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Evaluating the Economic Performance of the U.S. West Coast Groundfish Trawl Catch Share Program



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National Oceanic and Atmospheric Administration
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Northwest Fisheries Science Center

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Cover image: Two lines (one red, one blue) overlaid on an image of vessels docked in Newport, Oregon. The line plot shown here is not intended to summarize data, but is rather a representation of the Fisheye data exploration application described in this report. Photograph by E. Steiner, NMFS/NWFSC; image editing by S. Kim, NMFS/NWFSC.

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Evaluating the Economic Performance of the U.S. West Coast Groundfish Trawl Catch Share Program

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Executive Summary

The Economic Data Collection (EDC) Program was implemented as part of the West Coast Groundfish Trawl Catch Share Program. The catch share program consists of catcher vessels that deliver both shoreside to shorebased processors and at-sea to motherships, mothership vessels that act as floating processors, catcher-processor vessels that both catch and process fish, and first receiver/shorebased processors. All entities are required to submit an annual EDC form reporting costs and earnings from fishing and processing operations in U.S. West Coast fisheries.

Utilizing data from the EDC forms and fish tickets, the EDC Program developed a suite of metrics to evaluate the performance of the catch share program, and to provide fishery managers, industry, environmental not-for-profits, the public, and researchers with accessible fishery information. These performance metrics summarize vessel and processor characteristics, labor and wages, costs, revenue, net revenue, and employment and income impacts.

This report functions as a guide and reference document for the performance metrics. It contains detailed descriptions of the metrics, organized into four main sections: Purpose, Data, Methods, and Caveats. The purpose of each metric is discussed for context and insight as to how the metric might be used. The Data and Methods sections provide detailed explanations of which data were used and how the metric was calculated, including any relevant equations. In most cases, there are caveats that apply to the metric, such as data limitations or analyst decisions, that are very important to accurately interpret the metric.

Performance metrics are reported and made publically available on Fisheye, an interactive web application. Fisheye allows users to customize data summaries using select filters including location, size, entity type, and activity. These filters capture some of the variability in the data, and were chosen for their salience in fisheries management. “Location” filters vessels by homeport/state, and processors based on the location of their facility. “Size” filters vessels by vessel length, and processors by the number of employees. The “Entity type” filter provides an option to summarize data by whiting or non-whiting vessels and processors, which is an important distinction due to differences in landings and total allowable catch. The “Activity” filter describes the fisheries that vessels and processors participate in, and is a key component in providing representative data summaries.

To date, the performance metrics presented in Fisheye have been used to prepare Congressional testimony, support analysis of Pacific Fishery Management Council actions, supplement information for trade show keynotes, and were an essential component of the first five-year review of the catch share program. The performance metrics continue to support analysis of the performance of the catch share program and are used by agency staff, industry members, and Council staff. This technical memorandum serves as a companion to Fisheye, to document methods and provide guidance on the use and interpretation of these metrics. The information contained within this report will also be included in Fisheye to allow convenient access to this essential information.

Introduction

The West Coast Groundfish Trawl Catch Share Program has been operating since 2011. The Economic Data Collection (EDC) Program was implemented as part of the catch share program to monitor and evaluate the effects on participants. Each year, catcher vessels, shorebased processors, catcher-processors, and motherships are required to submit their annual cost and earnings data to the EDC Program. The catch share program consists of a wide range of target species, gear types, and business operations, and spans the entire U.S. West Coast. To provide information about the status of the catch share program to its participants, the Pacific Fishery Management Council, fisheries managers, and the public, performance metrics were developed for the five-year review of the catch share program that was conducted in 2016. These metrics are now provided through an interactive data exploration tool called Fisheye that allows individuals to see trends and distributions of these metrics for specific areas of interest. Since the original set of performance metrics was developed, Fisheye has been expanded to include additional metrics about labor, metrics to provide context and assist in interpreting the original set of performance metrics, and metrics that represent additional data collected by the EDC Program.

Although many metrics are simple calculations, because of the wide range of ways that each metric is summarized, it is important to document the specific methods in order to ensure proper interpretation and use of the metrics/statistics.

Data Sources

Calculation of performance metrics relies on four main sources of data:

1. **Fish Ticket Data:** These data are collected by each state and then compiled by the Pacific Fisheries Information Network (PacFIN). These data include vessel IDs, buyer IDs, gear, delivery date, species, landings weight, and ex-vessel revenue for each shorebased delivery. For the purposes of the performance metrics, this information is primarily used to obtain shoreside ex-vessel revenue, landings weight, and number of trips.
2. **Permit Data:** These data are obtained directly from the NOAA Fisheries West Coast Region Permits and Monitoring Branch, and include lists of which limited entry permits are on each vessel and for what time period. The same data are provided for First Receiver Site Licenses (FRSLs). For the purposes of the performance metrics, this information is primarily used to designate trips and associated ex-vessel revenue and landings to permit-specific fisheries.
3. **Observer Data:** Federal observer data collected on catcher-processors and motherships provide similar data to fish tickets, including catcher vessel IDs, fish buyer IDs, landings weight by species, and catch/delivery date. They do not include ex-vessel revenue for mothership deliveries, and there is no equivalent of ex-vessel revenue for catcher-processors because one vessel does both the harvesting and processing.
4. **EDC Data:** These data represent the bulk of the data presented in the performance metrics. More details about each data element can be found on the [EDC Forms web page](#)¹ and in the descriptions of the performance metrics.

All revenue and cost data are inflation-adjusted for reporting and are reported in the year of the most recent EDC data. The Gross Domestic Product: Implicit Price Deflator (GDPDEF) quarterly series is obtained from the Federal Reserve Bank of St. Louis (the St. Louis Fed), and averaged to create an annual deflator.

Not all entities receive revenue from each source or incur costs in each category listed on the form. For the purpose of performance metrics, zeroes are excluded in each statistic.

¹ <https://www.fisheries.noaa.gov/west-coast/science-data/economic-data-collection-forms>

Overall Methods

Population

The EDC population is set by regulation (USOFR 2010), and includes any vessel with a trawl permit or fish buyer with an FRSL. In Fisheye, the performance metrics are calculated using a subset of the population to reflect participation in the catch share program. This population is determined for each year by the following criteria:

- **Limited Entry Trawl Catcher Vessels:** All owners, lessees, and charterers of a catcher vessel registered to a limited entry trawl endorsed permit that took at least one catch share trip in a given year.
- **Catcher-processors:** All owners, lessees, and charterers of a catcher-processor vessel that participated in the Pacific whiting fishery in a given year.
- **Motherships:** All owners, lessees, and charterers of a mothership vessel that participated in the Pacific whiting fishery in a given year.
- **Shorebased Processors:** All buyers that received at least one landing of more than 1,000 lb of groundfish (including whiting) harvested with a limited entry trawl permit, and processed groundfish in a given year.²

Participants complete the annual EDC forms using information based on the fiscal year of the entity. For some entities, their fiscal year does not match the corresponding calendar year. For vessels, costs are allocated to calendar year using the Cost Allocation methods described below, and all vessel performance metrics are reported for calendar year. For processors, it is more difficult to adjust costs and earnings information because the timing of production activities within processing facilities throughout the year is not known. Therefore, processor metrics are reported for fiscal year. While data assigned to a calendar year may not overlap completely with the fiscal year, the total fiscal year purchases overlap with 94% of landed weight in each calendar year on average.

Confidentiality

The data collected by the EDC Program are protected by the Magnuson-Stevens Fishery Conservation and Management Act (MSA). In order to share information about the performance of the catch share program, without revealing any individual business's proprietary information, all data are summarized before reporting and the following rules are implemented:

- **Rule of 3:** No statistic can be shown if there are fewer than three entities.
- **Rule of 90/10:** No statistic can be shown if one entity's operation represents greater than 90% of the total within the statistic.

² Processing of groundfish or whiting is determined by whether EDC data indicate processed product types (i.e., listed as a product type other than "Unprocessed") and communication with the participant does not indicate otherwise.

- **Additive confidentiality restriction:** This rule suppresses all subgroup data summaries for a given aggregate group when one subgroup has been suppressed for confidentiality. For example, in Fisheye, we report summaries for all vessels as well as for two mutually exclusive groups: whiting vessels and non-whiting vessels. If the whiting group is suppressed for confidentiality, the non-whiting group will also be suppressed. Suppressing both categories allows for reporting of “all vessels” without indirectly revealing the values in the group that required confidential data suppression. This restriction applies to fishery and production activity groupings and to vessel and processor type groupings, described in [Fisheye](#).

Statistics

We calculate three annual statistics: mean, median, and total.³ The annual calculations are shown in the first column of Table 1, where n = number of entities (processors or vessels), i = individual entity, x = measure, and d = denominator. Many metrics are also presented as rates (Table 1, Column 2), e.g., per pound, per day, per dollar earned. To calculate the mean and median rates, the rate for each entity is calculated and then the statistic is calculated. The total rate is a weighted average, where the numerator and denominator are summed across all entities and then divided.

The simple average (mean rate) and the weighted average (total rate) convey two different types of information. Using ex-vessel prices as an example: the simple average is the price the average vessel received, whereas the weighted average is the average ex-vessel price for the entire fleet. In the weighted average, ex-vessel price for a vessel that delivered more fish influences the resulting statistic more than a vessel that just made one delivery.

Table 1. Fisheye annual statistics and rate statistics, with calculations.

	Annual	Rate
Mean*	$\frac{1}{n} \sum_{i=i}^n x_i$	$\frac{1}{n} \sum_{i=i}^n \frac{x_i}{d_i}$
Median	$median(x_i)$	$median\left(\frac{x_i}{d_i}\right)$
Total	$\sum_{i=i}^n x_i$	$\frac{\sum_{i=i}^n x_i}{\sum_{i=i}^n d_i}$

*The mean and mean rate can be described as simple averages, though because zeros are excluded, the mean represents the average value for vessels/processors that report nonzero responses.

We include measures of variance to illustrate the level of variation in the mean and median statistics. For mean statistics, the standard deviation is reported. For median statistics, we report lower (0.25) and upper (0.75) quantiles.⁴ Plots for mean and median statistics include variance bands. For mean statistics, the upper band limit is the value plus one standard deviation (SD), and the lower band is the value minus 1 SD. For median statistics, the upper band is the upper (0.75) quantile, and the lower band is the lower (0.25) quantile.

³ All statistics are calculated using R.

⁴ Lower and upper quantiles are calculated using the base R function, `quantile`, method: Type 8. The Type 8 method is a continuous sample quartile, and has certain advantages: it is robust to non-normally distributed data, its estimates do not show individual observations, and it can be calculated for sample sizes as small as three.

Two types of counts are reported for all metrics in Fisheye. As zeroes are excluded in statistics, the “Number of responses” is reported and shows the number of vessels/processors with nonzero responses. Reported statistics illustrate the mean, median, or total value for those vessels/processors that did not report a zero or an n/a. The “Number of vessels/processors” reports the count of the number of vessels/processors that meet the criterion for a given set of filters. If one wished to calculate the sectorwide mean including zeroes, one could do so by taking the value reported under “Total” and dividing by the “Number of vessels/processors.”

Fishery and Production Activity Designations

There is no single definition of *fishery*, nor is there a single agreed-upon method for assigning landings or vessels to fisheries. The EDC Program established its own set of fisheries and rules in order to respond to specific management questions and to account for differences in targeting strategies that might affect economic analysis and interpretation.

All catch delivered to motherships is assigned to the “At-sea Pacific whiting fishery,” and all catch by catcher–processors is assigned to the “Catcher–processor whiting fishery.”

For catcher vessels, ex-vessel revenue is used to categorize each delivery into either a catch share fishery (“At-sea Pacific whiting,” “Shoreside Pacific whiting,” “Non-whiting midwater trawl,” “DTS [Dover sole, thornyheads, sablefish] trawl with trawl endorsement,” “Non-whiting,” “Non-DTS with trawl endorsement,” or “Groundfish fixed gear with trawl endorsement”) or a non-catch share fishery (“Crab,” “Shrimp,” or “Other fisheries”). The “Other fisheries” category primarily consists of salmon, tuna, and fixed gear sablefish without a trawl permit. A delivery is assigned to a particular fishery based on the species or species group that contributes the largest proportion of revenue for that delivery. For example, if a fish ticket for a particular vessel on a specific day had a mix of rockfish and Pacific whiting, and the Pacific whiting landings accounted for the majority of the revenue, then all landings associated with that trip are designated as “Shoreside Pacific whiting fishery.”

