Estimation of recent groundfish catch distribution between federal and state waters off the U.S. West Coast (v2)

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Summary

The current analysis is an update of a <u>preliminary version</u> presented to the SSC in May, 2023, which estimated recent commercial groundfish catch distributions between federal and state waters, as proportions for a few nearshore species. The SSC provided feedback, and the analysis has since been expanded to include more than 90 groundfish species; it uses more recent data and additional sources, includes revised uncertainty, responses to SSC comments, and expanded findings. Methods remain functionally similar to the preliminary version, with several incremental changes/improvements.

This exercise is only intended to provide information about recent spatial distribution of *commercial fishery <u>catch</u>* occurring between federal and state territorial waters (jurisdictions), and <u>not</u> to make any inferences about population distribution. This analysis is intended as one piece of information among a mosaic, to assist the Council and NMFS in Phase 2 of the Council stock definitions process, in which location of fishing activity relative to jurisdiction is one of several important issues.

The vast majority of species off each state showed non-zero proportions in federal waters. Figures 1 through 3, and Table 1 show estimated mean annual proportions of catch in the federal EEZ, for FMP groundfish species, off each state, together with bootstrapped 95% confidence limits, among selected shoreside commercial groundfish fishery sectors.

For Washington state, the overwhelming majority of species showed high proportions of fishery catch in the federal EEZ at or near 1 (Figure 1); with just one species at zero, and only four others in between. This result owes in large part to the lack of a commercial nearshore fishery.

Results for California were a picture of variability (Figure 3, Table 1, Table 3a); a broad and diverse range of jurisdictional proportions among species, together with wide confidence intervals due to interannual variation. If the most recent five years were used to infer the near future, the results indicate a high degree of uncertainty in many jurisdictional catch proportions.

Oregon results were comparatively intermediate (Figure 2) between Washington and California, in terms of both range of proportion estimates, and interannual variation; but most proportions tended toward zero or one, with fewer intermediate values (U-shaped). This may be due to close mirroring of the 3 nm line (jurisdictional boundary) and the shoreward boundary of the non-trawl rockfish conservation area (RCA) off of Oregon. Catch distribution among sectors by species in Oregon showed highest proportions in catch share sectors, as well as nearshore.

There were a few species-state combinations with low sample sizes for proportion estimation, stemming from zero catch within a stratum. Although analysis of a longer time series may potentially be of benefit for some of these species-state combinations, if estimation of proportions is the ultimate goal, even coastwide some frequently show a fraction of a metric ton caught per year (GEMM product, WCGOP). Extremely low or zero catch of a species is also relevant information.

Table 4 shows annually summarized boundaries (fm) for the non-trawl RCA off the West Coast of the United States, over the past ten years, 2017 through June of 2024. The structure of the RCA was quite constant over the years included in the analysis (2017-2021), and through 2023, but has changed somewhat in 2024 north of 34°27' N lat., in order to decrease fishing in much of the southern nearshore, while at the same time opening more of the central shelf (seaward side of RCA) to fishing. Changes made effective April 1, 2024 added a latitudinal stratum from 37°07' - 34°27' N. lat. to enable finer control of trip limits, and promote conservation of quillback rockfish and vermilion/sunset rockfish off California, while balancing fishing opportunity.

Management measures aimed at reducing nearshore catch, if successful, could potentially inflate estimates for proportion of catch in Federal jurisdiction for certain species straddling the nearshore and shelf (e.g. lingcod, starry flounder, etc.; Love 2011), compared with values seen in this analysis. The results off Washington state, with no nearshore (commercial) fishery, offer a coarse example of this effect, where values for these species were dramatically higher, compared with both California and Oregon.

Nearshore sector catch has been discussed early in this process as an intuitive indicator of catch in state waters. Thus, proportional catch in the nearshore sector was explored for concordance with jurisdictional catch proportions. Results indicate that although well correlated, the proportion of catch in the nearshore sector among all sectors could serve as an indication, but not a precise proxy or predictor for proportion of catch in state or federal waters.

Changes from previous version

The current version of the analysis implements the following changes, compared with the preliminary analysis presented to the SSC in late May of 2023.

1) All data were updated to 2017-2021, compared with 2016 through 2020 previously.

2) One data source was added, the Fishery Observation Science (FOS) granular Electronic Monitoring (EM) data set, which enables complete coverage with fine location of hauls in all shorebased Catch Shares sectors, including bottom trawl, midwater trawl (shorebased whiting), midwater trawl (non-whiting, rockfish), and fixed gear. This makes a total of four data sources used; WCGOP GEMM product, WCGOP OBproc observer data product, FOS EMproc data product, and PacFIN landings, from the shorebased groundfish comprehensive table.

3) In the current version (v2) full implementation of FOS commercial groundfish sector definitions in PacFIN, which became available after the preliminary document, enabled the consistent, direct matching of data among the four sources, rather than using translation tables among different sector definition schema (necessary in previous version), resulting in less error.

4) The number of species included was extended to 94 groundfish fishery management plan (FMP) species or species categories, present with positive catch, and which could be matched across the four data sources.

5) Only the proportion of catch in the federal Exclusive Economic Zone (EEZ), was estimated, by state, rather than the corresponding proportion in state jurisdiction as well; this enabled estimation of annual means of proportions at the final step, and expression of uncertainty at the same step, rather than with estimating mean catch previously.

6) Bootstrapped confidence intervals were added to express uncertainty in mean proportions, for the same strata among years.

7) Figures were added to show proportions and confidence intervals of all species within each state, as well as annual proportions by species and state.

8) All data management and analysis was coded in R, with the exception of GIS haul location binning, which was performed in ArcGIS Pro, then read into R. Code is available upon request. Much of the data is publicly available, although portions of the raw data are confidential. Aggregated summaries of much of the data are provided within this document in tables and appendices.

9) The five-year data window was moved forward one year, to 2017-2021, years which were available across all sources at the time of analysis. This portrays a current picture of the evolving fishery, and to maintains consistent sector definitions across all years in the analysis, which change significantly over time to keep pace with the changing fishery.

10) The current list of major shoreside commercial, directed groundfish sectors (FOS definitions) included in this analysis is: Catch Shares, Catch Shares EM, Midwater Hake, Midwater Hake EM, Midwater Rockfish, Midwater Rockfish EM, Nearshore, Limited Entry Sablefish, LE Fixed Gear DTL, and OA Fixed Gear. FOS sector definitions appear in Somers et al. (2023).

Introduction

The Council is working to refine stock, and stock complex definitions within the Pacific Coast Groundfish Fishery Management Plan (FMP). One facet of this effort will be aided by improving our understanding of the spatial distribution of groundfish species catch, in terms of distance from shore. Groundfish species currently included in the FMP are caught to varying degrees in state territorial waters (0-3 nautical miles (nmi) from shore), versus the Exclusive Economic Zone (EEZ) (3-200 nmi from shore) along the West Coast. Although the preferred depth range is known for many groundfish species, depth bins map to different distances from shore with changing latitude, according to variation in benthic topography, and thus depth is not a suitable proxy for territorial waters boundary lines coastwide. We developed the approach in this document to estimate species-specific proportions of catch that occurs within federal waters, for FMP groundfish species using commercial fishery-dependent data, for each West Coast state; California, Oregon, and Washington. We expect this information to support scoping of future plans for stock definitions and area-specific fishery management by federal and state agencies.

A preliminary exploration of the method and results for three nearshore species was presented to the SSC for review and comment in late May of 2023. Since then, the number of species was expanded to more than 90 FMP groundfish species, and SSC comments and suggestions have been incorporated. The current results were produced during fall of 2023.

Updated results appear in Figures 1 through 3, and Tables 1 through 3. Estimates are inclusive of shoreside commercial, non-whiting groundfish fishery sectors only (no recreational, research, or tribal fishery data are included).

Currently, the primary data sources for location-specific catch for shoreside non-whiting groundfish sectors are observer and electronic monitoring (EM) data. The commercial fishery sectors that fish in the nearshore have been subject to partial observer coverage. Fishery sectors show dramatically different amounts of catch, and those distributions vary according to species; therefore we needed to scale catch

estimates by relative catch among fishery sectors, as well as within each state and area. No one data source had sufficient information alone to accomplish this, so four sources were utilized in concert as described below in the Methods section, in collaboration, and with guidance from the West Coast Groundfish Observer Program (WCGOP).

Methods

Data sources used

Four sources of data were used, which included (1) the Groundfish Expanded Multiyear Mortality (GEMM) product from WCGOP (summarizes Somers et al. 2022), (2) the Pacific Coast Fisheries Information Network (PacFIN) database, and (3) haul-level WCGOP observer data (OBproc data product), (4) haul-distributed EM data from FOS.

- (1) The GEMM product provided coastwide annual estimates of total catch by species and sector. This provided the total amounts of annual catch to be distributed among states, and between state and federal waters, informed by data sources (2) and (3) below.
- (2) The PacFIN database provided annual groundfish landings data by species, sector and state. These data were used to estimate the among-state distribution of catch of each species, from annual GEMM estimates.

It was considered the best available means to apportion GEMM coastwide total catch among states using the state agency field within PacFIN, which is based on port of landing, since PacFIN represents the most complete source of state-specific catch data, with all trips represented (haul-specific observer data is limited to observed hauls only, see below). In rare instances, near state borders (e.g. Astoria), some catch may be landed across state borders. Use of PacFIN catch area codes (latitudinal areas) was investigated as a potential solution, but abandoned after conversation with PacFIN staff about usefulness, due to completeness and verification of the fields.

The recent addition of the Fishery Observation Science (FOS) sector field to PacFIN data was also available in the comprehensive fish ticket table in the database, as well as state agency, at the time of query. The FOS sector field has made utilization of landings data more efficient, and less challenging to align fishery sectors among data sources in a standardized form among analysts.

- (3) Haul-level groundfish observer data from WCGOP (OBproc data product) provided fine scale location data for the portion of hauls that were observed, and enabled determination of which jurisdiction polygon each haul was located. FOS sectors were also available in the haul-level observer data. This data source is limited to observed hauls only, observation rates vary substantially among sectors, and can only cover a small fraction of total hauls in most sectors.
- (4) Haul-distributed electronically monitored data from FOS (EMproc data product) provided fine scale location data for hauls that were electronically monitored (EM), and enabled estimation of which jurisdictional polygons each haul fell. FOS sectors were also available in the haul-level observer data. This data source is limited to electronically monitored hauls only, monitoring rates have been growing since 2015. The shoreside whiting IFQ sector is greater than 90 percent EM, rather than observed, and rates are increasing for non-whiting trawl.

PacFIN landings were queried on March 23, 2022 (SQL script appears in Appendix A). Haul-level observer data were received on March 22, 2022. The GEMM data product used was updated to the September 2022 version, provided for the September, 2022 PFMC (Pacific Fishery Management Council) meeting.

Approach overview

The basic approach was to distribute total catch estimates for each species from the GEMM data product in two stages; first, among states using PacFIN landings, and second, between EEZ and state waters polygons off the coast of each state using haul-level observer and EM data.

WCGOP representatives (Dr. Kayleigh Somers, together with Jon McVeigh) outlined a specific approach and provided haul-level observer data. Haul locations were assigned to within or outside of state jurisdiction or federal (EEZ) polygons, using ArcGIS Pro. PacFIN landings data were queried using Oracle SQL Developer. Final estimates of average annual proportion of catch inside each of six jurisdictional bins, for FMP groundfish species (two off each state), in commercial fisheries were produced using R, as well as graphics. Some graphics and ancillary analyses were produced with JMP.

The most recent five-year period of data available at the time from all three sources was used for the analysis, from 2017 through 2021; a five-year a period is customary for many management action-focused analyses, e.g. harvest specifications impact projections modeling, salmon bycatch modeling for groundfish sectors, etc. The current estimates include up to 94 FMP groundfish species and species complexes or categories, where catch was present.

Summarized algorithm:

To estimate average annual proportions of catch made shoreward vs seaward of 3 nmi (as defined by official jurisdictional polygons), of select nearshore species, for each state, in commercial fisheries, we used the following algorithm, when we:

A) Calculated among-state distributions of PacFIN landings by species, sector and year and applied them to **apportion among states**, the coastwide catch from GEMM for each species, by sector and year.

$$(TC)_{sp,y,sec,st} = (TC)_{sp,y,sec} \cdot \frac{(L)_{sp,y,sec,st}}{(L)_{sp,y,sec}}$$
Equation (A)

Where TC is GEMM total catch estimates (mt), L is amount of PacFIN landings (mt); sp in the subscript stands for species, y for year, sec for year and st for state.

