Mean revenue, variable costs, variable cost net revenue, fixed costs, and total cost net revenue per metric ton produced ($).

Per metric ton Produced	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Revenue	$2,160	6	$2,647	6	$2,000	5	$1,715	5	$1,588	5	$2,267	5
(Variable costs)	$1,314	6	$1,639	6	$1,588	5	$1,655	5	$1,198	5	$1,668	5
Variable cost net revenue	**$847**	**6**	**$1,008**	**6**	**$412**	**5**	**$60**	**5**	**$390**	**5**	**$599**	**5**
(Fixed costs)	$890	6	$770	6	$297	5	$856	5	$378	5	$479	5
Total cost net revenue	**-$43**	**6**	**$237**	**6**	**$114**	**5**	**-$796**	**5**	**$12**	**5**	**$121**	**5**

Table 11.3: Net revenue per metric ton purchased. Mean revenue, variable costs, variable cost net revenue, fixed costs, and total cost net revenue per metric ton purchased ($).

Per mt Purchased	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Variable cost net revenue	$307	6	$276	6	$133	5	-$44	5	$158	5	$196	5
Total cost net revenue	-$8	6	$60	6	$28	5	-$501	5	-$5	5	$43	5

Markup and product recovery rates

The product markup for the mothership whiting sector represents the difference between the final processed product value and the cost of fish purchased from vessels, calculated using the formula

$$\frac{\sum_{n=1}^{N} R_n}{\sum_{n=1}^{N} C_n}$$

where N is the number of motherships that processed on the West Coast, R is the value of production for each mothership vessel, and C is the cost of fish purchases by each mothership vessel. The average markup is calculated for each survey year and shown in (Table 11.4).

Table 11.4: Markup rate. The markup rate (total value of production divided by total cost of fish purchases) for motherships on the West Coast (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Markup	4.57˙	6	3.83˙	6	3.36˙	5	3.28˙	5	3.15˙	5	3.51˙	5

The product recovery rate for the mothership whiting sector (Table 11.5) is calculated as

$$\frac{\sum_{n=1}^{N} WT_n^{fishoutputs}}{\sum_{n=1}^{N} WT_n^{fishinputs}}$$

where N is the number of motherships that purchased fish on the West Coast, $WT_n^{fishoutputs}$ is the weight of fish produced by each mothership vessel, and $WT_n^{fishinputs}$ is the weight of fish purchases from catcher vessels by each mothership vessel. The entity average product recovery rate is calculated for each survey year and shown in Table 11.5.

Table 11.5: Product recovery rate. The product recovery rate (total weight of production divided by total weight of fish purchases) for motherships on the West Coast (N = number of vessels with non-zero, non-NA responses).

	2009		2010		2011		2012		2013		2014	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Product recovery rate	0.39	6	0.27	6	0.34	5	0.50	5	0.50	5	0.33	5