U.S. National Bycatch Report
First Edition Update 2

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Table of Contents

[1] Formerly the Northeast Region.

Executive Summary

Since 2011, NOAA's National Marine Fisheries Service (NMFS) has published a series of National Bycatch Reports and Updates because estimating bycatch rates in fisheries in order to understand bycatch levels, as well as fishery interactions with protected species, is important to effective living marine resource management. These reports, along with other information sources, are expected to help improve NMFS' ability to monitor bycatch trends and set fishery monitoring priorities, as well as serve as a useful data tool for NMFS and its management partners.

The First Edition of the National Bycatch Report (NMFS 2011) documented bycatch estimates, using observer data and self-reported logbook data, for all fisheries for which this information was available in 2005. NMFS completed Update 1 (NMFS 2013a) in late 2013 and published it online in early 2014. Update 1 included bycatch estimates based for the most part on 2010 data only.

This report, Update 2, includes three sets of bycatch estimates based on data from 2011, 2012, and 2013. The Second Edition of the National Bycatch Report, scheduled for publication in late 2017, will include bycatch estimates based on data from 2014 and 2015, as well as National and regional bycatch ratios; discussion of the Tier Classification System, Key Stocks, and Fisheries of Focus; and a detailed discussion of bycatch estimation improvement plans.

Fish

In terms of weight, estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2011 totaled approximately 714.2 million pounds. Associated (retained) landings for these fisheries totaled approximately 6.1 billion pounds. In terms of weight, estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2012 totaled approximately 601.7 million pounds. Associated landings for these fisheries totaled approximately 6.0 billion pounds. In terms of weight, estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2013 totaled approximately 689.1 million pounds. Associated landings for these fisheries totaled approximately 6.1 billion pounds.

Marine Mammals

Bycatch estimates for marine mammals are based on numbers of lethal takes and serious injuries for 29 individual fisheries, as well as eight fishery groups from the Greater Atlantic and Alaska Regions. These eight fishery groups comprised 15 individual Greater Atlantic fisheries, which were classified into six groups, as well as eight individual Alaska fisheries, which were classified into two groups. This report also includes marine mammal bycatch estimates for 2012 and 2013 for the "Alaska statewide salmon fisheries."[2]

Sea Turtles

Sea turtle bycatch estimates are provided for 12 individual fisheries, as well as three Greater Atlantic Region fishery groups, which comprised 13 individual fisheries. (Sea turtle estimates

[2] The term "Alaska statewide salmon fisheries" reflects the formal list of fisheries established for the National Bycatch Report. For the bycatch estimates presented in this report, it may be more appropriate to refer to this fishery as "subdistricts of the Southeast Alaska drift gillnet fishery."

were not available for individual fisheries within groups.) This report does not include sea turtle bycatch estimates for the Gulf of Mexico Shrimp Trawl fishery and the Southern Atlantic Shrimp Trawl fishery, because no new sea turtle bycatch estimates were feasible for these fisheries. NMFS published a Biological Opinion dated April 18, 2014, which contains the most recent analysis of sea turtle mortalities in these fisheries, as well as a discussion of related data limitations. (For more information, see Section 4.7.)

Seabirds

Estimates of seabird bycatch are provided for 27 individual fisheries from various regions, as well as two fishery groups from the Alaska Region. These two fishery groups comprised eight individual Alaska fisheries; seabird estimates were not available for individual fisheries within the groups. This report does not include new seabird bycatch estimates for Greater Atlantic Region fisheries.

Highlights by Region

This report documents improvements in bycatch monitoring and reductions in bycatch in each region of the country. For example, in the **Greater Atlantic** Region, bycatch of loggerhead sea turtles in the mid-Atlantic gillnet fishery has been decreasing. Specifically, the average estimated bycatch rates in large mesh gear in warm southern mid-Atlantic waters declined from 2007 to 2011 relative to 1996 to 2006, along with total commercial fishing effort in this fishery. In addition to the decreased fishing effort, this decline in bycatch rate may have been due to regulatory measures such as the large mesh rolling closures for monkfish, which began in May 2000.

In the **Southeast** Region, the NMFS Southeast Fisheries Science Center calculated bycatch estimates for the Southeastern Atlantic Coastal Gillnet Fishery (including North Carolina) for the first time for this report. The fishery bycatch ratio[3] for the Gulf of Mexico shrimp trawl fishery has remained at or below 0.64 for the 3-year period documented in this report. This continues to be below the ratio of 0.76 reported in the First Edition of the National Bycatch Report.

In the **Alaska** Region, this report includes marine mammal bycatch estimates for 2012 and 2013 for the Alaska statewide salmon fisheries; the previous National Bycatch Report did not include such estimates. With the restructured North Pacific Groundfish and Halibut Observer Program in 2013, the Alaska longline halibut fishery had observer coverage for the first time in 2013, and NMFS' Alaska Fisheries Science Center has produced bycatch estimates for this fishery, including the first seabird bycatch estimates.

The **West Coast** Region's bycatch estimates were enhanced greatly through the 2011 implementation of a new management system for the West Coast groundfish trawl fishery, which required 100 percent at-sea observer coverage and 100 percent monitoring of shoreside landings. The West Coast region was able to provide coefficients of variation (CVs)[4] for estimated fish bycatch in many of its fisheries; the previous National Bycatch Report did not include these CVs.

[3] Fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, where total catch is bycatch plus landings.

[4] Coefficient of variation is the ratio of the square root of the variance of the bycatch estimate (i.e., the standard error) to the estimate, itself. For more information, see NMFS 2004.

In addition, the NMFS Northwest Fisheries Science Center included estimated weights for protected fish species that are managed based on the number of individuals, allowing for calculation of fishery bycatch ratios for 11 out of 13 West Coast fisheries in this report, as opposed to only four out of 13 West Coast fisheries in Update 1.

In the **Pacific Islands** Region, tuna and non-tuna fish bycatch for the American Samoa longline fishery declined from 17 percent of the total catch in 2011 to 13 percent in 2013. Green sea turtle bycatch in this fishery also declined, from an estimated 32 takes in 2011 to 0 takes in 2012 and 19 takes in 2013. This decline in bycatch is due to changes in the longline gear configuration in late 2011 to protect green sea turtles, and a higher level of retention of some fish species.

What's Next

For the Second Edition of the National Bycatch Report, scheduled for publication in late 2017, NMFS will continue to expand and improve bycatch estimates for 2014 and 2015, with some bycatch trend analyses for 2011–2015; attempt to estimate a national bycatch ratio and regional bycatch ratios; discuss the Tier Classification System, Key Stocks, and Fisheries of Focus; and report progress on and update bycatch estimation improvement plans. In addition, we expect that efforts to minimize bycatch through management regulations implemented by Regional Fishery Management Councils and other partners, as well as innovative conservation engineering research, will continue to reduce bycatch rates over time.

1. Introduction

1.1 Definition of Bycatch

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA)[5] defined the term *bycatch* and required that it be minimized to the extent practicable. Bycatch, as defined by the MSA (16 U.S.C. § 1802 (2)), "means fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such a term does not include fish released alive under a recreational catch and release fishery management program." In addition, the MSA defines fish as "finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds" at 16 U.S.C. § 1802 (12).

The MSA definition of fish bycatch distinguishes between economic and regulatory discards. According to the MSA at 16 U.S.C. § 1802 (9), economic discards are "fish which are the target of a fishery, but which are not retained because they are of an undesirable size, sex, or quality, or for other economic reasons." Regulatory discards are defined by the MSA at 16 U.S.C. § 1802 (38) as "fish harvested in a fishery which fishermen are required by regulation to discard whenever caught, or are required by regulation to retain but not sell." In more practical terms, an economic discard is a fish that is caught but is discarded because it has a low market value – it may be too small, too large, of poor quality, or discarded for other economic reasons. A regulatory discard is a fish that is discarded because regulations do not allow fishermen to retain the fish when it is caught. Bycatch monitoring programs typically are not designed to identify whether bycatch consists of economic or regulatory discards.

NOAA's National Marine Fisheries Service (NMFS) supports programs designed not only to minimize bycatch of fish, but also to reduce fishery interactions with protected species. NMFS is responsible for addressing interactions with protected species under the ESA, the Marine Mammal Protection Act (MMPA), and the U.S. National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries. Because of these broad mandates, *bycatch* for the purposes of this report is defined as:

> Discarded catch of any living marine resource plus unobserved mortality[6] due to a direct encounter with fishing gear.

Because information on unobserved mortality of fish is rarely available, it is not included in this report. Unobserved mortality is included in bycatch estimates for protected species where the data permit.

[5] See Appendix 1 for a complete list of acronyms used in this report.

[6] Unobserved mortality is the mortality of living marine resources due to a direct encounter with fishing gear that does not result in the capture of the species. This includes mortality due to lost or discarded fishing gear, as well as fish and other species that escape from fishing gear before it is retrieved but die due to the stress or injury resulting from the encounter (NMFS 2004).

In some fisheries, especially in the Pacific Islands, incidental fish catch that might otherwise be discarded as bycatch is retained. Retaining this incidental catch and utilizing it for consumption, bait, or processing (e.g., to create fish meal) can reduce bycatch rates.