B) Used haul-specific observer data to **spatially distribute** the state-distributed GEMM catch estimates from (1) **between areas** (jurisdictional polygons), within each state.

$$(TC)_{sp,y,sec,st,a} = (TC)_{sp,y,sec,st} \cdot \frac{\frac{1}{5} \sum_{y=1}^{5} (OBS)_{sp,y,sec,st,a}}{\frac{1}{5} \sum_{y=1}^{5} (OBS)_{sp,y,sec,st}}$$
Equation (B)

Where *TC* is GEMM total catch estimates (mt), *OBS* is haul level catch observed by WCGOP or monitored using EM (mt), *sp* in the subscript stands for species, *y* for year, *sec* for sector, *st* for state and *a* for catch in shoreward (and then seaward) of 3 nmi.

- C) Next, **summed over sectors**, to aggregate distributed catch to the species-state-area-year level $((TC)_{sp,y,st,a})$, distributed catch, resulting in annual catch among years, within state and area strata (juristictional polygons), for each species.
- D) Last, **calculated proportions** of catch (in federal EEZ), between areas and within state, from those annual distributed catch estimates, for each species. Calculated mean proportion values among years, and uncertainty as bootstrapped 95 percent confidence intervals.

$$(TCP)_{sp,st,a} = \overline{\left(\frac{(TC)_{sp,y,st,a}}{(TC)_{sp,y,st}}\right)}$$

Equation (D)

Detailed steps:

The estimations proceeded at the species-sector-year level, according to the following steps:

- 1) Aggregate GEMM data to the species-sector-year level, and PacFIN to the species-sector-stateyear level (from step A in Summarized Algorithm, above).
- Calculate annual coastwide total catch by species and sector, from GEMM data (summary step A).
- 3) Calculate annual proportion of landings within each state, for each species, by sector from PacFIN data (summary step A).
 - Multiply coastwide catch (GEMM) by state-specific landings proportions (PacFIN), to yield state-distributed catch.
- 4) Calculate state-specific annual sums of observed or electronically monitored catch in state vs federal EEZ polygons (observer/OBproc, or electronically monitored/EMproc), by species and year (summary step B), after spatial binning w/ArcGIS Pro.
- Calculate annual proportions (area proportions, within each state) from sums (4) summary step B.
- 6) Multiply state-specific, distributed, annual catch (3) by area (3 nmi) proportions (7) summary step B. Maintain year fidelity.
 - Result is annual estimates of area-within-state distributed, species-specific catch.
- 7) Aggregate catch from Step 6 among sectors, to year-state-area level (summary step C).
- 8) Calculate annual proportions in federal EEZ from distributed (area w/in state) catch to proportions, for each species (Table 1) summary step D.
- 9) Calculate annual means of (area w/in state) proportions in federal EEZ (7), and estimate uncertainty (CI) summary step D.

Annual catch for each species was aggregated by sector (in addition to state), to scale catch estimates by relative catch among fishery sectors, since fishery sectors exhibit substantial differences in amounts of catch, and those distributions vary by species.

Gear type, within sector, was initially considered as a more granular stratification to add precision, but was ultimately abandoned as over-stratifying, given existing challenges of merging several different data sources (see Detailed Steps) at the present level of aggregation.

Results and discussion

Figures 1 through 3 and Table 1 show estimated mean annual proportions of catch of FMP groundfish species in the federal EEZ off each West Coast state, with bootstrapped 95% confidence limits, among selected commercial shoreside groundfish fishery sectors. Dashes indicates no estimate; resulting from zero total catch off the state in that year, across both federal and state jurisdictions, thus a zero denominator for the proportion.

For Washington state, the overwhelming majority of species showed high proportions of fishery catch in the federal EEZ at or near 1 (Figure 1); with just one species at zero, and only four others in between. This result owes in large part to the lack of a commercial nearshore fishery; and also the importance of catch shares, midwater hake, midwater rockfish, and LE sablefish sectors off Washington state, as seen in mean catch proportions by sector in Table 3c.

Results for California showed a picture of variability (Figure 3, Table 1, Table 3a); a broad range of jurisdictional proportions among species, together with wide confidence intervals due to interannual variation. Among sectors, the highest proportions of catch tended to appear in catch shares and nearshore sectors, with little to no midwater catch, and lower proportions among fixed gear sablefish sectors and open access (Table 3a). If the most recent five years were used to infer the near future, the results indicate a high degree of uncertainty in many jurisdictional catch proportions.

Oregon results were comparatively intermediate (Figure 2) between Washington and California, in terms of both range of proportion estimates, and interannual variation, but most proportions tended toward zero or one, with fewer intermediate values. This may be due to close mirroring of the 3 nm line and the shoreward boundary of the non-trawl rockfish conservation area (RCA). Catch distribution among sectors by species in Oregon showed highest proportions in catch share sectors, as well as nearshore, with intermediate proportions of catch in midwater sectors (Table 3b).

Figures 4 through 6 show estimated annual proportions of catch in the federal EEZ off California, Oregon, and Washington. Proportions are shown together with annual catch (mt), by groundfish FMP species, among selected shoreside commercial groundfish fishery sectors. Dot size varies with amount of annual catch. These figures highlight numbers of years for which proportions could be estimated (nonzero catch); as well as the relative amount of catch per year, among all species in the figure; and whether proportions are stable over the five years examined, highly variable, or appear to be trending. Appendix B presents mean annual total catch (mt) and coefficient of variance (CV), including estimated discard mortality (GEMM) by species, apportioned by state according to landings distributions (PacFIN). Estimates include only the specific, major commercial groundfish sectors listed in the Methods section.

Figures 4 through 6 also reveal a few species-state combinations with low sample sizes for proportion estimation; few years with non-zero catch. Examples with two or less annual estimates each include Black skate, Calico rockfish, and Pink rockfish off California; Black rockfish, Harlequin rockfish, and Tiger rockfish off Washington (only a few fish in one year). Although analysis of a longer time series may potentially be of benefit for some of these species-state combinations, if estimation of proportions is the

ultimate goal, even coastwide some frequently show a fraction of a metric ton caught per year (GEMM product, WCGOP). Extremely low or zero catch of a species is also relevant information.

Table 2 shows the same information as Table 1, but sorted by increasing value of the proportion caught in the federal EEZ, making it easy to see where each species falls along the distribution between jurisdictions, from one end of the continuum to the other. Species generally show expected general distributional patterns among the nearshore, shelf and slope (Love et al. 2011, PFMC 2018, Matson and Gertseva 2020). Table 2 highlights that the overwhelming majority of species off each state show non-zero federal proportions.

Table 3 (a, b, and c) shows proportional distribution of average annual catch (2017-2021), for FMP groundfish species, among the major (commercial shorebased) fishery sectors, by state, as heatmaps, making it simple to gain a quick impression of a species fishery catch distribution among sectors, within state. Note that nearshore commercial fishing is not permitted off Washington. Distribution of catch among sectors varies widely according to species.

Table 4 shows annually summarized boundaries (fm) for the non-trawl Rockfish Conservation Area (RCA) off the West Coast of the United States, over the past ten years, 2017 through June of 2024. The structure of the RCA was quite constant over the years included in the analysis (2017-2021), and through 2023, but has changed somewhat in 2024 north of 34°27' N lat., to decrease fishing in much of the southern nearshore, while at the same time opening more of the central shelf (seaward side of RCA) to fishing. Changes made effective April 1, 2024 added a latitudinal stratum from 37°07' - 34°27' N. lat. to enable finer control of trip limits, and promote conservation of quillback rockfish and vermillion/sunset rockfish off California, while balancing fishing opportunity.

Management measures aimed at reducing nearshore catch, if successful, could potentially inflate aggregate estimates for proportion of catch in Federal jurisdiction for certain species straddling the nearshore and shelf (e.g. lingcod, starry flounder; Love 2011), compared with estimates seen in this analysis. Results off Washington state, with no nearshore (commercial) fishery, offers a potential straightforward example of this effect, where values for these species were dramatically higher, compared with both California and Oregon. The proportion in federal waters (pFed) for lingcod was 0.988 (95% CI = 0.955-1.00) off WA, versus 0.812 (95% CI = 0.778-0.864) off CA, and 0.745 (95% CI = 0.713-0.788) off OR. pFed for starry flounder was 1.00 (95% CI = 1.00-1.00) off WA (but n=1), 0.805 (95% CI = 0.686-0.940) off CA, and 0.754 off OR (95% CI = 0.460-0.999).

Nearshore catch has been discussed as an intuitive indicator of catch in state waters. Thus, proportional catch in the nearshore sector was explored for concordance with jurisdictional catch proportions. The proportion caught in federal waters was used here, since that is what we used for the main portion of the analysis. Figure 7 shows proportions of catch in the nearshore sector (x-axis), versus proportions of catch in federal jurisdiction, and frequency distributions for each variable, in a brief exploration of suitability of proportional nearshore catch as a proxy for proportion of federal jurisdiction in off California and Oregon, respectively. There is no commercial nearshore fishery off Washington. Non-parametric correlation values for California were: Spearman's p = -0.844 (p<0.0001), Kendall's Tau = -0.694 (p<0.0001); and for Oregon were: Spearman's p = -0.819 (p<0.0001), Kendall's Tau = -0.689 (p<0.0001). Results indicate that although well correlated, the proportion of nearshore catch could serve as a rough indication, but not a precise proxy or predictor for proportion of catch in state or federal waters. Figure 7 also shows histograms of catch proportions in the nearshore sector, and in federal waters, which were U-shaped for both states, but showing a particular lack of intermediate values for Oregon.

The Slope rockfish unidentified category off Washington was unpopulated for all but one year (2020) where there was a small amount of discard (37 lb) assigned to state jurisdiction, which appears most likely to be in error; thus it was shown as no estimate.

Comparisons with previous version

Current estimates track closely with the three species examined in the preliminary analysis, despite changes to years in data, and addition of the EM data source, including two FOS fishery sectors. For example, the mean proportion of China rockfish catch in federal waters off California was previously estimated at 0.036, and currently at 0.044; off Oregon previously at 0.016, and currently at 0.035; inestimable off Washington due to zero catch. For Copper rockfish off California, the mean federal proportion in previous version of the analysis was 0.143, and is currently 0.140; off Oregon, it was 0.023, and is currently 0.024, off Washington it is still inestimable. Lastly, for quillback rockfish off California, the current federal proportion is estimated at 0.139, while the previous estimate was 0.151; off Oregon it was 0.027, and is currently 0.052; off Washington the previous estimate was 1.0, but with only trace catch of 0.0001 mt, and is currently inestimable.

Proportional estimates in the literature with which to compare or validate those in Table 1, including China, copper, and quillback rockfish, have so far not been found. However, the high proportions indicated in state territorial waters, which encompass the region occupied by the latter three species, are in agreement with accepted classification of these three species as nearshore rockfish, used in West Coast groundfish management.

Further, China rockfish are reported as having an overall depth distribution of 0-70 fm with highest density from 2-50 fm; copper rockfish's overall, and highest density depth distribution are both reported as 0-100 fm (PFMC 2018), or 0-150 fm with most from 0-35 fm (Love 2011); and quillback rockfish are reported as having an overall depth distribution of 0-150 fm, with highest density between 22-33 fm (PFMC 2018; Love 2011). These relative depth ranges among the three species are generally in keeping with the proportional estimates in Table 1a. The relative proportions for California, with China rockfish showing >0.96 within 3 nmi from shore, and copper and quillback rockfish showing a less abrupt nearshore distribution (both at approximately 0.86 inside 3 nmi, within California), also reflect relative depth distributions from PFMC (2018), with tails of copper and quillback distributions running deeper than for China rockfish. Nearshore rockfish south of 40°10' N. lat. are further subdivided into shallow nearshore and deeper nearshore rockfish, with China rockfish included the former, and copper and quillback in the latter, which is in agreement with our results.

Uncertainty

The most immediate source of variability in the proportional estimates relevant to the goals of the analysis is interannual variation in catch distribution under the current stratification. This is reflected in confidence intervals around the mean proportion estimates. The results show substantial interannual variability in proportion of catch both among states (stratified) and among years, particularly off California, less so off Oregon, and least off Washington.

Other sources of uncertainty are more difficult to estimate and propagate. Landings are typically treated as known (e.g. in most stock assessments), and a great deal of confidence is placed in landings estimates from single species categories since 1981. Some uncertainty in the distributional proportions stems from sample size within strata, as number of observed hauls/sets. Such uncertainty would be quite low for the

current IFQ fishery, due to complete coverage as the sum of human and electronic monitoring (EM data are now included in this version). However other fishery sectors, with lower and variable observer coverage, would incur greater uncertainty, particularly for less common species. Fishery sectors that operate closer to shore, including the nearshore fishery, tend to have lower observer coverage rates, particularly the nearshore, LE fixed gear (non-sablefish), and open access fixed gear fisheries, which typically have single-digit coverage rates (Somers et al. 2022). The nearshore sector tends to include species with the highest proportions of catch within state jurisdiction. Limited entry, fixed gear fisheries have intermediate coverage rates, including the tier fishery. Propagating and expressing that uncertainty as part of confidence intervals surrounding the spatial distribution proportions would be challenging, and a solution has not been determined for the current analysis.

