

CANADA

**British Columbia Groundfish Fisheries and Their Investigations in 2016**

**April 2017**

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## I. Agency Overview

Fisheries and Oceans Canada (DFO), Science Branch, operates three principal facilities in the Pacific Region: the Pacific Biological Station (PBS), the Institute of Ocean Sciences (IOS), and the West Vancouver Laboratory (WVL). These facilities are located in Nanaimo, Sidney and West Vancouver, British Columbia (BC), respectively. Dr. Carmel Lowe is the Regional Director of Science. The Divisions and Sections are as follows:

Division Heads in Science Branch reporting to Dr. Lowe are:

|                                            |                   |
|--------------------------------------------|-------------------|
| Canadian Hydrographic Service              | Mr. David Prince  |
| Ocean Science                              | Ms. Kim Houston   |
| Aquatic Diagnostics, Genomics & Technology | Dr. Nathan Taylor |
| Ecosystem Science                          | Dr. Eddy Kennedy  |
| Aquatic Resource Research and Assessment   | Dr. John Holmes   |

Section Heads within the Aquatic Resource Research and Assessment Division (ARRAD) are:

|                                 |                     |
|---------------------------------|---------------------|
| Offshore (mostly Groundfish)    | Mr. Greg Workman    |
| Inshore (mostly Invertebrates)  | Ms. Lynne Yamanaka  |
| Quantitative Assessment Methods | Dr. Robyn Forrest   |
| Fisheries and Assessment Data   | Mr. Bruce Patten    |
| Salmon Assessment               | Ms. Arlene Tompkins |

Science Branch in the Pacific Region underwent a major re-organization during 2016 in an effort to better position itself to address its evolving and expanding mandate and distribute staff more evenly amongst divisions. Of particular note is the creation of the Ecosystem Science Division (ESD) with a mandate to focus on Ocean Act priorities (Marine Spatial Planning, Ocean Protection Program, Ecosystem Effects, etc), consolidation of all the fisheries related science in the Aquatic Resource Research and Assessment Division (ARRAD), and consolidation of Science “Services” in the Aquatic Diagnostics, Genomics & Technology Division (ADGT) (Schlerochronology Lab, Genetics, Animal health, Aquarium services). Groundfish research and stock assessment are now conducted amongst the Offshore, Fisheries and Assessment Data, and Quantitative Methods Sections within ARRAD. Groundfish specimen ageing is conducted in the Applied Technologies Section in ADGT. Acoustic fisheries research and surveys are led by the Ecology and Biogeochemistry Section in the Ocean Sciences Division.

The Canadian Coast Guard operates DFO research vessels. These research vessels include the *J.P. Tully*, *Vector*, and *Neocaligus*. The principle vessel used for groundfish research for the last 31 years, the *WE Ricker*, suffered a catastrophic failure of its main trawl winches during the West Coast Vancouver Island Synoptic Bottom Trawl Survey. Subsequent failures of key vessel systems have resulted in decommissioning of the ship. The replacement vessel for the *W.E. Ricker*, the *Sir John Franklin* is currently under construction with delivery anticipated in the spring of 2018. At sea operations for

groundfish surveys during 2017 will be conducted aboard chartered commercial fishing vessels.

The Pacific Region Headquarters (RHQ) of Fisheries and Oceans Canada is located in Vancouver, British Columbia. Management of groundfish resources is the responsibility of the Pacific Region Groundfish Regional Manager (Mr. Neil Davis) within the Fisheries and Aquaculture Management Branch (FAM). Fishery Managers receive assessment advice from ARRAD through the Canadian Centre for Scientific Advice Pacific (CSAP) review committee which is headed by Ms. Lesley MacDougall. Historically Groundfish held at least two meetings per year, in which stock assessments or other documents underwent scientific peer review (including external reviewers who are often from NOAA). The resulting Science Advisory Report summarizes the advice to Fishery Managers, with the full stock assessment becoming a Research Document. Both documents can be viewed on the Canadian Stock Assessment Secretariat website: <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm>. The future frequency of review meetings and production of stock assessment advice for fisheries managers will depend on departmental, branch and regional priorities potentially resulting in less frequent advice.

The Trawl, Sablefish, Rockfish, Lingcod, North Pacific Spiny Dogfish, and Halibut fishery sectors continue to be managed with Individual Vessel Quotas (IVQs). IVQs can be for specific areas or coastwide. Within the general IVQ context, managers also use a suite of management tactics including time and area specific closures and bycatch limits. Details for the February 2016 Groundfish Integrated Fisheries Management Plan can be viewed at <http://www.pac.dfo-mpo.gc.ca/fm-gp/ifmp-eng.html#Groundfish>.

Allocations of fish for financing scientific and management activities are identified in the Groundfish Integrated Fisheries Management Plan. Joint Project Agreements (JPAs) were developed for 2016-17 between Fisheries and Oceans Canada and several partner organizations to support groundfish science activities through the allocation of fish to finance the activities. These JPAs will be updated for 2017-18.

## II. Surveys

A number of multi-species surveys are conducted by the Groundfish Section and Groundfish staff participate in surveys conducted by other groups. For a summary of all research survey activity in 2016, please see Appendix 1.

## III. Reserves

Nothing to report for 2016.

## IV. Review of Agency Groundfish Research, Assessment and Management

### A. Hagfish

#### 1. Research

An experimental fishery has been conducted since 2013. The experimental program consist of three elements: 1) a systematic depth stratified survey in each of the 3 area pairs (PFMA 23/123, 25/125, and 8-9/108-109); 2) experimental fishing to fixed effort caps in each of the area pairs; and 3) monitoring the previously selected index site within PFMA 23 (Kirby Point).

The sequence of activities intended during the initial development of the science program was to undertake a survey in each of the area pairs and conduct an initial sampling at the Kirby Point site prior to commencing the depletion experiment; once these two activities were completed experimental fishing could then start with subsequent surveys occurring every 6 months. The reason for doing the surveys and sampling first is to establish a baseline snap-shot of the species distribution, relative abundance and biological condition prior to removals. It was anticipated that once experimental fishing began, changes (reductions) in survey and fishery CPUE would be detectable after some period of fishing. The levels of effort authorized for the experimental fishery should be sufficient to impose a detectable signal in the CPUE data that should make it possible to generate a depletion estimate of abundance, at least for the locations where fishing is taking place.

## 2. Assessment

An initial summary of the experimental fishery was compiled by DFO staff and further developed by a Fisheries consultant contracted by the proponent of the experimental fishery. Both reports noted significant gaps in compliance with the experimental protocol, with limited depletion detectable due to early termination of fishing activities or movement of the participating vessel to unauthorized areas.

## 3. Management

In light of the above findings as well as fulfillment of the three year term of the experimental agreement, the proponent has been directed to develop a new proposal for review by the department before further experimental fishing will be authorized.

### B. Dogfish and other sharks

#### 1. Research

Ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, recreational creel surveys. Anecdotal information continued to be collected through the Shark Sightings Network.

#### 1. Assessment

In May 2016, Basking Shark critical habitat was evaluated in the form a CSAP Science Response document. Basking Shark are currently listed under SARA as an Endangered species. Both a Recovery potential assessment (DFO 2009) and a Recovery Strategy have been completed for this species (DFO 2011). The Recovery Strategy notes that "Adequate information does not exist to identify critical habitat at this time" (p. iii). A schedule of studies was identified in the Recovery Strategy, outlining

research required to contribute to the future identification of critical habitat, with the recognition that it “may take decades to address the issue of identifying critical habitat, given the long lived nature of the species, a lack of documented recent sightings in Canada, and the associated long-term scope of this recovery strategy” (p. iii).

The Science Response reviewed the available information that would support the identification of habitat necessary for the survival and recovery of Basking Shark within Canadian Pacific waters. The conclusion was that, aside from foraging, the biological functions of Basking Shark that are supported by habitat in BC waters remain unknown. Spawning, nursery, and rearing locations remain undocumented throughout the geographic range for this population. Through modeling, areas of high primary productivity have been identified; however, they do not correlate with copepod productivity. The low resolution of zooplankton data and the low numbers of Basking Shark observations do not support identification of foraging habitat. No recommendation could be made regarding the habitat needed for survival and recovery of Basking Sharks within Canadian Pacific waters.

### C. Skates

#### 1. Research

Ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys.

### D. Pacific cod

#### 1. Research

Ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys. Collection of DNA was initiated during 2015 in the spawning areas of Hecate Strait (PSMFC Area 5D) and continued in 2016.

### E. Walleye pollock

#### 1. Research

There is no directed work being conducted on Walleye Pollock, but ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys.

#### 2. Assessment

Work was started on assessing Walleye Pollock along BC's outer coast, excluding the waters in the Strait of Georgia. Saunders et al. (1988) identify four primary spawning grounds in BC waters – Dixon Entrance/northern Hecate Strait, Queen Charlotte Sound, SW Vancouver Island, and the Strait of Georgia. These are illustrated by the highest capture rates from the commercial trawl fishery (bottom + midwater, averaged over 1996-2016, Figure E .1), which occur in Dixon Entrance (perhaps as part of a larger SE Alaska population, Thompson 1981), upper Moresby Gully, off Juan de Fuca Strait (gyre

in summer), and in the Strait of Georgia (two discrete patches north and south). The assessment is due for delivery in May 2017.

### 3. Management

Walleye Pollock is an IVQ (individual vessel quota) species with a 2016 TAC (total allowable catch) of 4,225 t coastwide (1,115 t in the Strait of Georgia, 1,790 t in 5AB + area 12, and 1,320 t in 5CDE). Area 3CD + area 20 did not receive an official TAC. Commercial total allowable catch for various groundfish species were allocated between the different groundfish sectors; however, Pollock was entirely (100%) allocated to the Trawl sector.

To support groundfish research and account for unavoidable mortality incurred during the 2016 Groundfish Trawl multi-species surveys planned for the west coast of Vancouver Island (WCVI, Groundfish Management Area or GMA 3C/D) and west coast of Haida Gwaii (WCHG, GMA 5E), 1.3 t and 0.3 t, respectively were accounted for before defining the Groundfish Trawl TACs.

Vessels on dedicated offshore Pacific Hake trips without an at-sea observer on board were permitted a by-catch allowance of Walleye Pollock restricted to thirty (30) percent of the offshore Hake trip landings. Any catch (other than Hake) in excess of the set allowance was relinquished. All by-catch was deducted from the vessel's IVQ holdings. Fishers who retained more than the by-catch allowance while on dedicated Hake trips were obliged to carry at-sea observers for those trips.



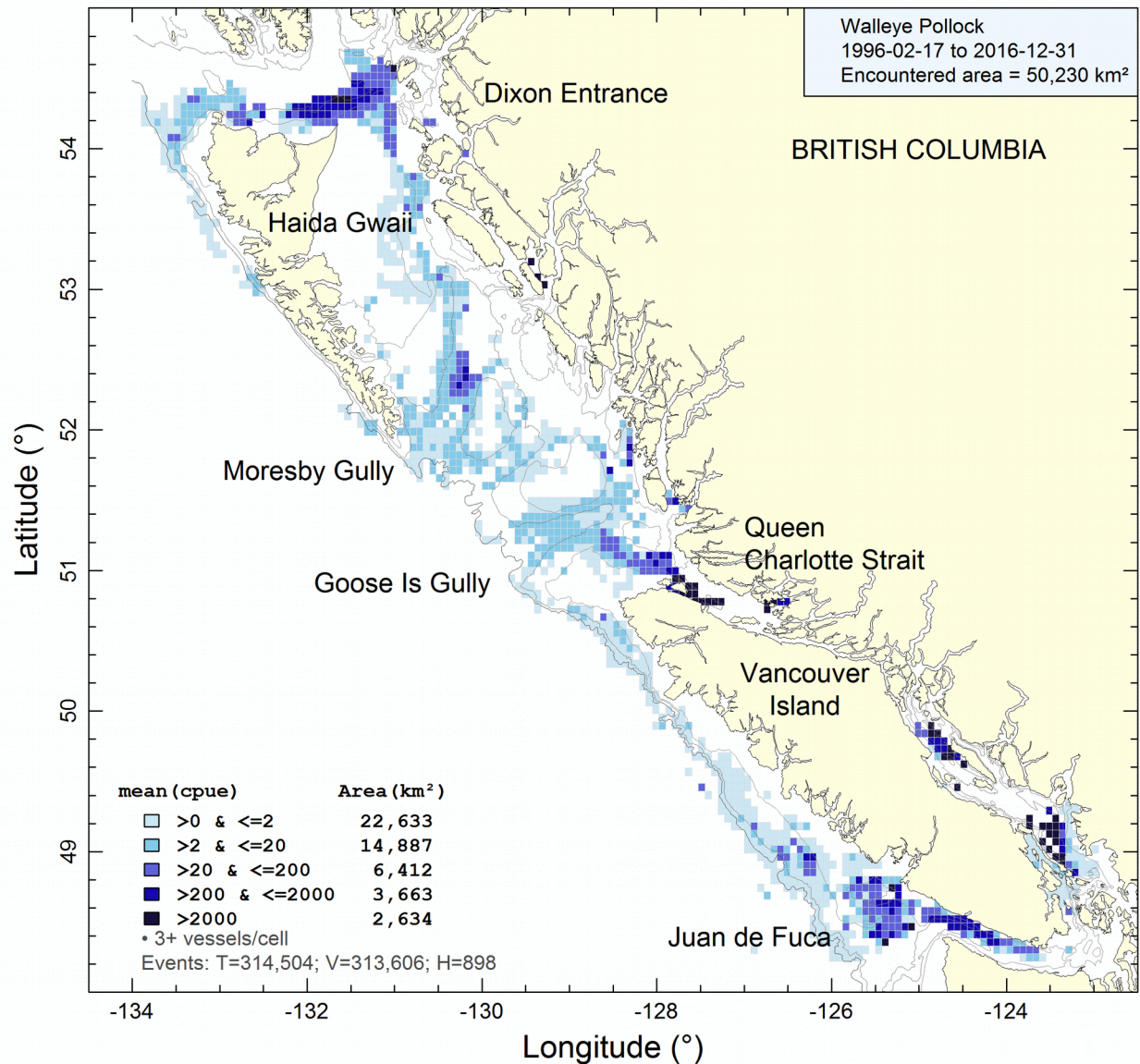


Figure E.1. Aerial distribution of Walleye Pollock mean trawl tow catch per unit effort (kg/hour) from Feb 17, 1996 to Dec 31, 2016. Isobaths show the 100, 200, and 500 m depth contours. Note that cells with <3 fishing vessels are not displayed. Each cell represents, on average, 32 km<sup>2</sup>.

## F. Pacific whiting (hake)

### 1. Research

In British Columbia there are two commercially harvested and managed stocks of Pacific Hake. The offshore stock is the principle target of the commercial fishery comprising the bulk of landings year over year. A smaller and discrete stock residing within the Strait of Georgia is targeted episodically when market demand is sufficient and the available fish are larger enough for processing.

From 1995 – 2001, the offshore stock was been the target of triennial acoustic surveys. From 2001 onwards, the surveys have occurred biennially, covering the known extent of

the offshore Pacific Hake stock, ranging from California to northern British Columbia. There was no survey in 2016, as it was an in-between year.

There has been a biennial acoustic survey for Pacific Hake in the Strait of Georgia since 2011. Methods are currently being developed to calculate a biomass estimate for these surveys, which will then be used as the primary index of abundance for the stock assessment. The 2017 survey was cancelled due to the decommissioning of the *C.C.G.S W.E. Ricker*, but there is a plan to continue the time series in 2018 with the new Offshore Fisheries Science Vessel.

#### 4. Assessment

As in previous years, the 2016 assessment and the 2017 harvest advice was prepared jointly by Canadian and U.S. scientists working together as part of the Joint Technical Committee (JTC) of the Pacific Hake/Whiting Agreement between the Governments of the United States and Canada. The assessment model used was Stock Synthesis 3 (SS3). The 2017 model had the same model structure used in 2016, with updates to catch and age compositions. The 1995 survey index, which was not included in the 2016 assessment, was re-introduced in 2017, along with slight modifications to the 1998 and 2015 indices. These changes had little effect to model outcome.

An apparent very large cohort of age-2 hake was caught in the fishery, which caused the model to predict the highest biomass ever seen by a factor of nearly 2, but with very large uncertainty. This seemed implausible and was addressed by the JTC by allowing the time-varying selectivity parameters more freedom in the estimation. This reduced the predicted biomass but increased the differences in selectivity between years when compared to the 2016 model. However, the differences in selectivity are thought to be a real effect, due to targeting of cohorts by the fisheries.

There has not been an assessment of Pacific Hake in the Strait of Georgia, although the recent increases in catch may warrant one.

#### 5. Management

Since 2011, management of Pacific Hake has been accomplished under a treaty between Canada and the United States known as the Pacific Hake/Whiting Agreement ("The Agreement"). The stock is managed by the Joint Management Committee (JMC) which is made up of fisheries managers and industry representatives from both the U.S. and Canada. These managers receive advice from the JTC and the Scientific Review Group (SRG), which is a committee responsible for the scientific review of the assessment.

The total Canadian TAC for 2016 was 129,947 t including a carryover of 15,020 t. The shoreside/freezer trawler sector was allocated 114,947 t of this and caught 69,741t (53.7% of total TAC). The Joint Venture (JV) fishery received a quota of 15,000 t in 2016, but did not choose to participate in the fishery. The majority of the Canadian Pacific Hake catch for the 2016 season was taken from the west coast of Vancouver Island.

The final decision on catch advice for the 2017 fishing season was made at the meeting of the International Pacific Hake JMC in Lynwood, Washington on Feb. 28 – Mar. 2, 2017. A coastwide TAC of 597,500 t for 2017 was agreed upon. As laid out in the treaty, Canada will receive 26.12% of this, or 156,067 t. Managers will choose how to allocate this between the domestic and joint venture fisheries as the season progresses.

The final assessment document and other treaty-related documents are posted at: [http://www.nwr.noaa.gov/fisheries/management/whiting/pacific\\_whiting\\_treaty.html](http://www.nwr.noaa.gov/fisheries/management/whiting/pacific_whiting_treaty.html)

Management of Strait of Georgia Pacific Hake has been implemented as ad-hoc quota allocation throughout the history of the fishery. Typical catch for the Strait has been approximately 10 - 40 metric tonnes for many years, but has seen a dramatic increase in the last few years. In 2014 the total catch was 2,774 t, in 2015 it was 4,962 t, and in 2016 it was 10,079 t. The TAC for 2016 was set at 7,000 t.

#### G. Grenadiers

##### 1. Research

There is no directed work being conducted on Grenadiers but ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys.

#### H. Rockfish

##### 1. Research

For research and assessment purposes, populations of rockfish (*Sebastes*) species are broadly grouped as “inshore” (shallow regions near shore that are accessible by many fisher groups) and “offshore,” with “offshore” further divided into “shelf” and “slope” (BC’s continental shelf and slope, often only accessible by the commercial industry). Ongoing data collection in support of directed work on rockfish continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys.

DFO tackles a variety of issues related to rockfish in addition to assessment needs: COSEWIC (Committee on the Status of Endangered Wildlife in Canada) listing requirements, oceanographic exploration, software development for the R statistical platform (<https://github.com/pbs-software>), and scientific research in marine ecological modelling. For stock assessment, DFO collaborates with outside contractors from agencies such as the Canadian Groundfish Research and Conservation Society and The School of Resource and Environmental Management at Simon Fraser University.

##### a) Inshore Rockfish Surveys on the Inside (PMFC Area 4B)

A DFO research longline survey was designed and initiated in 2003 to survey hard bottom (non-trawlable) areas over the Inside waters east of Vancouver Island (Strait of Georgia). Hard bottom areas were identified through bathymetric analyses, inshore

rockfish fishing records, and consultations with fishers. The hard bottom areas were overlain with a 2 km by 2 km grid and survey blocks were stratified by area and depth (41–70 m and 71 –100 m) and randomly selected for sampling (Lohead and Yamanaka 2004; 2006; 2007). The Inside waters are divided into two regions, Northern and Southern, and one region is surveyed each year. Twenty-three days of DFO ship time were allocated for the longline survey in the Northern region in August 2016. The Southern region is due to be surveyed over 25 days in July-August 2017. For complete details see Appendix 1.

b) Inshore Rockfish Surveys on the Outside (PMFC Areas 3CD, 5ABCDE)

Since 2003, the International Pacific Halibut Commission (IPHC) has allowed a third technician onboard charter vessels during the Area 2B setline survey to collect hook-by-hook catch data and conduct biological sampling of non-Halibut catch (e.g. Flemming et al. 2012). Funding for this third technician on the IPHC survey has evolved from industry sources to DFO National budgets through the survey series, with the exception of 2013 where no funding mechanism was available to fund the surveys. Since 2014, the survey program has been conducted under a “Use-of-Fish” DFO policy in conjunction with a Collaborative Agreement which outlines this project and includes responsibilities for the IPHC, the Pacific Halibut Management Association (PHMA) and DFO. For complete details see Appendix 1.

In collaboration with industry (PHMA), a research longline survey was designed and conducted in the outside BC coastal waters in 2006. Hard bottom areas were identified through bathymetric analyses, inshore rockfish fishing records, and fishermen consultations. The hard bottom survey areas were overlain with a 2 km by 2 km grid (matched with the adjacent trawl survey grid) and survey blocks were stratified by area and depth and chosen at random. 198 survey sets are targeted annually. The survey covers the coastwide outside waters over two years, alternating annually between the north and the south. Three chartered fishing vessels have conducted this survey annually between August 15 and September 15 with the exception of 2013. Similar to the IPHC survey, this survey program is conducted under a “Use-of-Fish” policy and Collaborative Agreement with the PHMA. For complete details see Appendix 1.

Both the IPHC and PHMA Collaborative Agreements are scheduled for renewal in 2017. The IPHC will conduct survey work over 170 fixed stations in BC. The PHMA will conduct surveys over the northern portion of B.C..

c) Inshore Rockfish: Assessment of Rockfish Conservation Areas (RCAs) using visual surveys

Late in 2014, competitive funding for three years was granted to continue the analysis of the visual data to assess inshore rockfishes within and adjacent to RCAs. A PhD thesis (Haggarty 2015) was completed in 2015, while documentation of survey methods and two additional papers were completed in 2016 (see Section VII Publications).

#### d) Slope Rockfish

In anticipation of upcoming assessments, ageing was initiated on 6,564 Redstripe Rockfish otoliths from commercial trips and/or research surveys for 1994, 1996, 1999-2015.

Genetic work on separating the Rougheye Rockfish complex (Rougheye Types I and II or the Rougheye/Blackspotted complex) was initiated in 2010 and is planned to continue in 2017. Tissues samples are processed annually; aging of specimen sampled for DNA was initiated in 2016 in anticipation of completing an assessment by 2020.

#### Literature Cited:

Flemming, R.G., Yamanaka, K.L., Cooke, K., and Dykstra C. 2012. Summary of non-Halibut catch from the standardized stock assessment survey conducted by the International Pacific Halibut Commission in British Columbia from June 3 to August 27, 2010. Can. Tech. Rep. Fish. Aquat. Sci. 2989: viii + 99 p.

Haggarty, Dana Rochelle. An evaluation of the effectiveness of rockfish conservation areas in British Columbia, Canada. Diss. University of British Columbia, 2015.

Lochead, J.K. and Yamanaka, K.L. 2007. Summary report for the inshore rockfish (*Sebastes* spp.) longline survey conducted in Statistical Areas 14 to 20, 28 and 29, August 11 – September 6, 2005. Can. Tech. Rep. Fish. Aquat. Sci. 2690: viii + 53 p.

Lochead, J.L. and Yamanaka, K.L. 2006. Summary report for the inshore rockfish (*Sebastes* spp.) longline survey conducted in Statistical Areas 12 and 13, August 24 – September 10, 2004. Can. Tech. Rep. Fish. Aquat. Sci. 2627: ix + 65 p.

Lochead, J.L. and Yamanaka, K.L. 2004. A New Longline Survey to Index Inshore Rockfish (*Sebastes* spp.): Summary Report on the Pilot Survey Conducted in Statistical Areas 12 and 13, August 17 – September 6, 2003. Can. Tech. Rep. Fish. Aquat. Sci. 2567: 59 p.

### 6. Assessment

#### a) Yelloweye Rockfish

A stock assessment for the Outside population of Yelloweye Rockfish in 2014 was reviewed by the Canadian Science Advisory Secretariat in September 2015. The Science Advisory Report from this process is available at: [http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2015/2015\\_060-eng.pdf](http://www.dfo-mpo.gc.ca/csas-sccs/publications/sar-as/2015/2015_060-eng.pdf). A synopsis of the assessment was presented in the 2016 TSC report, revisions to that research document have been finalized and publication on the CSAS website is anticipated during 2017.

The assessment suggests that the stock has continued to decline, despite more than a decade of rockfish conservation measures. Increases in Yelloweye Rockfish density have not yet been seen in Rockfish Conservation Areas, but given the low productivity of this species, benefits are not expected to be detected until at least 10 years after their closure.

#### e) Slope Rockfish

Work was started on an update assessment for Pacific Ocean Perch in PMFC area 5ABC. This stock was last assessed in 2010 and the assessment concluded that the spawning biomass at the start of 2011 had a probability of 0.96 or 0.82 of being above the limit reference point  $0.4B_{MSY}$ , and of 0.68 or 0.24 of being above the upper stock reference point  $0.8 B_{MSY}$ , depending on the model (estimate  $M$  and  $h$  vs. fix  $M=0.06$  and estimate  $h$ ). The spawning biomass depletion was estimated to be 0.26 (0.12-0.43) or 0.14 (0.08-0.24), where amounts in parentheses represent the 5 to 95% credible intervals derived from Bayesian output. The 2010 assessment resulted in a reduction of TAC for 5ABCD from 4,188 t to 3,413 t over 3 years, starting in 2011. The 2016 assessment, due in June 2017, should see if this reduction made any difference to the stock status.

Rougheye Rockfish (types I and II) were designated “Special Concern” by COSEWIC in 2007. A pre-COSEWIC report has been requested and is currently being prepared and is scheduled for presentation through CSAP in 2017. A full assessment has been requested, but is on hold until more genetics and aging work has been completed, and pending the outcome of the COSEWIC review.

### 7. Management

#### a) Inshore Rockfish

Management, in consultation with the commercial industry, will step down the current Outside Yelloweye Rockfish Total Allowable Catch (TAC) over the next three years to bring harvests from 290 t to 100 t by the 2018/19 fishing year. An industry proposal for a more spatially explicit quota apportionment was adopted by management, which shifts the current apportionment slightly to better match higher TACs with areas of higher survey CPUE. Similarly, recreational bag limits have been reduced from 3 to 2 Yelloweye Rockfish in the north and from 2 to 1 in the south.

Yelloweye Rockfish was listed as Special Concern under the SARA in 2011 and DFO is currently developing a SARA management plan. Yelloweye Rockfish is up for reassessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2018.

Subsequent to public consultations in 2012, the Minister of Environment has not made a decision on whether to list Quillback Rockfish as *Threatened* under Canada's *Species At Risk Act* (SARA). Quillback Rockfish remain unlisted in 2015. Quillback Rockfish is up for reassessment by the COSEWIC by November 2019.

#### f) Slope Rockfish



Pacific Ocean Perch is an IVQ (individual vessel quota) species with a 2016 trawl TAC (total allowable catch) of 5,192 t coastwide (750 t in 3CD, 1,687 t in 5AB, 1,544 t in 5C, and 1,200 t in 5DE). Commercial total allowable catch for various groundfish species were allocated between the different groundfish sectors; Pacific Ocean Perch was allocated 99.98% to the Trawl sector and 0.02% (1 t coastwide) to the ZN hook and line sector.