1.2 The Problem of Bycatch

Bycatch occurs when fishing methods are not sufficiently selective for the target species (including targeted size range and/or sex), or when incidental take of marine mammals, sea turtles, fish listed under the ESA, or seabirds occurs as a result of fishing activities. Bycatch may also occur when regulatory restrictions prohibit retention of particular species, sexes, or size ranges. Fisheries with less-selective fishing gear or methods can result in higher rates of bycatch, especially in areas where the fisheries overlap with protected species.

Bycatch should be examined in the context of biological, ecological, economic, and social impacts to provide a comprehensive evaluation of its overall significance. Biological impacts of bycatch have been demonstrated at the species, population/stock, and ecosystem levels (Hall et al. 2000; Kelleher 2004; Lewison et al. 2004; Read et al. 2006). These impacts include declines in populations, reduced reproductive rates, and less-resilient ecosystems.

Economic impacts may be substantial when current or potential future exploitable finfish or shellfish biomass is not available for harvest (Pascoe 1997; Larson et al. 1998; Patrick and Benaka 2013). In addition, when bycatch results in the mortality of protected or otherwise prohibited species, recovery efforts are undermined (for example, see Guy et al. 2013). Other issues arise when mortality of living marine resources results in lost productivity of commercially or recreationally important stocks, or when the public perceives bycatch as a waste (Hall et al. 2000). Costs for monitoring and mitigating bycatch may be high,[7] but these activities are an important part of sustainable fisheries management today.

Overall fishing mortality can be estimated only through an understanding of the magnitude of bycatch, as well as fishery interactions with protected species. In some cases, even very low overall bycatch levels (both mortality and interactions) may be of concern, especially if the bycaught species are protected or otherwise prohibited.

1.3 U.S. Laws and Regulations to Address Bycatch

The primary authorities for monitoring and reducing bycatch are contained in three statutes: the MSA, 16 U.S.C. 1801 et seq.; the MMPA, 16 U.S.C. 1361 et seq.; and the ESA, 16 U.S.C. 1531 et seq. Further information on these, as well as other statutes and international agreements pertaining to bycatch, is provided in the *U.S. National Bycatch Report First Edition* (first edition; NMFS 2011) and the *U.S. National Bycatch Report First Edition Update 1* (referred to hereafter as Update 1; NMFS 2013a).

Management measures have been implemented in many U.S. fisheries to reduce bycatch; these include regulatory measures that limit bycatch quantities and/or close target fisheries when

[7] For example, in 2012, total funding from all sources, including industry funding, for federal fisheries observer programs was $69 million (NMFS 2013b).

bycatch limits are reached. In some cases, other mitigation measures such as gear modifications have also been required.

In other cases, NMFS and Regional Fishery Management Councils have implemented catch share programs designed to reduce both the unintended harvest of their target species (e.g., undersized fish) and incidental species (wrong species). For example, in 2011, NMFS implemented the West Coast Groundfish Trawl Catch Share Program, which implemented an Individual Fishing Quota (IFQ) program for the shorebased trawl fleet, and cooperative programs for the at-sea mothership and catcher/processor trawl fleets. Instead of a single, fleet-wide quota to determine how many fish can be sustainably harvested, the catch shares system divides the total amount of an overall allowable catch or quota into shares controlled by individual fishermen or groups of fishermen (cooperatives). The program holds fishermen accountable for their target catch, as well as bycatch.

1.4 Purpose of This Report

The first edition of this report, published in 2011, documented bycatch estimates, using observer data and self-reported logbook data, for all fisheries for which this information was available in 2005. The first edition was the beginning of a series of updates and comprehensive reports that will document bycatch in additional U.S. fisheries over time, as well as improve consistency in reporting bycatch data. NMFS completed Update 1 (NMFS 2013a) in late 2013 and published it online in early 2014. Update 1 included bycatch estimates based on 2010 data. This report, Update 2, includes three sets of bycatch estimates based on data from 2011, 2012, and 2013.

NMFS developed these reports because estimating bycatch rates in fisheries in order to understand bycatch levels, as well as fishery interactions with protected species, is important to effective living marine resource management. These reports were designed to determine the extent to which reliable quantitative bycatch information exists for federally managed fisheries and for fisheries with relevant federal data-collection programs. In addition to describing the "state of bycatch reporting and estimation," these reports were designed as a resource to, along with other information sources, help address and prioritize sampling and estimation improvements in NMFS observer programs.

The first edition and its two updates focus only on commercial fisheries. The National Bycatch Report (NBR) Steering Committee (see Appendix 2) will explore ways to include fish bycatch estimates for recreational fisheries with established release mortality rates, as well as information about protected species interactions with recreational fisheries, in the next edition of the NBR, due to be published in late 2017. NMFS is attempting to address the lack of recreational fishery bycatch estimates through its Action Plan for Fish Release Mortality Science (Benaka et al. 2016), which will support improved estimation of release and discard mortality rates in recreational and commercial fisheries.

The first edition also provided four new monitoring and bycatch tracking tools: (1) Tier Classification System; (2) Key Stocks; (3) Fisheries of Focus; and (4) Bycatch Estimation Improvement Plans. (NMFS 2011 discusses these tools in detail.)

These reports and updates provide an ever-expanding national compilation of bycatch estimates in commercial U.S. fisheries, as well as an objective framework for evaluating the quality of bycatch estimates. Future editions and updates will include additional bycatch estimates as new fisheries are monitored. Over time, the reports, along with other information sources, should improve NMFS' ability to monitor bycatch trends and set fishery monitoring priorities, as well as serve as a useful data tool for NMFS' management partners.

1.5 About the Numbers Presented in This Report

This report presents an extensive set of numeric fish and protected species bycatch estimates. Fish bycatch estimates are expressed mostly in units of pounds, but in some fisheries fish bycatch estimates are expressed in units of individuals. In addition, bycatch estimates for protected species such as marine mammals, sea turtles, and seabirds are expressed in terms of individuals.

This report also presents numerous fishery and species bycatch ratios. A fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, where total catch is bycatch plus landings. Likewise, a species bycatch ratio is the ratio of bycatch of a single stock to total catch of that stock within the Region, where total catch of that stock is the species bycatch plus species landings. When species bycatch estimates are calculated in units of individuals, then it is impossible to present fishery or species bycatch ratios due to the difference in units required for the calculation (i.e., individuals versus pounds).

The first edition estimated a national bycatch ratio[8] of 0.17, which was lower than comparably defined estimates provided by the Food and Agriculture Organization of the United Nations (Kelleher 2004) and Harrington et al. (2005). Kelleher (2004) and Harrington et al. (2005) obtained bycatch estimates and associated landings data from published and grey literature, whereas the NBR and its updates used data from NMFS observer programs and landings records to develop estimates. The ratio identified in Kelleher (2004) was calculated as recorded discards divided by total recorded landings. Harrington et al. (2005) extrapolated the total amount of discarded fish for each component of a fishery using the ratio of discards to landings and the reported level of landings.

1.6 National Bycatch Report Publication Schedule

Soon after publication of the first edition in 2011, NMFS determined that, due to the time and resources required to compile the first comprehensive report, the report would be updated in 2013 and 2015 (rather than annually) with short national and regional overviews, including progress on addressing report recommendations, as appropriate. These updates would include new species-specific bycatch estimates for species from the first edition for which estimates are available, as well as new bycatch estimates for species not included in the first edition. The updates also would include updated bycatch estimates for all fisheries in the first edition that continue to be observed (with some consolidation of fisheries), as well as estimates for any newly observed fisheries.

[8] The national bycatch ratio was defined as the ratio of bycatch to total catch, where total catch equals landings plus bycatch.

On May 9, 2012, NMFS Office of Science and Technology staff, on behalf of the National Bycatch Report Steering Committee, received approval from the NMFS Science Board[9] to prepare biennial online bycatch updates for the report beginning in 2013, with a comprehensive bycatch report every 6 years, beginning in 2017. Unlike the biennial online updates, the next comprehensive report (second edition) in 2017 will include a:

- National and regional bycatch ratios.
- Discussion of the Tier Classification System, Key Stocks, and Fisheries of Focus.
- Detailed discussion of bycatch estimation improvement plans.

A timeline for updates through 2023 is shown in Table 1.1.

Table 1.1 Timeline for U.S. National Bycatch Reports and updates

Year	Document Type	Data Years Included[10]
2011	Comprehensive Report (first edition)	2005
2013	Online Update (first edition update 1)	2010
2015	Online Update (first edition update 2)	2011-2013
2017	Comprehensive Report (second edition)	2014-2015 + Analysis of trends for 2010–-2015
2019	Online Update (second edition update 1)	2016-2017
2021	Online Update (second edition update 2)	2018-2019
2023	Comprehensive Report (third edition)	2020-2021 + Analysis of trends for 2016–2021

[9] The NMFS Science Board is made up of the NMFS Chief Science Advisor, the Director of the NMFS Office of Science and Technology, and the Directors of each of the six regional NMFS Fisheries Science Centers.

[10] In some instances—especially for protected, rare-event species—a range of years was used to determine an average estimate across multiple years.

2. National Overview

2.1 Improvements in Bycatch Rates and Estimation

This report includes several notable improvements compared to Update 1. For example, in the Greater Atlantic Region, estimates of the mean annual mid-Atlantic gillnet bycatch of loggerhead turtles (*Caretta caretta*) declined from 350 animals during 1995–2006 to 89 animals during 2007–2011.