Last, one source of uncertainty involves trace amounts of catch in which a species was identified as caught in waters off Washington state, but landed in Oregon. These cases could plausibly arise from at least one of two scenarios 1) catch landed in Astoria, OR was caught north of the state border, or 2) an error in the latitude recorded for the location listed for the haul in observer data. This created an irresolvable disagreement in the algorithm for assignment of such catch amounts to jurisdiction polygons off Oregon state, and these trace, cross-border catch amounts were excluded from the calculations. All cases were from catch share sectors (catch share, midwater rockfish, and midwater hake). Among cases at the year-species-state-sector stratum level, approximately three percent (70) involved 1kg or more, although 67 of those 70 involved less than one percent (between 0.01 percent to 0.95 percent) of the stratum catch. Three cases (0.15 percent of cases) involved larger than 1 percent (1.24 to 2.56 percent) of the Oregon catch at the year-species-state-sector stratum level, and those were also inconsequential to the final result. Only one outlier case, which involved 0.31 mt of butter sole in one year from the catch shares sector, made up 61 percent of the stratum catch in that year, and the spatial proportion for that year was omitted, since this amount was potentially enough to compromise the estimate for this low catch species.

Responses to SSC comments

After reviewing the report "*Preliminary estimation of nearshore groundfish catch distribution shore ward and seaward of 3 nmi to inform future fishery management planning*" in June of 2023, the SSC provided specific comments. Responses appear below.

Key questions

1) Is the goal to describe the distribution of the catch or the distribution of the population?

The goal of this specific exercise is to estimate the proportion of recent (e.g. over the recent 5year period) groundfish *fishery <u>catch</u>* that has been occurring within federal waters (federal jurisdiction). *The current exercise only concerns where the fish have been caught in the fishery, and is not an attempt to estimate distribution of populations/stocks themselves, nor to make any inferences regarding population distribution or abundance*. Understanding what fraction of the commercial groundfish fishery catch for a given species occurs in federal jurisdiction, is one important piece of the stock definitions process, in considering which fisheries and stocks can be managed by the federal government consistent with the authority laid out in the Magnuson-Stevens Act. Again, the goal is <u>not</u> to make inferences about the population itself.

2) Is the goal to describe the unfished, current, or future distribution of the catch or population?

One goal is to estimate the recent *fishery* <u>catch</u> distribution, both in and of itself, and second, as an indication of likely near-future distribution of *fishery* catch, while the fishery continues to operate under similar conditions; again, only relative to federal versus state waters/jurisdiction. This analysis can be repeated periodically, in response to changing conditions which influence the fishery, to determine whether the current conditions remain consistent, or to what degree they change in the future. The goal is <u>not</u> to make inferences about the population itself.

3) What are the key sources of variability relevant to the goals of the analysis and how should they be propagated?

(Repeated from Discussion) Perhaps the most immediate and relevant source of variability in the proportional estimates, relevant to the goals of the analysis, is interannual variation in catch distribution under the current stratification scheme. This is reflected in the confidence intervals around the mean proportion estimates. The results show substantial interannual variability in proportion of catch both among states (stratified) and among years, particularly off California, less so off Oregon, and least off Washington.

Other sources of uncertainty are more difficult to estimate and propagate. Landings are typically treated as known (e.g. in most stock assessments), and a great deal of confidence is placed in landings estimates from single species categories on the West Coast since 1981. Some uncertainty in the distributional proportions stems from sample size within strata, as number of observed hauls/sets. Such uncertainty would be quite low for the current IFQ fishery, due to complete coverage as the sum of human and electronic monitoring (EM data are now included in this version). However other fishery sectors, with lower and variable observer coverage, would incur greater uncertainty, particularly for less common species. Fishery sectors that operate closer to shore, including the nearshore fishery, tend to have lower observer coverage rates, particularly the nearshore, LE fixed gear (non-sablefish), and open access fixed gear fisheries, which typically have single-digit coverage rates (Somers et al. 2022). The nearshore sector tends to include species with the highest proportions of catch within state jurisdiction. Limited entry, fixed gear fisheries have intermediate coverage rates, including the tier fishery. Propagating and expressing that uncertainty as part of confidence intervals surrounding the spatial distribution proportions would be challenging, and a solution has not been determined for the current analysis.

Last, one source of uncertainty involves trace amounts of catch in which a species was identified as caught in waters off Washington state, but landed in Oregon. These cases could plausibly arise from at least one of two scenarios 1) catch landed in Astoria, OR was caught north of the state border, 2) an error in the latitude recorded for the location listed for the haul in observer data. This created an irresolvable disagreement in the algorithm for assignment of such catch amounts to jurisdiction polygons off Oregon state, and these trace, cross-border catch amounts were excluded from the calculations. All cases were from catch share sectors (catch share, midwater rockfish, and midwater hake). Among cases at the year-species-state-sector stratum level, approximately three percent of cases (70) involved 1kg or more, although 67 of those 70 involved less than one percent (between 0.01 percent to 0.95 percent) of the stratum catch. Three cases (0.15 percent of cases) involved larger than 1 percent (1.24 to 2.56 percent) of the Oregon catch at the year-species-state-sector stratum level, and those were also inconsequential to the final result. Only one outlier case, which involved 0.31 mt of butter sole in one year from the catch shares sector, made up 61 percent of the stratum catch in that year, and the spatial proportion for

that year was omitted, since this amount was potentially enough to compromise the estimate for this low catch species.

- 4) Additional comments
 - a) "The SSC recommends that, depending on the analysis objectives, the analysts consider using more than five years of data"

Our current approach is to capture the most recent picture of the state of the fishery, thus the five-year window. In this version, data sources were expanded to include EM, for both IFQ non-whiting, and whiting trawl, in order to be more inclusive across the broader fishery. Increasing proportions of IFQ landings, particularly shorebased whiting IFQ have been electronically monitored over time. The five-year window of data was pushed forward one year, to the most recent available at the time, in order to reflect the current state and behavior of the fishery, and the near future. The analysis could be updated in the future to periodically reassess as the fishery changes.

b) "Representing year-specific catch distributions (as tables or figures) in conjunction with relevant fisheries regulations would facilitate the identification of their potential impacts on catch distribution."

A table summarizing non-trawl RCA boundaries is provided, with some accompanying discussion, given its influence on area of catch for shelf and nearshore groundfishes in particular.

c) "The SSC recommends that the unit of observation and associated measurement of variability be either the proportion of the catch or population inside state waters, given that this is likely the value that will be used to differentiate state and federal stocks."

This is an excellent idea; although we simply estimated its complement, the proportion of catch in federal waters. Expressing jurisdictional distribution of catch from this perspective made it easier to discuss relation to 50 CFR 600.305(c)(1), where "[...] Any stocks that are predominately caught in Federal waters and are overfished or subject to overfishing, or likely to become overfished or subject to overfishing, are considered to require conservation and management.", a central point in the topic. The mean among years, and 95 percent confidence intervals, as well as individual year estimates were estimated and plotted as requested.

d) "The analysts could consider weighting annual proportions by the amount of annual catch when quantifying uncertainty."

We considered weighting mean annual proportions by annual catch; and whether a particular year with higher catch would deserve more weight in expressing average spatial distribution of that catch. We concluded that given normal interannual variability within the short time scale chosen for the current version of this exercise (due to the desire to capture the most recent picture of the state of the fishery), it was reasonable to calculate unweighted means for the central tendency of the catch distribution and its variability. One consideration was that a comparatively lower amount of catch in one year doesn't necessarily diminish the importance of its spatial distribution.

Another possibility considered but not ultimately adopted for weighting proportions was progressively increasing the weight of more recent years of data.

e) "In addition, it would be useful to have a visual representation of proportions through time to understand variability."

Done. Added as figures 4-6.

f) "The SSC recommends that the analysts consider the use of species distribution models (SDMs) to estimate population or catch distributions if estimating the proportion of the population occurring inside state waters remains an objective of the analysis."

We conducted a preliminary investigation of population distribution between jurisdictions using sdmTMB to estimate abundance indices from fishery-independent surveys. Please see the accompanying document for that analysis.

g) "The SSC highlighted the potential for remotely operated vehicle (ROV) surveys and other nearshore fishery-independent surveys to inform the mapping of population distributions, though limited by a lack of sampling in Federal waters limiting application of species distribution modeling."

As the SSC stated, the lack of sampling in federal waters is a substantial limitation of ROV survey data. It is a substantial challenge to locate surveys with sufficient overlap spanning between both federal and state waters, sufficient to inform distributional estimates. We have currently preliminarily explored the NWFSC shelf-slope trawl survey, whose coverage is skewed toward federal waters, although coastwide, as well as the NWFSC California Bight longline survey, which is limited to Southern California, but shows a more balanced effort distribution between jurisdictions.

h) "The SSC highlights that the distribution and intensity of historical fishing effort may have impacted the distribution of the population and that additional analyses on this interaction may be warranted."

This is an excellent recommendation for future research, and although we are open to collaborate with the science centers on an analysis to address questions such as this, it would need to be prioritized appropriately. Also see response to comment 4b. To the extent that the future allowable fishing areas closely resemble the current and recent historical fishing effort, then the impact of past closed areas would be less of a concern relative the question of commercial catch distribution in federal waters.



Figure 1. Estimated proportions of FMP groundfish catch and categories by species/complex, in the federal EEZ off **Washington**, versus state waters, with 95% CI.



Figure 2. Estimated proportions of FMP groundfish catch by species and complex/category, in the federal EEZ off Oregon, versus state waters, with 95% CI.

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Figure 3. Estimated proportions of FMP groundfish catch by species/complex, in the federal EEZ off **California**, versus state waters, with 95% CI.

Species

Table 1. Estimated mean (annual) proportions of catch in the federal EEZ, and 95% confidence limits, by groundfish FMP species, for selected shoreside commercial groundfish fishery sectors, by area within state (sorted alphabetically by species). Dash indicates no estimate, and zero total catch for the state in that year, across both federal and state jurisdictions, thus a zero denominator for the proportion.