To support groundfish research and account for unavoidable mortality incurred during the 2016 Groundfish Trawl multi-species surveys planned for the west coast of Vancouver Island (WCVI, Groundfish Management Area or GMA 3C/D) and west coast of Haida Gwaii (WCHG, GMA 5E), 15.3 t and 41.8 t, respectively were accounted for before defining the Groundfish Trawl TACs.

An area called Tide Marks (near Goose Island Gully) was closed to all trawling from Feb 21, 2016 to May 31, 2016 and from Oct 1, 2016 to Mar 31, 2017 to reduce harvesting pressure on Pacific Ocean Perch stocks during the spawning period.

In 2016, an assessment for Silvergrey rockfish was finalized and published through the Canadian Science Advice Secretariat (CSAS). The working paper was prepared and reviewed in 2015.

## I. Thornyheads

### 1. Research

In anticipation of upcoming assessments, ~500 Longspine Thornyhead otoliths were selected for ageing after stratifying by length bin from the combined Thornyhead surveys (2001-2003). The final otolith sample: 70 (5-10cm), 97 (10-15 cm), 97 (15-20 cm), 97 (20-25 cm), 97 (25-30 cm), and 43 (30-35 cm). These data will perhaps contribute to estimating growth parameters for a delay-difference model.

### 8. Assessment

No Thornyhead assessments were conducted in 2016. Longspine Thornyhead was designated "Special Concern" by COSEWIC in 2007. It is anticipated that an assessment may be requested in the near future.

### 9. Management

Longspine and Shortspine Thornyhead are both IVQ species with a 2016 coastwide TAC (total allowable catch) of 425 t and 769 t, respectively. Commercial TACs for various groundfish species were allocated between the different groundfish sectors; Longspine Thornyhead was allocated 95.35% to the Trawl sector, 2.29% to the ZN hook and line sector, and 2.36% to the Halibut sector; Shortspine Thornyhead was allocated 95.40% to the Trawl sector, 2.27% to the ZN hook and line sector, and 2.33% to the Halibut sector.

To support groundfish research and account for unavoidable mortality incurred during the 2016 Groundfish Trawl multi-species surveys planned for the WCVI and the WCHG, 0.8 t and 3.3 t, respectively were accounted for before defining the Groundfish Trawl TACs for Shortspine Thornyhead. The adjustment for Longspine Thornyhead was only 0.4 t for the WCHG survey.

## J. Sablefish

### 1. Research

The Sablefish management system in British Columbia is an adaptive ecosystem-based approach in which three pillars of science – hypotheses, empirical data, and simulation - play a central role in defining management objectives and in assessing management performance relative to those objectives via Management Strategy Evaluation (MSE) processes. Objectives relate to outcomes for three categories of ecosystem resources: target species (TS), non-target species (NTS), and Sensitive Benthic Areas (SBAs). The MSE process is used to provide management advice each year that supplements the stock assessment process by providing a way to explicitly evaluate harvest strategies given a set of stock and fishery objectives and uncertainties/hypotheses about Sablefish fishery and resource dynamics. Fisheries and Oceans Canada (DFO) and Wild Canadian Sablefish Ltd. have collaborated for many years on fisheries management and scientific research with the aim of further supporting effective assessment and co-management of the Sablefish stock and the fishery in Canadian Pacific waters.

Fishery independent research includes the following activities:

#### a) A Stratified Random Survey using Longline Trap Gear (2003-2016)

This activity captures Sablefish for tagging and release following a depth and area stratified random survey design. Tag-recoveries are used for deriving estimates of gear selectivity and studying Sablefish movement. The catch rate data are used to derive an index of stock abundance. The survey also provides biological samples for determination of life history characteristics for Sablefish and non-target species (e.g., Blackspotted and Rougheye Rockfish).

#### a) An Inlets Survey using Longline Trap Gear (1995-2016)

This activity includes standardized sets at four (4) mainland inlet localities on coastal British Columbia (excludes Vancouver Island). Sablefish are tagged and released from inlet sets and are sampled for biological data.

Sablefish research surveys are planned for the fall of 2017 contingent on the availability of resources.

A new introduction to both surveys (a, b) in 2013-2016 was the deployment of (1) tri-axial accelerometers that produce measurements of quasi-continuous 3-axis motion and orientation of fishing traps, (2) deep-water autonomous cameras affixed to traps that produces motion-activated and fixed-interval high definition video of benthic



substrate type, gear interaction with the substrate, and biological communities; and (3) standard oceanographic probes that measure in-situ depth and temperature data needed for gear mobility (depth) and habitat suitability modeling (both). This novel equipment will be deployed for the 2017 survey, and has been deployed on commercial trap gear fishing trips to SGaan KInghlas-Bowie Seamount over the 2013-2016 period.

## 1. Assessment

The Sablefish operating model (OM) was revised in 2015/16 to account for potential structural model mis-specification and lack-of-fit to key observations recognized in previous models. Specific modifications include: (i) changing from an age-/growth-group operating model to a two-sex/age-structured model to account for differences in growth, mortality, and maturation of male and female Sablefish, (ii) adjusting model age-proportions via an ageing error matrix, (iii) testing time-varying selectivity models, and (iv) revising the multivariate-logistic age composition likelihood to reduce model sensitivity to small age proportions. Structural revisions to the operating model improved fits to age-composition and at-sea release data that were not well-fit by the previous operating model. Accounting for ageing errors improved the time-series estimates of age-1 Sablefish recruitment by reducing the unrealistic auto-correlation present in the previous model results. The resulting estimates clearly indicate strong year classes of Sablefish that are similar in timing and magnitude to estimates for the Gulf of Alaska. Two unanticipated results were that (i) time-varying selectivity parameters were not estimable (or necessarily helpful) despite informative prior information from tagging and (ii) improved recruitment estimates helped to explain the scale and temporal pattern of at-sea release in the trawl fishery. The latter finding represents a major improvement in the ability to assess regulations (e.g., size limits) and incentives aimed at reducing at-sea releases in all fisheries. Estimates of Sablefish stock status, productivity, and trends over the past several years are consistent with previous harvest strategy simulations.

In 2016/17 the updated operating model was used to generate simulated data to test the current and alternative management procedures (MPs). The joint posterior distribution of spawning biomass and stock-recruitment steepness was used to generate five scenarios that captured a range of hypotheses related to current spawning biomass and productivity. The effects of the new recruitment estimates and impacts of sub-legal mortality were much greater than estimated from the 2011 analyses (Cox et al. 2011), and estimated management parameters indicated a less productive stock. Estimates of fishing mortality on sub-legal fish were much higher than those based on the 2011 operating model (DFO 2016).

Simulations showed that the current MP (DFO 2014) may not be robust in the long-term under the revised operating model (DFO 2016) since productivity estimates from the revised OM are lower than previously estimated (Cox et al.<sup>1</sup>). As a result, a maximum harvest rate of 5.5%, which was typically less than stock assessment model estimates

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1 Cox, S., Holt, K., and Johnson, S. Evaluating the robustness of management procedures for the Sablefish (*Anoplopoma fimbria*) fishery in British Columbia, Canada for 2017-18. CSAP Working Paper 2014GRF08. *In revision*

of the harvest rate of at maximum sustainable yield,  $U_{MSY}$ , used in the current MP, was tested in the alternative MPs. Improving long-term conservation performance usually involves trade-offs between short-term and long-term yield; however, the TAC floor in the current MP limits the scope for adjusting performance in any time period. Alternatives to the current MP were derived based on combinations of TAC floors (0, 1,800, 1,992 t), phase-in periods over which new, lower maximum harvest rates are introduced (0, 3, 4, and 5 years), and sub-legal release regulations (all Sablefish < 55 cm fork length, full retention and accounting against TAC of all Sablefish caught, regardless of size). The alternative MPs also included a constraint on upward TAC changes in which TACs remain at a particular level until the recommended TAC increase is at least 200 t. This change was requested by industry to limit unnecessary upward movement in TACs. The alternative MPs also differed from the current MP in the level of tuning used to define prior distributions for  $U_{MSY}$  and MSY in the simulated stock assessment: they were given tighter and more precise prior distributions for these parameters to reflect the corresponding reductions in these values for the revised OM. The revised operating model continues to assume that the BC Sablefish stock is a closed population, despite evidence of movements among Sablefish stocks in Alaska and US waters south of BC. These movements may have implications for the assumptions made about Sablefish stock dynamics in BC (i.e., recruitment, productivity) that are not currently captured by the revised OM or reflected in MP performance evaluations.

#### Literature Cited:

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- DFO. 2014. Performance of a revised management procedure for Sablefish in British Columbia. DFO Can. Sci. Advis. Sec. Sci. Resp. 2014/025.
- DFO. 2016. A revised operating model for Sablefish (*Anoplopoma fimbria*) in British Columbia, Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/015.

## 2. Management

In 2013, fishing industry stakeholders proposed a TAC floor of 1,992 t, because lower quotas may increase economic risks. The management procedure first applied in 2010 was revised to implement this TAC floor and simulation analyses were conducted to determine whether the revised management procedure would continue to meet agreed conservation objectives. The revised procedure provides conservation performance that is comparable to the 2010 procedure. Applying the revised procedure to updated landings and biomass index data resulted in a harvest recommendation of 1,992 t for the 2016/17 fishing season. However, as a result of lower productivity estimates derived from the revised operating model and tested in 2016/17, the TAC floor could no longer be supported in the harvest control rule because long-term stock growth objectives could not be met in simulations. The current MP was replaced by a revised MP that does not include a TAC floor and phases in a reduction in the annual harvest

rate from 9.5% to 5.5% over five years; the resulting TAC for the 2017/18 fishing year is 2,276 t. Although MPs with full retention Sablefish regardless of size showed superior performance against objectives, these alternatives could not be implemented for the 2017/18 fishing season and will be evaluated further in 2017/18. An update of the MSE simulation work is planned for 2019/20.

#### K. Lingcod

##### 1. Research

Ongoing data collection continued in 2016 through the Groundfish Synoptic Surveys, port sampling, at-sea observer sampling, and recreational creel surveys.

##### 2. Assessment

In 2016, an assessment for Strait of Georgia lingcod was finalized and published through the Canadian Science Advice Secretariat (CSAS); the working paper was prepared and reviewed in 2014.

#### L. Atka mackerel

The distribution of Atka mackerel does not extend into the Canadian zone.

#### M. Flatfish

##### 1. Research

Ongoing data collection in support of the flatfish research program continued in 2016 through the Groundfish Synoptic Surveys, port sampling, and at-sea observer sampling.

##### 10. Assessment

In 2016, an assessment for Southern Rock sole was finalized and published through the Canadian Science Advice Secretariat (CSAS)

In anticipation of a request for an updated assessment aging of Dover sole otoliths was completed in 2016. Dover sole was last assessed in 1999.

Work initiated in 2015 to prepare an updated assessment for Petrale sole remains on hold until additional personnel resources can be assigned. In addition, the time series of ages needs to be updated.

##### 11. Management

Arrowtooth Flounder, Southern Rock Sole, English Sole and Petrale sole are all managed by annual coastwide or area specific TACs and harvested primarily by the IVQ multi-species bottom trawl fishery. Details of the current management plan are available at <http://www.pac.dfo-mpo.gc.ca/fm-gp/ifmp-eng.html#Groundfish>.

#### N. Pacific halibut & IPHC activities

Pacific halibut caught incidentally by Canadian groundfish trawlers are measured and assessed for condition prior to being released. Summaries of these length data are supplied annually to the IPHC. In addition, summaries of live and dead releases (based on condition) are provided.

O. Other groundfish species

V. Ecosystem Studies

A. Development of a tiered approach to the provision of harvest advice for B.C.'s groundfish

Many species of groundfish in B.C. are data deficient, such that the available data are inadequate to support complex stock assessment models. However, DFO's Sustainable Fisheries Framework (<http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/fish-ren-peche/sff-cpd/overview-cadre-eng.htm>) requires the provision of science advice on the status of, or risks to, species of groundfish affected by fishing activities.

Work was initiated on this project in 2015. In 2015 – 2016, a literature search and annotated bibliography was completed, looking at work on tiered approaches in other international jurisdictions. In May 2016, CSAP hosted a workshop focusing on the creation of a Tiered Approach framework for assessing groundfish stocks. The meeting included discussions on a proposed hierarchical system based on data (using a scorecard to assess data availability, quality, and reliability), candidate references points, and candidate performance metrics. Significant time was spent on the issue of data-limited species.

The workshop presented existing "Tiered Approaches" from four international jurisdictions, and compared the supporting data requirements and expected outputs (including advice types). Additionally, the federal Alaskan experience was presented by a NOAA representative. Lessons learned from other jurisdictions were reviewed and appreciated by RPR participants.

A candidate data scorecard was created for assessing data availability (quantity and quality) within four sectors – commercial, recreational, First Nations, and fishery-independent. The scorecard was presented and accepted as a means of classifying species as data-rich, data-moderate, or data-poor, and communicating this information.

A candidate five-tier system was presented as a tool to communicate data availability by species and determine the path forward for decision-making regarding stock assessment advice. Tier 1 (data-rich) would use statistical catch-age models and Tier 2 (data-moderate) would use statistical "delay-difference" and/or surplus production models. Tiers 3 (data-limited), 4 (data-poor), and 5 (data-less) would be amalgamated for analysis and use various data-limited methods, selected using closed-loop simulation methods. The most likely candidate for running the closed-loop simulations is DLMtool,

which incorporates numerous peer-reviewed assessment methods. DFO Science staff agreed to conduct further scoping of DLMtool to determine its suitability in this context.

Candidate management objectives and performance metrics were presented using examples from Sablefish, Pacific Halibut, and those built into DLMtool. The RPR group were not able to select further performance metrics, and a recommendation was made to proceed with the examples from Sablefish as a starting point.

Participants endorsed the development of a technical working (advisory) group (TWG), and recommended that a work plan and timelines be developed to help determine the appropriate membership for the TWG. It is expected that the TWG will assist with the completion of the decision tree, management objectives, performance metrics, simulation exercises, and evaluation, all contributing to the second CSAS working paper to be reviewed in a subsequent CSAS regional peer review.

The workshop also established that the TA project would not be conducting a full management strategy evaluation (MSE) initially, but will apply closed-loop simulation testing of management procedures to test the robustness of various assessment methods against performance metrics. The RPR group acknowledged that stakeholders and First Nations make credible and valuable contributions to full MSE processes, but this procedure was beyond the scope of the current TA project. The RPR group also recognized that the TA project could not at this time incorporate important aspects such as the multispecies nature of the fisheries, ecosystem effects, or climate change effects.

## VI. Other related studies

### A. Ecosystem Approach for single-species assessments

In November, 2016, DFO's TESA (Technical Expertise in Stock Assessment) sponsored a week-long working group on implementing an Ecosystem Approach in single-species stock assessment. DFO scientists from across Canada convened in Nanaimo to present some of their research and to form break-out groups to develop working examples for three models – data-poor, data-rich, and data-alternative. The data-poor group adopted DLMtool and used Darnley Bay Arctic Charr to explore how climate-change shifts in life history parameters would affect the stock. The data-rich group used a traditional catch-at-age model (Stock Synthesis 3) to explicitly model multivariate physical and biological factors on Atlantic Herring off western Newfoundland and time-varying natural mortality on Atlantic Cod in the Gulf of St. Lawrence. The data-alternative group adopted Empirical Dynamic Modelling (Ye et al. 2015) to explore ecosystem effects on a Snow Crab population.

### P. Groundfish Data Unit

As part of the Pacific Region Science reorganization that occurred in June 2016, the Groundfish Data Unit, previously operated as part of the Groundfish “Statistics and Sampling” program, was pulled out of the new “Offshore” section and placed in the new Fishery and Assessment Data Section (FADS). FADS incorporates data units from

shellfish and salmon, as well as groundfish. However, the Groundfish Data Unit remains strongly linked to the Offshore section.

Principal Groundfish Data Unit activities in 2016 included the ongoing population of the groundfish biological database (GFBio), scanning and archiving “rescued” data, and answering internal and external requests for groundfish data.

The GFBio database now includes 27,520 trips and approximately 10,972,000 specimens. Data entry activities concentrated on input of recent and historic research cruises, and current commercial biological data from at-sea and dockside observers as well as the from the groundfish port sampler and groundfish staff.

The groundfish trawl fishery continues to be covered by 100% dockside and virtually 100% observer coverage. In 2016, the at-sea observer program (ASOP) provided 498 length/sex/age samples and 264 length samples. A further 92 samples of hake and salmonids were collected from the hake fishery by the dockside monitoring program (DMP); 70 of the hake samples had aging structures. In addition, the Groundfish Port Sampler collected four samples from the domestic hake fishery, all with ageing structures (length/sex/age/weight). Groundfish program staff collected 15 samples from the Strait of Georgia (Gulf) hake fishery; all samples had aging structures and DNA. Pacific Halibut and Pacific Hake accounted for 75% of the approximately 96,000 specimens sampled from the trawl fishery.

Biological samples from the non-observed sablefish trap fishery are collected by an external contractor with assistance from the Groundfish Port Sampler. Fish designated for sampling are set aside in totes labelled to identify individual sets. In 2016, 23 length/sex/weight/age samples were collected.

Biological samples from the hagfish experimental trap fishery are collected by an external contractor. In 2016, 73 length samples from three hagfish trips were collected.

An extensive data rescue project has been ongoing from 2014. This project has involved searching manuscript reports and data files for research and commercial biological and other data of enduring value. The goal is to convert all paper data to digital format, load historical trips into GFBio, scan and verify the paper records, and destroy the originals or send to the DFO library for permanent archiving. In 2016, about 60 historical trips (1944 – 1963) were recovered and loaded into GFBio, as well as 25 observer trips from 1991 – 1992. To date, the data rescue scan archive comprises about 9,777 files or 88 GB.

The Groundfish Data unit responded to about 40 internal and external data requests in 2016. Work continues on a comprehensive “merged catch” table that will include commercial catch records from all the groundfish catch databases. At the same time, government-wide initiatives to make data publicly available are underway, which may help address many external requests in future.

## VII. Publications

### A. Primary Publications

- Haggarty, Dana R., Steve JD Martell, and Jonathan B. Shurin. 2016. Lack of recreational fishing compliance may compromise effectiveness of Rockfish Conservation Areas in British Columbia. *Canadian Journal of Fisheries and Aquatic Sciences* 73(10): 1587-1598.
- Haggarty, Dana R., Jonathan B. Shurin, and K. Lynne Yamanaka. 2016. Assessing population recovery inside British Columbia's Rockfish Conservation Areas with a remotely operated vehicle. *Fisheries Research* 183: 165-179.
- King, Jackie R., and A. Maria Surry. 2016. First record of Pacific Angel Shark (*Squatina californica*) in Canadian Pacific waters. *Canadian Field-Naturalist* 130(4): 302–303.

### Q. Other Publications

- Berger, A.M., Grandin, C.J., I.G. Taylor, A.M. Edwards, and S. Cox. 2017. Status of the Pacific Hake (whiting) stock in U.S. and Canadian waters in 2017. Prepared by the Joint Technical Committee of the U.S. and Canada Pacific Hake/ Whiting Agreement; National Marine Fishery Service and Fisheries and Oceans Canada. 202 p.
- DFO. 2016. A revised operating model for Sablefish (*Anoplopoma fimbria*) in British Columbia, Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/015.
- DFO. 2016. Evaluation of Information Available to Support the Identification of Habitat Necessary for the Survival and Recovery of Basking Shark in Canadian Pacific Waters. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/046.
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- Starr, P.J., Haigh, R., and Grandin, C. 2016. Stock assessment for Silvergray Rockfish (*Sebastes brevispinis*) along the Pacific coast of Canada. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/049. v + 170 p.





## Appendix 1

### Summary of Fisheries and Oceans, Canada Pacific Region Groundfish Survey Program in 2016

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#### Groundfish Surveys Program Overview

The Fisheries and Oceans, Canada (DFO) Offshore Assessment and Monitoring section of the Aquatic Resources Research and Assessment Division includes a surveys program. The cornerstone of the surveys program comprises a suite of randomized surveys using bottom trawl, longline hook, and longline trap gear to cover most of the BC coast. All surveys use random depth stratified designs and in aggregate provide good coverage for all offshore waters of Canada's Pacific Coast. They also have in common full enumeration of the catches (all catch sorted to the lowest taxon possible), size composition sampling for most species, and more detailed biological sampling of selected species. Most of the surveys are conducted in collaboration with the commercial fishing industry under the authorities of various Joint Project Agreements. In addition to the randomized surveys, we also conduct a hydroacoustic assessment of Pacific Hake as well as collecting additional information from a DFO Small-Mesh Bottom Trawl Survey and the International Pacific Halibut Commission (IPHC) setline survey.

Each year two or three area-specific randomized bottom trawl surveys are conducted in collaboration with the commercial fishing industry. We call these surveys the Multi-Species Synoptic Bottom Trawl Surveys. The commercial trawl industry provides the vessel for one survey a year while the other is conducted onboard a Canadian Coast Guard research trawler. Surveys are conducted with a combination of DFO staff and industry-hired sea-going technicians. The bottom trawl surveys provide coast-wide coverage of most of the trawlable habitat between 50 and 500 meters depth.

Each year two area-specific randomized longline hook surveys are conducted in collaboration with the commercial fishing industry. We call these surveys the Hard Bottom Longline Hook Surveys. The commercial longline hook industry contracts vessels and sea-going technicians for a survey of outside waters (not between Vancouver Island and the mainland) while a separate longline hook survey of inside waters (between Vancouver Island and the mainland) is conducted by DFO staff aboard a Canadian Coast Guard research vessel. The longline hook surveys provide coast-wide coverage of most of the non-trawlable habitat between 20 and 220 meters depth that is not covered by the bottom trawl surveys.

An annual, coast-wide longline trap survey targeting sablefish is conducted in collaboration with the commercial fishing industry. We call this survey the Sablefish Research and Assessment Survey. The commercial sablefish industry supplies the chartered commercial fishing vessel and the survey is conducted with a combination of DFO staff and industry-hired sea-going technicians. This survey covers the depth range of 150 m to 1500 m for the entire outer BC coast as well as a number of central coast inlets.

Each year an acoustic survey is conducted for Pacific Hake. We call this the Hake Acoustic Survey. The survey is conducted as part of the Pacific Whiting Treaty and typically alternates year to year between research and assessment activities. The survey is conducted aboard the Canadian Coast Guard research trawler by DFO staff.

Each year, DFO staff participates in a fixed-station survey of commercially important shrimp grounds onboard the Canadian Coast Guard research trawler. We call this survey the Multi-Species Small Mesh Bottom Trawl Survey. Groundfish program staff participates in the survey to provide assistance in enumerating the catch while also collecting biological samples from selected species.

During their survey, the IPHC only fully enumerates the catch for, and collects biological samples from Pacific Halibut. In an effort to acquire more data on hook and line groundfish species, particularly rockfish, the commercial fishing industry sponsors an additional technician aboard each of the IPHC chartered survey vessels. The extra technician fully enumerates the catch of all species and collects biological samples from all species of rockfish.

The following sections provide additional details as well as an annual summary of each survey.

## Multi-Species Small Mesh Bottom Trawl Survey

An annual fixed-station survey of commercially important shrimp grounds off the West Coast of Vancouver Island was initiated in 1973. In 1998, areas in Eastern Queen Charlotte Sound were added to the survey. Given that the survey is conducted using a shrimp bottom trawl without an excluder device, groundfish can make up a significant portion of the catch in many of the tows. Catch rate indices generated by the survey have been used to track the abundances of several groundfish stocks. Although catch rates are useful indicators of stock status, additional information such as the size and age composition of the catch improves the usefulness of the indices. Consequently, a program was initiated in 2003 to collect biological samples from all groundfish species caught during the survey. Groundfish staff provides assistance in catch sorting and species identification and also collect biological samples from selected species. From 2010 through 2013, the goal was to collect biological information from as many different species in each tow as possible - as opposed to detailed information from only a few species. As such, two groundfish program staff members were deployed and the biological sampling effort was focused on length by sex data in favour of collecting ageing structures. Starting in 2014, only one groundfish staff member participated in the survey and the biological sampling program was reduced so that a single person could accomplish all the work. In addition, the sampling program was rationalized to only include species where the survey is expected to provide a useful index of abundance.

Starting in 2013, the West Coast Vancouver Island portion of the survey also included locations in Barkley Sound that were surveyed by the CCGS Neocaligus in previous years. In 2014, the Queen Charlotte Sound portion of the survey was not conducted due to the limited number of vessel days available for the program. The Queen Charlotte Sound area was also not visited in 2015 due to staffing limitations. In 2016, both the West Coast Vancouver Island and Queen Charlotte Sound areas were surveyed.

The 2016 survey was conducted onboard the W.E. Ricker and ran from April 28 to May 22. A total of 190 usable tows were completed (Figure 2). The total catch weight of all species was 44,923 kg. The mean catch per tow was 233 kg, averaging 26 different species of fish and invertebrates in each. Over the entire survey, the most abundant fish species encountered were Arrowtooth Flounder (*Atheresthes stomias*), Flathead Sole (*Hippoglossoides elassodon*), Pacific Hake (*Merluccius productus*), and Rex Sole (*Glyptocephalus zachirus*). The number of tows where the species was captured, total catch weight, estimated biomass, and relative survey error for the top 25 fish species by weight are shown in Table 1 for the West Coast Vancouver Island tow locations and Table 2 for the Queen Charlotte Sound tow locations. Biomass indices have not been calculated for the Barkley Sound tow locations as these locations have not yet been used for any groundfish assessments.

Biological data were collected from a total of 14,943 individual fish from 20 different groundfish species (Table 3). Most biological samples included fish length and sex but age structures were also collected for Bocaccio (*Sebastes paucispinis*) and both age structures and tissue samples for DNA analysis were collected from Rougheye/ Blackspotted Rockfish (*Sebastes aleutianus*).

*melanostictus*) and Yelloweye Rockfish (*Sebastes ruberrimus*). Almost half of all the individual fish measured during the survey were Eulachon (*Thaleichthys pacificus*). Although we include this species in these summaries, the groundfish program staff typically does not directly collect the biological data from this species or American Shad (*Alosa sapidissima*).