Landings weight was explored as an alternative to using revenue to classify deliveries by subfishery. We compared the results of using revenue versus landings weight for designating the subfishery. The two methods resulted in identification of the same fishery for 95% of all cases. Given that there were few differences in identification of the fisheries, revenue was selected over landings weight because it is assumed to represent the target species more accurately.

For processors, production information is collected on the EDC form at the species level. Data are reported in Fisheye in three distinct categories of production activities: “Pacific whiting production,” “Non-whiting groundfish production,” and “Other species production.” Two aggregate categories of production activities are also reported: “All production” (aggregate of Pacific whiting, non-whiting groundfish, and other species) and “Groundfish production” (aggregate of Pacific whiting and non-whiting groundfish). “Non-whiting groundfish production” includes arrowtooth flounder, Dover sole, English sole, lingcod, Pacific sanddab, petrale sole, rex sole, rockfish, sablefish (black cod), thornyheads, and sharks, skates, and rays. “Other species production” includes coastal pelagics (including sardines and mackerel), crab, echinoderms (including sea urchins and sea cucumbers), California halibut, Pacific halibut, Pacific herring, salmon, squid, sturgeon, tuna, other shellfish, and other species.

Cost Allocation

Nearly all vessels and all shorebased processing companies participate in multiple activities off the coasts of California, Oregon, Washington, and Alaska. These activities include multiple fisheries as well as activities such as research, chartering, and tendering. To analyze the performance within specific fisheries, annual costs must be allocated to individual activities.

The EDC participants incur annual costs across multiple fisheries and/or activities. These are called “joint” costs in the economics and accounting literature, and include fixed costs (e.g., new vessel, processing equipment), or variable costs (e.g., fuel, labor). The former are joined by the nature of the costs themselves, while the latter are often joined due to observational limitations. It is difficult for a participant to assign fixed costs to a particular fishery because the level of the cost does not vary with business activity (at least over the short run). Many variable costs can theoretically be tracked by fishery, but it would be difficult or costly to do so. For example, although an EDC participant could theoretically set up a system to track expenditures on fuel by fishery, doing so would be burdensome.

Costs are allocated to each fishery or production activity using available fishery-specific and species-specific information. The fishery-level information for catcher vessels that is used to allocate costs includes days at sea (EDC data), ex-vessel revenue (fish tickets, EDC data), landings weight (fish tickets, observer data), gallon-days (EDC data), and crew share net revenue (fish tickets, EDC data). For processors, species-specific information is available in the EDC data, and it is used to allocate costs to each production activity. Three pieces of species-specific information are used for shorebased processor cost allocation: fish purchase weight, fish production weight, and “value-added.” “Value-added” is defined as total production value minus purchase cost. This is assumed to be a measure of the relative contribution of resources by the processing facility across production activities. Detailed information about cost allocation for each category is provided in its respective [Cost Metrics](#) section.

For motherships and catcher-processors, fixed costs must be distributed between U.S. West Coast and Alaska fishing. The only data available for this come from fish purchase/catch weights obtained on the EDC forms.

Fisheye

Fisheye is an interactive data exploration tool used to report EDC data and performance metrics. Harsch et al. (2018) provides background information on the development of Fisheye. Since development, the user interface of Fisheye has been updated and metrics have been added, and additional modules, beyond the **Performance Metrics** application, have been developed. This report only documents the **Performance Metrics** application.

Fisheye can be accessed at <https://dataexplorer.northwestscience.fisheries.noaa.gov/fisheye/>.

Filters for subsetting data/metrics

The U.S. West Coast groundfish trawl catch share fishery is a complex system with diverse participation types necessitating the ability to summarize data across participant groups. EDC data are used for a variety of purposes, and users require the flexibility to summarize and group data according to their interests. The primary filters that the EDC Program has developed include:

- **Location:** Homeport or region of operation.
- **Size:** Vessel length, or size of processing operation defined by number of employees.
- **Vessel/Processor Type:** Mutually exclusive categories for whiting or non-whiting vessel, and whiting or non-whiting processor.
- **Activity:** Fishing activity or production activity.

Location

Vessels are grouped by port groups and states according to the homeport reported on the EDC survey form. Each year, a small number of vessels report homeports in Alaska. To protect the confidentiality of these data, those vessels are included in the **Puget Sound/Alaska** port grouping and in the **Washington and Alaska** state grouping.

Mothership and catcher–processor performance metrics are not reported by location, because all are based out of the **Puget Sound** region.

Processors are grouped by region based on the location of each processor. Two regions are recognized: **Washington and Oregon**, and **California**. Washington and Oregon are combined to protect the confidentiality of the data.

Size

Catcher vessels are grouped into three categories representing the range of catcher vessel lengths: **Large Vessels** (>80 ft), **Medium Vessels** (>60 ft, ≤80 ft), and **Small Vessels** (≤60 ft).

Motherships and catcher–processors are not grouped into size categories because there are so few operations.

Shorebased processors are grouped into three size classes based on the number of production employees: **Large** (>200 workers), **Medium** (100–200 workers), and **Small** (<100 workers). On the EDC form, processors report the total number of production employees for the week that contains the 12th of each month. For each processor, we assume that the week with the highest number of production employees each year provides a reasonable estimate of the maximum number of employees at that processor at any given point in the year. We then average this annual maximum across all EDC years to place processors in one size category for all years.

Entity type

Vessel type

We include the option to summarize data by three types of vessels:

1. **All vessels:** The fleet as a whole.
2. **Whiting vessels:** Vessels that fished for Pacific whiting, including those that fished for both whiting and non-whiting.
3. **Non-whiting vessels:** Vessels that only participated in the non-whiting groundfish sector of the limited entry trawl fishery (Figure 1).

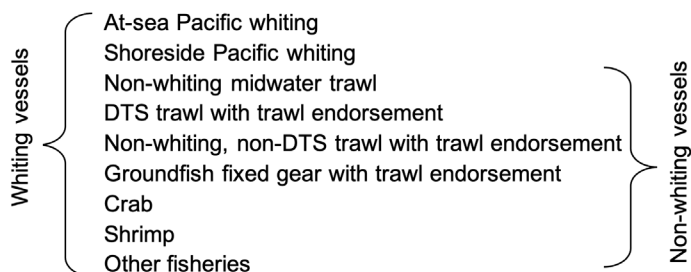


Figure 1. Diagram of vessel type groupings. Vessels that targeted whiting are categorized as a whiting vessel. Vessels that fish in at least one non-whiting groundfish trawl fishery and do not target whiting are non-whiting vessels. In both cases, vessels may participate in all other fisheries on the U.S. West Coast.

The purpose of separating the whiting from the non-whiting vessels is that the whiting vessels tend to be larger and catch a higher volume of fish. In addition, total allowable catch for Pacific whiting has more annual variation than total annual catch for species targeted in the non-whiting groundfish sector, which can make interpreting metrics more difficult.

Where possible, data are reported separately for the three vessel categories. If there are fewer than three vessels in either the **Whiting vessels** or **Non-whiting vessels** category, we only report the **All vessels** category.

Processor type

We include the option to summarize data by three types of processors:

1. **All Processors:** Processors of catch share fish purchases.
2. **Whiting Processors:** Any company that processed Pacific whiting, including those that process both whiting and non-whiting species.

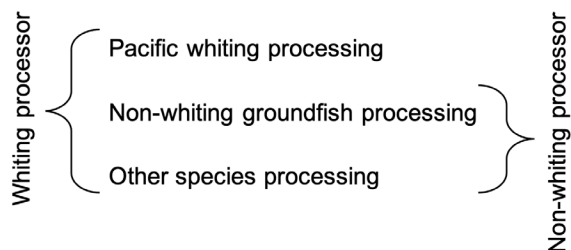


Figure 2. Diagram of processor type groupings. Companies that processed whiting are considered whiting processors, though they may also process non-whiting groundfish. Companies that did not process whiting are non-whiting processors.

3. **Non-whiting Processors:** Companies that process non-whiting groundfish species but did not process whiting (Figure 2).

Activity

The **Activity** filter is more complicated than the other filters because the filter operates differently depending on the type of metric. For some metrics, **Activity** operates like the other filters and alters which entities are included in the statistic. However, for other metrics, the filter also subsets the data for individual entities. Activities are defined by fisheries for catcher vessels and as production activities for processors. Most metrics only result in the entity-level filter. Exceptions to this rule are the following metrics, filtered by entity and data subset:⁵

- All cost metrics.
- All economic metrics.
 - Ex-vessel revenue.
 - Processor revenue from seafood sales, offloading, custom processing, and other.
 - Variable costs.
 - Variable cost net revenue.
 - Fixed costs.
 - Total cost net revenue.
- All impact metrics.
- Catcher vessel labor metrics.
- Days at sea.
- Speed while fishing.
- Average fuel use per day.
- Number of crew positions.

Fisheries

Vessel fishing activity is categorized into fishery groups (see [Fishery and Production Activity Designations](#)). The fisheries are defined in Table 2.

For catcher vessels, there is an additional filter that allows users to include Alaskan fisheries in their data summaries. Complete information is unavailable for the Alaskan portion of vessels' fishing operations, but information about the role of Alaskan fisheries can be explored using the following vessel characteristics metrics:

- Number of fisheries.⁶
- Proportion of revenue from catch share participation.
- Revenue diversification.

⁵ Speed while fishing, average fuel use per day, and number of crew positions are not additive. Unlike the other metrics in this list, the fishery-level values for these metrics cannot be added together to get a total fleetwide value.

⁶ All participation in Alaskan fisheries counts as one additional fishery.

Table 2. Description of the fishery categories used in Fisheye to describe catcher vessel fishing activities. Multiple tiers of fishery categories are reported to allow flexibility for the user. These fisheries are used in the **Fishery** filter in Fisheye. *DTS* = Dover sole, thornyheads, sablefish.

All fisheries			
All catch share fisheries			
Trawl-only catch share fisheries			
Pacific whiting	Groundfish with trawl gear	Groundfish fixed gear with trawl endorsement	Non-catch share fisheries
<ul style="list-style-type: none"> • At-sea Pacific whiting: Targets whiting with midwater trawl gear, delivers to motherships • Shoreside Pacific whiting: Targets whiting with midwater trawl gear, delivers shoreside 	<ul style="list-style-type: none"> • DTS with trawl endorsement: Targets Dover sole, thornyheads, sablefish with bottom trawl gear • Non-whiting midwater trawl: Targets widow and yellowtail rockfish with midwater trawl gear • Non-whiting, non-DTS with trawl endorsement: Targets species including petrale sole, other rockfish, and other flatfish with bottom trawl gear 	<ul style="list-style-type: none"> • Targets sablefish with pots and longline gear (commonly referred to as “gear switchers”) 	<ul style="list-style-type: none"> • Crab: Exclusively targets Dungeness crab • Shrimp: Exclusively targets pink shrimp

Production activity

Shorebased processor production activity is categorized into species groups (see [Fishery and Production Activity Designations](#)), as information on the EDC form is collected at the species level, not at the fishery level like the catcher vessels. Production activity categories used in Fisheye are: **Pacific whiting production**, **Non-whiting groundfish production**, **Other species production**, **All production** (aggregate of **Pacific whiting**, **Non-whiting groundfish**, and **Other species production**), and **Groundfish production** (aggregate of **Pacific whiting** and **Non-whiting groundfish production**).

Multiple filters

In some cases, data users are interested in specific subsets of the data, which requires applying multiple filters. Ideally, all combinations of filters would be presented, but due to the small total number of entities, there are not enough observations to show all combinations in a meaningful way. Filter combinations are provided when feasible.

The **Vessel/Processor Type** filter represents a broad categorization of participation types, and can be combined with all filters. **Vessel/Processor Type**, combined with the **Fisheries** filter, represents vessels or processors of the selected type with activities in the selected fishery group. For instance, if the user selects **Whiting vessels** (**Vessel Type** filter) and **Non-whiting midwater trawl** (**Fishery** filter), the data summarized would only reflect whiting vessels (those that fished for Pacific whiting) that also fished for non-whiting species

with midwater trawl. The result of these filter combinations varies by the type of metric. For example, for the metric **Vessel length**, the filter combination described above would summarize the vessel length for all whiting vessels that fished in the midwater trawl fishery. In contrast, for **Revenue**, the data included in the calculation reflect only revenue from midwater trawl fishing for whiting vessels. In the former, the two filters subset only which vessels are included in the statistic, whereas, in the latter, the filters subset both the vessels included (whiting vessels) and which data are included (only midwater trawl revenue).