		California			Oregon			Washington	L
Species	Low CL	Mean	High CL	Low CL	Mean	High CL	Low CL	Mean	High CL
Arrowtooth Flounder	0.985	0.994	1.000	0.987	0.995	1.000	0.999	1.000	1.000
Aurora Rockfish	0.824	0.928	0.999	0.999	1.000	1.000	0.949	0.986	1.000
Bank Rockfish	0.979	0.991	1.000	0.997	0.999	1.000	0.000	0.667	1.000
Big Skate	0.973	0.988	0.998	0.981	0.992	0.997	0.964	0.987	1.000
Black and Yellow Rockfish	0.000	0.022	0.060	0.000	0.000	0.000	-	-	-
Black Rockfish	0.000	0.009	0.029	0.012	0.024	0.034	1.000	1.000	1.000
Black Skate	0.986	0.993	1.000	-	-	-	-	-	-
Blackgill Rockfish	0.602	0.837	0.997	0.885	0.959	1.000	0.825	0.938	0.998
Blue/Deacon Rockfish	0.003	0.056	0.135	0.005	0.024	0.045	-	-	-
Bocaccio Rockfish	0.937	0.971	0.997	0.985	0.994	1.000	0.820	0.950	0.999
Brown Rockfish	0.005	0.051	0.104	0.000	0.000	0.000	-	-	-
Butter Sole	-	-	-	1.000	1.000	1.000	-	-	-
Cabezon	0.012	0.051	0.103	0.006	0.042	0.121	-	-	-
California Scorpionfish	0.000	0.258	0.749	-	-	-	-	-	-
California Skate	0.985	0.995	1.000	-	-	-	-	-	-
Canary Rockfish	0.843	0.893	0.949	0.972	0.977	0.983	0.993	0.996	0.998
Chilipepper Rockfish	0.986	0.995	0.999	0.999	1.000	1.000	0.981	0.994	1.000
China Rockfish	0.001	0.044	0.122	0.007	0.035	0.087	-	-	-
Copper Rockfish	0.066	0.140	0.208	0.001	0.024	0.043	-	-	-
Cowcod Rockfish	0.999	1.000	1.000	1.000	1.000	1.000	-	-	-
Curlfin Sole	0.971	0.989	0.999	1.000	1.000	1.000	-	-	-
Darkblotched Rockfish	0.982	0.992	0.998	0.996	0.998	1.000	0.974	0.990	1.000
Dover Sole	0.999	0.999	1.000	1.000	1.000	1.000	0.999	1.000	1.000
English Sole	0.982	0.992	0.999	0.997	0.999	1.000	1.000	1.000	1.000
Flag Rockfish	0.458	0.726	0.923	-	-	-	-	-	-
Flatfish Unid	0.937	0.961	0.997	1.000	1.000	1.000	1.000	1.000	1.000
Flathead Sole	1.000	1.000	1.000	1.000	1.000	1.000	-	-	-
Gopher Rockfish	0.010	0.023	0.035	0.000	0.012	0.045	-	-	-
Grass Rockfish	0.000	0.002	0.007	0.000	0.000	0.000	-	-	-
Greenblotched Rockfish	0.250	0.681	1.000	-	-	-	-	-	-
Greenspotted Rockfish	0.771	0.908	0.999	0.769	0.907	0.999	0.229	0.614	1.000
Greenstriped Rockfish	0.847	0.934	0.997	0.997	0.998	1.000	0.948	0.979	1.000
Grenadier Unid	0.885	0.958	0.996	1.000	1.000	1.000	-	-	-
Groundfish Unid	-	-	-	1.000	1.000	1.000	-	-	-
Harlequin Rockfish	-	-	-	1.000	1.000	1.000	1.000	1.000	1.000
Honey comb Rockfish	0.205	0.429	0.603	-	-	-	-	-	-
Kelp Greenling	0.000	0.000	0.000	0.010	0.034	0.059	-	-	-
Kelp Rockfish	0.000	0.000	0.000	-	-	-	-	-	-
Leopard Shark	0.000	0.250	0.775	-	-	-	-	-	-
Lingcod	0.778	0.812	0.864	0.713	0.745	0.788	0.955	0.988	1.000
Longnose Skate	0.978	0.989	0.997	0.993	0.996	1.000	0.944	0.974	0.998
Longspine Thornyhead	0.962	0.987	0.997	1.000	1.000	1.000	1.000	1.000	1.000
Mexican Rockfish	0.308	0.769	1.000	-	-	-	-	-	-
NS Rockfish Unid	0.000	0.025	0.062	-	-	-	1.000	1.000	1.000
Olive Rockfish	0.001	0.178	0.440	0.000	0.000	0.000	-	-	-
Pacific Cod	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

		California			Oregon			Washington	
Species	Low CL	Mean	High CL	Low CL	Mean	High CL	Low CL	Mean	High CL
Pacific Grenadier	0.905	0.953	1.000	-	-	-	-	-	-
Pacific Hake	0.988	0.996	0.999	1.000	1.000	1.000	0.996	0.998	1.000
Pacific Ocean Perch	0.933	0.962	0.994	1.000	1.000	1.000	0.993	0.997	1.000
Pacific Sanddab	0.748	0.912	0.990	0.998	1.000	1.000	-	-	-
Petrale Sole	0.990	0.995	0.999	1.000	1.000	1.000	0.999	0.999	1.000
Pink Rockfish	1.000	1.000	1.000	-	-	-	-	-	-
Quillback Rockfish	0.001	0.151	0.393	0.023	0.052	0.087	-	-	-
Redbanded Rockfish	0.930	0.961	0.989	0.925	0.963	0.998	0.886	0.966	1.000
Redstripe Rockfish	-	-	-	1.000	1.000	1.000	0.969	0.991	1.000
Rex Sole	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Rock Sole	0.337	0.645	0.871	0.996	0.998	1.000	1.000	1.000	1.000
Rockfish Unid	0.000	0.500	1.000	-	-	-	-	-	-
Rosethorn Rockfish	0.405	0.604	0.752	0.980	0.993	0.999	0.998	0.999	1.000
Rosy Rockfish	0.044	0.171	0.385	0.000	0.304	0.912	-	-	-
Rgheye/Blksp Rockfish	0.900	0.946	0.988	0.812	0.940	1.000	0.971	0.988	1.000
Sablefish	0.957	0.972	0.992	0.983	0.992	0.999	0.983	0.991	0.997
Sand Sole	0.330	0.613	0.913	0.769	0.929	1.000	1.000	1.000	1.000
Sanddab Unid	0.055	0.741	1.000	-	-	-	1.000	1.000	1.000
Sharpchin Rockfish	0.996	0.999	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shelf Rockfish Unid	0.241	0.663	0.929	0.942	0.983	1.000	0.000	0.500	1.000
Shortbelly Rockfish	0.995	0.998	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Shortraker Rockfish	1.000	1.000	1.000	0.996	0.999	1.000	0.948	0.986	1.000
Shortspine Thornyhead	0.866	0.943	0.987	1.000	1.000	1.000	0.983	0.993	1.000
Shortspine/Longspine	0.465	0.726	1 000						
Thornyhead	0.403	0.720	1.000	-	-	-	-	-	-
Silvergray Rockfish	1.000	1.000	1.000	0.988	0.995	1.000	0.999	1.000	1.000
Slope Rockfish Unid*	0.714	0.924	1.000	0.830	0.910	0.985	-	-	-
Soupfin Shark	0.429	0.679	0.887	0.950	0.987	1.000	1.000	1.000	1.000
Speckled Rockfish	0.648	0.859	1.000	-	-	-	-	-	-
Spiny Dogfish Shark	0.978	0.992	0.999	0.971	0.992	1.000	1.000	1.000	1.000
Splitnose Rockfish	0.994	0.998	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Spotted Ratfish	0.995	0.998	1.000	0.925	0.979	1.000	1.000	1.000	1.000
Squarespot Rockfish	0.244	0.469	0.674	-	-	-	-	-	-
Starry Flounder	0.686	0.805	0.940	0.460	0.754	0.999	1.000	1.000	1.000
Starry Rockfish	0.326	0.562	0.790	-	-	-	-	-	-
Stripetail Rockfish	0.998	0.999	1.000	1.000	1.000	1.000	-	-	-
Tiger Rockfish	0.000	0.330	0.989	0.005	0.038	0.095	0.000	0.000	0.000
Treefish Rockfish	0.000	0.043	0.104	-	-	-	-	-	-
Vermilion Rockfish	0.510	0.661	0.780	0.013	0.049	0.083	-	-	-
Widow Rockfish	0.989	0.994	0.997	1.000	1.000	1.000	1.000	1.000	1.000
Yelloweye Rockfish	0.281	0.705	1.000	0.387	0.719	0.978	0.250	0.800	1.000
Yellowmouth Rockfish	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Yellowtail Rockfish	0.468	0.644	0.825	0.999	1.000	1.000	0.993	0.998	1.000
Calico Rockfish	0.000	0.158	0.316	-	-	-	-	-	-
Pygmy Rockfish	-	-	-	1.000	1.000	1.000	-	-	-
Freckled Rockfish	1.000	1.000	1.000	-	-	-	-	-	-
Chameleon Rockfish	0.088	0.088	0.088	-			-		_
Pinkrose Rockfish	1.000	1.000	1.000	-	-	-	-	-	-



Figure 4. Estimated annual proportions of catch in the federal EEZ off **California**, and annual catch (mt), by groundfish FMP species, for selected shoreside commercial groundfish fishery sectors. Dot size represents relative amount of annual catch; scale is approximately zero (minimum) to 2,000 mt, maximum.



Figure 5. Estimated annual proportions of catch in the federal EEZ off **Oregon**, and annual catch (mt), by groundfish FMP species, for selected shoreside commercial groundfish fishery sectors. Dot size represents relative amount of annual catch; scale is to 10,000 mt, maximum (Pacific hake removed to preserve variability in scale).



Figure 6. Estimated annual proportions of catch in the federal EEZ off **Washington**, and annual catch (mt), by groundfish FMP species, for selected shoreside commercial groundfish fishery sectors. Dot size represents relative amount of annual catch; scale is to 2,000 mt, maximum (Pacific hake removed to preserve variability in scale).



Figure 7. Proportions of catch in the nearshore sector (x-axis), versus estimated proportions of catch in federal jurisdiction, and frequency distributions for each variable, in an exploration of suitability of proportional nearshore catch as a proxy for proportion of federal jurisdiction in off California and Oregon, respectively. There is no commercial nearshore fishery off Washington.Non-parametric correlation values for California were: Spearman p = -0.844 (p<0.0001), Kendall's Tau = -0.694 (p<0.0001); and for Oregon were: Spearman p = -0.819 (p<0.0001), Kendall's Tau = -0.689 (p<0.0001). Results indicate that although well (negatively) correlated, the proportion of nearshore catch could serve as a rough approximation, but not a precise proxy or predictor for proportion of catch in state or federal waters. Shaded zones indicate sample density.

	California			Oregon Washington Uich CL Species (OP) Low CL Mapping (WA) Low CL Mapping (WA)							
Species (CA)	LowCL	Mean	High CL	Species (OR)	LowCL	Mean	High CL	Species (WA)	LowCL	Mean	High CL
Kelp Greenling	0.000	0.000	0.000	Blk & Ylw Rockfish	0.000	0.000	0.000	Tiger Rockfish	0.000	0.000	0.000
Kelp Rockfish	0.000	0.000	0.000	Brown Rockfish	0.000	0.000	0.000	Shelf Rockfish Unid	0.000	0.500	1.000
Grass Rockfish	0.000	0.002	0.007	Grass Rockfish	0.000	0.000	0.000	Greenspotted Rockfish	0.229	0.614	1.000
Black Rockfish	0.000	0.009	0.029	Olive Rockfish	0.000	0.000	0.000	Bank Rockfish	0.000	0.667	1.000
Blk & Ylw Rockfish	0.000	0.022	0.060	Gopher Rockfish	0.000	0.012	0.045	Yelloweye Rockfish	0.250	0.800	1.000
Gopher Rockfish	0.010	0.023	0.035	Copper Rockfish	0.001	0.024	0.043	Blackgill Rockfish	0.825	0.938	0.998
NS Rockfish Unid	0.000	0.025	0.062	Black Rockfish	0.012	0.024	0.034	Bocaccio Rockfish	0.820	0.950	0.999
Treefish Rockfish	0.000	0.043	0.104	Blue/Deacon Rockfish	0.005	0.024	0.045	Redbanded Rockfish	0.886	0.966	1.000
China Rockfish	0.001	0.044	0.122	Kelp Greenling	0.010	0.034	0.059	Longnose Skate	0.944	0.974	0.998
Brown Rockfish	0.005	0.051	0.104	China Rockfish	0.007	0.035	0.087	Greenstriped Rockfish	0.948	0.979	1.000
Cabezon	0.012	0.051	0.103	Tiger Rockfish	0.005	0.038	0.095	Aurora Rockfish	0.949	0.986	1.000
Blue/Deacon Rockfish	0.003	0.056	0.135	Cabezon	0.006	0.042	0.121	Shortraker Rockfish	0.948	0.986	1.000
Chameleon Rockfish	0.088	0.088	0.088	Vermilion Rockfish	0.013	0.049	0.083	Big Skate	0.964	0.987	1.000
Copper Rockfish	0.066	0.140	0.208	Quillback Rockfish	0.023	0.052	0.087	Rgheye/Blksp Rockfish	0.971	0.988	1.000
Quillback Rockfish	0.001	0.151	0.393	Rosy Rockfish	0.000	0.304	0.912	Lingcod	0.955	0.988	1.000
Calico Rockfish	0.000	0.158	0.316	Yelloweye Rockfish	0.387	0.719	0.978	Darkblotched Rockfish	0.974	0.990	1.000
Rosy Rockfish	0.044	0.171	0.385	Lingcod	0.713	0.745	0.788	Sablefish	0.983	0.991	0.997
Olive Rockfish	0.001	0.178	0.440	Starry Flounder	0.460	0.754	0.999	Redstripe Rockfish	0.969	0.991	1.000
Leopard Shark	0.000	0.250	0.775	Greenspotted Rockfish	0.769	0.907	0.999	Shortspine Thomyhead	0.983	0.993	1.000
California Scorpionfish	0.000	0.258	0.749	Slope Rockfish Unid	0.830	0.910	0.985	Chilipepper Rockfish	0.981	0.994	1.000
Tiger Rockfish	0.000	0.330	0.989	Sand Sole	0.769	0.929	1.000	Canary Rockfish	0.993	0.996	0.998
Honeycomb Rockfish	0.205	0.429	0.603	Rgheye/Blksp Rockfish	0.812	0.940	1.000	Pacific Ocean Perch	0.993	0.997	1.000
Squarespot Rockfish	0.244	0.469	0.674	Blackgill Rockfish	0.885	0.959	1.000	Yellowtail Rockfish	0.993	0.998	1.000
Rockfish Unid	0.000	0.500	1.000	Redbanded Rockfish	0.925	0.963	0.998	Pacific Hake	0.996	0.998	1.000
Starry Rockfish	0.326	0.562	0.790	Canary Rockfish	0.972	0.977	0.983	Rosethorn Rockfish	0.998	0.999	1.000

Table 2. Sorted ascending, estimated mean (annual) proportions of catch in the federal EEZ, and 95% confidence limits, by groundfish FMP species, for selected shoreside commercial groundfish fishery sectors, by area within state. Dash indicates no estimate, and zero total catch for the state in that year, across both federal and state jurisdictions, thus a zero denominator for the proportion.

