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Pacific Halibut Bycatch in US West Coast Fisheries (2002-2014)

Jason Jannot
Kayleigh Somers
Jon McVeigh
Neil Riley

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NWFSC Observer Program
National Marine Fisheries Service
Northwest Fisheries Science Center
Fishery Resource Analysis and Monitoring Division
2725 Montlake Blvd. E.
Seattle, WA 98112

Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries (2002-2014)

Jason E. Jannot,* Kayleigh Somers, Jon McVeigh, Neil B. Riley

August 10, 2015

NWFSC Observer Program Fishery Resource Analysis and Monitoring Division National Marine Fisheries Service Northwest Fisheries Science Center 2725 Montlake Blvd. E. Seattle, WA 98112

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*jason.jannot@noaa.gov

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1 EXECUTIVE SUMMARY

Pacific halibut mortality estimates are provided for the years 2002 through 2014 from all fishery sectors observed by the Northwest Fishery Science Center Groundfish Observer Program. These include:

- IFQ fisheries, including Shoreside Hake (2011-2014)
- Limited entry (LE) bottom trawl (2002-2010)
- Non-nearshore fixed gear targeting groundfish (2002-2014)
- Nearshore fixed gear (2003-2014)
- Pink shrimp trawl (2004-2014)
- California halibut trawl (2002-2014)
- At-sea Pacific hake (2002-2014)

Final estimates are shown in Table 1, which is equivalent to Table 37 in the report. We include in these two tables (and elsewhere in the report), the small amount of P. halibut landed and subsequently discarded at the dock in the IFQ Shoreside Hake and Non-Hake Bottom and Midwater Trawl fisheries. These landed and then discarded at the dock amounts are listed by strata in Tables 7 and 8 of the report. In 2014, the Limited Entry Sablefish Endorsed sector constituted the largest source of discard mortality of P. halibut among the sectors analyzed, with the majority of this bycatch occurring north of Pt. Chehalis, WA. IFQ vessels fishing bottom trawl gear caught the next most P. halibut, only about 1 mt less than the LE Sablefish Endorsed sector. These two sectors comprised approximately 95% of the 2014 P. halibut discard mortality in U.S. west coast groundfish fisheries.

The 2014 IFQ fishery estimate of P. halibut discard mortality, both north and south of 40^{o} 10' N. lat., was 27.47 mt (summing values from Table 1 might result in small difference due to rounding), less than the 2013 estimate (33 mt, see Table 1). As in prior years, bottom trawl gear produced the largest component of IFQ discard mortality, followed in decreasing magnitude by, hook-&-line gear, shoreside hake, and pot gear.

Nearly all of 2014 non-nearshore fixed gear estimated P. halibut discard mortality occurred in the limited entry (LE) sablefish endorsed component, which consists of federally permitted vessels fishing sablefish tier quota during the primary season (April-October). Specifically, discard rates for the non-nearshore fixed gear sector were highest on LE sablefish endorsed vessels fishing with longline gear in the area north of Point Chehalis, Washington. A smaller amount of P. halibut mortality also occurred on LE sablefish endorsed vessels fishing longline gear south of Point Chehalis and open access (OA) vessels targeting non-nearshore groundfish species with hook-&-line gear.

Pacific halibut discard in the nearshore fixed gear, pink shrimp trawl, California halibut trawl, and at-sea Pacific hake fisheries combined represents a very small component of total P. halibut mortality (Figure 1).

The methods in this report are unchanged from the last report with three very minor exceptions. First, as requested by the IPHC, length frequency tables are reported by viability category for each length bin. Second, also requested by IPHC, is the addition of a separate table for the At-sea hake fishery P. halibut mortality by sector (Table 35) and the At-sea hake fishery P. halibut length frequency distribution (Table 36). Finally, the IFQ pot sector for 2014 is reported coastwide to maintain confidentiality, rather than by latitudinal strata. The base data used in this report has been updated to include the most recent observer data available (2002-2014). Pacific Fisheries Information Network (PacFIN) data used in this report were accessed May 2015. The estimates for all sectors and years (except LE Trawl 2002-2010) have been recalculated based on these base data. In all other respects, this 2015 report uses the same methods as reported in Jannot et at. (2014).

Table 1: Pacific halibut discard mortality estimates (mt, including a small amount discarded at the dock in Shoreside hake and IFQ Bottom & Midwater Trawl fisheries) for all sectors observed by the NWFSC Groundfish Observer Program. Mortality rates of less than 100% were applied in the bottom trawl fisheries (LE and IFQ), IFQ hook and line, IFQ pot, and non-IFQ, non-nearshore fixed gear sectors, for which some information regarding gear specific survivorship was available. For all other sectors, a 100% mortality rate was applied either because gear specific survivorship information is not available or to maintain confidentiality. Rounding of values might mask very small weights in some categories and are presented here as zero (0). Tables with unrounded values are provided on the NOAA/NWFSC/FOS website. All weights are estimated based on whole fish (a.k.a. 'round weight', not head-&-gut). *=confidential data, less then 3 vessels observed; - = no observer coverage.

Year	LE bottom trawl 2002-10	IFQ Fishery 2011-present						Non-Nearshore fixed gear			Nearshore Fixed Gear [1]	Pink Shrimp [1]	CA Halibut [1,2]	At-sea Hake [1]	Totals		
		Bottom Trawl [3,4]	LE CA Halibut [1,3]	Hook and Line	Pot	Midwater Trawl [1]	Shoreside Hake [1,4]	LE Endorsed	LE Non-Endorsed	OA					All sectors	<100% mortality rate [5]	100% mortality rate [6]
Total Discard Mortality (mt)																	
2002	344.82							22.71	0.00	-	-	-	-	1.14	368.67	367.53	1.14
2003	124.43							30.19	0.03	-	0.00	-	0.00	2.65	157.30	154.65	2.65
2004	133.12							38.42	0.00	-	1.00	0.00	0.70	1.13	174.37	172.24	2.13
2005	286.52							33.77	0.00	-	2.19	0.04	0.03	1.97	324.52	320.32	4.20
2006	242.47							104.08	0.01	-	0.54	-	-	0.83	347.93	346.56	1.37
2007	208.81							20.25	0.28	3.58	0.09	0.21	0.06	1.18	234.46	232.98	1.48
2008	207.81							41.53	0.47	6.79	0.36	0.00	0.31	3.98	261.25	256.91	4.34
2009	251.1							51.62	0.04	5.87	1.30	0.00	0.00	0.33	310.26	308.63	1.63
2010	180.97							21.91	0.06	5.34	0.08	0.00	0.00	1.57	209.93	208.28	1.65
2011		31.43	0	0.97	0.88	*	0.03	18.23	3.92	2.19	3.08	0.19	0.00	0.61	61.53	57.62	3.91
2012		40.52	*	2.34	0.51	0.0	0.00	24.23	2.56	3.98	2.27	0.00	0.00	0.64	77.05	74.14	2.91
2013		32.26	see[3]	0.48	0.21	0.0	0.05	3.54	0.00	0.30	1.37	0.00	0.00	1.06	39.27	36.79	2.48
2014		26.65	see[3]	0.63	0.08	0.0	0.11	27.73	0.00	0.58	0.97	0.00	0.00	0.37	57.12	55.67	1.45

[1] 100% mortality rate

[2] Starting in 2011, this sector only includes OA CA halibut

[3] Starting in 2013, LE CA Halibut estimates are combined with IFQ Bottom Trawl estimates.

[4] Includes a small amount landed and discarded at the dock.

[5] LE Bottom Trawl, IFQ Bottom Trawl, IFQ hook and line, IFQ pot, LE and OA CA Halibut, Non-Nearshore Fixed Gear

[6] IFQ Midwater Trawl, Shoreside Hake, Nearshore fixed gear, Pink Shrimp, At-sea Hake

Table 2: A comparison of P. halibut IBQ (mt, north of 40 °10′ N. lat.; mortality rates applied) between the Vessel Account System (VAS) and the NWFSC Observer Program final estimation (includes a small amount discarded at the dock). The two systems use different approaches (see Methods and Appendix B) to estimate P. halibut mortality.

	Total IBQ mortality of P. halibut (mt)	
Year	**VAS**	**Observer Program**
2011	32.14	33.10
2012	45.65	42.72
2013	32.98	32.46
2014	27.49	27.47

Table 3: Percent of legal-sized P. halibut bycatch, by weight (mt) in the non-hake IFQ Bottom Trawl fishery north of 40 °10′ N. lat. (mortality rate applied).

Year	**% legal-sized P. halibut in non-hake IFQ bottom trawl north of 40 °10′ N. lat.**
2011	67%
2012	67%
2013	64%
2014	60%

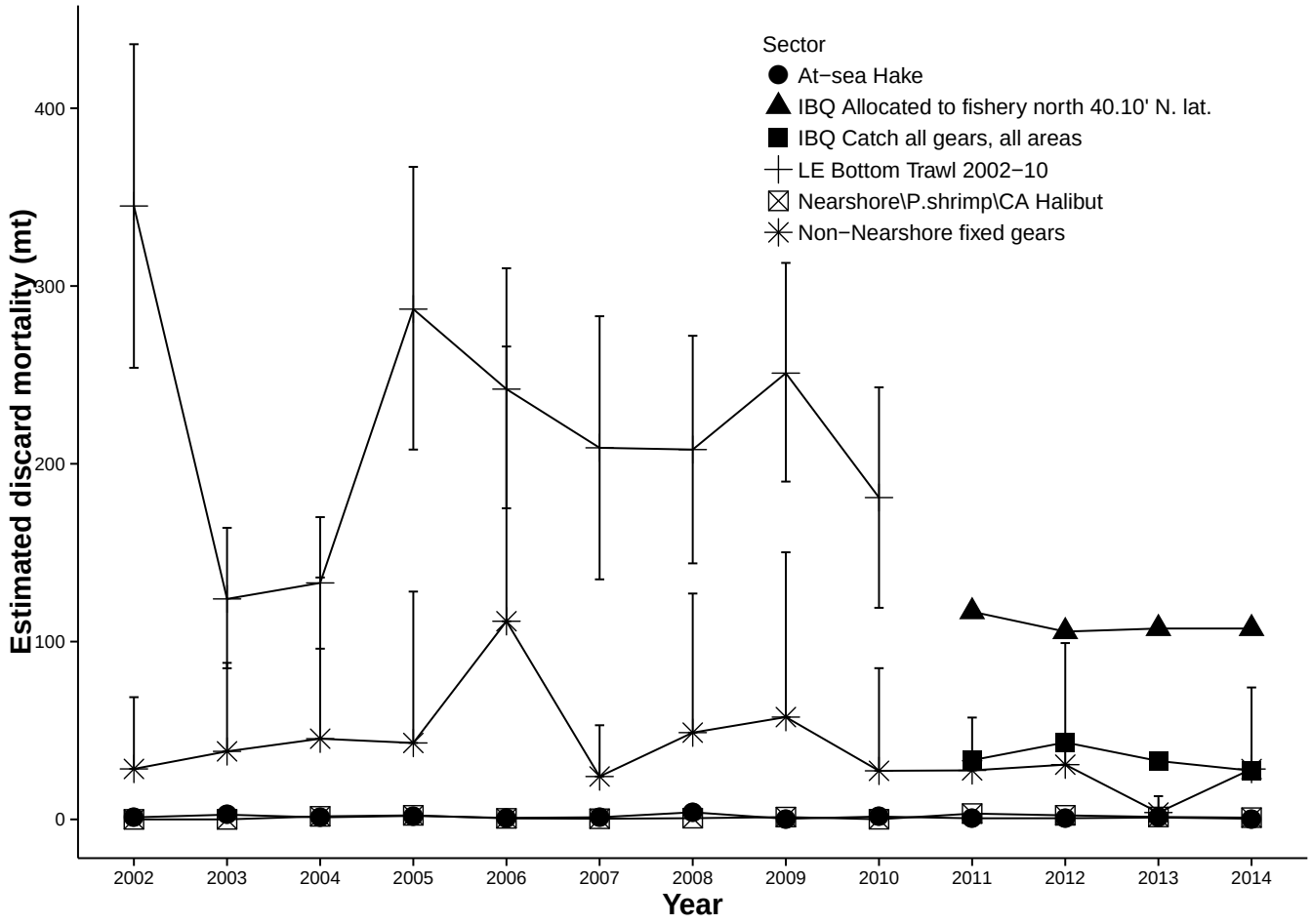

Figure 1: Total estimated P. halibut discard mortality (mt ± 1 SE, with mortality rates applied if applicable) from all sectors observed by the NWFSC Groundfish Observer Program. Estimates are not included for sectors and years where there were insufficient observer data. IBQ observations include all sectors and gears except At-sea Hake which is shown separately. Values are reported in Table 1

2 INTRODUCTION

Pacific halibut (*Hippoglossus stenolepis*) is found in coastal waters throughout the North Pacific. Off the west coast of the United States, it inhabits continental shelf areas (<150 fm) from Washington to central California (Clark and Hare 1998). Pacific halibut has long supported a directed commercial fishery in the U.S. and Canada, but it is also caught as bycatch in other fisheries that target demersal species inhabiting similar depths and seafloor habitat types (Chastain 2012). The objective of this report is to provide estimates of P. halibut bycatch in the U.S. west coast groundfish fisheries from 2002-2014.

2.1 West Coast Groundfish Fishery

The west coast groundfish fishery is a multi-species fishery that utilizes a variety of gear types. The fishery harvests species designated in the Pacific Coast Groundfish Fishery Management Plan (FMP; PFMC 2011) and is managed by the Pacific Fishery Management Council (PFMC). Over 90 species are listed in the groundfish FMP, including a variety of rockfish, flatfish, roundfish, skates, and sharks. These species are found in both federal (>5.6 km off-shore) and state waters (0-5.6 km). Groundfish are both targeted and caught incidentally by trawl nets, hook-&-line gears, and fish pots. Under the FMP, the groundfish fishery consists of four management components:

- The Limited Entry (LE) component encompasses all commercial fisheries who hold a federal limited entry permit. The total number of limited entry permits available is restricted. Vessels with an LE permit are allocated a larger portion of the total allowable catch for commercially desirable species than vessels without an LE permit.
- The Open Access (OA) component encompasses commercial fishers who do not hold a federal LE permit. Some states require fishers to carry a state issued OA permit for certain OA sectors.
- The Recreational component includes recreational anglers who target or incidentally catch groundfish species. Estimate of P. halibut bycatch in recreational fisheries are compiled by the IPHC and are not covered by this report.
- The Tribal component includes native tribal commercial fishers in Washington State that have treaty rights to fish groundfish. Estimates of P. halibut bycatch from tribal fisheries are compiled by the IPHC and are not included in this report, with the exception of the observed tribal at-sea Pacific hake sector which are included as part of the "At-sea hake" values included in ES Table1 and Table 22.

These four components can be further subdivided into sectors based on gear type, target species, permits and other regulatory factors. This report includes data from the following sectors:

- IFQ fishery (formerly LE bottom trawl 2002-2010): This sector is subdivided into the following components due to differences in gear type and target strategy:
  - Bottom Trawl: Bottom trawl nets are used to catch a variety of non-hake groundfish species. Catch is delivered to shore-based processors.
  - Midwater non-hake trawl: Midwater trawl nets are used to target mid-water non-hake species. Catch is delivered to shore-based processors.
  - Pot: Pot gear is used to target groundfish species, primarily sablefish. Catch is delivered to shore-based processors.
  - Hook-and-Line: Longlines are primarily used to target groundfish species, mainly sablefish. Catch is delivered to shore-based processors.
  - LE California halibut trawl: Bottom trawl nets are used to target California halibut by fishers holding a state California halibut permit and an LE federal trawl groundfish permit. Catch is delivered to shore-based processors.
  - Shoreside hake trawl: Midwater trawl nets are used to catch Pacific hake. Catch is delivered to shore-based processors.
  - At-sea motherships: Midwater trawl nets are used to catch Pacific hake. Catcher vessels deliver unsorted catch to a mothership. The catch is sorted and processed aboard the mothership.

  - At-sea catcher-processors: Midwater trawl nets are used to catch and process Pacific hake at sea. This component also includes the at-sea processing component of the tribal sector. The tribal sector must operate within defined boundaries in waters off northwest Washington.

- OA pink shrimp trawl: Trawl nets are used to target pink shrimp. Catch is delivered to shore-based processors.
- OA California halibut trawl: Trawl nets are used to target California halibut by fishers holding a state California halibut permit. Catch is delivered to shore-based processors.
- LE fixed gear (non-nearshore): This sector is subdivided into two components based on differences in permitting and management:
  - LE sablefish endorsed: Longlines and pots are used to target sablefish. Catch is generally delivered to shore-based processors.
  - LE sablefish non-endorsed: Longlines and pots are used to target groundfish, primarily sablefish and thornyheads. Catch is delivered to shore-based processors or sold alive.
- OA fixed gear (non-nearshore): Fixed gear, including longlines, pots, fishing poles, stick gear, etc. is used to target non-nearshore groundfish. Catch is delivered to shore-based processors.
- Nearshore fixed gear: A variety of fixed gear, including longline, pots, fishing poles, stick gear, etc. are used to target nearshore rockfish and other nearshore species managed by state permits in Oregon and California. Catch is delivered to shore-based processors or sold live.

2.2 NW Fisheries Science Center (NWFSC) Groundfish Observer Program

The NWFSC Groundfish Observer Program observes commercial sectors that target or take groundfish as bycatch. The observer program has two units: the West Coast Groundfish Observer Program (WCGOP) and the At-Sea Hake Observer Program (A-SHOP).

The WCGOP program was established in May 2001 by NOAA Fisheries (a.k.a., National Marine Fisheries Service, NMFS) in accordance with the Pacific Coast Groundfish Fishery Management Plan (50 CFR Part 660) (50 FR 20609). This regulation requires all vessels that catch groundfish in the U.S. EEZ from 3-200 miles offshore carry an observer when notified to do so by NMFS or its designated agent. Subsequent state rule-making has extended NMFS's ability to require vessels fishing in the 0-3 mile state territorial zone to carry observers.

The NWFSC Groundfish Observer Program's goal is to improve estimates of total catch and discard by observing groundfish fisheries along the U.S. west coast. The WCGOP and A-SHOP observe distinct sectors of the groundfish fishery. The WCGOP observes multiple sectors of the groundfish fishery, including: IFQ shore-side delivery of groundfish and Pacific hake, at-sea mothership catcher-vessels fishing for Pacific hake, LE and OA fixed gear, and state-permitted nearshore fixed gear sectors. The WCGOP also observes several fisheries that incidentally catch groundfish, including the California halibut trawl and pink shrimp trawl fisheries. The A-SHOP observes the fishery that catches and delivers Pacific hake at-sea including: catcher-processor, mothership, and tribal vessels.

2.3 Pacific Halibut Management and Fishery Interaction

The International Pacific Halibut Commission (IPHC), a body founded through treaty agreement between the U.S. and Canada, sets the P. halibut annual total allowable catch (TAC) for IPHC area 2A, the collective U.S. waters off the states of Washington, Oregon and California. The TAC is based on bycatch mortality, which takes into account potential survival after being discarded. Regulations for area 2A are set by NOAA Fisheries West Coast Regional Office. Pacific halibut catch in Area 2A is divided between tribal and non-tribal fisheries, between commercial and recreational fisheries, and between recreational fisheries in different states (Washington, Oregon and California). The Pacific Fishery Management Council describes this P. halibut catch division each year in a catch-sharing plan. In 2014, the LE fixed gear sablefish endorsed sector was allowed to retain and land P. halibut north of Point Chehalis, WA. The IFQ Shoreside Pacific hake fishery is a maximized-retention fishery. Under this fishery, small amount of incidental take are allowed to be landed and subsequently donated to food banks or destroyed. In all other West Coast commercial groundfish fishery sectors, P. halibut must be discarded at-sea. However, small amounts of P. halibut are, on rare occasions, mixed with target species and accidentally landed. These individuals are subsequently donated or destroyed as in the IFQ Shoreside hake fishery.

In 2011, the limited entry (LE) bottom trawl sector of the U.S. west coast groundfish fishery began fishing under an Individual Fishing Quota (IFQ) management program. An IFQ is defined as a federal permit under a limited access system to harvest a quantity of fish, representing a portion of the total allowable catch of a fishery that can be received or held for exclusive use by a person (MSA 16 UlC 1802(23)). The implementation of the IFQ management program in 2011 resulted in changes to the method used for estimating fishing mortality, including the mandate that vessels must carry NMFS observers on all IFQ fishing trips. A full list of changes to the fishery can be found in Jannot, et al. 2012.

Under the IFQ program, P. halibut is managed at the permit level, through Individual Bycatch Quota (IBQ) pounds. An IBQ accounts for bycatch mortality, which takes into account potential survivorship after capture. Currently, this is the only species managed under IBQ for the west coast groundfish IFQ fishery. Each federal groundfish permit with a trawl endorsement is allocated IBQ pounds for P. halibut caught north of 40° 10' N. latitude. Pacific halibut caught south of 40° 10' N. latitude are not managed by an IBQ quota but are reported here under the IFQ fishery.

Data collection and reporting for this fishery is described in the "Pacific Halibut Data Collection in the shore-based IFQ Fishery" sections by gear type. The shore-based IFQ fishery includes all IFQ fishery components with the exception of at-sea motherships and catcher-processors. Motherships and catcher-processors have a bycatch quota for P. halibut, but it is not accounted for at the permit level.

With the exception of the IFQ fishery, P. halibut bycatch mortality is accounted for at the fishery sector level only. P. halibut is regularly caught as bycatch in the LE sablefish endorsed fixed gear, LE sablefish non-endorsed fixed gear, and OA fixed gear sectors.

3 METHODS

3.1 Data Sources

Data sources for this analysis include onboard observer data (from the WCGOP and A-SHOP), and landing receipt data (referred to as fish tickets, obtained from PacFIN). To date, observer data is used as the sole source for discard estimation in the IFQ sectors. A list of fisheries, coverage priorities and data collection methods employed by WCGOP in each observed fishery can be found in the WCGOP manuals (NWFSC 2014b). A-SHOP program information and documentation or data collection methods can be found in the A-SHOP observer manual (NWFSC 2014b).

The sampling protocol employed by the WCGOP is primarily focused on the discarded portion of catch. To ensure that the recorded weights for the retained portion of the observed catch are accurate, haul-level retained catch weights recorded by observers are adjusted based on trip-level fish ticket records. This process is described in further detail on the WCGOP Data Processing webpage (NWFSC 2014a) and was conducted prior to the analyses presented in this report. All weights of P. halibut presented in this report are round weights, that is, whole fish. IPHC converts these weights to dressed weight (i.e., head and organs removed).

For data processing purposes, species and species groups were defined based on management (NWFSC 2014c). A complete listing of groundfish species is defined in the Pacific Coast Groundfish Fishery Management Plan (PFMC 2011).

Fish ticket landing receipts are completed by fish-buyers in each port for each delivery of fish by a vessel. Fish tickets are trip-aggregate sales receipts for market categories that may represent single or multiple species. Fish tickets are issued to fish-buyers by a state agency and must be returned to the agency for processing. Fish ticket and species-composition data are submitted by state agencies to the PacFIN regional database. Annual fish ticket landings data were retrieved from the PacFIN database (May 2015) and subsequently divided into various sectors of the groundfish fishery as indicated in Figure 8 and in further detail online (NWFSC 2014c).

3.2 Shore-based IFQ Fishery

The methods used to report in-season IBQ estimates via the Vessel Account System (VAS) are separate from those methods used to estimate final fleet-wide P. halibut mortality. Methods for in-season IBQ estimation are discussed in Appendix B 10.2. Results obtained by methods described here resulted in fleet-wide estimates of P. halibut mortality that are very close to those reported by the VAS (Table 2).

3.2.1 Pacific Halibut Data Collection in the Shore-based IFQ Fishery

The WCGOP discard sampling methodologies ensure that P. halibut mortality can be estimated, regardless of the limitations imposed by the vessel, catch composition, or catch quantity. Three pieces of information are necessary to estimate P. halibut mortality (also see Table 4):

1. A count of individual P. halibut in the haul or sample
2. Actual or visual length measurements (cm)
3. A viability obtained by physical assessment of individual P. halibut using IPHC designed dichotomous keys that relate the physical condition of the fish to a viability code (NWFSC 2014b). A unique key is used for each gear type (trawl, longline, pot).

Observers could sample all or a subset of P. halibut caught in a haul/set. The proportion of P. halibut sampled is based on the number of P. halibut caught in the haul/set, the level of assistance provided by the crew, as well as other variables (e.g., physical space, weather). Sampling and assessment of P. halibut is dependent on crew assistance and cooperation. Regulations prohibit vessel crew from discarding any P. halibut without first notifying the observer. The vessel crew must comply with requests by the observer to ensure proper P. halibut sampling, including but not limited to: modifying P. halibut sorting procedure, assisting the observer by delivering the P. halibut to the observer, and modifying operations to ensure P. halibut sampling is completed. Table 1 describes the P. halibut data obtained on IFQ-permitted vessels fishing different gear types.

On vessels fishing fixed gear (pot or hook-&-line), observers must sample at least 50% of the gear per set. Actual length measurements are obtained on bottom trawl, midwater trawl, and pot vessels, but only visual length estimates are made on vessels fishing hook-&-line gear. Visual estimates are in 10 cm increments (55-64 cm, 65-74 cm, etc.).

The crew's cooperation is vital to the observer's sampling success during hook-&-line fishing. When an observer samples for P. halibut, the crew are not permitted to shake loose or discard any P. halibut before the observer can estimate the fish length, nor can they restrict the observer's view of the line as it comes out of the water. If requested by the observer, the crew is required to physically hand an individual fish to the observer or slow the gear retrieval.

Table 4: Data collected from P. halibut caught on IFQ vessels using different types of gear.

Gear	Count	Length Measurement	Viability
Bottom trawl	all in the haul	actual, all or subset	yes
Midwater trawl	all in the haul	actual, all of subset	yes
Pot	all in sampled portion	actual, all or subset	yes
Hook -and- line	all in sampled portion	visual, all or subset	no

Viability is assessed at the point of fish release when returned to sea. On vessels using "resuscitation boxes" or other techniques to increase the likelihood of survival, condition sampling is performed prior to the fish being returned to sea. Observations of several condition characteristics are used to assign each fish to one of three viability categories for trawl and pot gear: Excellent, Poor, or Dead (NWFSC 2014; Williams and Chen 2004). Observer field estimates of viability for P. halibut discarded in the IFQ fishery by vessels fishing bottom trawl or pot gear are used to compute the total estimated mortality of discarded P. halibut. IBQ weight (or simply IBQ) refers to the estimated mortality of discarded P. halibut, with the appropriate mortality rate applied based on viability (Tables 2 & 3). If no viability data or mortality rates are available, we assume 100% mortality.