When filtering by **Location** or **Size**, those filters can also be combined with the aggregate **Fishery** groupings for vessels (e.g., all fisheries, all catch share fisheries, all trawl catch share fisheries, and all non-catch share fisheries) and production **Activities** for processors (all production, groundfish production, other species production). For example, if the user selects **California** (**Geographic region** filter) and **Groundfish production** (**Aggregate fishery** filter), the data summarized would only reflect processors in California that sell groundfish products.

Confidentiality

Data are suppressed according to the confidentiality rules described above; suppressed data are reported as **n/a** and are not plotted. Fisheye provides “nested” filters, which complicates implementation of confidential data protections. For instance, if the number of whiting processors (**Processor Type** filter) for a particular metric selection is less than three, data are suppressed for whiting *and* non-whiting processors. Additive confidentiality is further complicated when the **Vessel/Processor Type** filter is combined with the **Fishery** filter, as the **Fishery** filter has multiple levels. Given the complexity of multiple levels in the **Fishery** filter, only **All vessels** (**Vessel type** filter) is shown for additive metrics when the most-specific **Fishery** filter level (i.e., **Non-whiting, non-DTS with trawl endorsement**) is selected.

Metrics

Processor/Vessel Characteristics

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Number of vessels	✓	✓	✓	
Number of processors				✓
Vessel fuel capacity	✓	✓	✓	
Vessel horsepower	✓	✓	✓	
Vessel length	✓	✓	✓	
Vessel market value	✓	✓	✓	
Vessel replacement value	✓	✓	✓	

Number of vessels and Number of processors

Applicable Sectors: CV/MS/CP/P.

Purpose: The number of participants is reported, both to monitor for changes in participation and to provide context for other metrics (PFMC and NMFS 2017, 3.1.1(b)(1)). Filters are also provided to show how the number of participants varies by fishery, operation size, and location.

Data: The number of vessels participating in the catch share program is obtained from state fish tickets for the shorebased sector and from the North Pacific (NORPAC) database for the at-sea sectors. The number of processors participating in the catch share program is obtained from state fish tickets and EDC data. There is no record of processing operations outside of EDC data; therefore, whether or not a company processes fish is determined using fish production information provided by companies on their EDC submissions.

Method: The total number of participants is reported for all sectors. The number of vessels is reported for the catcher vessel, mothership, and catcher-processor sectors, and the number of companies is reported for shorebased processors. A vessel is counted as a participant if it made at least one delivery within the fishery being reported. See [Fishery and Production Activity Designations](#) for a description of how fisheries are defined and how vessels are designated to a fishery. A processor is counted as a participant of the catch share program for a given survey year if: 1) state fish tickets indicate it received at least one catch share delivery of more than 1,000 lb of groundfish (including whiting), and 2) EDC data indicate the processing of groundfish or whiting. Processing of groundfish or whiting is determined by whether EDC data indicate processed product types (i.e., listed as product type other than **Unprocessed**) and communication with the participant does not indicate otherwise.

Caveats: Some operations own multiple vessels. Analyzing the performance of sets of operations is outside of the scope of the current analysis. For processors, the unit of analysis is the FRSL owner (or company), which takes into account how businesses self-identify their operations. For license owners with multiple site licenses under the same company name, data are aggregated together. FRSLs under different company names that are linked by a broader corporate ownership are not grouped together as a single company.

Vessel attributes

Metrics included: Vessel fuel capacity, Vessel horsepower, Vessel length.

Applicable Sectors: CV/MS/CP.

Purpose: The following suite of metrics captures characteristics of a vessel that contribute to operational capacity. Changes in fuel capacity, horsepower, and length may indicate improvements to vessel efficiency or ability to catch fish.

Data: EDC forms request vessels to report the fuel capacity, horsepower, and length of the vessel for catcher vessels, motherships, and catcher-processors.

Methods: The following metrics are used as reported in the forms, and summarized as vessel averages (mean and median). Total is only reported for vessel fuel capacity.

- **Vessel fuel capacity** (gallons).
- **Vessel horsepower.**
- **Vessel length** (feet).

Caveats: Changes in these metrics can be the result of physical changes made to vessels or changes in the composition of vessels participating.

Vessel market value and Vessel replacement value

Applicable Sectors: CV/MS/CP.

Purpose: Vessel market and vessel replacement values provide information about a company's physical assets.

Data: EDC forms request the market and replacement values of the vessel related to the most recent marine survey.

Methods: The following metrics are used as reported in the forms and summarized as vessel averages (mean and median); total values are not reported:

- **Vessel market value.**
- **Vessel replacement value.**

Caveats: A small number of vessels include the values of permits, quota, and fishing gear in the market and replacement values. Increases in market value can indicate that existing vessels have invested in vessel improvements and/or that newer/more-valuable vessels have entered the fishery. Differences in replacement value and market value may indicate that vessels in the fleet are aging and improvements are not keeping pace with depreciation.

For processors, the EDC form requests information on market value and replacement value of facilities based on the most recent appraisal. However, we do not report these values, as very few processors provide non-n/a responses. This may in part be due to lease arrangements between the processing company and the owners of the facilities where they are located.

Measures of Specialization

Vessels in the West Coast Groundfish Trawl Catch Share Program participate in multiple fisheries within the program and also fish in state-managed fisheries such as crab and shrimp. Processors purchase and process species from a variety of fisheries, depending on their operation. Implementation of catch shares was expected to lead to increased fishery specialization (PFMC and NMFS 2017, 3.1.2(d)(1), 3.1.2(d)(5)), and the following metrics allow for exploration of changes in diversification and specialization over time.

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Number of fisheries	✓			
Revenue diversification	✓			✓
Proportion of ex-vessel revenue from the catch share fishery	✓			
Proportion of landings from the catch share fishery		✓	✓	
Number of species processed				✓
Number of species sold				✓
Proportion of production value from groundfish				✓
Number of processors who fillet non-whiting groundfish				✓

Number of fisheries

Applicable Sectors: CV.

Purpose: The **Number of fisheries** metric, as well as **Revenue diversification** (described below), may be used to track trends in fishery participation. See **Number of species processed** and **Number of species sold** for the processor equivalent of this metric. This metric is not calculated for the mothership and catcher-processor sectors, as whiting is the only fishery these sectors participate in on the U.S. West Coast.

Data: Ex-vessel revenue is obtained from EDC data; fish tickets are maintained by PacFIN. The EDC Program categorizes trips by fishery (see [Fishery and Production Activity Designations](#)).

Methods: For each vessel, the number of fisheries is calculated by counting the number of fisheries where revenue was greater than zero, and is reported as the mean or median across all vessels. The fleetwide total is not reported for this metric.

Caveats: This metric does not consider the amount of participation within each fishery. For instance, if a vessel earned 98% of its revenue from crab and 2% from groundfish fixed gear with trawl endorsement, the number of fisheries would still be two.

Fisheye: If the **Include Alaska** button is toggled on, then participation in fisheries in Alaska is counted as one additional fishery for each vessel that fishes in Alaska.

Revenue diversification

Applicable Sectors: CV/P.

Purpose: This metric provides similar information to the **Number of fisheries** metric described above, but it also takes into account how much the vessel participates in each fishery or how much each species contributes to the total production value for the processor. This metric is not calculated for the mothership and catcher–processor sectors, as whiting is the only fishery these sectors participate in on the U.S. West Coast.

Data: For catcher vessels, ex-vessel revenue is aggregated to the vessel–fishery–year level from fish tickets and EDC forms. For processors, species- (or species group-)level production values are obtained from EDC forms.

Methods: The Effective Shannon Index (ESI; Equation 1) is calculated for each individual (vessel or processor) by first calculating the individual proportions (p_f) of revenue (R_f) for each component of their operation (f). The ESI for each vessel or processor is the exponentiated negative sum of the product of the proportions of revenue (p_f) for each fishery (f) and the log proportions $\ln(p_f)$. The ESI is calculated for each vessel or processor and summarized as mean and median; total is not calculated.

$$p_f = \frac{R_f}{\sum_{f=1}^F R_f} \tag{1}$$
$$ESI = e^{-\sum p_f \ln p_f}$$

Caveats: Fishery or species groupings used in this calculation differ for vessels and processors. The ESI is calculated for catcher vessels by fishery, whereas processors use the species or species groups as collected on the EDC processor form (see [Fishery and Production Activity Designations](#)). This metric emphasizes the effective number of fisheries or species relied on for revenue. (The number of species processed is also reported in a separate metric.) If the number of fisheries (or number of species processed) is higher than the ESI, it indicates that individual operations within the sector rely more on certain fisheries (species) for revenue than others. If the ESI is the same as the number of fisheries, then the operations rely evenly on all of the fisheries.

Fisheye: An annual ESI is calculated for each vessel or processor. The filters only determine which vessels/processors are included in the statistic—not which parts of their operations (except for the **Include Alaska** button, which recalculates the ESI to include Alaska fisheries in the calculation). For the purposes of Fisheye, all Alaska participation is treated as one fishery.

Proportion of ex-vessel revenue (or landings) from catch share fishery

Applicable Sectors: CV/MS/CP.

Purpose: Catch share management was expected to lead to increased fishery specialization. The **Proportion of ex-vessel revenue (or landings) from the catch share fishery** metric monitors vessel revenue (or landings weight) from catch shares relative to other fisheries, and may indicate specialization (or lack thereof). Proportion of ex-vessel revenue is reported for catcher vessels; proportion of landings is reported for the mothership and catcher–processor sectors.

Data: Ex-vessel revenue and landings weight are obtained from fish tickets maintained by PacFIN. The EDC forms require motherships and catcher–processors to report landings weight on the U.S. West Coast and Alaska.

Methods: This metric is calculated using landings weight (catcher–processors, motherships) and ex-vessel revenue (catcher vessels). Revenue or landings weight from the catch share fishery are compared to the vessel’s total revenue or catch/purchase weight, and summarized as vessel averages (mean and median; Equation 2); total is not calculated for this metric.

$$Proportion_{cs} = \frac{R_{cs}}{R_{cs} + R_{other}} \quad (2)$$

where R_{cs} for each vessel and year is total revenue (or landings) from participation in catch share fisheries and R_{other} is revenue (or landings) from participation in all other fisheries.

Caveats: None.

Fisheye: If the **Include Alaska** button is toggled on, then revenue from fishing in Alaska is included in the denominator for the calculation. The proportion is always 1 for catcher–processors and motherships if the **Include Alaska** button is toggled off, because those vessels only fish in one fishery on the U.S. West Coast.

Number of species processed

Applicable Sectors: P.

Purpose: The number of species processed offers insight into the production activities and product diversification of processors.

Data: EDC forms require processors to report production revenue by species and product type. [Fishery and Production Activity Designations](#) describes the list of species requested on the EDC forms. For most species on the EDC form, product types include **Processed Fresh, Frozen, Unprocessed,** and **Other**. For the following species, **Canned** is also listed as a product type: coastal pelagics, crab, shrimp, sturgeon, and tuna. For salmon, **Canned** and **Smoked** are also listed as product types. For Pacific whiting, product types include **Surimi, H&G/HGT** (headed and gutted/headed, gutted, tail off), **Filletts, Roe, Frozen whole, Unprocessed,** and **Other**.

Methods: The number of unique species sold as a type of processed product are counted for each processor and summarized as the mean or median. Processed product types are defined as any product type other than unprocessed. The total number of species processed represents the total number of unique species processed across processors.

Caveats: The product type **Fresh** (used in 2009–10) was renamed **Processed Fresh** from 2011 onward; this may have influenced what respondents include in this category (e.g., whole round unprocessed products may have been included under **Fresh** in 2009–10). It is counted as a processed product type for this metric. This metric does not consider the amount of product or product value generated by each species. For instance, if 90% of a processor’s processed products are whiting and 10% are rockfish, the number of species processed would still be two. The EDC form requests production information for 24 species/species groups (see [Fishery and Production Activity Designations](#) for full list), so the total number of species sold is subject to these groupings and therefore the maximum value is 24. This information is not reported for catcher–processors or motherships, because they only process one species.

Number of species sold

Applicable Sectors: P.

Purpose: The number of species sold offers insight into the production activities and product diversification of processors.