	California		High CL Species (OR) LowCL Mean High CL Species (WA) LowCL Mean High CL								
Species (CA)	LowCL	Mean	High CL	Species (OR)	LowCL	Mean	High CL	Species (WA)	LowCL	Mean	High CL
Rosethorn Rockfish	0.405	0.604	0.752	Spotted Ratfish	0.925	0.979	1.000	Petrale Sole	0.999	0.999	1.000
Sand Sole	0.330	0.613	0.913	Shelf Rockfish Unid	0.942	0.983	1.000	Arrowtooth Flounder	0.999	1.000	1.000
Yellowtail Rockfish	0.468	0.644	0.825	Soupfin Shark	0.950	0.987	1.000	Dover Sole	0.999	1.000	1.000
Rock Sole	0.337	0.645	0.871	Sablefish	0.983	0.992	0.999	Silvergray Rockfish	0.999	1.000	1.000
Vermilion Rockfish	0.510	0.661	0.780	Spiny Dogfish Shark	0.971	0.992	1.000	Harlequin Rockfish	1.000	1.000	1.000
Shelf Rockfish Unid	0.241	0.663	0.929	Big Skate	0.981	0.992	0.997	WidowRockfish	1.000	1.000	1.000
Soupfin Shark	0.429	0.679	0.887	Rosethorn Rockfish	0.980	0.993	0.999	Spiny Dogfish Shark	1.000	1.000	1.000
Greenblotched Rockfish	0.250	0.681	1.000	Bocaccio Rockfish	0.985	0.994	1.000	Splitnose Rockfish	1.000	1.000	1.000
Yelloweye Rockfish	0.281	0.705	1.000	Arrowtooth Flounder	0.987	0.995	1.000	Longspine Thomyhead	1.000	1.000	1.000
Flag Rockfish	0.458	0.726	0.923	Silvergray Rockfish	0.988	0.995	1.000	Black Rockfish	1.000	1.000	1.000
Ssp/Lsp Thornyhead	0.465	0.726	1.000	Longnose Skate	0.993	0.996	1.000	English Sole	1.000	1.000	1.000
Sanddab Unid	0.055	0.741	1.000	Darkblotched Rockfish	0.996	0.998	1.000	Flatfish Unid	1.000	1.000	1.000
Mexican Rockfish	0.308	0.769	1.000	Rock Sole	0.996	0.998	1.000	NS Rockfish Unid	1.000	1.000	1.000
Starry Flounder	0.686	0.805	0.940	Greenstriped Rockfish	0.997	0.998	1.000	Pacific Cod	1.000	1.000	1.000
Lingcod	0.778	0.812	0.864	Shortraker Rockfish	0.996	0.999	1.000	Rex Sole	1.000	1.000	1.000
Blackgill Rockfish	0.602	0.837	0.997	Bank Rockfish	0.997	0.999	1.000	Rock Sole	1.000	1.000	1.000
Speckled Rockfish	0.648	0.859	1.000	English Sole	0.997	0.999	1.000	Sand Sole	1.000	1.000	1.000
Canary Rockfish	0.843	0.893	0.949	Pacific Sanddab	0.998	1.000	1.000	Sanddab Unid	1.000	1.000	1.000
Greenspotted Rockfish	0.771	0.908	0.999	Yellowtail Rockfish	0.999	1.000	1.000	Sharpchin Rockfish	1.000	1.000	1.000
Pacific Sanddab	0.748	0.912	0.990	Aurora Rockfish	0.999	1.000	1.000	Shortbelly Rockfish	1.000	1.000	1.000
Slope Rockfish Unid	0.714	0.924	1.000	Chilipepper Rockfish	0.999	1.000	1.000	Soupfin Shark	1.000	1.000	1.000
Aurora Rockfish	0.824	0.928	0.999	Short spine Thorny head	1.000	1.000	1.000	Spotted Ratfish	1.000	1.000	1.000
Greenstriped Rockfish	0.847	0.934	0.997	WidowRockfish	1.000	1.000	1.000	Starry Flounder	1.000	1.000	1.000
Shortspine Thomyhead	0.866	0.943	0.987	Petrale Sole	1.000	1.000	1.000	Yellowmouth Rockfish	1.000	1.000	1.000
Rgheye/Blksp Rockfish	0.900	0.946	0.988	Curlfin Sole	1.000	1.000	1.000	Slope Rockfish Unid*	-	-	-
Pacific Grenadier	0.905	0.953	1.000	Butter Sole	1.000	1.000	1.000	Blk & Ylw Rockfish	-	-	-
Grenadier Unid	0.885	0.958	0.996	Stripetail Rockfish	1.000	1.000	1.000	Black Skate	-	-	-
Redbanded Rockfish	0.930	0.961	0.989	Pacific Hake	1.000	1.000	1.000	Blue/Deacon Rockfish	-	-	-

(California			Oregon Washington High CL Species (OR) LowCL Mean High CL Species (WA) LowCL Mean							
Species (CA)	LowCL	Mean	High CL	Species (OR)	LowCL	Mean	High CL	Species (WA)	LowCL	Mean	High CL
Flatfish Unid	0.937	0.961	0.997	Longspine Thomyhead	1.000	1.000	1.000	Brown Rockfish	-	-	-
Pacific Ocean Perch	0.933	0.962	0.994	Rex Sole	1.000	1.000	1.000	Butter Sole	-	-	-
Bocaccio Rockfish	0.937	0.971	0.997	Splitnose Rockfish	1.000	1.000	1.000	Cabezon	-	-	-
Sablefish	0.957	0.972	0.992	Dover Sole	1.000	1.000	1.000	California Scorpionfish	-	-	-
Longspine Thomyhead	0.962	0.987	0.997	Pacific Ocean Perch	1.000	1.000	1.000	California Skate	-	-	-
Big Skate	0.973	0.988	0.998	Grenadier Unid	1.000	1.000	1.000	China Rockfish	-	-	-
Longnose Skate	0.978	0.989	0.997	Flathead Sole	1.000	1.000	1.000	Copper Rockfish	-	-	-
Curlfin Sole	0.971	0.989	0.999	Shortbelly Rockfish	1.000	1.000	1.000	Cowcod Rockfish	-	-	-
Bank Rockfish	0.979	0.991	1.000	Pacific Cod	1.000	1.000	1.000	Curlfin Sole	-	-	-
Spiny Dogfish Shark	0.978	0.992	0.999	Sharpchin Rockfish	1.000	1.000	1.000	Flag Rockfish	-	-	-
Darkblotched Rockfish	0.982	0.992	0.998	Cowcod Rockfish	1.000	1.000	1.000	Flathead Sole	-	-	-
English Sole	0.982	0.992	0.999	Flatfish Unid	1.000	1.000	1.000	Gopher Rockfish	-	-	-
Black Skate	0.986	0.993	1.000	Groundfish Unid	1.000	1.000	1.000	Grass Rockfish	-	-	-
Arrowtooth Flounder	0.985	0.994	1.000	Harlequin Rockfish	1.000	1.000	1.000	Greenblotched Rockfish	-	-	-
WidowRockfish	0.989	0.994	0.997	Redstripe Rockfish	1.000	1.000	1.000	Grenadier Unid	-	-	-
California Skate	0.985	0.995	1.000	Yellowmouth Rockfish	1.000	1.000	1.000	Groundfish Unid	-	-	-
Chilipepper Rockfish	0.986	0.995	0.999	Pygmy Rockfish	1.000	1.000	1.000	Honeycomb Rockfish	-	-	-
Petrale Sole	0.990	0.995	0.999	Black Skate	-	-	-	Kelp Greenling	-	-	-
Pacific Hake	0.988	0.996	0.999	California Scorpionfish	-	-	-	Kelp Rockfish	-	-	-
Shortbelly Rockfish	0.995	0.998	1.000	California Skate	-	-	-	Leopard Shark	-	-	-
Splitnose Rockfish	0.994	0.998	1.000	Flag Rockfish	-	-	-	Mexican Rockfish	-	-	-
Spotted Ratfish	0.995	0.998	1.000	Greenblotched Rockfish	-	-	-	Olive Rockfish	-	-	-
Sharpchin Rockfish	0.996	0.999	1.000	Honeycomb Rockfish	-	-	-	Pacific Grenadier	-	-	-
Stripetail Rockfish	0.998	0.999	1.000	Kelp Rockfish	-	-	-	Pacific Sanddab	-	-	-
Dover Sole	0.999	0.999	1.000	Leopard Shark	-	-	-	Pink Rockfish	-	-	-
Rex Sole	0.999	1.000	1.000	Mexican Rockfish	-	-	-	Quillback Rockfish	-	-	-
Cowcod Rockfish	0.999	1.000	1.000	NS Rockfish Unid	-	-	-	Rockfish Unid	-	-	-
Flathead Sole	1.000	1.000	1.000	Pacific Grenadier	-	-	-	Rosy Rockfish	-	-	-

	California			Oregon Washington							
Species (CA)	LowCL	Mean	High CL	Species (OR)	LowCL	Mean	High CL	Species (WA)	LowCL	Mean	High CL
Pacific Cod	1.000	1.000	1.000	Pink Rockfish	-	-	-	Ssp/Lsp Thornyhead	-	-	-
Pink Rockfish	1.000	1.000	1.000	Rockfish Unid	-	-	-	Speckled Rockfish	-	-	-
Shortraker Rockfish	1.000	1.000	1.000	Sanddab Unid	-	-	-	Squarespot Rockfish	-	-	-
Silvergray Rockfish	1.000	1.000	1.000	Ssp/Lsp Thornyhead	-	-	-	Starry Rockfish	-	-	-
Yellowmouth Rockfish	1.000	1.000	1.000	Speckled Rockfish	-	-	-	Stripetail Rockfish	-	-	-
Freckled Rockfish	1.000	1.000	1.000	Squarespot Rockfish	-	-	-	Treefish Rockfish	-	-	-
Pinkrose Rockfish	1.000	1.000	1.000	Starry Rockfish	-	-	-	Vermilion Rockfish	-	-	-
Butter Sole	-	-	-	Treefish Rockfish	-	-	-	Calico Rockfish	-	-	-
Groundfish Unid	-	-	-	Calico Rockfish	-	-	-	Pygmy Rockfish	-	-	-
Harlequin Rockfish	-	-	-	Freckled Rockfish	-	-	-	Freckled Rockfish	-	-	-
Redstripe Rockfish	-	-	-	Chameleon Rockfish	-	-	-	Chameleon Rockfish	-	-	-
Pygmy Rockfish	-	-	-	Pinkrose Rockfish	-	-	-	Pinkrose Rockfish	-	-	-

Table 3 (a, b, and c). Proportional distribution of average annual catch (2017-2021), for FMP groundfish species, among selected (commercial shorebased) observed sectors, by state; shown as heatmaps (green-to-red scale; green = low, red = high values).

	Catch	Catch Shares	LE Fixed Gear	Limited Entry	Midwater	Midwater	Midwater	Midwater Rockfish		OA Fixed
Species / Sector (CA)	Shares	EM	DTL	Sablefish	Hake	Hake EM	Rockfish	EM	Nearshore	Gear
Arrowtooth Flounder	0.147	0.842	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.004
Aurora Rockfish	0.554	0.358	0.079	0.006	0.000	0.000	0.000	0.000	0.000	0.002
Bank Rockfish	0.877	0.083	0.028	0.000	0.000	0.000	0.000	0.000	0.000	0.012
Big Skate	0.831	0.135	0.027	0.005	0.000	0.000	0.000	0.000	0.001	0.002
Black and Yellow Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.928	0.072
Black Rockfish	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.983	0.016
Black Skate	0.337	0.266	0.353	0.020	0.000	0.000	0.000	0.000	0.000	0.024
Blackgill Rockfish	0.227	0.229	0.305	0.166	0.000	0.000	0.000	0.000	0.000	0.073
Blue/Deacon Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.998	0.002
Bocaccio Rockfish	0.503	0.417	0.049	0.003	0.000	0.000	0.000	0.003	0.007	0.018
Brown Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.995	0.004
Butter Sole	-	-	-	-	-	-	-	-	-	-
Cabezon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.972	0.028
Calico Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
California Scorpionfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
California Skate	0.363	0.554	0.083	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Canary Rockfish	0.834	0.058	0.000	0.002	0.000	0.000	0.000	0.003	0.057	0.046
Chameleon Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Chilipepper Rockfish	0.623	0.351	0.019	0.001	0.000	0.000	0.000	0.002	0.000	0.003
China Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.996	0.004
Copper Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.984	0.016
Cowcod Rockfish	0.219	0.781	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Curlfin Sole	0.565	0.435	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Darkblotched Rockfish	0.654	0.315	0.010	0.015	0.000	0.000	0.000	0.000	0.000	0.006
Dover Sole	0.513	0.484	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000
English Sole	0.599	0.401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Flag Rockfish	0.092	0.008	0.258	0.005	0.000	0.000	0.000	0.000	0.236	0.401
Flatfish Unid	0.009	0.852	0.064	0.000	0.000	0.000	0.000	0.000	0.014	0.061
Flathead Sole	0.072	0.928	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Freckled Rockfish	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gopher Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.980	0.020

3.a. California; proportional distribution of average annual catch among sectors, sorted alphabetically by species.