Viability categories are used to assign mortality rates to P. halibut. Mortality rates for vessels fishing bottom trawl gear are based on mortality data collected by Hoag (1975), who found some survivorship among fish in the dead condition category. Mortality rates for vessels fishing pot gear are based on conservative assumptions of likely survival from pot-induced injuries (Williams and Wilderbuer 1995). Because of the difficulties of collecting P. halibut viability on hook-and-line vessels, we used a discard mortality rate (DMR) of 0.16, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008). Discard mortality was assumed to be 100% for all midwater trawl bycatch estimates.

Table 5: Mortality rates used for each of the condition categories (m_c) for IFQ bottom trawl vessels (Clark et al. 1992).

$\boldsymbol{m_c}$	**Rate**
m_{exc}	0.20
m_{poor}	0.55
m_{dead}	0.90

Table 6: Mortality rates used for each of the condition categories (m_c) for IFQ pot gear vessels (IPHC, 2011).

$\boldsymbol{m_c}$	**Rate**
m_{exc}	0.00
m_{poor}	1.00
m_{dead}	1.00

3.2.2 Shore-based IFQ fishery Bycatch Estimation

We stratified IFQ P. halibut bycatch data based on sector (shoreside non-hake groundfish, shoreside Pacific hake, at-sea Pacific hake, and LE California halibut) and gear (bottom trawl, midwater trawl, pot, hook-&-line). LE California halibut tows were separated from IFQ bottom trawl tows in 2011-12, but have been combined with IFQ bottom trawl since 2013 to maintain confidentiality. Within the shoreside non-hake groundfish sector, we further stratified using area and depth within each gear type. We maintained area and depth strata that were applied to bottom trawl, hook-&-line, and pot gear in previous reports (see Table 4 of this report for specific strata; Heery et al. 2010, Jannot et al. 2011, 2012, 2013) because prior work demonstrated that these variables were correlated with P. halibut bycatch (Heery et al. 2010). Observations from IFQ vessels fishing midwater trawl gear targeting Pacific hake or other midwater target species were not post-stratified. In addition to the strata described above, we also provide bycatch estimates north and south of the North/South groundfish management line (40°10' N. lat.) for each sector and gear type.

Despite the 100% observer coverage mandate in 2014, there were some rare occasions (e.g., observer illness) when tows or sets were either only partially sampled or not sampled. We used ratio estimators to apportion unsampled weight to P. halibut, within each stratum. To obtain the estimated weight of P. halibut ($\hat{W}$) when the entire haul or set was unsampled, the unsampled discard weight, summed across unsampled hauls within the stratum, was multiplied by the ratio of the weight of P. halibut discard (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species in all fully sampled hauls within a stratum:

$$\hat{W}_{u,s} = \sum_{u} x_{u,s} \times \frac{\sum_f w_{f,s}}{\sum_f x_{f,s}} \tag{1}$$

where, for each stratum:

s = stratum, which includes sector and year and could include, area, depth, gear

u = unsampled haul
f = fully sampled haul
x = weight of discarded catch
$\hat{W}$ = estimated weight of unsampled P. halibut in the stratum
w = sampled weight of P. halibut

The unsampled weight of partially sampled hauls or sets was categorized into weight of non-IFQ species (NIFQ) or IFQ species. Unsampled IFQ species weight was further categorized into IFQ flatfish (IFQFF), IFQ rockfish (IFQRF), IFQ roundfish (IFQRD) and IFQ mixed species (IFQM). For the purposes of this report, we assume that unsampled P. halibut would only occur in NIFQ (south of 40°10' north latitude only), IFQM, or IFQFF unsampled categories. Thus, those are the only categories for which P. halibut is estimated. IFQM included all 2014 IFQ managed species (see 76 FR 27508 for a listing of IFQ species). NIFQ include all species encountered that were not designated as an IFQ managed species. IFQFF included all IFQ flatfish species managed as a complex under the groundfish FMP. North of the 40°10' north latitude groundfish management line, P. halibut would be included in unsampled IFQFF or IFQM categories. South of the groundfish management line, P. halibut would only be included in the unsampled NIFQ category.

To obtain the estimated weight of P. halibut ($\hat{W}$) in partially sampled hauls or sets, the unsampled discard weight, summed across partially sampled hauls within the stratum, was multiplied by the ratio of the weight of P. halibut (summed across fully sampled hauls within a stratum) divided by the total discard weight of all species occurring within a category (NIFQ, IFQFF, IFQM) in all fully sampled hauls within a stratum. Estimated P. halibut weight was summed across unsampled categories.

$$\hat{W}_{p,s} = \sum_{y} \left(\sum_{p} x_{p,y,s} \times \frac{\sum_{f} w_{f,s}}{\sum_{f} x_{f,y,s}} \right) \tag{2}$$

where, for each stratum:

s = stratum, which includes year and sector, and could include, area, depth, gear
y = unsampled category (either NIFQ, IFQFF, or IFQM)
p = partially sampled haul
f = fully sampled haul
x = weight of discarded catch
$\hat{W}$ = estimated weight of unsampled P. halibut in the stratum
w = sampled weight of P. halibut

Expanded weights of P. halibut obtained using the equations above for unsampled or partially sampled hauls were then added to the sampled weight of P. halibut within each stratum to obtain the total P. halibut weight per stratum.

3.2.3 Viability Analysis

We used observer field estimates of viability for P. halibut discarded in the IFQ fishery by vessels fishing bottom or pot gear to compute the total estimated mortality of discarded P. halibut by IFQ gear/sector and stratum.

To account for the impact of fish size on survivorship, we computed a weighted mortality rate for each condition category. Length measurements associated with each viability record were converted to weight based on the IPHC length-weight table provided in Appendix C 10.3.

A discard mortality rate for each condition category was then computed as the proportion of P. halibut sampled weight in a viability category multiplied by the viability category-specific mortality rate (see Tables 5 and 6 above):

$$DMR_{csj} = m_c \times P_{csj} \tag{3}$$

where:

s = stratum, which could include, area, depth, gear, and sector

c = viability condition (Excellent, Poor, Dead)
j = year
m = mortality rate
t = proportion of sampled P. halibut weight (w)
DMR= discard mortality rate

Discard mortality rates for each condition category c and stratum s were then multiplied by gross discard estimates to compute total estimated discard mortality for each gear type separately :

$$\hat{F}_{sj} = \sum_{c} (B_{sj} \times DMRsj) \tag{4}$$

where:

s = stratum, which could include, area, depth, gear, and sector
c = viability condition (Excellent, Poor, Dead)
j = year
F = total estimated discard mortality
B = gross estimated discard weight
DMR = discard mortality rate

Viability data are collected from only a subsample of the P. halibut that observers encounter. Based on previous evaluations by Wallace and Hastie (2009), we expect that survivorship of P. halibut in bottom trawl tows are most directly affected by the length of the tow and the amount of catch that fills the net. These variables are not part of the bycatch ratio stratification process (above), and their use in stratifying viability data would make it difficult to then apply discard mortality rates to initial gross estimates of bycatch. We found that tow duration was directly related to depth, one of the variables used to stratify discard ratios and initial gross discard estimates for bottom trawl gear. Because depth and tow duration appeared to co-vary, we used depth and area to stratify IFQ viability data collected from bottom trawl gear. For IFQ viability data collected from pot gear, only area is used to stratify the data. For longline gear, we used a discard morality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

Final estimates of P. halibut bycatch and discard mortality are also presented in the context of the estimated mortality of legal-sized halibut. This was computed by applying the proportion of sampled P. halibut weighed in each depth stratum that was from legal-sized fish (82 cm or larger) to initial estimates. Viabilities were then applied to gross legal-sized discard estimates in the same manner as described above.

3.2.4 Length Frequencies

The length frequency distribution for P. halibut in the 2011-2014 IFQ fishery is provided in Table 17. Pacific halibut pose unique challenges for observer sampling. Observers typically measure the length of P. halibut and then convert the measurement to weight using the IPHC length-weight conversion table (Table 9 in 10.3). Occasionally, observers weigh individual fish. Sometimes crew members presort the catch by removing P. halibut and immediately return them to sea. Vessel crews presort P. halibut to increase the likelihood of survival of the discarded fish. Presorting is prevalent on vessels fishing with hook-&-line gear. Fishers have raised concerns regarding crew safety when landing large P. halibut. In addition, hook-&-line fishers are concerned that P. halibut individuals would be injured during landing because of their interaction with the vessel 'crucifer' (gear used to strip the bait and any catch off of the hook and ganglion line). Therefore, shake-offs prior to the crucifier (a form of pre-sorting) is almost universal on IFQ hook-&-line vessels. Another case of pre-sorting can occur when halibut are too heavy and/or awkward to weigh in observer baskets. In all cases of pre-sorting, random samples are not available. Therefore, observers visually estimate the length of the halibut in ten-centimeter units (40cm, 50cm, 60cm, etc.), which are later converted to weight using the IPHC length-weight conversion table (Table 9 in Appendix C 10.3).

Table 38 (Appendix A 10.1) provides the actual observed length frequency distributions of discarded P. halibut for vessels fishing IFQ using bottom trawl or pot gear. These length frequencies have been weighted based on the ratio of total estimated P. halibut discard weight to the weight of P. halibut that was measured in each stratum (see Appendix A 10.1 for further details). Because size-specific mortality rates have not been determined, we were not

able to compute the length frequency distribution of discarded fish that died. However, we have summarized the proportion of length measurements in each condition category (Excellent, Poor, and Dead) in Table 39 (Appendix A 10.1) to inform size-specific modeling of mortality. The frequency of sampled fish within each condition category was weighed in the same manner as length frequency distributions and then summarized for each 2 cm length bin.

3.3 Non-nearshore Fixed Gear Fishery

The WCGOP samples each non-nearshore fixed gear sector through separate random selection processes, with the limited entry (LE) sablefish endorsed season permits receiving the highest level of coverage, then LE sablefish non-endorsed permits, and open access (OA) fixed gear the lowest. LE sablefish endorsed vessels that fish outside of the primary season or that have reached their tier quota in the primary season are not randomly chosen for observation. Given this sampling structure and anticipated differences in variance from one sector to the next, we chose to maintain sector as a stratification variable in our analysis. Testing of alternative stratification schemes (Heery et al. 2010) indicated that latitude and gear type were the most important variables with respect to P. halibut bycatch in the non-nearshore fixed gear groundfish fishery. Bycatch estimates were produced separately for each sector and gear combination. Two latitudinal strata were applied to the LE sablefish endorsed longline sector (north and south of Point Chehalis, Washington = 46° 53.30' N. lat.) because previous modeling demonstrated that these strata significantly improved the fit of predicted bycatch amounts to the amounts observed (Heery et al. 2010). Point Chehalis, WA was used in previous estimates of P. halibut bycatch in the LE sablefish endorsed season longline sector because of its relevance to groundfish management and its apparent apparent ability to split out higher bycatch rates off the northern coast of Washington (Heery and Bellman 2009). Evaluations of latitudinal strata for the other fixed gear sectors did not improve the fit of models to an extent that justified their use. Thus, we maintained previous stratifications for the other groundfish fixed gear sectors (Heery and Bellman 2009, Heery et al. 2010, Jannot et al. 2011, 2012, 2013).

3.3.1 Discard Estimation

A deterministic approach was used to estimate P. halibut discard for all sectors of the non-nearshore groundfish fixed gear fishery. Discard ratios were computed from observer data as the discarded weight of P. halibut divided by the retained weight of either sablefish or all FMP groundfish (except Pacific hake), depending on the sector (Table 23; FMP groundfish species: NWFSC 2014c). Ratio denominators were identified for each sector of the non-nearshore fixed gear fishery based on the targeting behavior of that sector. Discard ratios were then multiplied by the total sector landed weight of either sablefish or FMP groundfish (except Pacific hake), corresponding to the denominator used to compute the observed discard ratio for each sector. This provided an expanded gross estimate of P. halibut discard for each sector. A discard mortality rate (discussed below) was then applied to compute estimated discard mortality.

Total landed weights for each sector are obtained from fish ticket landing receipts. Fish tickets for fixed gear that included recorded weights for sablefish were included in the non-nearshore fixed gear sector. Commercial fixed gear fish tickets with recorded nearshore species weight were not used in this portion of the fixed gear analysis, regardless of whether they included recorded weights for sablefish (Figure 8). In addition, fixed gear fish tickets without recorded sablefish or nearshore species were included in the non-nearshore fixed gear sectors only if groundfish landings were greater than non-groundfish landings based on a unique vessel and landing date.

Fish tickets from the non-nearshore fixed gear sector were partitioned into the three commercial fixed-gear sectors (LE sablefish endorsed season, LE sablefish non-endorsed, and OA fixed gear) through the following process. Commercial fixed-gear fish tickets were first divided out by whether the vessel had a federal groundfish permit (limited entry) or no federal groundfish permit (open access). OA fish tickets were placed in the OA fixed gear groundfish sector. Next, LE fish tickets were separated based on whether the vessel's federal groundfish permit(s) had a sablefish endorsement with tier quota for the primary season or if it was not endorsed (also referred to as 'zero' tier). Fish tickets for all LE sablefish vessels with tier endorsements that were operating within this period and within their allotted tier quota were placed in the LE sablefish endorsed sector. If LE sablefish endorsed vessels fished outside of the primary season (November through March) or made trips within the season after they had reached their tier quota, the fish tickets were placed in the LE sablefish non-endorsed sector. In addition, fish tickets from non-endorsed LE vessels were also placed in the LE sablefish non-endorsed sector.

Further processing of fish tickets identified and removed the directed commercial P. halibut fishery landings from

the non-nearshore fixed gear analysis. The directed P. halibut fishery occurs for only a few days each year, during 10-hour openings that are designated by the IPHC. LE and OA fixed gear vessels that typically target groundfish can participate in the directed fishery. For most fixed gear vessels, (other than LE sablefish endorsed vessels north of Point Chehalis) this is the only time during which they are allowed to land P. halibut. Fish tickets that included P. halibut landings on or within the 2 days after a directed fishery opening were considered to be part of the directed fishery and not part of the non-nearshore fixed gear fishery targeting federal FMP groundfish. These fish tickets were removed prior to our analysis. This approach may have resulted in the removal of some non-directed fishery landings north of Point Chehalis, but any bias introduced by this step is considered to be extremely small given the short time period across which fish tickets were removed.

WCGOP observer data were stratified according to sector and gear type (longline and pot/trap). As previously described, one additional latitudinal stratum at Point Chehalis, Washington (46° 53.30' N. lat.) was used for the LE sablefish endorsed longline sector. Some retention of P. halibut was allowed in the LE sablefish endorsed season in the area north of Point Chehalis. The Point Chehalis line was the only latitudinal stratification incorporated into this portion of the analysis and was only applied to the LE sablefish endorsed sector. Discard amounts provided for the other two field gear sectors represent coast-wide estimates.

The number of observed trips, sets, and vessels are summarized for each sector, gear type, and area (where applicable) (Tables 19, 20 & 21). The landed weight of sablefish and FMP groundfish (excluding Pacific hake) is used as a measure for expanding discard from observed trips to the entire fleet (Tables 22 & 23). Observed discard ratios were calculated by sector, gear type and area based on the following equation:

$$\hat{D}_s = \frac{\sum_t d_{st}}{\sum_t r_t} \times F_s \tag{5}$$

s = stratum, including gear, sector, gear type, and area
t = observed sets
d = observed discard (mt) of P. halibut
r = observed retained weight (mt) of sablefish or all FMP groundfish except Pacific hake
F = weight (mt) of retained sablefish or all FMP groundfish excluding Pacific hake recorded on fish tickets in strata s
$\hat{D}_s$ = discard estimate for stratum s

For all strata except the LE sablefish non-endorsed longline and the OA sectors, discard ratios were calculated by dividing the stratum discard weight of P. halibut by the retained catch weight of sablefish. Retained groundfish was used as the ratio denominator for the LE sablefish non-endorsed longline and the OA sectors because these sectors target a wider range of groundfish species. A broader denominator was therefore necessary to effectively capture the level of fishing effort in these sectors. Please refer to earlier reports for further details of data pooling and discard ratios on prior years of observer coverage.

Where FMP groundfish (excluding Pacific hake) was used to compute discard ratios, and retained weights recorded by the observer not appearing on fish tickets were excluded from the denominator. This prevents double-counting associated with differences in the species codes used by observers and processors. For instance, while observers may record rockfish catch at the species level, various species of rockfish are often grouped, weighed, and recorded together on the fish ticket by the processor under a grouped market category, e.g., northern unspecified scope rockfish. In some cases, this difference in species coding prevents observer and fish ticket weights from being marched and adjusted properly. Species coding on fish tickets varies considerably between processors and over time, and it is not possible to make assumptions regarding which individual observer-recorded species likely coincide with species grouping codes on fish tickets. By using only the retained groundfish weight from fish tickets in discard ratio denominators, we prevent double-counting of retained weights. This is not a factor when using a single species in the denominator, such as sablefish, as any retained weights in observer and fish ticket data that share the same species code will match and adjust properly.

The expansion factors for each fishery sector and gear type can be found in Table 23. The discard rate multiplied by the expansion factor yielded an expanded gross P. halibut discard estimate for each stratum (Table 25). If landings were made by a fixed gear sector for which there were zero or very few WCGOP observations, the most appropriate observed discard ratio was selected and applied to those landings based on similarities in the fishery

management structure, fishing and discard behavior, and the gear fished. The LE sablefish endorsed vessels fishing outside of the primary season with pot gear often land a small amount of groundfish; however, this portion of the fleet is not observed by the WCGOP program. Given similarities in gear type and catch composition, OA fixed gear pot observations were selected as the most appropriate source of information for an observed discard rate (Table 22).

3.3.2 Discard Mortality Rates

Once an initial gross P. halibut discard was estimated, this value was multiplied by a discard mortality rate (Table 25) to generate final discard mortality estimates (Tables 25 & 26, Figure 5). Ideally, discard mortality would be approximated based on viabilities in a manner similar to the approach used for IFQ bottom trawl and pot gear. WCGOP observers do record viability conditions as P. halibut are discarded from non-IFQ longline vessels. However, observers only started systematically sampling P. halibut viabilities on non-IFQ longline vessels in 2011 and not enough observations are available at this point in time to effectively use these data. Viabilities from pot gear would be appropriate to use in estimating discard mortality, however bycatch of P. halibut in pot gear is infrequent and the sample size was too small to utilize in this analysis.

Thus, P. halibut viabilities recorded from the non-nearshore fixed gear fishery were not used in our analysis because we have too few observations. We plan to incorporate viabilities from fixed gear vessels in a future report. Discard mortality rates therefore had to be identified through other means. Review of the literature on P. halibut bycatch revealed little that could be applied to the entire discard estimate. Several studies have examined the survivorship of P. halibut in various conditions (Kaimmer and Trumble 1998, Trumble et al. 2000). However, without any information on the state of discard P. halibut, the findings from these examinations could not be used.

Instead, we relied on discard mortality rates computed for Alaska groundfish fisheries (Williams 2008). An 18% discard mortality rate was applied to estimates for pot gear, coinciding with the DMR used for the sablefish pot CDQ fishery in Alaska. For longline gear, we used a discard mortality rate of 16%, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008).

For additional context, we present the length frequency distribution of P. halibut from visual length estimates and physically measured lengths in non-nearshore fixed gear sectors (Tables 27, 28, 29, & 30) and the proportion of sampled P. halibut discard of legal (>82 cm) and sublegal (<82 cm) sizes in non-nearshore fixed gear sectors (Table 31). The majority of P. halibut lengths recorded in these fisheries were visual estimate of length, rounded to the nearest 10 cm. In other words, specimens that are 76 cm and 82 cm are both visually estimated to be 80 cm. With this level of resolution, it was not possible to compute the exact proportion of sublegal versus legal P. halibut from visually estimated lengths. Visual estimates were instead summarized in the manner in which they are recorded; with sublegal and legal sized halibut falling within the 75-84 cm length bin. Observers have been instructed to make physical measurements of P. halibut lengths from randomly sampled fish on LE sablefish endorsed vessels, with the help of vessel crew.

3.4 Other Fisheries

Pacific halibut bycatch was also observed in the nearshore groundfish fixed gear sector (Table 32), the state pink shrimp trawl fisheries (Table 33), and the OA California halibut trawl fishery (Table 34) The LE California halibut fishery is covered under the IFQ fishery. Bycatch estimates for these three fishery sectors were computed based on the following equation:

$$\hat{B} = \frac{\sum_t b_t}{\sum_t r_t} \times F \tag{6}$$

b = observed discard (mt) of P. halibut on set/haul t
r = observed retained weight (mt) of target species on set/haul t
F = weight (mt) of retained target species
$\hat{B}$ = Discard estimate of P. halibut (mt)

The nearshore fixed gear fishery targets a variety of groundfish species that inhabit areas less than 50 fathoms deep. All species included in the nearshore target group as listed in the WCGOP data processing appendix (NWFSC 2014c 7) were included in the denominator when calculating bycatch ratios for the nearshore fixed gear sector. Pink shrimp and California halibut were considered the target species in their respective fisheries. Discard

mortality rates are not available for these fisheries due to a lack of information regarding survivorship (California halibut and pink shrimp fisheries). To maintain confidentiality, the Nearshore fisheries cannot be split out by gear type (hook-and-line vs. pot). For these reasons, we assumed 100% mortality in the Nearshore, Pink Shrimp, and CA halibut fisheries.

4 RESULTS

4.1 IFQ Fishery

All participating vessels carry an observer on all fishing trips under IFQ management (100% trips observed). For most strata, 99% or more of the observed IFQ tows or sets were sampled (Tables 7, 8, & 9). Non-IFQ species represented the largest portion of unsampled catch (Table 10); non-IFQ species sampling is a lower priority under WCGOP sampling protocols (NWFSC 2014b).

The total estimated weight of P. halibut from unsampled tows or sets in 2014 represents a small fraction (2.36 mt, or ˜ 3.9%) of the total 2014 IFQ gross discard weight of P. halibut (Tables 10, 11 & 12). Unsampled P. halibut catch in 2014 from both unsampled and partially sampled hauls represented 4.7% of the total gross discard weight (2.87 of 61.17 mt). Thirty-one percent of the estimated gross discard weight (0.52 mt) came from unsampled IFQM, whereas the remainder (2.36 mt) came from unsampled hauls (Tables 10, 11 & 12, see also Table 37).

Gross bycatch estimates and total discard mortality estimates were largest for vessels fishing bottom trawl gear, north of the 40°10' N. latitude management line in depths greater than 60 fathoms (Table 14). This gear-area-depth stratum accounts for ˜70% of the 2014 P. halibut discard mortality in the fishery. The next largest fraction (˜21%) of total discard mortality was found in the same gear-area combination in shallow waters (<60 fm). Together, bottom trawl gear fishing north of the 40°10' N. latitude management line accounts for 91% of the 2014 P. halibut discard mortality in the IFQ fishery (Table 14).

In terms of viability, the majority of individuals were classified as either Excellent or Dead, depending on the stratum (Table 13). The majority of individuals caught with bottom trawl were in Excellent condition in the area north of Point Chehalis and in shallow depths between 40°10' N. latitude and Pt. Chehalis (Table 13). In deeper depths between 40°10' N. latitude and Pt. Chehalis individuals were more evenly split between Excellent and Dead. South of Point Chehalis the majority of individuals were Dead in deeper depths (Table 13).

Of the few individuals sampled from midwater trawl gear in the Shoreside Hake sector, most individual were categorized as Excellent (Table 13). Midwater trawl vessels fishing for hake to be delivered shoreside place the catch directly in the hold, with only rare presorting events. The majority of P. halibut caught with pot gear were categorized as Excellent viability (Table 13).

Estimated P. halibut discard mortality from all sectors and gears of the 2014 IFQ fishery was 35% less than the largest IFQ estimated discard mortality to date, which occurred in 2012. The 2014 IFQ discard mortality estimate is also significantly less than last year's estimate. From the current data, it is not clear why IFQ estimates have declined. Two possible reasons are that there is less effort, as measured by fewer trips and tows in the IFQ bottom trawl fleet (Table 7). In addition, the number of tow hours has also declined from last year (Table 7). Tow hours might be reduced in two ways: fewer overall tows and shorter individual tow times.

The 2014 IFQ estimated P. halibut discard mortality for all gears is 85% less than the estimated discard morality from the 2010 LE bottom trawl fishery (Figure 1) and 88% less than the average mortality in the LE bottom trawl fishery over the years 2002-2010. The changes in the fishery could explain this decrease in P. halibut catch. First, IBQs for P. halibut might have increased fisher incentives to avoid P. halibut bycatch and thereby changed fisher behavior (i.e., changing fishing grounds or gear). Second, testing and use of gear to exclude P. halibut from the catch became general practice in much of the trawl fleet, which enabled fishermen to increase fishing activity without additional risk to quota.

Estimated bycatch weight of P. halibut (0.4 mt, Tables 35 & 37) from the At-sea Hake component of the 2014 IFQ fishery decreased to a near historic low (Table 37). At-sea hake P. halibut length frequencies are given in Table 36.

4.2 Non-Nearshore Fixed Gear Fishery

The 2014 estimated discard mortality of P. halibut in the longline portion of the LE sablefish endorsed sector increased from 2013 historic low (Table 25). Compared to 2013, the 2014 observed discard ratio increased both north and south of Point Chehalis, while the fleet-wide landings of sablefish remained similar to 2013 (Table 23). This indicates an increase in P. halibut encounters in this sector, particularly north of Pt. Chehalis (Table 24). Gross estimated discard of P. halibut from the pot portion of the LE sablefish endorsed sector was up from 2013, but still relatively low compared to longline gears (Table 25). This uptick on pot vessels is likely due to increased encounter rates (Table 24).

Discard of P. halibut among the sablefish non-endorsed fixed gear sectors (LE and OA) during 2014 was similar to 2013. In both 2013 and 2014, estimated discard mortality in both the LE and OA sablefish non-endorsed longline/hook-&-line sectors were both at or near historical lows relative to previous years (Table 25). Effort in the LE sablefish non-endorsed sector was down (Table 21) in 2014, and no P. halibut were observed in this sector (Table 24). OA longline vessels, trips and sets increased (Table 21) relative to last year and there is a slight increase in P. halibut discards on OA longline vessels (Table 25) compared to last year. The estimated discard mortality for OA pot gear vessels showed a slight uptick from 2013 (Table 25), probably due to the slight increase in effort relative to 2013 (Table 21).