In the Southeast Region, the estimated bycatch ratio[11] for the Atlantic and Gulf of Mexico Pelagic Longline fishery decreased from 0.27 in 2011 to 0.18 in 2013. In addition, NMFS provided species bycatch ratios for six species for 2011–2013, an increase over the bycatch ratios for only two species in Update 1.

For the Alaska Region, NMFS provided marine mammal bycatch estimates for 2012 and 2013 in a recently observed Alaska salmon fishery; Update 1 did not include such estimates. With the restructured North Pacific Groundfish and Halibut Observer Program, the Alaska longline halibut fishery had observer coverage for the first time in 2013, and NMFS produced bycatch estimates for this fishery, including the first seabird bycatch estimates for this fishery. In addition, the bycatch ratio for arrowtooth flounder (*Reinhardtius stomias*), a species with a high amount of bycatch in Alaska, decreased again because the fishing industry has continued to develop markets for the species. Based on feedback from the North Pacific Fishery Management Council (NPFMC), the NBR Steering Committee removed the Gulf of Alaska Pacific Cod Jig fishery from Update 2 due the lack of observer data for that fishery.

In 2011, NMFS implemented a new management system for the West Coast groundfish trawl fishery, which required 100 percent at-sea observer coverage and 100 percent monitoring of landings shoreside. The West Coast region was able to provide CVs for estimated fish bycatch in many of its fisheries; Update 1 did not include these CVs. In addition, the Northwest Fisheries Science Center included estimated weights for protected fish species that are managed based on the number of individuals, allowing for calculation of fishery bycatch ratios for 11 out of 13 West Coast fisheries in this report, an increase from four out of 13 West Coast fisheries in Update 1. Additionally, the West Coast Region provided discard estimates for all fish and invertebrate species observed, which was not the case in Update 1.

For the Pacific Islands Region, NMFS provided fish bycatch estimates for the American Samoa Pelagic Longline fishery; these estimates were not generated for Update 1. In addition, fishery bycatch ratios decreased from 2011 to 2013 for the American Samoa Pelagic Longline fishery and the Hawaii-Based Shallow-Set Pelagic Longline Fishery for Swordfish and remained stable in the Hawaii-Based Deep-Set Pelagic Longline Fishery for Tuna.

[11] Fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, or bycatch divided by bycatch plus landings.

2.2 Data Sources for Estimating Bycatch

Data sources vary among regions, as well as among fisheries, primarily due to differences in data-collection goals, objectives, and available resources. Commercial fisheries vary greatly in scale and fishing practice, and these factors impact bycatch data-collection programs. The major sources of data used for the bycatch estimates presented in this update were observer data and self-reported logbook data, as well as landings data in some cases. Pursuant to section 402(b) of the MSA, this update does not include certain landings data or bycatch estimates in order to protect confidential information.

The NBR Regional Teams (see Appendix 2) uploaded bycatch estimates and footnotes into a database specially developed by the NMFS Office of Science and Technology for these reports and updates. A version of this database is accessible by members of the public via a NMFS website.

The commercial landings data used in this report were derived from the most recently updated datasets available and have been checked by the NBR Steering Committee for accuracy. All of the landings data were queried at the same time, as opposed to different time periods for different regions. North Carolina, whose landings are split between the Greater Atlantic and Southeast Regions, was able to provide spatial information that allowed for a direct assignment of landings to the appropriate Region. Because landings data are constantly updated as new information becomes available, readers should use caution when comparing landings data in this report to the first edition of the NBR or to other landings datasets for the same time period.

Data sources for commercial landings in the various regions are as follows:

- Greater Atlantic Region, Maine through North Carolina (north of Cape Hatteras): Atlantic Coastal Cooperative Statistics Program (ACCSP) and NMFS Greater Atlantic Region Fisheries Office
- Southeast Region, North Carolina (south of Cape Hatteras) through Texas: ACCSP and NMFS Southeast Fisheries Science Center
- West Coast Region (Washington, Oregon, California): Pacific Fisheries Information Network
- Alaska: Alaska Fisheries Information Network
- Pacific Islands: Western Pacific Fisheries Information Network

Regional divisions used in this report that occur within the state boundaries of North Carolina were established with assistance from the North Carolina Department of Environment and Natural Resources and the ACCSP.

2.3 Bycatch and Landings Summary

In terms of weight,[12] estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2011 totaled approximately 714.2 million pounds. Associated landings for these fisheries totaled approximately 6.1 billion pounds (Table 2.1).

Table 2.1 2011 Total estimated fisheries bycatch and landings for each NMFS region for fisheries included in this report. Weights are live weights and are rounded to the nearest pound. Data sources are described in Section 2.2 above. Landings and bycatch in this table do not represent all Regional fisheries but rather the fisheries for which this report provides bycatch estimates. Appendix 3 indicates which Regional fisheries have fish bycatch estimates for 2011.

Region	Fish Bycatch (lb)	Fish Landings (lb)
Greater Atlantic	140,390,426	895,070,175
Southeast	297,849,791	175,387,692
Alaska	247,966,998	4,330,032,390
West Coast	17,132,532	633,681,461
Pacific Islands	10,810,845	33,864,791
Totals	714,150,592	6,068,036,509

In terms of weight, estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2012 totaled approximately 601.7 million pounds. Associated landings for these fisheries totaled approximately 6.0 billion pounds (Table 2.2).

Table 2.2 2012 Total estimated fisheries bycatch and landings for each NMFS region for fisheries included in this report. Weights are live weights and are rounded to the nearest pound. Data sources are described in Section 2.2 above. Landings and bycatch in this table do not represent all Regional fisheries but rather the fisheries for which this report provides bycatch estimates. Appendix 3 indicates which Regional fisheries have fish bycatch estimates for 2012.

Region	Fish Bycatch (lb)	Fish Landings (lb)
Greater Atlantic	135,792,252	906,795,534
Southeast	207,330,118	168,710,178
Alaska	232,869,918	4,438,602,276
West Coast	15,461,611	476,763,946
Pacific Islands	10,198,589	35,011,084
Totals	601,652,488	6,025,883,018

In terms of weight, estimated fish bycatch for the U.S. commercial fisheries considered in this report for 2013 totaled approximately 689.1 million pounds. Associated landings for these fisheries totaled approximately 6.1 billion pounds (Table 2.3).

[12] Bycatch and landings weights used in the NBR are live weights as opposed to live and landed weights. Specifically, live weight refers to the weight of a fish when it is taken out of the water, whereas landed weight refers to the weight of a fish post-processing (for example, the weight of scallop meat after it has been removed from its shell).

Table 2.3 2013 Total estimated fisheries bycatch and landings for each NMFS region for fisheries included in this report. Weights are live weights and are rounded to the nearest pound. Data sources are described in Section 2.2 above. Landings and bycatch in this table do not represent all Regional fisheries but rather the fisheries for which this report provides bycatch estimates. Appendix 3 indicates which Regional fisheries have fish bycatch estimates for 2013.

Region	Fish Bycatch (lb)	Fish Landings (lb)
Greater Atlantic	140,219,526	738,953,648
Southeast	243,558,458	156,063,630
Alaska	279,161,533	4,545,327,715
West Coast	15,562,500	643,331,523
Pacific Islands	10,628,968	33,277,790
Totals	689,130,985	6,116,954,306

Total fish landings in Tables 2.1, 2.2, and 2.3 represent total landings for the 78 fisheries with fish bycatch estimates included in this report. These tables do not include individual fish bycatch estimates for Southeast and West Coast Regions. These Regions estimate some bycatch in units of individuals due to the design of particular observer programs or because the bycatch consists of protected fish species. Please see Sections 4 (Southeast Region) and 6 (West Coast Region) of this report for additional information on these individual fish bycatch estimates.

NMFS has estimated bycatch totals for marine mammals, sea turtles, and seabirds for each of its Regions where this protected species bycatch occurred. The fisheries with protected species bycatch estimates can vary from year to year within a region, and readers should refer to subsequent regional overviews and linked tables for specifics on estimation timeframes for marine mammals, sea turtles, fish listed under the ESA, and seabirds, as well as actual protected species bycatch estimates for particular fisheries.

Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*) is a fish species protected under the ESA that is captured as bycatch in U.S. commercial fisheries considered in this report. NMFS published a Biological Opinion dated December 16, 2013, which contains current information on the anticipated bycatch of Atlantic sturgeon in several fisheries authorized by NMFS under their respective fishery management plans (FMPs).

This report includes bycatch estimates for marine mammals, based on numbers of lethal takes and serious injuries, for 32 individual fisheries, as well as eight fishery groups from the Greater Atlantic and Alaska Regions. These eight total fishery groups comprised 15 individual Greater Atlantic fisheries, which were classified into six groups, as well as eight individual Alaska fisheries, which were classified into two groups. Estimates were not available for individual fisheries within groups. Fisheries with marine mammal bycatch estimates can vary from year to year within a Region, and readers should refer to subsequent Regional overviews and linked tables for specifics on estimation timeframes for marine mammal bycatch estimates.

With some exceptions, marine mammal bycatch estimates reported here are primarily annual averages over five years, as recommended by NMFS' guidelines for assessing marine mammal stocks (NMFS 2005). Interactions between individual fisheries and marine mammals are typically rare events, and several years of data are needed to provide statistically robust

estimates. Multi-year averages also have been used for some other protected species for these reasons.