	Catch	Catch Shares	LE Fixed Gear	Limited Entry	Midwater	Midwater	Midwater	Midwater Rockfish		OA Fixed
Species / Sector (CA)	Shares	EM	DTL	Sablefish	Hake	Hake EM	Rockfish	EM	Nearshore	Gear
Grass Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.990	0.010
Greenblotched Rockfish	0.029	0.025	0.008	0.000	0.000	0.000	0.000	0.000	0.403	0.535
Greenspotted Rockfish	0.233	0.079	0.165	0.016	0.000	0.000	0.000	0.001	0.129	0.377
Greenstriped Rockfish	0.709	0.221	0.020	0.007	0.000	0.000	0.000	0.002	0.005	0.037
Grenadier Unid	0.000	0.044	0.485	0.137	0.000	0.000	0.000	0.000	0.000	0.334
Groundfish Unid	-	-	-	-	-	-	-	-	-	-
Harlequin Rockfish	-	-	-	-	-	-	-	-	-	-
Honey comb Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.748	0.252
Kelp Greenling	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.994	0.006
Kelp Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Leopard Shark	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.262	0.735
Lingcod	0.588	0.152	0.011	0.013	0.000	0.000	0.000	0.000	0.122	0.113
Longnose Skate	0.501	0.436	0.045	0.012	0.000	0.000	0.000	0.000	0.002	0.004
Longspine Thornyhead	0.284	0.643	0.064	0.005	0.000	0.000	0.000	0.003	0.000	0.001
Mexican Rockfish	0.207	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.059	0.726
Nearshore Rockfish Unid	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.998	0.000
Olive Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.484	0.516
Pacific Cod	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pacific Grenadier	0.454	0.078	0.180	0.243	0.000	0.000	0.000	0.000	0.000	0.045
Pacific Hake	0.635	0.341	0.005	0.005	0.000	0.000	0.000	0.013	0.000	0.001
Pacific Ocean Perch	0.448	0.466	0.004	0.059	0.000	0.000	0.000	0.000	0.000	0.023
Pacific Sanddab	0.283	0.625	0.029	0.000	0.000	0.000	0.000	0.000	0.039	0.022
Petrale Sole	0.599	0.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Pink Rockfish	0.297	0.703	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pinkrose Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000
Py gmy Rockfish	-	-	-	-	-	-	-	-	-	-
Quillback Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.992	0.008
Redbanded Rockfish	0.212	0.232	0.060	0.352	0.000	0.000	0.000	0.000	0.076	0.068
Redstripe Rockfish	-	-	-	-	-	-	-	-	-	-
Rex Sole	0.705	0.295	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rock Sole	0.214	0.505	0.000	0.000	0.000	0.000	0.000	0.000	0.138	0.143
Rockfish Unid	0.920	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.080	0.000
Rosethorn Rockfish	0.016	0.160	0.043	0.380	0.000	0.000	0.000	0.000	0.316	0.085
Rosy Rockfish	0.000	0.003	0.027	0.006	0.000	0.000	0.000	0.000	0.767	0.198
Rougheye/Blackspotted Rockfish	0.236	0.138	0.031	0.485	0.000	0.000	0.000	0.000	0.000	0.111

Spacing / Sastor (CA)	Catch	Catch Shares	LE Fixed Gear	Limited Entry Sablafiab	Midwater	Midwater	Midwater	Midwater Rockfish	Naarahara	OA Fixed
Species / Sector (CA)	0.162	EM 0.162	0.278		0.000		0.000			0.126
Sablerish Sand Solo	0.102	0.102	0.278	0.234	0.000	0.000	0.000	0.000	0.008	0.130
Sand Sole	0.139	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.230	0.000
Sham ahin Dealifish	0.007	0.111	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.800
Shalf Dealrfish Unid	0.227	0.773	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Shen Kocklish Ullid	0.307	0.031	0.209	0.008	0.000	0.000	0.000	0.000	0.099	0.207
Shortbelly Rocklish	0.528	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000
Shortraker Rocklish	0.588	0.387	0.000	0.025	0.000	0.000	0.000	0.000	0.000	0.000
Shortspine I hornyhead	0.201	0.291	0.439	0.056	0.000	0.000	0.000	0.001	0.003	0.011
Thorny head	0.000	0.000	0.680	0.194	0.000	0.000	0.000	0.000	0.000	0.126
Silvergray Rockfish	0.043	0.957	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Slope Rockfish Unid	0.026	0.002	0.000	0.895	0.000	0.000	0.000	0.000	0.000	0.077
Soupfin Shark	0.108	0.338	0.008	0.000	0.000	0.000	0.000	0.000	0.295	0.252
Speckled Rockfish	0.000	0.000	0.177	0.036	0.000	0.000	0.000	0.000	0.369	0.419
Spiny Dogfish Shark	0.811	0.058	0.054	0.057	0.000	0.000	0.000	0.000	0.001	0.019
Splitnose Rockfish	0.762	0.233	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.002
Spotted Ratfish	0.711	0.283	0.006	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Squarespot Rockfish	0.000	0.000	0.270	0.000	0.000	0.000	0.000	0.000	0.435	0.295
Starry Flounder	0.076	0.895	0.000	0.000	0.000	0.000	0.000	0.000	0.029	0.000
Starry Rockfish	0.000	0.000	0.370	0.000	0.000	0.000	0.000	0.000	0.384	0.246
Stripetail Rockfish	0.929	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tiger Rockfish	0.000	0.000	0.000	0.986	0.000	0.000	0.000	0.000	0.014	0.000
Treefish Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Vermilion Rockfish	0.002	0.002	0.246	0.004	0.000	0.000	0.000	0.000	0.366	0.380
Widow Rockfish	0.050	0.015	0.003	0.001	0.000	0.000	0.115	0.788	0.004	0.023
Yelloweye Rockfish	0.014	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.782	0.192
Yellowmouth Rockfish	0.060	0.940	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Yellowtail Rockfish	0.305	0.016	0.015	0.101	0.000	0.000	0.000	0.043	0.197	0.323

	Catal	Catal	LE Eined	Limited	Midaustan	Milanter	Milanter	Midwater		O A Eine d
Species/Sector (OR)	Shares	Shares EM	Gear DTL	Entry Sablefish	Hake	Midwater Hake EM	Rockfish	EM	Nearshore	Gear
Arrowtooth Flounder	0.930	0.010	0.012	0.033	0.004	0.003	0.000	0.000	0.000	0.006
Aurora Rockfish	0.992	0.007	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Bank Rockfish	0.338	0.006	0.000	0.012	0.099	0.361	0.155	0.029	0.000	0.001
Big Skate	0.943	0.000	0.003	0.017	0.007	0.007	0.003	0.001	0.001	0.017
Black and Yellow Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Black Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.986	0.014
Black Skate	-	-	-	-	-	-	-	-	-	-
Blackgill Rockfish	0.782	0.022	0.083	0.106	0.000	0.000	0.000	0.000	0.000	0.007
Blue/Deacon Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.982	0.011
Bocaccio Rockfish	0.153	0.000	0.000	0.009	0.340	0.102	0.209	0.179	0.000	0.007
Brown Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.804	0.196
Butter Sole	0.963	0.000	0.000	0.000	0.000	0.037	0.000	0.000	0.000	0.000
Cabezon	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.988	0.012
Calico Rockfish	-	-	-	-	-	-	-	-	-	-
California Scorpionfish	-	-	-	-	-	-	-	-	-	-
California Skate	-	-	-	-	-	-	-	-	-	-
Canary Rockfish	0.325	0.000	0.000	0.004	0.243	0.221	0.091	0.097	0.015	0.004
Chameleon Rockfish	-	-	-	-	-	-	-	-	-	-
Chilipepper Rockfish	0.337	0.000	0.000	0.003	0.090	0.493	0.047	0.029	0.000	0.001
China Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.987	0.013
Copper Rockfish	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.908	0.091
Cowcod Rockfish	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Curlfin Sole	0.966	0.019	0.000	0.000	0.005	0.005	0.005	0.000	0.000	0.000
Darkblotched Rockfish	0.661	0.012	0.004	0.006	0.160	0.152	0.001	0.000	0.000	0.003
Dover Sole	0.967	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
English Sole	0.977	0.018	0.000	0.000	0.002	0.000	0.002	0.001	0.000	0.000
Flag Rockfish	-	-	-	-	-	-	-	-	-	-
Flatfish Unid	0.984	0.000	0.000	0.000	0.011	0.002	0.002	0.000	0.000	0.000
Flathead Sole	0.995	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000
Freckled Rockfish	-	-	-	-	-	-	-	-	-	-
Gopher Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000

3.b. Oregon; proportional distribution of average annual catch among sectors, sorted alphabetically by species.

Sparing/Sactor (OD)	Catch	Catch	LE Fixed	Limited Entry Sablafiab	Midwater	Midwater Haka FM	Midwater	Midwater Rockfish	Naarahara	OA Fixed
Grass Rockfish	0.000				0.000		0.000	0.000	0.070	0.021
Greenblotched Rockfish	-	-	-	-	-	-	-	-	-	-
Greenspotted Rockfish	0.917	0.002	0.000	0.044	0.000	0.000	0.000	0.000	0.009	0.029
Greenstriped Rockfish	0.962	0.000	0.000	0.023	0.009	0.002	0.002	0.001	0.000	0.001
Grenadier Unid	0.891	0.109	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Groundfish Unid	0.000	0.000	0.000	0.000	0.800	0.199	0.000	0.001	0.000	0.000
Harlequin Rockfish	0.015	0.000	0.000	0.000	0.043	0.545	0.239	0.159	0.000	0.000
Honey comb Rockfish	-	-	-	-	-	-	-	-	-	-
Kelp Greenling	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.989	0.006
Kelp Rockfish	-	-	-	-	-	-	-	-	-	-
Leopard Shark	-	-	-	-	-	-	-	-	-	-
Lingcod	0.662	0.004	0.002	0.024	0.020	0.016	0.006	0.002	0.168	0.096
Longnose Skate	0.933	0.017	0.005	0.025	0.001	0.000	0.001	0.000	0.000	0.016
Longspine Thorny head	0.907	0.093	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mexican Rockfish	-	-	-	-	-	-	-	-	-	-
Nearshore Rockfish Unid	-	-	-	-	-	-	-	-	-	-
Olive Rockfish	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000
Pacific Cod	0.959	0.000	0.000	0.000	0.009	0.018	0.008	0.005	0.000	0.000
Pacific Grenadier	-	-	-	-	-	-	-	-	-	-
Pacific Hake	0.001	0.000	0.000	0.000	0.519	0.478	0.000	0.001	0.000	0.000
Pacific Ocean Perch	0.705	0.005	0.000	0.000	0.127	0.063	0.097	0.003	0.000	0.000
Pacific Sanddab	0.983	0.000	0.000	0.000	0.015	0.001	0.000	0.000	0.000	0.000
Petrale Sole	0.983	0.016	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pink Rockfish	-	-	-	-	-	-	-	-	-	-
Pinkrose Rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy Rockfish	0.000	0.000	0.000	0.000	0.000	0.618	0.000	0.382	0.000	0.000
Quillback Rockfish	0.031	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.934	0.029
Redbanded Rockfish	0.446	0.021	0.081	0.368	0.012	0.009	0.000	0.001	0.000	0.061
Redstripe Rockfish	0.017	0.028	0.000	0.000	0.190	0.248	0.261	0.257	0.000	0.000
Rex Sole	0.978	0.018	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.000
Rock Sole	0.990	0.001	0.000	0.000	0.001	0.002	0.004	0.000	0.002	0.000
Rockfish Unid	-	-	-	-	-	-	-	-	-	-
Rosethorn Rockfish	0.734	0.000	0.012	0.019	0.026	0.000	0.204	0.002	0.000	0.002