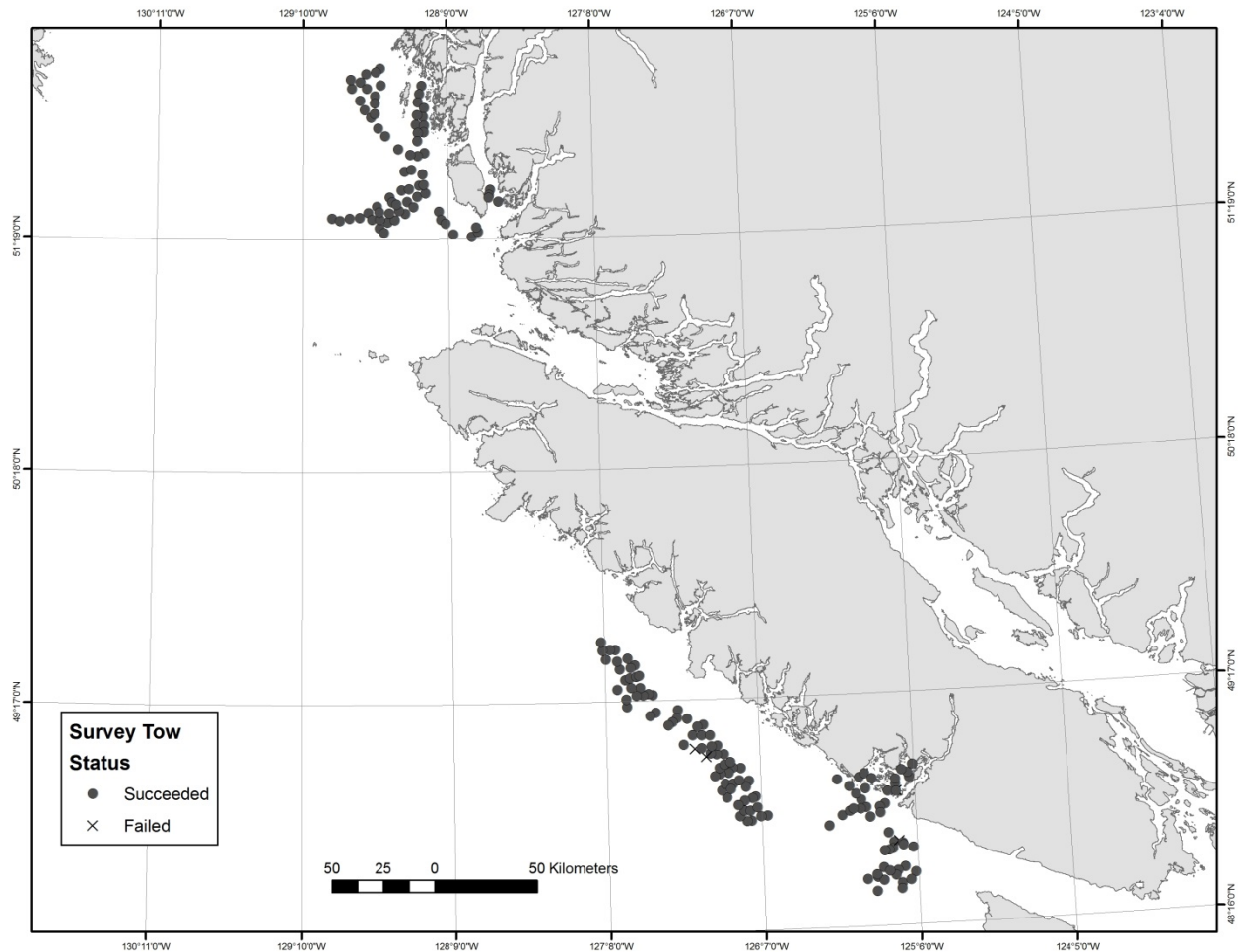


Figure 2. Tow locations of the 2016 Multi-species Small Mesh Bottom Trawl Survey.

Table 1. Number of tows, catch weight, estimated biomass, and relative survey error for the top 25 species (by weight) captured in the West Coast Vancouver Island tow locations of the 2016 Multi-species Small Mesh Bottom Trawl Survey.

| Species               | Scientific Name                | Number of<br>Tows | Catch<br>(kg) | Biomass<br>(t) | Relative<br>Error |
|-----------------------|--------------------------------|-------------------|---------------|----------------|-------------------|
| Pacific Hake          | <i>Merluccius productus</i>    | 62                | 2075          | 2058           | 0.28              |
| Flathead Sole         | <i>Hippoglossoides</i>         | 66                | 1779          | 1842           | 0.13              |
| Arrowtooth Flounder   | <i>Atheresthes stomias</i>     | 67                | 1500          | 1569           | 0.11              |
| Eulachon              | <i>Thaleichthys pacificus</i>  | 65                | 1354          | 1369           | 0.14              |
| Rex Sole              | <i>Glyptocephalus zachirus</i> | 66                | 1301          | 1377           | 0.09              |
| Pacific Herring       | <i>Clupea pallasii</i>         | 60                | 1115          | 1144           | 0.56              |
| Pacific Cod           | <i>Gadus macrocephalus</i>     | 50                | 667           | 724            | 0.22              |
| Slender Sole          | <i>Lyopsetta exilis</i>        | 66                | 662           | 700            | 0.12              |
| Pacific Sanddab       | <i>Citharichthys sordidus</i>  | 37                | 602           | 592            | 0.19              |
| Sablefish             | <i>Anoplopoma fimbria</i>      | 60                | 566           | 580            | 0.22              |
| Dover Sole            | <i>Microstomus pacificus</i>   | 64                | 546           | 558            | 0.14              |
| Walleye Pollock       | <i>Gadus chalcogrammus</i>     | 52                | 378           | 410            | 0.29              |
| Yellowtail Rockfish   | <i>Sebastes flavidus</i>       | 33                | 276           | 283            | 0.34              |
| North Pacific Spiny   | <i>Squalus suckleyi</i>        | 17                | 187           | 201            | 0.4               |
| Lingcod               | <i>Ophiodon elongatus</i>      | 21                | 142           | 157            | 0.3               |
| English Sole          | <i>Parophrys vetulus</i>       | 54                | 141           | 145            | 0.17              |
| Pacific Halibut       | <i>Hippoglossus stenolepis</i> | 22                | 132           | 150            | 0.18              |
| Spotted Ratfish       | <i>Hydrolagus colliei</i>      | 43                | 101           | 96             | 0.15              |
| Blackbelly Eelpout    | <i>Lycodes pacificus</i>       | 56                | 70            | 68             | 0.19              |
| American Shad         | <i>Alosa sapidissima</i>       | 32                | 53            | 48             | 0.26              |
| Petrale Sole          | <i>Eopsetta jordani</i>        | 21                | 38            | 38             | 0.29              |
| Chinook Salmon        | <i>Oncorhynchus</i>            | 24                | 36            | 38             | 0.22              |
| Darkblotched Rockfish | <i>Sebastes crameri</i>        | 30                | 29            | 32             | 0.54              |
| Longnose Skate        | <i>Raja rhina</i>              | 15                | 27            | 25             | 0.27              |
| Silvergray Rockfish   | <i>Sebastes brevispinis</i>    | 2                 | 14            | 17             | 0.8               |

Table 2. Number of tows, catch weight, estimated biomass, and relative survey error for the top 25 species (by weight) captured in the Queen Charlotte Sound tow locations of the 2016 Multi-species Small Mesh Bottom Trawl Survey.

| Species                         | Scientific Name                           | Number of Tows | Catch (kg) | Biomass (t) | Relative Error |
|---------------------------------|-------------------------------------------|----------------|------------|-------------|----------------|
| Arrowtooth Flounder             | <i>Atheresthes stomias</i>                | 67             | 6605       | 5124        | 0.24           |
| Flathead Sole                   | <i>Hippoglossoides elassodon</i>          | 66             | 1297       | 956         | 0.1            |
| Walleye Pollock                 | <i>Gadus chalcogrammus</i>                | 63             | 1293       | 885         | 0.26           |
| Dover Sole                      | <i>Microstomus pacificus</i>              | 58             | 1120       | 938         | 0.29           |
| Pacific Ocean Perch             | <i>Sebastes alutus</i>                    | 37             | 1070       | 757         | 0.35           |
| Eulachon                        | <i>Thaleichthys pacificus</i>             | 49             | 612        | 428         | 0.2            |
| Pacific Hake                    | <i>Merluccius productus</i>               | 54             | 465        | 344         | 0.2            |
| Rex Sole                        | <i>Glyptocephalus zachirus</i>            | 66             | 446        | 326         | 0.14           |
| Spotted Ratfish                 | <i>Hydrolagus colliei</i>                 | 49             | 339        | 241         | 0.29           |
| Sablefish                       | <i>Anoplopoma fimbria</i>                 | 58             | 283        | 208         | 0.18           |
| Blackbelly Eelpout              | <i>Lycodes pacificus</i>                  | 51             | 267        | 192         | 0.23           |
| Slender Sole                    | <i>Lyopsetta exilis</i>                   | 62             | 119        | 83          | 0.12           |
| Redbanded Rockfish              | <i>Sebastes babcocki</i>                  | 16             | 83         | 67          | 0.33           |
| Pacific Halibut                 | <i>Hippoglossus stenolepis</i>            | 11             | 79         | 59          | 0.4            |
| Longnose Skate                  | <i>Raja rhina</i>                         | 17             | 78         | 55          | 0.27           |
| Pacific Cod                     | <i>Gadus macrocephalus</i>                | 25             | 74         | 59          | 0.25           |
| Silvergray Rockfish             | <i>Sebastes brevispinis</i>               | 14             | 37         | 28          | 0.36           |
| Yellowmouth Rockfish            | <i>Sebastes reedi</i>                     | 5              | 32         | 16          | 0.61           |
| Shortspine Thornyhead           | <i>Sebastolobus alascanus</i>             | 13             | 28         | 20          | 0.33           |
| Pacific Herring                 | <i>Clupea pallasii</i>                    | 13             | 27         | 18          | 0.24           |
| Darkblotched Rockfish           | <i>Sebastes crameri</i>                   | 23             | 27         | 19          | 0.41           |
| English Sole                    | <i>Parophrys vetulus</i>                  | 13             | 25         | 18          | 0.44           |
| Rougheye/ Blackspotted Rockfish | <i>Sebastes aleutianus/ melanostictus</i> | 24             | 25         | 18          | 0.25           |
| Canary Rockfish                 | <i>Sebastes pinniger</i>                  | 9              | 19         | 13          | 0.34           |
| Yellowtail Rockfish             | <i>Sebastes flavidus</i>                  | 7              | 14         | 11          | 0.39           |

Table 3. Number of fish sampled for biological data during the 2016 Multi-species Small Mesh Bottom Trawl Survey showing the number of lengths and age structures that were collected by species.

| <b>Species</b>              | <b>Scientific Name</b>         | <b>Lengths</b> | <b>Age Structures</b> |
|-----------------------------|--------------------------------|----------------|-----------------------|
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 47             | 0                     |
| Big Skate                   | <i>Beringraja binoculata</i>   | 4              | 0                     |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>    | 29             | 0                     |
| Longnose Skate              | <i>Raja rhina</i>              | 231            | 0                     |
| American Shad               | <i>Alosa sapidissima</i>       | 440            | 0                     |
| Pacific Herring             | <i>Clupea pallasii</i>         | 148            | 0                     |
| Eulachon                    | <i>Thaleichthys pacificus</i>  | 7123           | 0                     |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 164            | 0                     |
| Walleye Pollock             | <i>Gadus chalcogrammus</i>     | 1239           | 0                     |
| Rougeye/ Blackspotted       | <i>Sebastes aleutianus/</i>    | 139            | 140                   |
| Bocaccio                    | <i>Sebastes paucispinis</i>    | 2              | 2                     |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 3              | 3                     |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 923            | 0                     |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 15             | 0                     |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 1416           | 0                     |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 91             | 0                     |
| Rex Sole                    | <i>Glyptocephalus zachirus</i> | 1857           | 0                     |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 58             | 0                     |
| Dover Sole                  | <i>Microstomus pacificus</i>   | 851            | 0                     |
| English Sole                | <i>Parophrys vetulus</i>       | 163            | 0                     |

## Multi-Species Synoptic Bottom Trawl Surveys

Fisheries and Oceans, Canada (DFO) together with the Canadian Groundfish Research and Conservation Society (CGRCS) have implemented a comprehensive multi-species bottom trawl survey strategy that covers most of the BC Coast. The objectives of these surveys are to provide fishery independent abundance indices of as many benthic and near benthic fish species available to bottom trawling as is reasonable while obtaining supporting biological samples from selected species. The abundance indices and biological information are incorporated into stock assessments, status reports, and research publications.

All of the synoptic bottom trawl surveys along the British Columbia coast have followed the same random depth-stratified design. Each survey area is divided into 2 km by 2 km blocks and each block is assigned one of four depth strata based on the average bottom depth in the block. The four depth strata vary between areas. For each survey, blocks are randomly selected within each depth stratum. If a survey block is not fishable for any reason it will be abandoned and the vessel will proceed to the next block.

There are four core surveys, two of which are conducted each year. The Hecate Strait survey and the Queen Charlotte Sound survey are conducted in odd-numbered years while the West Coast Vancouver Island survey and the West Coast Haida Gwaii (formerly Queen Charlotte Islands) survey are conducted in even-numbered years.

In addition to the four core surveys, a Strait of Georgia survey was initiated in 2012 with the intention of repeating the survey every 3 years. The first scheduled repeat of the survey was in 2015 but it was not possible to conduct the survey during March. Nonetheless, research vessel time was available during May and it appeared that the time period would remain available in future years. Unfortunately, due to changing priorities, the May time period will not be available in future years. Research vessel time has been secured for March 2017 and the new plan is to move forward conducting the Strait of Georgia survey biennially, in odd numbered years.

The synoptic bottom trawl surveys are conducted on both chartered commercial vessels and government research vessels. The Hecate Strait survey, the West Coast Vancouver Island survey, and the Strait of Georgia survey are all conducted on a Canadian Coastguard research trawler while the Queen Charlotte Sound survey and the West Coast Haida Gwaii are conducted on chartered commercial fishing vessels.

The four core synoptic surveys (Hecate Strait, Queen Charlotte Sound, West Coast Vancouver Island, and West Coast Haida Gwaii) are all fished using an Atlantic Western bottom trawl. In contrast, the SOG survey is fished using a much smaller Yankee 36 bottom trawl. The decision to use the smaller trawl makes direct comparisons between the areas difficult but allowed us to conduct the survey in the available days. The use of the smaller trawl allows more blocks to be fished each day as the net is faster to deploy and retrieve and catches tend to be smaller.

In 2016 the West Coast of Vancouver Island and the West Coast of Haida Gwaii surveys were conducted.



## West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey

The West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey was conducted on the Canadian Coast Guard Ship W. E. Ricker between May 24 and June 16, 2016. We assessed a total of 176 blocks (Table 4, Figure 3). Of the 147 total tows conducted, 140 were successful and 7 were failures due to hang ups or insufficient bottom time. Note that some blocks are only successfully fished following more than one attempt. The relatively large number of blocks that remained unassessed at the end of the survey (31) was due to days lost to a mechanical breakdown with four days remaining in the survey.

A total of 15 different DFO staff persons and four volunteer students participated in the survey.

The total catch weight of all species was 125,192 kg. The mean catch per tow was 857 kg, averaging 27 different species of fish and invertebrates in each. The most abundant fish species encountered were Arrowtooth Flounder (*Atheresthes stomias*), Splitnose Rockfish (*Sebastes diploproa*), Pacific Ocean Perch (*Sebastes alutus*), Redstripe Rockfish (*Sebastes proriger*), and Sablefish (*Anoplopoma fimbria*). The number of tows where the species was captured and total catch weight from usable tows as well as the estimated biomass and relative survey error for the 25 most abundant species are shown in Table 5. Biological data, including individual length, weight, sex, maturity, and age structure were collected from a total of 33,948 individual fish of 51 different species (Table 6). Oceanographic data, including water temperature, depth, salinity, and dissolve oxygen were also recorded for most tows.

Table 4. 2016 West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey final block summary showing the number of blocks rejected based on fishing master's knowledge or by on-ground inspection, number of failed blocks (due to hang-ups or insufficient bottom time), number of successful tows, and number of un-fished blocks (due to other reasons such as tide, weather, or other vessels in the area) by stratum.

| Depth Stratum | Rejected Prior | Rejected Inspected | Failed   | Success    | Not Assessed | Total      |
|---------------|----------------|--------------------|----------|------------|--------------|------------|
| 50m to 125 m  | 2              | 15                 | 0        | 54         | 13           | 84         |
| 125m to 200 m | 2              | 8                  | 2        | 41         | 11           | 64         |
| 200m to 330 m | 0              | 2                  | 1        | 26         | 4            | 33         |
| 330m to 500 m | 0              | 4                  | 0        | 19         | 3            | 26         |
| <b>Total</b>  | <b>4</b>       | <b>29</b>          | <b>3</b> | <b>140</b> | <b>31</b>    | <b>207</b> |

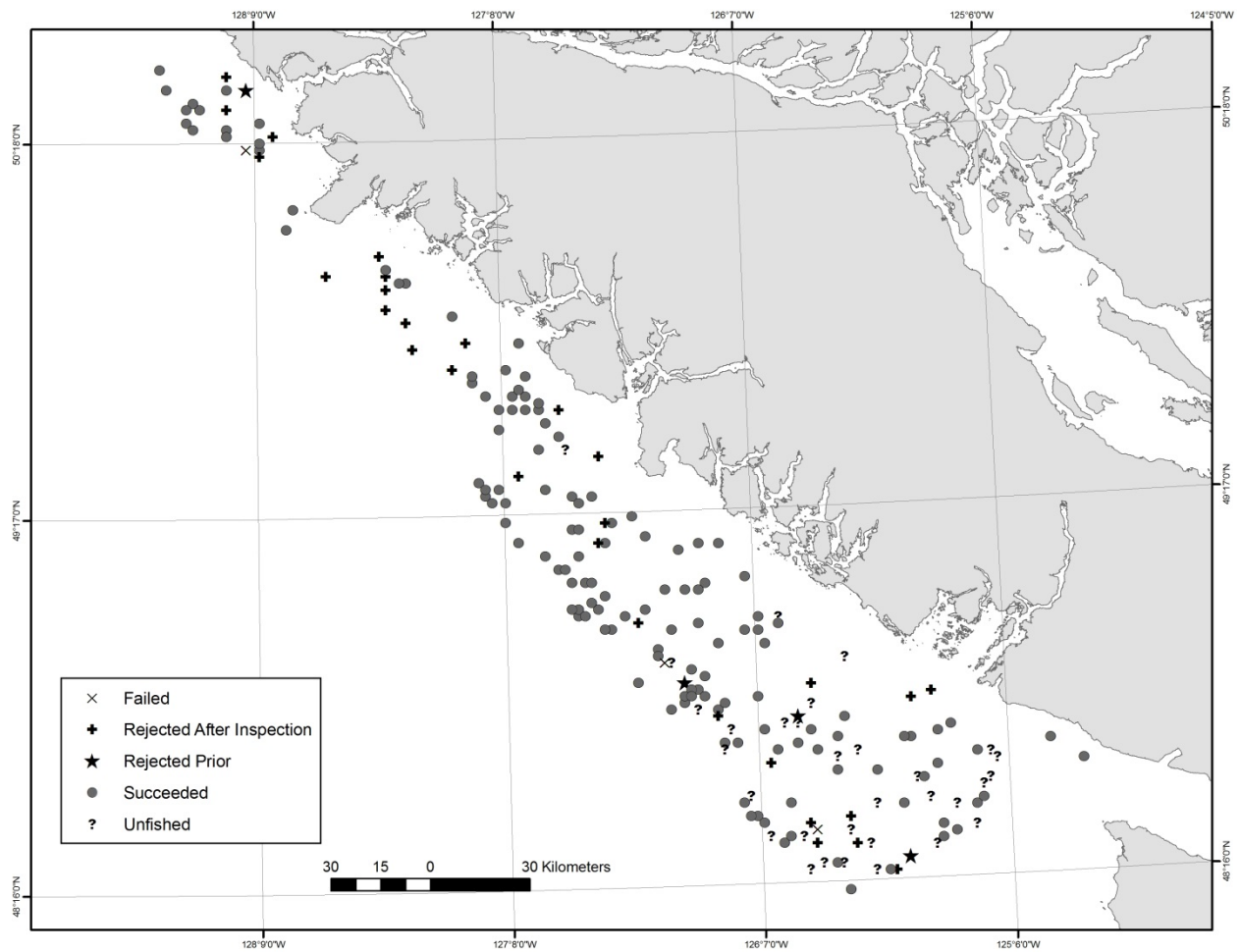


Figure 3. Final status of the allocated blocks for the 2016 West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey.

Table 5. Number of catches and total catch weight from usable tows, estimated biomass, and relative survey error for the top 25 species (by weight) captured in the 2016 West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey.

| Species                         | Scientific Name                           | Number of | Catch | Biomass | Relative |
|---------------------------------|-------------------------------------------|-----------|-------|---------|----------|
| Arrowtooth Flounder             | <i>Atheresthes stomias</i>                | 126       | 19940 | 10282   | 0.24     |
| Splitnose Rockfish              | <i>Sebastes diploproa</i>                 | 29        | 11493 | 2606    | 0.37     |
| Pacific Ocean Perch             | <i>Sebastes alutus</i>                    | 57        | 10306 | 2399    | 0.19     |
| Sablefish                       | <i>Anoplopoma fimbria</i>                 | 103       | 8767  | 3536    | 0.23     |
| Redstripe Rockfish              | <i>Sebastes proriger</i>                  | 42        | 7957  | 5513    | 0.41     |
| Sharpchin Rockfish              | <i>Sebastes zacentrus</i>                 | 43        | 6518  | 2016    | 0.22     |
| Rex Sole                        | <i>Glyptocephalus zachirus</i>            | 132       | 5929  | 3625    | 0.07     |
| North Pacific Spiny Dogfish     | <i>Squalus suckleyi</i>                   | 102       | 5861  | 3474    | 0.24     |
| Yellowtail Rockfish             | <i>Sebastes flavidus</i>                  | 68        | 4956  | 3293    | 0.49     |
| Dover Sole                      | <i>Microstomus pacificus</i>              | 123       | 4040  | 2001    | 0.12     |
| Pacific Hake                    | <i>Merluccius productus</i>               | 82        | 3476  | 2664    | 0.29     |
| Pacific Cod                     | <i>Gadus macrocephalus</i>                | 99        | 2895  | 2047    | 0.19     |
| Canary Rockfish                 | <i>Sebastes pinniger</i>                  | 55        | 2860  | 1566    | 0.35     |
| Spotted Ratfish                 | <i>Hydrolagus coliei</i>                  | 128       | 2717  | 2194    | 0.39     |
| English Sole                    | <i>Parophrys vetulus</i>                  | 88        | 2270  | 2006    | 0.2      |
| Greenstriped Rockfish           | <i>Sebastes elongatus</i>                 | 76        | 2028  | 995     | 0.18     |
| Flathead Sole                   | <i>Hippoglossoides elassodon</i>          | 60        | 1847  | 1476    | 0.2      |
| Rougheye/ Blackspotted Rockfish | <i>Sebastes aleutianus/ melanostictus</i> | 35        | 1811  | 439     | 0.37     |
| Lingcod                         | <i>Ophiodon elongatus</i>                 | 80        | 1714  | 1292    | 0.24     |
| Pacific Halibut                 | <i>Hippoglossus stenolepis</i>            | 94        | 1590  | 1094    | 0.18     |
| Shortspine Thornyhead           | <i>Sebastolobus alascanus</i>             | 41        | 1509  | 366     | 0.16     |
| Petrale Sole                    | <i>Eopsetta jordani</i>                   | 89        | 1442  | 1206    | 0.27     |
| Pacific Sanddab                 | <i>Citharichthys sordidus</i>             | 50        | 1128  | 1056    | 0.23     |
| Silvergray Rockfish             | <i>Sebastes brevispinis</i>               | 45        | 1064  | 407     | 0.34     |
| Longnose Skate                  | <i>Raja rhina</i>                         | 61        | 638   | 308     | 0.15     |

Table 6. Number of fish sampled for biological data during the 2016 West Coast Vancouver Island Multi-Species Synoptic Bottom Trawl Survey showing the number of lengths and age structures that were collected by species.

| Species                         | Scientific Name                           | Lengths Collected | Age Structures Collected |
|---------------------------------|-------------------------------------------|-------------------|--------------------------|
| Brown Cat Shark                 | <i>Apristurus brunneus</i>                | 41                | 0                        |
| North Pacific Spiny Dogfish     | <i>Squalus suckleyi</i>                   | 1006              | 266                      |
| Big Skate                       | <i>Beringraja binocularata</i>            | 32                | 0                        |
| Sandpaper Skate                 | <i>Bathyraja interrupta</i>               | 27                | 0                        |
| Longnose Skate                  | <i>Raja rhina</i>                         | 159               | 0                        |
| Alaska Skate                    | <i>Bathyraja parmifera</i>                | 1                 | 0                        |
| Spotted Ratfish                 | <i>Hydrolagus colliei</i>                 | 792               | 0                        |
| Green Sturgeon                  | <i>Acipenser medirostris</i>              | 1                 | 0                        |
| Eulachon                        | <i>Thaleichthys pacificus</i>             | 1246              | 0                        |
| Pacific Cod                     | <i>Gadus macrocephalus</i>                | 971               | 839                      |
| Pacific Hake                    | <i>Merluccius productus</i>               | 1174              | 141                      |
| Pacific Tomcod                  | <i>Microgadus proximus</i>                | 176               | 0                        |
| Walleye Pollock                 | <i>Gadus chalcogrammus</i>                | 459               | 26                       |
| Wolf Eel                        | <i>Anarrhichthys ocellatus</i>            | 1                 | 0                        |
| Rougheye/ Blackspotted Rockfish | <i>Sebastes aleutianus/ melanostictus</i> | 379               | 379                      |
| Pacific Ocean Perch             | <i>Sebastes alutus</i>                    | 1236              | 846                      |
| Aurora Rockfish                 | <i>Sebastes aurora</i>                    | 29                | 0                        |
| Redbanded Rockfish              | <i>Sebastes babcocki</i>                  | 484               | 484                      |
| Shortraker Rockfish             | <i>Sebastes borealis</i>                  | 11                | 11                       |
| Silvergray Rockfish             | <i>Sebastes brevispinis</i>               | 302               | 137                      |
| Darkblotched Rockfish           | <i>Sebastes crameri</i>                   | 256               | 0                        |
| Splitnose Rockfish              | <i>Sebastes diploproa</i>                 | 598               | 301                      |
| Greenstriped Rockfish           | <i>Sebastes elongatus</i>                 | 1280              | 0                        |
| Puget Sound Rockfish            | <i>Sebastes emphaeus</i>                  | 50                | 50                       |
| Yellowtail Rockfish             | <i>Sebastes flavidus</i>                  | 674               | 218                      |
| Rosethorn Rockfish              | <i>Sebastes helvomaculatus</i>            | 661               | 0                        |
| Shortbelly Rockfish             | <i>Sebastes jordani</i>                   | 75                | 0                        |
| Quillback Rockfish              | <i>Sebastes maliger</i>                   | 46                | 46                       |
| Bocaccio                        | <i>Sebastes paucispinis</i>               | 17                | 17                       |
| Canary Rockfish                 | <i>Sebastes pinniger</i>                  | 531               | 422                      |
| Redstripe Rockfish              | <i>Sebastes proriger</i>                  | 765               | 393                      |
| Yellowmouth Rockfish            | <i>Sebastes reedi</i>                     | 20                | 0                        |

| <b>Species</b>        | <b>Scientific Name</b>           | <b>Lengths<br/>Collected</b> | <b>Age Structures<br/>Collected</b> |
|-----------------------|----------------------------------|------------------------------|-------------------------------------|
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>       | 63                           | 63                                  |
| Stripetail Rockfish   | <i>Sebastes saxicola</i>         | 27                           | 0                                   |
| Pygmy Rockfish        | <i>Sebastes wilsoni</i>          | 327                          | 0                                   |
| Sharpchin Rockfish    | <i>Sebastes zacentrus</i>        | 1058                         | 0                                   |
| Shortspine Thornyhead | <i>Sebastolobus alascanus</i>    | 1061                         | 102                                 |
| Sablefish             | <i>Anoplopoma fimbria</i>        | 1705                         | 2                                   |
| Kelp Greenling        | <i>Hexagrammos</i>               | 39                           | 0                                   |
| Lingcod               | <i>Ophiodon elongatus</i>        | 355                          | 323                                 |
| Pacific Sanddab       | <i>Citharichthys sordidus</i>    | 1336                         | 0                                   |
| Arrowtooth Flounder   | <i>Atheresthes stomias</i>       | 2491                         | 411                                 |
| Petrale Sole          | <i>Eopsetta jordani</i>          | 747                          | 615                                 |
| Rex Sole              | <i>Glyptocephalus zachirus</i>   | 3698                         | 231                                 |
| Flathead Sole         | <i>Hippoglossoides elassodon</i> | 1146                         | 0                                   |
| Pacific Halibut       | <i>Hippoglossus stenolepis</i>   | 314                          | 0                                   |
| Southern Rock Sole    | <i>Lepidopsetta bilineata</i>    | 528                          | 271                                 |
| Slender Sole          | <i>Lyopsetta exilis</i>          | 1444                         | 0                                   |
| Dover Sole            | <i>Microstomus pacificus</i>     | 2451                         | 852                                 |
| English Sole          | <i>Parophrys vetulus</i>         | 1574                         | 663                                 |
| Curlfin Sole          | <i>Pleuronichthys decurrens</i>  | 84                           | 0                                   |

## West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey

The West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey was conducted on the F/V Frosti between August 25 and September 26, 2016. We assessed a total of 130 blocks (Table 7, Figure 4). Of the 120 total tows conducted, 112 were successful and 8 were failures due to hang ups or insufficient bottom time. Note that some blocks are only successfully fished following more than one attempt. Two blocks remained unassessed at the end of the survey.