4.3 Other Fisheries

Very small amounts of P. halibut bycatch were recorded in other observed fisheries. Even assuming 100% mortality, bycatch estimates for the nearshore groundfish fixed gear sector, pink shrimp trawl fishery, and the OA sector of the California halibut trawl fishery made up a minor portion of the 2014 total mortality estimate for P. halibut (Tables 32, 33, & 34).

5 SUMMARY & CONCLUSIONS

5.1 IFQ Fishery

- Estimated P. halibut discard mortality from the 2014 IFQ fishery represents a 17% decrease from 2013, 85% lower than the 2010 LE bottom trawl fishery estimate.
- The cause of the decrease from 2013 to 2014 has not been definitively determined at this point; however, reduced number of trips, tows and shorter tow duration probably contribute to this decline.
- P. halibut discard from the at-sea Pacific hake fishery in 2014 decreased relative to 2013, to the low end of the historical range (2002-2013).

5.2 Non-IFQ Fisheries

- The 2014 estimates of P. halibut discard morality in the LE sablefish endorsed sector was up significantly from 2013; increased encounter rates probably drive the increase in discard mortality estimates; however, the source of increased encounter rates remains unclear at this point. The LE sablefish non-endorsed and open access fixed gear sectors P. halibut discard mortality estimates remained near historic lows.
- Estimated P. halibut mortality in all other non-IFQ observed fisheries remain low relative to the IFQ and Non-Nearshore sectors, and are within the range observed in previous years.

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8 TABLES

Table 7: Number of vessels, trips, and tows observed and metric tons of sampled Pacific halibut discard at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) in the IFQ bottom trawl fishery. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). Some tows are only partially sampled. Partially sampled tows are included in the No. of sampled tows field, but for clarity the number of unsampled catch categories in partially sampled tows is provided. Some tows are completely unsampled. (*) confidential data, (-) not applicable.

Bottom Trawl

Area / Depth (fm) / Year	No. of vessels	No. of trips	No. sampled tows	No. unsampled tows	sampled tow hours	unsampled tow hours	discarded at sea (mt)	discarded at dock (mt)	Unsampled categories from partially sampled hauls: IFQFF	IFQM	Non-IFQ	Coverage Rate: %tows sampled	% tow hrs. sampled
N. of Pt. Chehalis													
0-60													
2011	13	46	303	0	836.17	0.00	7.36	0.00	1	4	8	100.00%	100.00%
2012	13	65	316	5	704.40	6.80	4.77	0.00	0	0	1	98.44%	99.04%
2013	11	96	464	1	1154.16	3.05	5.43	0.00	1	0	10	99.78%	99.74%
2014	10	31	187	1	395.29	3.00	1.97	0.00	0	3	3	99.47%	99.25%
>60													
2011	22	146	1108	2	4264.79	11.83	21.65	0.01	1	5	48	99.82%	99.72%
2012	19	168	1337	3	5141.66	13.67	30.18	0.03	0	13	30	99.78%	99.73%
2013	17	203	1703	4	6198.48	15.70	29.66	0.14	2	3	32	99.77%	99.75%
2014	13	149	1203	7	4887.72	21.19	24.88	0.08	0	3	11	99.42%	99.57%
40°10′ to Pt. Chehalis													
0-60													
2011	20	137	1115	12	2126.97	24.40	10.48	0.00	9	2	33	98.94%	98.87%
2012	21	154	973	8	1946.79	18.51	7.73	0.00	1	3	14	99.18%	99.06%
2013	20	207	949	2	2215.74	5.25	8.47	0.00	0	8	14	99.79%	99.76%
2014	18	197	1081	8	2456.07	23.66	10.05	0.00	0	16	21	99.27%	99.05%
>60													
2011	56	754	5105	25	26499.73	133.26	22.02	0.01	5	13	133	99.51%	99.50%
2012	54	709	4548	24	23737.91	91.42	19.87	0.04	2	17	111	99.48%	99.62%
2013	54	755	4995	14	25389.74	64.76	20.44	0.02	1	18	143	99.72%	99.75%
2014	50	626	3839	12	19771.63	47.67	16.95	0.01	0	8	77	99.69%	99.76%
S. of 40°10′ N. lat.													
0-60													
2011	3	23	66	0	163.75	0.00	0.17	0.00	3	0	1	100.00%	100.00%
2012	*	*	*	*	*	*	*	*	*	*	*	*	*
2013‡	4	56	171	0	453.42	0.00	0.03	0.00	0	0	0	100.00%	100.00%
2014‡	5	16	40	1	78.37	2.08	0.00	0.00	0	0	1	97.56%	97.41%
>60													
2011	15	241	1373	3	5982.88	12.07	0.16	0.00	3	0	34	99.78%	99.80%
2012	13	255	1645	3	6214.78	4.08	0.81	0.00	1	1	66	99.82%	99.93%
2013‡	14	283	1787	2	6806.14	2.75	0.88	0.00	0	2	69	99.89%	99.96%
2014‡	14	277	1896	12	6436.96	50.11	0.56	0.00	1	0	35	99.37%	99.23%
LE CA Halibut S. of 40°10′ N. lat.													
All depths													
2011	3	63	157	0	513.33	0.00	0.00	0.00	0	0	2	100.00%	100.00%
2012	*	*	*	*	*	*	*	*	*	*	*	*	*

‡Combined IFQ and LE CA Halibut bottom trawl.

Table 8: Number of vessels, trips, and tows observed and metric tons of sampled Pacific halibut discard at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) in the IFQ midwater trawl fisheries. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). Some tows are only partially sampled. Partially sampled tows are included in the No. of sampled tows field, but for clarity the number of unsampled catch categories in partially sampled tow is provided. Some tows are completely unsampled. (*) confidential data, (-) not applicable.

Gear / **Sector-Area** / Year	**No. of vessels**	**No. of trips**	**No. sampled tows**	**No. un-sampled tows**	**sampled tow hours**	**unsampled tow hours**	**discarded at sea (mt)**	**discarded at dock (mt)**	**Unsampled categories from partially sampled hauls**			**Coverage Rate**	
									IFQFF	**IFQM**	**Non-IFQ**	**%tows sampled**	**% tow hrs. sampled**
Midwater Trawl													
Non-hake Shoreside													
North of 40°10′													
2011	*	*	*	*	*	*	*	*	*	*	*	*	*
2012	4	9	30	0	70.39	0.00	0.00	0.00	0	0	0	100.00%	100.00%
2013	5	19	58	0	113.14	0.00	0.00	0.00	0	0	0	100.00%	100.00%
2014	9	34	125	0	257.12	0.00	0.00	0.00	0	0	0	100.00%	100.00%
Shoreside Hake													
North of 40°10′													
2011	26	913	1701	0	3940.07	0.00	0.03	0.33	0	0	2	100.00%	100.00%
2012	24	715	1564	0	5902.29	0.00	0.00	0.62	0	0	3	100.00%	100.00%
2013	24	940	1702	0	4593.74	0.00	0.05	1.26	0	0	1	100.00%	100.00%
2014	25	954	1679	0	4666.26	0.00	0.11	1.25	0	0	7	100.00%	100.00%

Table 9: Number of vessels, trips, and sets observed and metric tons of sampled Pacific halibut discard at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) in the IFQ fixed gear fisheries. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). Some sets are only partially sampled. Partially sampled sets are included in the No. of sampled sets field, but for clarity the number of unsampled catch categories in partially sampled sets is provided. Some sets are completely unsampled. (*) confidential data, (-) not applicable.

Gear / **Area** / Year		**No. of vessels**	**No. of trips**	**No. sampled sets**	**No. un-sampled sets**	**discarded at sea (mt)**	**discarded at dock (mt)**	**Unsampled categories from partially sampled hauls**			**Coverage Rate**
								IFQFF	**IFQM**	**Non-IFQ**	**%sets sampled**
Hook and Line											
North of 40°10′											
	2011	6	21	410	1	6.06	0.00	0	0	0	99.76%
	2012	6	22	486	0	14.66	0.00	0	0	0	100.00%
South of 40°10′											
	2011	6	71	212	0	0.00	0.00	0	0	1	100.00%
	2012	*	*	*	*	*	*	*	*	*	*
Coastwide											
	2013	4	18	153	0	3.00	0.00	0	0	0	100.00%
	2014	4	18	178	21	3.43	0.00	0	0	0	89.45%
Pot											
North of Pt. Chehalis											
	2011	3	12	63	0	1.03	0.00	0	0	0	100.00%
	2012	5	45	419	0	1.27	0.00	0	0	7	100.00%
	2013	3	12	165	0	0.22	0.00	0	0	1	100.00%
40°10′ to Pt. Chehalis											
	2011	8	75	714	2	2.30	0.00	0	0	1	99.72%
	2012	9	60	468	0	0.62	0.00	0	0	0	100.00%
	2013	5	40	502	0	0.76	0.00	0	0	2	100.00%
South of 40°10′											
	2011	11	148	738	0	0.00	0.00	0	0	2	100.00%
	2012	13	167	812	0	0.00	0.00	0	0	1	100.00%
	2013	6	41	411	0	0.00	0.00	0	0	2	100.00%
Coastwide	2014	14	113	1246	0	0.32	0.00	0	0	9	100.00%

Table 10: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ bottom trawl fisheries by year. Unsampled catch weight could be assigned to one of four categories: IFQ flatfish species, IFQ mixed species, non-IFQ species, or unsorted (a mix of both IFQ and non-IFQ species). The sampled weight, discard ratio, unsampled weight and estimated P. halibut gross discard are presented within each category, as a function of sector, management area, depth, and area north or south of Pt. Chehalis, WA. The sum of expanded weight is the sum of the estimated gross P. halibut discard across categories. The sampled discarded PHLB weight is the sum of sampled PHLB. The total discard (gross) is the sum of the PHLB in unsampled hauls plus the sampled PHLB. All weights are metric tons (mt). (*) confidential data.

Bottom Trawl

Area / Depth (fm) / Year	IFQ Flatfish				Mixed IFQ species				Non-IFQ Species				Unsorted				Sum of Exp. Discard Weight	Samp. Discarded PHLB	Total Discard
	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard			
N. of Pt. Chehalis																			
0-60																			
2011	60.63	0.12	0.14	0.02	80.91	0.09	3.86	0.35	59.76	0.00	2.27	0.00	140.78	0.05	0.00	0.00	0.44	7.36	7.81
2012	50.77	0.09	0.00	0.00	56.29	0.08	0.00	0.00	46.48	0.00	0.09	0.00	102.78	0.05	0.56	0.03	0.03	4.77	4.80
2013	104.68	0.05	0.07	0.00	114.61	0.05	0.00	0.00	93.55	0.00	1.41	0.00	208.19	0.03	0.91	0.02	0.03	5.43	5.46
2014	26.44	0.07	0.00	0.00	32.70	0.06	1.62	0.10	27.69	0.00	0.72	0.00	60.41	0.03	0.02	0.00	0.10	1.97	2.07
>60																			
2011	115.56	0.19	0.45	0.09	143.92	0.16	0.84	0.13	213.94	0.00	3.19	0.00	368.37	0.06	0.10	0.01	1.05	21.65	22.69
2012	94.35	0.42	0.00	0.00	132.42	0.30	1.48	0.44	278.10	0.00	4.70	0.00	417.57	0.09	12.10	1.14	10.89	30.18	41.07
2013	185.79	0.16	0.20	0.03	227.34	0.13	1.07	0.14	238.54	0.00	2.41	0.00	943.44	0.13	1.39	0.09	0.26	29.66	29.92
2014	194.07	0.13	0.00	0.00	235.38	0.11	0.87	0.09	293.59	0.00	0.51	0.00	532.21	0.05	22.74	1.07	1.16	24.88	26.04
40°10′ to Pt. Chehalis																			
0-60																			
2011	97.22	0.11	0.61	0.07	118.33	0.09	2.40	0.22	192.03	0.00	5.03	0.00	310.71	0.03	3.77	0.13	0.59	10.48	11.07
2012	72.52	0.11	0.28	0.03	86.27	0.09	0.85	0.08	145.63	0.00	1.07	0.00	232.25	0.03	1.95	0.06	0.17	7.73	7.91
2013	109.66	0.08	0.00	0.00	120.95	0.07	0.86	0.06	138.68	0.00	1.60	0.00	259.71	0.03	0.41	0.01	0.07	8.47	8.55
2014	178.00	0.06	0.00	0.00	195.83	0.05	4.37	0.23	206.98	0.00	3.57	0.00	403.52	0.02	17.07	0.43	0.65	10.05	10.71
>60																			
2011	190.51	0.12	0.78	0.09	352.78	0.06	3.77	0.24	649.12	0.00	12.08	0.00	1114.17	0.02	6.38	0.13	0.49	22.02	22.51
2012	180.28	0.11	0.06	0.01	369.65	0.05	6.42	0.35	527.45	0.00	8.29	0.00	1016.03	0.02	6.63	0.13	0.50	19.87	20.36
2013	229.40	0.09	0.07	0.01	401.88	0.05	9.27	0.47	609.08	0.00	9.36	0.00	2229.10	0.04	9.59	0.18	0.65	20.44	21.10
2014	335.76	0.05	0.00	0.00	501.23	0.03	3.02	0.10	446.11	0.00	3.73	0.00	2021.99	0.03	19.43	0.33	0.43	16.95	17.39
S. of 40°10′ N. lat.																			
0-60																			
2011	4.60	0.00	0.04	0.00	5.04	0.00	0.00	0.00	11.74	0.01	0.01	0.00	16.79	0.01	0.00	0.00	0.00	0.17	0.17
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2013‡	4.55	0.00	0.00	0.00	6.65	0.00	0.00	0.00	65.53	0.00	0.00	0.00	73.58	0.00	0.00	0.00	0.00	0.03	0.03
2014‡	0.86	0.00	0.00	0.00	2.38	0.00	0.00	0.00	4.43	0.00	0.45	0.00	6.84	0.00	0.02	0.00	0.00	0.00	0.00
>60																			
2011	155.01	0.00	0.10	0.00	275.06	0.00	0.00	0.00	193.35	0.00	2.86	0.00	498.76	0.00	1.36	0.00	0.00	0.16	0.16
2012	80.42	0.00	0.01	0.00	266.50	0.00	0.03	0.00	203.88	0.00	7.08	0.03	489.48	0.00	1.93	0.00	0.03	0.81	0.84
2013‡	119.64	0.00	0.00	0.00	364.86	0.00	0.07	0.00	261.65	0.00	7.47	0.03	1323.49	0.00	0.23	0.00	0.03	0.88	0.91
2014‡	169.03	0.00	0.03	0.00	363.22	0.00	0.00	0.00	309.54	0.00	1.22	0.00	704.84	0.00	5.64	0.00	0.01	0.56	0.57
LE CA Halibut S. of 40°10′ N. lat.																			
All depths																			
2011	0.73	0.00	0.00	0.00	0.74	0.00	0.00	0.00	75.34	0.00	0.01	0.00	76.16	0.00	0.00	0.00	0.00	0.00	0.00
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

‡Combined IFQ and LE CA Halibut bottom trawl.

Table 11: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ midwater trawl fisheries by year. Unsampled catch weight could be assigned to one of four categories: IFQ flatfish species, IFQ mixed species, non-IFQ species, or unsorted (a mix of both IFQ and non-IFQ species). The sampled weight, discard ratio, unsampled weight and estimated P. halibut gross discard are presented within each category, as a function of sector. All midwater trawling occurs north of 40 °10' and all depths are included in the summaries. The sum of expanded weight is the sum of the estimated gross P. halibut discard across categories. The sampled discarded PHLB weight is the sum of sampled PHLB. The total discard (gross) is the sum of the PHLB in unsampled hauls plus the sampled PHLB. All weights are metric tons (mt). (*) confidential data.

Midwater Trawl

Area / Depth (fm) / Year	IFQ Flatfish				Mixed IFQ species				Non-IFQ Species				Unsorted				Sum of Exp. Discard Weight	Samp. Discarded PHLB	Total Discard
	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard			
Non-hake Shoreside Midwater Trawl																			
2011	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.02	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00
2014	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00
Shoreside Hake Midwater Trawl																			
2011	0.03	0.99	0.00	0.00	521.49	0.00	0.00	0.00	3.82	0.00	1.37	0.00	525.31	0.00	0.00	0.00	0.00	0.03	0.03
2012	0.00	0.00	0.00	0.00	128.31	0.00	0.00	0.00	8.19	0.00	0.36	0.00	136.50	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.05	1.00	0.00	0.00	460.78	0.00	0.00	0.00	7.29	0.00	0.23	0.00	468.07	0.00	0.00	0.00	0.00	0.05	0.05
2014	0.16	0.71	0.00	0.00	498.24	0.00	0.00	0.00	13.04	0.00	0.23	0.00	511.28	0.00	0.05	0.00	0.00	0.11	0.11

Table 12: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category in the U.S. west coast groundfish IFQ fixed gear fisheries by year. Unsampled catch weight could be assigned to one of four categories: IFQ flatfish species, IFQ mixed species, non-IFQ species, or unsorted (a mix of both IFQ and non-IFQ species). The sampled weight, discard ratio, unsampled weight and estimated P. halibut gross discard are presented within each category, as a function of gear, management area, and, for pot gear, by areas north and south of Point Chehalis, WA. All depths fished are included in the summaries. The sum of expanded weight is the sum of the estimated gross P. halibut discard across categories. The sampled discarded PHLB weight is the sum of sampled PHLB. The total discard (gross) is the sum of the PHLB in unsampled sets plus the sampled PHLB. All weights are metric tons (mt). (*) confidential data.

Area / Depth (fm) / Year	IFQ Flatfish				Mixed IFQ species				Non-IFQ Species				Unsorted						
	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Samp. Weight	Discard Ratio	Unsamp. Weight	Est. Discard	Sum of Exp. Discard Weight	Samp. Discarded PHLB	Total Discard
Hook and Line																			
North of 40°10′ N. lat.																			
2011	7.19	0.84	0.00	0.00	22.06	0.27	0.00	0.00	43.43	0.00	0.00	0.00	78.81	0.08	0.00	0.00	0.00	6.06	6.06
2012	19.30	0.76	0.00	0.00	36.79	0.40	0.00	0.00	91.44	0.00	0.00	0.00	133.38	0.11	0.00	0.00	0.00	14.66	14.66
South of 40°10′ N. lat.																			
2011	0.18	0.00	0.00	0.00	3.72	0.00	0.00	0.00	14.12	0.00	0.00	0.00	24.78	0.00	0.00	0.00	0.00	0.00	0.00
2012	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Coastwide																			
2013	5.10	0.59	0.00	0.00	8.23	0.36	0.00	0.00	26.81	0.00	0.00	0.00	35.83	0.08	0.00	0.00	0.00	3.00	3.00
2014	6.46	0.68	0.00	0.00	9.53	0.46	0.00	0.00	35.53	0.00	0.00	0.00	45.75	0.10	5.55	0.53	0.53	3.43	3.96
Pot																			
North of Pt. Chehalis																			
2011	1.05	0.98	0.00	0.00	1.56	0.66	0.00	0.00	0.26	0.00	0.00	0.00	1.82	0.57	0.00	0.00	0.00	1.03	1.03
2012	2.46	0.52	0.00	0.00	9.15	0.14	0.00	0.00	1.59	0.00	0.01	0.00	11.42	0.11	0.00	0.00	0.00	1.27	1.27
2013	0.28	0.79	0.00	0.00	1.08	0.20	0.00	0.00	0.52	0.00	0.01	0.00	1.73	0.13	0.00	0.00	0.00	0.22	0.22
Pt. Chehalis to 40°10′ N. lat.																			
2011	2.45	0.94	0.00	0.00	7.95	0.29	0.00	0.00	2.64	0.00	0.00	0.00	11.33	0.20	0.01	0.00	0.00	2.30	2.31
2012	1.22	0.51	0.00	0.00	3.86	0.16	0.00	0.00	3.29	0.00	0.00	0.00	9.88	0.06	0.00	0.00	0.00	0.62	0.62
2013	1.23	0.62	0.00	0.00	6.77	0.11	0.00	0.00	8.99	0.00	0.00	0.00	17.67	0.04	0.00	0.00	0.00	0.76	0.76
South of 40°10′ N. lat.																			
2011	0.30	0.00	0.00	0.00	6.49	0.00	0.00	0.00	5.34	0.00	0.00	0.00	13.41	0.00	0.00	0.00	0.00	0.00	0.00
2012	0.52	0.00	0.00	0.00	4.21	0.00	0.00	0.00	3.11	0.00	0.00	0.00	8.80	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.03	0.00	0.00	0.00	3.01	0.00	0.00	0.00	2.89	0.00	0.00	0.00	6.64	0.00	0.00	0.00	0.00	0.00	0.00
Coastwide																			
2014	0.58	0.55	0.00	0.00	11.53	0.03	0.00	0.00	10.39	0.00	0.01	0.00	28.11	0.01	0.00	0.00	0.00	0.32	0.32

Table 13: Pacific halibut viabilities in the U.S. west coast groundfish IFQ fishery by gear, management area, area north and south of Point Chehalis, WA, depth (bottom trawl only), and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead (see Appendices in WCGOP manual), consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. In addition, all years combined are also shown. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate provided, see text for explanation.

Area / Depth (fm) / Year	Number				Weighted percentages in each category		
	Exc	Poor	Dead	Total	Exc	Poor	Dead
Bottom Trawl							
North of Pt. Chehalis							
0-60							
2011	517	137	308	962	57.34%	14.21%	28.45%
2012	314	156	299	769	45.94%	20.28%	33.78%
2013	327	114	464	905	41.06%	13.61%	45.33%
2014	252	27	26	305	85.12%	8.02%	6.86%
All	1410	434	1097	2941	52.87%	14.92%	32.21%
>60							
2011	1063	439	927	2429	46.75%	18.24%	35.01%
2012	1299	709	1368	3376	40.36%	20.82%	38.82%
2013	2100	534	984	3618	62.12%	14.22%	23.65%
2014	1669	595	1055	3319	52.59%	16.97%	30.43%
All	6131	2277	4334	12742	50.62%	17.55%	31.84%
40°10′ to Pt. Chehalis							
0-60							
2011	1076	169	199	1444	80.30%	9.53%	10.17%
2012	791	175	229	1195	67.68%	13.89%	18.44%
2013	659	238	260	1157	59.12%	21.69%	19.19%
2014	1095	229	307	1631	68.69%	13.72%	17.59%
All	3621	811	995	5427	69.61%	14.38%	16.01%
>60							
2011	967	554	1188	2709	37.57%	20.22%	42.22%
2012	850	446	1201	2497	35.47%	17.55%	46.97%
2013	753	404	1100	2257	34.57%	18.55%	46.88%
2014	765	363	865	1993	42.04%	17.22%	40.74%
All	3335	1767	4354	9456	37.31%	18.46%	44.23%
South of 40°10′ N. lat.							
0-60							
2011	0	0	10	10	0.00%	0.00%	100.00%
2012	*	*	*	*	*	*	*
2013‡	2	0	0	2	100.00%	0.00%	0.00%
2014‡	0	0	0	0	0.00%	0.00%	0.00%
All‡	*	*	*	*	*	*	*
>60							
2011	7	1	6	14	48.21%	6.06%	45.73%
2012	35	7	36	78	49.26%	9.18%	41.56%
2013‡	27	14	51	92	32.05%	16.05%	51.90%
2014‡	24	9	14	47	63.47%	13.76%	22.76%

All‡	93	31	107	231	46.27%	12.54%	41.18%
LE CA Halibut S. of 40°10′ N. lat.							
All depths							
2011	0	0	0	0	0.00%	0.00%	0.00%
2012	*	*	*	*	*	*	*
All	*	*	*	*	*	*	*
Midwater Trawl							
Non-hake Shoreside							
North of 40°10′ N. lat.							
All depths							
2011	*	*	*	*	*	*	*
2012	0	0	0	0	0.00%	0.00%	0.00%
2013	0	0	0	0	0.00%	0.00%	0.00%
2014	0	0	0	0	0.00%	0.00%	0.00%
All	*	*	*	*	*	*	*
Shoreside Hake							
North of 40°10′ N. lat.							
All depths							
2011	0	1	2	3	0.00%	46.01%	53.99%
2012	0	0	0	0	0.00%	0.00%	0.00%
2013	2	0	1	3	91.76%	0.00%	8.24%
2014	6	2	0	8	89.99%	10.01%	0.00%
All	8	3	3	14	78.15%	12.12%	9.73%
Hook and Line							
North of 40°10′ N. lat.							
2011	-	-	-	902	-	-	-
2012	-	-	-	1271	-	-	-
All	-	-	-	2173	-	-	-
South of 40°10′ N. lat.							
2011	-	-	-	0	-	-	-
2012	-	-	-	*	-	-	-
All	-	-	-	*	-	-	-
Coastwide							
2013	-	-	-	404	-	-	-
2014	-	-	-	698	-	-	-
All	-	-	-	1102	-	-	-
Pot							
North of Pt. Chehalis							
2011	53	3	19	75	83.58%	2.14%	14.27%
2012	103	21	24	148	66.34%	16.72%	16.94%
2013	18	1	11	30	60.78%	1.83%	37.39%
All	*	*	*	*	*	*	*
Pt. Chehalis to 40°10′ N. lat.							
2011	149	10	65	224	69.06%	4.57%	26.37%
2012	58	4	3	65	86.97%	7.77%	5.27%
2013	76	7	8	91	83.18%	6.94%	9.88%
All	283	21	76	380	75.22%	5.64%	19.14%
South of 40°10′ N. lat.							
2011	0	0	0	0	0.00%	0.00%	0.00%
2012	0	0	0	0	0.00%	0.00%	0.00%
2013	0	0	0	0	0.00%	0.00%	0.00%
All	0	0	0	0	0.00%	0.00%	0.00%
Coastwide							
2014	24	0	8	32	73.71%	0.00%	26.29%
All	24	0	8	32	73.71%	0.00%	26.29%

Table 14: Estimated Pacific halibut gross discard (mt) and discard mortality (mt) in the U.S. west coast groundfish IFQ fishery by gear type, management area, area north or south of Pt. Chehalis, WA, depth (bottom trawl only), and year. Estimates were allocated to three condition categories based on information presented in Table 13. DMR=Discard Mortality Rate. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation.