This report includes sea turtle bycatch estimates for 12 individual fisheries, as well as three Greater Atlantic Region fishery groups, which comprised 13 individual fisheries. Sea turtle estimates were not available for individual fisheries within groups. Fisheries with sea turtle bycatch estimates can vary from year to year within a region, and readers should refer to subsequent regional overviews and linked tables for specifics on estimation timeframes for sea turtle bycatch estimates. This report does not include sea turtle bycatch estimates for the Gulf of Mexico Shrimp Trawl fishery and the Southern Atlantic Shrimp Trawl fishery, because no new sea turtle bycatch estimates were produced for this report for these fisheries. However, NMFS published a Biological Opinion dated April 18, 2014, which contains more current sea turtle estimates.

This report also provides estimates of seabird bycatch for 27 individual fisheries, as well as two fishery groups from the Alaska Region. These two fishery groups represent eight individual Alaska fisheries. Seabird estimates were not available for individual fisheries within groups. This report does not include seabird bycatch estimates for Greater Atlantic Region fisheries because no new seabird bycatch estimates were produced for this report for these fisheries. Fisheries with seabird bycatch estimates can vary from year to year within a Region, and readers should refer to subsequent Regional overviews and linked tables for specifics on estimation timeframes for seabird bycatch estimates.

Appendix 3 lists the fisheries that have been identified for the NBR. The fisheries generally are identified as federal, state, tribal, international, or some combination of these categories. NMFS is not able to provide fish/invertebrate, marine mammal, sea turtle, and/or seabird bycatch estimates for each of these fisheries individually. However, for 2011–2013, NMFS was able to provide fish/invertebrate, marine mammal, sea turtle, and/or seabird bycatch estimates for the following proportions of federally managed[13] fisheries for each region:

- Greater Atlantic—24 out of 48 (50%)
- Southeast—10 out of 21 (48%)
- Alaska—25 out of 27 (93%)
- West Coast—11 out of 19 (58%)
- Pacific Islands—3 out of 17 (18%)

Appendix 3 indicates which fisheries have fish/invertebrate, marine mammal, sea turtle, and/or seabird bycatch estimates.

2.4 Expected Improvements in Bycatch Estimates

For the *U.S. National Bycatch Report Second Edition*, scheduled for publication in late 2017, NMFS plans to continue to expand and improve bycatch estimates; attempt to estimate a national bycatch ratio and regional bycatch ratios; discuss the Tier Classification System, Key Stocks,

[13] In this instance, "federally managed" means fisheries that are solely federally managed, or managed federally in partnership with state, tribal, or international organizations.

and Fisheries of Focus; and report progress on and update bycatch estimation improvement plans (see NMFS 2011 for more information on these performance metrics).

NMFS also plans to continue to increase consistency regarding how fish bycatch is reported among Regions, especially for the Southeast, which estimates bycatch as individuals in many fisheries, thereby preventing the calculation of fishery bycatch ratios. The NMFS Southeast Fisheries Science Center (SEFSC) is investigating the calculation of conversion rates so that individuals can be reported in pounds, where feasible.

The SEFSC also is completing an independent statistical review of the Gulf of Mexico Reef Fish Observer Program, which should provide improved methodologies for vessel selection protocols, as well as bycatch estimation techniques for both abundant and rare species. In addition, an independent statistical review of Southeast observer program sampling designs is being finalized; this analysis was designed to examine current sampling designs and recommend various approaches, if warranted, to enhance bycatch estimation.

NMFS is continuing to enhance observer program documentation of deep-sea coral and sponge bycatch species that can form large, complex structures used by fish and invertebrates as habitats in the Greater Atlantic, West Coast, and Alaska Regions. NMFS is continuing to provide training to fishery observers to help them identify corals and sponges, which should lead to more detailed bycatch estimates in the second edition.

A revised Standardized Bycatch Reporting Methodology was implemented in 2015 to estimate bycatch and appropriate levels of observer coverage in all federally managed fisheries in the Greater Atlantic Region. This methodology could result in increased coverage to new fisheries and more precise bycatch estimates.

In Alaska, the restructured North Pacific Groundfish and Halibut Observer Program, which went into effect on January 1, 2013, will continue to enable NMFS to deploy observers using a more statistically robust sampling plan and implement an annual review process that provides flexibility in the deployment to meet scientifically based estimation needs within the constraints of the available budget. Also in Alaska, beginning in 2017, NMFS plans to estimate seabird mortality on trawl vessels due to interactions with trawl warps, third wires, and net wings, which are not monitored through standard observer sampling.

The next few years will see continued focus by NMFS and its partners on electronic monitoring to supplement observer programs, consistent with its May 2013 Policy on Electronic Technologies and Fishery-Dependent Data Collection. These new electronic monitoring efforts may help increase the number of bycatch estimates, particularly in difficult-to-observe fisheries. Additionally, the *U.S. National Bycatch Report Second Edition* may consider recreational fisheries issues, including post-release mortality estimates and protected species interactions.

Finally, continued efforts to minimize bycatch through management regulations implemented by Regional Fishery Management Councils and other partners (e.g., Chinook salmon bycatch reduction for Alaska pollock fisheries, as well as Pacific halibut bycatch reduction in groundfish

trawl fisheries), as well as innovative conservation engineering research (e.g., through NMFS' Bycatch Reduction Engineering Program), will continue to reduce bycatch rates over time.

6. West Coast Overview

6.1 Summary of Fisheries Included in This Report

This report combines the previous Northwest and Southwest regions into a single West Coast Region. This report provides 2011, 2012, and 2013 fish bycatch estimates for a total of 13 West Coast Region commercial fisheries (see Appendix 3), which is equivalent to the number of fisheries the NBR First Edition Update 1, although the composition has changed slightly (NMFS 2013a).

Vessels carrying limited entry trawl permits can fish with fixed gear beginning in 2011, due to management structure changes to the West Coast limited entry bottom trawl; bottom and midwater trawl fishery. Bycatch estimates for this sector of the fishery are provided as West Coast limited entry bottom trawl; fixed gear in this report. Additionally, the small-mesh drift gillnet fishery is no longer observed.

This report provides marine mammal bycatch estimates for 10 West Coast fisheries for 2011. In addition, this report provides marine mammal bycatch estimates for 10 West Coast fisheries for 2012, and estimates for nine West Coast fisheries for 2013. Estimates were calculated using ratio estimations of five-year bycatch rates for all fisheries other than the (1) West Coast Limited Entry Bottom Trawl; Fixed Gear, West Coast Limited Entry Bottom Trawl; (2) Groundfish Bottom and Midwater Trawl; and (3) West Coast Mid-Water Trawl for Whiting, Shoreside Processing, which use three-year bycatch rates for estimation (Jannot et al. 2011, Carretta et al. 2015a, Feist et al. 2015, Hanson et al. 2015). The management of those three fisheries changed substantially in 2011, so it would be inappropriate to include estimates from previous years (NMFS 2005). Marine mammal bycatch was estimated in three observed commercial fisheries as zero in 2011 and 2012. In addition, marine mammal bycatch was estimated in four observed commercial fisheries as zero in 2013.

Sea turtle bycatch was observed only in 2012 in the California/Oregon drift gillnet (mesh size >14 in) for swordfish and thresher shark fishery. No other sea turtle bycatch was observed from 2011 to 2013 in the 12 other observed West Coast Region fisheries (for additional information, see Eguchi et al. 2015).

This report provides 2011, 2012, and 2013 seabird bycatch estimates based on ratio estimations of single-year bycatch rates for six, six, and three Northwest Region commercial fisheries when bycatch was observed, respectively (Jannot et al. 2011, Guy et al. 2013, Good et al. 2015), compared to seven in the NBR First Edition Update 1 (NMFS 2013a). In 2013 no estimate was available for the California halibut/white seabass and other species set gillnet (>3.5 in mesh). Seabird bycatch of the endangered short-tailed albatross remains closely monitored due to a documented mortality in the U.S. West Coast groundfish fishery in 2011.

Current sampling and analytical methods provide estimates of seabird mortalities from standard observer sampling techniques only. Estimates of seabird bycatch outside of regular sampling, including interactions with fishing gear that do not result in seabirds falling into an observer's species composition sample (i.e., are not randomly sampled), are reported as opportunistic

observations. Because of the non-random nature of opportunistic observations, they are not included in expansions of fleet-wide bycatch. An account of opportunistic observations of black-footed and short-tailed albatross for the period 2011–2013 can be found in Table 3 of Good et al. (2015). Opportunistic observations of other seabird species can be found in Jannot et al. 2014 (Marine Mammal, Seabird, Sea Turtle Annual Summary of Observations, currently available upon request to Northwest Fisheries Science Center Observer Program).

6.2 Changes to Observer Coverage

In 2011, NMFS implemented a new management system for the West Coast groundfish trawl fishery. The new framework, known as a catch shares system, transformed how groundfish are harvested off the West Coast. The trawl catch share program, also called the trawl rationalization program, consists of an IFQ program for the shore-based trawl fleet and cooperative programs for the at-sea mothership and catcher/processor trawl fleets. This management program requires 100 percent observer coverage at sea and 100 percent monitoring of landings shoreside. This IFQ program also allows fishermen to use midwater trawl, pot, or hook-and-line gears, in addition to bottom trawl gear.

NMFS began targeting 30 percent observer coverage in the California/Oregon Drift Gillnet (Mesh Size >14 in) for Swordfish and Thresher Shark Fishery in 2013. Observer coverage in 2013 was 37.4 percent of total fishing effort. Target observer coverage in this fishery had been 20 percent since 1990.