Data: EDC forms require processors to report production revenue by species. [Fishery and Production Activity Designations](#) describes the list of species requested on the EDC forms.

Methods: The number of species sold is counted for each processor and summarized as the mean or median. The total number of species sold represents the total number of unique species sold across processors. Unlike **Number of species processed**, this metric includes all seafood products, processed or unprocessed.

Caveats: This metric does not consider the amount of product or product value generated by each species. The EDC form requests production information for 24 species/species groups (see [Fishery and Production Activity Designations](#) for full list), so the total number of species sold is subject to these groupings and therefore the maximum value is 24. The EDC form requests processors report production for all products made or acquired in that fiscal year, not necessarily sold; therefore, inventories from previous years are not included, while products held in inventory at the end of the fiscal year to be sold at a later date are included.

Proportion of production value from groundfish

Applicable Sectors: P.

Purpose: This is a measure of dependence on groundfish species, including whiting, for overall processor production revenue.

Data: EDC forms require processors to report production revenue by species. Fishery and Production Activity Designations describes the list of species requested on the EDC forms.

Methods: Production value for all groundfish species (including whiting) is compared to the total production value for all species. Proportions are calculated per processor and summarized as processor averages (mean, Equation 3, and median). Proportions are also calculated for the overall sector, by summing the numerator and denominator across all processors (total, Equation 4).

$$\begin{aligned} \text{Mean} &= \frac{1}{N} \sum_{i=1}^N p_i, \\ p_i &= \frac{\sum_{s \in G} \text{Rev}_{is}}{\sum_{s \in L} \text{Rev}_{is}}. \end{aligned} \tag{3}$$

where G = set of all groundfish species groups, including whiting, listed on EDC form, and L = set of all species groups listed on EDC form, including all groundfish species.

$$\text{Total} = \frac{\sum_{i=1}^N \sum_{s \in G} \text{Rev}_{is}}{\sum_{i=1}^N \sum_{s \in L} \text{Rev}_{is}}. \tag{4}$$

Caveats: The production value for groundfish species may include groundfish from fisheries outside the catch share program (i.e., open access, limited entry fixed gear, primary sablefish, and tribal); however, the average volume of non-catch share groundfish purchases is small relative to catch share purchases (7% of purchase volumes on average from 2009 to 2018; PFMC and NMFS 2017, 3.1). The total production value includes production of all seafood, including shellfish, aquaculture, and imported products.

Number of processors that fillet non-whiting groundfish

Applicable Sectors: P.

Purpose: This metric tracks the number of processors that fillet non-whiting groundfish as an indicator of potential changes in groundfish processing operations.

Data: Beginning in 2017, the EDC forms required processors to report if the facility filleted non-whiting groundfish.

Methods: Count of the number of processors that report that their operation fillets non-whiting groundfish. This metric is only presented as a total.

Caveats: The EDC form only requires processors to report whether a facility does or does not fillet some non-whiting groundfish species. This metric is not able to detect changes in which species are filleted, the quantity that is filleted, or what portion of filleted groundfish is sold as fresh or frozen. Changes in this metric can be the result of changes made within processors or changes in the composition of processors participating. This metric is not available prior to 2017.

Labor Metrics

Captain and crew are vital components of any fishery, but are often overlooked due to a lack of data. In addition, little is known about those employed at fish processing facilities; jobs which were also expected to be impacted by catch shares. To track potential changes, the EDC forms request information about captain and crew compensation, the crew share system (share percentages and the cost categories deducted from ex-vessel revenue before applying percentages), the number of crew for a particular fishery, and the number of individuals employed by the vessel. This is also one of the few surveys that collect data about processing labor. Fisheye contains a number of metrics to track crew compensation and employment. For more information and findings about crew, please refer to Steiner et al. (2019). There are two purposes for reporting labor information. The first is to report on the welfare of crew (and allows a comprehensive analysis of how much individuals work, what share of revenues they earn, and how much they earn). The second is to report crew and captain compensation costs as inputs to fishing/processing operations (see [Cost Metrics](#)).

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher- processor (CP)	Processor (P)
Number of positions				
Number of crew	✓			
Number of processing crew		✓	✓	
Number of non-processing crew		✓	✓	
Number of crew-days	✓			
Number of processing crew-days		✓	✓	
Number of non-processing crew-days		✓	✓	
Number of non-production employees				✓
Average monthly number of production employees				✓
Maximum monthly number of production employees				✓
Labor payments				
Crew payments	✓			
Processing crew payments		✓	✓	
Non-processing crew payments		✓	✓	
Production employee payments				✓
Non-production employee payments				✓
Labor productivity				
Revenue per crew-day	✓			

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Wage rates				
Hourly compensation per production employee				✓
Annual compensation per non-production employee				✓
Captain wage per year	✓			
Crew wage per year	✓			
Processing crew wage per year		✓	✓	
Non-processing crew wage per year		✓	✓	
Captain wage per day	✓			
Crew wage per day	✓			
Processing crew wage per day		✓	✓	
Non-processing crew wage per day		✓	✓	
Captain wage per dollar revenue	✓			
Crew wage per dollar revenue	✓			
Processing crew wage per dollar revenue		✓	✓	
Non-processing crew wage per dollar revenue		✓	✓	
Processing wage per value-added				✓

Number of positions

Number of positions and position-days

Metrics included: **Number of crew, Number of processing crew, Number of non-processing crew, Number of crew-days, Number of processing crew-days, Number of non-processing crew-days.**
Applicable Sectors: CV/MS/CP.

Purpose: Catch share programs are expected to reduce the number of vessels in the fishery, resulting in less effort and fewer jobs. The total number of crew is reported to monitor these expected impacts, and the number of crew-days provides a measure of effort (PFMC and NMFS 2017, 3.1.2(a)(3)).

Data: The EDC forms request the number of days fishing and number of crew positions (crew) by fishery for catcher vessels. Catcher-processors and motherships are required to report the average number of processing crew members and non-processing crew members when operating in the U.S. West Coast whiting fishery. Processing crew includes: line workers, fishmeal crew, quality control, technicians, cleanup, factory managers, mechanics who work on processing equipment, and combis. Non-processing crew includes: captain, deckhands, wheelhouse, galley, and engine room. Catcher-processors and motherships are also required to report the number of days for offloading, steaming, fishing, and/or processing on the U.S. West Coast, steaming between the U.S. West Coast and Alaska, and days at sea for all Alaska fisheries.

Methods: For catcher vessels, the number of crew and crew-days are reported by fishery. For catcher-processors and motherships, we report the number of non-processing and processing crew and crew-days. Crew-days are calculated by multiplying the number of crew for a specific fishery by the number of days fished in that fishery. Data are summarized as vessel averages (mean and median) and fleetwide totals.

Caveats: The number of crew is a lower-bound estimate of the number of individuals employed as crew. As reported here, it represents the number of positions on the vessel, excluding captain, and does not take into account turnover or multiple individuals that may fill one position.

Number of shorebased processor employees

Metrics included: **Number of non-production employees, Average monthly number of production employees, Maximum monthly number of production employees.**

Applicable Sectors: P.

Purpose: Monitoring the number of employees at shorebased processors provides information about the number of processing jobs (PFMC and NMFS 2017, 3.1.2(a)(D)).

Data: The EDC forms request information about the number of production and non-production employees. This information includes full and part-time employees, contract workers, and temporary employees. A production employee is defined as a worker (up through and including the line supervisor level) engaged in fabricating, processing, assembling, inspecting, receiving, packing, warehousing, shipping, maintenance, repair, janitorial, product development, or transporting product on-site. A non-production employee is defined as one involved in supervision above the line supervisor level as well as sales, advertising, credit, collection, installation, cafeteria, recordkeeping, clerical and routine office functions, guard services, executive, purchasing, finance, and legal. For production employees, the EDC form collects the number of production employees and total hours worked for the week that contains the 12th of each month, to capture a weekly snapshot of employment that is assumed to be representative for each month throughout the year. For non-production employees, the EDC form asks for the number of employees and total hours worked for the week that includes 12 March, as non-production employment is assumed to be relatively stable throughout the year.⁷

Methods: The following metrics are reported for shorebased processor employee numbers:

- **Number of non-production employees:** Number of non-production employees the week of 12 March, assumed to be representative of the year. This metric is reported for the average processor (mean and median) and for the sector as a whole (total).
- **Average monthly number of production employees:** For each processor, the mean of the number of production workers in each month (as represented by the week of the 12th of each month) is calculated. Data are summarized as processor averages (mean and median) and sectorwide totals. The total represents a sum of the workers employed in an average month across the year for all processors.
- **Maximum monthly number of production employees:** For each processor, the maximum number of production workers of all months (as represented by the week of the 12th of each month) is calculated. Data are summarized as processor averages (mean and median). The total is not calculated.

⁷This approach follows the one used in the U.S. Census Bureau's Annual Survey of Manufacturers.

Caveats: There are several limitations to the methods. Given that the data are collected for specific weeks of the year, it may be that a given week is not representative of labor throughout the month and/or year. The number of employees is a lower-bound estimate of the number of individuals employed at processing facilities. As reported here, it represents the number of positions, and does not take into account turnover or multiple individuals that may fill one position over the year. For the sector total average monthly number of production employees, the total is a sum of the number of employees in an average month for each processor; therefore, it may not represent the actual total number of production employees working at any point in the year. If companies have a wide range of employment across months due to seasonality, the average may not be representative of any specific month.

Fisheye: These metrics are only reported for the production activity **All production**, as information on number of employees is not requested by species group on the processor EDC form given the potential difficulty of such reporting.

Compensation

Labor payments

Metrics included: **Crew payments, Processing crew payments, Non-processing crew payments, Production employee payments, Non-production employee payments.**

Applicable Sectors: CV/MS/CP/P.

Purpose: Labor is one of the highest variable costs incurred by fishing and processing operations. Cost Metrics reports on total labor payments, whereas the labor payments metrics provide total payments made by labor category.

Data: The EDC forms request information about compensation to individuals on vessels or at shorebased processors. See **Number of positions and position-days** for full description of the individual labor categories. See the table at the top of this section for a list of which labor categories apply to which sectors. Labor payments include wages, bonuses, benefits, payroll taxes, and unemployment insurance.

Methods: Labor payments are summarized as reported on the EDC form: crew and captain payments are reported for catcher vessels; processing crew and non-processing crew are reported for motherships and catcher-processors; production employees and non-production employees are reported for processors. Data are reported as vessel/processor averages (mean and median) and fleetwide/sectorwide totals.

Caveats: Crew/employee payments represent total crew/employee payments, whereas wage rates (as described below) summarize compensation per crewmember/employee.

Fisheye: Shorebased processor production employee payments and non-production employee payments are only reported for the production activity **All production**.

Shorebased processor employee wage rates

Metrics included: **Hourly compensation per production employee, Annual compensation per non-production employee.**

Applicable Sectors: P.

Purpose: To understand processing employee compensation, it is helpful to summarize overall compensation per unit. These metrics provide estimates of compensation per employee for both production and non-production employees of shorebased processors.

Data: The EDC forms request information about the number of production and non-production employees and hours worked, as well as total annual labor expenses by type of employee. For production employees, the EDC form collects the number of production workers and total hours worked for the week that contains the 12th of each month, to capture a snapshot of weekly employment. The week that contains the 12th of each month is assumed to be representative of each week in a given month throughout the year. For non-production employees, the EDC form asks for the number of employees and total hours worked for the week that includes the 12th of March, as non-production employment is assumed to be relatively stable throughout the year.

Methods: The following metrics are reported to summarize compensation and wage rates for shorebased processor employees:

- **Hourly compensation per production employee:** Average hourly compensation for production workers is calculated by dividing annual labor expenses by an estimate of total annual hours worked. Estimates of total annual hours worked for each processor are calculated by assuming that employment information for the week of the 12th is representative of the entire month, and by weighting each month equally using the formula below. This metric is reported as processor averages (mean and median). Total statistics are also reported, and represent weighted averages.

$$\sum_{m=1}^{12} \left(\frac{\text{hours}}{\text{week}} \right)_m \times \frac{52}{12}. \quad (5)$$

- **Annual compensation per non-production employee:** Compensation per non-production employee position is calculated by dividing annual labor expenses by the number of non-production employees in the week containing 12 March, assumed to be representative of the number of positions in all weeks during the year. This metric is reported as processor averages (mean and median); total statistics are not reported.