A total of six different DFO staff persons and five contract science staff from Archipelago Marine Research participated in the survey.

The total catch weight of all species was 160,511 kg. The mean catch per tow was 1337 kg, averaging 22 different species of fish and invertebrates in each. The most abundant fish species encountered were Pacific Ocean Perch (*Sebastes alutus*), Rougheye/ Blackspotted Rockfish (*Sebastes aleutianus/ Sebastes melanostictus*), Sharpchin Rockfish (*Sebastes zacentrus*), Silvergray Rockfish (*Sebastes brevispinis*), and Redstripe Rockfish (*Sebastes proriger*). The number of tows where the species was captured and total catch weight from usable tows as well as the estimated biomass and relative survey error for the 25 most abundant species are shown in Table 8. Biological data, including individual length, weight, sex, maturity, and age structure were collected from a total of 28,686 individual fish of 46 different species (Table 9). Oceanographic data, including water temperature, depth, salinity, and dissolve oxygen were also recorded for most tows.

Table 7. 2016 West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey final block summary showing the number of blocks rejected based on fishing master's knowledge or by on-ground inspection, number of failed blocks (due to hang-ups or insufficient bottom time), number of successful tows, and number of un-fished blocks (due to other reasons such as tide, weather, or other vessels in the area) by stratum.

| Depth Stratum (m) | Rejected Prior | Rejected Inspected | Failed   | Success    | Not Assessed | Total      |
|-------------------|----------------|--------------------|----------|------------|--------------|------------|
| 180 to 330 m      | 0              | 3                  | 1        | 71         | 2            | 77         |
| 330 to 500 m      | 0              | 7                  | 0        | 26         | 0            | 33         |
| 500 to 800 m      | 0              | 5                  | 1        | 5          | 0            | 11         |
| 800 to 1300 m     | 0              | 1                  | 0        | 10         | 0            | 11         |
| <b>Total</b>      | <b>0</b>       | <b>16</b>          | <b>2</b> | <b>112</b> | <b>2</b>     | <b>132</b> |

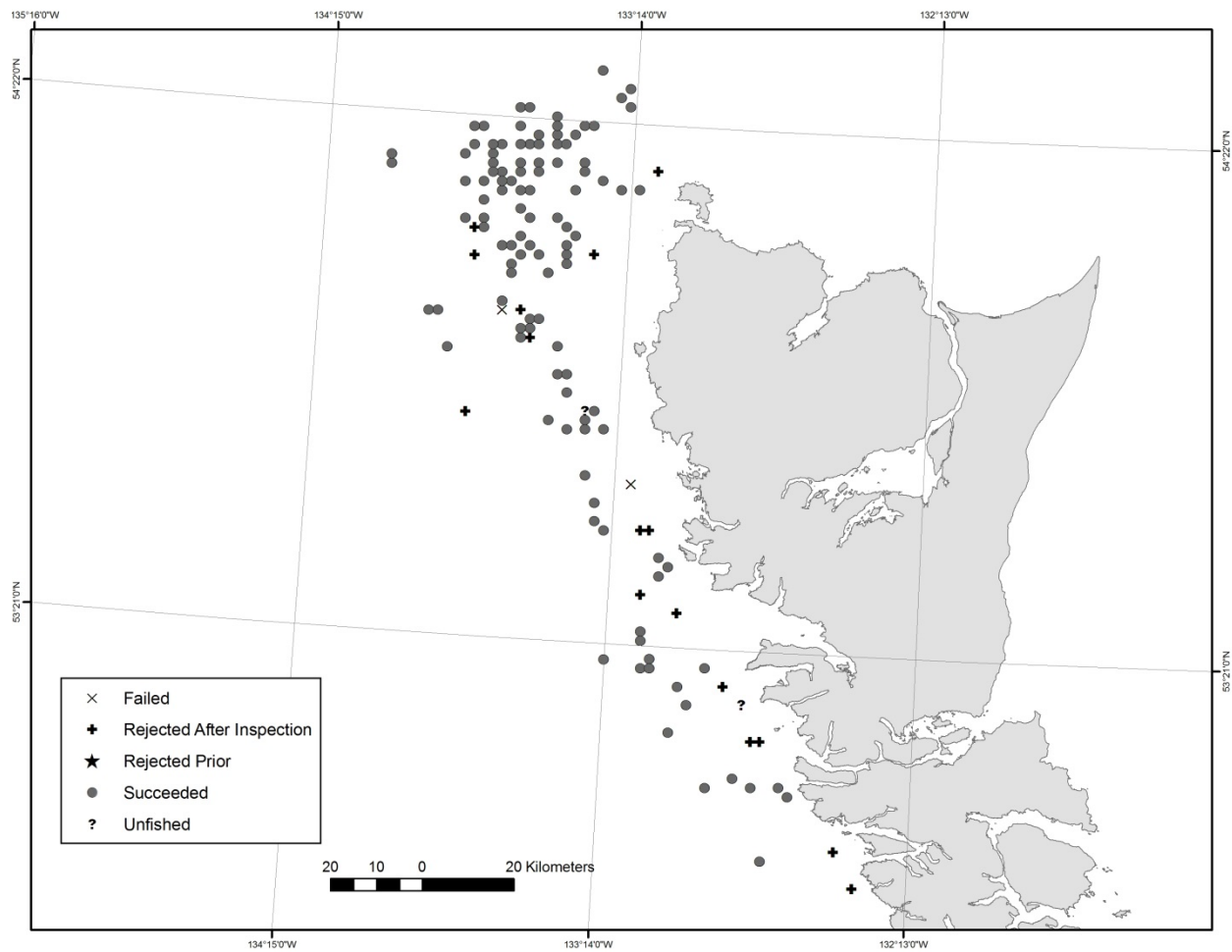


Figure 4. Final status of the allocated blocks for the 2016 West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey.

Table 8. Number of catches and total catch weight from usable tows, estimated biomass, and relative survey error for the top 25 species (by weight) captured in the 2016 West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey.

| Species                            | Scientific Name                           | Number of Tows | Catch (kg) | Biomass (t) | Relative Error |
|------------------------------------|-------------------------------------------|----------------|------------|-------------|----------------|
| Pacific Ocean Perch                | <i>Sebastes alutus</i>                    | 90             | 79901      | 13925       | 0.19           |
| Rougheye/<br>Blackspotted Rockfish | <i>Sebastes aleutianus/ melanostictus</i> | 49             | 15754      | 6969        | 0.43           |
| Sharpchin Rockfish                 | <i>Sebastes zacentrus</i>                 | 59             | 13205      | 1734        | 0.23           |
| Silvergray Rockfish                | <i>Sebastes brevispinis</i>               | 74             | 9949       | 3748        | 0.52           |
| Redstripe Rockfish                 | <i>Sebastes proriger</i>                  | 55             | 7170       | 2052        | 0.4            |
| Shortspine Thornyhead              | <i>Sebastolobus alascanus</i>             | 100            | 6617       | 3912        | 0.13           |
| Yellowmouth Rockfish               | <i>Sebastes reedi</i>                     | 40             | 6251       | 1712        | 0.68           |
| Canary Rockfish                    | <i>Sebastes pinniger</i>                  | 14             | 3245       | 777         | 0.51           |
| Sablefish                          | <i>Anoplopoma fimbria</i>                 | 55             | 1664       | 6371        | 0.18           |
| Arrowtooth Flounder                | <i>Atheresthes stomias</i>                | 75             | 1616       | 361         | 0.32           |
| Redbanded Rockfish                 | <i>Sebastes babcocki</i>                  | 72             | 864        | 120         | 0.19           |
| Dover Sole                         | <i>Microstomus pacificus</i>              | 84             | 853        | 432         | 0.36           |
| Pacific Hake                       | <i>Merluccius productus</i>               | 33             | 835        | 211         | 0.21           |
| Rex Sole                           | <i>Glyptocephalus zachirus</i>            | 88             | 823        | 309         | 0.55           |
| Rosethorn Rockfish                 | <i>Sebastes helvomaculatus</i>            | 70             | 745        | 111         | 0.19           |
| Pacific Grenadier                  | <i>Coryphaenoides acrolepis</i>           | 14             | 701        | 11693       | 0.27           |
| Splitnose Rockfish                 | <i>Sebastes diploproa</i>                 | 13             | 642        | 80          | 0.61           |
| Widow Rockfish                     | <i>Sebastes entomelas</i>                 | 33             | 611        | 168         | 0.46           |
| Giant Grenadier                    | <i>Albatrossia pectoralis</i>             | 15             | 569        | 8321        | 0.2            |
| Longspine Thornyhead               | <i>Sebastolobus altivelis</i>             | 15             | 521        | 7109        | 0.14           |
| Walleye Pollock                    | <i>Gadus chalcogrammus</i>                | 41             | 493        | 121         | 0.48           |
| Pacific Halibut                    | <i>Hippoglossus stenolepis</i>            | 25             | 446        | 451         | 0.77           |
| Longnose Skate                     | <i>Raja rhina</i>                         | 32             | 353        | 73          | 0.2            |
| Shortraker Rockfish                | <i>Sebastes borealis</i>                  | 10             | 352        | 152         | 0.43           |
| Spotted Ratfish                    | <i>Hydrolagus colliei</i>                 | 60             | 320        | 58          | 0.27           |



Table 9. Number of fish sampled for biological data during the 2016 West Coast Haida Gwaii Multi-Species Synoptic Bottom Trawl Survey showing the number of lengths and age structures that were collected by species.

| <b>Species</b>                  | <b>Scientific Name</b>                    | <b>Lengths Collected</b> | <b>Age Structures Collected</b> |
|---------------------------------|-------------------------------------------|--------------------------|---------------------------------|
| Brown Cat Shark                 | <i>Apristurus brunneus</i>                | 5                        | 0                               |
| North Pacific Spiny Dogfish     | <i>Squalus suckleyi</i>                   | 11                       | 8                               |
| Aleutian Skate                  | <i>Bathyraja aleutica</i>                 | 9                        | 0                               |
| Big Skate                       | <i>Beringraja binoculata</i>              | 2                        | 0                               |
| Roughtail Skate                 | <i>Bathyraja trachura</i>                 | 39                       | 0                               |
| Sandpaper Skate                 | <i>Bathyraja interrupta</i>               | 21                       | 0                               |
| Longnose Skate                  | <i>Raja rhina</i>                         | 44                       | 0                               |
| Spotted Ratfish                 | <i>Hydrolagus colliei</i>                 | 133                      | 0                               |
| Pacific Flatnose                | <i>Antimora microlepis</i>                | 43                       | 21                              |
| Pacific Cod                     | <i>Gadus macrocephalus</i>                | 51                       | 0                               |
| Pacific Hake                    | <i>Merluccius productus</i>               | 273                      | 48                              |
| Walleye Pollock                 | <i>Gadus chalcogrammus</i>                | 242                      | 25                              |
| Popeye                          | <i>Coryphaenoides cinereus</i>            | 245                      | 0                               |
| Pacific Grenadier               | <i>Coryphaenoides acrolepis</i>           | 612                      | 0                               |
| Giant Grenadier                 | <i>Albatrossia pectoralis</i>             | 446                      | 50                              |
| Rougheye/ Blackspotted Rockfish | <i>Sebastes aleutianus/ melanostictus</i> | 685                      | 682                             |
| Pacific Ocean Perch             | <i>Sebastes alutus</i>                    | 2356                     | 1564                            |
| Redbanded Rockfish              | <i>Sebastes babcocki</i>                  | 496                      | 495                             |
| Shortraker Rockfish             | <i>Sebastes borealis</i>                  | 77                       | 77                              |
| Silvergray Rockfish             | <i>Sebastes brevispinis</i>               | 908                      | 548                             |
| Splitnose Rockfish              | <i>Sebastes diploproa</i>                 | 131                      | 85                              |

| Species               | Scientific Name                | Lengths Collected | Age Structures Collected |
|-----------------------|--------------------------------|-------------------|--------------------------|
| Greenstriped Rockfish | <i>Sebastes elongatus</i>      | 174               | 0                        |
| Widow Rockfish        | <i>Sebastes entomelas</i>      | 72                | 0                        |
| Rosethorn Rockfish    | <i>Sebastes helvomaculatus</i> | 1069              | 0                        |
| Bocaccio              | <i>Sebastes paucispinis</i>    | 8                 | 8                        |
| Canary Rockfish       | <i>Sebastes pinniger</i>       | 185               | 185                      |
| Redstripe Rockfish    | <i>Sebastes proriger</i>       | 834               | 475                      |
| Yellowmouth Rockfish  | <i>Sebastes reedi</i>          | 419               | 350                      |
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>     | 16                | 16                       |
| Harlequin Rockfish    | <i>Sebastes variegatus</i>     | 79                | 0                        |
| Sharpchin Rockfish    | <i>Sebastes zacentrus</i>      | 1275              | 0                        |
| Shortspine Thornyhead | <i>Sebastolobus alascanus</i>  | 2383              | 685                      |
| Longspine Thornyhead  | <i>Sebastolobus altivelis</i>  | 480               | 458                      |
| Sablefish             | <i>Anoplopoma fimbria</i>      | 539               | 0                        |
| Lingcod               | <i>Ophiodon elongatus</i>      | 28                | 0                        |
| Arrowtooth Flounder   | <i>Atheresthes stomias</i>     | 239               | 87                       |
| Petrale Sole          | <i>Eopsetta jordani</i>        | 32                | 25                       |
| Rex Sole              | <i>Glyptocephalus zachirus</i> | 1002              | 191                      |
| Pacific Halibut       | <i>Hippoglossus stenolepis</i> | 29                | 0                        |
| Dover Sole            | <i>Microstomus pacificus</i>   | 570               | 405                      |
| English Sole          | <i>Parophrys vetulus</i>       | 30                | 30                       |

## Hard Bottom Longline Hook Surveys

This Hard Bottom Longline Hook survey program is designed to provide hook by hook species composition and catch rates for all species available to longline hook gear from 20 to 260 m depth. The surveys are intended to cover areas that are not covered by the synoptic bottom trawl surveys. The goal of the surveys is to provide relative abundance indices for commonly caught species, distributional and occurrence data for all other species, and detailed biological data for inshore rockfish population studies. These data are incorporated into stock assessments, status reports, and research publications.

The program includes an industry-funded survey of outside waters and a DFO-funded survey of inside waters. Fisheries and Oceans Canada (DFO), together with the Pacific Halibut Management Association of BC (PHMA) have implemented an annual research longline hook survey of the “outside” area. The “outside” area covers the entire British Columbia coast excluding inlets and the protected waters east of Vancouver Island. The “inside” area includes waters east of Vancouver Island. Each year, approximately half of each survey area is covered and alternates between northern and southern portions year to year.

The northern portion of the outside survey area includes the mainland coast north of Milbanke Sound, Dixon Entrance, and both sides of Haida Gwaii while the southern portion includes the mainland coast south of Milbanke Sound, Queen Charlotte Sound, and the north and west coasts of Vancouver Island. The northern portion of the outside area was surveyed during even numbered years from 2006 to 2012 and the southern portion was surveyed in odd years from 2007 to 2011. The survey had a one year hiatus in 2013 but resumed in 2014 in the southern portion. The current schedule is to survey the northern portion in odd numbered years and the southern portion in even numbered years.

The northern portion of the inside area includes Johnstone Strait and the Broughton Archipelago while the southern portion includes the Desolation Sound, the Strait of Georgia and the southern Gulf Islands. The survey has been conducted annually since 2003 excluding 2006. Currently the northern portion is surveyed in even numbered years while the southern portion is surveyed in odd numbered years.

Both of the Hard Bottom Longline Hook surveys follow the same random depth-stratified design using standardized “snap and swivel” longline hook gear with prescribed fishing protocols including bait, soak time and set locations within the selected blocks. Hard bottom regions within each survey were identified through bathymetry analyses, inshore rockfish fishing records and fishermen consultations. Each survey area is divided into 2 km by 2 km blocks and each block within the hard bottom regions is assigned a depth stratum based on the average bottom depth within the block. The three depth strata for the outside area are 20 to 70 meters, 71 to 150 meters, and 151 to 260 meters. Suitable hard bottom regions in the Strait of Georgia and Johnstone Strait are more limited so the depth strata for the inside area are 20 to 70 meters and 71 to 100 meters.

In 2016 the southern portion of the outside area and the northern portion of the inside areas were surveyed.

#### Outside Area – Pacific Halibut Management Association Longline Survey

The Pacific Halibut Management Association (PHMA) Longline Survey was conducted in the southern portion of the outside area. Three commercial hook and line vessels were chartered in August and together completed a total of 197 blocks (Figure 5). The Pacific Ambition surveyed the area off the mainland coast and in Queen Charlotte Sound (Figure 5) and completed a total of 65 sets from August 7 to 23. The Borealis 1 surveyed the area off the north coast of Vancouver Island and north half of the west coast of Vancouver Island (Figure 5) and completed a total of 66 sets from August 1 to 18, 2017. The Banker II surveyed the area off the southern half of the west coast of Vancouver Island (Figure 5) and completed a total of 66 sets from August 7 to 25, 2016.

The most common species captured during the 2016 PHMA longline survey was Yelloweye Rockfish (*Sebastes ruberrimus*), followed by Pacific Halibut (*Hippoglossus stenolepis*), Quillback Rockfish (*Sebastes maliger*), and Pacific Cod (*Gadus macrocephalus*) (Table 10). Table 11 shows the breakdown by major area of the top 25 species in the survey catch while Table 12 through Table 14 show the catch of all species by each vessel. provides an annual summary of the total catch of the PHMA Longline Survey in the southern region while Table 16 provides an annual summary of the catch landed from the PHMA longline survey in both northern and southern regions.

During the PHMA longline survey, detailed biological samples including ageing structures are collected from 50 rockfish in each set with a focus on Yelloweye Rockfish (*Sebastes ruberrimus*). If time permits additional rockfish will be sampled. Error: Reference source not found provides an annual summary by species of the number of fish that were sampled for biological data during the PHMA Longline Survey in the southern region. A total of 4506 individual fish were sampled for biological data in 2016. On the Banker II, biological data were collected from a total of 979 individual fish (Table 18), while on the Pacific Ambition biological data were collected from a total of 1427 individual fish (Table 19), and on the Borealis 1 biological data were collected from a total of 2100 individual fish (Table 20).

A temperature depth recorder was attached to most of the sets during the 2016 PHMA longline survey.

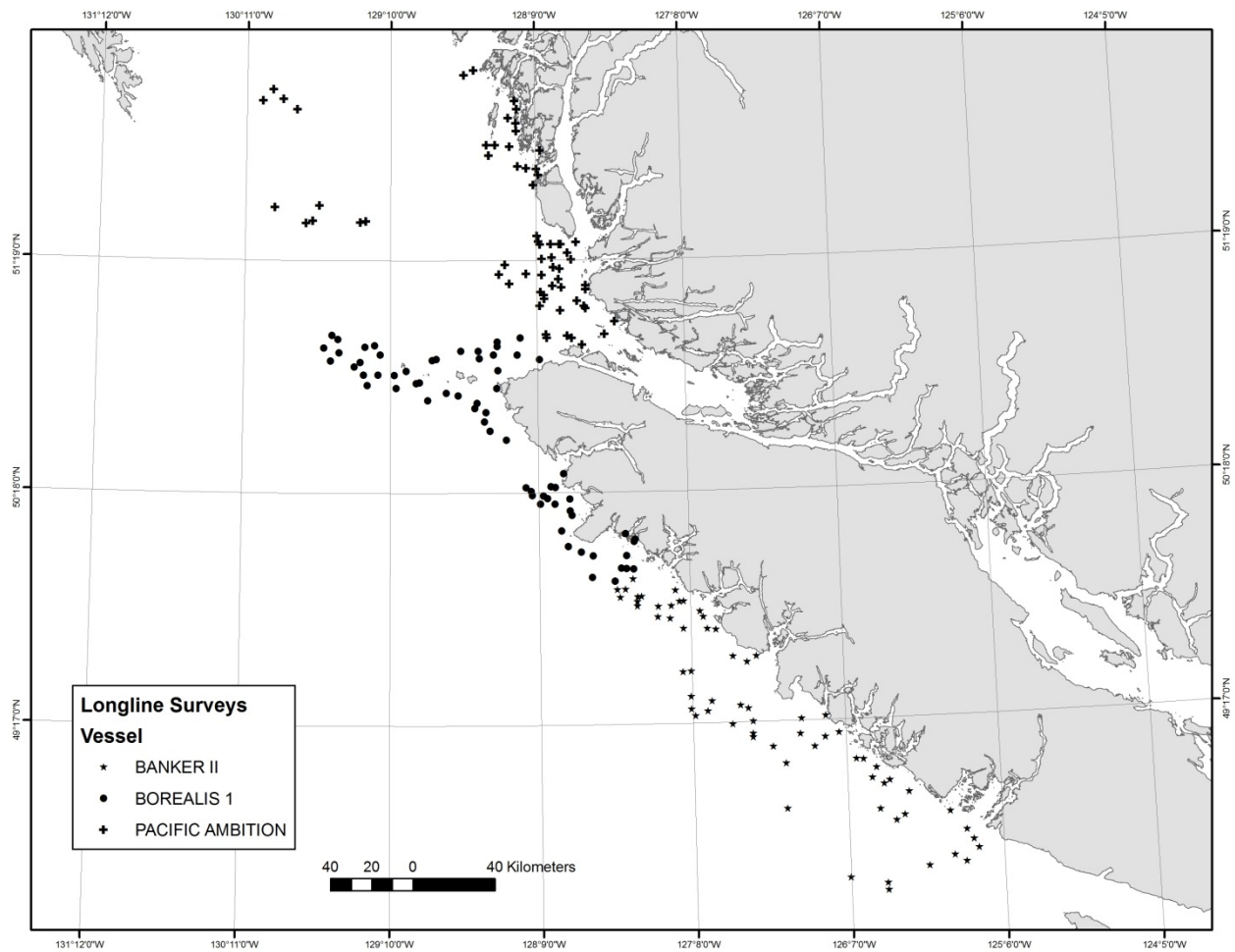


Figure 5. Longline set locations of the 2016 PHMA longline survey.

Table 10. Number of sets, catch (piece count), and proportion of the total fish caught catch of the top 25 fish species (by piece count) from the 2016 PHMA longline survey.

| Species                     | Scientific Name                | Number of Sets | Catch (count) | Proportion of Total Catch (%) |
|-----------------------------|--------------------------------|----------------|---------------|-------------------------------|
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 107            | 2444          | 16.67                         |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 183            | 2303          | 15.71                         |
| Quillback Rockfish          | <i>Sebastes maliger</i>        | 99             | 1477          | 10.08                         |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 84             | 1249          | 8.52                          |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 57             | 1128          | 7.69                          |
| Spotted Ratfish             | <i>Hydrolagus colliei</i>      | 131            | 941           | 6.42                          |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 93             | 820           | 5.59                          |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 116            | 779           | 5.31                          |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 77             | 616           | 4.20                          |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 30             | 529           | 3.61                          |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 110            | 473           | 3.23                          |
| Longnose Skate              | <i>Raja rhina</i>              | 93             | 429           | 2.93                          |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 30             | 277           | 1.89                          |
| Big Skate                   | <i>Beringraja binoculata</i>   | 66             | 209           | 1.43                          |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>      | 47             | 176           | 1.20                          |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i> | 40             | 137           | 0.93                          |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 37             | 137           | 0.93                          |
| Copper Rockfish             | <i>Sebastes caurinus</i>       | 29             | 127           | 0.87                          |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 9              | 85            | 0.58                          |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>       | 23             | 58            | 0.40                          |
| Southern Rock Sole          | <i>Lepidopsetta bilineata</i>  | 20             | 39            | 0.27                          |
| Vermilion Rockfish          | <i>Sebastes miniatus</i>       | 14             | 32            | 0.22                          |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>    | 25             | 31            | 0.21                          |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 20             | 28            | 0.19                          |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>   | 15             | 23            | 0.16                          |

Table 11. Catch (piece count) by major area for the top 25 fish species (by piece count) from the 2016 PHMA longline survey.

| Species                     | Scientific Name                | 4B | 3C  | 3D  | 5A   | 5B  |
|-----------------------------|--------------------------------|----|-----|-----|------|-----|
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 23 | 20  | 783 | 1185 | 433 |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 9  | 126 | 919 | 697  | 552 |
| Quillback Rockfish          | <i>Sebastes maliger</i>        | 27 | 225 | 261 | 524  | 440 |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 10 | 133 | 537 | 389  | 180 |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 0  | 186 | 298 | 329  | 315 |
| Spotted Ratfish             | <i>Hydrolagus coliei</i>       | 46 | 73  | 144 | 351  | 327 |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 6  | 72  | 404 | 216  | 122 |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 20 | 392 | 266 | 56   | 45  |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 2  | 23  | 287 | 182  | 122 |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 0  | 1   | 251 | 223  | 54  |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 4  | 71  | 220 | 144  | 34  |
| Longnose Skate              | <i>Raja rhina</i>              | 1  | 40  | 148 | 157  | 83  |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 0  | 67  | 96  | 108  | 6   |
| Big Skate                   | <i>Beringraja binocularata</i> | 1  | 64  | 103 | 33   | 8   |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>      | 1  | 16  | 62  | 78   | 19  |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i> | 0  | 8   | 40  | 62   | 27  |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 1  | 0   | 27  | 90   | 19  |
| Copper Rockfish             | <i>Sebastes caurinus</i>       | 0  | 27  | 52  | 34   | 14  |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 0  | 0   | 0   | 79   | 6   |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>       | 1  | 2   | 13  | 29   | 13  |
| Southern Rock Sole          | <i>Lepidopsetta bilineata</i>  | 0  | 4   | 8   | 15   | 12  |
| Vermilion Rockfish          | <i>Sebastes miniatus</i>       | 0  | 2   | 13  | 14   | 3   |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>    | 0  | 11  | 7   | 8    | 5   |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 0  | 5   | 8   | 10   | 5   |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>   | 1  | 1   | 3   | 12   | 6   |

Table 12. Total catch (piece count) by species for the 2016 PHMA Longline Survey sets completed by the Pacific Ambition.

| Species            | Scientific Name         | Total Catch (count) |
|--------------------|-------------------------|---------------------|
| Quillback Rockfish | <i>Sebastes maliger</i> | 801                 |

| Species                     | Scientific Name                | Total Catch (count) |
|-----------------------------|--------------------------------|---------------------|
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 706                 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 667                 |
| Spotted Ratfish             | <i>Hydrolagus colliei</i>      | 649                 |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 404                 |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 267                 |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 175                 |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 160                 |
| Longnose Skate              | <i>Raja rhina</i>              | 91                  |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 89                  |
| Starfish                    | <i>Asteroidea</i>              | 79                  |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 63                  |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 62                  |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 57                  |
| Copper Rockfish             | <i>Sebastes caurinus</i>       | 39                  |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i> | 38                  |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>      | 30                  |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 29                  |
| Southern Rock Sole          | <i>Lepidopsetta bilineata</i>  | 21                  |
| Big Skate                   | <i>Beringraja binoculata</i>   | 17                  |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>       | 14                  |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>   | 12                  |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 12                  |
| Vermilion Rockfish          | <i>Sebastes miniatus</i>       | 10                  |
|                             | <i>Solasteridae</i>            | 9                   |
| Dover Sole                  | <i>Microstomus pacificus</i>   | 8                   |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 6                   |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>    | 6                   |
| Sponges                     | <i>Porifera</i>                | 5                   |
| Walleye Pollock             | <i>Gadus chalcogrammus</i>     | 3                   |



| Species               | Scientific Name                    | Total Catch (count) |
|-----------------------|------------------------------------|---------------------|
| Darkblotched Rockfish | <i>Sebastes crameri</i>            | 2                   |
| Sea Pens              | <i>Pennatulacea</i>                | 2                   |
| Red Irish Lord        | <i>Hemilepidotus hemilepidotus</i> | 2                   |
| Cabazon               | <i>Scorpaenichthys marmoratus</i>  | 2                   |
| Shortspine Thornyhead | <i>Sebastolobus alascanus</i>      | 2                   |
| Greenlings            | <i>Hexagrammidae</i>               | 1                   |
| Redstripe Rockfish    | <i>Sebastes proriger</i>           | 1                   |
| Rougheye Rockfish     | <i>Sebastes aleutianus</i>         | 1                   |
| Stony Corals          | <i>Scleractinia</i>                | 1                   |
| Anemone               | <i>Actiniaria</i>                  | 1                   |
| C-o Sole              | <i>Pleuronichthys coenosus</i>     | 1                   |
|                       | <i>Echinoidea</i>                  | 1                   |
| Giant Pacific Octopus | <i>Enteroctopus dofleini</i>       | 1                   |
| Box Crabs             | <i>Lopholithodes</i>               | 1                   |