In September 2013, NMFS instituted a temporary 100 percent observer coverage zone in the California/Oregon Drift Gillnet (Mesh Size >14 in) for Swordfish and Thresher Shark Fishery in waters deeper than 2,000 meters. The increased observer coverage was required to monitor potential interactions with sperm whales (*Physeter microcephalus*). The 100 percent observer coverage zone expired in August 2014.

6.3 Changes to Catch and Bycatch Estimation Methods

Although the use of ratio estimators to estimate bycatch at the fleet level used in the former Northwest Region fisheries remains unchanged from Update 1 (NMFS 2013a), the estimation methods for unsampled discard in fisheries with 100 percent observer coverage differs from those fisheries with lower coverage rates. In 100-percent-observed fisheries, the small amount of unsampled discards was expanded for fish and seabird bycatch, based on the type of discard and related observed bycatch rates. Marine mammal estimation did not include expansions in fisheries with 100 percent observer coverage, because observers are required to sample every marine mammal in the catch. Additional description of these methods can be found in Somers et al. 2015.

NMFS now includes CVs for the total estimated bycatch of each species, summed across the strata in many West Coast Region fisheries, calculated using the following formula with an assumption of independence between strata:

$$CV\left(\sum_{s}\widehat{D}_s\right) = \frac{\sqrt{var\left(\sum \widehat{D}_s\right)}}{\sum \widehat{D}_s} = \frac{\sqrt{{K_1}^2 \cdot s(\hat{R}_1)^2 + {K_2}^2 \cdot s(\hat{R}_2)^2 + \cdots + {K_s}^2 \cdot s(\hat{R}_s)^2}}{\widehat{D}_1 + \widehat{D}_2 + \cdots + \widehat{D}_s}$$

Where,

$s =$ strata identifier

$\widehat{D} =$ estimated total discard (of a species in a strata)

$K =$ total landed weight of target species in a strata

$\hat{R} =$ estimated discard ratio

$s(\widehat{R}) =$ standard error of estimated discard ratio

In the following fisheries with 100 percent coverage, NMFS does not list CVs, as the amount of uncertainty is too small to detect with confidence:

- West Coast Limited Entry Bottom Trawl; Fixed Gear
- West Coast Limited Entry Bottom Trawl; Groundfish Bottom and Midwater Trawl
- West Coast Mid-Water Trawl for Whiting, At-Sea Processing
- West Coast Mid-Water Trawl for Whiting, Shoreside Processing

This report does not present CVs for a small number of protected fish species, as data at the level of aggregation needed for this report were unavailable. However, measures of uncertainty at differing levels of stratification for eulachon, green sturgeon, and salmon species are available in recent independent bycatch reports (Gustafson et al. 2015, Lee et al. 2015, Somers et al. 2015, respectively).

This report includes estimated weights for protected fish species that are managed based on the number of individuals, allowing for calculation of fishery bycatch ratios for 11 out of 13 West Coast fisheries in this report, as opposed to only four out of 13 West Coast fisheries in Update 1 (NMFS 2013a). However, this report also provides protected fish species bycatch estimates as individual fish, as opposed to estimated weights, for 2011, 2012, and 2013, in Tables 6.3.1, 6.3.2, and 6.3.3, respectively.

To estimate marine mammal bycatch, the West Coast Region used mortality and serious injury determinations made by NMFS' marine mammal experts per NMFS' policy (NMFS 2012c).

6.4 Progress on Bycatch Implementation Improvement Plans

NMFS has made further progress to address Northwest Region improvement plan recommendations outlined in Section 4.4.8 of the first edition of the report (NMFS 2011). NMFS now provides discard estimates for all fish and invertebrate species seen in observed fisheries. However, it should be noted that the sampling protocol and expansion techniques used by the West Coast Groundfish Observer Program (WCGOP) and the At-Sea Hake Observer Program (A-SHOP) were developed for fish species and have not been extensively tested for sponges, corals, or invertebrates. The WCGOP also provides CVs for bycatch. With the introduction of the IFQ program and mandated 100 percent coverage, only a very small amount of discard in some fisheries needs to be estimated. For these fisheries, uncertainty in estimates is so low that the CV cannot be calculated with confidence and has not been reported.

As well as maintaining observer coverage levels in observed fisheries, coverage has been expanded to include additional fishing sectors targeting or discarding groundfish. Electronic monitoring also is currently being tested in the IFQ program, including whiting[19] catcher vessels. Additional analyst staff has been added to the WCGOP observer program to expand and improve bycatch estimates. Marine mammal injury determinations are also now being made by regional NMFS marine mammal experts.

By including weight estimates as well as counts for protected fish species that are managed by counts of individuals, the WCGOP and A-SHOP have improved the accuracy of total fishery level bycatch ratio estimates. In addition, the WCGOP now provides bycatch estimations for all seabird species that were observed as bycatch.

NMFS began targeting 30 percent fleet-wide observer coverage in the California/Oregon drift gillnet (mesh size >14 in) fishery for swordfish and thresher shark in 2013. This increase was instituted to address a Southwest Region improvement plan recommendation in the first edition of the report (NMFS 2011). Target observer coverage in this fishery had been 20 percent since 1990.

6.5 Fish Bycatch

This section presents fish bycatch estimates in West Coast Region fisheries based on data from 2011, 2012, and 2013. This section also includes both fishery bycatch ratios and species bycatch ratios for each year.

6.5.1 Fish Bycatch Estimates for 2011

Fishery bycatch estimates based on 2011 data calculated as weights ranged from ~286,100 lbs in the fixed gear portion of the West Coast limited entry bottom trawl fishery to more than 5.3 million pounds in the trawl portion of the West Coast limited entry bottom trawl fishery; estimates calculated as individuals ranged from 2,488 individuals in the California/Oregon drift

[19] The term whiting is sometimes used interchangeably to describe Pacific hake (*Merluccius productus*) and the fishery in general (i.e., West Coast Mid-Water Trawl for Whiting). In this report, the terms are used interchangeably due to historical reasons.

gillnet fishery to 134,257 individuals in the non-tribal West Coast salmon troll ocean fishery (Table 6.5.1a). Figure 6.1 shows fishery bycatch ratios for 11 West Coast Region fisheries based on 2011 data.

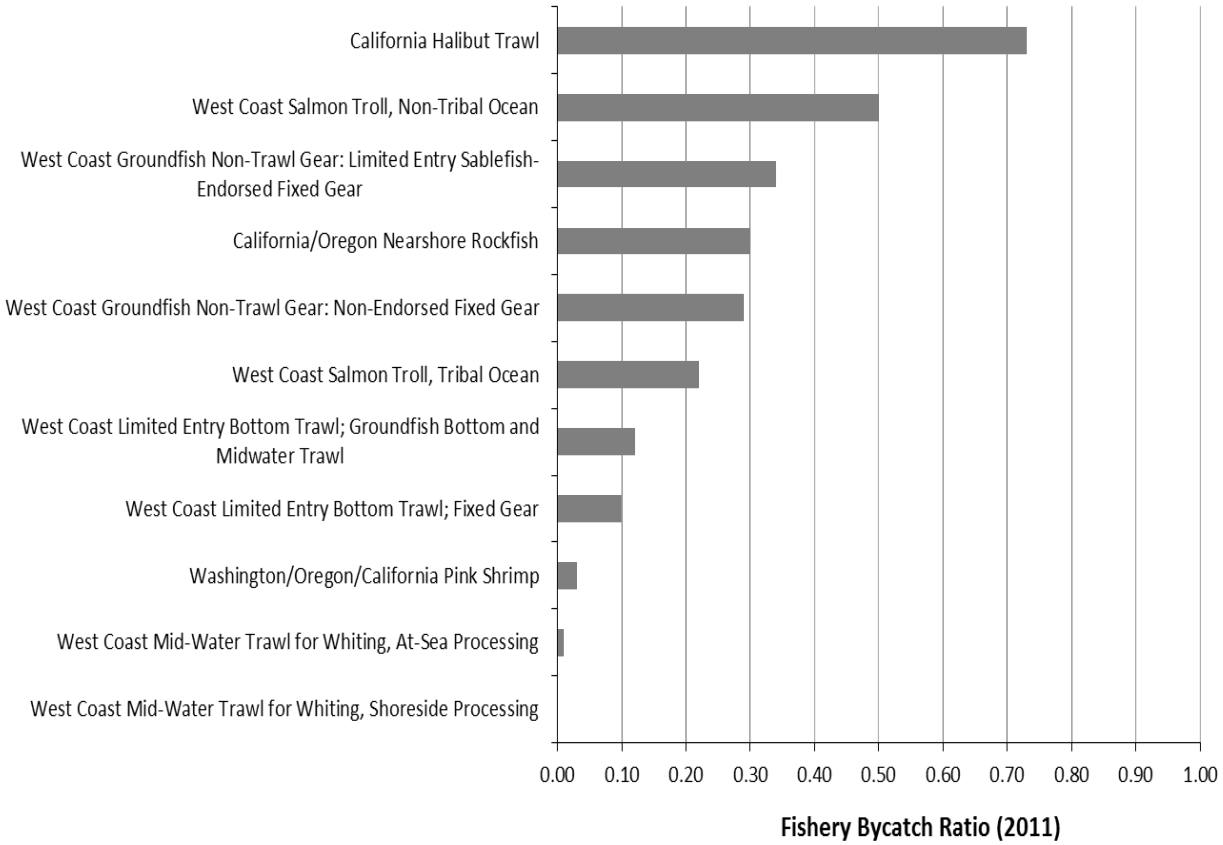

Figure 6.1 West Coast Region Fishery Bycatch Ratios for 2011 (fisheries for which fish bycatch estimates were available; fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, where total catch is bycatch plus landings). The ratio for West Coast Mid-Water Trawl for Whiting, Shoreside Processing is not 0.00 but is less than 0.01.