Area / Depth (fm) / Year	Estimated Gross Discard (mt)				Estimated Discard Mortality				DMR
	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	m(Total)	
Bottom Trawl									
North of Pt. Chehalis									
0-60									
2011	4.48	1.11	2.22	7.81	0.90	0.61	2.00	3.51	44.89%
2012	2.20	0.97	1.62	4.80	0.44	0.54	1.46	2.44	50.74%
2013	2.24	0.74	2.47	5.46	0.45	0.41	2.23	3.08	56.50%
2014	1.76	0.17	0.14	2.07	0.35	0.09	0.13	0.57	27.61%
>60									
2011	10.61	4.14	7.95	22.69	2.12	2.28	7.15	11.55	50.89%
2012	16.57	8.55	15.94	41.07	3.31	4.70	14.35	22.37	54.46%
2013	18.59	4.26	7.08	29.92	3.72	2.34	6.37	12.43	41.54%
2014	13.69	4.42	7.92	26.04	2.74	2.43	7.13	12.30	47.24%
40°10′ to Pt. Chehalis									
0-60									
2011	8.89	1.06	1.13	11.07	1.78	0.58	1.01	3.37	30.46%
2012	5.35	1.10	1.46	7.91	1.07	0.60	1.31	2.99	37.77%
2013	5.05	1.85	1.64	8.55	1.01	1.02	1.48	3.51	41.03%
2014	7.35	1.47	1.88	10.71	1.47	0.81	1.70	3.97	37.12%
>60									
2011	8.46	4.55	9.50	22.51	1.69	2.50	8.55	12.75	56.63%
2012	7.22	3.57	9.57	20.36	1.44	1.97	8.61	12.02	59.02%
2013	7.29	3.91	9.89	21.10	1.46	2.15	8.90	12.51	59.31%
2014	7.31	2.99	7.08	17.39	1.46	1.65	6.38	9.48	54.55%
South of 40°10′ N. lat.									
0-60									
2011	0.00	0.00	0.17	0.17	0.00	0.00	0.15	0.15	90.00%
2012	*	*	*	*	*	*	*	*	*
2013‡	0.03	0.00	0.00	0.03	0.01	0.00	0.00	0.01	20.00%
2014‡	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
>60									
2011	0.08	0.01	0.08	0.16	0.02	0.01	0.07	0.09	54.13%
2012	0.42	0.08	0.35	0.84	0.08	0.04	0.32	0.44	52.31%
2013‡	0.29	0.15	0.47	0.91	0.06	0.08	0.42	0.56	61.95%
2014‡	0.36	0.08	0.13	0.57	0.07	0.04	0.12	0.23	40.75%
LE CA Halibut S. of 40°10′ N. lat.									
All depths									
2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2012	*	*	*	*	*	*	*	*	*
Midwater Trawl									
Non-hake Shoreside									
North of 40°10′ N. lat.									
All depths									

2011	*	*	*	*	*	*	*	*	*
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Shoreside Hake									
North of 40°10′ N. lat.									
All depths									
2011	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.03	100.00%
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2013	0.05	0.00	0.00	0.05	0.00	0.00	0.00	0.05	100.00%
2014	0.10	0.01	0.00	0.11	0.00	0.00	0.00	0.11	100.00%
Hook and Line									
North of 40°10′ N. lat.									
2011	-	-	-	6.06	-	-	-	0.97	16.00%
2012	-	-	-	14.66	-	-	-	2.34	16.00%
South of 40°10′ N. lat.									
2011	-	-	-	0.00	-	-	-	0.00	0.00%
2012	-	-	-	*	-	-	-	*	*
Coastwide									
2013	-	-	-	3.00	-	-	-	0.48	16.00%
2014	-	-	-	3.96	-	-	-	0.63	16.00%
Pot									
North of Pt. Chehalis									
2011	0.86	0.02	0.15	1.03	0.00	0.02	0.15	0.17	16.42%
2012	0.84	0.21	0.21	1.27	0.00	0.21	0.21	0.43	33.66%
2013	0.13	0.00	0.08	0.22	0.00	0.00	0.08	0.09	39.22%
Pt. Chehalis to 40°10′ N. lat.									
2011	1.59	0.11	0.61	2.31	0.00	0.11	0.61	0.71	30.94%
2012	0.54	0.05	0.03	0.62	0.00	0.05	0.03	0.08	13.03%
2013	0.63	0.05	0.07	0.76	0.00	0.05	0.07	0.13	16.82%
South of 40°10′ N. lat.									
2011	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
Coastwide									
2014	0.23	0.00	0.08	0.32	0.00	0.00	0.08	0.08	26.29%

Table 15: Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight in the U.S. west coast groundfish IFQ fisheries by gear, management area, area north and south of Pt. Chehalis WA, depth (bottom trawl only) and year. The proportion of legal-sized P. halibut in the non-hake IFQ bottom trawl sector north of 40°10′ N. lat. is 60.06%. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation.

Area / Depth (fm) / Year	Total discard (mt)	Total discard mortality (mt)	Estimated legal-sized mortality (mt)	Estimated % legal-size discarded by weight
Bottom Trawl				
North of Pt. Chehalis				
0-60				
2011	7.81	3.51	1.92	54.66%
2012	4.80	2.44	1.14	46.94%
2013	5.46	3.08	1.23	39.75%
2014	2.07	0.57	0.27	47.57%
>60				
2011	22.69	11.55	8.14	70.52%
2012	41.07	22.37	15.48	69.20%
2013	29.92	12.43	7.96	64.07%
2014	26.04	12.30	6.58	53.50%
40°10′ to Pt. Chehalis				
0-60				
2011	11.07	3.37	2.10	62.18%
2012	7.91	2.99	1.58	53.02%
2013	8.55	3.51	2.18	62.10%
2014	10.71	3.97	1.95	49.16%
>60				
2011	22.51	12.75	8.78	68.87%
2012	20.36	12.02	8.47	70.44%
2013	21.10	12.51	8.82	70.48%
2014	17.39	9.48	7.01	73.89%
South of 40°10′ N. lat.				
0-60				
2011	0.17	0.15	0.15	100.00%
2012	*	*	*	*
2013‡	0.03	0.01	0.01	100.00%
2014‡	0.00	0.00	0.00	0.00%
>60				
2011	0.16	0.09	0.09	96.93%
2012	0.84	0.44	0.38	86.31%
2013‡	0.91	0.56	0.45	80.25%
2014‡	0.57	0.23	0.21	90.96%
LE CA Halibut S. of 40°10′ N. lat.				
All depths				
2011	0.00	0.00	0.00	0.00%
2012	*	*	*	*
Midwater Trawl				

Non-hake Shoreside				
North of 40°10′ N. lat.				
All depths				
2011	*	*	*	*
2012	0.00	0.00	0.00	0.00%
2013	0.00	0.00	0.00	0.00%
2014	0.00	0.00	0.00	0.00%
Shoreside Hake				
North of 40°10′ N. lat.				
All depths				
2011	0.03	0.03	0.02	76.43%
2012	0.00	0.00	0.00	0.00%
2013	0.05	0.05	0.05	91.55%
2014	0.11	0.11	0.10	90.18%
Hook and Line				
North of 40°10′ N. lat.				
2011	6.06	0.97	0.43	44.63%
2012	14.66	2.34	1.81	76.98%
South of 40°10′ N. lat.				
2011	0.00	0.00	0.00	0.00%
2012	*	*	*	*
Coastwide				
2013	3.00	0.48	0.24	49.71%
2014	3.96	0.63	0.32	49.85%
Pot				
North of Pt. Chehalis				
2011	1.03	0.17	0.13	77.01%
2012	1.27	0.43	0.34	80.73%
2013	0.22	0.09	0.07	77.82%
Pt. Chehalis to 40°10′ N. lat.				
2011	2.31	0.71	0.53	74.48%
2012	0.62	0.08	0.06	73.98%
2013	0.76	0.13	0.09	70.54%
South of 40°10′ N. lat.				
2011	0.00	0.00	0.00	0.00%
2012	0.00	0.00	0.00	0.00%
2013	0.00	0.00	0.00	0.00%
Coastwide				
2014	0.32	0.08	0.07	84.94%

Table 16: Pacific halibut bycatch by month for vessels fishing bottom trawl gear in the 2014 IFQ fishery. We present coastwide estimates across all depths to maintain confidentiality.

Month	**Expanded Discard (mt)**	**Sampled Discard (mt)**	**Total Bycatch (mt)**
Jan	0.02	8.19	8.21
Feb	0.43	8.15	8.58
Mar	0.00	6.20	6.20
Apr	0.00	2.90	2.91
May	0.02	5.30	5.32
Jun	0.00	5.55	5.55
Jul	0.05	5.79	5.84
Aug	0.06	5.87	5.93
Sep	0.35	3.33	3.68
Oct	0.03	0.75	0.78
Nov	0.09	1.57	1.66
Dec	0.01	1.19	1.20

Table 17: Physical measurements of P. halibut length (cm) in the U.S. west coast groundfish IFQ fishery (2011-2014) for vessels using bottom trawl gear and pot gear. Total represents the total number of individuals measured. The number of dead individuals was obtained by multiplying the number of measured individuals of a given conditions category (Excellent, Poor, Dead) by the corresponding gear-specific mortality rate. See text for mortality rates. Length bins include the lower bound and exclude the upper bound. These are only the sampled P. halibut and do not represent the small amount of expanded P. halibut.

	No. Bottom Trawl Individuals		No. Pot Individuals	
Length bin (cm)	Total	Dead	Total	Dead
18-20	1	0	0	0
22-24	1	0	0	0
30-32	3	1	0	0
32-34	4	2	0	0
34-36	4	1	0	0
36-38	2	0	0	0
38-40	8	3	0	0
40-42	8	4	0	0
42-44	13	5	0	0
44-46	3	2	1	0
46-48	13	5	1	0
48-50	22	9	0	0
50-52	26	16	0	0
52-54	43	24	0	0
54-56	61	33	3	1
56-58	81	45	1	0
58-60	223	134	2	1
60-62	462	258	9	3
62-64	798	430	8	5
64-66	1136	609	8	3
66-68	1342	696	4	1
68-70	1546	797	13	2
70-72	1890	956	22	9
72-74	2042	1062	40	7
74-76	2145	1119	34	8
76-78	1982	1048	21	10
78-80	1848	962	45	13
80-82	1827	908	56	14
82-84	1701	874	65	21
84-86	1617	821	56	14
86-88	1308	663	43	10
88-90	1171	600	41	6
90-92	1136	566	37	9
92-94	1044	513	22	9
94-96	833	400	23	6
96-98	679	327	24	10
98-100	592	295	10	3
100-102	571	260	14	2
102-104	474	226	11	2
104-106	386	182	5	2
106-108	292	125	11	4
108-110	256	119	4	2
110-112	248	109	5	1
112-114	192	83	2	0
114-116	150	69	6	3
116-118	109	48	3	1
118-120	85	38	3	2
120-122	64	31	2	0
122-124	66	26	3	0
124-126	51	23	0	0
126-128	31	16	0	0
128-130	24	10	1	0
130-132	11	4	1	0
132-134	14	5	0	0
134-136	11	3	1	0
136-138	8	3	1	0
138-140	5	3	1	0
140-142	2	1	0	0
142-144	5	3	0	0
144-146	5	2	0	0
146-148	3	1	0	0
148-150	2	1	0	0
150-152	1	1	0	0
152-154	1	0	0	0
166-168	0	0	1	0
200-202	0	0	1	0

Table 18: Visual estimates of P halibut lengths (cm) from the U.S. west coast groundfish IFQ fishery (2011-2014) for vessels using bottom trawl, pot, and hook and line gear. Length bins include the lower bound and exclude the upper bound.

Length bin (cm)	No. Bottom Trawl Individuals	No. Pot Individuals	No. Hook and Line Individuals
25-34	0	1	21
35-44	2	2	112
45-54	3	1	242
55-64	6	2	552
65-74	25	4	751
75-84	22	13	594
85-94	31	8	414
95-104	21	7	269
105-114	6	1	157
115-124	6	2	91
125-134	6	1	29
135-144	3	0	13
145-154	4	0	2
155-164	1	0	1
165-174	0	0	2
175-184	1	0	1

Table 19: Number of observed vessels, trips, and sets by year and gear type in the LE Sablefish Endorsed fishery.

LE Sablefish Endorsed									
	Longline						Pot		
	North			South					
Year	vessels	trips	sets	vessels	trips	sets	vessels	trips	sets
2002	9	23	207	18	47	181	6	23	247
2003	8	25	191	8	25	158	6	35	362
2004	6	13	115	13	35	205	3	13	139
2005	10	31	388	18	73	275	7	39	491
2006	9	31	291	10	34	159	7	39	288
2007	9	36	381	14	40	136	4	30	154
2008	6	17	194	13	60	345	6	24	329
2009	4	13	178	6	34	109	3	27	67
2010	5	18	251	20	127	505	7	43	314
2011	7	18	284	20	84	389	3	22	227
2012	5	7	47	16	86	485	5	19	351
2013	6	12	135	14	49	218	3	14	47
2014	5	12	239	13	74	247	4	16	194

Table 20: Number of observed vessels, trips, and sets by year and gear type in the LE Sablefish NonEndorsed fishery. The WCGOP only covers Longline vessels in this fishery.

LE Sablefish Non-Endorsed			
	Longline		
Year	vessels	trips	sets
2002	4	11	22
2003	17	130	219
2004	14	62	130
2005	11	35	60
2006	21	121	196
2007	36	158	303
2008	32	122	220
2009	34	138	271
2010	38	226	470
2011	38	201	426
2012	26	128	252
2013	22	124	248
2014	18	77	154

Table 21: Number of observed vessels, trips, and sets by year and gear type in the OA Fixed Gear fishery.

OA Fixed Gear						
	Longline			Pot		
Year	vessels	trips	sets	vessels	trips	sets
2002	0	0	0	0	0	0
2003	13	41	49	7	16	50
2004	14	42	50	17	96	185
2005	10	34	37	14	43	50
2006	7	10	11	15	38	39
2007	25	50	66	20	45	72
2008	33	58	68	20	55	74
2009	33	68	101	18	30	45
2010	37	69	104	26	40	69
2011	40	68	100	28	60	84
2012	24	34	53	19	35	70
2013	14	23	30	17	25	48
2014	21	28	38	21	41	63

Table 22: Expansion factors and WCGOP observed discard rate by gear type for limited entry (LE) and open access (OA) non-nearshore fixed gear sectors used to expand discard estimates of *Pacific halibut* to the entire fleet.

Sector	**Gear**	**Expansion Factor**	**Sector and Gear Type Rate Applied**
LE Sablefish Endorsed	Longline	Sablefish	LE Sablefish Endorsed Longline
LE Sablefish Endorsed	Longline	Sablefish	LE Sablefish Endorsed Pot
LE Sablefish Non-Endorsed	Longline	Groundfish	LE Sablefish Non-Endorsed Longline
LE Sablefish Non-Endorsed	Pot	Sablefish	OA Fixd Gear[1] Pot
OA Fixed Gear	Hook and Line	Groundfish	OA Fixd Gear[1] Hook and Line
OA Fixed Gear	Pot	Groundfish	OA Fixd Gear[1] Pot

[1]No discard ratio or discard estimate was computed in the OA fixed gear sector for 2002-06 because the WCGOP only covered OA vessels in California during this time

Table 23: Total sablefish or groundfish landings (mt) and observed discard ratios (1SE) for each sector and gear type in the non-nearshore fixed gear fishery. Sablefish landings were used as the expansion factor in all cases except for the LE Sablefish Non-Endorsed and the OA Fixed Gear sectors, where target species include a variety of groundfish species.

Year	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook-and-Line	Pot
	North of Pt. Chehalis	South of Pt. Chehalis					
Expansion Factors							
2002	382	407	352	627	7	387	109
2003	458	571	604	546	7	549	186
2004	653	653	620	400	11	474	186
2005	586	674	615	554	3	625	379
2006	660	709	582	468	30	495	443
2007	467	605	428	515	2	272	258
2008	394	695	433	642	3	428	241
2009	435	1004	489	812	7	668	373
2010	259	1031	509	1016	17	774	326
2011	223	924	372	1242	24	446	256
2012	200	855	297	806	9	333	127
2013	216	528	283	796	15	204	72
2014	181	556	337	715	4	228	148
Discard Ratios							
2002	0.3297 (0.05)	0.0283 (0.01)	0.0114 (0.00)	- -	- -	- -	- -
2003	0.3532 (0.05)	0.0467 (0.01)	0.0005 (0.00)	0.0003 (0.00)	- -	- -	- -
2004	0.2369 (0.07)	0.0746 (0.01)	0.0526 (0.01)	- -	- -	- -	- -
2005	0.3318 (0.07)	0.0204 (0.00)	0.0043 (0.00)	- -	- -	- -	- -
2006	0.7827 (0.11)	0.1636 (0.05)	0.0271 (0.00)	- -	- -	- -	- -
2007	0.2184 (0.03)	0.0333 (0.01)	0.0092 (0.00)	0.0033 (0.00)	- -	0.0785 (0.02)	0.0035 (0.00)
2008	0.3715 (0.07)	0.1523 (0.03)	0.0153 (0.00)	0.0046 (0.00)	- -	0.0986 (0.04)	0.0009 (0.00)
2009	0.6436 (0.10)	0.0413 (0.01)	0.0017 (0.00)	0.0003 (0.00)	- -	0.0545 (0.02)	0.0007 (0.00)
2010	0.2522 (0.06)	0.0637 (0.01)	0.0101 (0.00)	0.0004 (0.00)	- -	0.0424 (0.03)	0.0016 (0.00)
2011	0.4780 (0.06)	0.0281 (0.00)	0.0110 (0.00)	0.0172 (0.01)	- -	0.0305 (0.01)	0.0003 (0.00)
2012	0.4534 (0.16)	0.0628 (0.01)	0.0209 (0.00)	0.0198 (0.01)	- -	0.0731 (0.03)	0.0032 (0.00)
2013	0.0871 (0.02)	0.0063 (0.00)	0.0000 (0.00)	- -	- -	0.0089 (0.00)	0.0008 (0.00)
2014	0.8890 (0.13)	0.0181 (0.00)	0.0060 (0.00)	- -	- -	0.0152 (0.00)	0.0011 (0.00)

Table 24: Percent of observed trips that caught Pacific halibut by sector, gear, and area (where applicable). Observed average, minimum and maximum annual catch and discard weights and the percent of P. halibut catch weight discarded by year. n.o.c. No observed catch of P. halibut and thus a % discard calculation is not possible. – No WCGOP observers were deployed for the sector-year-gear type combination.

Year	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook-and-Line	Pot
	North of Pt. Chehalis	South of Pt. Chehalis					
% of observed trips that caught P. halibut							
2002	95.7%	46.8%	17.4%	0.0%	–	0.0%	0.0%
2003	100.0%	52.0%	8.6%	0.8%	–	0.0%	0.0%
2004	100.0%	71.4%	38.5%	0.0%	–	0.0%	0.0%
2005	96.8%	58.9%	33.3%	0.0%	–	0.0%	0.0%
2006	100.0%	76.5%	56.4%	0.0%	–	10.0%	0.0%
2007	94.4%	47.5%	33.3%	1.9%	–	26.0%	6.7%
2008	100.0%	78.3%	83.3%	3.3%	–	34.5%	5.5%
2009	84.6%	35.3%	33.3%	0.7%	–	38.2%	10.0%
2010	83.3%	47.2%	51.2%	1.3%	–	21.7%	2.5%
2011	88.9%	42.9%	45.5%	6.0%	–	30.9%	6.7%
2012	71.4%	58.1%	31.6%	7.0%	–	32.4%	8.6%
2013	83.3%	26.5%	21.4%	0.0%	–	13.0%	4.0%
2014	100.0%	24.3%	56.2%	0.0%	–	25.0%	9.8%
Observed annaul catch (mt) of Pacific haibut							
Mean	41.0	10.2	1.9	0.3	–	0.7	0.0
Min	8.0	0.7	0.1	0.0	–	0.0	0.0
Max	118.4	36.6	5.4	1.4	–	1.6	0.0
Observed annaul discard (mt) of Pacific haibut							
Mean	36.0	10.1	1.9	0.3	–	0.7	0.0
Min	5.5	0.7	0.1	0.0	–	0.0	0.0
Max	109.6	36.6	5.4	1.4	–	1.6	0.0
% of Pacific haibut catch that was discarded							
2002	77.6%	95.5%	100.0%	n.o.c.	–	n.o.c.	n.o.c.
2003	80.1%	99.4%	100.0%	0.0%	–	n.o.c.	n.o.c.
2004	76.3%	97.3%	100.0%	n.o.c.	–	n.o.c.	n.o.c.
2005	82.7%	100.0%	100.0%	n.o.c.	–	n.o.c.	n.o.c.
2006	92.6%	97.5%	100.0%	n.o.c.	–	100.0%	n.o.c.
2007	78.0%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2008	87.4%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2009	100.0%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2010	100.0%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2011	100.0%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2012	96.6%	100.0%	100.0%	0.0%	–	100.0%	100.0%
2013	69.0%	100.0%	0.0%	0.0%	–	100.0%	100.0%
2014	95.7%	100.0%	100.0%	0.0%	–	100.0%	100.0%

Table 25: Estimated gross discard (mt) and discard mortality (mt) in the limited entry (LE) sablefish endorsed, LE sablefish non-endorsed, and open access (OA) fixed gear sectors. Esimated discard mortality (mt) was computed by applying a 16 % (longline) or 18% (pot) discard mortality rate to gross discard estimates. Discard estimates were not initially computed for the 2002-06 OA fixed gear sector because the WCGOP only observed the OA fixed gear vessels off of California during that time. To estimate values for these years, a combined discard rate from 2007-08 (coastwide observations) was applied. The results of assuming the 2007-08 discard rate are shown in brackets.

Year	LE Sablefish Endorsed				LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline			Pot	Longline	Pot	Hook-and-Line	Pot
	North of Pt. Chehalis	South of Pt. Chehalis	Coastwide					
Gross Discard Estimates								
2002	125.90	11.50	137.40	4.03	0.00	[0.02] *	[35.17] *	[0.23] *
2003	161.70	26.66	188.36	0.30	0.17	[0.01] *	[49.80] *	[0.39] *
2004	154.74	48.68	203.42	32.60	0.00	[0.02] *	[43.06] *	[0.39] *
2005	194.36	13.76	208.12	2.62	0.00	[0.01] *	[56.72] *	[0.79] *
2006	516.79	115.97	632.76	15.79	0.00	[0.06] *	[44.95] *	[0.92] *
2007	102.01	20.15	122.16	3.94	1.72	0.01	21.37	0.89
2008	146.34	105.80	252.14	6.62	2.94	0.00	42.20	0.23
2009	280.20	41.48	321.69	0.85	0.26	0.01	36.37	0.27
2010	65.43	65.71	131.14	5.13	0.37	0.03	32.82	0.51
2011	106.72	25.95	132.67	4.08	21.36	0.01	13.58	0.06
2012	90.74	53.72	144.46	6.22	16.00	0.03	24.39	0.41
2013	18.80	3.35	22.15	0.00	0.00	0.01	1.81	0.06
2014	160.96	10.08	171.05	2.03	0.00	0.00	3.46	0.16
Estimated Discard Mortality (16% or 18%)								
2002	20.14	1.84	21.98	0.73	0.00	– *	– *	– *
2003	25.87	4.27	30.14	0.05	0.03	– *	– *	– *
2004	24.76	7.79	32.55	5.87	0.00	– *	– *	– *
2005	31.10	2.20	33.30	0.47	0.00	– *	– *	– *
2006	82.69	18.56	101.24	2.84	0.00	– *	– *	– *
2007	16.32	3.22	19.55	0.71	0.28	0.00	3.42	0.16
2008	23.41	16.93	40.34	1.19	0.47	0.00	6.75	0.04
2009	44.83	6.64	51.47	0.15	0.04	0.00	5.82	0.05
2010	10.47	10.51	20.98	0.92	0.06	0.00	5.25	0.09
2011	17.08	4.15	21.23	0.73	3.42	0.00	2.17	0.01
2012	14.52	8.60	23.11	1.12	2.56	0.00	3.90	0.07
2013	3.01	0.54	3.54	0.00	0.00	0.00	0.29	0.01
2014	25.75	1.61	27.37	0.37	0.00	0.00	0.55	0.03

*The LE sablefish non-endorsed pot sector has not been observed by the WCGOP and therefore estimates are based on discard rates from observed OA fixed gear pot vessels. OA fixed gear vessels were not observed coastwide until 2007 and thus 2002-06 estimates are based on the 2007-08 coastwide discard rate, shown in brackets.

Table 26: Estimated discard mortality (mt) from each sector of the non-nearshore fixed gear fishery by year.

	Estimated discard mortality (mt)			
	LE Sablefish Endorsed	**LE Sablefish Non-Endorsed**	**OA Fixed Gear**	**All Sectors**
2002	22.71	0.00	0.00	22.71
2003	30.19	0.03	0.00	30.22
2004	38.42	0.00	0.00	38.42
2005	33.77	0.00	0.00	33.77
2006	104.08	0.00	0.00	104.08
2007	20.25	0.28	3.58	24.11
2008	41.53	0.47	6.79	48.80
2009	51.62	0.04	5.87	57.53
2010	21.91	0.06	5.34	27.31
2011	21.96	3.42	2.19	27.56
2012	24.23	2.56	3.98	30.77
2013	3.54	0.00	0.30	3.85
2014	27.73	0.00	0.58	28.32

Table 27: Physical measurements of P. halibut length (cm) from the U.S. west coast LE Sablefish Endorsed fishery (2002-2014) for vessels using hook and line or pot gear. Number of dead individuals represents the number dead after applying condition-based gear specific mortality rates (100% for hook and line, see table in text for pot rates). Length bins include the lower bound and exclude the upper bound.

	No. Hook and Line Individuals		No. Pot Individuals	
Length bin (cm)	Total	Dead	Total	Dead
42-44	1	1	0	0
44-46	1	1	0	0
48-50	4	4	0	0
50-52	3	3	0	0
52-54	2	2	0	0
54-56	2	2	0	0
56-58	12	12	0	0
58-60	7	7	0	0
60-62	17	17	5	1
62-64	28	28	1	1
64-66	42	42	7	0
66-68	44	44	7	1
68-70	86	86	7	0
70-72	106	106	22	1
72-74	120	120	23	4
74-76	156	156	48	4
76-78	163	163	37	5
78-80	191	191	42	5
80-82	152	152	36	2
82-84	154	154	33	6
84-86	144	144	45	4
86-88	148	148	35	5
88-90	123	123	28	3
90-92	120	120	19	3
92-94	117	117	18	2
94-96	116	116	22	5
96-98	89	89	15	2
98-100	78	78	9	2
100-102	60	60	6	2
102-104	60	60	5	1
104-106	44	44	4	1
106-108	33	33	1	0
108-110	33	33	2	0
110-112	22	22	3	1
112-114	26	26	0	0
114-116	24	24	1	0
116-118	12	12	1	0
118-120	11	11	1	0
120-122	10	10	0	0
122-124	4	4	5	2
124-126	3	3	0	0
126-128	5	5	0	0
130-132	1	1	1	0
132-134	2	2	0	0
134-136	1	1	0	0
136-138	1	1	0	0
146-148	0	0	1	0
	1	1	0	0

Table 28: Physical measurements of P. halibut length (cm) from the U.S. west coast LE Sablefish Non-Endorsed fishery (2002-2014) for vessels using hook and line gear. The WCGOP does not cover vessels fishing pot gear in this fishery. Number of dead individuals represents the number dead after applying condition-based gear specific mortality rates (100% for hook and line, see table in text for pot rates).Length bins include the lower bound and exclude the upper bound.