Table 13. Total catch (piece count) by species for the 2016 PHMA Longline Survey sets completed by the Borealis 1.

| Species                     | Scientific name                | Total Catch (count) |
|-----------------------------|--------------------------------|---------------------|
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 1583                |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 783                 |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 462                 |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 437                 |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 417                 |
| Quillback Rockfish          | <i>Sebastes maliger</i>        | 304                 |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 256                 |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 255                 |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 231                 |
| Longnose Skate              | <i>Raja rhina</i>              | 226                 |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 222                 |
| Spotted Ratfish             | <i>Hydrolagus coliei</i>       | 156                 |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 115                 |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 107                 |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>      | 99                  |
| Fish-Eating Star            | <i>Stylasterias forreri</i>    | 91                  |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 79                  |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i> | 71                  |
| Big Skate                   | <i>Beringraja binoculata</i>   | 56                  |
| Copper Rockfish             | <i>Sebastes caurinus</i>       | 50                  |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>       | 41                  |
| Vermilion Rockfish          | <i>Sebastes miniatus</i>       | 20                  |
| Deacon Rockfish             | <i>Sebastes diaconus</i>       | 14                  |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>    | 9                   |
| Scallop                     | <i>Pectinidae</i>              | 9                   |
| Starfish                    | <i>Asteroidea</i>              | 8                   |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>   | 8                   |

| Species               | Scientific name                    | Total Catch (count) |
|-----------------------|------------------------------------|---------------------|
| Leather Star          | <i>Dermasterias imbricata</i>      | 7                   |
|                       | <i>Metridium</i>                   | 7                   |
| Southern Rock Sole    | <i>Lepidopsetta bilineata</i>      | 7                   |
| Red Irish Lord        | <i>Hemilepidotus hemilepidotus</i> | 6                   |
| Cabezón               | <i>Scorpaenichthys marmoratus</i>  | 6                   |
| Anemone               | <i>Actiniaria</i>                  | 5                   |
| Sea Cucumbers         | <i>Holothuroidea</i>               | 4                   |
| Petrale Sole          | <i>Eopsetta jordani</i>            | 4                   |
| Sea Pens              | <i>Pennatulacea</i>                | 3                   |
| Echinoderms           | <i>Echinodermata</i>               | 3                   |
| Greenlings            | <i>Hexagrammidae</i>               | 3                   |
| Bocaccio              | <i>Sebastes paucispinis</i>        | 3                   |
|                       | <i>Solasteridae</i>                | 3                   |
| Redstripe Rockfish    | <i>Sebastes proriger</i>           | 3                   |
| Shortspine Thornyhead | <i>Sebastolobus alascanus</i>      | 2                   |
| Skates                | <i>Rajidae</i>                     | 2                   |
| Alaska Skate          | <i>Bathyraja parvifera</i>         | 2                   |
| Pacific Sanddab       | <i>Citharichthys sordidus</i>      | 2                   |
| Speckled Sanddab      | <i>Citharichthys stigmaeus</i>     | 2                   |
|                       | <i>Primnoa</i>                     | 2                   |
| Dover Sole            | <i>Microstomus pacificus</i>       | 2                   |
| Octopus               | <i>Octopoda</i>                    | 1                   |
| Chum Salmon           | <i>Oncorhynchus keta</i>           | 1                   |
| Blue Shark            | <i>Prionace glauca</i>             | 1                   |
| Oregon Triton         | <i>Fusitriton oregonensis</i>      | 1                   |
| Pacific Hake          | <i>Merluccius productus</i>        | 1                   |
| Hydroid               | <i>Hydrozoa</i>                    | 1                   |
| Barnacles             | <i>Cirripedia</i>                  | 1                   |
| Kelp Greenling        | <i>Hexagrammos decagrammus</i>     | 1                   |

| Species     | Scientific name  | Total Catch (count) |
|-------------|------------------|---------------------|
| Sea Urchins | <i>Echinacea</i> | 1                   |

Table 14. Total catch (piece count) by species for the 2016 PHMA Longline Survey sets completed by the Banker II.

| Species                     | Scientific Name                          | Total Catch (count) |
|-----------------------------|------------------------------------------|---------------------|
| Pacific Halibut             | <i>Hippoglossus stenolepis</i>           | 814                 |
| Pacific Cod                 | <i>Gadus macrocephalus</i>               | 520                 |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>                  | 468                 |
| Sablefish                   | <i>Anoplopoma fimbria</i>                | 468                 |
| Quillback Rockfish          | <i>Sebastes maliger</i>                  | 372                 |
| Canary Rockfish             | <i>Sebastes pinniger</i>                 | 208                 |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>               | 201                 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>               | 194                 |
| Lingcod                     | <i>Ophiodon elongatus</i>                | 181                 |
| Big Skate                   | <i>Beringraja binocularata</i>           | 136                 |
| Spotted Ratfish             | <i>Hydrolagus collieri</i>               | 136                 |
| Longnose Skate              | <i>Raja rhina</i>                        | 112                 |
| China Rockfish              | <i>Sebastes nebulosus</i>                | 99                  |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>                 | 55                  |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>                | 47                  |
| Copper Rockfish             | <i>Sebastes caurinus</i>                 | 38                  |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i>           | 28                  |
| Fish-eating Star            | <i>Stylasterias forreri</i>              | 19                  |
| Sandpaper Skate             | <i>Bathyraja interrupta</i>              | 16                  |
| Pacific Sanddab             | <i>Citharichthys sordidus</i>            | 15                  |
| Petrale Sole                | <i>Eopsetta jordani</i>                  | 12                  |
| Southern Rock Sole          | <i>Lepidopsetta bilineata</i>            | 11                  |
| Pacific Staghorn Sculpin    | <i>Leptocottus armatus</i>               | 9                   |
| Anemone                     | <i>Actiniaria</i>                        | 9                   |
| Great Sculpin               | <i>Myoxocephalus polyacanthocephalus</i> | 7                   |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>             | 3                   |
| Starfish                    | <i>Asteroidea</i>                        | 3                   |

| Species             | Scientific Name                    | Total Catch (count) |
|---------------------|------------------------------------|---------------------|
| Yellowtail Rockfish | <i>Sebastes flavidus</i>           | 3                   |
| Vermilion Rockfish  | <i>Sebastes miniatus</i>           | 2                   |
| Wolf Eel            | <i>Anarrhichthys ocellatus</i>     | 2                   |
| Sunflower Starfish  | <i>Pycnopodia helianthoides</i>    | 2                   |
| Dover Sole          | <i>Microstomus pacificus</i>       | 2                   |
| Sea Cucumbers       | <i>Holothuroidea</i>               | 2                   |
| Octopus             | <i>Octopoda</i>                    | 1                   |
| Sand Sole           | <i>Psettichthys melanostictus</i>  | 1                   |
| Scallop             | <i>Pectinidae</i>                  | 1                   |
| Red Irish Lord      | <i>Hemilepidotus hemilepidotus</i> | 1                   |
| Sand Star           | <i>Luidia foliolata</i>            | 1                   |
|                     | <i>Tealia</i>                      | 1                   |
| Plainfin Midshipman | <i>Porichthys notatus</i>          | 1                   |
| Silvergray Rockfish | <i>Sebastes brevispinis</i>        | 1                   |

Table 15. Annual summary of the total catch (piece count) for the top 25 species (by total piece count over all years) for the PHMA Longline Survey southern region.

| <b>Species</b>              | <b>2007</b> | <b>2009</b> | <b>2011</b> | <b>2014</b> | <b>2016</b> | <b>Total</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|--------------|
| North Pacific Spiny Dogfish | 8240        | 4896        | 5854        | 1457        | 779         | 21226        |
| Yelloweye Rockfish          | 3784        | 3520        | 4079        | 2523        | 2444        | 16350        |
| Pacific Halibut             | 2753        | 1760        | 1808        | 2881        | 2303        | 11505        |
| Quillback Rockfish          | 1604        | 966         | 1718        | 1463        | 1477        | 7228         |
| Sablefish                   | 1257        | 1340        | 912         | 534         | 1128        | 5171         |
| Longnose Skate              | 1498        | 645         | 698         | 621         | 429         | 3891         |
| Spotted Ratfish             | 1029        | 263         | 1188        | 400         | 941         | 3821         |
| Redbanded Rockfish          | 841         | 1125        | 647         | 507         | 529         | 3649         |
| Lingcod                     | 1188        | 610         | 493         | 767         | 473         | 3531         |
| Pacific Cod                 | 486         | 493         | 552         | 725         | 1249        | 3505         |
| Arrowtooth Flounder         | 789         | 874         | 682         | 402         | 616         | 3363         |
| Canary Rockfish             | 751         | 537         | 593         | 469         | 820         | 3170         |
| Silvergray Rockfish         | 592         | 689         | 293         | 96          | 137         | 1807         |
| China Rockfish              | 446         | 82          | 419         | 304         | 277         | 1528         |
| Copper Rockfish             | 242         | 144         | 235         | 197         | 127         | 945          |
| Greenstriped Rockfish       | 122         | 127         | 226         | 122         | 176         | 773          |
| Rosethorn Rockfish          | 108         | 108         | 252         | 111         | 137         | 716          |
| Big Skate                   | 92          | 134         | 118         | 93          | 209         | 646          |
| Yellowmouth Rockfish        | 115         | 84          | 28          | 37          | 85          | 349          |
| Vermilion Rockfish          | 92          | 12          | 80          | 55          | 32          | 271          |
| Yellowtail Rockfish         | 30          | 30          | 60          | 43          | 58          | 221          |
| Cabazon                     | 42          | 16          | 28          | 51          | 8           | 145          |
| Petrale Sole                | 30          | 13          | 46          | 20          | 28          | 137          |
| Tiger Rockfish              | 41          | 23          | 30          | 17          | 23          | 134          |
| Southern Rock Sole          | 25          | 10          | 12          | 20          | 39          | 106          |

Table 16. Annual summary of the total landed weight (1000 kg) by species for the PHMA Longline Survey including both southern and northern regions.

| Species                     | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2014 | 2015  | 2016 | Total  |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|------|-------|------|--------|
| Pacific Halibut             | 16.24 | 8.53  | 16.4  | 6.37  | 14.58 | 7.05  | 19.64 | 9.38 | 22.91 | 7.5  | 128.6  |
| Yelloweye Rockfish          | 12.95 | 11.82 | 13.55 | 11.19 | 12.16 | 12.63 | 14.22 | 8.58 | 16.43 | 7.86 | 121.38 |
| Lingcod                     | 6.34  | 6.42  | 6.88  | 2.68  | 3.17  | 2.6   | 4.21  | 3.46 | 3.25  | 2.09 | 41.11  |
| Longnose Skate              | 4.6   | 8.16  | 4.22  | 3.18  | 3.23  | 3.65  | 3.69  | 1.82 | 0     | 0    | 32.55  |
| Quillback Rockfish          | 2.32  | 1.79  | 2.5   | 1.01  | 2.65  | 1.84  | 3.09  | 1.63 | 3.14  | 1.65 | 21.62  |
| Pacific Cod                 | 2.02  | 0.84  | 1.85  | 0.75  | 2.33  | 1.1   | 2.99  | 0.98 | 1.71  | 2.32 | 16.87  |
| Redbanded Rockfish          | 2.33  | 1.64  | 1.28  | 2.3   | 1.06  | 1.21  | 1.97  | 0.93 | 1.05  | 0.96 | 14.73  |
| Silvergray Rockfish         | 2.56  | 1.24  | 2.24  | 1.43  | 1.59  | 0.54  | 2.31  | 0.19 | 1.22  | 0.26 | 13.58  |
| Sablefish                   | 1.41  | 2.14  | 1.01  | 2.46  | 0.5   | 0.83  | 0.97  | 1.14 | 0.53  | 1.11 | 12.09  |
| Canary Rockfish             | 1.39  | 1.36  | 1.39  | 1.09  | 0.88  | 1.01  | 1.68  | 0.81 | 0.87  | 1.38 | 11.86  |
| Big Skate                   | 1.9   | 0.98  | 1.71  | 2.42  | 1.13  | 1.38  | 1.42  | 0.75 | 0     | 0    | 11.68  |
| North Pacific Spiny Dogfish | 0     | 2.16  | 0     | 0     | 0     | 0     | 0     | 0    | 0     | 0    | 2.16   |
| Copper Rockfish             | 0.22  | 0.26  | 0.21  | 0.25  | 0.18  | 0.29  | 0.21  | 0.23 | 0.17  | 0.15 | 2.16   |
| China Rockfish              | 0.05  | 0.35  | 0.13  | 0.06  | 0.14  | 0.32  | 0.14  | 0.23 | 0.11  | 0.22 | 1.75   |
| Bocaccio                    | 0.13  | 0.19  | 0.18  | 0.07  | 0.07  | 0.08  | 0.07  | 0    | 0.04  | 0.02 | 0.86   |
| Sandpaper Skate             | 0.39  | 0.02  | 0.25  | 0.02  | 0.05  | 0     | 0.11  | 0    | 0     | 0    | 0.84   |
| Vermilion Rockfish          | 0.04  | 0.19  | 0.03  | 0.03  | 0.01  | 0.21  | 0.05  | 0.13 | 0.07  | 0.08 | 0.84   |
| Rosethorn Rockfish          | 0.05  | 0.05  | 0.07  | 0.04  | 0.06  | 0.1   | 0.1   | 0.04 | 0.07  | 0.06 | 0.64   |
| Yellowtail Rockfish         | 0.06  | 0.04  | 0.04  | 0.05  | 0.03  | 0.09  | 0.12  | 0.05 | 0.05  | 0.09 | 0.63   |
| Rougheye Rockfish           | 0.1   | 0.06  | 0.22  | 0.03  | 0.04  | 0     | 0.09  | 0.01 | 0.03  | 0    | 0.58   |
| Shortspine Thornyhead       | 0.12  | 0.01  | 0.27  | 0.01  | 0.05  | 0.01  | 0.05  | 0.02 | 0.04  | 0    | 0.58   |
| Yellowmouth                 | 0     | 0.16  | 0.01  | 0.16  | 0     | 0.05  | 0.03  | 0.05 | 0     | 0.12 | 0.57   |



[illegible]

Table 17. Annual summary of the number of fish sampled for biological data during the PHMA Longline Survey in the southern region.

| <b>Species</b>        | <b>2007</b> | <b>2009</b> | <b>2011</b> | <b>2014</b> | <b>2016</b> | <b>Total</b> |
|-----------------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Yelloweye Rockfish    | 2758        | 2579        | 3072        | 1939        | 1899        | 12247        |
| Quillback Rockfish    | 1330        | 782         | 1296        | 1449        | 1107        | 5964         |
| Redbanded Rockfish    | 468         | 603         | 265         | 355         | 413         | 2104         |
| Canary Rockfish       | 238         | 332         | 192         | 445         | 426         | 1633         |
| China Rockfish        | 224         | 69          | 228         | 308         | 266         | 1095         |
| Copper Rockfish       | 221         | 144         | 221         | 192         | 130         | 908          |
| Silvergray Rockfish   | 86          | 195         | 104         | 93          | 23          | 501          |
| Greenstriped Rockfish | 35          | 85          | 72          | 125         | 74          | 391          |
| Rosethorn Rockfish    | 34          | 18          | 92          | 113         | 85          | 342          |
| Vermilion Rockfish    | 27          | 4           | 16          | 54          | 32          | 133          |
| Pacific Cod           | 0           | 0           | 0           | 119         | 0           | 119          |
| Yellowtail Rockfish   | 4           | 15          | 22          | 41          | 11          | 93           |
| Tiger Rockfish        | 23          | 7           | 22          | 17          | 23          | 92           |
| Rougheye Rockfish     | 58          | 22          | 1           | 3           | 1           | 85           |
| Yellowmouth Rockfish  | 0           | 5           | 2           | 36          | 2           | 45           |
| Black Rockfish        | 4           | 1           | 26          | 8           | 0           | 39           |
| Shortspine Thornyhead | 6           | 6           | 8           | 16          | 0           | 36           |
| Bocaccio              | 5           | 11          | 5           | 1           | 0           | 22           |
| Deacon Rockfish       | 6           | 0           | 0           | 0           | 14          | 20           |
| Redstripe Rockfish    | 0           | 1           | 5           | 0           | 0           | 6            |
| Southern Rock Sole    | 0           | 0           | 5           | 0           | 0           | 5            |
| Widow Rockfish        | 0           | 0           | 2           | 0           | 0           | 2            |
| Pacific Ocean Perch   | 0           | 0           | 1           | 0           | 0           | 1            |
| Sharpchin Rockfish    | 0           | 0           | 0           | 1           | 0           | 1            |
| Shortraker Rockfish   | 0           | 0           | 0           | 1           | 0           | 1            |
| Dusky Rockfish        | 0           | 1           | 0           | 0           | 0           | 1            |
| Chilipepper           | 0           | 0           | 1           | 0           | 0           | 1            |



Table 18. Number of fish sampled for biological data during the 2016 PHMA Longline Survey on the Banker II showing the number of lengths and age structures that were collected by species.

| <b>Species</b>        | <b>Scientific Name</b>         | <b>Lengths Collected</b> | <b>Age Structures Collected</b> |
|-----------------------|--------------------------------|--------------------------|---------------------------------|
| Canary Rockfish       | <i>Sebastes pinniger</i>       | 207                      | 144                             |
| China Rockfish        | <i>Sebastes nebulosus</i>      | 90                       | 90                              |
| Copper Rockfish       | <i>Sebastes caurinus</i>       | 41                       | 41                              |
| Greenstriped Rockfish | <i>Sebastes elongatus</i>      | 45                       | 41                              |
| Quillback Rockfish    | <i>Sebastes maliger</i>        | 309                      | 295                             |
| Redbanded Rockfish    | <i>Sebastes babcocki</i>       | 54                       | 54                              |
| Rosethorn Rockfish    | <i>Sebastes helvomaculatus</i> | 32                       | 20                              |
| Tiger Rockfish        | <i>Sebastes nigrocinctus</i>   | 3                        | 3                               |
| Vermilion Rockfish    | <i>Sebastes miniatus</i>       | 3                        | 3                               |
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>     | 192                      | 192                             |
| Yellowtail Rockfish   | <i>Sebastes flavidus</i>       | 3                        | 3                               |

Table 19. Number of fish sampled for biological data during the 2016 PHMA Longline Survey on the Pacific Ambition showing the number of lengths and age structures that were collected by species.

| <b>Species</b>        | <b>Scientific Name</b>         | <b>Lengths Collected</b> | <b>Age Structures Collected</b> |
|-----------------------|--------------------------------|--------------------------|---------------------------------|
| Canary Rockfish       | <i>Sebastes pinniger</i>       | 100                      | 100                             |
| China Rockfish        | <i>Sebastes nebulosus</i>      | 61                       | 61                              |
| Copper Rockfish       | <i>Sebastes caurinus</i>       | 40                       | 40                              |
| Greenstriped Rockfish | <i>Sebastes elongatus</i>      | 14                       | 14                              |
| Quillback Rockfish    | <i>Sebastes maliger</i>        | 500                      | 500                             |
| Redbanded Rockfish    | <i>Sebastes babcocki</i>       | 56                       | 56                              |
| Rosethorn Rockfish    | <i>Sebastes helvomaculatus</i> | 34                       | 34                              |
| Rougheye Rockfish     | <i>Sebastes aleutianus</i>     | 1                        | 1                               |
| Silvergray Rockfish   | <i>Sebastes brevispinis</i>    | 18                       | 18                              |
| Tiger Rockfish        | <i>Sebastes nigrocinctus</i>   | 12                       | 12                              |

|                     |                            |     |     |
|---------------------|----------------------------|-----|-----|
| Vermilion Rockfish  | <i>Sebastes miniatus</i>   | 9   | 9   |
| Yelloweye Rockfish  | <i>Sebastes ruberrimus</i> | 579 | 526 |
| Yellowtail Rockfish | <i>Sebastes flavidus</i>   | 3   | 3   |

Table 20. Number of fish sampled for biological data during the 2016 PHMA Longline Survey on the Borealis 1 showing the number of lengths and age structures that were collected by species.

| Species               | Scientific Name                | Lengths Collected | Age Structures Collected |
|-----------------------|--------------------------------|-------------------|--------------------------|
| Canary Rockfish       | <i>Sebastes pinniger</i>       | 119               | 119                      |
| China Rockfish        | <i>Sebastes nebulosus</i>      | 115               | 115                      |
| Copper Rockfish       | <i>Sebastes caurinus</i>       | 49                | 49                       |
| Deacon Rockfish       | <i>Sebastes diaconus</i>       | 14                | 14                       |
| Greenstriped Rockfish | <i>Sebastes elongatus</i>      | 15                | 15                       |
| Quillback Rockfish    | <i>Sebastes maliger</i>        | 298               | 300                      |
| Redbanded Rockfish    | <i>Sebastes babcocki</i>       | 303               | 303                      |
| Rosethorn Rockfish    | <i>Sebastes helvomaculatus</i> | 19                | 19                       |
| Silvergray Rockfish   | <i>Sebastes brevispinis</i>    | 5                 | 5                        |
| Tiger Rockfish        | <i>Sebastes nigrocinctus</i>   | 8                 | 8                        |
| Vermilion Rockfish    | <i>Sebastes miniatus</i>       | 20                | 20                       |
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>     | 1128              | 1128                     |
| Yellowmouth Rockfish  | <i>Sebastes reedi</i>          | 2                 | 2                        |
| Yellowtail Rockfish   | <i>Sebastes flavidus</i>       | 5                 | 5                        |

#### Inside Area – DFO Hard Bottom Longline Hook

The DFO Hard Bottom Longline Hook Survey was conducted in the northern portion of the inside area on board the Canadian Coast Guard Ship Neocaligus from August 1 to 23, 2016. A total of 71 sets were completed (Figure 6). Six different DFO science staff and one volunteer student participated in the survey. The total catch of the survey was 6281 kg (Table 21). The average catch per set was 88 kg, averaging five different species of fish and invertebrates in each. The most abundant fish species encountered were North Pacific Spiny Dogfish (*Squalus suckleyi*), followed by Quillback Rockfish (*Sebastes maliger*), Yelloweye Rockfish (*Sebastes ruberrimus*), and Spotted Ratfish (*Hydrolagus collieri*). The number of sets where the species was captured as well as the total catch count and proportion of the total catch for the 25 most abundant species are shown in Error: Reference source not found. An annual summary of catch by species in the southern area is shown in Table 23. Biological data, including individual

length, weight, sex, maturity, and age structure were collected from a total of 3719 individual fish of 20 different species (Table 24). An annual summary of the number of fish sampled for biological data in the southern area is shown in Table 25.

One vertical CTD (conductivity, temperature, and depth recorder) cast was made at each selected block during the 2016 DFO Hard Bottom Longline Hook Survey. The CTD also included a dissolved oxygen sensor. In addition, a temperature depth recorder were deployed at the start, middle, and end of every fishing set.

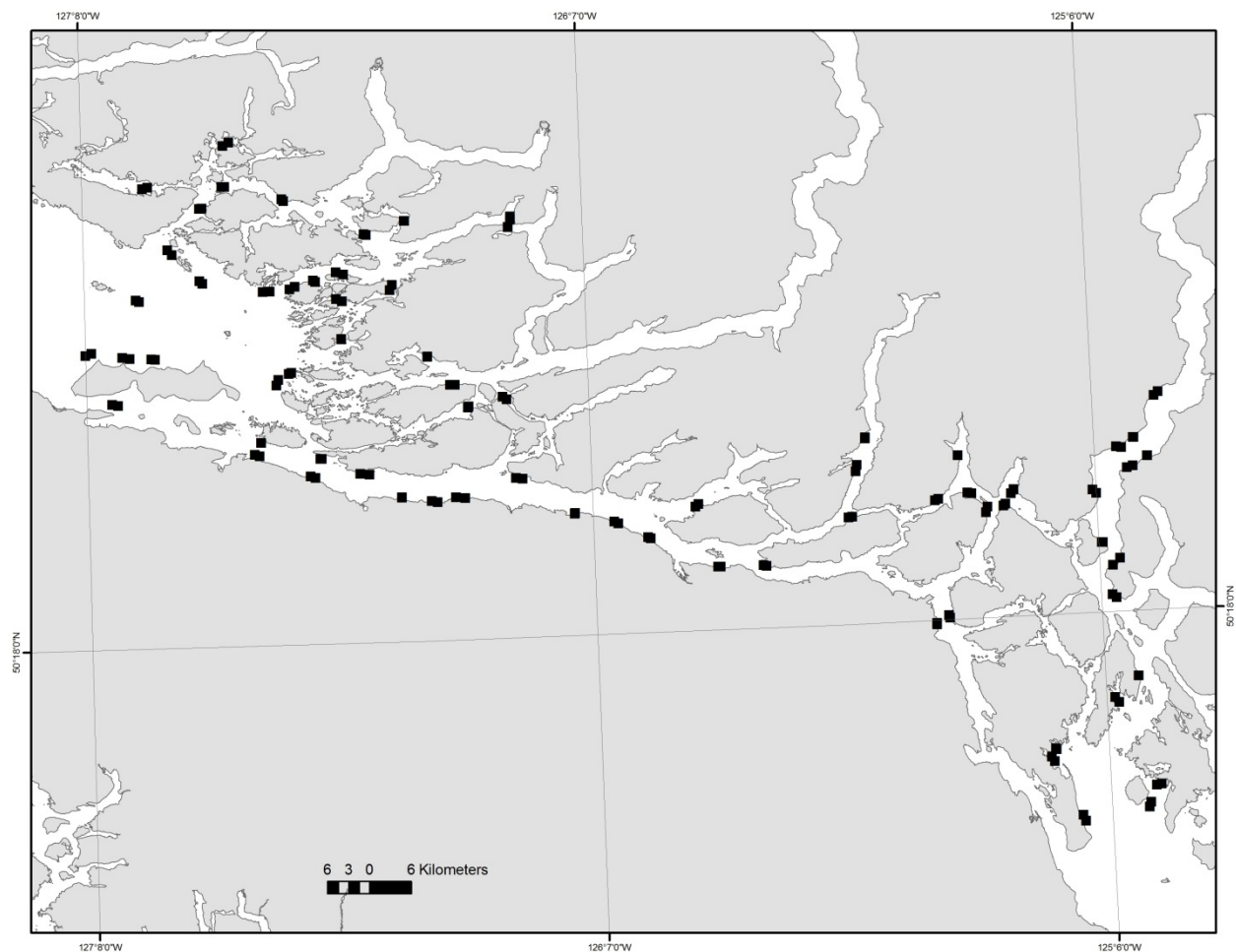


Figure 6. Longline set locations of the 2016 DFO Hard Bottom Longline Hook Survey.