This report includes fish and invertebrate estimates based on 2011 data for 814 West Coast Region stocks, species, and groups (Table 6.5.1b). Figure 6.2 shows fish and invertebrate bycatch ratios for 51 West Coast Region stocks, species, and groups based on 2011 data. (Species are referred to using FSSI stock names; FSSI stock names do not correspond to regional FMP names.)

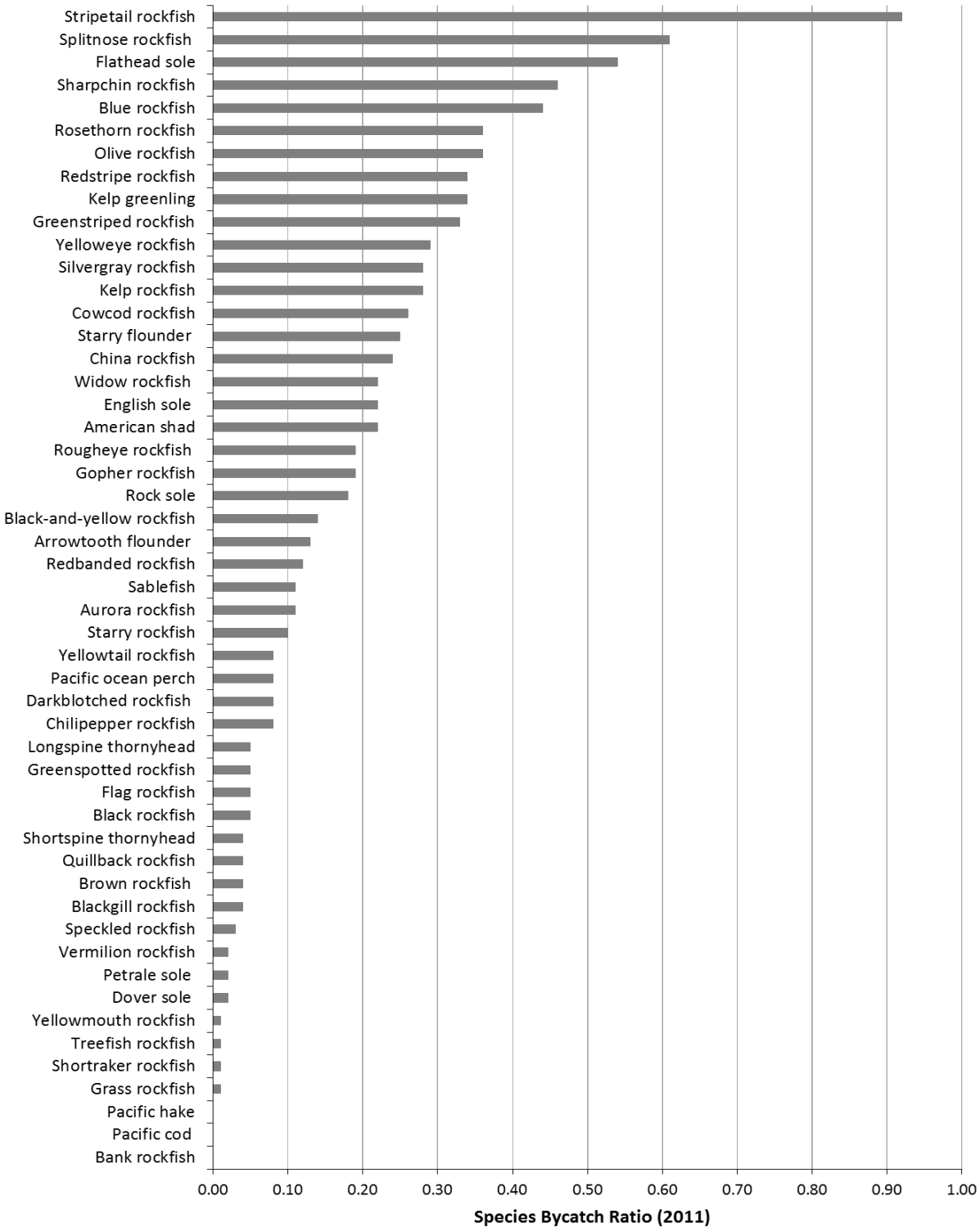

Figure 6.2 West Coast Region Species Bycatch Ratios for 2011 (species bycatch ratio is the ratio of bycatch of a single stock to total catch of that stock within the Region, where total catch of that stock is the species bycatch plus species landings). The ratios for Pacific hake (*Merluccius productus*), Pacific cod, and bank rockfish (*Sebastes rufus*) are not 0.00 but are less than 0.01.

6.5.2 Fish Bycatch Estimates for 2012

Fishery bycatch estimates based on 2012 data calculated as weights ranged from ~320,400 lbs in the shoreside processing portion of the West Coast mid-water trawl for whiting fishery to more than 5 million lbs in the West Coast limited entry trawl fishery; estimates calculated as individuals ranged from 3,348 individuals in the California/Oregon drift gillnet fishery to more than 500,000 individuals in the non-tribal West Coast salmon troll ocean fishery (Table 6.5.2a). Figure 6.3 shows fishery bycatch ratios for 11 West Coast Region fisheries based on 2012 data.

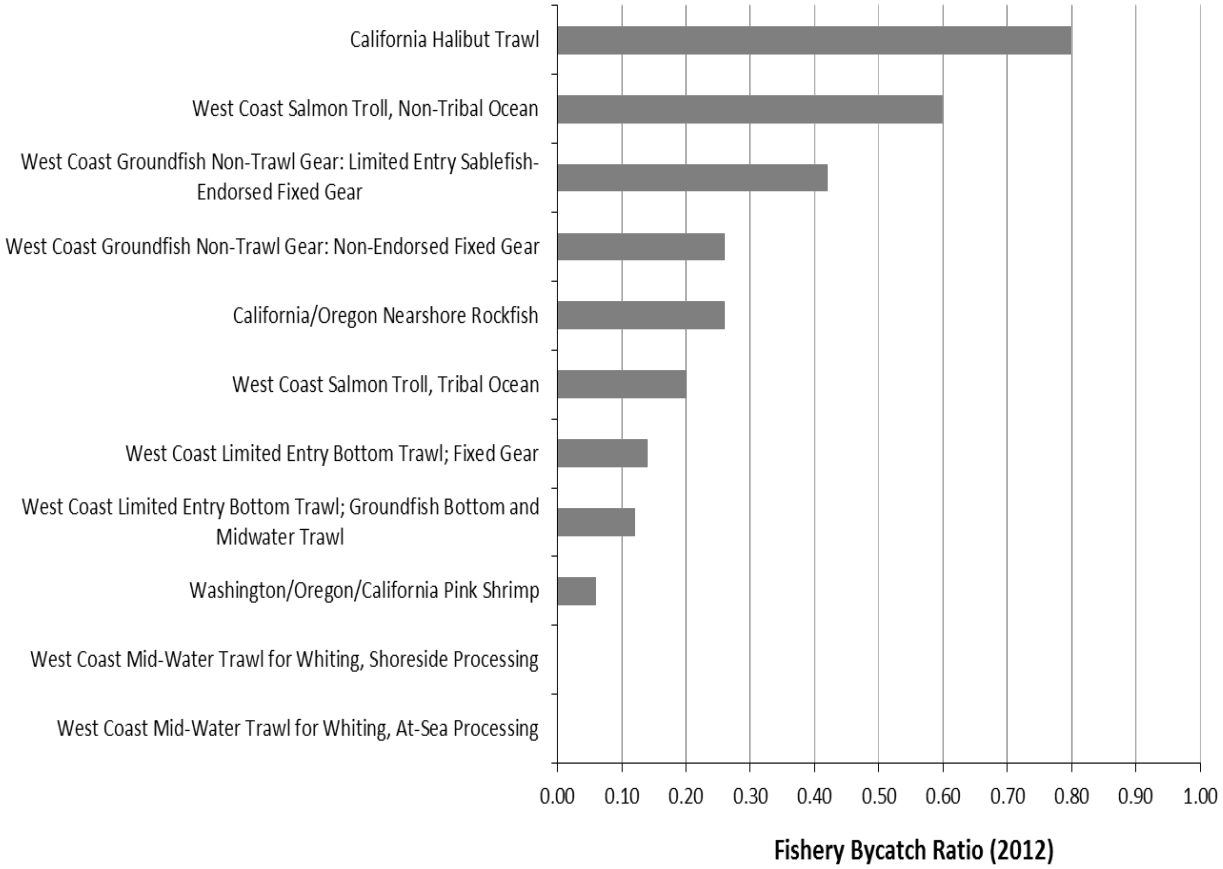

Figure 6.3 West Coast Region Fishery Bycatch Ratios for 2012 (fisheries for which fish bycatch estimates were available; fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, where total catch is bycatch plus landings). The ratios for West Coast Mid-Water Trawl for Whiting, Shoreside Processing and West Coast Mid-Water Trawl for Whiting, At-Sea Processing, are not 0.00 but are less than 0.01.