	LE Sablefish Non-Endorsed Hook and Line	
Length bin (cm)	Total	Dead
66-68	1	1
68-70	3	3
72-74	4	4
74-76	4	4
76-78	6	6
78-80	4	4
80-82	3	3
82-84	3	3
84-86	2	2
86-88	5	5
88-90	6	6
90-92	5	5
92-94	4	4
94-96	2	2
96-98	2	2
98-100	3	3
102-104	2	2
104-106	2	2
106-108	2	2
110-112	1	1
112-114	3	3
118-120	2	2
122-124	1	1
134-136	1	1

Table 29: Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2014) for vessels using hook and line or pot gear. Number of dead individuals represents the number dead after applying condition-based gear specific mortality rates (100% for hook and line, see table in text for pot rates).Length bins include the lower bound and exclude the upper bound.

	No. Hook and Line Individuals		No. Pot Individuals	
Length bin (cm)	Total	Dead	Total	Dead
44-46	2	2	0	0
48-50	1	1	0	0
54-56	1	1	0	0
58-60	1	1	0	0
60-62	1	1	0	0
62-64	2	2	0	0
64-66	5	5	0	0
66-68	2	2	1	1
68-70	2	2	0	0
70-72	3	3	2	0
72-74	6	6	0	0
74-76	9	9	1	0
76-78	6	6	1	0
78-80	5	5	1	0
80-82	8	8	1	1
82-84	5	5	0	0
84-86	12	12	1	0
86-88	9	9	2	0
88-90	4	4	0	0
90-92	8	8	0	0
92-94	4	4	0	0
94-96	4	4	0	0
96-98	5	5	0	0
98-100	2	2	0	0
100-102	4	4	0	0
102-104	1	1	0	0
104-106	4	4	0	0
106-108	2	2	0	0
108-110	4	4	1	0
110-112	2	2	0	0
112-114	1	1	0	0
114-116	3	3	0	0
120-122	1	1	0	0
122-124	1	1	0	0

Table 30: Visual estimates of P halibut lengths (cm) from the U.S. west coast groundfish Non-Nearshore fixed gear fisheries (2002-2014) for vessels using hook and line gear and pot gear. Numbers are the numbers of individuals caught with each gear type. The WCGOP does not observe LE Non-Endorsed Sablefish vessels fishing with pot gear. Length bins include the lower bound and exclude the upper bound.

	LE Sablefish Endorsed		LE Sablefish Non-Endorsed	OA Fixed Gear	
Length bin (cm)	No. Hook and Line	No. Pot	No. Hook and Line	No. Hook and Line	No. Pot
15-24	0	0	0	0	0
25-34	21	0	0	0	0
35-44	58	1	0	1	0
45-54	334	5	2	3	0
55-64	3287	43	11	13	0
65-74	6127	103	28	26	0
75-84	6909	77	37	47	2
85-94	5665	71	23	30	0
95-104	3366	36	14	14	0
105-114	1123	16	8	6	0
115-124	404	9	9	1	0
125-134	119	2	4	1	0
135-144	22	2	0	0	0
145-154	6	0	0	0	0
155-164	1	0	0	0	0
165-174	0	0	0	0	0

Table 31: Pacific halibut physically measured lengths and visual estimates of lengths approximating legal(82 cm>) versus sublegal defintions (IPHC), collected by the WCGOP in the IFQ fishery (2011-present), Non-Nearshore fixed gear fisheries (LE sablefish endorsed, LE non-endorsed, OA fixed gear; 2002-present), and the At-sea Hake sectors. Note that visual length estimates are not taken in the At-sea Hake sectors.

Fishery	Type of Measurement	Length bin (cm)	No. of individuals	Percentage of Total
Non-Nearshore Fixed Gear	actual	0-82.0	1459	44.5\%
Non-Nearshore Fixed Gear	actual	82.0>	1822	55.5\%
Non-Nearshore Fixed Gear	visual	0-74.0	11684	37.1\%
Non-Nearshore Fixed Gear	visual	75.0-84.0	7766	24.7\%
Non-Nearshore Fixed Gear	visual	84.0>	12051	38.3\%
Catch Shares	actual	0-82.0	17802	56.8\%
Catch Shares	actual	82.0>	13545	43.2\%
Catch Shares	visual	0-74.0	1724	50.3\%
Catch Shares	visual	75.0-84.0	629	18.3\%
Catch Shares	visual	84.0>	1077	31.4\%
At-sea Hake	actual	0-82.0	193	28.0\%
At-sea Hake	actual	82.0>	496	72.0\%

Table 32: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Oregon and California nearshore fixed gear groundfish fisheries by state and year. The WCGOP began observing the California nearshore fishery in 2003 and the Oregon nearshore fishery in 2004. Gear specific mortality rates cannot be applied to P. halibut bycatch in this fishery because of confidentiality issues. Coverage rate in the state nearshore fisheries is defined as the proportion of nearshore target species landings that were observed. Nearshore target species are listed in the WCGOP Data Processing Appendix. Washington does not allow a state nearshore fishery.

Nearshore fixed gear groundfish fishery

State	**Observed**								**Estimated**		
Year	Fleet observer coverage rate	Number of observed sets	% of sets with P. halibut	P. halibut bycatch (mt)	Nearshore species retained (mt)	P. halibut bycatch rate	SE bycatch rate	Total fleet catch of nearshore species (mt)	P. halibut bycatch (mt)	Bycatch lower bound (mt)	Bycatch upper bound (mt)
Oregon											
2002	*not observed*	–	–	–	–	–	–	278.73	–	–	–
2003	*not observed*	–	–	–	–	–	–	207.78	–	–	–
2004	4.87%	207	1.93%	0.05	10.21	0.00	0.00	209.72	1.005	0.441	1.568
2005	6.33%	167	0.60%	0.03	11.42	0.00	0.00	180.52	0.514	0.412	0.616
2006	11.59%	380	1.32%	0.06	19.47	0.00	0.00	167.94	0.542	0.281	0.804
2007	8.87%	242	0.41%	0.01	16.10	0.00	0.00	181.61	0.087	0.073	0.102
2008	7.55%	183	0.55%	0.03	14.29	0.00	0.00	189.15	0.360	0.296	0.425
2009	6.17%	219	2.28%	0.08	13.85	0.01	0.00	224.42	1.298	0.756	1.841
2010	7.68%	210	0.48%	0.01	13.26	0.00	0.00	172.77	0.080	0.066	0.094
2011	8.13%	244	2.05%	0.09	15.87	0.01	0.00	195.12	1.102	0.403	1.801
2012	10.39%	287	1.39%	0.11	20.53	0.01	0.00	197.50	1.081	0.327	1.836
2013	7.69%	262	0.76%	0.02	16.08	0.00	0.00	209.22	0.294	0.199	0.389
2014	8.11%	195	2.05%	0.08	16.64	0.00	0.00	205.26	0.972	0.558	1.387
California											
2002	*not observed*	–	–	–	–	–	–	381.31	–	–	–
2003	3.17%	205	0.00%	0.00	8.11	0.00	0.00	256.15	0.000	0.000	0.000
2004	7.97%	422	0.00%	0.00	23.24	0.00	0.00	291.67	0.000	0.000	0.000
2005	4.74%	219	0.91%	0.08	13.29	0.01	0.00	280.28	1.676	0.003	3.503
2006	3.22%	158	0.00%	0.00	8.33	0.00	0.00	258.51	0.000	0.000	0.000
2007	4.41%	224	0.00%	0.00	12.10	0.00	0.00	274.58	0.000	0.000	0.000
2008	2.22%	87	0.00%	0.00	6.53	0.00	0.00	294.16	0.000	0.000	0.000
2009	2.58%	122	0.00%	0.00	6.71	0.00	0.00	260.61	0.000	0.000	0.000
2010	3.22%	117	0.00%	0.00	7.07	0.00	0.00	219.58	0.000	0.000	0.000
2011	3.91%	210	0.48%	0.08	8.47	0.01	0.00	216.65	1.976	1.540	2.412
2012	5.93%	239	1.26%	0.07	11.91	0.01	0.00	200.97	1.192	0.174	2.209
2013	5.30%	192	1.56%	0.06	11.67	0.00	0.00	220.00	1.073	0.562	1.584
2014	4.73%	179	0.00%	0.00	11.71	0.00	0.00	247.67	0.000	0.000	0.000

Table 33: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the state pink shrimp fisheries by state and year. The WCGOP began observing the OR and CA state pink shrimp fisheries in 2004, but was unable to observe these fisheries in 2006. The WA state pink shrimp fishery was added for observation in 2010. Mortality rates are not applied to P. halibut bycatch in these fisheries because mortality rates for pink shrimp trawl gear have not been estiamted. Coverage rate in the pink shrimp fisheries is defined as the proportion of pink shrimp landings that were observed. (*) = Confidential data; (–) = not observed.

Pink shrimp trawl fishery

State	**Observed**								**Estimated**		
Year	Fleet observer coverage rate	Number of observed sets	% of sets with P. halibut	P. halibut bycatch (kg)	Pink shrimp retained (kg)	P. halibut bycatch rate	SE bycatch rate	Total fleet catch of pink shrimp (mt)	P. halibut bycatch (mt)	Bycatch lower bound (mt)	Bycatch upper bound (mt)
Washington											
2010	9.60%	334	0.00%	0.00	412351	0.00000	0.00000	4296	0.00	0.00	0.00
2011	16.55%	566	0.18%	7.66	697238	0.00001	0.00000	4212	0.05	0.04	0.05
2012	14.75%	516	0.00%	0.00	625952	0.00000	0.00000	4242	0.00	0.00	0.00
2013	10.18%	384	0.00%	0.00	626823	0.00000	0.00000	6158	0.00	0.00	0.00
2014	7.07%	393	0.00%	0.00	980854	0.00000	0.00000	13876	0.00	0.00	0.00
Oregon											
2002	*not observed*	–	–	–	–	–	–	18898	–	–	–
2003	*not observed*	–	–	–	–	–	–	9328	–	–	–
2004	7.72%	734	0.00%	0.00	427212	0.00000	0.00000	5537	0.00	0.00	0.00
2005	5.63%	482	0.21%	2.27	402886	0.00001	0.00000	7159	0.04	0.04	0.05
2006	*not observed*	–	–	–	–	–	–	5532	–	–	–
2007	7.12%	921	0.22%	15.26	649983	0.00002	0.00001	9129	0.21	0.03	0.39
2008	5.81%	768	0.00%	0.00	672491	0.00000	0.00000	11576	0.00	0.00	0.00
2009	7.48%	631	0.00%	0.00	751198	0.00000	0.00000	10049	0.00	0.00	0.00
2010	11.93%	1186	0.00%	0.00	1705447	0.00000	0.00000	14290	0.00	0.00	0.00
2011	13.63%	1819	0.11%	19.33	2985964	0.00001	0.00000	21915	0.14	0.05	0.24
2012	13.52%	2046	0.00%	0.00	3014219	0.00000	0.00000	22292	0.00	0.00	0.00
2013	10.74%	1353	0.00%	0.00	2313243	0.00000	0.00000	21538	0.00	0.00	0.00
2014	9.73%	1424	0.00%	0.00	2291345	0.00000	0.00000	23551	0.00	0.00	0.00
California											
2002	*not observed*	–	–	–	–	–	–	1853	–	–	–
2003	*not observed*	–	–	–	–	–	–	978	–	–	–
2004	*	*	*	*	*	*	*	997	*	*	*
2005	*	*	*	*	*	*	*	861	*	*	*
2006	*not observed*	–	–	–	–	–	–	64	–	–	–
2007	*	*	*	*	*	*	*	289	*	*	*
2008	*	*	*	*	*	*	*	945	*	*	*
2009	*	*	*	*	*	*	*	1184	*	*	*
2010	14.99%	134	0.00%	0.00	265531	0.00000	0.00000	1771	0.00	0.00	0.00
2011	12.62%	194	0.00%	0.00	420595	0.00000	0.00000	3333	0.00	0.00	0.00
2012	12.46%	169	0.00%	0.00	347598	0.00000	0.00000	2791	0.00	0.00	0.00
2013	9.19%	179	0.00%	0.00	359770	0.00000	0.00000	3915	0.00	0.00	0.00
2014	15.54%	311	0.00%	0.00	597530	0.00000	0.00000	3845	0.00	0.00	0.00

Table 34: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the state California halibut trawl fishery by sector and year. The WCGOP recognizes two sectors; a limited entry sector and an open access sector. In 2010, the LE and OA sectors are combined to maintain confidentiality. Beginning in 2011, the limited entry sector is observed under the IFQ groundfish fishery and estimates for this sector are included in the IFQ tables (above). Mortality rates are not applied to P. halibut bycatch in these fisheries because mortality rates for CA halibut trawl gear have not been estiamted. Coverage rate in the CA halibut fishery is defined as the proportion of CA halibut landings that were observed.

California halibut trawl fishery

Sector	**Observed**								**Estimated**		
Year	Fleet observer coverage rate	Number of observed tows	% of tows with P. halibut	P. halibut bycatch (kg)	CA halibut retained (kg)	P. halibut bycatch rate	SE bycatch rate	Total fleet catch of CA halibut (mt)	P. halibut bycatch (mt)	Bycatch lower bound (mt)	Bycatch upper bound (mt)
Limited Entry Sector											
2002	3.41%	52	0.00%	0.000	3590	0.00000	0.00000	105	0.000	0.000	0.000
2003	18.10%	206	0.00%	0.000	19105	0.00000	0.00000	106	0.000	0.000	0.000
2004	23.10%	170	0.59%	3.493	31488	0.00011	0.00001	136	0.015	0.012	0.018
2005	16.16%	233	0.43%	4.717	30514	0.00015	0.00001	189	0.029	0.024	0.034
2006	11.95%	224	0.89%	2.903	14286	0.00020	0.00007	120	0.024	0.007	0.042
2007	13.90%	80	1.25%	8.119	5447	0.00149	0.00023	39	0.058	0.041	0.076
2008	26.48%	118	8.47%	82.605	9637	0.00857	0.00162	36	0.312	0.196	0.428
2009	6.14%	29	0.00%	0.000	2898	0.00000	0.00000	47	0.000	0.000	0.000
LE & OA Sectors combined											
2010	7.08%	152	0.00%	0.000	8745	0.00000	0.00000	124	0.000	0.000	0.000
2011-present	Observed under IFQ fisheries, see Table 14										
Open Access Sector											
2002	*not observed*	–	–	–	–	–	–	36	–	–	–
2003	7.68%	110	0.00%	0.000	1977	0.00000	0.00000	26	0.000	0.000	0.000
2004	7.20%	244	1.64%	49.351	5100	0.00968	0.00334	71	0.685	0.221	1.149
2005	11.61%	360	0.00%	0.000	7489	0.00000	0.00000	65	0.000	0.000	0.000
2006	*not observed*	–	–	–	–	–	–	55	–	–	–
2007	6.88%	226	0.00%	0.000	2694	0.00000	0.00000	39	0.000	0.000	0.000
2008	5.03%	197	0.00%	0.000	2610	0.00000	0.00000	52	0.000	0.000	0.000
2009	0.77%	30	0.00%	0.000	634	0.00000	0.00000	82	0.000	0.000	0.000
2011	15.57%	204	0.00%	0.000	12446	0.00000	0.00000	80	0.000	0.000	0.000
2012	6.42%	77	0.00%	0.000	3541	0.00000	0.00000	55	0.000	0.000	0.000
2013	6.25%	81	0.00%	0.000	4305	0.00000	0.00000	69	0.000	0.000	0.000
2014	22.28%	145	0.00%	0.000	18139	0.00000	0.00000	81	0.000	0.000	0.000

Table 35: Coverage information, and Pacific halibut bycatch in the At-sea Pacific hake fisheries by sector and year. Tribal At-sea P. hake fishery did not operate in 2013 or 2014. Gear specific mortality rates cannot be applied to P. halibut bycatch in this fishery because mortality rates have not been determined for midwater trawl gear.

At-sea Pacific hake fishery

Sector Year	Fleet observer coverage	Number of observed sets	% of sets with P. halibut	P. halibut bycatch (mt)
Tribal Sector				
2002	100%	633	0.32%	0.079
2003	100%	540	0.00%	0.000
2004	100%	632	0.00%	0.000
2005	100%	633	0.79%	0.182
2006	100%	160	3.12%	0.192
2007	100%	156	0.64%	0.053
2008	100%	382	7.33%	1.280
2009	100%	404	0.99%	0.064
2010	100%	516	3.49%	0.349
2011	100%	228	0.88%	0.034
2012	100%	4	0.00%	0.000
Catcher-Processor				
2002	100%	559	3.22%	1.013
2003	100%	768	4.04%	2.619
2004	100%	1501	1.07%	0.806
2005	100%	1337	1.72%	1.217
2006	100%	1497	0.27%	0.111
2007	100%	1577	1.65%	0.504
2008	100%	1886	5.51%	2.070
2009	100%	868	0.12%	0.014
2010	100%	1068	0.47%	0.143
2011	100%	1549	1.48%	0.488
2012	100%	1107	2.35%	0.542
2013	100%	1459	1.30%	0.667
2014	100%	1696	0.06%	0.039
Mothership Catcher Vessels				
2002	100%	574	0.17%	0.048
2003	100%	536	0.37%	0.035
2004	100%	571	1.23%	0.323
2005	100%	1040	1.25%	0.567
2006	100%	1283	1.95%	0.532
2007	100%	1147	2.01%	0.621
2008	100%	1349	2.82%	0.629
2009	100%	600	3.50%	0.255
2010	100%	908	3.41%	1.080
2011	100%	1248	0.48%	0.085
2012	100%	949	0.63%	0.099
2013	100%	1256	2.15%	0.397
2014	100%	1308	1.22%	0.332

Table 36: Physical P. halibut length frequencies (cm) collected by ASHOP observers in the At-sea hake fishery (2002-present). Length bins include the lower bound and exclude the upper bound. Viabilities are D=dead, P=poor, E=excellent, U=unknown.

At-sea Hake					
Length bin (cm)	**No. of individuals**	**Viability**	**Length bin (cm)**	**No. of individuals**	**Viability**
58-60	2	D	96-98	21	D
60-62	3	D	98-100	28	D
60-62	1	P	100-102	32	D
62-64	2	D	100-102	4	P
64-66	6	D	102-104	20	D
64-66	2	P	102-104	1	E
66-68	9	D	102-104	1	P
68-70	10	D	104-106	22	D
68-70	1	E	104-106	1	P
70-72	19	D	106-108	22	D
70-72	1	P	108-110	22	D
72-74	20	D	108-110	2	E
72-74	1	E	108-110	1	P
74-76	19	D	108-110	1	U
74-76	1	P	110-112	17	D
76-78	20	D	110-112	1	E
76-78	1	E	112-114	8	D
76-78	1	P	112-114	1	E
76-78	1	U	114-116	8	D
78-80	26	D	116-118	10	D
80-82	45	D	116-118	1	P
80-82	1	E	116-118	1	U
80-82	1	U	118-120	7	D
82-84	21	D	120-122	6	D
82-84	2	E	122-124	7	D
84-86	29	D	124-126	4	D
86-88	27	D	126-128	1	D
86-88	1	P	126-128	1	P
88-90	39	D	128-130	4	D
88-90	2	E	130-132	5	D
88-90	2	U	132-134	2	D
90-92	35	D	136-138	2	D
90-92	1	U	138-140	1	D
92-94	29	D	140-142	2	D
94-96	36	D	142-144	1	D
94-96	1	E	154-156	1	D
94-96	2	P			

Table 37: Discard estimates for all fishery sectors observed by the NWFSC Groundfish Observer Program, 2002-2013. Total discard mortality estimates are also provided where discard mortality rates were applied.

Year	LE bottom trawl 2002-10	IFQ Fishery 2011-present						Non-Nearshore fixed gear			Nearshore Fixed Gear [1]	Pink Shrimp [1]	CA Halibut [1,2]	At-sea Hake [1]	Total
		Bottom Trawl [3]	LE CA Halibut [1,3]	Hook and Line	Pot	Midwater Trawl [1]	Shoreside Hake [1]	LE Endorsed	LE Non-Endorsed	OA					
Gross Discard Estimates (mt)															
2002	524.41							141.43	0.02	-	-	-	-	1.14	667.00
2003	186.65							188.67	0.19	-	0.00	-	0.00	2.65	378.16
2004	212.43							236.02	0.02	-	1.00	0.00	0.70	1.13	451.30
2005	460.35							210.73	0.01	-	2.19	0.04	0.03	1.97	675.32
2006	390.91							648.55	0.06	-	0.54	-	-	0.83	1040.89
2007	294.38							126.10	1.73	22.26	0.09	0.21	0.06	1.18	446.01
2008	305.21							258.75	2.94	42.42	0.36	0.00	0.31	3.98	613.97
2009	385.24							322.54	0.26	36.64	1.30	0.00	0.00	0.33	746.31
2010	265.08							136.27	0.40	33.33	0.08	0.00	0.00	1.57	436.73
2011		64.42	0	6.06	3.34	*	0.03	113.45	24.49	13.65	3.08	0.19	0.00	0.61	229.32
2012		75.20	*	14.66	1.89	0.0	0.00	150.68	16.03	24.80	2.27	0.00	0.00	0.64	286.17
2013		65.96	see[3]	3.00	0.98	0.0	0.05	22.15	0.01	1.87	1.37	0.00	0.00	1.06	96.45
2014		56.76	see[3]	3.96	0.32	0.0	0.11	173.07	0.00	3.62	0.97	0.00	0.00	0.37	239.18
Total Discard Mortality (mt)															
2002	344.82							22.71	0.00	-	-	-	-	1.14	368.67
2003	124.43							30.19	0.03	-	0.00	-	0.00	2.65	157.30
2004	133.12							38.42	0.00	-	1.00	0.00	0.70	1.13	174.37
2005	286.52							33.77	0.00	-	2.19	0.04	0.03	1.97	324.52
2006	242.47							104.08	0.01	-	0.54	-	-	0.83	347.93
2007	208.81							20.25	0.28	3.58	0.09	0.21	0.06	1.18	234.46
2008	207.81							41.53	0.47	6.79	0.36	0.00	0.31	3.98	261.25
2009	251.1							51.62	0.04	5.87	1.30	0.00	0.00	0.33	310.26
2010	180.97							21.91	0.06	5.34	0.08	0.00	0.00	1.57	209.93
2011		31.43	0	0.97	0.88	*	0.03	18.23	3.92	2.19	3.08	0.19	0.00	0.61	61.53
2012		40.52	*	2.34	0.51	0.0	0.00	24.23	2.56	3.98	2.27	0.00	0.00	0.64	77.05
2013		32.26	see[3]	0.48	0.21	0.0	0.05	3.54	0.00	0.30	1.37	0.00	0.00	1.06	39.27
2014		26.65	see[3]	0.63	0.08	0.0	0.11	27.73	0.00	0.58	0.97	0.00	0.00	0.37	57.12

[1] 100% mortality rate

[2] Starting in 2011, this sector only includes OA CA halibut

[3] Starting in 2013, LE CA Halibut estimates are combined with IFQ Bottom Trawl estimates.

9 FIGURES

Figure 2: Number of vessels by month for IFQ bottom trawl vessels in 2014 (solid line) and averaged over the 2011-14 period (dotted line). Grey ribbon represents the monthy maximum and minimum across 2011-2014.

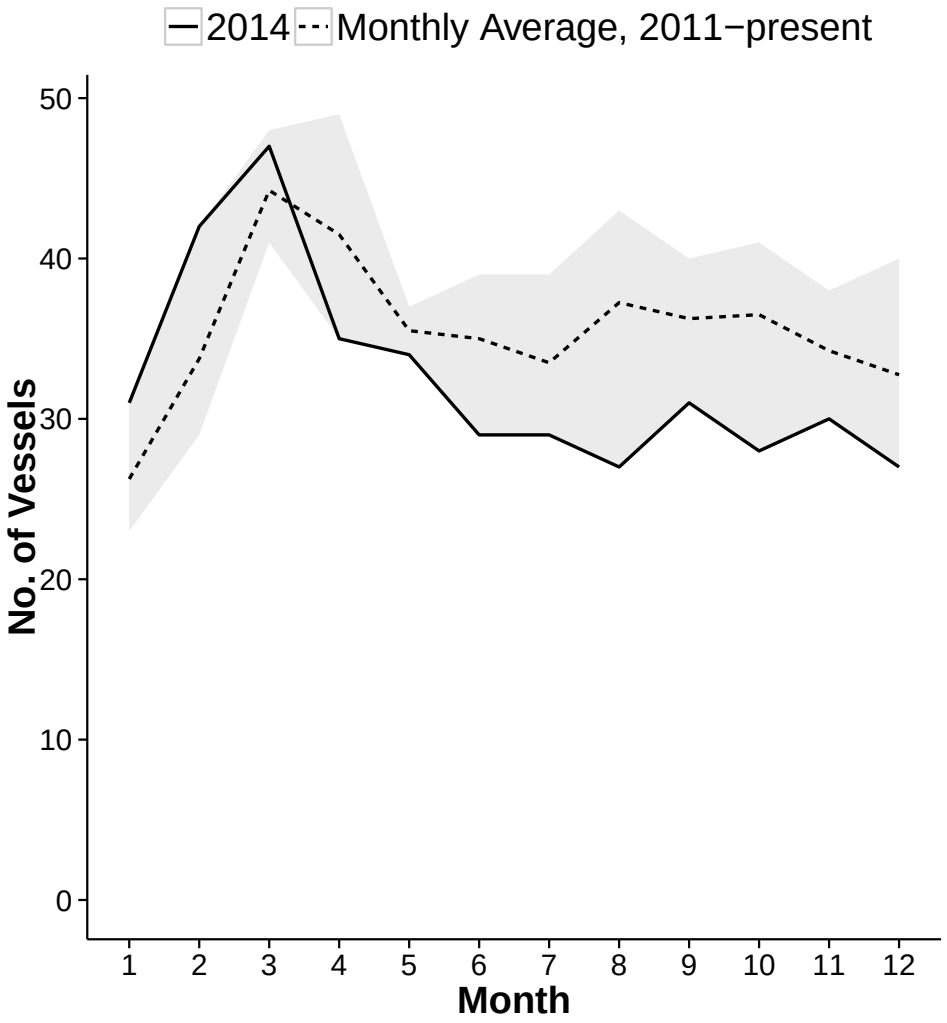


Figure 3: Number of tows by month for IFQ bottom trawl vessels in 2014 (solid line) and averaged over the 2011-14 period (dotted line). Grey ribbon represents the monthy maximum and minimum across 2011-2014.