Table 21. Total catch, showing both piece count and weight by species for the 2016 DFO Hard Bottom Longline Hook Survey.

| Species                     | Scientific Name                 | Total Catch<br>(count) | Total<br>Catch (kg) |
|-----------------------------|---------------------------------|------------------------|---------------------|
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>         | 2290                   | 3550                |
| Quillback Rockfish          | <i>Sebastes maliger</i>         | 570                    | 507                 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>      | 246                    | 575                 |
| Spotted Ratfish             | <i>Hydrolagus coliei</i>        | 242                    | 293                 |
| Sablefish                   | <i>Anoplopoma fimbria</i>       | 137                    | 91                  |
| Lingcod                     | <i>Ophiodon elongatus</i>       | 90                     | 578                 |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i>  | 41                     | 465                 |
| Sponges                     | <i>Porifera</i>                 | 28                     | 7                   |
| Longnose Skate              | <i>Raja rhina</i>               | 19                     | 55                  |
| Copper Rockfish             | <i>Sebastes caurinus</i>        | 16                     | 20                  |
| Pink Scallop                | <i>Chlamys rubida</i>           | 15                     |                     |
| Sunflower Starfish          | <i>Pycnopodia helianthoides</i> | 13                     | 13                  |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>       | 13                     | 5                   |
| Pacific Cod                 | <i>Gadus macrocephalus</i>      | 11                     | 12                  |
| Gastropods                  | <i>Gastropoda</i>               | 9                      |                     |
| Big Skate                   | <i>Beringraja binocularata</i>  | 7                      | 65                  |
|                             | <i>Bryozoa</i>                  | 7                      |                     |
| Canary Rockfish             | <i>Sebastes pinniger</i>        | 7                      | 16                  |
| Kelp Greenling              | <i>Hexagrammos decagrammus</i>  | 6                      | 5                   |
| Sea Pens                    | <i>Pennatulacea</i>             | 5                      | 0                   |
| Oregontriton                | <i>Fusitriton oregonensis</i>   | 5                      | 0                   |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>        | 3                      | 2                   |
| Lampshells                  | <i>Brachiopoda</i>              | 3                      | 0                   |
| Anemone                     | <i>Actiniaria</i>               | 2                      | 0                   |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>    | 2                      | 1                   |
| Starfish                    | <i>Asteroidea</i>               | 2                      | 1                   |

| Species                  | Scientific Name                          | Total Catch<br>(count) | Total<br>Catch (kg) |
|--------------------------|------------------------------------------|------------------------|---------------------|
| Mottled Star             | <i>Evasterias troschelii</i>             | 2                      | 0                   |
| Great Sculpin            | <i>Myoxocephalus polyacanthocephalus</i> | 2                      | 1                   |
| Barnacles                | <i>Cirripedia</i>                        | 2                      | 2                   |
| Red Rock Crab            | <i>Cancer productus</i>                  | 2                      | 0                   |
| Bivalve Molluscs         | <i>Bivalvia</i>                          | 2                      |                     |
| Inshore Tanner Crab      | <i>Chionoecetes bairdi</i>               | 1                      | 0                   |
| Box Crabs                | <i>Lopholithodes</i>                     | 1                      | 0                   |
| Brown Box Crab           | <i>Lopholithodes foraminatus</i>         | 1                      | 1                   |
| Squat Lobster            | <i>Munida quadrispina</i>                | 1                      |                     |
| Pacific Sanddab          | <i>Citharichthys sordidus</i>            | 1                      | 0                   |
| Pacific Staghorn Sculpin | <i>Leptocottus armatus</i>               | 1                      | 0                   |
|                          | <i>Tunicata</i>                          | 1                      |                     |
| Southern Rock Sole       | <i>Lepidopsetta bilineata</i>            | 1                      | 0                   |
|                          | <i>Antedonidae</i>                       | 1                      |                     |
|                          | <i>Coralliidae</i>                       | 1                      |                     |
| Sea Whip                 | <i>Balticina septentrionalis</i>         | 1                      | 0                   |
| Glass Sponges            | <i>Hexactinellida</i>                    |                        | 0                   |



Table 22. Number of sets, catch (piece count), and proportion of the total fish caught catch of the top 25 fish species (by piece count) from the 2016 DFO Hard Bottom Longline Hook Survey.

| Species                     | Number of Sets | Catch (count) | Proportion of Total Catch (%) |
|-----------------------------|----------------|---------------|-------------------------------|
| North Pacific Spiny Dogfish | 58             | 2290          | 61.81                         |
| Quillback Rockfish          | 62             | 570           | 15.38                         |
| Yelloweye Rockfish          | 41             | 246           | 6.64                          |
| Spotted Ratfish             | 42             | 242           | 6.53                          |
| Sablefish                   | 6              | 137           | 3.70                          |
| Lingcod                     | 31             | 90            | 2.43                          |
| Pacific Halibut             | 21             | 41            | 1.11                          |
| Longnose Skate              | 11             | 19            | 0.51                          |
| Copper Rockfish             | 10             | 16            | 0.43                          |
| Greenstriped Rockfish       | 8              | 13            | 0.35                          |
| Pacific Cod                 | 8              | 11            | 0.30                          |
| Canary Rockfish             | 2              | 7             | 0.19                          |
| Big Skate                   | 3              | 7             | 0.19                          |
| Kelp Greenling              | 5              | 6             | 0.16                          |
| Yellowtail Rockfish         | 3              | 3             | 0.08                          |
| Great Sculpin               | 2              | 2             | 0.05                          |
| Tiger Rockfish              | 2              | 2             | 0.05                          |
| Southern Rock Sole          | 1              | 1             | 0.03                          |
| Pacific Staghorn Sculpin    | 1              | 1             | 0.03                          |
| Pacific Sanddab             | 1              | 1             | 0.03                          |

Table 23. Annual summary of the total catch (piece count) for the top 25 species (by total piece count over all years) for the DFO Hard Bottom Longline Survey southern region.

| <b>Species</b>              | <b>2007</b> | <b>2008</b> | <b>2010</b> | <b>2012</b> | <b>2014</b> | <b>2016</b> | <b>Total</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| North Pacific Spiny Dogfish | 3035        | 5082        | 2716        | 2749        | 3004        | 2290        | 28194        |
| Quillback Rockfish          | 745         | 158         | 441         | 757         | 526         | 570         | 4157         |
| Spotted Ratfish             | 640         | 18          | 267         | 353         | 142         | 242         | 2776         |
| Yelloweye Rockfish          | 116         | 202         | 156         | 170         | 156         | 246         | 1392         |
| Pacific Halibut             | 168         | 3           | 27          | 62          | 79          | 41          | 475          |
| Lingcod                     | 38          | 38          | 65          | 75          | 45          | 90          | 411          |
| Pacific Cod                 | 96          | 15          | 26          | 32          | 22          | 11          | 379          |
| Sablefish                   | 23          | 0           | 26          | 47          | 14          | 137         | 366          |
| Longnose Skate              | 42          | 15          | 33          | 17          | 8           | 19          | 221          |
| Greenstriped Rockfish       | 48          | 4           | 10          | 23          | 7           | 13          | 184          |
| Red Irish Lord              | 75          | 2           | 7           | 25          | 3           | 0           | 160          |
| Copper Rockfish             | 4           | 38          | 11          | 25          | 10          | 16          | 126          |
| Pacific Sanddab             | 7           | 5           | 9           | 21          | 3           | 1           | 86           |
| Yellowtail Rockfish         | 21          | 1           | 3           | 1           | 5           | 3           | 65           |
| Canary Rockfish             | 4           | 3           | 0           | 8           | 17          | 7           | 56           |
| Tiger Rockfish              | 15          | 3           | 2           | 11          | 1           | 2           | 53           |
| Arrowtooth Flounder         | 6           | 0           | 7           | 8           | 13          | 0           | 44           |
| Big Skate                   | 3           | 1           | 3           | 0           | 1           | 7           | 33           |
| Buffalo Sculpin             | 0           | 0           | 25          | 7           | 0           | 0           | 32           |
| Southern Rock Sole          | 0           | 5           | 7           | 10          | 1           | 1           | 28           |
| Kelp Greenling              | 4           | 1           | 3           | 4           | 0           | 6           | 24           |
| Cabazon                     | 0           | 3           | 2           | 5           | 7           | 0           | 19           |
| Brown Irish Lord            | 2           | 0           | 0           | 0           | 0           | 0           | 18           |
| Great Sculpin               | 0           | 0           | 4           | 6           | 3           | 2           | 16           |
| Silvergray Rockfish         | 1           | 2           | 8           | 3           | 0           | 0           | 15           |

Table 24. Number of fish sampled for biological data during the 2016 DFO Hard Bottom Longline Hook survey showing the number of lengths and age structures that were collected by species.

| Species                     | Scientific Name                          | Lengths Collected | Age Structures Collected |
|-----------------------------|------------------------------------------|-------------------|--------------------------|
| Big Skate                   | <i>Beringraja binoculata</i>             | 7                 | 0                        |
| Canary Rockfish             | <i>Sebastes pinniger</i>                 | 7                 | 0                        |
| Copper Rockfish             | <i>Sebastes caurinus</i>                 | 16                | 16                       |
| Great Sculpin               | <i>Myoxocephalus polyacanthocephalus</i> | 2                 | 0                        |
| Greenstriped Rockfish       | <i>Sebastes elongatus</i>                | 13                | 0                        |
| Kelp Greenling              | <i>Hexagrammos decagrammus</i>           | 6                 | 0                        |
| Lingcod                     | <i>Ophiodon elongatus</i>                | 89                | 0                        |
| Longnose Skate              | <i>Raja rhina</i>                        | 18                | 0                        |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>                  | 2289              | 0                        |
| Pacific Cod                 | <i>Gadus macrocephalus</i>               | 9                 | 0                        |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i>           | 37                | 0                        |
| Pacific Sanddab             | <i>Citharichthys sordidus</i>            | 1                 | 0                        |
| Pacific Staghorn Sculpin    | <i>Leptocottus armatus</i>               | 1                 | 0                        |
| Quillback Rockfish          | <i>Sebastes maliger</i>                  | 568               | 569                      |
| Sablefish                   | <i>Anoplopoma fimbria</i>                | 133               | 118                      |
| Southern Rock Sole          | <i>Lepidopsetta bilineata</i>            | 1                 | 0                        |
| Spotted Ratfish             | <i>Hydrolagus coliei</i>                 | 283               | 0                        |
| Tiger Rockfish              | <i>Sebastes nigrocinctus</i>             | 2                 | 2                        |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>               | 235               | 235                      |
| Yellowtail Rockfish         | <i>Sebastes flavidus</i>                 | 2                 | 0                        |

Table 25. Annual summary of the number of fish sampled for biological data during the DFO Hard Bottom Longline Survey in the northern region.

| <b>Species</b>              | <b>2007</b> | <b>2008</b> | <b>2010</b> | <b>2012</b> | <b>2014</b> | <b>2016</b> | <b>Total</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| North Pacific Spiny Dogfish | 2952        | 5061        | 2701        | 2747        | 3195        | 2289        | 26002        |
| Quillback Rockfish          | 637         | 152         | 438         | 744         | 520         | 568         | 3991         |
| Spotted Ratfish             | 553         | 11          | 255         | 339         | 135         | 283         | 2511         |
| Yelloweye Rockfish          | 115         | 201         | 153         | 169         | 156         | 235         | 1372         |
| Lingcod                     | 36          | 36          | 64          | 75          | 45          | 89          | 402          |
| Sablefish                   | 24          | 0           | 24          | 47          | 13          | 133         | 354          |
| Pacific Cod                 | 72          | 9           | 25          | 27          | 18          | 9           | 310          |
| Pacific Halibut             | 3           | 2           | 26          | 62          | 79          | 37          | 294          |
| Greenstriped Rockfish       | 43          | 3           | 9           | 18          | 7           | 13          | 164          |
| Longnose Skate              | 12          | 0           | 33          | 15          | 8           | 18          | 160          |
| Copper Rockfish             | 4           | 36          | 11          | 25          | 10          | 16          | 121          |
| Red Irish Lord              | 0           | 1           | 1           | 21          | 3           | 0           | 74           |
| Pacific Sanddab             | 0           | 0           | 8           | 20          | 1           | 1           | 61           |
| Canary Rockfish             | 3           | 3           | 0           | 8           | 17          | 7           | 55           |
| Yellowtail Rockfish         | 13          | 1           | 3           | 1           | 5           | 2           | 54           |
| Tiger Rockfish              | 14          | 3           | 2           | 11          | 1           | 2           | 51           |
| Arrowtooth Flounder         | 1           | 0           | 8           | 8           | 13          | 0           | 35           |
| Big Skate                   | 2           | 0           | 3           | 0           | 1           | 7           | 30           |
| Southern Rock Sole          | 0           | 3           | 6           | 10          | 1           | 1           | 24           |
| Kelp Greenling              | 2           | 1           | 3           | 4           | 0           | 6           | 22           |
| Silvergray Rockfish         | 2           | 2           | 8           | 3           | 0           | 0           | 16           |
| Brown Irish Lord            | 0           | 0           | 0           | 0           | 0           | 0           | 14           |
| Great Sculpin               | 0           | 0           | 3           | 6           | 3           | 2           | 14           |
| Black Rockfish              | 0           | 0           | 0           | 0           | 0           | 0           | 12           |
| Cabazon                     | 0           | 0           | 2           | 2           | 7           | 0           | 11           |
| China Rockfish              | 1           | 0           | 0           | 0           | 0           | 0           | 10           |
| Redstripe Rockfish          | 5           | 0           | 0           | 0           | 0           | 0           | 9            |

| Species                  | 2007 | 2008 | 2010 | 2012 | 2014 | 2016 | Total |
|--------------------------|------|------|------|------|------|------|-------|
| Rosethorn Rockfish       | 3    | 0    | 0    | 0    | 0    | 0    | 6     |
| Pacific Staghorn Sculpin | 0    | 0    | 1    | 2    | 1    | 1    | 5     |
| Sandpaper Skate          | 0    | 0    | 0    | 0    | 0    | 0    | 5     |
| Buffalo Sculpin          | 0    | 0    | 0    | 5    | 0    | 0    | 5     |
| Harlequin Rockfish       | 1    | 0    | 0    | 0    | 0    | 0    | 2     |
| Sharpchin Rockfish       | 1    | 0    | 0    | 0    | 0    | 0    | 2     |
| Widow Rockfish           | 0    | 0    | 0    | 0    | 0    | 0    | 1     |
| Petrable Sole            | 0    | 0    | 0    | 1    | 0    | 0    | 1     |
| Northern Ronquil         | 0    | 0    | 0    | 1    | 0    | 0    | 1     |
| Deacon Rockfish          | 0    | 0    | 0    | 0    | 0    | 0    | 1     |
| Flathead Sole            | 0    | 0    | 1    | 0    | 0    | 0    | 1     |

#### International Pacific Halibut Commission Standardized Stock Assessment Survey

The International Pacific Halibut Commission's (IPHC) Standardized Stock Assessment (SSA) survey is a fixed-station longline survey that extends from southern Oregon to the Bering Sea. This survey serves to index Pacific Halibut (*Hippoglossus stenolepis*) abundance and provide accompanying biological samples to assess the Pacific Halibut stock. The British Columbia (regulatory area 2B) portion of this survey has been conducted annually in various configurations from 1963 to the present ([www.iphc.washington.edu](http://www.iphc.washington.edu)).

Since 2003, the IPHC has provided the opportunity to deploy an additional technician during the survey to identify the catch to species level on a hook-by-hook basis and to collect biological samples from rockfish. This information was been collected every year since 2003 except for a one-year hiatus in 2013. This program is designed to fully enumerate the non-halibut catch in the survey and collect biological samples from inshore rockfish species.

The IPHC Longline Survey was conducted by two chartered commercial hook and line vessels and together completed a total of 170 sets (Figure 7). The Pender Isle completed a total of 86 sets at the IPHC Charlotte and James stations from June 16 to July 25, 2016. The Free to Wander completed a total of 84 sets in the IPHC Goose Island, James, and Vancouver stations from July 7 to August 13, 2016.

The most common species captured during the 2016 IPHC survey was Pacific Halibut (*Hippoglossus stenolepis*), followed by North Pacific Spiny Dogfish (*Squalus suckleyi*), Sablefish (*Anoplopoma fimbria*), and Yelloweye Rockfish (*Sebastes ruberrimus*) (Table 26). Table 27 shows the breakdown by major area of the top 25 species in the survey catch while Table 28 and Table 29 show the catch of all species by each vessel. Table 30 provides an annual

summary of the total catch of the IPHC survey. Table 31 provides an annual summary of the catch landed from the IPHC survey.

During the IPHC longline survey, detailed biological samples including ageing structures are collected from rockfish in each set with a focus on inshore species. Table 32 provides an annual summary by species of the number of fish that were sampled for biological data during the IPHC Survey. A total of 2184 individual fish were sampled for biological data in 2016. On the Pender Isle, biological data were collected from a total of 896 individual fish (Table 33), while on the Free to Wander biological data were collected from a total of 1288 individual fish (Table 34).

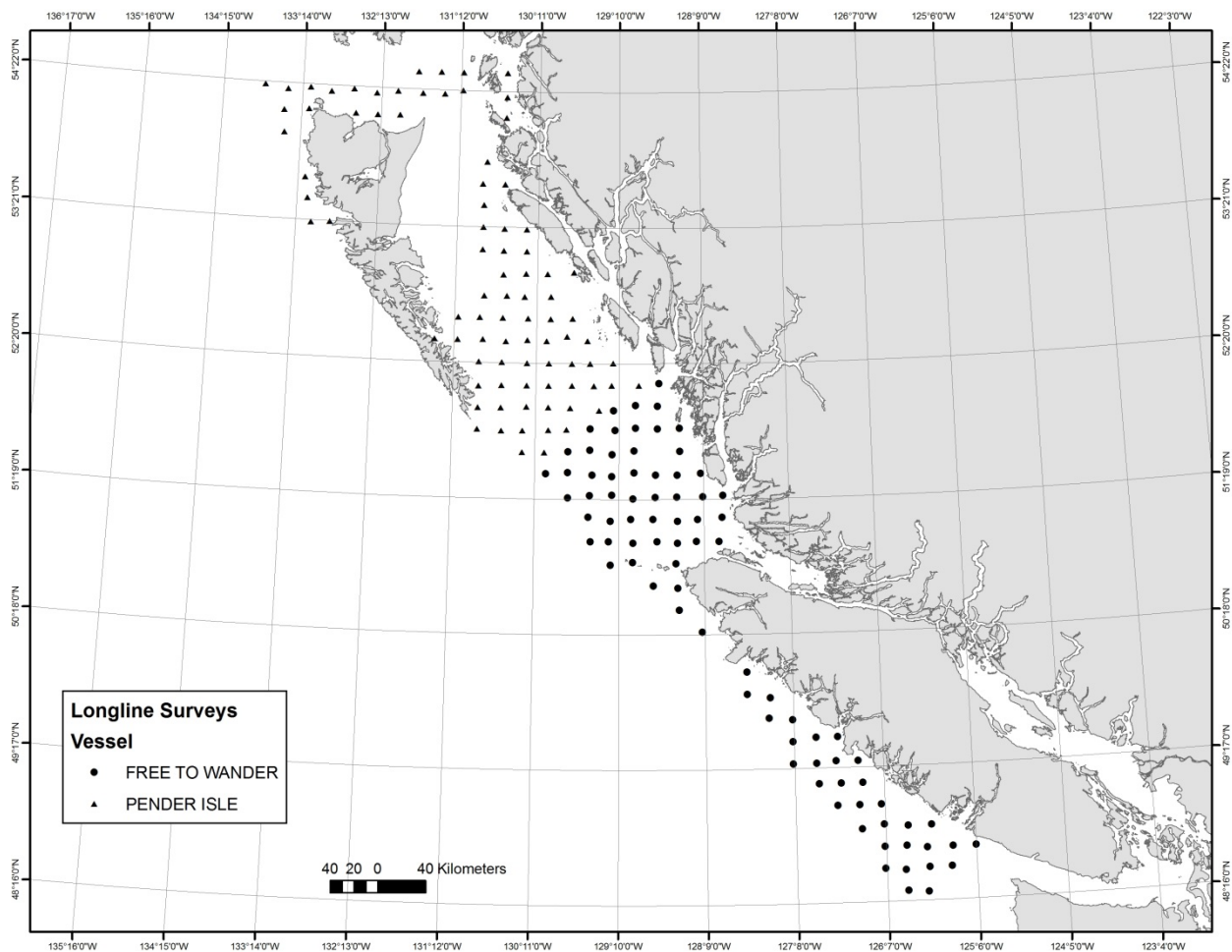


Figure 7. Longline set locations of the 2016 IPHC longline survey.

Table 26. Number of sets, catch (piece count), and proportion of the total fish caught catch of the top 25 fish species (by piece count) from the 2016 IPHC survey.

| Species | Scientific Name | Number of Sets | Catch (count) | Proportion of Total Catch (%) |
|---------|-----------------|----------------|---------------|-------------------------------|
|---------|-----------------|----------------|---------------|-------------------------------|

|                             |                                |     |      |       |
|-----------------------------|--------------------------------|-----|------|-------|
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 166 | 8135 | 39.02 |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 162 | 5563 | 26.69 |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 106 | 2404 | 11.53 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 61  | 926  | 4.44  |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 73  | 871  | 4.18  |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 97  | 830  | 3.98  |
| Longnose Skate              | <i>Raja rhina</i>              | 134 | 740  | 3.55  |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 54  | 243  | 1.17  |
| Rougheye Rockfish           | <i>Sebastes aleutianus</i>     | 17  | 178  | 0.85  |
| Big Skate                   | <i>Beringraja binocularata</i> | 56  | 141  | 0.68  |
| Quillback Rockfish          | <i>Sebastes maliger</i>        | 25  | 139  | 0.67  |
| Shortspine Thornyhead       | <i>Sebastolobus alascanus</i>  | 23  | 130  | 0.62  |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 46  | 113  | 0.54  |
| Tope Shark                  | <i>Galeorhinus galeus</i>      | 13  | 67   | 0.32  |
| Blue Shark                  | <i>Prionace glauca</i>         | 37  | 66   | 0.32  |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 25  | 60   | 0.29  |
| Spotted Ratfish             | <i>Hydrolagus coliei</i>       | 23  | 43   | 0.21  |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 20  | 39   | 0.19  |
| Aleutian Skate              | <i>Bathyraja aleutica</i>      | 15  | 36   | 0.17  |
| Shortraker Rockfish         | <i>Sebastes borealis</i>       | 5   | 31   | 0.15  |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 16  | 24   | 0.12  |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 4   | 9    | 0.04  |
| Flatfishes                  | <i>Pleuronectiformes</i>       | 5   | 8    | 0.04  |
| Bocaccio                    | <i>Sebastes paucispinis</i>    | 4   | 8    | 0.04  |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 2   | 7    | 0.03  |

Table 27. Catch (piece count) by major area for the top 25 fish species (by piece count) from the 2016 IPHC survey.

| Species         | Scientific Name                | 3C  | 3D  | 5A  | 5B   | 5C   | 5D   | 5E  |
|-----------------|--------------------------------|-----|-----|-----|------|------|------|-----|
| Pacific Halibut | <i>Hippoglossus stenolepis</i> | 429 | 866 | 920 | 2365 | 1436 | 1248 | 871 |

|                             |                               |      |     |     |      |     |     |     |
|-----------------------------|-------------------------------|------|-----|-----|------|-----|-----|-----|
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>       | 2328 | 254 | 101 | 1398 | 949 | 373 | 160 |
| Sablefish                   | <i>Anoplopoma fimbria</i>     | 345  | 298 | 183 | 626  | 462 | 223 | 267 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>    | 21   | 58  | 72  | 524  | 127 | 5   | 119 |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>      | 10   | 102 | 54  | 281  | 274 | 66  | 84  |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>    | 55   | 101 | 122 | 105  | 256 | 180 | 11  |
| Longnose Skate              | <i>Raja rhina</i>             | 83   | 80  | 60  | 203  | 100 | 133 | 81  |
| Lingcod                     | <i>Ophiodon elongatus</i>     | 17   | 99  | 37  | 24   | 33  | 2   | 31  |
| Rougheye Rockfish           | <i>Sebastes aleutianus</i>    | 2    | 1   | 3   | 54   | 0   | 17  | 101 |
| Big Skate                   | <i>Beringraja binoculata</i>  | 26   | 13  | 7   | 28   | 20  | 38  | 9   |
| Quillback Rockfish          | <i>Sebastes maliger</i>       | 49   | 12  | 10  | 16   | 32  | 2   | 18  |
| Shortspine Thornyhead       | <i>Sebastolobus alascanus</i> | 8    | 2   | 0   | 56   | 9   | 24  | 31  |
| Pacific Cod                 | <i>Gadus macrocephalus</i>    | 15   | 14  | 5   | 12   | 24  | 35  | 8   |
| Tope Shark                  | <i>Galeorhinus galeus</i>     | 53   | 11  | 0   | 3    | 0   | 0   | 0   |
| Blue Shark                  | <i>Prionace glauca</i>        | 11   | 19  | 7   | 20   | 9   | 0   | 0   |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>   | 0    | 5   | 2   | 22   | 5   | 6   | 20  |
| Spotted Ratfish             | <i>Hydrolagus collieri</i>    | 10   | 0   | 3   | 7    | 11  | 5   | 7   |
| Petrale Sole                | <i>Eopsetta jordani</i>       | 2    | 4   | 15  | 5    | 11  | 2   | 0   |
| Aleutian Skate              | <i>Bathyraja aleutica</i>     | 0    | 0   | 0   | 0    | 12  | 13  | 11  |
| Shortraker Rockfish         | <i>Sebastes borealis</i>      | 0    | 5   | 0   | 7    | 1   | 0   | 18  |
| Canary Rockfish             | <i>Sebastes pinniger</i>      | 1    | 6   | 0   | 3    | 8   | 2   | 4   |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>         | 0    | 0   | 4   | 4    | 0   | 0   | 1   |
| Flatfishes                  | <i>Pleuronectiformes</i>      | 0    | 0   | 1   | 0    | 0   | 1   | 6   |
| Bocaccio                    | <i>Sebastes paucispinis</i>   | 0    | 1   | 1   | 6    | 0   | 0   | 0   |
| China Rockfish              | <i>Sebastes nebulosus</i>     | 6    | 1   | 0   | 0    | 0   | 0   | 0   |

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Table 28. Total catch (piece count) by species for the 2016 IPHC survey sets completed by the Pender Isle.