This report includes fish and invertebrate estimates based on 2012 data for 817 West Coast Region stocks, species, and groups (Table 6.5.2b). Figure 6.4 shows fish and invertebrate bycatch ratios for 51 West Coast Region stocks, species, and groups based on 2012 data.

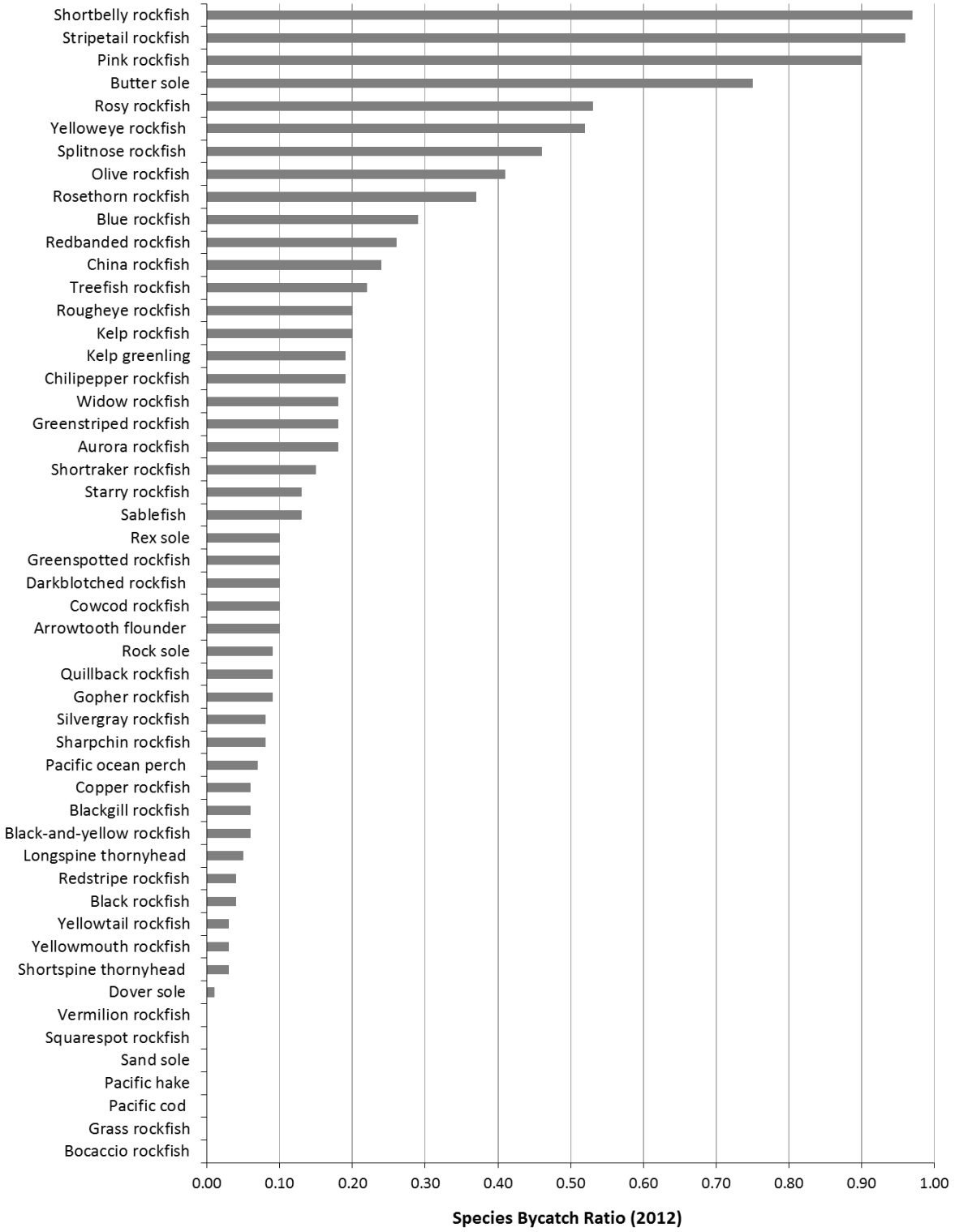

Figure 6.4 West Coast Region Species Bycatch Ratios for 2012 (species bycatch ratio is the ratio of bycatch of a single stock to total catch of that stock within the Region, where total catch of that stock is the species bycatch plus species landings). The ratios for vermillion rockfish (*Sebastes miniatus*), squarespot rockfish (*Sebastes hopkinsi*), sand sole (*Psettichthys melanostictus*), Pacific hake, Pacific cod, grass rockfish (*Sebastes rastrelliger*), and bocaccio rockfish (*Sebastes paucispinis*) are not 0.00 but are less than 0.01.

6.5.3 Fish Bycatch Estimates for 2013

Fishery bycatch estimates based on 2013 data calculated as weights ranged from ~136,000 lbs in the fixed gear portion of the West Coast limited entry trawl fishery to more than 5.9 million lbs in the trawl portion of the West Coast limited entry trawl fishery; estimates calculated as individuals ranged from 4,099 individuals in the California/Oregon drift gillnet fishery to more than 266,000 individuals in the non-tribal West Coast salmon troll ocean fishery (Table 6.5.3a). Figure 6.5 shows fishery bycatch ratios for 11 West Coast Region fisheries based on 2013 data.

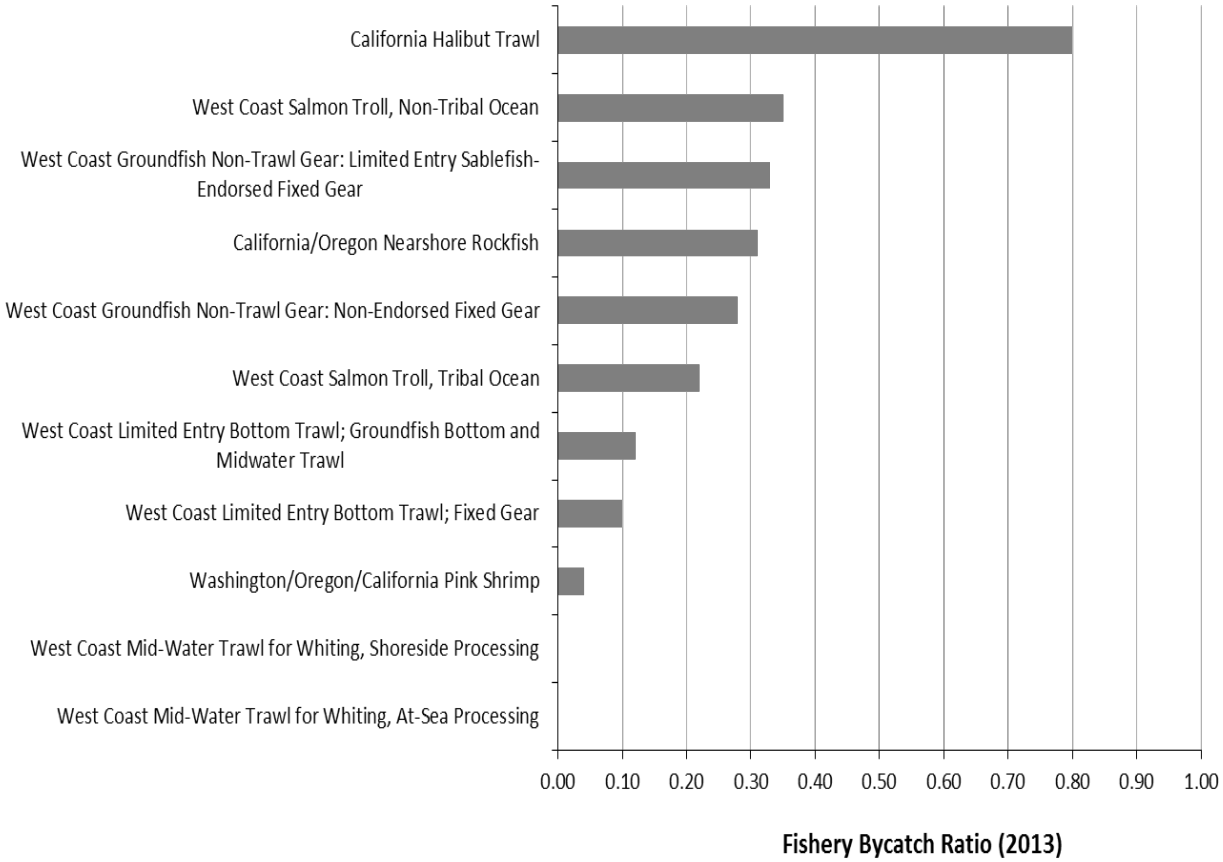

Figure 6.5 West Coast Region Fishery Bycatch Ratios for 2013 (fisheries for which fish bycatch estimates were available; fishery bycatch ratio is the ratio of the total fishery bycatch to total fishery catch, where total catch is bycatch plus landings). The ratios for West Coast Mid-Water Trawl for Whiting, Shoreside Processing and West Coast Mid-Water Trawl for Whiting, At-Sea Processing, are not 0.00 but are less than 0.01.