Caveats: To measure annual hours worked, the form asks for the total hours worked by production employees within one week (the week of the 12th) for each month in the year. There are some limitations to this approach, as the given week may not be representative of labor throughout the month. Additionally, each employee is assumed to be compensated equally where, in reality, wage rates may differ by employee. The EDC survey asks for total compensation, which includes wages, bonuses, benefits (including housing), payroll taxes, unemployment insurance, and other forms of compensation; therefore, the wage rates reported also include these forms of compensation.

Fisheye: These metrics are only reported for the production activity **All production**, as information on number of employees and hours worked is not requested by species group on the processor EDC form, given the potential difficulty of such reporting.

Vessel wage rates

Metrics included: **Captain wage per year, Crew wage per year, Processing crew wage per year, Non-processing crew wage per year, Captain wage per day, Crew wage per day, Processing crew wage per day, Non-processing crew wage per day, Captain wage per dollar revenue, Crew wage per dollar revenue, Processing crew wage per dollar revenue, Non-processing crew wage per dollar revenue.**

Applicable Sectors: CV/MS/CP.

Purpose: To understand captain and crew compensation, it is helpful to summarize overall compensation per unit, e.g., per year, per day, or per dollar of revenue. For instance, crew wage per year is a measure of annual compensation, while crew wage per dollar of revenue is the effective crew share, independent of the share system itself. Crew wage per day provides a standardized rate to compare across operations, because vessels do not operate under a typical 2,080-hour work year.

Data: The EDC forms request information about the total compensation to captain and crew, as well as two pieces of information about the crew share system (costs deducted from ex-vessel revenue and share percentage paid to crew and captain) for catcher vessels. The EDC forms also request the number of days fishing and number of crew by fishery for catcher vessels, and total days spent fishing, steaming, and processing in the U.S. West Coast fishery for motherships and catcher-processors. Ex-vessel revenue is obtained from fish ticket data maintained by PacFIN; at-sea revenue and production value are obtained from the EDC forms. See **Number of positions and position-days** for full description of the individual labor categories.

Methods: For catcher vessels, the following methods are used for captain and crew, and for catcher-processors and motherships the same methods are applied to both processing and non-processing crew.

- **Wage per year:** Total compensation/number of positions.
- **Wage per day:** Wage per year/number of days fishing.
- **Wage per dollar revenue:** Wage per year/ex-vessel revenue.

Crew rates are summarized as vessel averages (mean and median). Total statistics are also reported, and represent weighted averages. For example, total crew wage per day is calculated as the sum of crew wages for all vessels divided by the sum of days at sea for all vessels.

See [Cost Metrics](#) for a description of cost allocation for crew and captain wages.

Caveats: Crew wage statistics are based on the number of crew positions, which is a lower-bound estimate for the actual number of individuals employed and does not account for turnover. Each crewmember is assumed to be compensated equally. This is also a limitation,

because we expect crew with more experience to be paid more. The measure of wage per day likely overestimates the wage per unit effort, because the time spent in shorebased activities such as vessel repairs or bait preparation is not included in the denominator. Lastly, annual crew compensation does not necessarily reflect the total personal income for a given crew member, who may fish on additional vessels or have non-fishing employment.

Processing wage per value-added

Applicable Sectors: P.

Purpose: This metric measures return on employee compensation by calculating the proportion of earnings from fish sales that is used to compensate production employees. This demonstrates how the economic inputs of labor are converted into processor value-added. This ratio can be used as an indicator of potentially changing profit margins for processors; if value-added rises, but compensation costs rise more, the ratio will rise, which, all other things equal, likely indicates declining processor profit margins. Selling highly processed products that require extensive skilled labor may increase the value-added, but may also require that a greater proportion of the markup be dedicated to employee compensation. When this ratio decreases, it suggests that either the company has increased its value-added without increasing labor costs, or has found a way to be more efficient with labor.

Data: This metric is calculated using data provided by processors on EDC forms, including total compensation for production employees, total value of fish production, total cost of fish purchases, custom processing expenses paid by a processor, and total revenue earned by custom processing fish owned by other entities.

Methods: The numerator of this ratio is total production employee compensation, taken directly from EDC forms. The denominator of the ratio is value-added, which is calculated by subtracting the cost of all fish purchases from the revenue of all fish production, adjusted for custom processing activities. In this calculation, custom processing values are included, as revenue earned for custom processing fish that is owned by other entities would not be possible without the labor that is included in the numerator. Furthermore, any expenses paid to other companies who custom process fish for a processor would result in fish production revenue without labor expenses, so custom processing expenses must be taken into consideration. This metric is reported as processor averages (mean and median). Total statistics are also reported, and represent weighted averages.

$$\text{Ratio} = \text{Total production employee compensation} / [(\text{fish production revenue} + \text{custom processing earnings}) - (\text{fish purchase cost} + \text{custom processing expenses})]$$

Caveats: As mentioned under **Number of shorebased processor employees**, production employees include employees in a variety of roles, many of which do not directly impact the net value of fish purchases and production.

Fisheye: This metric is only reported for the production activity **All production**.

Labor productivity

Revenue per crew-day

Applicable Sectors: CV/MS/CP.

Purpose: This metric is a measure of productivity (in terms of revenue generation) of crew. Productivity is related to economic efficiency and shows how economic inputs are converted to outputs. In this case, we measure labor productivity, where the inputs are the number of crew and days fishing, and the output is ex-vessel revenue.

Data: The EDC forms request the number of days fishing and number of crew by fishery. Ex-vessel revenue is obtained from fish tickets maintained by PacFIN, and Alaska/at-sea revenue and production value from the EDC forms.

Methods: This metric is calculated by dividing ex-vessel revenue by the number of crew-days; where crew-days are calculated by multiplying the number of crew for a specific fishery by the number of days fished in that fishery. This metric is reported as vessel averages (mean and median), as well as fleetwide totals. Total revenue per crew-day is a weighted average, and is calculated as total revenue across all vessels divided by total number of crew-days across all vessels.

Caveats: This metric should be interpreted as labor productivity in terms of revenue generation, and not productivity in general or total factor productivity. Other measures of productivity would involve additional inputs and outputs.

Cost Metrics

In Fisheye, costs are categorized as fixed costs and variable costs. Variable costs vary with the level of fishing/processing, and include items such as fuel and labor payments, whereas fixed costs do not vary directly with the level of fishing/processing, and include items such as vessel (or processor) capital improvements. We report total costs for all **Fixed costs** or all **Variable costs**, and also report costs by category, where possible. Some cost categories do not have enough observations to be reported individually, and are grouped together in either **Other fixed costs** or **Other variable costs**.

Finally, there are a variety of costs that are associated with running a catcher vessel or operating a shorebased processor that are not requested on the form because it is difficult to determine the share of the cost associated with the specific operations. These costs include items that can be used for activities other than fishing/processing, or are too difficult to allocate to a particular vessel/facility in a multi-operation company. For vessels, these expenses include office space, pickup trucks, storage of equipment, professional fees, and marketing. For processors, common costs that are not collected are trucks and professional fees. For these reasons, the EDC Program's aggregated measures of costs (variable costs, fixed costs, and total costs) underestimate the true costs of operating a business.

The costs and earnings associated with quota are not currently included in these calculations. A separate technical memorandum will detail the flow of costs and earnings related to quota and the impacts on profitability.

All cost metrics are summarized as a fleetwide (or sectorwide) total, mean, or median per vessel or processor (PFMC and NMFS 2017, 3.1.2(a)(1)). In addition, cost metrics are summarized as rates. For vessels, costs are summarized per day, per metric ton caught (or in the case of motherships, metric ton purchased), and per dollar of revenue; and for motherships and catcher-processors, per metric ton produced. For processors, costs are summarized per dollar of revenue and per metric ton produced.

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Fixed costs				
Fishing gear	✓	✓	✓	
On-board equipment	✓	✓	✓	
Processing equipment	*	✓	✓	
Buildings				✓
Equipment				✓
Other fixed costs	✓	✓	✓	✓
Variable costs				
Labor	✓	✓	✓	✓
Fish purchases		✓		✓
Fuel	✓	✓	✓	
Observers/Electronic monitoring	✓	✓	✓	
Shoreside monitoring				✓
Buyback fees	✓			
Cost recovery fees	✓			
Additives				✓
Electricity				✓
Freight and trucking				✓
Gas				✓
Offloading				✓
Offsite freezing and storage				✓
Packing materials				✓
Production supplies				✓
Taxes				✓
Waste and byproduct disposal				✓
Water				✓
Other variable costs	✓	✓	✓	✓

* Processing equipment is included in On-board equipment for catcher vessels.

Fixed costs

Fishing gear

Applicable Sectors: CV/MS/CP.

Purpose: Fishing gear is a major fixed cost incurred by vessels.

Data: The EDC forms request fishing gear costs for fishing gear used in both U.S. West Coast, Alaska, and other fisheries, and fishing gear used only on the U.S. West Coast. In the context of the EDC Program, fishing gear includes the purchases of nets, doors, traps, pots, cables, and fishing machinery used in U.S. West Coast fisheries, as well as repairs or maintenance of the fishing gear. Fishing gear that is only used in Alaska is not requested.

Methods: Fisheye reports one metric for fishing gear expenses. Fishing gear used in all fisheries and fishing gear used only on the U.S. West Coast are added together after costs are allocated to individual fisheries based on the proportion of revenue in each fishery, annually.

Caveats: Some vessels do not track fishing gear expenses separately from vessel and on-board equipment costs; therefore, this metric may underestimate fishing gear costs. Fishing gear expenses are different from other costs like fuel or safety equipment, which are likely used for all vessel activities, as fishing gear is likely purchased for a single specific fishery. Data are not available at the fishery level, so costs are allocated proportionally across fisheries. This does result in a misallocation of costs associated with fishery-specific gear.

On-board equipment

Applicable Sectors: CV/MS/CP.

Purpose: Vessel and on-board equipment is a major fixed cost incurred by vessels.

Data: The EDC forms request vessel and on-board equipment costs used in U.S. West Coast, Alaska, and other fisheries. In the context of the EDC Program, vessel and on-board equipment costs include the purchases of electronics, safety equipment, and machinery not used to harvest or process fish, as well as major upgrades, repairs, or maintenance to the vessel or equipment.

Methods: Respondents do not provide costs broken out by fishery on the EDC forms. The following cost allocation methods are used to report costs by fishery on Fisheye. For catcher vessels, costs are allocated to fisheries according to the annual proportion of ex-vessel revenue in each fishery. For motherships and catcher-processors, a five-year rolling average of total purchases/catch is used to allocate the costs between U.S. West Coast and Alaska fishing operations. The average proportion is used for motherships and catcher-processors because the proportions can vary greatly by year (depending on the TAC) and would result in large artificial swings in the allocation of fixed costs and, indirectly, swings in total cost net revenue.

Caveats: Some vessels do not track fishing gear expenses separately from vessel and on-board equipment costs, such that those costs are included in equipment costs; therefore, this metric may overestimate vessel and on-board equipment costs. While the EDC form requests that the purchase of a vessel be included in vessel and on-board equipment costs, this metric excludes vessel purchases in order to provide a better per-vessel annual cost estimate. For catcher vessels, processing equipment is also included in on-board equipment. Processing equipment is reported separately for motherships and catcher-processors.

Processing equipment

Applicable Sectors: MS/CP.

Purpose: For motherships and catcher-processors, processing equipment is a major fixed cost, and is therefore presented separately.

Data: EDC forms request that motherships and catcher-processors report costs for processing equipment used only on the U.S. West Coast and for equipment shared by U.S. West Coast and all other fisheries. In the context of the EDC forms, processing equipment includes on-board freezers, storage equipment, packing equipment, conveyors, and on-board cargo handling, and does not include equipment, machines, or buildings based primarily on shore. While the EDC forms also request that catcher vessels report any processing equipment used to process or head and gut the fish on board, **Processing equipment** costs are included in **On-board equipment** for these vessels because there are so few responses that all of them would be suppressed for confidentiality purposes.

Method: Fisheye reports one metric for processing equipment expenses. Equipment used in all fisheries and equipment used only on the U.S. West Coast are added together after costs are allocated to individual fisheries based on the purchase weight (motherships) or proportion of catch (catcher-processors) on the U.S. West Coast, annually. For motherships and catcher-processors, a five-year rolling average of total purchases/catch is used to allocate the costs between U.S. West Coast and Alaska fishing operations. The average proportion is used for motherships and catcher-processors because the proportions can vary greatly by year depending on the TAC and would result in large artificial swings in the allocation of fixed costs and, indirectly, swings in total cost net revenue.