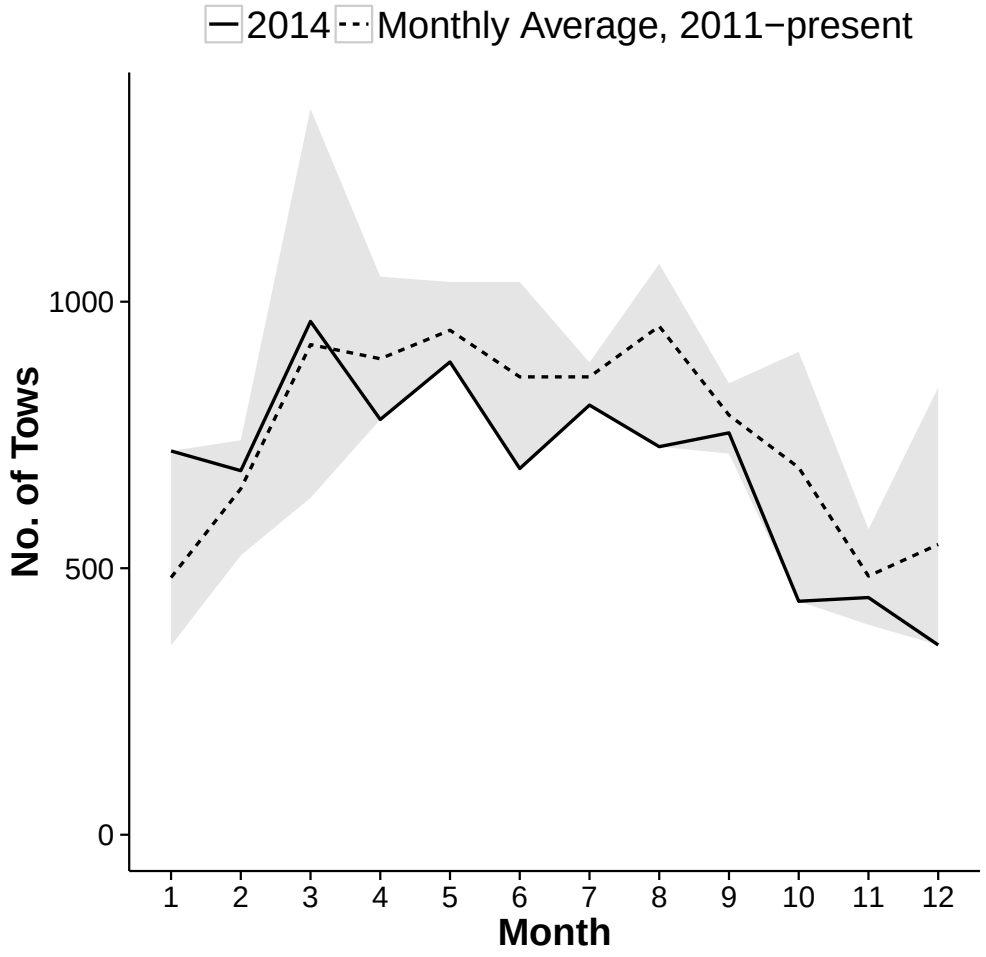


Figure 4: Tow hours by month for IFQ bottom trawl vessels in 2014 (solid line) and averaged over the 2011-14 period (dotted line). Grey ribbon represents the monthy maximum and minimum across 2011-2014.

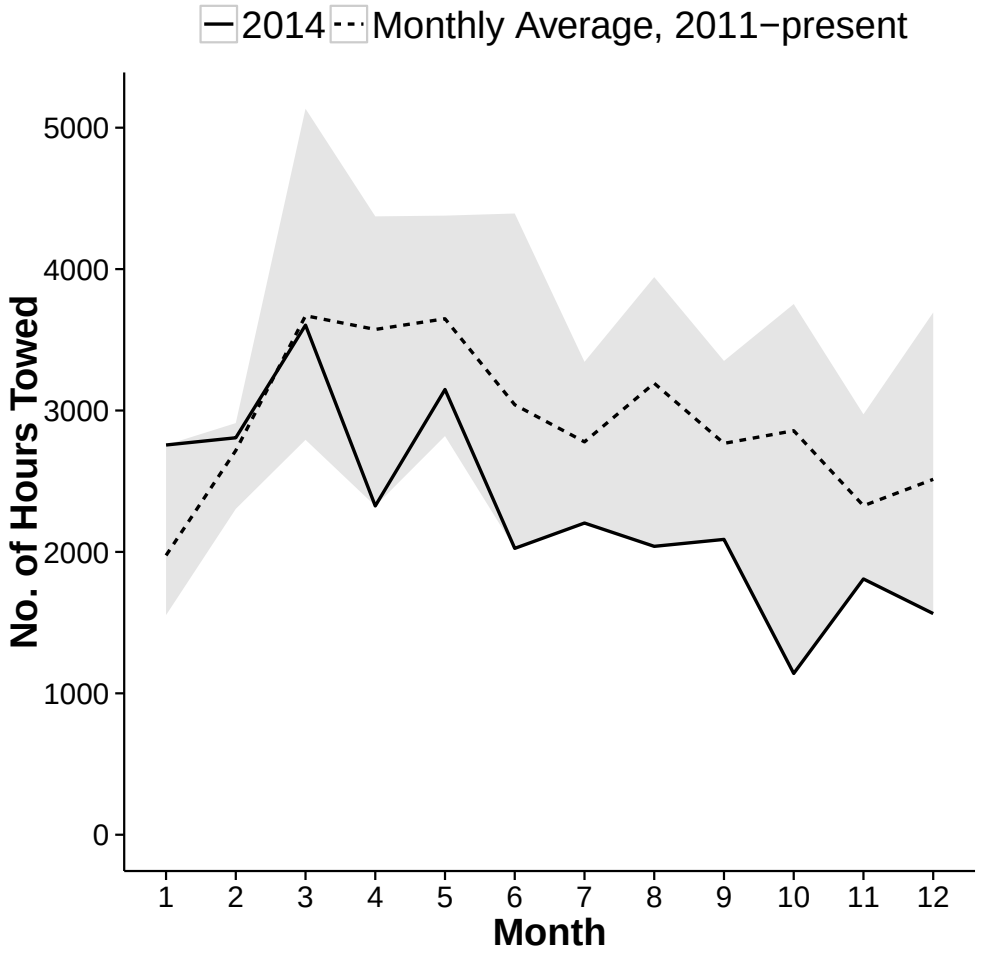


Figure 5: Estimated discard mortality of *P.halibut* in the non-nearshore fixed gear fishery by sector and year. The OA fixed gear fishery was only observed from 2003-06 in California and was not observed at all in 2002. Therefore, we apply a fixed average discard rate from 2007-08 data to generate 2002-06 discard estimates for the OA sector. The 'Other fixed gear sectors' includes LE sablefish non-endorsed and OA fixed gear vessels fishing with pot gear. The inset is an expanded view of each of the sectors, except LE sablefish endorsed longline gear, during recent years.

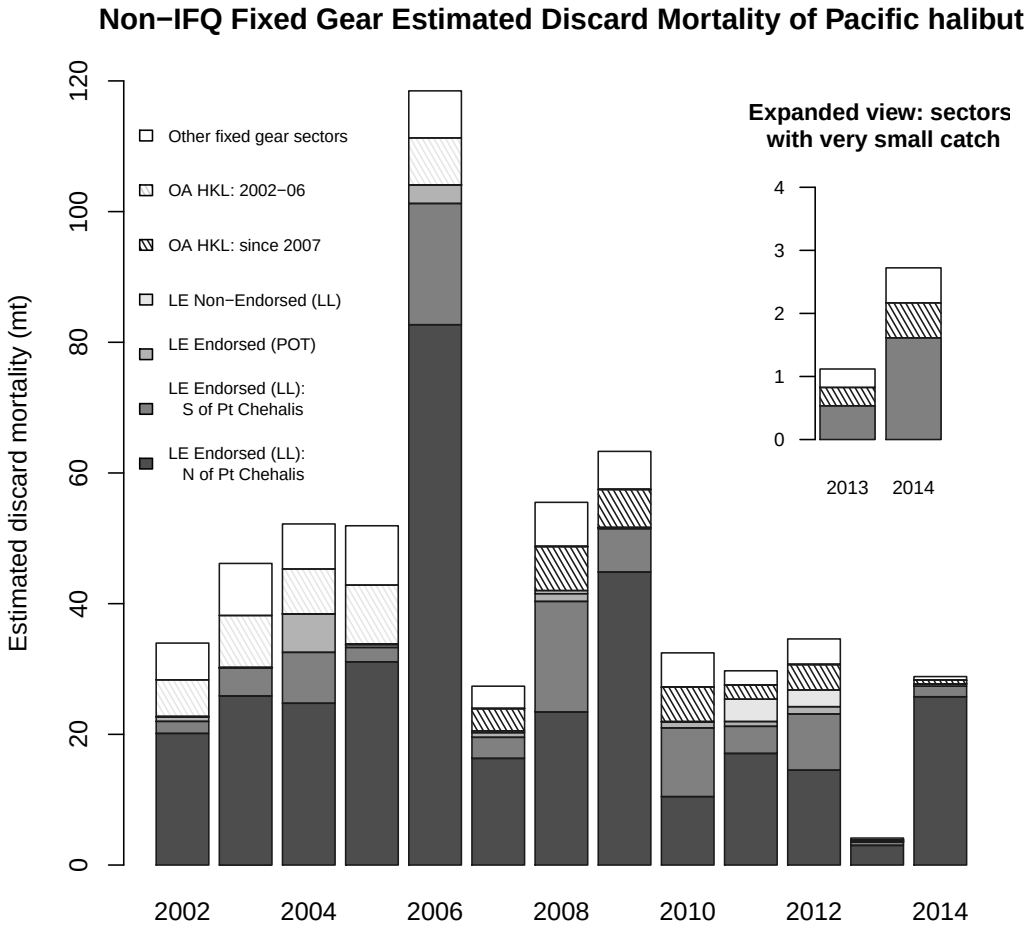


Figure 6: Length frequency distribution of discarded Pacific halibut on WCGOP observed Non-Nearshore Fixed Gear limited entry (LE) and open access (OA) groundfish vessels from September 2003 through December 2014. The majority of P. halibut lengths collected in this fishery were visual estimates (grey bars), which are only estimated in 10 cm bins.

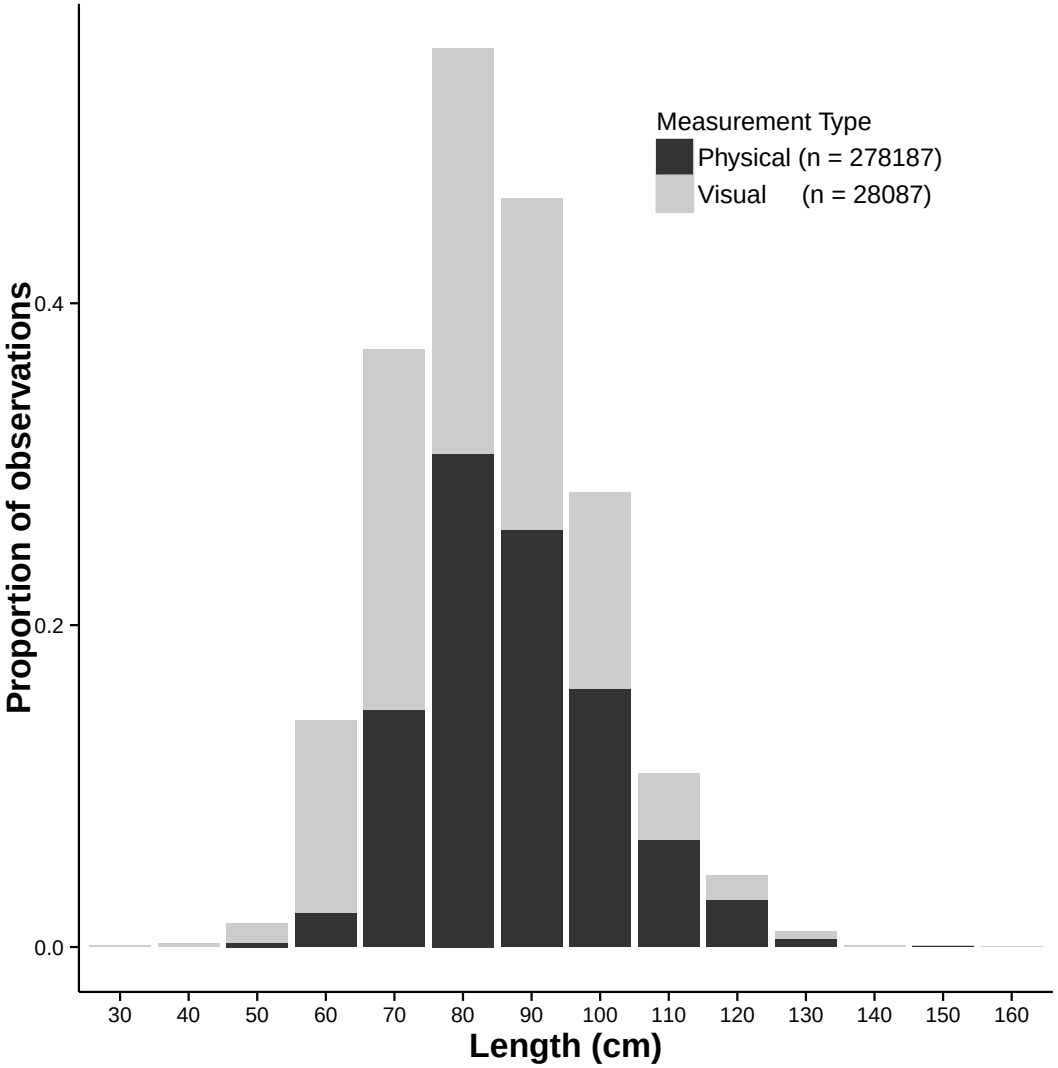


Figure 7: Spatial distribution of Pacific halibut bycatch (mt/km^2) observed by West Coast Groundfish Observer Program (2002-2014), off the U.S. west coast. Gear types observed by the WCGOP include bottom trawl, midwater trawl, shrimp trawl, fixed gear hook-&-line and pot gear. The five catch classifications were defined by excluding any 0 values and then applying the Jenks natural breaks classification method. Cells calculated from less than 3 vessels were omitted from the map to maintain confidentiality.

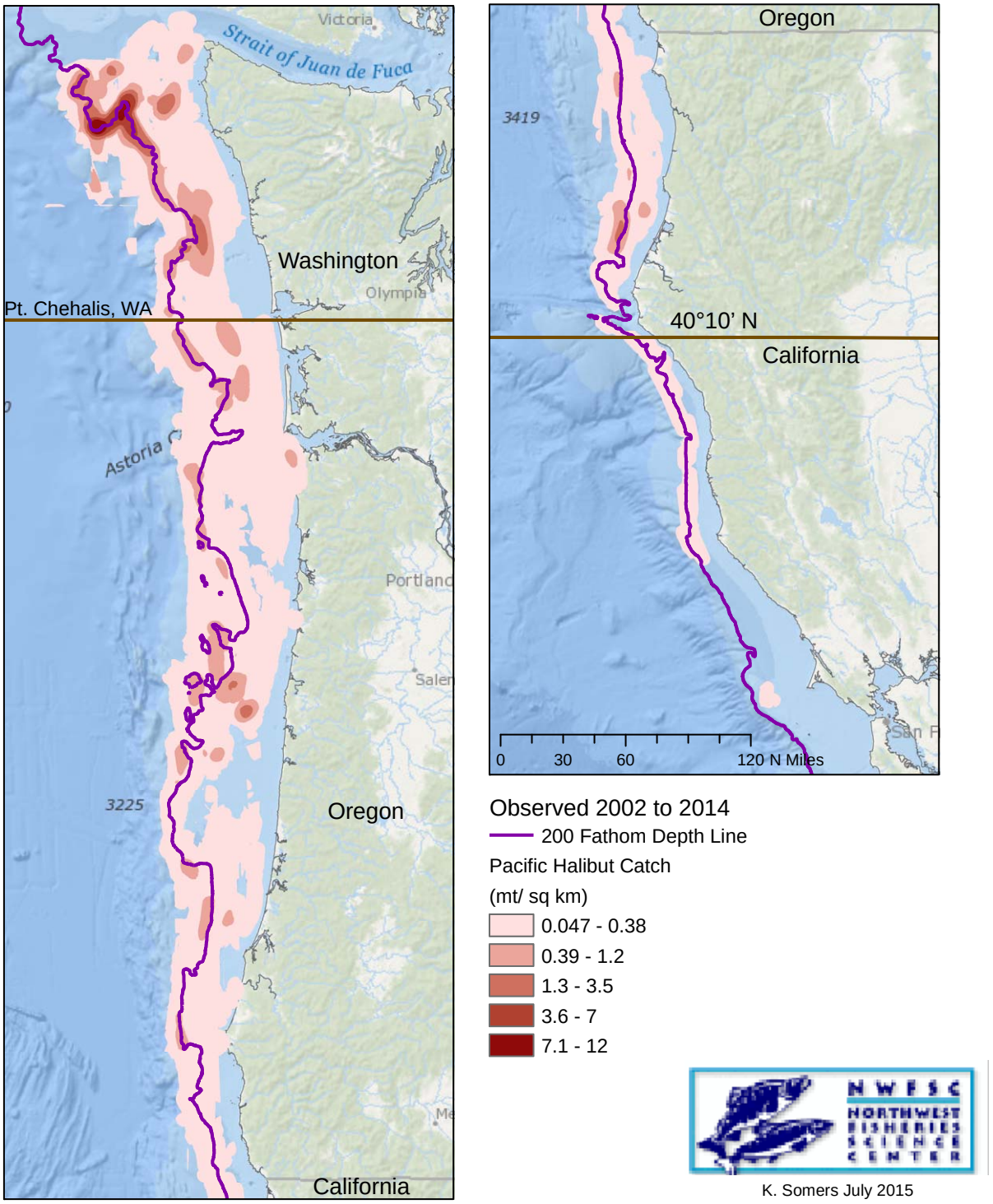
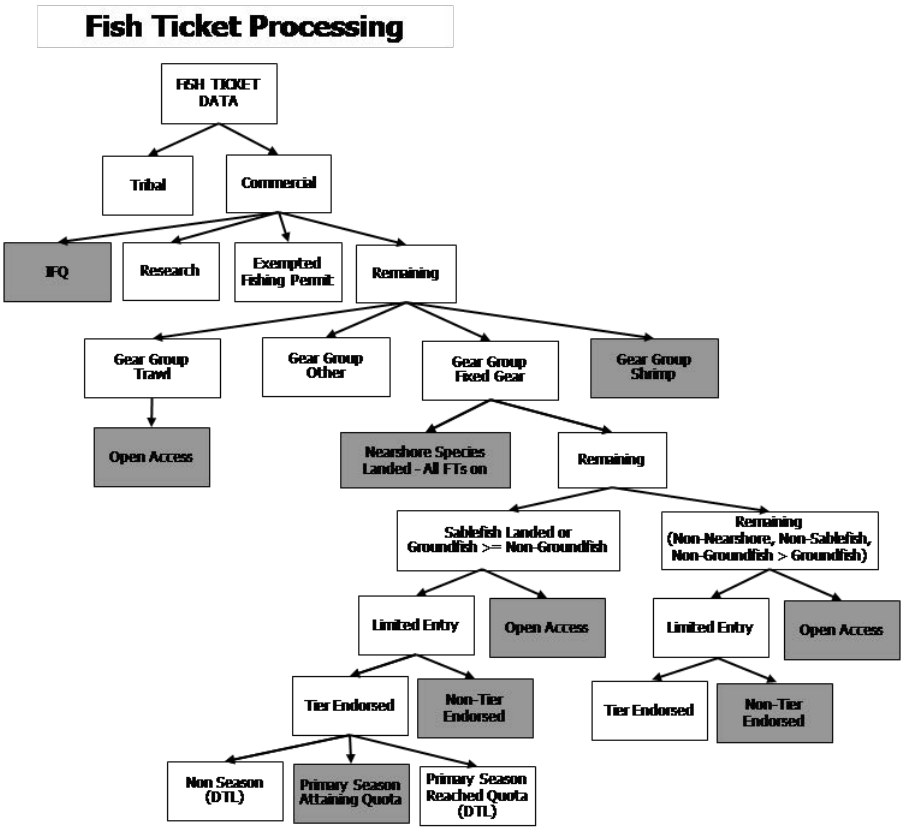


Figure 8: Fish ticket data processing for division into 2014 groundfish fishery sectors after retrieval from the Pacific Fisheries Information Network (PacFIN) database. Grey boxes indicate sectors for which federal observer data is available. Fish ticket processing methods are updated annually, thus, this figure might differ from similar figures in previous reports.



10 APPENDICES

10.1 Appendix A

Weighted catch composition data from the IFQ fishery for bottom trawl and pot gears. The frequency within each length bin was weighted based on the following equation:

$$n_{wghtd_l} = n_l \times \frac{W_{st}}{\sum_l w_{stl}} \times \frac{\sum_t W_{st}}{W_{st}} \times \frac{\hat{W}_s}{\sum_t W_{st}} = n_l \times \frac{\hat{W}_s}{\sum_l w_{stl}} \tag{7}$$

where:

n_l = number of measured fish in length bin l
w_{stl} = total weight of length l fish measured, as determined through the IPHC length-weight relationship (Table 9 in Appendix C 10.3)
W_{st} = total observed discard weight of Pacific halibut on tow t, in stratum s
$\hat{W}_s$ = estimated total discard weight of P. halibut in stratum s

Table 38: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for bottom trawl and pot gears, by year. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. Since 2013, IFQ bottom trawl lengths could also include lengths taken on both IFQ and LE California halibut bottom trawl fisheries.

	Bottom Trawl				Pot					Bottom Trawl				Pot			
Length bin (cm)	2011	2012	2013	2014	2011	2012	2013	2014	**Length bin (cm)**	2011	2012	2013	2014	2011	2012	2013	2014
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	102	0.0071	0.0076	0.0161	0.0047	0.0025	0.0085	0.0103	0.0519
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	104	0.0054	0.0043	0.0052	0.0119	0.0024	0.0054	0.0043	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	106	0.0039	0.0036	0.0143	0.0025	0.0000	0.0137	0.0170	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	108	0.0030	0.0034	0.0089	0.0020	0.0035	0.0012	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	110	0.0025	0.0033	0.0022	0.0019	0.0014	0.0011	0.0045	0.0138
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	112	0.0021	0.0021	0.0158	0.0013	0.0013	0.0010	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	114	0.0017	0.0015	0.0011	0.0009	0.0028	0.0020	0.0000	0.0123
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	116	0.0011	0.0012	0.0009	0.0005	0.0005	0.0000	0.0000	0.0233
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	118	0.0009	0.0007	0.0007	0.0004	0.0011	0.0009	0.0028	0.0000
18	0.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	120	0.0005	0.0009	0.0062	0.0003	0.0015	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	122	0.0005	0.0005	0.0005	0.0069	0.0029	0.0000	0.0000	0.0000
22	0.0000	0.0114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	124	0.0006	0.0003	0.0002	0.0133	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	126	0.0003	0.0004	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	128	0.0003	0.0000	0.0001	0.0002	0.0008	0.0000	0.0000	0.0000
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	130	0.0001	0.0000	0.0000	0.0001	0.0004	0.0000	0.0000	0.0000
30	0.0000	0.0083	0.0038	0.0000	0.0000	0.0000	0.0000	0.0000	132	0.0002	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0067	0.0030	0.0028	0.0000	0.0000	0.0000	0.0000	134	0.0000	0.0000	0.0001	0.0053	0.0007	0.0000	0.0000	0.0000
34	0.0000	0.0108	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	136	0.0001	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000	0.0000
36	0.0000	0.0046	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	138	0.0000	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0000
38	0.0000	0.0112	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	140	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.0014	0.0056	0.0019	0.0014	0.0000	0.0000	0.0000	0.0000	142	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	0.0023	0.0114	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	144	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0000	0.0025	0.0000	0.0000	0.0247	0.0000	0.0000	0.0000	146	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000
46	0.0003	0.0073	0.0006	0.0004	0.0000	0.0000	0.0560	0.0000	148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
48	0.0029	0.0066	0.0028	0.0011	0.0000	0.0000	0.0000	0.0000	150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
50	0.0034	0.0074	0.0032	0.0000	0.0000	0.0000	0.0000	0.0000	152	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52	0.0045	0.0073	0.0048	0.0021	0.0000	0.0000	0.0000	0.0000	154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54	0.0079	0.0056	0.0058	0.0044	0.0129	0.0000	0.0440	0.0000	156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
56	0.0074	0.0063	0.0074	0.0050	0.0054	0.0000	0.0000	0.0000	158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
58	0.0194	0.0150	0.0155	0.0141	0.0151	0.0000	0.0000	0.0000	160	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
60	0.0323	0.0292	0.0275	0.0304	0.0670	0.0000	0.0074	0.0935	162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
62	0.0442	0.0431	0.0554	0.0552	0.0539	0.0000	0.0000	0.0000	164	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0565	0.0529	0.0233	0.0741	0.0217	0.0377	0.0000	0.0000	166	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000
66	0.0588	0.0535	0.0709	0.0777	0.0136	0.0113	0.0052	0.0000	168	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
68	0.0570	0.0613	0.0674	0.0910	0.0215	0.0308	0.0265	0.0000	170	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
70	0.0762	0.0704	0.0770	0.0897	0.0745	0.0239	0.0396	0.0000	172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
72	0.0736	0.0699	0.0815	0.0848	0.0908	0.0608	0.1316	0.0547	174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
74	0.0858	0.0671	0.0720	0.1064	0.0541	0.0595	0.1028	0.1000	176	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
76	0.0669	0.0624	0.0671	0.0666	0.0183	0.0295	0.0698	0.0459	178	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
78	0.0561	0.0533	0.0586	0.0591	0.0744	0.0907	0.0737	0.0422	180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
80	0.0571	0.0491	0.0522	0.0491	0.1015	0.0891	0.0642	0.1135	182	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
82	0.0479	0.0469	0.0541	0.1270	0.0631	0.1473	0.1079	0.0703	184	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
84	0.0461	0.0372	0.0394	0.0477	0.0543	0.1230	0.0470	0.0995	186	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
86	0.0309	0.0301	0.0279	0.1097	0.0411	0.0636	0.0379	0.1218	188	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
88	0.0285	0.0253	0.0259	0.0214	0.0372	0.0659	0.0496	0.0275	190	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90	0.0258	0.0236	0.0246	0.0743	0.0473	0.0399	0.0358	0.0000	192	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
92	0.0213	0.0213	0.0370	0.0162	0.0216	0.0337	0.0188	0.0239	194	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
94	0.0167	0.0160	0.0152	0.0117	0.0187	0.0260	0.0150	0.0461	196	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
96	0.0134	0.0109	0.0114	0.0104	0.0153	0.0259	0.0235	0.0208	198	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
98	0.0097	0.0097	0.0062	0.0077	0.0123	0.0016	0.0000	0.0201	200	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
100	0.0086	0.0084	0.0058	0.0075	0.0163	0.0062	0.0047	0.0189									

Table 39: Percentage of weighted length measurements in each viability category, by gear type and year in the IFQ groundfish fishery. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. Since 2013, IFQ bottom trawl lengths could also include lengths taken on both IFQ and LE California halibut bottom trawl fisheries.