This report includes fish and invertebrate estimates based on 2013 data for 826 West Coast Region stocks, species, and groups (Table 6.5.3b). Figure 6.6 shows fish and invertebrate bycatch ratios for 58 West Coast Region stocks, species, and groups based on 2013 data.

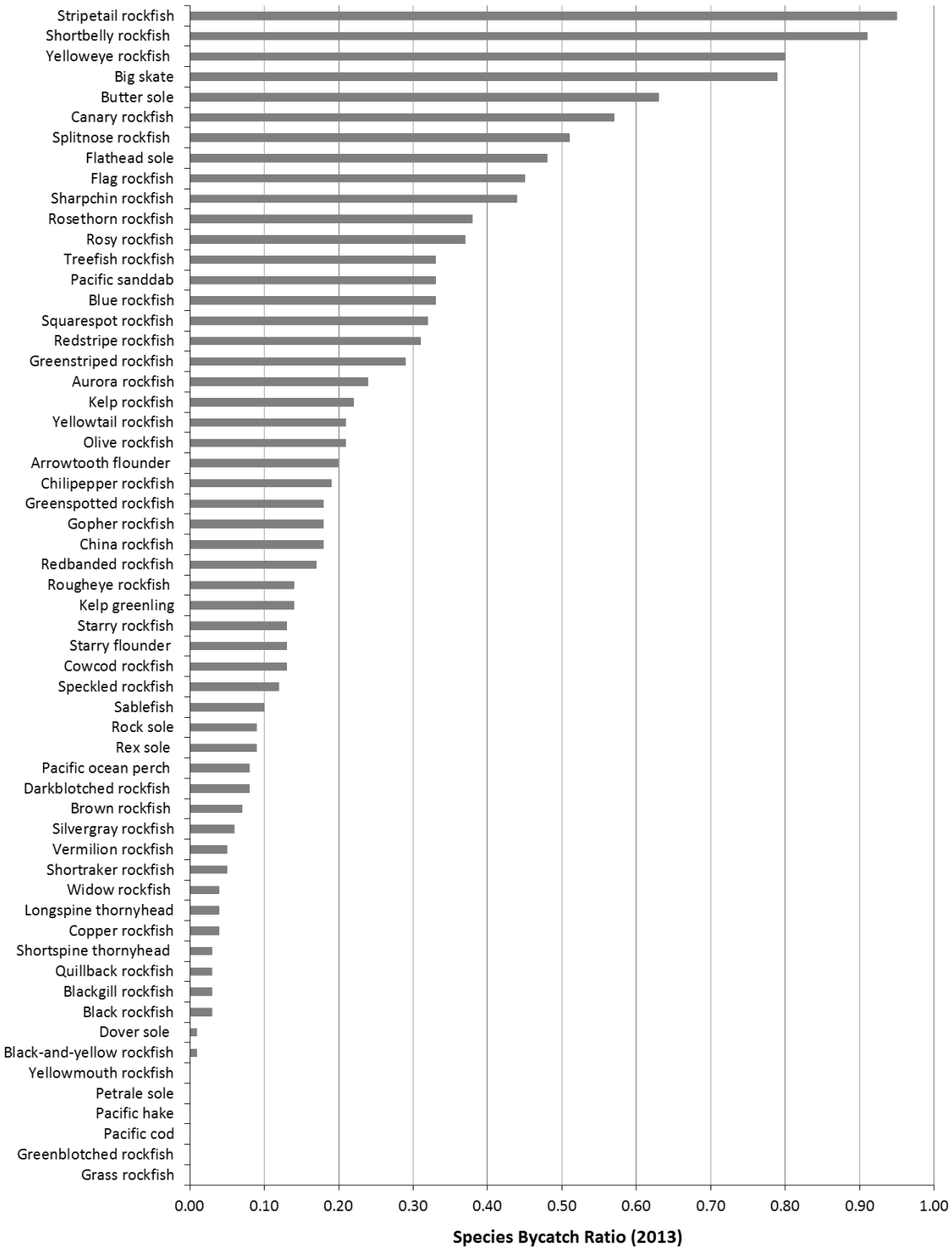

Figure 6.6 West Coast Region Species Bycatch Ratios for 2013 (species bycatch ratio is the ratio of bycatch of a single stock to total catch of that stock within the Region, where total catch of that stock is the species bycatch plus species landings). The ratios for yellowmouth rockfish (*Sebastes reedi*), petrale sole (*Eopsetta jordani*), Pacific hake, Pacific cod, greenblotched rockfish (*Sebastes rosenblatti*), and grass rockfish are not 0.00 but are less than 0.01.

6.5.4 Discussion

In the former Northwest Region, total annual bycatch from 2011 to 2013 has been almost 3,000 mt less than that in 2010. With the introduction of individual fishing quota management to the bottom trawl fishery, bycatch rates and discard amounts decreased sharply between 2010 and 2011 (Bellman et al. 2012). Twice the number of species decreased in amount of bycatch from 2010 to 2013 compared to those that increased. Spiny dogfish (*Squalus suckleyi*) shark bycatch has decreased through 2013, to almost half the level of 2010. Arrowtooth flounder and dover sole (*Solea solea*) both decreased from 2010 to 2012, but increased slightly in 2013. Longspine thornyhead (*Sebastolobus altivelis*) bycatch has decreased to 10 percent of 2010 levels, while dark-blotched rockfish (*Sebastes crameri*) has decreased to 7 percent and Pacific Ocean perch to 8 percent of 2010 levels.

6.6 Marine Mammal Bycatch

Table 6.6.1 shows annual average marine mammal bycatch estimates for 2011, which include 13 marine mammal stocks/species/groups and 10 West Coast Region commercial gear types/fisheries where bycatch was estimated. Table 6.6.2 shows annual average marine mammal bycatch estimates for 2012, which include 13 marine mammal stocks/species/groups and 10 West Coast commercial gear types/fisheries where bycatch was estimated. Table 6.6.3 shows annual average marine mammal bycatch estimates for 2013, which include 14 marine mammal stocks and nine West Coast commercial gear types/fisheries where bycatch was estimated.

The five-year mean estimate of California sea lions (*Zalophus californianus*) in the California Halibut Trawl fishery decreased slightly from 19 to 17 individuals per year from 2011 to 2013. The five-year mean estimated bycatch of harbor seals (*Phoca vitulina richardii*) in the California/Oregon Nearshore Rockfish fishery also decreased, from 5 to 0 individuals annually over the same time period. The five-year mean estimated bycatch of northern elephant seals (*Mirounga angustirostris*) increased slightly from 1 to 2 individuals annually in the West Coast Groundfish Non-Trawl Gear: Limited Entry Sablefish-Endorsed Fixed Gear fishery from 2011 to 2013.

Due to the estimation process used in the California/Oregon Drift Gillnet (Mesh Size >14 in) Fishery for Swordfish and Thresher Shark, and the California Halibut/White Seabass and Other Species Set Gillnet (>3.5 in Mesh) fishery, estimates for each marine mammal stock were similar across the three sets of estimates in this report for these two fisheries. Two bottlenose dolphin individuals were caught in 2013, although they had not been observed in the previous 2 years for these fisheries. The total number of bycaught harbor seals, California sea lions, northern right whale dolphins (*Lissodelphis borealis*), long-beaked common dolphins (*Delphinus capensis*), Risso's dolphins (*Grampus griseus*), and short-beaked common dolphins were estimated at constant levels from 2011 to 2013 for these two fisheries. In addition, Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) bycatch was greater in 2013 than in the two previous years by three individuals. Three sperm whales also were estimated as bycatch in 2012 and 2013. The Marine Mammal Stock Assessment Reports, particularly Caretta et al. (2015b), contain more information on the status of these stocks.

6.7 Sea Turtle Bycatch

Table 6.7.1 shows 2012 sea turtle bycatch estimates for the single West Coast Region commercial gear types/fisheries where bycatch was observed, when five leatherback sea turtles were estimated as bycatch. In all other observed fisheries and years, no sea turtles were observed caught.

6.8 Seabird Bycatch

Table 6.8.1 shows 2011 seabird bycatch estimates for six West Coast Region commercial fisheries where bycatch was observed. Table 6.8.2 shows 2012 seabird bycatch estimates for six West Coast Region commercial fisheries where bycatch was observed. Table 6.8.3 shows 2013 seabird bycatch estimates for three West Coast Region commercial fisheries where bycatch was observed. In 2013, no seabird estimate was available for the California Halibut/White Seabass and Other Species Set Gillnet (>3.5 in Mesh) fishery; in all other cases, a lack of reported bycatch estimates for an observed fishery in the tables above represents zero bycatch.

In 2013, only seven seabird stocks/species/groups were bycaught, compared to 10 in 2011 and 13 in 2012. Black-footed albatross bycatch was observed in a species composition sample in a single fishery in 2013. In addition, a number of individuals were sampled opportunistically but were unable to be used in expanded estimates. The number of western gulls (*Larus occidentalis*) estimated as bycatch greatly decreased. The estimated number of northern fulmar individuals remained at four, the same estimated in 2012. For a small number of stocks/species/groups, the amount of bycatch increased. In 2011 and 2012, no Cassin's auklet (*Ptychoramphus aleuticusor*) or Leach's storm petrel (*Oceanodroma leucorhoa*) individuals were observed, but in 2013 two of each species/stock were estimated as bycatch. The estimated bycatch of unidentified and sooty shearwaters (*Puffinus griseus*) was greater in 2013 than in either 2011 or 2012.