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September 2019

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Pacific Halibut Bycatch in US West Coast Fisheries (2002-2018)

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U.S. Department of Commerce | National Oceanic and Atmospheric Administration | National Marine Fisheries Service

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NWFSC Observer Program

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PACIFIC HALIBUT BYCATCH 2002-2018

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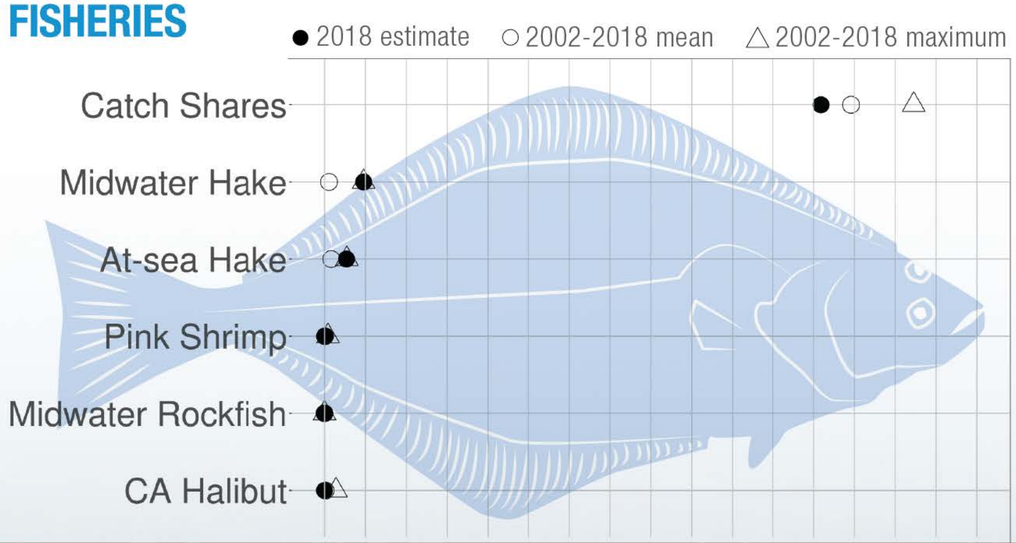
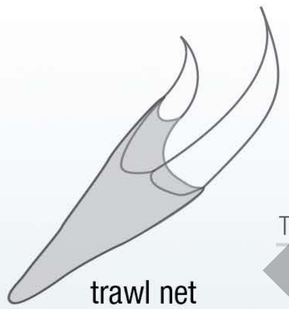
http://tinyurl.com/PhalibutReports

NOAA FISHERIES

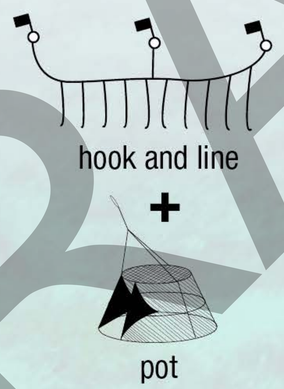


Ridgeback Prawn fisheries had zero (0) observed P. halibut.

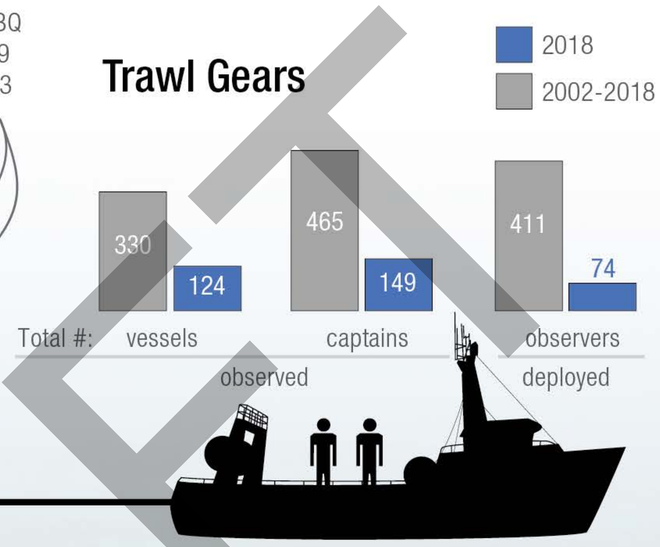
2018 Catch Shares IBQ
Allocation (mt) : 79.9
Attainment (mt): 31.3