Caveats: Processing equipment is grouped into vessel and on-board equipment for catcher vessels because so few vessels report that cost category.

Other fixed costs (vessels only)

Applicable Sectors: CV/MS/CP.

Purpose: The **Other fixed costs** category includes insurance, moorage, and lease of vessel.

Data: Each cost category is requested as a separate field on the EDC form.

Methods: Costs are allocated to each fishery according to the proportion of revenue in each fishery. Once allocated, the costs are summed for each vessel before calculating performance metric statistics.

Caveats: Insurance and moorage are paid by almost all vessels; lease costs are rare.

Shorebased processing-related fixed costs

Metrics included: **Buildings, Equipment, Other fixed costs.**

Applicable Sectors: P.

Purpose: Fixed costs incurred by processors do not vary with the level of fish production at facilities and generally include items such as plant facility costs and processing equipment.

Data: The EDC forms collect information on fixed costs associated with operating a shorebased processor, and each cost category is requested as a separate field. This includes capitalized expenditures on buildings, machinery, and equipment, as well as annual expenses on rental and lease payments and repair and maintenance. Only equipment used to process, transport, or store fish onsite should be included. Processing equipment is defined as all equipment present at this physical location that is used for preparation or packaging of seafood to render it suitable for human consumption, retail sale, industrial uses, or long-term storage, including, but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil. Transportation equipment is defined as equipment such as trucks, forklifts, etc., used to transport seafood within the physical location. Storage equipment is defined as equipment present at the physical location for packaging and freezing seafood. Annual expenses on insurance payments are also included in fixed costs.

Methods: The following metrics are reported to summarize fixed costs incurred by shorebased processors:

- **Buildings:** Capitalized expenditures on buildings (excluding land but including building improvements), and rental or lease of buildings, job-site trailers, and other structures (including land).
- **Equipment:** Capitalized expenditures on new and used machinery and equipment, and rental or lease of processing machinery or equipment.
- **Other fixed costs:** Total expenses on repair and maintenance of facility buildings, machinery, and equipment, and insurance payments (including property, product, personal liability, and fire liability).

All fixed costs are allocated to production activity according to the value added for that species group. Not all processors incur expenses for each cost category listed on the EDC form. Only nonzero values are included in summary statistics, and the number of responses indicates the number of processors with nonzero, non-NA values. Number of processors indicates all processors that meet the criterion for a given set of filters.

Caveats: The EDC forms do not collect information about financing costs of large purchases and investments, but instead collect the capitalized expenditures or total costs associated with the purchases, repair, maintenance, or improvements. For example, if new equipment is purchased, the total cost of the equipment is reported even though the actual cash outlay, if it were financed, would only be the principal and interest payments. 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 reported on Fisheye and used in the context of the EDC Program.

Variable costs

Labor

Applicable Sectors: CV/MS/CP/P.

Purpose: Report the total cost to fishing and processing operations for labor.

Data: The EDC forms request information about the total compensation to individuals on vessels or at shorebased processors. Each sector reports on two categories of compensation, but the categories vary by sector. The two categories for catcher vessels are crew and captain, whereas the categories for motherships, catcher-processors, and shorebased processors are processing and non-processing workers.

Method: The two compensation categories are added together to report total labor costs for each sector. The metrics included in [Labor Metrics](#) provide more detailed information about the individual labor categories. Processor labor costs are allocated to production activity according to the value added for that species group.

Caveats: All catcher vessels in the catch share program use a crew share system to calculate wages (Steiner et al. 2019). The typical share system is based on a contract where wage is calculated as “crew share net revenue” times the crew share percentage (typically 10–15% per crew member). Crew share net revenue is the ex-vessel revenue received by the vessel minus certain costs. Just as with all other cost categories, EDC participants report total crew wages. In order to report fishery-level wages, total wages are allocated to fisheries by calculating the proportion of “crew share net revenue” in each fishery. Some motherships and catcher-processors use a crew share system, but shorebased processors have never reported using any sort of revenue share system.

Fish purchases

Applicable Sectors: MS/P.

Purpose: Fish purchases are the single highest variable cost incurred by motherships and shorebased processors.

Data: EDC forms request the total cost of fish purchases by species, which for motherships includes only Pacific whiting. The list of species available for shorebased processors can be found in [Fishery and Production Activity Designations](#).

Method: Cost of fish purchases is reported by species group and source for shorebased processors (Pacific whiting for motherships). Sources include both vessels as well as non-vessel sources like other processors, first receivers, wholesale dealers, or aquaculture producers.

Caveats: Although mothership vessels bring non-whiting species on board, the volume is very low and only whiting costs are reported on the EDC forms.

Fuel

Applicable Sectors: CV/MS/CP.

Purpose: Fuel is always one of the three highest variable costs incurred by vessels.

Data: EDC forms request vessels to report fuel and lubrication costs for all activities on the U.S. West Coast. Vessels are instructed not to include fuel costs for steaming between the U.S. West Coast and Alaska.

Method: Fuel and lubrication costs for catcher vessels are reported by fishery, and for all U.S. West Coast activities combined for motherships and catcher-processors. Unlike other metrics that use days, revenue, or landings to allocate costs, fuel and lubrication costs are allocated by total gallons used per fishery. Gallons are calculated by multiplying the average fuel use per day by fishery and days at sea by fishery for each vessel. See the metric descriptions for **Days at sea** and **Fuel use per day** in [Other Metrics](#) for more information.

Caveats: Changes in fuel costs are the result of fishing conditions, fishing locations, technological change, and global fuel prices.

Observers/Electronic monitoring

Applicable Sectors: CV/MS/CP.

Purpose: The catch share program requires 100% observer coverage for all at-sea and shorebased catcher vessels (PFMC and NMFS 2017, 3.4.2(a)(2)). While motherships and catcher-processors have had 100% (or near-100%) coverage since the mid-1970s, catcher vessels had only 14–24% coverage beginning in 2001, until transitioning to 100% with the catch share program (Somers et al. 2017b). To reduce the immediate burden of this cost on industry, NMFS subsidized daily observer coverage fees for catcher vessels; the subsidy gradually decreased from \$330 to \$0 between 2011 and 2016 (Warlick et al. 2018). Costs such as observer coverage fees, which were introduced with catch shares, were expected to contribute to consolidation and a decrease in profits (Lian et al. 2009). In response to concerns about the cost to industry for observer coverage, electronic monitoring (EM) was introduced as an alternative to observer coverage for catcher vessels. Observer costs are presented to track this new cost in the fishery, particularly per dollar revenue and per day.

Data: The EDC form requests that vessels report observer and/or EM costs associated with fishing on the U.S. West Coast.

Methods: This metric captures both observer and EM costs. Both costs are allocated to fishery by the proportion of days at sea in each fishery. Other U.S. West Coast fisheries do not require observers, and are therefore not allocated observer costs.

Caveats: Electronic monitoring was piloted through the Exempted Fishing Permit (EFP) program beginning in 2015. 34% of shorebased whiting vessels used EM in 2015, and 42% in 2016 (PFMC and NMFS 2017, 3.4.2(a)(2)). In 2019, the Pacific Fishery Management Council (PFMC) recommended that EM be an option for all midwater trawl vessels in the Pacific whiting fishery and for fixed gear vessels in the Individual Fishing Quota (IFQ) fishery beginning in 2021. In 2020, PFMC requested a one-year delay in implementation to develop a mechanism for industry to fund the program. EM fees are structured differently than observer fees. As of 2020, vessels are typically charged a daily rate for observers, whereas for EM there is an initial installation fee, and annual service contracts for technical support and ongoing maintenance estimated at \$5,000–\$6,000—though some vessels may buy the equipment outright. Additionally, some vessels initially received grants from the Pacific States Marine Fisheries Commission for EM hardware procurement, which brought the total and averages down as those costs were not reported to the EDC Program. We are unable to report observer and EM costs separately due to confidentiality issues.

Shoreside monitoring

Applicable Sectors: P.

Purpose: Just as vessels are required to host observers or use electronic monitoring, the catch share program requires 100% catch monitoring coverage, such that shorebased buyers must have a catch monitor to buy fish caught as part of the catch share program (PFMC and NMFS 2017, 3.4.2(a)(2)). To reduce the immediate burden of this cost on industry, NMFS subsidized the cost of catch monitors at \$41/hr with a maximum of \$328/day in 2011 and 2012. This subsidy decreased to \$27/hr and \$216/day in 2014, and \$108/day in 2015. From 2016 onward, first receivers have been required to pay the full cost of monitoring.

Data: The EDC form asks processors to report annual total expenditures on catch monitors.

Method: Monitoring costs are allocated to production activity (Pacific whiting or non-whiting groundfish production) by fish purchase weight. Receipt of other species does not require catch monitoring; therefore, no monitoring costs are allocated to other species production.

Caveat: There are nonzero values of shoreside monitoring costs prior to catch shares for Pacific whiting activities. In 2009 and 2010, all deliveries of Pacific whiting to a shorebased first receiver were verified by catch monitors, funded entirely by industry.

Buyback fees

Applicable Sectors: CV.

Purpose: In 2003, 91 vessels fishing in the U.S. West Coast groundfish trawl fishery were purchased through a buyback program to reduce capacity in the fishery. The buyback was financed through a government loan, which continues to be paid back by a 4–5% landings fee on groundfish caught in the catch share program (Holland et al. 2017). Landings fees for crab and shrimp were also initiated to pay for the purchase of crab and shrimp permits associated with the buyback vessels.

Data: Buyback fees are calculated using ex-vessel revenue from fish tickets maintained by PacFIN.

Method: Buyback fees are calculated as a percentage of ex-vessel revenue. Table 3 describes buyback fees by year, state, and fishery group. Each fishery was allocated a share of the initial loan amount. Once the fishery has repaid its portion, the buyback fee is reduced to zero.

Table 3. Buyback fees as a percentage of ex-vessel revenue, by year (or range of years) and fishery group.

Fishery group	2005–07	2008–12	2013–14	2015–16	2017	2018	2019
Groundfish species	5.00%	5.00%	5.00%	5.00%	5.00%	4.50%	4.00%
California crab	1.24%	1.24%	—	—	—	—	—
Oregon crab	0.55%	0.55%	0.55%	—	—	—	—
Washington crab	0.17%	0.17%	0.17%	0.17%	0.17%	—	—
California shrimp	5.00%	5.00%	5.00%	5.00%	—	—	—
Oregon shrimp	3.75%	4.70%	—	—	—	—	—

Caveats: Each sector was responsible for paying back a certain portion of the original loan. Dashes in the table above indicate when the loan portion was repaid.

Cost recovery fees

Applicable Sectors: CV/CP.

Purpose: Cost recovery fees are a new cost associated with the transition to catch share management. In 2014, NOAA Fisheries initiated the collection of cost recovery fees—not to exceed 3% of ex-vessel revenue in a given year—from all shorebased and at-sea participants in the catch share fishery, as required under the MSA (Warlick et al. 2018).

Data: Cost recovery fees are calculated using ex-vessel revenue from fish tickets maintained by PacFIN. Cost recovery rates are determined annually and published in the Federal Register.

Method: Cost recovery fees are calculated as a percentage of ex-vessel revenue. According to the Federal Register, cost recovery fees range from 2.88% to 3.00% for shoreside landings; 0% to 2.50% for motherships; and 0% to 1.10% for catcher–processors.

Caveats: There are many years when catcher-processors and catcher vessels in the mothership fishery are not required to pay cost recovery fees because the fees collected in a previous year exceeded the direct program costs for the year of the collection.

Other variable costs (vessels only)

Applicable Sectors: CV/MS/CP.

Purpose: The categories included in **Other variable costs** vary by vessel type:

- **Catcher vessels:** Communications, fishing association dues, freight, ice, offloading, supplies, travel, trucking of fish, license fees, bait, and food.
- **Catcher-processors:** Additives, communications, cooperative fees, food, freight, marine stewardship council fees, offloading, supplies, packaging, Sea State fees, travel, and lease of co-op shares.
- **Motherships:** Additives, communications, cooperative fees, food, freight, packaging, offloading, supplies, and travel.

Data: Each cost category is requested as a separate field on the EDC form.