| Species                     | Scientific Name                 | Total Catch (count) |
|-----------------------------|---------------------------------|---------------------|
| Pacific Halibut             | <i>Hippoglossus stenolepis</i>  | 4510                |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>         | 1853                |
| Sablefish                   | <i>Anoplopoma fimbria</i>       | 1185                |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>      | 552                 |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>        | 480                 |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>      | 468                 |
| Longnose Skate              | <i>Raja rhina</i>               | 389                 |
| Rougheye Rockfish           | <i>Sebastes aleutianus</i>      | 142                 |
| Shortspine Thornyhead       | <i>Sebastolobus alascanus</i>   | 95                  |
| Lingcod                     | <i>Ophiodon elongatus</i>       | 77                  |
| Pacific Cod                 | <i>Gadus macrocephalus</i>      | 73                  |
| Big Skate                   | <i>Beringraja binoculata</i>    | 71                  |
| Quillback Rockfish          | <i>Sebastes maliger</i>         | 52                  |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>     | 49                  |
| Aleutian Skate              | <i>Bathyraja aleutica</i>       | 36                  |
| Spotted Ratfish             | <i>Hydrolagus colliei</i>       | 26                  |
|                             | <i>Anthozoa</i>                 | 25                  |
| Fish-eating Star            | <i>Stylasterias forreri</i>     | 24                  |
| Shortraker Rockfish         | <i>Sebastes borealis</i>        | 19                  |
| Blue Shark                  | <i>Prionace glauca</i>          | 17                  |
| Canary Rockfish             | <i>Sebastes pinniger</i>        | 14                  |
| Petrale Sole                | <i>Eopsetta jordani</i>         | 13                  |
| Scallop                     | <i>Pectinidae</i>               | 11                  |
| Starfish                    | <i>Asteroidea</i>               | 11                  |
| Sunflower Starfish          | <i>Pycnopodia helianthoides</i> | 11                  |
| Anemone                     | <i>Actiniaria</i>               | 11                  |
| Basket Stars                | <i>Euryalina</i>                | 8                   |

| Species                 | Scientific Name                  | Total Catch (count) |
|-------------------------|----------------------------------|---------------------|
| Flatfishes              | <i>Pleuronectiformes</i>         | 7                   |
| Sponges                 | <i>Porifera</i>                  | 7                   |
| Bocaccio                | <i>Sebastes paucispinis</i>      | 6                   |
| Yellowmouth Rockfish    | <i>Sebastes reedi</i>            | 4                   |
|                         | <i>Radiata</i>                   | 4                   |
| Pacific Sleeper Shark   | <i>Somniosus pacificus</i>       | 4                   |
| Sandpaper Skate         | <i>Bathyraja interrupta</i>      | 3                   |
| Sea Urchins             | <i>Echinacea</i>                 | 3                   |
| Octopus                 | <i>Octopoda</i>                  | 3                   |
| Giant Wrymouth          | <i>Cryptacanthodes giganteus</i> | 2                   |
| Bluntnose Sixgill Shark | <i>Hexanchus griseus</i>         | 2                   |
| Sea Pens                | <i>Pennatulacea</i>              | 2                   |
| Copper Rockfish         | <i>Sebastes caurinus</i>         | 2                   |
| Skates                  | <i>Rajidae</i>                   | 1                   |
| Inanimate Object(s)     | <i>Inanimate object(s)</i>       | 1                   |
| Pacific Hagfish         | <i>Eptatretus stoutii</i>        | 1                   |
| Glass Sponges           | <i>Hexactinellida</i>            | 1                   |
| Walleye Pollock         | <i>Gadus chalcogrammus</i>       | 1                   |
| Sleeper Sharks          | <i>Somniosidae</i>               | 1                   |

Table 29. Total catch (piece count) by species for the 2016 IPHC Survey sets completed by the Free to Wander.

| Species                     | Scientific Name                | Total Catch (count) |
|-----------------------------|--------------------------------|---------------------|
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>        | 3710                |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i> | 3625                |
| Sablefish                   | <i>Anoplopoma fimbria</i>      | 1219                |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>       | 391                 |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>     | 374                 |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>     | 362                 |
| Longnose Skate              | <i>Raja rhina</i>              | 351                 |
| Lingcod                     | <i>Ophiodon elongatus</i>      | 166                 |
| Quillback Rockfish          | <i>Sebastes maliger</i>        | 87                  |
| Big Skate                   | <i>Beringraja binoculata</i>   | 70                  |
| Tope Shark                  | <i>Galeorhinus galeus</i>      | 67                  |
| Blue Shark                  | <i>Prionace glauca</i>         | 49                  |
| Pacific Cod                 | <i>Gadus macrocephalus</i>     | 40                  |
| Rougheye Rockfish           | <i>Sebastes aleutianus</i>     | 36                  |
| Shortspine Thornyhead       | <i>Sebastolobus alascanus</i>  | 35                  |
| Petrale Sole                | <i>Eopsetta jordani</i>        | 26                  |
| Fish-eating Star            | <i>Stylasterias forreri</i>    | 24                  |
| Spotted Ratfish             | <i>Hydrolagus colliei</i>      | 17                  |
| Shortraker Rockfish         | <i>Sebastes borealis</i>       | 12                  |
| Silvergray Rockfish         | <i>Sebastes brevispinis</i>    | 11                  |
| Canary Rockfish             | <i>Sebastes pinniger</i>       | 10                  |
| Anemone                     | <i>Actiniaria</i>              | 10                  |
| Inanimate Object(s)         | <i>Inanimate object(s)</i>     | 8                   |
| China Rockfish              | <i>Sebastes nebulosus</i>      | 7                   |
| Octopus                     | <i>Octopoda</i>                | 6                   |
| Basket Stars                | <i>Euryalina</i>               | 5                   |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>          | 5                   |

| Species                 | Scientific Name                | Total Catch (count) |
|-------------------------|--------------------------------|---------------------|
|                         | <i>Radiata</i>                 | 4                   |
| Sea Urchins             | <i>Echinacea</i>               | 4                   |
| Thornyheads             | <i>Sebastobinae</i>            | 3                   |
| Starfish                | <i>Asteroidea</i>              | 3                   |
| Bocaccio                | <i>Sebastes paucispinis</i>    | 2                   |
| Wolf Eel                | <i>Anarrhichthys ocellatus</i> | 2                   |
|                         | <i>Anthozoa</i>                | 2                   |
| Copper Rockfish         | <i>Sebastes caurinus</i>       | 2                   |
| Southern Rock Sole      | <i>Lepidopsetta bilineata</i>  | 2                   |
| Dover Sole              | <i>Microstomus pacificus</i>   | 1                   |
| Scallop                 | <i>Pectinidae</i>              | 1                   |
| Greenstriped Rockfish   | <i>Sebastes elongatus</i>      | 1                   |
|                         | <i>Bryozoa</i>                 | 1                   |
| Walleye Pollock         | <i>Gadus chalcogrammus</i>     | 1                   |
| Sponges                 | <i>Porifera</i>                | 1                   |
| Bluntnose Sixgill Shark | <i>Hexanchus griseus</i>       | 1                   |
| Pacific Sleeper Shark   | <i>Somniosus pacificus</i>     | 1                   |
| Sandpaper Skate         | <i>Bathyraja interrupta</i>    | 1                   |
| Vermilion Rockfish      | <i>Sebastes miniatus</i>       | 1                   |
| Tiger Rockfish          | <i>Sebastes nigrocinctus</i>   | 1                   |
| Pacific Sanddab         | <i>Citharichthys sordidus</i>  | 1                   |
| Flatfishes              | <i>Pleuronectiformes</i>       | 1                   |

Table 30. Annual summary of the total catch (piece count) for the top 25 species (by total piece count over all years) for the IPHC Survey.

| Species                     | 2003  | 2004  | 2005  | 2006  | 2007  | 2008 | 2009  | 2010  | 2011  | 2012 | 2014 | 2015  | 2016 | Total  |
|-----------------------------|-------|-------|-------|-------|-------|------|-------|-------|-------|------|------|-------|------|--------|
| North Pacific Spiny Dogfish | 14166 | 11814 | 15114 | 13984 | 12952 | 8854 | 19112 | 17562 | 12847 | 7985 | 8938 | 6617  | 5563 | 155508 |
| Pacific Halibut             | 7101  | 8570  | 7075  | 5567  | 4912  | 6901 | 9308  | 10784 | 6487  | 8480 | 9642 | 10268 | 8135 | 103230 |
| Sablefish                   | 4169  | 5610  | 5033  | 3000  | 2020  | 2360 | 3342  | 4077  | 2648  | 1933 | 1716 | 2444  | 2404 | 40756  |
| Arrowtooth Flounder         | 1381  | 2135  | 1671  | 1060  | 724   | 1109 | 1910  | 2014  | 1238  | 981  | 910  | 896   | 830  | 16859  |
| Redbanded Rockfish          | 1309  | 2013  | 1597  | 1285  | 739   | 1157 | 1946  | 1625  | 973   | 848  | 939  | 597   | 871  | 15899  |
| Yelloweye Rockfish          | 1225  | 1545  | 1174  | 1005  | 693   | 840  | 1371  | 1744  | 955   | 877  | 716  | 708   | 926  | 13779  |
| Longnose Skate              | 926   | 1147  | 1011  | 795   | 645   | 781  | 1243  | 1385  | 922   | 1008 | 1161 | 1086  | 740  | 12850  |
| Lingcod                     | 263   | 308   | 201   | 375   | 335   | 411  | 504   | 324   | 237   | 311  | 321  | 324   | 243  | 4157   |
| Rougheye Rockfish           | 287   | 474   | 541   | 216   | 121   | 279  | 346   | 159   | 229   | 156  | 190  | 139   | 178  | 3315   |
| Quillback Rockfish          | 156   | 144   | 300   | 198   | 122   | 88   | 182   | 251   | 182   | 114  | 155  | 188   | 139  | 2219   |
| Big Skate                   | 222   | 256   | 236   | 159   | 102   | 95   | 116   | 221   | 202   | 150  | 201  | 109   | 141  | 2210   |
| Pacific Cod                 | 80    | 333   | 253   | 162   | 62    | 52   | 98    | 149   | 269   | 117  | 248  | 260   | 113  | 2196   |
| Shortspine Thornyhead       | 202   | 190   | 216   | 152   | 59    | 92   | 157   | 171   | 13    | 61   | 52   | 14    | 130  | 1509   |
| Silvergray Rockfish         | 62    | 68    | 109   | 155   | 65    | 140  | 78    | 87    | 118   | 63   | 70   | 35    | 60   | 1110   |
| Spotted Ratfish             | 58    | 47    | 98    | 100   | 32    | 46   | 36    | 34    | 77    | 52   | 71   | 57    | 43   | 751    |
| Canary Rockfish             | 19    | 25    | 69    | 63    | 21    | 43   | 70    | 35    | 34    | 19   | 36   | 34    | 24   | 492    |
| Shortraker Rockfish         | 33    | 27    | 30    | 17    | 44    | 18   | 152   | 17    | 16    | 12   | 42   | 19    | 31   | 458    |
| Unknown Fish                | 2     | 0     | 0     | 420   | 0     | 0    | 0     | 1     | 2     | 0    | 0    | 0     | 0    | 425    |

| <b>Species</b>        | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>Total</b> |
|-----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Blue Shark            | 19          | 125         | 12          | 0           | 3           | 1           | 8           | 15          | 0           | 14          | 24          | 57          | 66          | 344          |
| Thornyheads           | 0           | 0           | 0           | 0           | 15          | 17          | 0           | 1           | 108         | 30          | 60          | 91          | 3           | 325          |
| Tope Shark            | 5           | 30          | 17          | 2           | 2           | 11          | 16          | 25          | 9           | 3           | 18          | 87          | 67          | 292          |
| Petrale Sole          | 10          | 27          | 18          | 16          | 14          | 14          | 16          | 19          | 35          | 19          | 25          | 29          | 39          | 281          |
| Bocaccio              | 19          | 32          | 16          | 37          | 15          | 32          | 24          | 15          | 23          | 14          | 13          | 10          | 8           | 258          |
| Aleutian Skate        | 0           | 0           | 0           | 12          | 16          | 19          | 8           | 19          | 14          | 20          | 34          | 22          | 36          | 200          |
| Pacific Sleeper Shark | 8           | 21          | 5           | 7           | 9           | 5           | 9           | 5           | 3           | 2           | 3           | 3           | 5           | 85           |

Table 31. Annual summary of the total landed weight (1000 kg) by species for the IPHC Survey. Data from 2003 are not included as the landings records are not available in the FOS database.

| Species               | 2004  | 2005  | 2006 | 2007  | 2008  | 2009  | 2010  | 2011 | 2012  | 2013 | 2014  | 2015  | 2016  | Total |
|-----------------------|-------|-------|------|-------|-------|-------|-------|------|-------|------|-------|-------|-------|-------|
| Pacific Halibut       | 34.04 | 37.62 | 24.7 | 18.22 | 32.59 | 45.09 | 55.19 | 36.3 | 49.44 | 0    | 48.12 | 48.01 | 40.84 | 488.4 |
| Yelloweye Rockfish    | 5.55  | 4.04  | 3.3  | 1.89  | 2.8   | 4.54  | 5.93  | 3.14 | 3.06  | 0    | 2.41  | 2.52  | 3.31  | 45.53 |
| Redbanded Rockfish    | 4.92  | 3.84  | 3.07 | 1.47  | 2.77  | 4.49  | 3.7   | 2.23 | 2.01  | 0    | 2.16  | 1.36  | 2     | 36.68 |
| Sablefish             | 6.74  | 0     | 1.14 | 0     | 2.28  | 0     | 0     | 1.85 | 2.13  | 0    | 2.28  | 0     | 0     | 16.92 |
| Rougeye Rockfish      | 0.97  | 1.16  | 0.47 | 0.23  | 0.61  | 1     | 0.34  | 0.46 | 0.31  | 0    | 0.4   | 0.27  | 0.39  | 7.1   |
| Pacific Cod           | 0.63  | 0.45  | 0.09 | 0.17  | 0.09  | 0.1   | 0.3   | 0.46 | 0.2   | 0    | 0.2   | 0.11  | 0.16  | 3.08  |
| Quillback Rockfish    | 0.17  | 0.36  | 0.24 | 0.15  | 0.11  | 0.22  | 0.29  | 0.23 | 0.14  | 0    | 0.19  | 0.21  | 0.16  | 2.56  |
| Silvergray Rockfish   | 0.17  | 0.24  | 0.35 | 0.1   | 0.3   | 0.17  | 0.19  | 0.25 | 0.13  | 0    | 0.15  | 0.07  | 0.13  | 2.35  |
| Shortraker Rockfish   | 0.18  | 0.16  | 0.06 | 0.16  | 0.06  | 0.26  | 0.09  | 0.08 | 0.1   | 0    | 0.25  | 0.15  | 0.22  | 2.05  |
| Shortspine Thornyhead | 0.23  | 0.32  | 0.2  | 0.09  | 0.17  | 0.25  | 0.25  | 0.24 | 0     | 0    | 0     | 0     | 0     | 2.04  |
| Bocaccio              | 0.11  | 0.07  | 0.16 | 0.04  | 0.11  | 0.1   | 0.06  | 0.09 | 0.06  | 0    | 0.05  | 0.04  | 0.03  | 1     |
| Canary Rockfish       | 0.05  | 0.12  | 0.12 | 0.04  | 0.08  | 0.13  | 0.07  | 0.06 | 0.04  | 0    | 0.07  | 0.06  | 0.05  | 0.89  |
| Lingcod               | 0.1   | 0     | 0    | 0     | 0     | 0     | 0     | 0    | 0     | 0    | 0     | 0     | 0     | 0.1   |
| Yellowmouth Rockfish  | 0.01  | 0.02  | 0    | 0     | 0.01  | 0.01  | 0     | 0.01 | 0.01  | 0    | 0     | 0.01  | 0.01  | 0.1   |
| China Rockfish        | 0     | 0.01  | 0    | 0.01  | 0.01  | 0.01  | 0     | 0.01 | 0     | 0    | 0     | 0     | 0.01  | 0.05  |
| Copper Rockfish       | 0.01  | 0     | 0    | 0     | 0.01  | 0     | 0     | 0    | 0.01  | 0    | 0     | 0     | 0     | 0.04  |
| Yellowtail Rockfish   | 0.01  | 0.01  | 0    | 0     | 0     | 0     | 0     | 0    | 0     | 0    | 0     | 0.01  | 0     | 0.03  |
| Vermilion Rockfish    | 0     | 0     | 0.01 | 0     | 0     | 0.01  | 0     | 0    | 0     | 0    | 0     | 0.01  | 0     | 0.02  |

[illegible]



Table 32. Annual summary of the number of fish sampled for biological data during the IPHC Survey.

| <b>Species</b>              | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>Total</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Redbanded Rockfish          | 866         | 1312        | 1379        | 1201        | 712         | 1130        | 1889        | 1598        | 971         | 843         | 927         | 582         | 823         | 14233        |
| Yelloweye Rockfish          | 838         | 1240        | 1065        | 958         | 682         | 832         | 1349        | 1727        | 950         | 878         | 711         | 699         | 926         | 12855        |
| Sablefish                   | 2216        | 2917        | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 5133         |
| Rougheye Rockfish           | 102         | 292         | 525         | 210         | 112         | 277         | 368         | 149         | 230         | 154         | 179         | 131         | 164         | 2893         |
| Quillback Rockfish          | 115         | 133         | 234         | 186         | 119         | 86          | 177         | 246         | 179         | 112         | 150         | 177         | 128         | 2042         |
| Silvergray Rockfish         | 21          | 24          | 47          | 141         | 60          | 136         | 77          | 87          | 114         | 57          | 67          | 32          | 56          | 919          |
| North Pacific Spiny Dogfish | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 485         | 0           | 0           | 0           | 0           | 485          |
| Shortspine Thornyhead       | 0           | 120         | 151         | 136         | 0           | 0           | 0           | 75          | 0           | 0           | 0           | 0           | 0           | 482          |
| Canary Rockfish             | 5           | 19          | 39          | 60          | 15          | 43          | 65          | 33          | 32          | 17          | 35          | 32          | 22          | 417          |
| Shortraker Rockfish         | 15          | 10          | 29          | 16          | 44          | 16          | 116         | 19          | 15          | 12          | 40          | 18          | 30          | 380          |
| Bocaccio                    | 4           | 14          | 7           | 33          | 13          | 31          | 24          | 14          | 23          | 14          | 11          | 10          | 8           | 206          |
| Yellowmouth Rockfish        | 0           | 2           | 2           | 3           | 9           | 6           | 12          | 4           | 5           | 3           | 4           | 5           | 9           | 64           |
| China Rockfish              | 1           | 5           | 6           | 0           | 8           | 9           | 6           | 1           | 5           | 2           | 2           | 3           | 7           | 55           |
| Copper Rockfish             | 0           | 5           | 2           | 0           | 0           | 6           | 2           | 4           | 4           | 12          | 0           | 1           | 4           | 40           |
| Greenstriped Rockfish       | 0           | 8           | 2           | 2           | 2           | 2           | 2           | 2           | 5           | 2           | 2           | 1           | 1           | 31           |
| Blackspotted Rockfish       | 0           | 0           | 0           | 0           | 0           | 0           | 24          | 0           | 0           | 0           | 0           | 0           | 0           | 24           |
| Yellowtail Rockfish         | 0           | 5           | 4           | 4           | 1           | 0           | 0           | 1           | 2           | 0           | 1           | 2           | 0           | 20           |
| Rosethorn Rockfish          | 0           | 0           | 0           | 0           | 1           | 3           | 1           | 1           | 2           | 3           | 4           | 2           | 0           | 17           |
| Vermilion Rockfish          | 0           | 0           | 0           | 2           | 0           | 0           | 0           | 0           | 0           | 0           | 1           | 2           | 1           | 6            |

[illegible]

Table 33. Number of fish sampled for biological data during the 2016 IPHC Survey on the Pender Isle showing the number of lengths and age structures that were collected by species.

| Species              | Scientific Name             | Lengths Collected | Age Structures Collected |
|----------------------|-----------------------------|-------------------|--------------------------|
| Blue Shark           | <i>Prionace glauca</i>      | 2                 | 0                        |
| Bocaccio             | <i>Sebastes paucispinis</i> | 6                 | 6                        |
| Canary Rockfish      | <i>Sebastes pinniger</i>    | 13                | 13                       |
| Copper Rockfish      | <i>Sebastes caurinus</i>    | 2                 | 2                        |
| Quillback Rockfish   | <i>Sebastes maliger</i>     | 47                | 47                       |
| Redbanded Rockfish   | <i>Sebastes babcocki</i>    | 469               | 468                      |
| Rougheye Rockfish    | <i>Sebastes aleutianus</i>  | 135               | 111                      |
| Shortraker Rockfish  | <i>Sebastes borealis</i>    | 18                | 1                        |
| Silvergray Rockfish  | <i>Sebastes brevispinis</i> | 48                | 47                       |
| Sleeper Sharks       | <i>Somniosidae</i>          | 2                 | 0                        |
| Yelloweye Rockfish   | <i>Sebastes ruberrimus</i>  | 542               | 544                      |
| Yellowmouth Rockfish | <i>Sebastes reedi</i>       | 4                 | 4                        |

Table 34. Number of fish sampled for biological data during the 2016 IPHC Survey on the Free to Wander showing the number of lengths and age structures that were collected by species.

| <b>Species</b>        | <b>Scientific Name</b>       | <b>Lengths<br/>Collected</b> | <b>Age Structures<br/>Collected</b> |
|-----------------------|------------------------------|------------------------------|-------------------------------------|
| Bocaccio              | <i>Sebastes paucispinis</i>  | 2                            | 2                                   |
| Canary Rockfish       | <i>Sebastes pinniger</i>     | 9                            | 9                                   |
| China Rockfish        | <i>Sebastes nebulosus</i>    | 7                            | 7                                   |
| Copper Rockfish       | <i>Sebastes caurinus</i>     | 2                            | 2                                   |
| Greenstriped Rockfish | <i>Sebastes elongatus</i>    | 1                            | 1                                   |
| Quillback Rockfish    | <i>Sebastes maliger</i>      | 81                           | 80                                  |
| Redbanded Rockfish    | <i>Sebastes babcocki</i>     | 354                          | 353                                 |
| Rougheye Rockfish     | <i>Sebastes aleutianus</i>   | 29                           | 29                                  |
| Shortraker Rockfish   | <i>Sebastes borealis</i>     | 12                           | 12                                  |
| Silvergray Rockfish   | <i>Sebastes brevispinis</i>  | 8                            | 8                                   |
| Tiger Rockfish        | <i>Sebastes nigrocinctus</i> | 1                            | 1                                   |
| Vermilion Rockfish    | <i>Sebastes miniatus</i>     | 1                            | 1                                   |
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>   | 384                          | 328                                 |
| Yellowmouth Rockfish  | <i>Sebastes reedi</i>        | 5                            | 5                                   |

## Sablefish Research and Assessment Survey

Fisheries and Oceans Canada, in collaboration with the commercial sablefish industry, initiated an annual research and assessment survey of British Columbia Sablefish in 1988. Each year, fishing is conducted at selected localities using trap gear consistent with the commercial fishery. The fishing protocol was refined over the first few years of the survey and was standardized beginning in 1990. These standardized sets were intended to track trends in abundance and biological characteristics at the survey localities. We refer to these sets as the Traditional Standardized Program. Sablefish from standardized sets were tagged and released beginning in 1991. Then, in 1994, sets with the sole purpose of capturing Sablefish for tag and release were added at the existing localities. We refer to these sets as the Traditional Tagging Program. Also in 1994, sets were made in selected mainland inlet localities. In 1995, additional offshore localities were added specifically for tagging sets. The Traditional Tagging Program has not been conducted since 2007 and the Traditional Standardized Program has not been conducted since 2010.

A pilot stratified random design was introduced for the 2003 survey with the dual purposes of random release of tagged fish and development of a second stock abundance index. The offshore survey area was divided into five spatial strata (Figure 8). Each spatial stratum was further divided into 2 km by 2 km blocks and each block was assigned to one three depth strata. Each year, blocks are randomly selected within each combination of spatial and depth strata. From 2003 through 2010, the selected blocks were allocated equally among the strata. An analysis was conducted for the 2011 survey to estimate the optimal allocation of blocks and that allocation was used in both 2011 and 2012. In 2013 the number of blocks in the survey was reduced in an effort to reduce the overall cost of the survey. The allocation from 2013 has been used for all subsequent surveys and will be used again in 2016.

The 2016 Sablefish research and assessment survey was comprised of two main components:

**A Randomized Tagging Program** that releases tagged Sablefish at randomly selected fishing locations in offshore waters. These sets also produce a time series of catch rate and biological data that can be used for assessing changes in stock abundance.

**An Inlets Program** that releases tagged Sablefish from fixed-stations at four mainland inlet localities (Figure 9). These sets also provide a time series of catch rate and biological data that can be used for assessing changes in stock abundance.

In addition to the main survey programs, the Sablefish Research and Assessment Survey included a Bottom Contact Research Project to investigate gear interaction with the substrate. Autonomous, trap-mounted cameras captured high definition video of benthic substrate type, gear interaction with the substrate, and biological communities. In addition, trap-mounted accelerometers recorded motion and orientation of the traps. Oceanographic data from trap-mounted recorders including temperature, depth, salinity and dissolved oxygen were also recorded.

The 2016 Sablefish Research and Assessment Survey was conducted on the Ocean Pearl from October 7 to November 22, 2016. A total of 111 sets were completed (Error: Reference source not found) including 91 Randomized Tagging Program sets (Table 35) and 20 Inlets Program sets (Table 36).

A total of six different DFO staff persons and four contract science staff from Archipelago Marine Research participated in the survey. The total catch of the survey was 67,166 kg (Table 37) and the average catch per set was 605 kg. The most abundant fish species encountered by weight were Sablefish (*Anoplopoma fimbria*), followed by Pacific Halibut (*Hippoglossus stenolepis*), North Pacific Spiny Dogfish (*Squalus suckleyi*), and Lingcod (*Ophiodon elongatus*). The number of sets where the species was captured as well as the total catch count, proportion of the total catch, and a breakdown by area for the 25 most abundant species are shown in Table 38. An annual summary of catch for common species are shown for the Randomized Tagging Program in Table 39 and in for the Inlet Program. Biological data, including individual length, weight, sex, maturity, and age structure were collected from a total of 13583 individual fish of 7 different species (). An annual summary of the number of fish sampled for biological data during the Randomized Tagging Program is shown in Table 42 and in Table 42 for the Inlets Program.

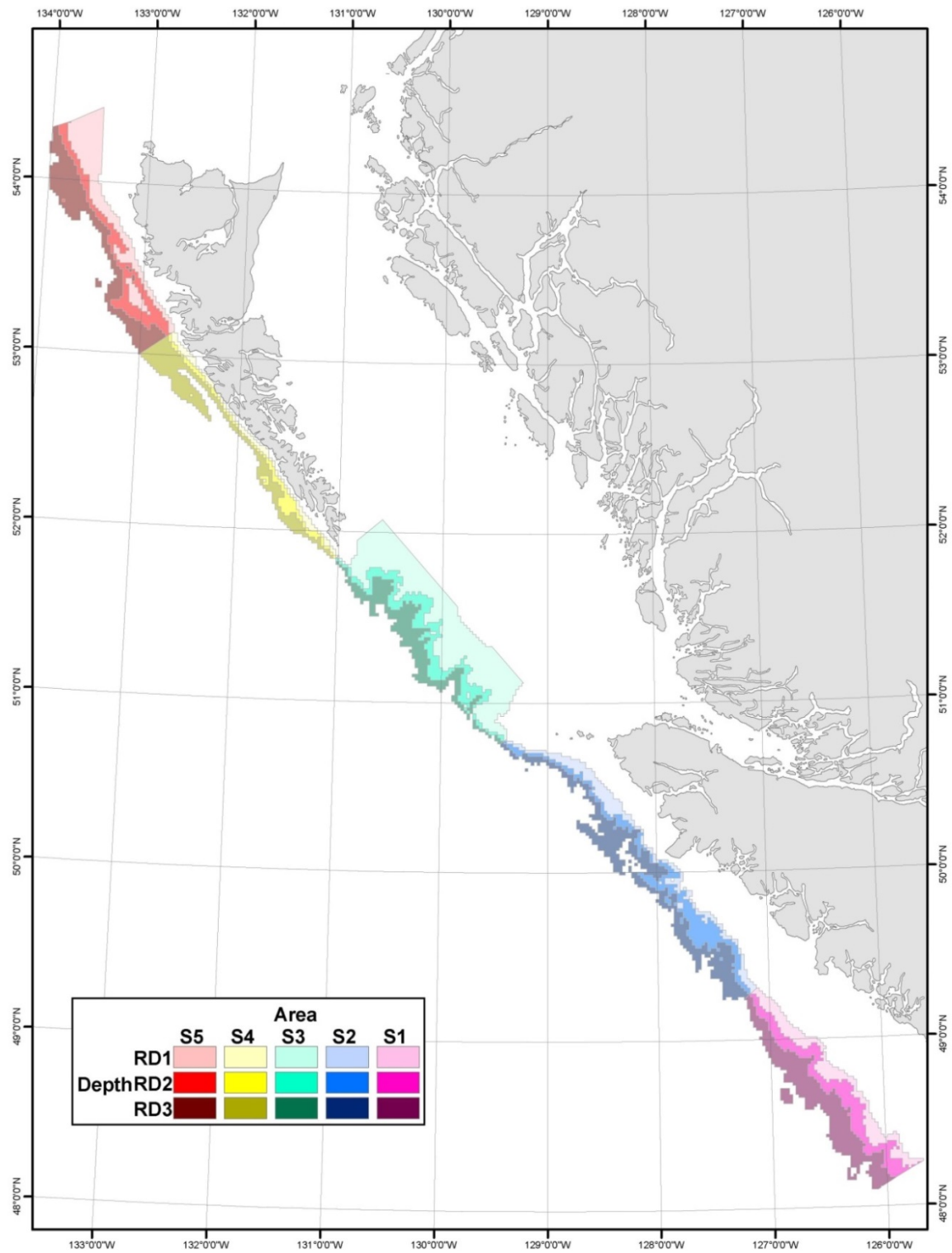


Figure 8. Sablefish Research and Assessment Survey randomized tagging program design showing the boundaries of each of the spatial and depth strata.