Species/Sector (OR)	Catch	Catch Shares EM	LE Fixed Gear DTL	Limited Entry Sablefish	Midwater Hake	Midwater Hake EM	Midwater Rockfish	Midwater Rockfish EM	Nearshore	OA Fixed Gear
Rosy Rockfish	0.000	0.000	0.000	0.733	0.000	0.000	0.000	0.000	0.066	0.201
Rougheve/Blackspotted Rockfish	0.352	0.004	0.091	0.192	0.260	0.026	0.000	0.000	0.000	0.075
Sablefish	0.559	0.086	0.015	0.255	0.039	0.014	0.000	0.000	0.000	0.032
Sand Sole	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sanddab Unid	-	-	-	-	-	-	-	-	-	-
Sharpchin Rockfish	0.553	0.013	0.000	0.000	0.192	0.129	0.101	0.012	0.000	0.000
Shelf Rockfish Unid	0.936	0.000	0.000	0.010	0.012	0.019	0.014	0.001	0.001	0.008
Shortbelly Rockfish	0.006	0.000	0.000	0.000	0.460	0.367	0.050	0.117	0.000	0.000
Shortraker Rockfish	0.926	0.013	0.002	0.039	0.013	0.003	0.001	0.002	0.000	0.002
Shortspine Thorny head	0.940	0.045	0.000	0.002	0.009	0.003	0.000	0.000	0.000	0.001
Shortspine/Longspine Thornyhead	-	-	-	-	-	-	-	-	-	-
Silvergray Rockfish	0.854	0.000	0.000	0.006	0.033	0.058	0.030	0.014	0.000	0.006
Slope Rockfish Unid	0.321	0.048	0.082	0.133	0.000	0.338	0.015	0.028	0.000	0.035
Soupfin Shark	0.000	0.000	0.000	0.000	0.011	0.755	0.110	0.113	0.011	0.000
Speckled Rockfish	-	-	-	-	-	-	-	-	-	-
Spiny Dogfish Shark	0.117	0.000	0.008	0.218	0.324	0.230	0.001	0.087	0.000	0.014
Splitnose Rockfish	0.363	0.003	0.000	0.000	0.185	0.420	0.019	0.010	0.000	0.000
Spotted Ratfish	0.935	0.038	0.009	0.000	0.000	0.000	0.010	0.008	0.000	0.000
Squarespot Rockfish	-	-	-	-	-	-	-	-	-	-
Starry Flounder	0.999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000
Starry Rockfish	-	-	-	-	-	-	-	-	-	-
Stripetail Rockfish	0.979	0.010	0.000	0.000	0.006	0.000	0.003	0.001	0.000	0.000
Tiger Rockfish	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.973	0.023
Treefish Rockfish	-	-	-	-	-	-	-	-	-	-
Vermilion Rockfish	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.976	0.022
Widow Rockfish	0.006	0.000	0.000	0.000	0.056	0.086	0.441	0.411	0.000	0.000
Yelloweye Rockfish	0.076	0.000	0.000	0.467	0.036	0.002	0.001	0.001	0.369	0.047
Yellowmouth Rockfish	0.683	0.059	0.000	0.052	0.074	0.027	0.093	0.011	0.000	0.002
Yellowtail Rockfish	0.107	0.000	0.000	0.000	0.282	0.193	0.255	0.162	0.000	0.000

	Catch	Catch	LE Fixed	LE	Midwater	Midwater	Midwater	Midwater		OA Fixed
Species / Sector (Washington)	Shares	Shares EM	Gear DTL	Sablefish	Hake	Hake EM	Rockfish	Rockfish EM	Nearshore	Gear
Arrowtooth Flounder	0.869	0.002	0.000	0.013	0.001	0.109	0.003	0.000	0.000	0.002
Aurora Rockfish	0.861	0.001	0.000	0.024	0.000	0.104	0.001	0.007	0.000	0.003
Bank Rockfish	0.855	0.000	0.003	0.142	0.000	0.000	0.000	0.000	0.000	0.000
Big Skate	0.837	0.000	0.006	0.094	0.003	0.057	0.002	0.002	0.000	0.000
Black and Yellow Rockfish	-	-	-	-	-	-	-	-	-	-
Black Rockfish	0.445	0.000	0.000	0.000	0.000	0.000	0.000	0.555	0.000	0.000
Black Skate	-	-	-	-	-	-	-	-	-	-
Blackgill Rockfish	0.073	0.016	0.004	0.876	0.000	0.000	0.000	0.000	0.000	0.031
Blue/Deacon Rockfish	-	-	-	-	-	-	-	-	-	-
Bocaccio Rockfish	0.094	0.000	0.001	0.005	0.001	0.375	0.077	0.445	0.000	0.002
Brown Rockfish	-	-	-	-	-	-	-	-	-	-
Butter Sole	-	-	-	-	-	-	-	-	-	-
Cabezon	-	-	-	-	-	-	-	-	-	-
Calico Rockfish	-	-	-	-	-	-	-	-	-	-
California Scorpionfish	-	-	-	-	-	-	-	-	-	-
California Skate	-	-	-	-	-	-	-	-	-	-
Canary Rockfish	0.011	0.000	0.000	0.004	0.001	0.817	0.013	0.153	0.000	0.001
Chameleon Rockfish	-	-	-	-	-	-	-	-	-	-
Chilipepper Rockfish	0.057	0.000	0.041	0.363	0.000	0.000	0.386	0.131	0.000	0.022
China Rockfish	-	-	-	-	-	-	-	-	-	-
Copper Rockfish	-	-	-	-	-	-	-	-	-	-
Cowcod Rockfish	-	-	-	-	-	-	-	-	-	-
Curlfin Sole	-	-	-	-	-	-	-	-	-	-
Darkblotched Rockfish	0.397	0.000	0.002	0.016	0.000	0.572	0.006	0.003	0.000	0.004
Dover Sole	0.985	0.000	0.000	0.008	0.000	0.000	0.007	0.000	0.000	0.000
English Sole	0.942	0.000	0.000	0.000	0.000	0.002	0.050	0.005	0.000	0.000
Flag Rockfish	-	-	-	-	-	-	-	-	-	-
Flatfish Unid	0.903	0.039	0.000	0.000	0.000	0.019	0.036	0.003	0.000	0.000
Flathead Sole	-	-	-	-	-	-	-	-	-	-
Freckled Rockfish	-	-	-	-	-	-	-	-	-	-
Gopher Rockfish	-	-	-	-	-	-	-	-	-	-
Grass Rockfish	-	-	-	-	-	-	-	-	-	-
Greenblotched Rockfish	-	-	-	-	-	-	-	-	-	-
Greenspotted Rockfish	0.000	0.000	0.000	0.922	0.000	0.000	0.000	0.000	0.000	0.078

3.c. Washington; proportional distribution of average annual catch among sectors, sorted alphabetically by species.

Species / Sector (Washington)	Catch Shares	Catch Shares EM	LE Fixed Gear DTL	LE Sablefish	Midwater Hake	Midwater Hake EM	Midwater Rockfish	Midwater Rockfish EM	Nearshore	OA Fixed Gear
Greenstriped Rockfish	0.365	0.000	0.005	0.529	0.000	0.000	0.000	0.087	0.000	0.015
Grenadier Unid	-	-	-	-	-	-	-	-	-	-
Groundfish Unid	-	-	-	-	-	-	-	-	-	-
Harlequin Rockfish	0.000	0.000	0.000	0.000	0.002	0.997	0.000	0.001	0.000	0.000
Honey comb Rockfish	-	-	-	-	-	-	-	-	-	-
Kelp Greenling	-	-	-	-	-	-	-	-	-	-
Kelp Rockfish	-	-	-	-	-	-	-	-	-	-
Leopard Shark	-	-	-	-	-	-	-	-	-	-
Lingcod	0.838	0.002	0.003	0.074	0.000	0.069	0.003	0.006	0.000	0.006
Longnose Skate	0.468	0.000	0.025	0.476	0.000	0.002	0.004	0.000	0.000	0.023
Longspine Thornyhead	0.691	0.001	0.000	0.006	0.000	0.000	0.302	0.000	0.000	0.000
Mexican Rockfish	-	-	-	-	-	-	-	-	-	-
Nearshore Rockfish Unid	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
Olive Rockfish	-	-	-	-	-	-	-	-	-	-
Pacific Cod	0.059	0.000	0.000	0.815	0.010	0.106	0.000	0.000	0.000	0.011
Pacific Grenadier	-	-	-	-	-	-	-	-	-	-
Pacific Hake	0.000	0.000	0.000	0.000	0.008	0.991	0.000	0.001	0.000	0.000
Pacific Ocean Perch	0.531	0.000	0.000	0.001	0.002	0.454	0.006	0.005	0.000	0.000
Pacific Sanddab	-	-	-	-	-	-	-	-	-	-
Petrale Sole	0.984	0.001	0.001	0.007	0.000	0.000	0.005	0.000	0.000	0.003
Pink Rockfish	-	-	-	-	-	-	-	-	-	-
Pinkrose Rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy Rockfish	-	-	-	-	-	-	-	-	-	-
Quillback Rockfish	-	-	-	-	-	-	-	-	-	-
Redbanded Rockfish	0.209	0.001	0.013	0.720	0.000	0.000	0.000	0.001	0.000	0.056
Redstripe Rockfish	0.162	0.000	0.000	0.002	0.001	0.582	0.026	0.227	0.000	0.000
Rex Sole	0.990	0.000	0.000	0.000	0.000	0.001	0.009	0.000	0.000	0.000
Rock Sole	0.807	0.000	0.000	0.000	0.000	0.000	0.000	0.193	0.000	0.000
Rockfish Unid	-	-	-	-	-	-	-	-	-	-
Rosethorn Rockfish	0.944	0.000	0.001	0.040	0.000	0.000	0.005	0.008	0.000	0.002
Rosy Rockfish	-	-	-	-	-	-	-	-	-	-
Rougheye/Blackspotted Rockfish	0.133	0.000	0.036	0.693	0.000	0.048	0.001	0.002	0.000	0.086
Sablefish	0.162	0.066	0.019	0.649	0.001	0.057	0.002	0.000	0.000	0.045
Sand Sole	0.796	0.000	0.000	0.000	0.000	0.000	0.000	0.204	0.000	0.000

	Catch	Catch	LE Fixed	LE	Midwater	Midwater	Midwater	Midwater		OA Fixed
Species / Sector (Washington)	Shares	Shares EM	Gear DTL	Sablefish	Hake	Hake EM	Rockfish	Rockfish EM	Nearshore	Gear
Sanddab Unid	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sharpchin Rockfish	0.958	0.000	0.000	0.004	0.000	0.000	0.025	0.014	0.000	0.000
Shelf Rockfish Unid	0.000	0.000	0.000	0.670	0.000	0.171	0.000	0.007	0.000	0.153
Shortbelly Rockfish	0.000	0.000	0.000	0.000	0.000	0.961	0.005	0.034	0.000	0.000
Shortraker Rockfish	0.203	0.000	0.014	0.659	0.000	0.012	0.068	0.000	0.000	0.044
Shortspine Thorny head	0.506	0.003	0.016	0.430	0.000	0.000	0.031	0.000	0.000	0.013
Shortspine/Longspine										
Thornyhead	-	-	-	-	-	-	-	-	-	-
Silvergray Rockfish	0.921	0.000	0.000	0.015	0.000	0.056	0.006	0.002	0.000	0.000
Slope Rockfish Unid	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000
Soup fin Shark	0.000	0.000	0.000	0.000	0.164	0.816	0.000	0.020	0.000	0.000
Speckled Rockfish	-	-	-	-	-	-	-	-	-	-
Spiny Dogfish Shark	0.140	0.000	0.000	0.000	0.000	0.803	0.000	0.037	0.000	0.019
Splitnose Rockfish	0.968	0.000	0.000	0.001	0.000	0.024	0.000	0.006	0.000	0.000
Spotted Ratfish	0.914	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.086
Squarespot Rockfish	-	-	-	-	-	-	-	-	-	-
Starry Flounder	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Starry Rockfish	-	-	-	-	-	-	-	-	-	-
Stripetail Rockfish	-	-	-	-	-	-	-	-	-	-
Tiger Rockfish	0.000	0.000	0.000	0.909	0.000	0.000	0.000	0.000	0.000	0.091
Treefish Rockfish	-	-	-	-	-	-	-	-	-	-
Vermilion Rockfish	-	-	-	-	-	-	-	-	-	-
Widow Rockfish	0.000	0.000	0.000	0.000	0.001	0.117	0.135	0.746	0.000	0.000
Yelloweye Rockfish	0.009	0.000	0.000	0.930	0.000	0.000	0.000	0.003	0.000	0.058
Yellowmouth Rockfish	0.001	0.000	0.000	0.005	0.000	0.065	0.000	0.929	0.000	0.000
Yellowtail Rockfish	0.008	0.000	0.000	0.001	0.007	0.676	0.038	0.270	0.000	0.000

Table 4. Annually summarized boundaries (fm) for the non-trawl Rockfish Conservation Area (RCA) off the West Coast of the United States, over the past ten years, 2017 through June of 2024 (bold font indicates data years used in the present analysis). The structure of the RCA was quite constant over the years included in the analysis, but has changed somewhat in 2024 north of 34°27' N lat., to decrease fishing in much of the southern nearshore, while at the same time opening more of the central shelf (seaward side of RCA) to fishing. Adapted from Jessi Doerpinghaus' historical RCA summary tables.