	Bottom Trawl												**Pot**											
	Excellent				Poor				Dead				Excellent				Poor				Dead			
Length bin (cm)	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
4	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
12	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
16	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
18	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
22	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	0.0%	50.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	0.0%	82.3%	0.0%	0.0%	0.0%	15.8%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40	0.0%	85.5%	22.2%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	14.5%	77.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
42	48.3%	68.6%	0.0%	0.0%	51.7%	24.4%	0.0%	0.0%	0.0%	6.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
44	0.0%	47.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	52.6%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
46	0.0%	85.8%	0.0%	0.0%	0.0%	14.2%	0.0%	0.0%	100.0%	0.0%	100.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
48	25.0%	97.0%	34.3%	100.0%	25.0%	0.0%	29.0%	0.0%	49.9%	3.0%	36.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	29.9%	67.5%	20.7%	0.0%	0.0%	10.8%	22.1%	0.0%	70.1%	21.7%	57.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
52	23.1%	52.2%	29.7%	30.1%	42.4%	14.9%	22.3%	11.6%	34.6%	32.9%	48.0%	58.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
54	15.6%	60.8%	40.3%	50.8%	43.0%	29.9%	18.2%	0.0%	41.3%	9.2%	41.5%	49.2%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
56	20.7%	44.2%	54.8%	35.4%	45.5%	13.4%	1.9%	0.8%	33.8%	42.4%	43.3%	63.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
58	19.9%	41.1%	36.5%	32.9%	31.2%	9.7%	23.0%	31.2%	48.9%	49.1%	40.5%	35.8%	67.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	32.1%	0.0%	0.0%	0.0%
60	32.8%	36.2%	39.5%	38.7%	24.3%	22.1%	8.3%	23.6%	42.9%	41.7%	52.1%	37.7%	57.3%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	42.7%	0.0%	0.0%	0.0%
62	37.7%	40.1%	43.4%	43.4%	22.7%	21.1%	18.7%	20.1%	39.6%	38.9%	37.9%	36.5%	38.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	62.0%	0.0%	0.0%	0.0%
64	39.6%	31.8%	46.1%	45.0%	18.7%	21.0%	17.6%	19.7%	41.7%	47.2%	36.3%	35.3%	34.5%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	65.5%	0.0%	0.0%	0.0%
66	36.6%	35.0%	45.1%	48.9%	21.1%	22.5%	14.3%	23.7%	42.3%	42.5%	40.6%	27.5%	50.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%
68	42.6%	34.8%	50.5%	46.7%	12.0%	21.4%	12.3%	20.8%	45.4%	43.8%	37.2%	32.5%	69.9%	100.0%	36.2%	0.0%	0.0%	0.0%	63.8%	0.0%	30.1%	0.0%	0.0%	0.0%
70	41.5%	39.5%	45.2%	53.6%	20.8%	19.8%	17.1%	17.8%	37.7%	40.7%	37.7%	28.6%	62.2%	100.0%	77.9%	0.0%	3.4%	0.0%	10.8%	0.0%	34.4%	0.0%	11.3%	0.0%
72	38.6%	31.4%	48.6%	50.8%	20.9%	19.4%	16.9%	18.4%	40.6%	49.2%	34.5%	30.8%	77.3%	85.9%	96.9%	100.0%	0.0%	14.1%	0.0%	0.0%	22.7%	0.0%	3.1%	0.0%
74	40.0%	32.3%	47.4%	53.7%	17.5%	22.0%	19.1%	14.8%	42.5%	45.7%	33.5%	31.6%	69.2%	93.6%	64.1%	100.0%	9.1%	6.4%	12.0%	0.0%	21.7%	0.0%	24.0%	0.0%
76	45.5%	36.8%	45.0%	44.1%	17.0%	17.1%	17.8%	18.2%	37.5%	46.1%	37.2%	37.7%	43.2%	49.7%	50.0%	100.0%	0.0%	37.8%	33.1%	0.0%	56.8%	12.4%	16.9%	0.0%
78	41.1%	33.0%	44.6%	52.3%	19.0%	24.9%	16.0%	17.9%	39.9%	42.1%	39.5%	29.8%	59.1%	63.3%	100.0%	100.0%	7.9%	14.6%	0.0%	0.0%	33.0%	22.2%	0.0%	0.0%
80	45.7%	38.5%	53.9%	50.1%	16.0%	18.8%	13.1%	16.6%	38.4%	42.7%	33.0%	33.3%	57.6%	100.0%	95.5%	65.8%	1.7%	0.0%	0.0%	0.0%	40.7%	0.0%	4.5%	34.2%
82	45.7%	36.3%	45.4%	50.6%	19.9%	21.3%	18.3%	11.3%	34.3%	42.3%	36.3%	38.1%	86.4%	54.9%	61.6%	100.0%	5.6%	9.6%	16.8%	0.0%	8.0%	35.5%	21.6%	0.0%
84	50.2%	38.6%	50.6%	45.6%	14.8%	19.3%	14.5%	13.3%	35.1%	42.0%	34.9%	41.1%	59.3%	73.6%	100.0%	100.0%	6.0%	13.2%	0.0%	0.0%	34.7%	13.2%	0.0%	0.0%
86	44.7%	36.6%	55.6%	48.8%	14.6%	21.7%	15.5%	18.1%	40.8%	41.8%	28.9%	33.2%	85.3%	76.6%	87.9%	25.2%	7.4%	7.6%	0.0%	0.0%	7.4%	15.8%	12.1%	74.8%
88	41.7%	39.6%	52.9%	43.5%	16.1%	22.1%	15.2%	22.0%	42.2%	38.3%	31.9%	34.5%	92.4%	79.3%	91.4%	100.0%	0.0%	6.8%	0.0%	0.0%	7.6%	13.9%	8.6%	0.0%
90	48.3%	41.2%	57.9%	43.1%	17.0%	19.2%	13.8%	18.7%	34.7%	39.7%	28.4%	38.2%	70.5%	68.2%	100.0%	0.0%	0.0%	21.4%	0.0%	0.0%	29.5%	10.5%	0.0%	0.0%
92	46.7%	41.2%	58.4%	50.6%	17.3%	20.3%	14.7%	14.0%	36.0%	38.5%	26.9%	35.4%	55.8%	59.0%	100.0%	0.0%	22.1%	23.5%	0.0%	0.0%	22.1%	17.4%	0.0%	100.0%
94	51.2%	46.6%	54.6%	49.4%	20.1%	14.3%	15.6%	17.6%	28.7%	39.1%	29.8%	33.1%	52.2%	100.0%	88.9%	50.0%	23.9%	0.0%	0.0%	0.0%	23.9%	0.0%	11.1%	50.0%
96	49.4%	40.7%	58.5%	57.5%	14.6%	17.1%	12.5%	14.6%	36.0%	42.2%	29.0%	27.9%	45.6%	80.2%	47.1%	0.0%	13.4%	13.1%	0.0%	0.0%	41.0%	6.7%	52.9%	100.0%
98	50.0%	40.0%	52.5%	43.5%	18.2%	17.6%	19.6%	23.2%	31.8%	42.5%	27.9%	33.3%	53.2%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	46.8%	0.0%	0.0%	0.0%
100	53.8%	43.5%	60.9%	57.3%	18.2%	21.1%	14.8%	5.6%	27.9%	35.4%	24.3%	37.2%	77.6%	100.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	22.4%	0.0%	0.0%	0.0%
102	47.3%	51.9%	58.6%	52.2%	16.1%	16.0%	14.3%	13.3%	36.6%	32.1%	27.1%	34.5%	100.0%	34.0%	100.0%	100.0%	0.0%	33.0%	0.0%	0.0%	0.0%	33.0%	0.0%	0.0%
104	53.0%	45.2%	55.6%	60.8%	18.8%	10.4%	14.3%	17.8%	28.2%	44.4%	30.1%	21.4%	100.0%	0.0%	100.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%

Table 40: Table 39 continued. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm.

	Bottom Trawl												Pot											
	Excellent				Poor				Dead				Excellent				Poor				Dead			
Length bin (cm)	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014	2011	2012	2013	2014
106	54.3%	39.9%	71.7%	66.3%	18.4%	27.1%	12.7%	9.2%	27.3%	32.9%	15.6%	24.6%	0.0%	45.4%	76.4%	0.0%	0.0%	54.6%	23.6%	0.0%	0.0%	0.0%	0.0%	0.0%
108	53.4%	44.8%	58.5%	62.6%	20.3%	15.9%	14.1%	23.2%	26.3%	39.3%	27.4%	14.2%	18.5%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	81.5%	0.0%	0.0%	0.0%
110	56.4%	50.5%	56.2%	60.9%	11.2%	14.3%	26.9%	16.0%	32.4%	35.2%	16.9%	23.1%	100.0%	100.0%	23.1%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	76.9%	0.0%
112	56.7%	53.9%	58.0%	53.5%	22.5%	23.0%	20.7%	14.9%	20.8%	23.1%	21.3%	31.6%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
114	49.8%	44.7%	68.4%	64.7%	25.2%	22.6%	12.7%	12.9%	25.0%	32.7%	18.9%	22.3%	57.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	42.4%	100.0%	0.0%	100.0%
116	60.7%	41.7%	59.7%	42.6%	13.5%	20.6%	20.0%	37.1%	25.8%	37.8%	20.2%	20.2%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
118	55.9%	58.1%	62.8%	62.3%	9.8%	5.6%	17.3%	29.2%	34.3%	36.4%	19.8%	8.5%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
120	47.5%	20.0%	79.4%	81.7%	28.2%	17.0%	18.8%	0.0%	24.3%	63.1%	1.8%	18.3%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
122	54.4%	57.4%	59.0%	80.1%	8.1%	32.7%	14.5%	0.0%	37.5%	9.9%	26.5%	19.9%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
124	39.8%	35.4%	47.7%	73.5%	21.7%	51.4%	16.1%	16.1%	38.5%	13.2%	36.1%	10.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
126	41.9%	30.7%	100.0%	0.0%	19.2%	29.7%	0.0%	37.8%	38.9%	39.7%	0.0%	62.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
128	52.9%	96.3%	49.5%	85.0%	35.6%	0.0%	50.5%	0.0%	11.5%	3.7%	0.0%	15.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
130	75.3%	0.0%	77.8%	100.0%	24.7%	0.0%	0.0%	0.0%	0.0%	100.0%	22.2%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
132	45.2%	100.0%	22.2%	100.0%	18.5%	0.0%	0.0%	0.0%	36.3%	0.0%	77.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
134	79.5%	100.0%	67.0%	100.0%	20.5%	0.0%	33.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
136	25.3%	100.0%	100.0%	100.0%	49.3%	0.0%	0.0%	0.0%	25.3%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
138	0.0%	7.2%	0.0%	0.0%	100.0%	61.6%	100.0%	0.0%	0.0%	31.2%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
140	49.2%	0.0%	0.0%	0.0%	50.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
142	25.0%	0.0%	0.0%	0.0%	25.1%	100.0%	0.0%	0.0%	49.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
144	59.3%	0.0%	0.0%	60.0%	40.7%	0.0%	0.0%	40.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
146	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
148	49.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
150	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
152	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
154	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
162	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
166	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
168	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
170	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
172	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
174	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
176	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
178	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
180	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
182	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
184	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
186	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
188	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
190	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
192	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
194	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
196	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
198	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
200	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
202	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 41: Weighted length frequency distributions for Pacific halibut in the limited entry bottom trawl fishery, 2002-10. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm.

	Weighted length frequency distribution						
Length bin (cm)	2004	2005	2006	2007	2008	2009	2010
22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0125	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
36	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.0048	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	0.0000	0.0044	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0025	0.0012	0.0057	0.0000	0.0000	0.0010	0.0000
46	0.0037	0.0000	0.0094	0.0000	0.0000	0.0009	0.0000
48	0.0000	0.0034	0.0046	0.0000	0.0000	0.0000	0.0000
50	0.0027	0.0068	0.0092	0.0000	0.0007	0.0010	0.0000
52	0.0021	0.0069	0.0080	0.0041	0.0001	0.0053	0.0000
54	0.0156	0.0076	0.0164	0.0042	0.0025	0.0004	0.0000
56	0.0138	0.0211	0.0242	0.0071	0.0022	0.0019	0.0000
58	0.0187	0.0331	0.0322	0.0293	0.0027	0.0091	0.0022
60	0.0400	0.0431	0.0670	0.0593	0.0169	0.0175	0.0056
62	0.0329	0.0719	0.0751	0.0638	0.0285	0.0275	0.0121
64	0.0428	0.0783	0.1001	0.0932	0.0614	0.0545	0.0155
66	0.0532	0.0807	0.0979	0.1150	0.0705	0.0606	0.0185
68	0.0757	0.0845	0.0870	0.0000	0.0599	0.0835	0.0256
70	0.0672	0.0851	0.0986	0.1022	0.0871	0.0971	0.0154
72	0.0774	0.0882	0.0478	0.1029	0.0973	0.0972	0.0314
74	0.0998	0.0746	0.0588	0.0840	0.1023	0.0941	0.0383
76	0.0890	0.0538	0.0461	0.0710	0.0743	0.0697	0.0284
78	0.0658	0.0506	0.0423	0.0539	0.0688	0.0744	0.0349
80	0.0586	0.0427	0.0372	0.0460	0.0599	0.0527	0.0298
82	0.0486	0.0320	0.0258	0.0325	0.0443	0.0434	0.0239
84	0.0337	0.0255	0.0186	0.0316	0.0428	0.0335	0.0227
86	0.0221	0.0166	0.0130	0.0000	0.0300	0.0290	0.0141
88	0.0235	0.0115	0.0120	0.0154	0.0263	0.0290	0.0122
90	0.0193	0.0127	0.0115	0.0168	0.0225	0.0263	0.0100
92	0.0157	0.0092	0.0101	0.0122	0.0179	0.0204	0.0094

	Weighted length frequency distribution						
Length bin (cm)	2004	2005	2006	2007	2008	2009	2010
94	0.0169	0.0108	0.0099	0.0148	0.0164	0.0151	0.0053
96	0.0062	0.0052	0.0066	0.0089	0.0143	0.0087	0.0066
98	0.0034	0.0058	0.0066	0.0091	0.0110	0.0103	0.0067
100	0.0089	0.0045	0.0025	0.0053	0.0080	0.0088	0.0023
102	0.0060	0.0034	0.0029	0.0036	0.0061	0.0069	0.0018
104	0.0065	0.0023	0.0027	0.0041	0.0083	0.0062	0.0021
106	0.0043	0.0029	0.0032	0.0031	0.0059	0.0028	0.0013
108	0.0016	0.0014	0.0019	0.0018	0.0027	0.0025	0.0014
110	0.0048	0.0015	0.0004	0.0017	0.0018	0.0021	0.0009
112	0.0015	0.0007	0.0020	0.0010	0.0016	0.0024	0.0013
114	0.0020	0.0010	0.0007	0.0007	0.0020	0.0017	0.0001
116	0.0026	0.0006	0.0002	0.0000	0.0010	0.0005	0.0005
118	0.0007	0.0004	0.0003	0.0002	0.0004	0.0002	0.0002
120	0.0013	0.0005	0.0002	0.0002	0.0005	0.0003	0.0002
122	0.0008	0.0003	0.0000	0.0004	0.0003	0.0003	0.0002
124	0.0010	0.0002	0.0001	0.0000	0.0003	0.0002	0.0003
126	0.0000	0.0001	0.0002	0.0001	0.0001	0.0002	0.0002
128	0.0002	0.0000	0.0002	0.0000	0.0000	0.0002	0.0000
130	0.0003	0.0002	0.0001	0.0002	0.0000	0.0002	0.0000
132	0.0005	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
134	0.0006	0.0000	0.0001	0.0000	0.0001	0.0001	0.0000
136	0.0001	0.0001	0.0002	0.0000	0.0000	0.0001	0.0000
138	0.0000	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000
140	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
142	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000
144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
146	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150	0.0001	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
152	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
154	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
156	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
158	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
160	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
162	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
164	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 42: Percentage of weighted length measurements in each condition category for the limited entry bottom trawl fishery, 2002-10. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm.

Length	2004			2005			2006		
bin (cm)	Exc	Poor	Dead	Exc	Poor	Dead	Exc	Poor	Dead
22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
42	0.0%	0.0%	0.0%	0.0%	88.4%	11.6%	0.0%	0.0%	0.0%
44	0.0%	0.0%	100.0%	0.0%	70.8%	29.2%	0.0%	0.0%	100.0%
46	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
48	0.0%	0.0%	0.0%	22.4%	0.0%	77.6%	0.0%	0.0%	100.0%
50	0.0%	0.0%	100.0%	61.1%	9.9%	29.0%	0.0%	0.0%	100.0%
52	100.0%	0.0%	0.0%	23.6%	31.3%	45.2%	0.0%	0.0%	100.0%
54	75.5%	11.9%	12.6%	10.0%	20.8%	69.2%	16.9%	0.0%	83.1%
56	12.6%	37.9%	49.5%	25.1%	12.7%	62.2%	22.0%	15.2%	62.8%
58	21.4%	25.6%	53.0%	15.1%	29.5%	55.4%	4.1%	20.2%	75.7%
60	58.6%	14.4%	27.0%	18.2%	21.0%	60.8%	12.9%	25.5%	61.6%
62	40.0%	21.6%	38.4%	18.5%	23.7%	57.8%	27.3%	22.3%	50.4%
64	33.4%	18.4%	48.2%	25.2%	28.4%	46.4%	31.5%	21.0%	47.5%
66	23.9%	24.7%	51.4%	20.9%	26.7%	52.3%	29.6%	17.3%	53.0%
68	38.2%	21.9%	39.9%	17.0%	27.5%	55.5%	35.5%	18.8%	45.7%
70	29.5%	18.9%	51.6%	20.1%	30.3%	49.5%	30.2%	16.6%	53.2%
72	22.9%	17.9%	59.2%	20.3%	27.1%	52.6%	37.2%	21.1%	41.8%
74	23.8%	25.5%	50.7%	24.5%	23.4%	52.1%	39.6%	13.9%	46.5%
76	24.0%	23.2%	52.8%	26.8%	29.1%	44.1%	31.2%	19.2%	49.6%
78	18.8%	18.4%	62.9%	18.1%	23.5%	58.4%	35.0%	21.2%	43.8%
80	19.1%	19.6%	61.3%	23.1%	27.9%	49.0%	34.3%	15.4%	50.2%
82	14.4%	26.1%	59.5%	30.4%	25.1%	44.6%	31.7%	27.8%	40.5%
84	21.7%	9.5%	68.9%	27.0%	18.9%	54.0%	30.1%	13.2%	56.7%
86	32.4%	24.0%	43.6%	35.5%	24.7%	39.8%	31.3%	15.0%	53.7%
88	27.8%	14.8%	57.5%	31.2%	27.8%	41.0%	22.9%	12.4%	64.7%
90	30.2%	34.6%	35.2%	28.0%	16.6%	55.4%	23.8%	18.7%	57.5%
92	40.2%	28.1%	31.7%	42.5%	21.7%	35.9%	43.7%	10.7%	45.6%
94	26.1%	33.3%	40.6%	33.4%	16.3%	50.3%	35.3%	7.1%	57.6%
96	19.9%	30.0%	50.1%	34.6%	19.2%	46.2%	16.5%	13.9%	69.6%
98	33.8%	28.4%	37.8%	32.3%	22.8%	44.9%	16.8%	13.0%	70.2%
100	14.6%	26.9%	58.5%	28.1%	17.4%	54.5%	48.5%	9.6%	41.9%
102	16.0%	49.3%	34.7%	43.1%	6.9%	50.0%	13.7%	0.0%	86.3%
104	19.0%	47.5%	33.5%	36.4%	16.2%	47.4%	49.6%	6.4%	44.0%
106	23.6%	22.6%	53.9%	58.4%	11.9%	29.7%	10.4%	22.8%	66.8%
108	27.6%	3.0%	69.4%	28.6%	22.6%	48.8%	42.2%	15.1%	42.6%
110	25.4%	12.6%	62.0%	22.7%	28.1%	49.2%	32.0%	3.1%	64.9%
112	95.8%	1.2%	3.0%	16.2%	0.0%	83.8%	7.2%	14.1%	78.7%
114	0.0%	26.2%	73.8%	24.4%	4.9%	70.7%	38.9%	0.0%	61.1%
116	58.7%	6.9%	34.4%	69.4%	0.0%	30.6%	77.8%	0.0%	22.2%
118	2.7%	7.5%	89.9%	44.9%	35.0%	20.1%	33.8%	31.5%	34.7%
120	5.7%	26.2%	68.0%	9.5%	28.7%	61.8%	0.0%	0.0%	100.0%
122	40.8%	40.3%	18.9%	1.5%	15.2%	83.4%	50.0%	50.0%	0.0%
124	70.3%	14.8%	14.8%	79.9%	0.0%	20.1%	15.6%	0.0%	84.4%
126	0.0%	100.0%	0.0%	89.0%	11.0%	0.0%	47.1%	0.0%	52.9%
128	82.0%	9.0%	9.0%	18.7%	0.0%	81.3%	89.8%	0.0%	10.2%
130	13.5%	0.0%	86.5%	4.9%	47.6%	47.6%	0.0%	0.0%	100.0%
132	100.0%	0.0%	0.0%	20.2%	63.3%	16.5%	0.0%	100.0%	0.0%
134	80.0%	0.0%	20.0%	100.0%	0.0%	0.0%	22.2%	0.0%	77.8%
136	0.0%	0.0%	100.0%	10.5%	16.1%	73.4%	0.0%	0.0%	100.0%
138	0.0%	0.0%	0.0%	15.2%	0.0%	84.8%	0.0%	0.0%	0.0%
140	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%
142	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
144	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
146	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
148	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
150	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%
152	100.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
154	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
162	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Length	2007			2008			2009		
bin (cm)	Exc	Poor	Dead	Exc	Poor	Dead	Exc	Poor	Dead
22	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
26	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
34	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
36	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
38	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
40	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
42	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
44	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
46	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
48	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
52	33.4%	0.0%	66.6%	100.0%	0.0%	0.0%	99.5%	0.5%	0.0%
54	35.6%	0.0%	64.4%	0.0%	4.4%	95.6%	42.3%	57.7%	0.0%
56	33.9%	0.0%	66.1%	0.0%	0.0%	100.0%	15.7%	65.3%	19.0%
58	9.4%	6.8%	83.8%	3.3%	3.3%	93.3%	51.0%	4.4%	44.6%
60	5.3%	7.4%	87.2%	9.0%	14.3%	76.8%	28.7%	21.9%	49.4%
62	20.8%	9.5%	69.7%	6.1%	15.7%	78.2%	19.3%	19.5%	61.2%
64	18.9%	5.3%	75.8%	17.3%	7.5%	75.2%	38.0%	9.4%	52.6%
66	9.1%	12.5%	78.4%	25.8%	8.9%	65.4%	26.7%	19.7%	53.6%
68	54.5%	45.5%	0.0%	17.4%	13.2%	69.4%	30.1%	17.5%	52.4%
70	16.0%	7.6%	76.4%	13.1%	14.0%	73.0%	27.4%	17.5%	55.1%
72	14.8%	9.1%	76.0%	19.1%	13.7%	67.2%	22.9%	18.3%	58.8%
74	17.6%	16.9%	65.5%	24.8%	13.8%	61.3%	27.7%	14.8%	57.5%
76	14.0%	9.9%	76.1%	21.9%	11.5%	66.6%	26.2%	16.6%	57.2%
78	15.5%	13.4%	71.2%	24.7%	10.4%	64.9%	18.5%	12.1%	69.4%
80	14.7%	11.6%	73.6%	21.2%	11.4%	67.4%	20.5%	14.1%	65.3%
82	14.6%	3.0%	82.4%	21.5%	16.1%	62.4%	16.3%	18.5%	65.2%
84	17.9%	7.0%	75.1%	15.9%	22.8%	61.3%	17.0%	12.0%	71.0%
86	56.6%	43.4%	0.0%	17.6%	22.5%	59.8%	18.6%	15.5%	65.9%
88	12.3%	10.5%	77.1%	18.1%	18.8%	63.1%	20.1%	17.2%	62.8%
90	6.3%	3.7%	90.0%	23.9%	17.1%	59.0%	18.6%	13.6%	67.8%
92	20.7%	8.4%	70.9%	20.9%	25.1%	54.0%	25.3%	11.8%	62.9%
94	17.0%	18.4%	64.6%	18.8%	13.3%	67.9%	15.2%	18.4%	66.4%
96	16.7%	3.6%	79.7%	15.4%	21.3%	63.4%	27.6%	19.6%	52.8%
98	10.4%	8.2%	81.4%	28.4%	29.4%	42.3%	20.2%	16.9%	62.9%
100	15.4%	23.2%	61.4%	15.0%	19.4%	65.6%	13.4%	25.5%	61.1%
102	40.3%	9.2%	50.6%	27.6%	28.4%	44.1%	24.8%	23.8%	51.4%
104	16.7%	15.8%	67.5%	36.6%	11.7%	51.7%	28.0%	8.4%	63.7%
106	30.7%	20.1%	49.2%	34.8%	7.7%	57.6%	24.0%	13.5%	62.5%
108	29.0%	2.3%	68.7%	19.4%	14.2%	66.4%	18.2%	27.7%	54.1%
110	11.7%	45.1%	43.2%	40.2%	8.0%	51.9%	29.6%	10.4%	60.0%
112	26.9%	23.3%	49.8%	25.1%	9.2%	65.7%	14.7%	17.4%	67.9%
114	20.1%	0.0%	79.9%	22.4%	22.7%	54.9%	31.2%	7.4%	61.5%
116	0.0%	0.0%	100.0%	41.6%	4.8%	53.6%	79.5%	0.5%	20.0%
118	0.0%	0.0%	100.0%	25.5%	38.6%	35.9%	40.9%	4.4%	54.6%
120	85.1%	0.0%	14.9%	65.5%	34.5%	0.0%	48.0%	0.7%	51.2%
122	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	34.7%	0.0%	65.3%
124	0.0%	0.0%	0.0%	0.0%	70.9%	29.1%	26.1%	37.0%	37.0%
126	49.4%	0.0%	50.6%	0.0%	0.0%	100.0%	59.2%	40.8%	0.0%
128	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	55.7%	1.0%	43.3%
130	13.8%	0.0%	86.2%	0.0%	0.0%	0.0%	35.0%	65.0%	0.0%
132	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%
134	0.0%	0.0%	0.0%	94.7%	0.0%	5.3%	100.0%	0.0%	0.0%
136	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%
138	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
140	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%
142	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	0.0%	0.0%
144	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
146	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
148	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
150	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
152	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
154	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
156	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
158	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
160	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
162	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
164	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 43: Continuation of Table 42. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm.