Methods: For catcher vessels, communications, food, ice, and other supplies are allocated to individual fisheries by days at sea. Bait, offloading fees, and trucking are allocated by delivery weight. Fishing association, travel, and license fees are allocated by ex-vessel revenue. Once allocated, the categories are summed for each vessel before calculating performance metric statistics.

Caveats: Not all vessels incur all cost categories in the **Other variable costs** category.

Other shorebased processing-related variable costs

Metrics included: Additives, Electricity, Freight and trucking, Gas, Offloading, Offsite freezing and storage, Packing materials, Production supplies, Taxes, Waste and byproduct disposal, Water, Other variable costs.

Applicable Sectors: P.

Purpose: Variable costs incurred by processors vary with the level of fish production at facilities, and generally include items such as production and cleaning supplies, additives, and utilities. Labor, fish purchases, and shoreside monitoring costs are also variable costs collected on the EDC form; they are described separately, under the metrics **Labor**, **Fish purchases**, and **Shoreside monitoring**.

Data: The EDC forms collect information on variable costs associated with operating a shorebased processor. Each cost category is requested as a separate field, although some cost categories are combined for reporting. In general, the EDC forms aim to collect costs that are directly related to facility maintenance and processing operations and not costs that are related to activities or equipment beyond the facility (one exception is **Offsite freezing and storage**).

Methods: The following metrics summarize variable costs incurred by shorebased processors:

- **Additives:** Expenses on additives and non-fish ingredients. Additive costs are allocated to production activity proportional to the value added for the associated species group.
- **Electricity:** Utility expenses on electricity. Electricity costs are allocated to production activity proportional to the fish input weight of the associated species group.
- **Freight and trucking:** This metric combines two cost categories on the EDC form: freight costs for supplies (excluding fish) delivered to the facility, and trucking of fish to the facility. Freight and trucking costs are allocated to production activity proportional to the value added for the associated species group. Outbound freight and trucking costs are not included on the EDC forms.
- **Gas:** This metric combines three cost categories on the form: natural gas, propane gas for transportation and processing, and other gas (not gasoline). Natural gas costs are allocated to production activity proportional to the fish input weight of the associated species group. Propane gas costs are allocated to production activity proportional to the value added for the associated species group. Other gas costs are allocated to production activity proportional to the fish output weight of the associated species group.
- **Offloading:** Offloading expenses paid to other facilities for their services. Offloading costs are allocated to production activity proportional to the fish input weight of the associated species group.
- **Offsite freezing and storage:** Expenses on offsite product freezing and storage. It is the only cost category related to activities beyond the facility. Offsite freezing and storage costs are allocated to production activity proportional to the value added for the associated species group.
- **Packing materials:** Expenses on packing materials. Packing material costs are allocated to production activity proportional to the value added for the associated species group.
- **Production supplies:** Expenses on production supplies, including boots, smocks, hairnets, and knives. Production supply costs are allocated to production activity proportional to the value added for the associated species group.
- **Taxes:** Expenses on taxes, including property or excise taxes. Tax costs are allocated to production activity proportional to the fish output weight of the associated species group.
- **Waste and byproduct disposal:** Expenses on sewer, waste, and byproduct disposal. Waste and byproduct disposal costs are allocated to production activity proportional to the fish input weight of the associated species group.
- **Water:** Utility expenses on water. Water costs are allocated to production activity proportional to the value added for the associated species group.
- **Other variable costs:** This metric combines all remaining variable costs collected on the EDC form, including licensing fees, cleaning and custodial supplies, and communications and office supplies for the facility, which are all allocated to production activity proportional to the value added for the associated species group. This metric also includes expenses for custom processing of fish owned by a processor that was performed by another processor outside of this facility, which are collected separately for each production activity and therefore are already allocated.

Not all processors incur expenses for each cost category listed on the EDC form. Only nonzero values are included in summary statistics, and the number of responses indicates the number of processors with nonzero, non-**n/a** values. The number of processors indicates all processors that meet the criterion for a given set of filters.

Caveats: Not all cost categories have been present on the EDC form from 2009 to present, as cost categories have been amended and expanded over the years.

Economic Metrics

Economic metrics summarize revenue and costs data reported on EDC forms. The EDC program measures the net economic benefits of the catch share program by summarizing two types of net revenue: variable cost net revenue (VCNR) and total cost net revenue (TCNR; PFMC and NMFS 2017, 3.1.1, 3.1.2; Figure 3). VCNR represents the operating profits—accounting for only the costs of production that vary with the level of activity. TCNR is a representation of cash-flow profitability. EDC forms only capture costs directly related to fishing operations; therefore, net revenue metrics are likely an overestimate of true net revenue for vessels.

All economic metrics are summarized as a fleetwide (or sectorwide) total, mean, or median per vessel (or processor). In addition, economic metrics are summarized as rates. For vessels, metrics are summarized per day and per metric ton caught (or in the case of motherships, metric ton purchased); and for motherships and catcher-processors, per metric ton produced. For processors, metrics are summarized per metric ton produced.

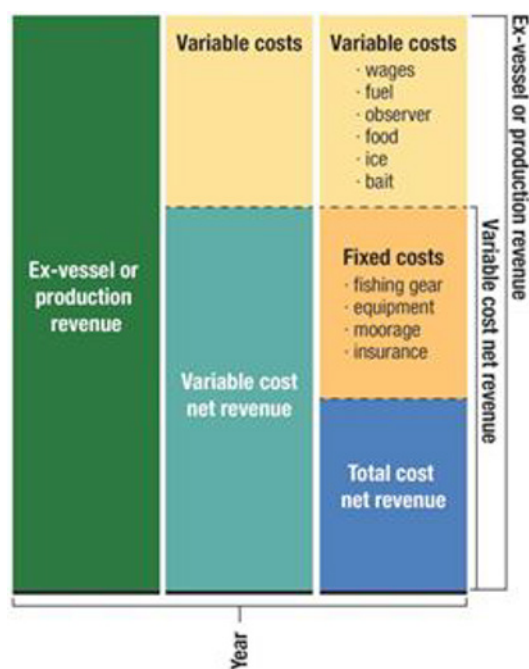


Figure 3. Graphical representation of variable cost net revenue and total cost net revenue relative to variable costs, total costs, and revenue.

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Revenue	✓	✓	✓	✓
Seafood sales revenue*				✓
Offload revenue*				✓
Custom processing and other revenue*				✓
Variable costs	✓	✓	✓	✓
Fixed costs	✓	✓	✓	✓
Variable cost net revenue	✓	✓	✓	✓
Total cost net revenue	✓	✓	✓	✓

*For processors, total **Revenue** is also shown broken out by its components, specifically **Seafood sales revenue**, **Offload revenue**, and **Custom processing and other revenue**.

Revenue

Applicable Sectors: CV/MS/CP/P.

Purpose: This metric captures changes in total harvest volume and ex-vessel prices, as well as changes in total production volume and value for at-sea and shorebased processors.

Data: Ex-vessel revenue is obtained from fish tickets maintained by PacFIN, and Alaska revenue, at-sea ex-vessel revenue, and production value from the EDC forms. EDC forms require shorebased processors to report revenue from seafood sales (by species group and product type) as well as revenue from offloading, custom processing, and insurance settlements. EDC forms for the mothership and catcher–processor sectors include production revenue by product type.

Methods: Ex-vessel revenue is summarized for catcher vessels for all fisheries they participate in. Total production revenue is summarized for motherships and catcher–processors for production in the whiting fishery. Total revenue is summarized for processors and is also reported for the following components of total revenue:

- **Seafood sales revenue:** Total value of fish products that were made or acquired within the survey fiscal year.
- **Offload revenue:** Earnings received for offloading services for others. Offloading revenue is allocated to production activity proportional to the fish input weight for the associated species group.
- **Custom processing and other revenue:** Earnings received for custom processing of fish owned by another processor outside of the facility or received for activities besides seafood sales or offloading, such as ice sales. Revenue from custom processing is collected separately for each production activity and therefore is already allocated. Other revenue is allocated to production activity proportional to the fish input weight for the associated species group.

Not all processors receive earnings from each revenue source listed on the EDC form. Only nonzero values are included in summary statistics, and the number of responses indicates the number of processors with nonzero, non-**n/a** values. The number of processors indicates all processors that meet the criterion for a given set of filters.

Caveats: Fishing revenue and seafood sales represent the majority of revenue for catcher vessels, and motherships and catcher–processors, respectively; however, vessels may also generate revenue from other sources, such as the sale and lease of quota, chartering, or insurance settlements. Currently, other sources of revenue for vessels are not included here. For processors, the EDC form also provides a field to write in any other revenue not specified on the form; however, for analytical consistency across processors, that revenue is not included here. Not all revenue categories have been present on the processor EDC form from 2009 to present, as revenue categories have expanded over the years.

Variable costs and fixed costs

Applicable Sectors: CV/MS/CP/P.

Variable costs include fuel, observers, shoreside monitoring costs, fish purchases, and other expenses that vary with activity. Fixed costs include fishing gear, on-board equipment, processing equipment, and other expenses that are incurred independent of the level of activity. These summary cost categories are used to calculate variable cost net revenue and total cost net revenue. They are reported in this section for context; see [Cost Metrics](#) for more details about the types of costs that are included.

Variable cost net revenue

Applicable Sectors: CV/MS/CP/P.

Purpose: Variable cost net revenue (VCNR) is a measure of the operating profit of the average vessel or processor, and is one of the measures used to summarize net economic benefits of the catch share program.

Data: As described above, revenue data are obtained from fish tickets maintained by PacFIN for catcher vessels, while seafood production, other revenue, and variable costs data are obtained from EDC forms.

Methods: VCNR is calculated as revenue minus variable costs, and summarized as vessel (or processor) averages or fleetwide (or sectorwide) rates.

Caveats: The EDC forms do not capture all costs, so VCNR should be considered an “upper bound.” Quota costs and earnings are not included in the calculation. For processors, the EDC form also provides a field to write in any other costs or revenues not specified on the form; however, for analytical consistency across processors, these are not included here.

Total cost net revenue

Applicable Sectors: CV/MS/CP/P.

Purpose: When measured over many years, total cost net revenue (TCNR) is an indication of long-term profitability, and is one of the measures used to summarize net economic benefits of the catch share program. There may be year-to-year fluctuations in TCNR related to unusually high fixed costs (such as a new engine).

Data: As described above, revenue data are obtained from fish tickets maintained by PacFIN for catcher vessels, while seafood production, other revenue, and fixed and variable costs data are obtained from EDC forms.

Methods: TCNR is calculated as revenue minus variable and fixed costs, and summarized as vessel (or processor) averages or fleetwide (or sectorwide) rates.

Caveats: The EDC forms do not capture all costs, so TCNR should be considered an “upper bound.” Quota costs and earnings are not included in the calculation. For processors, the EDC form also provides a field to write in any other costs or revenues not specified on the form; however, for analytical consistency across processors, these are not included here.

Impact Metrics

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Employment impacts	✓	✓	✓	
Income impacts	✓	✓	✓	

Economic contribution (impacts) to the U.S. West Coast economy

Applicable Sectors: CV.

Purpose: Provide the total economic contribution (income and employment) of the catch share program to the U.S. West Coast economy.

Data: Data from fish tickets, EDC forms, and the Input-Output Model for Pacific Coast fisheries (IO-PAC; Leonard 2011) are used to calculate total impacts. The number of positions and direct expenditures are obtained directly from the EDC data. Proprietary income is calculated based on revenue from fish tickets and the EDC forms minus EDC-reported expenditures. Multipliers for employment and income are obtained from IO-PAC.

Methods: Economic contributions are calculated by combining costs allocated to individual fisheries (see [Cost Allocation](#)) and ex-vessel revenue with IO-PAC multipliers to calculate total U.S. West Coast employment and income impacts:

$$\text{Vessel employment impacts} = \sum_{c=1}^n \mathbf{C}_c \mathbf{m}_c^E + P m_p^E + Crew + 1$$

Total **Employment impacts** for each vessel includes the indirect/induced employment (E) impacts ($C_c m_c^E$) from direct expenditures (C_c) for vessel operations for each cost category (c), indirect/induced impacts from proprietary income ($P m_p^E$), the total number of crew positions ($Crew$), and captain (1) employment, where cost-specific multipliers (m_c^E) and multipliers for proprietary income (m_p^E) are obtained from IO-PAC.

$$\text{Vessel income impacts} = \sum_{c=1}^n \mathbf{C}_c \mathbf{m}_c^I + P m_p^I + P + w_{crew} + w_{captain}$$

Total **Income impacts** for each vessel includes indirect/induced income (I) impacts from expenditures for vessel operations ($C_c m_c^I$), indirect/induced impacts from proprietary income ($P m_p^I$), direct payments to proprietors (P), and direct wage payments to crew and captain (w), where cost-specific multipliers (m_c^I) and multipliers for proprietary income (m_p^I) are obtained from IO-PAC.