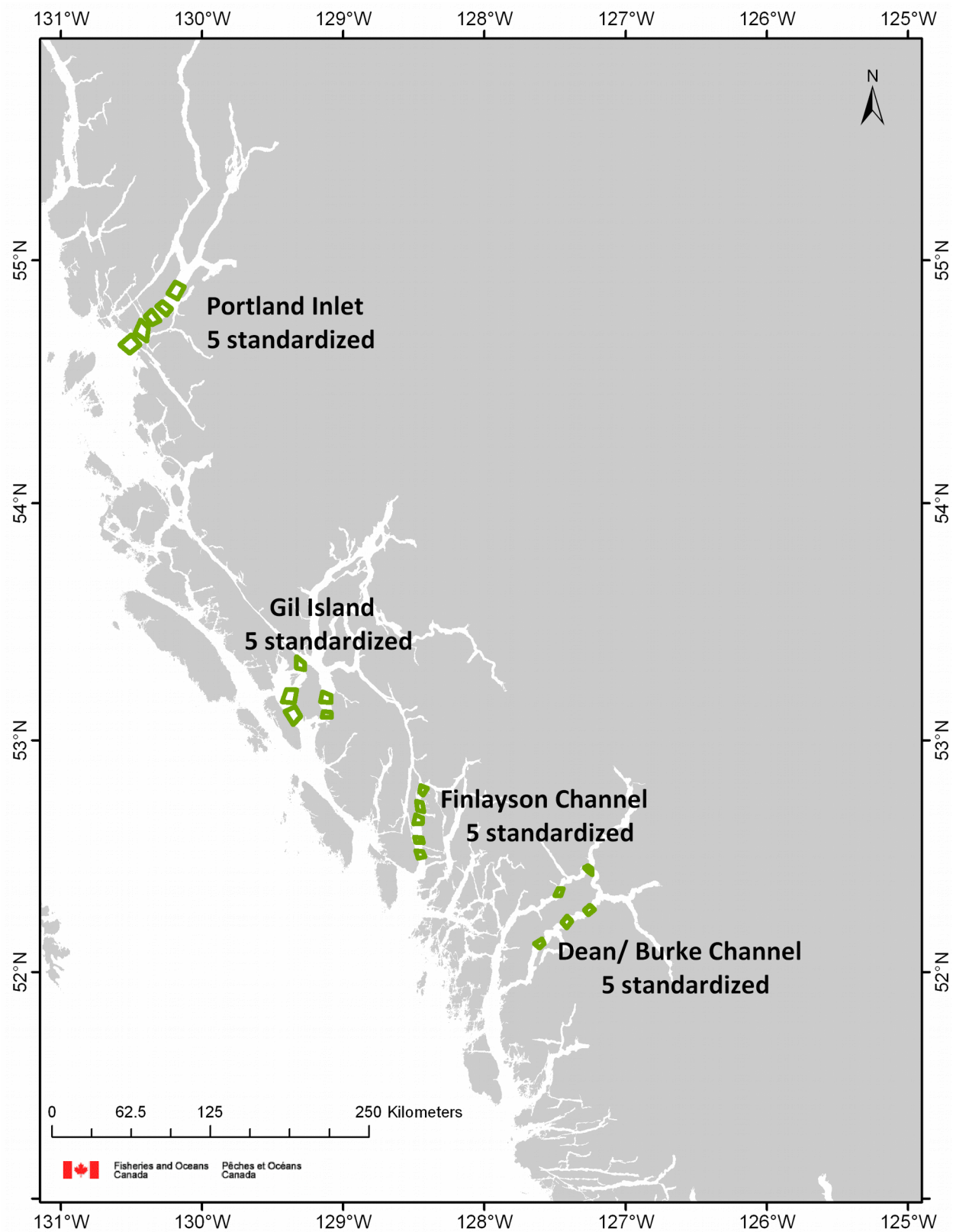


Figure 9. Sablefish Research and Assessment Survey Inlets program locations.



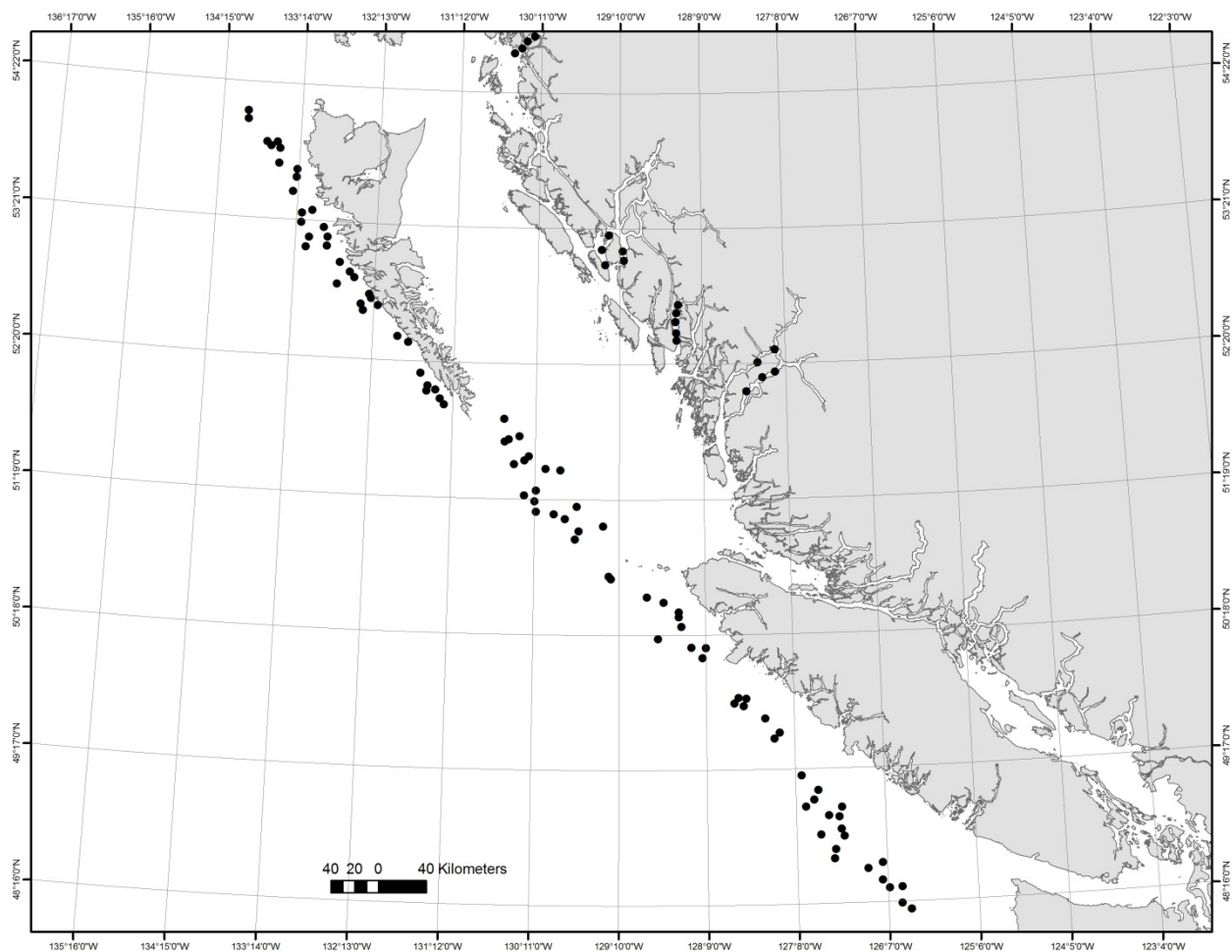


Figure 10. Set locations of the 2016 Sablefish Research and Assessment Survey.

Table 35. Summary of sets made during the 2016 Sablefish Randomized Tagging Program showing the number of sets in each combination of spatial and depth strata.

| Spatial Strata                                  | Depth Strata        |                     |                  | Total     |
|-------------------------------------------------|---------------------|---------------------|------------------|-----------|
|                                                 | RD1<br>(100-250 fm) | RD2<br>(250-450 fm) | RD3<br>(450-750) |           |
| S1 (South West Coast Vancouver Island or SWCVI) | 6                   | 8                   | 5                | 19        |
| S2 (North West Coast Vancouver Island or NWCVI) | 6                   | 7                   | 5                | 18        |
| S3 (Queen Charlotte Sound or QCS)               | 8                   | 6                   | 5                | 19        |
| S4 (South West Coast Haida Gwaii or SWCHG)      | 6                   | 6                   | 5                | 17        |
| S5 (North West Coast Haida Gwaii or NWCHG)      | 6                   | 7                   | 5                | 18        |
| <b>Total</b>                                    | <b>32</b>           | <b>34</b>           | <b>25</b>        | <b>91</b> |

Table 36. Summary of sets made during the 2016 Sablefish Inlets Program.

| Location           | Number of sets |
|--------------------|----------------|
| Dean/Burke Channel | 5              |
| Finlayson Channel  | 5              |
| Gil Island         | 5              |
| Portland Inlet     | 5              |

Table 37. Total catch for the top 35 species (by weight) captured during the 2016 Sablefish Research and Assessment Survey.

| Species                     | Scientific Name                 | Total Catch (count) | Total Catch (kg) |
|-----------------------------|---------------------------------|---------------------|------------------|
| Sablefish                   | <i>Anoplopoma fimbria</i>       | 23123               | 55575            |
| Pacific Halibut             | <i>Hippoglossus stenolepis</i>  | 526                 | 3870             |
| North Pacific Spiny Dogfish | <i>Squalus suckleyi</i>         | 713                 | 2014             |
| Lingcod                     | <i>Ophiodon elongatus</i>       | 154                 | 1558             |
| Arrowtooth Flounder         | <i>Atheresthes stomias</i>      | 451                 | 899              |
| Rougheye Rockfish           | <i>Sebastes aleutianus</i>      | 387                 | 659              |
| Pacific Grenadier           | <i>Coryphaenoides acrolepis</i> | 627                 | 575              |
| Yelloweye Rockfish          | <i>Sebastes ruberrimus</i>      | 97                  | 346              |
| Redbanded Rockfish          | <i>Sebastes babcocki</i>        | 217                 | 345              |
| Giant Grenadier             | <i>Albatrossia pectoralis</i>   | 72                  | 288              |
| Shortraker Rockfish         | <i>Sebastes borealis</i>        | 59                  | 276              |
| Grooved Tanner Crab         | <i>Chionoecetes tanneri</i>     | 539                 | 260              |
| Pacific Sleeper Shark       | <i>Somniosus pacificus</i>      | 2                   | 225              |
| Shortspine Thornyhead       | <i>Sebastolobus alascanus</i>   | 60                  | 85               |
| NULL                        | <i>Paralomis multispina</i>     | 65                  | 31               |
| Dover Sole                  | <i>Microstomus pacificus</i>    | 24                  | 29               |
| NULL                        | <i>Lithodes couesi</i>          | 45                  | 26               |
| Yellowmouth Rockfish        | <i>Sebastes reedi</i>           | 9                   | 12               |
| Fragile Urchin              | <i>Allocentrotus fragilis</i>   | 93                  | 12               |
| Pacific Flatnose            | <i>Antimora microlepis</i>      | 10                  | 12               |
| Bocaccio                    | <i>Sebastes paucispinis</i>     | 1                   | 7                |
| Canary Rockfish             | <i>Sebastes pinniger</i>        | 2                   | 5                |
| Jellyfish                   | <i>Scyphozoa</i>                |                     | 5                |
| Rosethorn Rockfish          | <i>Sebastes helvomaculatus</i>  | 15                  | 5                |
| Pink Snailfish              | <i>Paraliparis rosaceus</i>     | 9                   | 4                |
| Rockfishes                  | <i>Sebastes</i>                 | 3                   | 3                |
| Anemone                     | <i>Actiniaria</i>               | 3                   | 3                |

| Species               | Scientific Name                  | Total Catch (count) | Total Catch (kg) |
|-----------------------|----------------------------------|---------------------|------------------|
| Longspine Thornyhead  | <i>Sebastolobus altivelis</i>    | 17                  | 3                |
| Golden King Crab      | <i>Lithodes aequispinus</i>      | 4                   | 3                |
| Giant Pacific Octopus | <i>Enteroctopus dofleini</i>     | 3                   | 2                |
| Oregontriton          | <i>Fusitriton oregonensis</i>    | 44                  | 2                |
| Walleye Pollock       | <i>Gadus chalcogrammus</i>       | 2                   | 2                |
| Brown Box Crab        | <i>Lopholithodes foraminatus</i> | 2                   | 2                |
| Pacific Cod           | <i>Gadus macrocephalus</i>       | 1                   | 1                |
| Spotted Ratfish       | <i>Hydrolagus colliei</i>        | 1                   | 1                |

Table 38. Number of sets where the species was captured, total catch count, proportion of the total catch, and a breakdown by area for the 25 most abundant species (by weight) captured during the 2016 Sablefish Research and Assessment Survey.

| Species                     | Number of Sets | Catch (count) | Proportion of Total Catch (%) | 4B | 3C   | 3D   | 5A   | 5B   | 5C   | 5D   | 5E   |
|-----------------------------|----------------|---------------|-------------------------------|----|------|------|------|------|------|------|------|
| Sablefish                   | 110            | 23123         | 86.97                         | 0  | 5022 | 3652 | 2463 | 4300 | 2137 | 2210 | 3339 |
| North Pacific Spiny Dogfish | 34             | 713           | 2.68                          | 0  | 24   | 122  | 51   | 199  | 14   | 0    | 303  |
| Pacific Grenadier           | 17             | 627           | 2.36                          | 0  | 102  | 98   | 68   | 63   | 0    | 0    | 296  |
| Pacific Halibut             | 59             | 526           | 1.98                          | 0  | 28   | 99   | 17   | 33   | 68   | 160  | 121  |
| Arrowtooth Flounder         | 56             | 451           | 1.70                          | 0  | 92   | 76   | 27   | 65   | 15   | 3    | 173  |
| Rougheye Rockfish           | 29             | 387           | 1.46                          | 0  | 40   | 4    | 51   | 29   | 0    | 0    | 263  |
| Redbanded Rockfish          | 31             | 217           | 0.82                          | 0  | 13   | 93   | 22   | 48   | 0    | 0    | 41   |
| Lingcod                     | 18             | 154           | 0.58                          | 0  | 2    | 52   | 45   | 6    | 0    | 0    | 49   |
| Yelloweye Rockfish          | 7              | 97            | 0.36                          | 0  | 1    | 6    | 64   | 20   | 0    | 0    | 6    |
| Giant Grenadier             | 21             | 72            | 0.27                          | 0  | 19   | 9    | 1    | 3    | 0    | 0    | 40   |
| Shortspine Thornyhead       | 32             | 60            | 0.23                          | 0  | 7    | 14   | 7    | 3    | 0    | 1    | 28   |
| Shortraker Rockfish         | 21             | 59            | 0.22                          | 0  | 3    | 4    | 3    | 6    | 0    | 0    | 43   |
| Dover Sole                  | 11             | 24            | 0.09                          | 0  | 13   | 0    | 0    | 3    | 0    | 0    | 8    |
| Longspine Thornyhead        | 10             | 17            | 0.06                          | 0  | 0    | 11   | 1    | 0    | 0    | 0    | 5    |

| Species               | Number<br>of Sets | Catch<br>(count) | Proportion of<br>Total Catch<br>(%) | 4B | 3C | 3D | 5A | 5B | 5C | 5D | 5E |
|-----------------------|-------------------|------------------|-------------------------------------|----|----|----|----|----|----|----|----|
| Rosethorn Rockfish    | 8                 | 15               | 0.06                                | 0  | 2  | 2  | 2  | 5  | 0  | 0  | 4  |
| Pacific Flatnose      | 6                 | 10               | 0.04                                | 0  | 7  | 1  | 0  | 0  | 0  | 0  | 2  |
| Pink Snailfish        | 3                 | 9                | 0.03                                | 0  | 5  | 4  | 0  | 0  | 0  | 0  | 0  |
| Yellowmouth Rockfish  | 3                 | 9                | 0.03                                | 0  | 0  | 0  | 3  | 6  | 0  | 0  | 0  |
| Rockfishes            | 3                 | 3                | 0.01                                | 0  | 2  | 1  | 0  | 0  | 0  | 0  | 0  |
| Canary Rockfish       | 2                 | 2                | 0.01                                | 0  | 0  | 2  | 0  | 0  | 0  | 0  | 0  |
| Greenstriped Rockfish | 2                 | 2                | 0.01                                | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 0  |
| Pacific Sleeper Shark | 2                 | 2                | 0.01                                | 0  | 0  | 0  | 0  | 0  | 2  | 0  | 0  |
| Walleye Pollock       | 1                 | 2                | 0.01                                | 0  | 0  | 0  | 0  | 0  | 0  | 2  | 0  |
| Pacific Hake          | 1                 | 1                | 0.00                                | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |
| Pacific Cod           | 1                 | 1                | 0.00                                | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  |

Table 39. Annual summary of the total catch (piece count) for the top 10 species (by total piece count over all years) for the Sablefish Research and Assessment Survey Randomized Tagging Program sets.

| Species                        | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | Total  |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| Sablefish                      | 22055 | 16348 | 17730 | 24105 | 18833 | 20326 | 15529 | 17375 | 22568 | 16845 | 18095 | 14266 | 25428 | 18073 | 267576 |
| Arrowtooth<br>Flounder         | 352   | 665   | 598   | 763   | 1655  | 1163  | 1787  | 553   | 1037  | 921   | 414   | 864   | 610   | 427   | 11809  |
| Pacific<br>Grenadier           | 338   | 644   | 399   | 313   | 880   | 608   | 829   | 676   | 742   | 715   | 254   | 534   | 686   | 627   | 8245   |
| North Pacific<br>Spiny Dogfish | 800   | 532   | 465   | 317   | 437   | 162   | 565   | 414   | 868   | 966   | 386   | 287   | 365   | 699   | 7263   |
| Rougheye<br>Rockfish           | 187   | 398   | 166   | 355   | 558   | 513   | 418   | 406   | 266   | 941   | 223   | 488   | 320   | 386   | 5625   |
| Pacific<br>Halibut             | 76    | 71    | 114   | 163   | 185   | 125   | 224   | 172   | 256   | 342   | 99    | 447   | 444   | 283   | 3001   |
| Redbanded<br>Rockfish          | 111   | 101   | 113   | 93    | 154   | 257   | 150   | 131   | 244   | 208   | 127   | 241   | 295   | 217   | 2442   |
| Giant<br>Grenadier             | 29    | 132   | 97    | 67    | 162   | 146   | 179   | 118   | 105   | 195   | 80    | 87    | 206   | 72    | 1675   |
| Lingcod                        | 89    | 76    | 128   | 108   | 201   | 109   | 93    | 97    | 165   | 71    | 88    | 92    | 121   | 154   | 1592   |
| Yelloweye<br>Rockfish          | 18    | 41    | 33    | 22    | 71    | 58    | 60    | 21    | 106   | 34    | 13    | 17    | 81    | 97    | 672    |





Table 40. Annual summary of the total catch (piece count) for the top 10 species (by total piece count over all years) for the Sablefish Research and Assessment Survey Inlet Program sets.

| <b>Species</b>              | <b>2003</b> | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>Total</b> |
|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| Sablefish                   | 9964        | 9933        | 7066        | 5062        | 3453        | 2498        | 4339        | 7507        | 11034       | 6213        | 3271        | 3341        | 2708        | 5050        | 127899       |
| Pacific Halibut             | 39          | 63          | 72          | 104         | 111         | 99          | 78          | 109         | 108         | 113         | 88          | 265         | 333         | 243         | 2112         |
| Arrowtooth Flounder         | 10          | 14          | 23          | 46          | 101         | 108         | 49          | 25          | 11          | 20          | 11          | 49          | 30          | 24          | 762          |
| North Pacific Spiny Dogfish | 0           | 6           | 6           | 6           | 8           | 1           | 2           | 15          | 18          | 12          | 4           | 5           | 44          | 14          | 180          |
| Pacific Sleeper Shark       | 1           | 6           | 1           | 5           | 5           | 4           | 2           | 0           | 1           | 0           | 0           | 2           | 0           | 2           | 67           |
| Dover Sole                  | 1           | 0           | 4           | 4           | 4           | 23          | 1           | 0           | 0           | 1           | 2           | 5           | 1           | 1           | 64           |
| Walleye Pollock             | 2           | 0           | 7           | 1           | 6           | 3           | 3           | 3           | 3           | 4           | 1           | 4           | 2           | 2           | 44           |
| Shortraker Rockfish         | 0           | 0           | 0           | 4           | 4           | 5           | 4           | 1           | 3           | 2           | 0           | 0           | 3           | 0           | 37           |
| Pacific Cod                 | 0           | 0           | 0           | 0           | 0           | 8           | 1           | 5           | 0           | 1           | 1           | 2           | 1           | 0           | 25           |
| Rougheye Rockfish           | 0           | 2           | 0           | 1           | 2           | 1           | 1           | 1           | 0           | 2           | 0           | 2           | 0           | 1           | 25           |

Table 41. Number of fish sampled for biological data during the 2016 Sablefish Research and Assessment Survey showing the number of tag releases, lengths and age structures that were collected by species.

| Species               | Scientific Name             | Tags | Lengths Collected | Age Structures Collected |
|-----------------------|-----------------------------|------|-------------------|--------------------------|
| Bocaccio              | <i>Sebastes paucispinis</i> | 0    | 1                 | 1                        |
| Pacific Flatnose      | <i>Antimora microlepis</i>  | 0    | 10                | 10                       |
| Pacific Sleeper Shark | <i>Somniosus pacificus</i>  | 0    | 2                 | 0                        |
| Rougheye Rockfish     | <i>Sebastes aleutianus</i>  | 0    | 271               | 271                      |
| Sablefish             | <i>Anoplopoma fimbria</i>   | 8460 | 13205             | 4675                     |
| Shortraker Rockfish   | <i>Sebastes borealis</i>    | 0    | 59                | 59                       |
| Yelloweye Rockfish    | <i>Sebastes ruberrimus</i>  | 0    | 58                | 58                       |

Table 42. Annual summary of the number of common fish species sampled for biological data during the Sablefish Research and Assessment Survey Randomized Tagging Program sets.

| Species                     | 2003  | 2004 | 2005 | 2006  | 2007  | 2008  | 2009 | 2010  | 2011  | 2012  | 2013  | 2014 | 2015  | 2016 | Total  |
|-----------------------------|-------|------|------|-------|-------|-------|------|-------|-------|-------|-------|------|-------|------|--------|
| Sablefish                   | 21017 | 8837 | 8999 | 12210 | 10385 | 11059 | 9331 | 10270 | 12463 | 10486 | 10118 | 8204 | 12094 | 9910 | 155383 |
| Rougheye Rockfish           | 0     | 0    | 0    | 56    | 0     | 282   | 289  | 266   | 240   | 393   | 179   | 373  | 270   | 270  | 2618   |
| Pacific Grenadier           | 0     | 0    | 0    | 0     | 0     | 461   | 562  | 378   | 471   | 380   | 188   | 0    | 0     | 0    | 2440   |
| Arrowtooth Flounder         | 0     | 0    | 0    | 0     | 0     | 441   | 379  | 245   | 400   | 656   | 140   | 0    | 0     | 0    | 2261   |
| North Pacific Spiny Dogfish | 0     | 0    | 0    | 0     | 0     | 0     | 219  | 326   | 440   | 674   | 207   | 0    | 0     | 0    | 1866   |
| Redbanded Rockfish          | 0     | 0    | 0    | 0     | 0     | 224   | 145  | 131   | 243   | 204   | 113   | 0    | 0     | 0    | 1060   |
| Giant Grenadier             | 0     | 0    | 0    | 0     | 0     | 129   | 141  | 111   | 99    | 195   | 79    | 0    | 0     | 0    | 754    |
| Yelloweye Rockfish          | 0     | 0    | 0    | 0     | 0     | 55    | 60   | 21    | 106   | 32    | 12    | 0    | 75    | 58   | 419    |
| Shortraker Rockfish         | 8     | 0    | 0    | 0     | 0     | 53    | 65   | 73    | 18    | 59    | 18    | 13   | 10    | 59   | 376    |
| Pacific Flatnose            | 0     | 0    | 0    | 0     | 0     | 18    | 39   | 27    | 17    | 24    | 11    | 0    | 0     | 10   | 146    |
| Shortspine Thornyhead       | 0     | 0    | 0    | 0     | 0     | 1     | 9    | 26    | 22    | 53    | 34    | 0    | 0     | 0    | 145    |
| Pacific Halibut             | 0     | 0    | 0    | 0     | 0     | 0     | 2    | 60    | 5     | 15    | 0     | 0    | 0     | 0    | 82     |
| Lingcod                     | 0     | 0    | 0    | 0     | 0     | 0     | 27   | 36    | 1     | 3     | 1     | 0    | 0     | 0    | 68     |
| Rosethorn Rockfish          | 0     | 0    | 0    | 0     | 0     | 8     | 6    | 2     | 23    | 7     | 3     | 0    | 0     | 0    | 49     |

|                      |   |   |   |   |   |    |   |   |    |    |   |   |   |   |    |
|----------------------|---|---|---|---|---|----|---|---|----|----|---|---|---|---|----|
| Dover Sole           | 0 | 0 | 0 | 0 | 0 | 3  | 1 | 3 | 13 | 18 | 3 | 0 | 0 | 0 | 41 |
| Emarginate Snailfish | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 1  | 0  | 0 | 0 | 0 | 0 | 31 |

Table 43. Annual summary of the number of common fish species sampled for biological data during the Sablefish Research and Assessment Survey Randomized Inlet Program sets.

| Species                     | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | Total |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|
| Sablefish                   | 5497 | 6022 | 4394 | 3506 | 2554 | 1993 | 3070 | 5064 | 5984 | 3900 | 2503 | 2379 | 2234 | 3272 | 98410 |
| North Pacific Spiny Dogfish | 0    | 0    | 6    | 0    | 0    | 0    | 0    | 0    | 8    | 11   | 0    | 0    | 0    | 0    | 25    |
| Arrowtooth Flounder         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 3    | 18   | 0    | 0    | 0    | 0    | 21    |
| Shortraker Rockfish         | 0    | 0    | 0    | 0    | 0    | 0    | 3    | 1    | 2    | 2    | 0    | 0    | 3    | 0    | 12    |
| Walleye Pollock             | 0    | 0    | 7    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 9     |
| Pacific Sleeper Shark       | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 2    | 6     |
| Rougheye Rockfish           | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 2    | 0    | 2    | 0    | 1    | 6     |