Length	2010			Length	2010			Length	2010		
bin (cm)	Exc	Poor	Dead	bin	Exc	Poor	Dead	bin	Exc	Poor	Dead
10	0.0%	100.0%	0.0%	58	100.0%	0.0%	0.0%	106	2.4%	0.0%	97.6%
12	0.0%	0.0%	0.0%	60	33.4%	0.0%	66.6%	108	0.0%	20.1%	79.9%
14	0.0%	0.0%	0.0%	62	15.7%	29.4%	54.9%	110	14.2%	58.8%	27.0%
16	0.0%	0.0%	0.0%	64	30.1%	21.2%	48.7%	112	39.9%	0.0%	60.1%
18	0.0%	0.0%	0.0%	66	17.8%	15.4%	66.8%	114	0.0%	0.0%	100.0%
20	0.0%	0.0%	0.0%	68	15.0%	10.3%	74.8%	116	50.0%	0.0%	50.0%
22	0.0%	0.0%	0.0%	70	22.2%	7.4%	70.4%	118	0.0%	100.0%	0.0%
24	0.0%	0.0%	0.0%	72	23.6%	17.4%	59.0%	120	0.0%	0.0%	100.0%
26	0.0%	0.0%	0.0%	74	13.5%	24.8%	61.7%	122	0.0%	0.0%	100.0%
28	0.0%	0.0%	0.0%	76	20.1%	16.9%	63.0%	124	100.0%	0.0%	0.0%
30	0.0%	0.0%	0.0%	78	17.0%	17.4%	65.7%	126	0.0%	100.0%	0.0%
32	0.0%	0.0%	0.0%	80	10.6%	22.8%	66.6%	128	0.0%	0.0%	0.0%
34	0.0%	0.0%	0.0%	82	18.9%	19.9%	61.2%	130	0.0%	0.0%	0.0%
36	0.0%	0.0%	0.0%	84	21.9%	25.3%	52.8%	132	0.0%	0.0%	0.0%
38	0.0%	0.0%	0.0%	86	14.9%	16.4%	68.7%	134	0.0%	0.0%	0.0%
40	0.0%	0.0%	0.0%	88	24.8%	17.8%	57.4%	136	100.0%	0.0%	0.0%
42	0.0%	0.0%	0.0%	90	25.8%	24.2%	50.1%	138	0.0%	0.0%	0.0%
44	0.0%	0.0%	0.0%	92	5.0%	9.9%	85.1%	140	0.0%	0.0%	0.0%
46	0.0%	0.0%	0.0%	94	26.1%	29.2%	44.7%	142	0.0%	0.0%	0.0%
48	0.0%	0.0%	0.0%	96	17.4%	39.9%	42.7%	144	0.0%	0.0%	0.0%
50	0.0%	0.0%	0.0%	98	14.3%	23.3%	62.4%	146	0.0%	0.0%	0.0%
52	0.0%	0.0%	0.0%	100	2.2%	31.0%	66.8%	148	0.0%	0.0%	0.0%
54	0.0%	0.0%	0.0%	102	21.7%	20.6%	57.8%	150	0.0%	0.0%	0.0%
56	0.0%	0.0%	0.0%	104	18.3%	37.2%	44.6%	152	0.0%	100.0%	0.0%
								154	0.0%	0.0%	0.0%

10.2 Appendix B: Pacific Halibut IBQ Expansions for In-Season Management, Special Cases

10.2.1 In season reporting to the Vessel Account System

The Vessel Account System (VAS) is a NOAA, West Coast Region database that allows fishers to manage their IFQ quota pounds. On a weekly basis, the WCGOP provides trip-level estimates of discarded P. halibut IBQ to the Pacific States Marine Fisheries Commission (PSMFC). The PSMFC then uploads the data to the VAS. Occasionally, special circumstances required alternative calculations of P. halibut IBQ. Alternative calculations of P. halibut IBQ were identified by observer program staff and incorporated into the VAS. Scenarios triggering an alternative calculation and the equations used for those calculations are given in Table 45 below.

The WCGOP database calculates IBQ weight at the haul-level when the observer collects all the required data elements. The calculation is dependent on the gear fished.

10.2.2 In season IBQ Weight Calculations for Bottom Trawl Gear

The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table (Table 9 in Appendix C 10.3). The total weight of P. halibut in the haul is calculated as:

$$W = \frac{w}{n} \times N \tag{8}$$

where, for each haul:

W = total weight of P. halibut
w = sampled weight of P. halibut
n = sampled number of P. halibut
N = total number of P. halibut

IBQ weight for each haul is then calculated as:

$$W_{IBQ} = \sum_{c} \left(\frac{w_c}{\sum_c w_c} \times W \times m_c \right) \tag{9}$$

where, for each haul:

c = viability condition category
W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
W = total weight of P. halibut in haul
w = sampled weight of P. halibut
m = mortality rate (Table 5)

10.2.3 In season IBQ Weight Calculations for Pot Gear

The sampled P. halibut lengths are converted to weight using the IPHC length-weight conversion table (Table 9 in Appendix C 10.3). Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level. The total weight of P. halibut in the set is calculated as:

$$W = \left(\frac{w}{n} \times N \right) \times \left(\frac{P}{p} \right) \tag{10}$$

where, for each set:

W = total weight of P. halibut
w = sampled weight of P. halibut
n = sampled number of P. halibut
N = total number of P. halibut
P = total number of pots fished
p = sampled number of pots

IBQ weight for each haul is then calculated as:

$$W_{IBQ} = \sum_{c} \left(\frac{w_c}{\sum_c w_c} \times W \times m_c \right) \tag{11}$$

where, for each set:

c = viability condition category
W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
W = total weight of P. halibut in set
w = sampled weight of P. halibut
m = mortality rate (Table 6)

10.2.4 In season IBQ Weight Calculations for Hook-&-Line Gear

The visual estimates of Pacific halibut length (10 cm increments) are converted to weight using the IPHC length-weight conversion table (Table 9 in Appendix C 10.3). Observers are not always able to sample 100% of all gear units due to time constraints and logistics, therefore sample weights need to be expanded to the haul/set level. The total weight of P. halibut in the set is calculated as:

$$W_{IBQ} = \left(\frac{H}{h} \times w \right) \times 0.16 \tag{12}$$

where, for each set:

W_{IBQ} = IBQ weight (mortality rate applied) of P. halibut
w= sampled weight of P. halibut
H= total number or hooks fished
h= sampled number of hooks
0.16 = IPHC mortality rate applied to hook-&-line gear

10.2.5 In season IBQ Weight Alternative Calculation Scenarios

The most prevalent causes for alternative IBQ calculations were due to pre-sorting of P. halibut by the crew and improper sampling. In these scenarios, observer program staff reviewed the trip and calculated IBQ weight manually.

To determine the most appropriate method to calculate IBQ weight, the observer program data management team consulted with the IPHC. For bottom trawl and pot gear, the IPHC preferred the use of manually measured fish from other properly sampled hauls within the same trip, rather than the use of visually estimated lengths from the haul. All calculations utilized data from the same trip or a different trip from the same vessel. In other words, there was never a circumstance where data from Vessel A was used to calculate IBQ weight for Vessel B.

In addition to scenarios where the observer did not collect all required data, there were also instances of hauls where P. halibut was not sampled by the observer or all the gear was lost. In these instances, properly sampled hauls were used to estimate IBQ weight for the unsampled haul. Methods for expanding P. halibut weight to unsampled or partially sampled hauls varied by gear type.

To calculate P. halibut IBQ weight for unsampled trawl hauls, the sum of all IBQ weight from other properly sampled hauls is divided by the sum of tow duration (hours) from sampled hauls and multiplied by tow duration of the unsampled haul.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t d} \right) \times D \tag{13}$$

where, for each tow:

t = tow
W_{IBQ}= unsampled IBQ weight (mortality rate applied) of P. halibut
w_{IBQ}= sampled IBQ weight (mortality rate applied) of P. halibut

d= tow duration (hr) of sampled haul
D= tow duration (hr) of unsampled haul

To calculate P. halibut IBQ weight when trawl gear is lost (i.e., entire net or codend is lost), the sum of all P. halibut expanded species weight from other properly sampled hauls is divided by the sum of tow durations prom sampled hauls, multiplied by the tow duration of the unsampled haul. For lost trawl gear, a mortality rate for the "dead" P. halibut viability condition (0.90) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t d} \right) \times D \times 0.90 \tag{14}$$

where, for each tow with lost gear:
t = tow
W_{IBQ}= unsampled IBQ weight (mortality rate applied) of P. halibut
w_{IBQ}= sampled IBQ weight (mortality rate applied) of P. halibut
d= tow duration (hr) of sampled haul
D= tow duration (hr) of unsampled haul

To calculate P. halibut IBQ weight in unsampled fixed gear sets, the sum of all P. halibut IBQ weight from sets with similar properties (i.e., date, depth, target, gear type, area; determined by WCGOP data managers) is divided by the sum of the number of gear units sampled, and the result is multiplied by the total number of gear units fished from the unsampled set.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g} \right) \times G \tag{15}$$

where, for each set:
t = tow
W_{IBQ}= unsampled IBQ weight (mortality rate applied) of P. halibut
w_{IBQ}= sampled IBQ weight (mortality rate applied) of P. halibut
g= number of sampled gear units (e.g., hooks, pots)
G= total number of gear units (e.g., hooks, pots) fished in the unsampled set

To calculate P. halibut IBQ weight when fixed gear is lost, the sum of P. halibut weight from the sampled portion of the set, or, if all gear is lost, from sets with similar properties is divided by the sum of units sampled, and the result is multiplied by the total hooks from the unsampled set. For any lost fixed gear, a mortality rate for the "dead" P. halibut viability condition (1.0) is applied.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g} \right) \times G \times 1.0 \tag{16}$$

where, for each set with lost gear:

t = tow
W_{IBQ}= unsampled IBQ weight (mortality rate applied) of P. halibut
w_{IBQ}= sampled IBQ weight (mortality rate applied) of P. halibut
g= number of sampled gear units (e.g., hooks, pots)
G= total number of gear units (e.g., hooks, pots) fished in the unsampled set

Table 44: The number of vessels and trips that required alternative expansions of P. halibut IBQ weight in the 2013 U.S. west coast groundfish IFQ fishery. All values are counts unless otherwise stated.

				Lost Gear				
Unit	**Year**	**P.halibut Scenarios**	**Unsampled trawl tows**	**Trawl**	**Fixed**	**Total**	**IFQ Total**	**% of Total**
Vessels	2011	13	16	4	1	24	108	22.2‡
	2012	9	10	4	4	22	105	21.0
	2013[2]	8	8	3	9	12	103	11.7
	2014	6	2	3	12	22	107	20.6
Trips	2011	19	21	4	3	38	2443	1.6
	2012	10	24	4	7[1]	32	2181	1.5
	2013[2]	16	23	3	36	46	2335	2.0
	2014	7	7	3	38	53	2206	2.4

‡Percentage of vessels with manually calculated discard may be included in one or more categories.

[1]Partial gear loss for fixed gear trips was not reported in 2012.

[2]Manual calculations due to unsampled or lost gear were performed in 2013. All discard for these events were reported via the automated load process.

Scenario 1: *Total count of P. halibut exists with no length or viability data.*
Resolution: Determine an average mortality weight per individual P. halibut in the trip from all sampled hauls. Multiply that average by the total count of P. halibut to determine an IBQ.

Scenario 2: *Total count of P. halibut exists with actual lengths and no viability data.*
Resolution: Determine catch weight for P. halibut using the lengths in the haul and then apply that to the total count for a total weight. Determine CATCH_WEIGHT_MORT for all viabilities (E, P, D) from all other properly sampled hauls in the trip and apply to the CATCH_WEIGHT for IBQ estimate.

Scenario 3: *Total count of P. halibut exists with visual estimates of P. halibut lengths and no viabilities.*
Resolution: The use of visual lengths was discouraged by the IPHC so the most appropriate method is to determine an average IBQ per individual P. halibut in the trip from all sampled hauls. Multiply that average by the total count of P. halibut to determine an IBQ.

Scenario 4: *Total count of P. halibut exists with visual estimates of P. halibut lengths and proper in-hand viabilities.*
Resolution: The use of visual lengths was discouraged by the IPHC, so the most appropriate method here would be to determine an average IBQ per individual P. halibut in the trip from all sampled hauls. Multiply that average by the total count of P. halibut to determine an IBQ.

Scenario 5: *P. halibut not sampled or only visual estimates of length are available.*
Resolution: Confirm P. halibut was present in the haul, and no data was collected on them. Determine an average IBQ per haul for all sampled hauls in the trip. This scenario is unlikely and, to date, das never occurred.

Scenario 6: *Total count of P. halibut does not exist with length and no viability data.*
Resolution: Catch weight of the haul will be determined by taking the measured P. halibut sample, converted to weight, divided by the number of fish sampled, multiplied by the average number of P. halibut for all sampled hauls in the trip. Then the average mortality rates from the sampled hauls are applied to the calculated P. halibut weight and, to date, has never occurred.

Scenario 7: *Total count of P. halibut does not exist with length and viability data.*
Resolution: P. halibut catch weight for the haul will be determined by taking the length of the P. halibut sample, converted to weight, divided by the number of fish sampled, multiplied by the average number of P. halibut for all sampled hauls in the trip. Because viabilities and lengths exist, IBQ can be determined using normal protocols and the calculated catch weight and, to date, has never occurred.

Scenario 8: *Total count of P. halibut does not exist with visual length and viability data.*
Resolution: Determine an average IBQ per haul for all sampled hauls in the trip and apply to the unsampled haul(s).

Scenario 9: *Observer encounters predated fish that are dead and badly damaged so that accurate biological data*

cannot be collected.
Resolution: If properly sampled P. halibut exist in the haul they can be used to determine the portion of the catch weight attributed to the predated and non-predated fish. The IBQ for the P. halibut not predated would be calculated separately using the data collected in the haul. The IBQ for the predated fish would be the portion of the P. halibut catch weight attributed to the predated fish multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear.

If all P. halibut in the haul are heavily predated then a catch weight for the haul will need to be determined. This can be done by taking the total count of P. halibut in the haul times an average catch weight (not IBQ estimates) per P. halibut from other hauls in the trip (or like "sets" if P. halibut doesn't exist in any other hauls). The estimated catch weight will then be multiplied by the mortality rate for "dead" from the IPHC viability tables for that gear to determine IBQ. In 2011, there were two instances where a P. halibut IBQ was manually calculated due to sand flea predation.

Table 45: Calculations used by the Vessel Account System (VAS) to determine Pacific halibut IBQ weight for unsampled or partially sampled fishing events in the U.S. west coast groundfish IFQ fishery. The calculated values, $\hat{w}_{IBQ_{u,p}}$, are added to the sampled P. halibut to obtain total IBQ weight. Note that these calculations differ slightly from the methods used in this report. Comparisons between this report and the VAS can be found in Table 2.

Scenario(s)	Calculation
1,3,4	$\hat{w}_{IBQ_u} = \left(\frac{\sum_{h,v}(l_{h,v} \times r_v)}{\sum_h c_h}\right) \times c_u$
2	$\hat{w}_{IBQ_u} = \sum_v \left(\left(\frac{\sum_{h,v} l_{h,v}}{\sum_h l_h}\right) \times \left(\frac{\sum_f l_f}{\sum_f c_f}\right) \times r_v\right)$
6,7	$\hat{w}_{IBQ_u} = \sum_v \left(\left[\left(\frac{\sum_f l_f}{\sum_f c_f}\right) \times \frac{\sum_h c_h}{h}\right] \times \left(\frac{\sum_{h,v} l_{h,v}}{\sum_h l_h}\right) \times r_v\right)$
5,8	$\hat{w}_{IBQ_u} = \frac{\sum_h w_{IBQ_h}}{\sum_h t_h} \times \sum_u t_u$
9	$\hat{w}_{IBQ_p} = \frac{\sum_h l_h}{\sum_h c_h} \times c_p$

where:
c = count of P. halibut
w = weight of P. halibut
l = length of P. halibut, converted to weight via IPHC length-weight table
v = viability of P. halibut, Excellent, Poor, or Dead
r = mortality rate applied for a given viability and gear combination, see Tables 5 & 6
h = sampled hauls
u = unsampled hauls
f = individual sampled P. halibut
t = tow time
p = predated fish

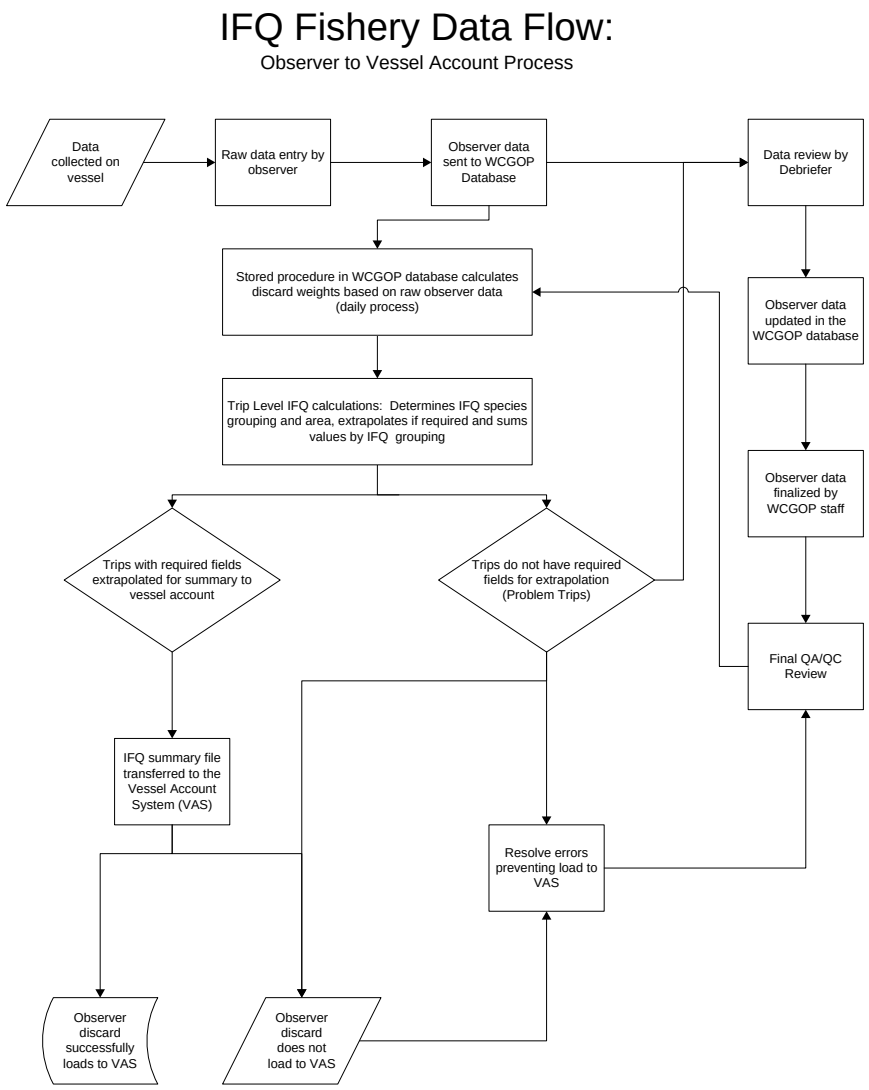
10.3 Appendix C:IPHC Length-Weight Table

Figure 9: IPHC length-weight conversion table for Pacific halibut.

Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms	Centimeter	Pounds	Kilograms
10	0.02	0.01	71	9.19	4.17	131	66.82	30.31	191	226.70	102.83
11	0.02	0.01	72	9.61	4.36	132	68.48	31.06	192	230.56	104.58
12	0.02	0.01	73	10.05	4.56	133	70.17	31.83	193	234.48	106.36
13	0.04	0.02	74	10.49	4.76	134	71.89	32.61	194	238.45	108.16
14	0.04	0.02	75	10.98	4.98	135	73.66	33.41	195	242.44	109.97
15	0.07	0.03	76	11.44	5.19	136	75.44	34.22	196	246.50	111.81
16	0.07	0.03	77	11.95	5.42	137	77.25	35.04	197	250.60	113.67
17	0.09	0.04	78	12.46	5.65	138	79.08	35.87	198	255.74	116.00
18	0.11	0.05	79	12.99	5.89	139	80.95	36.72	199	258.93	117.45
19	0.13	0.06	80	13.51	6.13	140	82.87	37.59	200	263.17	119.37
20	0.15	0.07	81	14.07	6.38	141	84.79	38.46	201	267.46	121.32
21	0.18	0.08	82	14.64	6.64	142	86.75	39.35	202	271.79	123.28
22	0.20	0.09	83	15.23	6.91	143	88.76	40.26	203	276.17	125.27
23	0.24	0.11	84	15.83	7.18	144	90.79	41.18	204	280.60	127.28
24	0.26	0.12	85	16.45	7.46	145	92.84	42.11	205	285.10	129.32
25	0.31	0.14	86	17.09	7.75	146	94.93	43.06	206	289.62	131.37
26	0.35	0.16	87	17.75	8.05	147	97.05	44.02	207	294.21	133.45
27	0.40	0.18	88	18.41	8.35	148	99.21	45.00	208	298.84	135.55
28	0.46	0.21	89	19.09	8.66	149	101.39	45.99	209	303.51	137.67
29	0.51	0.23	90	19.80	8.98	150	103.62	47.00	210	308.25	139.82
30	0.57	0.26	91	20.53	9.31	151	105.87	48.02	211	313.03	141.99
31	0.62	0.28	92	21.25	9.64	152	108.16	49.06	212	317.86	144.18
32	0.71	0.32	93	22.02	9.99	153	110.50	50.12	213	322.73	146.39
33	0.77	0.35	94	22.80	10.34	154	112.83	51.18	214	327.67	148.63
34	0.84	0.38	95	23.59	10.70	155	115.24	52.27	215	332.65	150.89
35	0.93	0.42	96	24.41	11.07	156	117.66	53.37	216	337.70	153.18
36	1.01	0.46	97	25.24	11.45	157	120.13	54.49	217	342.79	155.49
37	1.10	0.50	98	26.08	11.83	158	122.62	55.62	218	347.93	157.82
38	1.21	0.55	99	26.96	12.23	159	125.16	56.77	219	353.13	160.18
39	1.32	0.60	100	27.87	12.64	160	127.71	57.93	220	358.38	162.56
40	1.43	0.65	101	28.77	13.05	161	130.32	59.11	221	363.69	164.97
41	1.59	0.72	102	29.70	13.47	162	132.96	60.31	222	369.05	167.40
42	1.68	0.76	103	30.67	13.91	163	135.65	61.53	223	374.45	169.85
43	1.81	0.82	104	31.64	14.35	164	138.36	62.76	224	379.92	172.33
44	1.94	0.88	105	32.63	14.80	165	141.12	64.01	225	385.45	174.84
45	2.09	0.95	106	33.64	15.26	166	143.90	65.27	226	391.03	177.37
46	2.25	1.02	107	34.68	15.73	167	146.72	66.55	227	396.67	179.93
47	2.43	1.10	108	35.74	16.21	168	149.54	67.83	228	402.36	182.51
48	2.58	1.17	109	36.84	16.71	169	152.49	69.17	229	408.09	185.11
49	2.76	1.25	110	37.94	17.21	170	155.45	70.51	230	413.91	187.75
50	2.95	1.34	111	39.07	17.72	171	158.42	71.86	231	419.76	190.40
51	3.15	1.43	112	40.21	18.24	172	161.44	73.23	232	425.69	193.09
52	3.35	1.52	113	41.38	18.77	173	164.51	74.62	233	431.66	195.80
53	3.57	1.62	114	42.59	19.32	174	167.60	76.02	234	437.68	198.53
54	3.79	1.72	115	43.81	19.87	175	170.75	77.45	235	443.76	201.29
55	4.01	1.82	116	45.06	20.44	176	173.92	78.89	236	449.91	204.08
56	4.25	1.93	117	46.32	21.01	177	177.14	80.35	237	456.13	206.90
57	4.52	2.05	118	47.62	21.60	178	180.40	81.83	238	462.39	209.74
58	4.76	2.16	119	48.94	22.20	179	183.71	83.33	239	468.72	212.61
59	5.05	2.29	120	50.29	22.81	180	187.06	84.85	240	475.09	215.50
60	5.31	2.41	121	51.65	23.43	181	190.46	86.39	241	481.55	218.43
61	5.62	2.55	122	53.07	24.07	182	193.87	87.94	242	488.05	221.38
62	5.93	2.69	123	54.48	24.71	183	197.36	89.52	243	494.60	224.35
63	6.24	2.83	124	55.93	25.37	184	200.86	91.11	244	501.24	227.36
64	6.57	2.98	125	57.41	26.04	185	204.43	92.73	245	507.92	230.39
65	6.90	3.13	126	58.91	26.72	186	208.03	94.36	246	514.66	233.45
66	7.25	3.29	127	60.43	27.41	187	211.67	96.01	247	521.48	236.54
67	7.61	3.45	128	61.99	28.12	188	214.71	97.39	248	528.36	239.66
68	7.98	3.62	129	63.56	28.83	189	218.50	99.11	249	535.28	242.80
69	8.38	3.80	130	65.17	29.56	190	222.89	101.10	250	542.29	245.98
70	8.77	3.98									

10.4 Appendix D: Data flow

Figure 10: IFQ groundfish fishery data flow from the Northwest Fisheries Science Center Observer Program to the Vessel Account System (VAS) of the NMFS Western Regional Office.



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