Caveats: The impacts calculated for EDC performance metrics measure the total economic impacts of a particular fishing activity, port, state, or vessel grouping on the entire U.S. West Coast economy. This is in contrast to the impacts that are calculated for the Biennial Harvest Specification (NMFS WCR 2020) which, depending on the analysis, reports on the economic contribution of landings to port areas and states.

Fisheye: Impacts are calculated for each fishery the vessel participates in. This allows us to report the economic impacts of specific activities and types of operations to the West Coast economy. For example, this method allows for reporting of the total economic impact of all landings within the DTS fishery, or the total contribution of all catch share vessels homeported in Astoria, Oregon.

Other Metrics

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Days at sea				
Days at sea	✓			
Days fishing, processing, and steaming in AK		✓	✓	
Days fishing, processing, and steaming on the WC*		✓	✓	
Days offloading on the WC*		✓	✓	
Days steaming between the WC and AK*		✓	✓	
Fuel use				
Fuel use per day	✓	✓	✓	
Annual fuel use	✓	✓	✓	
Coverage of U.S. West Coast groundfish landings				
Percentage of WC groundfish landed weight purchased*				✓
Percentage of WC groundfish landed value purchased*				✓
Weight of landings/purchases				
Landed weight	✓			
Purchase weight (AK)		✓		
Purchase weight (WC)*		✓		
Catch weight (AK)			✓	
Catch weight (WC)*			✓	

* WC = U.S. West Coast (WA, OR, and CA).

Metric	Catcher vessel (CV)	Mothership (MS)	Catcher-processor (CP)	Processor (P)
Other metrics				
Speed while fishing	✓			
Share of landings by state	✓			
Gini coefficient	✓	✓	✓	✓
Seasonality	✓	✓	✓	
Percentage of production processed				✓
Percentage of purchases from non-vessel sources				✓
Trips	✓			

Days at sea

Metrics included: **Days at sea, Days fishing, processing, and steaming in AK, Days fishing, processing, and steaming on the WC, Days offloading on the WC, Days steaming between the WC and AK.**

Applicable Sectors: CV/MS/CP.

Purpose: **Days at sea** is a measure of fishing effort and fishery participation. The catch share program in the U.S. West Coast groundfish trawl fishery was expected to result in greater specialization related to the costs of switching between other fisheries, while there were year-round fishing opportunities in the groundfish fishery (PFMC and NMFS 2017, 3.1.2(d)(1)). The number of days spent operating in the U.S. West Coast groundfish trawl fishery is driven by a vessel’s ability to obtain quota, fishery-specific costs, and opportunities in other fisheries relative to the groundfish fishery.

Data: For all U.S. West Coast fisheries and Alaskan fisheries, EDC forms for catcher vessels request information on the number of days at sea the vessel spent fishing. For catcher-processors and motherships, the forms request the number of days spent fishing and processing, steaming, and offloading in the U.S. West Coast Pacific whiting fishery, as well as the days spent steaming between the U.S. West Coast and Alaska, and fishing in Alaska. Partial days are rounded up to full days.

Methods: The following metrics are summarized as vessel averages (mean and median) and fleetwide totals:

- Catcher vessels:
 - **Days at sea**, by fishery.
- Catcher-processors and motherships:
 - **Days fishing, processing, and steaming in AK.**
 - **Days fishing, processing, and steaming on the WC.**
 - **Days offloading on the WC.**
 - **Days steaming between the WC and AK.**

Caveats: For use in rate calculations, we use U.S. West Coast fishing days for catcher-processors and motherships, as this is most representative of fishing effort.

Fuel use

Metrics included: **Fuel use per day, Annual fuel use.**

Applicable Sectors: CV/MS/CP.

Purpose: **Fuel use per day** (by fishery) provides information about the relative fuel costs across activities as well as across different vessels. This information is also used in combination with days at sea to allocate fuel costs to each fishery. **Annual fuel use** is also reported.

Data: The current EDC catcher vessel form requests average fuel use per day for 11 separate fisheries. The EDC forms request fuel use per day for each fishery the vessel participates in. Catcher-processors report average fuel use for all U.S. West Coast activities combined, including fishing, processing, and steaming. Similarly, motherships report average fuel use, but only for processing and steaming, since fishing is performed by catcher vessels. Catcher-processors and motherships also report the amount of fuel used annually.

Methods: For fuel use per day, data are summarized as reported on EDC forms, and reported as vessel averages (mean and median). Total fuel use per day is not reported. For catcher-processors and motherships, annual fuel use is also summarized as reported on EDC forms. Annual fuel use by fishery for catcher vessels is calculated by multiplying fuel use per day and days at sea by fishery. Annual fuel use is reported as vessel averages (mean and median), and fleetwide totals.

Caveats: For catcher vessels, the fisheries requested on the EDC form have changed slightly over time.

Coverage of U.S. West Coast groundfish landings

Metrics included: **Percentage of West Coast groundfish landed weight purchased, Percentage of West Coast groundfish landed value purchased.**

Applicable Sectors: P.

Purpose: These metrics summarize the percentage of total weight and value of all U.S. West Coast groundfish landed in each calendar year that are purchased by the processors in the Fisheye population. This provides an indication of Fisheye's coverage of all U.S. West Coast groundfish landings.

Data: Landed weight and value are obtained from state fish tickets. All groundfish landed are included, even on trips where groundfish species were not targeted. For participants that enter or exit the Fisheye population or for participants that have a fiscal year that does not align with the calendar year, the numerator includes landed weight and value purchased on dates when the participant was active in the Fisheye population.

Methods: Landed weight (or value) of groundfish species purchased by Fisheye processors in a given calendar year is divided by the total landed weight (value) of groundfish species landed on the U.S. West Coast in that calendar year, multiplied by 100. This metric is reported for the sector as a whole (total).

Caveats: Unlike other processor metrics, these metrics are reported by calendar year rather than survey year (fiscal year), as fiscal years are not known for buyers who do not submit an EDC form. These metrics do not include groundfish purchases from non-vessel sources reported on EDC forms, to avoid double-counting fish transferred between Fisheye processors.

Weight of landings/purchases

Metrics included: **Landed weight, Purchase weight (AK), Purchase weight (WC), Catch weight (AK), Catch weight (WC).**

Applicable sectors: CV/MS/CP.

Purpose: Fish weight landed or caught is often reported alongside ex-vessel revenue, to provide context to changes in ex-vessel revenue.

Data: Landed weight for catcher vessels is obtained from PacFIN; and catch or purchase weight for motherships and catcher-processors is reported on the EDC forms.

Methods: Landed weight is reported by fishery for catcher vessels. Purchase weight on the U.S. West Coast and Alaska is reported separately for motherships. Catch weight on the U.S. West Coast and Alaska is reported separately for catcher-processors. Weight metrics are reported as vessel averages (mean and median) and as fleetwide totals.

Caveats: The landed weight reported for catcher vessels does not include at-sea discards.

Other metrics

Speed while fishing

Applicable Sectors: CV.

Purpose: Speed is collected as a vessel-fishery characteristic. This information is most useful for the development of economic models.

Data: Similar to fuel use per day and number of crew, the EDC forms request speed while fishing (in knots) for each fishery on the U.S. West Coast that the vessel fishes in. This information is only collected for catcher vessels.

Methods: This metric is summarized as reported as a vessel average (mean and median); it is not summarized as a fleetwide total as it would not make sense to sum all values together.

Caveats: These values are estimates and represent a vessel's average speed while fishing in a particular fishery.

Share of landings by state

Applicable Sectors: CV.

Purpose: The U.S. West Coast groundfish trawl fishery spans three states—California, Oregon, and Washington—which necessitates regional comparisons (PFMC and NMFS 2017, 3.1.2(d)(3)(A)). **Share of landings by state** compares revenue across states and the at-sea fishery as a percentage of total revenue. This metric is only calculated for catcher vessels.

Data: Ex-vessel revenue is obtained from fish ticket data maintained by PacFIN.

Methods: Data are grouped by state to determine revenue by state, divided by total ex-vessel revenue, and multiplied by 100 to get the percentage of revenue by state.

Caveats: Unlike most other metrics, **Share of landings by state** is not summarized as mean, median, or total; it is visualized with a separate line for each state.

Gini coefficient

Applicable Sectors: CV/MS/CP/P.

Purpose: **Gini coefficient** provides a measure of revenue equality, and ranges from zero (perfect equality, where everyone receives an equal share) to one (perfect inequality, where one recipient receives all of the shares; PFMC and NMFS 2017, Table 4). A higher Gini coefficient over time indicates that revenue concentration is increasing.

Data: The Gini coefficient is calculated for all sectors. For vessels, we use ex-vessel revenue from fish tickets maintained by PacFIN and NORPAC. For processors, we use revenue reported on the EDC forms.

Method: We use the `Gini` function in R to estimate the Gini coefficient. Gini is estimated by determining the Lorenz curve (distribution of revenue) and subtracting the area under the Lorenz curve from the area under the line of equality (0.5) divided by the area under the line of equality, or essentially double the area between the Lorenz curve and the line of equality.

Caveats: Mean, median, and total statistics do not apply to **Gini coefficient**.

Seasonality

Applicable Sectors: CV/MS/CP.

Purpose: It was expected that the additional flexibility associated with catch shares would change the timing of landings. This metric summarizes the timing of landings by reporting the day of the year upon which 50% of that year's total catch was landed.

Data: Seasonality is calculated for catcher vessels, motherships, and catcher-processors using ex-vessel revenue from fish tickets maintained by PacFIN and NORPAC.

Method: We summarize landings weight by day of year, and then calculate the cumulative totals for each day. The day of the year where the cumulative total is 50% of the annual total is then reported.

Caveats: Mean, median, and total statistics do not apply to **Seasonality**. This metric is meant to provide a broad overview of the timing of fisheries; for more in-depth information, the NWFSC Landings Tracker is available in Fisheye.

Percentage of production processed

Applicable Sectors: P.

Purpose: Shorebased processors sell both processed and unprocessed products. This metric summarizes the percentage of processed seafood products (i.e., not recorded as unprocessed) sold, and provides an indication of processing operations within this sector.

Data: The EDC forms require processors to report production weight by product type. See **Number of species processed** ([Measures of Specialization](#)) for a list of product types by species.

Methods: For this metric, all production listed as any product type other than “Unprocessed” is considered processed products. Production weight of processed products is divided by total production weight of all products (processed and unprocessed), and multiplied by 100. This metric is reported as processor averages (mean and median); total percentage of production processed is not reported.

Caveats: The product type **Fresh** (used in 2009–10) was renamed **Processed Fresh** from 2011 onward; this may have influenced what respondents include in this category. It is counted as a processed product type for this metric.

Percentage of purchases from non-vessel sources

Applicable Sectors: P.

Purpose: Some processors purchase fish from non-vessel sources, in addition to vessel sources. This metric summarizes the percentage of fish inputs purchased from non-vessel sources, which can include first receivers, processors, wholesale dealers, brokers, and aquaculture producers.

Data: EDC forms require processors to report purchases by source, including limited entry trawl vessels, limited entry fixed gear vessels, other vessels, and non-vessel sources.

Methods: Purchase weight of non-vessel-sourced fish is divided by total purchase weight of all fish inputs, and multiplied by 100. This metric is reported for the average processor (mean and median) and for the sector as a whole (total).

Caveats: This metric is not available for 2009 and 2010, as non-vessel sources were not explicitly requested on the EDC forms in those years.

Trips

Applicable sectors: CV.

Purpose: **Trips** is another measure of effort, and is a common unit of analysis. In some cases, trips may be preferred over days at sea because the **Trips** metric does not include the uncertainty associated with self-reporting days at sea.

Data: Data are obtained from PacFIN.

Methods: For each vessel, trips are summed by fishery to yield the number of trips. Trips are summarized as vessel averages (mean and median) and fleetwide totals.

Caveats: Currently this metric is not provided for motherships or catcher-processors.



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