	2024	2023	2022	2021	2020	2019	2018	2017
North of 46°16' N. lat. (WA/OR border)	Shoreward EEZ- 100	shore - 100						
42° - 46°16' N. lat. (WA/OR to OR/CA border)	30-75							
40°10' - 42° N. lat. (N/S Management line - OR/CA border)	Shoreward EEZ- 75	30-100	30 - 100*	30 - 100*	30 - 100	30 - 100	30 - 100	30 - 100
38°57' - 40°10' N. lat. (Pt. Arena, CA - N/S Management line)	Shoreward EEZ- 75	40 - 125	40 - 125	40 - 125	40 - 125	40 - 125	40 - 125	30 -125; 40 - 125
37°07' N. lat 38°57' N. lat. (Pt. Arena, CA)	Shoreward EEZ- 75	50 125	50 125	50 125	40 125	40 125	40 125	30 -125;
34°27' N. lat. (Point Conception, CA) - 37°07' N. lat.	50-75	50 - 125	50 - 125	50 - 125	40 - 123	40 - 125	40 - 125	40 - 125
South 34°27' N. lat. (+ islands; S. of Pt. Conception, CA)	100-150	100-150	100-150	100-150	75 - 150	75 - 150	75 - 150	75 - 150

*except between 30-40 fm, certain gear types allowed.

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Appendix A. SQL script used to query PacFIN landings.

```
SELECT T.AGENCY_CODE AS "AGENCY_CODE",
```

```
ROUND(SUM(T.ROUND_WEIGHT_MTONS),4) AS "ROUND_WEIGHT_MTONS",
  T.NOMINAL_TO_ACTUAL_PACFIN_SPECIES_NAME AS "NOMINAL_TO_ACTUAL_PACFIN_SPECIES_NAME",
  T.MANAGEMENT_GROUP_CODE AS "MANAGEMENT_GROUP_CODE",
  T.COUNCIL_CODE AS "COUNCIL_CODE",
  T.DAHL_GROUNDFISH_CODE AS "DAHL_GROUNDFISH_CODE",
T.FOS_GROUNDFISHSECTOR_CODE,
  T.PACFIN_YEAR AS "PACFIN_YEAR",
  T.PACFIN_GROUP_GEAR_CODE AS "PACFIN_GROUP_GEAR_CODE"
FROM NWFSC.COMPREHENSIVE_FT_WITH_FOS_CODEST
WHERE T.PACFIN_YEAR BETWEEN 2015 AND 2021
 AND T.COUNCIL_CODE = 'P'
 AND T.MANAGEMENT_GROUP_CODE = 'GRND'
GROUP BY T.AGENCY_CODE,
    T.NOMINAL_TO_ACTUAL_PACFIN_SPECIES_NAME,
    T.MANAGEMENT_GROUP_CODE,
    T.COUNCIL_CODE,
    T.DAHL_GROUNDFISH_CODE,
  T.FOS_GROUNDFISHSECTOR_CODE,
    T.PACFIN_YEAR,
```

```
T.PACFIN_GROUP_GEAR_CODE
```

Appendix B. Mean annual total catch (mt) and coefficient of variance (CV), including estimated discard mortality (GEMM) by species, apportioned by state according to landings distributions (PacFIN). Estimates include only the specific, major shorebased commercial groundfish sectors listed in the Methods section.

	California		Orego	n	Washington		
Species	Mean	CV	Mean	CV	Mean	CV	
Arrowtooth Flounder	48.676	43.1%	877.382	32.0%	31.345	104.6%	
Aurora Rockfish	10.209	57.9%	22.960	52.2%	3.348	123.7%	
Bank Rockfish	33.375	17.6%	1.932	26.4%	0.049	146.6%	
Big Skate	26.347	16.9%	133.654	34.1%	8.603	183.3%	
Black and Yellow Rockfish	16.140	14.4%	0.014	132.9%	0.000	-	
Black Rockfish	42.293	15.9%	116.265	13.2%	0.002	173.3%	
Black Skate	2.853	146.5%	0.000	-	0.000	-	
Blackgill Rockfish	42.810	35.6%	4.315	81.8%	0.076	175.8%	
Blue/Deacon Rockfish	17.771	9.1%	7.152	20.5%	0.000	-	
Bocaccio Rockfish	299.736	32.4%	24.240	68.7%	5.536	72.0%	
Brown Rockfish	19.818	5.7%	0.050	98.6%	0.000	-	
Butter Sole	0.000	-	0.007	189.9%	0.000	-	
Cabezon	23.087	9.3%	27.248	14.5%	0.000	-	
Calico Rockfish	0.018	181.8%	0.000	-	0.000	-	
California Scorpionfish	0.764	86.2%	0.000	-	0.000	-	
California Skate	1.176	69.9%	0.000	-	0.000	-	
Canary Rockfish	120.894	36.3%	216.597	25.4%	43.783	119.5%	
Chameleon Rockfish	0.008	223.6%	0.000	-	0.000	-	
Chilipepper Rockfish	526.522	50.9%	40.877	38.6%	0.005	137.1%	
China Rockfish	1.991	56.8%	6.512	19.3%	0.000	-	
Copper Rockfish	14.217	21.1%	2.055	13.3%	0.000	-	
Cowcod Rockfish	0.940	74.5%	0.024	75.4%	0.000	-	
Curlfin Sole	0.470	93.9%	0.091	108.1%	0.000	-	
Darkblotched Rockfish	23.604	40.9%	234.001	18.5%	12.706	74.1%	
Dover Sole	1,587.077	16.4%	3,917.582	28.6%	250.345	58.2%	
English Sole	98.184	48.4%	121.292	24.5%	2.447	80.8%	
Flag Rockfish	0.206	45.1%	0.000	-	0.000	-	
Flatfish Unid	0.547	84.5%	4.072	55.4%	0.215	107.1%	
Flathead Sole	0.001	223.6%	23.172	52.7%	0.000	-	
Freckled Rockfish	0.003	223.6%	0.000	-	0.000	-	
Gopher Rockfish	27.984	8.6%	0.051	42.0%	0.000	-	
Grass Rockfish	9.643	10.4%	0.093	65.6%	0.000	-	
Greenblotched Rockfish	0.741	147.9%	0.000	-	0.000	-	
Greenspotted Rockfish	4.591	90.0%	0.316	174.1%	0.001	148.2%	

	Califor	California Oregon		Washington		
Species	Mean	CV	Mean	CV	Mean	CV
Greenstriped Rockfish	6.588	58.9%	37.152	30.1%	1.340	126.7%
Grenadier Unid	14.401	33.8%	2.843	193.6%	0.000	-
Groundfish Unid	0.000	-	0.356	93.7%	0.000	-
Harlequin Rockfish	0.000	-	0.009	146.1%	0.013	223.6%
Honeycomb Rockfish	0.026	101.7%	0.000	-	0.000	-
Kelp Greenling	2.282	28.0%	9.788	30.4%	0.000	-
Kelp Rockfish	0.979	19.7%	0.000	-	0.000	-
Leopard Shark	0.607	136.1%	0.000	-	0.000	-
Lingcod	234.098	17.5%	353.333	18.7%	61.513	110.3%
Longnose Skate	137.704	16.4%	490.144	15.7%	67.428	58.2%
Longspine Thornyhead	220.605	98.1%	182.523	121.4%	3.707	73.3%
Mexican Rockfish	0.528	176.6%	0.000	-	0.000	-
Nearshore Rockfish Unid	0.551	170.8%	0.000	-	0.000	223.6%
Olive Rockfish	1.951	75.9%	0.014	109.4%	0.000	-
Pacific Cod	0.000	223.6%	11.812	147.5%	1.113	62.8%
Pacific Grenadier	8.349	140.8%	0.000	-	0.000	-
Pacific Hake	85.057	51.3%	117,441.156	23.1%	19,818.742	137.4%
Pacific Ocean Perch	0.362	78.2%	280.303	77.6%	44.465	109.7%
Pacific Sanddab	53.198	51.6%	42.313	47.5%	0.000	-
Petrale Sole	635.290	16.4%	1,794.288	11.5%	151.697	39.4%
Pink Rockfish	0.007	192.2%	0.000	-	0.000	-
Pinkrose Rockfish	0.004	223.6%	0.000	-	0.000	-
Pygmy Rockfish	0.000	-	0.000	223.6%	0.000	-
Quillback Rockfish	3.645	34.5%	2.513	22.2%	0.000	-
Redbanded Rockfish	10.147	18.1%	17.205	17.5%	11.579	45.3%
Redstripe Rockfish	0.000	-	35.408	30.1%	3.169	93.4%
Rex Sole	81.501	22.2%	338.714	24.4%	7.262	57.3%
Rock Sole	0.324	65.2%	0.756	58.5%	0.004	211.1%
Rockfish Unid	0.017	202.0%	0.000	-	0.000	-
Rosethorn Rockfish	0.220	45.3%	6.624	46.5%	7.096	174.4%
Rosy Rockfish	0.547	41.2%	0.001	138.0%	0.000	-
Rougheye/Blackspotted Rockfish	1.001	63.0%	44.621	26.2%	24.741	60.8%
Sablefish	1,446.463	15.7%	2,504.868	10.0%	641.668	18.9%
Sand Sole	0.180	151.0%	1.197	193.0%	0.002	210.2%
Sanddab Unid	0.487	128.2%	0.000	-	1.205	223.6%
Sharpchin Rockfish	0.028	141.7%	32.460	100.6%	1.320	195.3%
Shelf Rockfish Unid	7.095	91.5%	16.377	82.1%	0.006	150.3%

	California		Oregoi	n	Washington		
Species	Mean	CV	Mean	CV	Mean	CV	
Shortbelly Rockfish	2.584	78.9%	281.613	56.8%	6.027	124.4%	
Shortraker Rockfish	0.082	49.9%	5.398	27.9%	3.921	73.9%	
Shortspine Thornyhead	246.492	42.2%	415.086	40.7%	26.261	47.7%	
Shortspine/Longspine	1.314	136.8%	0.000	-	0.000	-	
Silvergrov Bookfish	0.382	210.8%	27 200	122.004	16 687	173 70/	
	0.382	210.870	57.299	122.970	10.087	173.7%	
Slope Rockfish Unid	4.723	84.9%	5.768	45.4%	0.003	223.6%	
Soupfin Shark	5.177	64.6%	0.221	104.2%	0.115	134.3%	
Speckled Rockfish	0.640	84.7%	0.000	-	0.000	-	
Spiny Dogfish Shark	122.576	84.5%	337.749	70.6%	89.888	99.9%	
Splitnose Rockfish	15.388	90.9%	79.939	19.4%	8.571	163.7%	
Spotted Ratfish	31.307	87.5%	49.038	69.1%	6.769	76.5%	
Squarespot Rockfish	0.075	60.0%	0.000	-	0.000	-	
Starry Flounder	0.640	181.2%	1.692	174.4%	0.013	223.6%	
Starry Rockfish	1.484	58.0%	0.000	-	0.000	-	
Stripetail Rockfish	18.793	73.7%	33.909	76.5%	0.000	-	
Tiger Rockfish	0.058	131.8%	0.299	22.2%	0.000	199.2%	
Treefish Rockfish	2.533	15.2%	0.000	-	0.000	-	
Vermilion Rockfish	55.170	24.3%	3.238	12.2%	0.000	-	
Widow Rockfish	147.026	51.0%	7,465.646	17.9%	1,316.418	47.8%	
Yelloweye Rockfish	1.448	131.9%	1.420	110.5%	0.267	192.8%	
Yellowmouth Rockfish	0.154	223.1%	17.945	85.7%	4.704	222.8%	
Yellowtail Rockfish	18.902	61.8%	2,470.217	19.7%	489.680	53.9%	