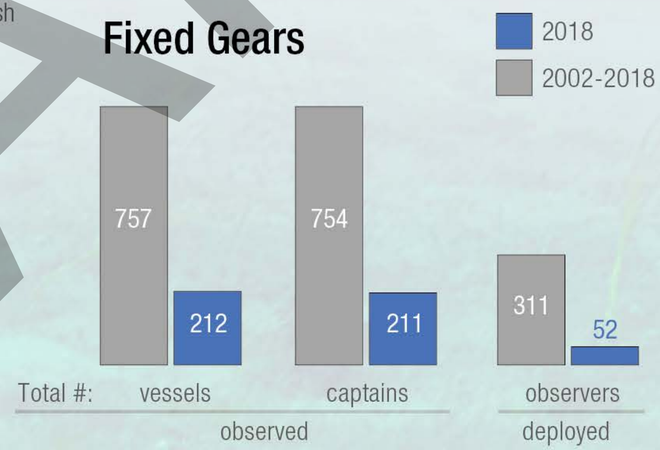
△ = 107.3 mt
2002-2018 *LE Sablefish



Trawl Gears



Fixed Gears



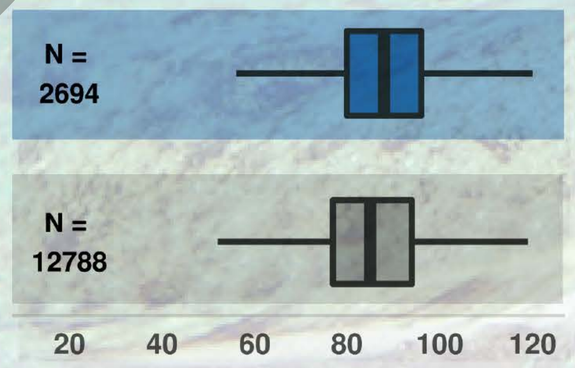
Pacific Halibut Bycatch
Observed 2002-2018

Map by K. Somers

25% Median 75%

Trawl Gears

Fixed Gears



Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries (2002-2018)

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August 8, 2019

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Contents

1 EXECUTIVE SUMMARY

Pacific halibut mortality estimates are provided for the years 2002 through 2018 from all fishery sectors observed by the Northwest Fishery Science Center Fisheries Observation Science Program (Table 1).

Table 1: Pacific halibut mortality estimates for 2018 and the years of observation, for all fishery sectors observed by the Northwest Fishery Science Center Groundfish Observer Program. Estimates include both individuals discarded at the dock and with mortality rates applied, where appropriate.

Sector	Years Observed	2018 Pacific halibut Discard Mortality (mt)
Individual Fishing Quota (IFQ) fisheries[1]	2011-2018	25.77
IFQ Electronic Monitoring (EM) EFP[2]	2015-2018	6.88
At-sea Pacific hake	2002-2018	0.66
Non-nearshore fixed gear targeting groundfish	2002-2018	29.87
Nearshore fixed gear	2003-2018	1.60
Pink shrimp trawl	2004-2018	0.01
California halibut trawl	2002-2018	0.00
P. halibut directed	2017-2018	2.39
Ridgeback Prawn	2017-2018	0.00
Sea Cucumber	2017-2018	*

[1] Does not include estimates from IFQ vessels with Electronic Monitoring
[2] EFP = Exempted Fishing Permit, includes all gears

In 2018 non-nearshore fixed gear targeting groundfish had the largest estimated P. halibut discard mortality of any sector (29.87 mt, Tables 1 & 2). Nearly all of that bycatch (24.55 mt, or 83%) occurred on the LE Sablefish Endorsed vessels. These vessels fish federally permitted sablefish tier quota during the primary season (April-October). Almost all of the LE Sablefish Endorsed bycatch occurred fishing longline gear north of Point Chehalis, WA (17.48 mt or 59%, Table 55). A smaller amount of P. halibut mortality also occurred on LE sablefish endorsed vessels fishing longline gear south of Pt. Chehalis (7.07 mt). Open access (OA) vessels targeting non-nearshore groundfish species with hook & line gear caught substantially less than the LE sector (4.31 mt).

The 2018 IFQ fishery estimate of P. halibut discard mortality, coast-wide, was 25.77 mt, with an additional 6.88 mt caught by IFQ EM EFP vessels (Tables 1 & 42) which is included in the IFQ estimate in Tables 2 and 78. The IFQ total (IFQ + IFQ EM EFP: 32.65 mt) is 4.23 mt less than the 2017 estimate (36.88 mt, see Table 2) and, as in past years, well below the IBQ[1] allocation (79.86 mt). As in prior years, bottom trawl gear produced the largest component of IFQ discard mortality (IFQ + IFQ EM = 30.45 mt), almost half of which was from bottom trawl vessels fishing between Pt. Chehalis, WA and 40°10′ N. lat. deeper than 60 fathoms (15.02 mt, Table 24).

[1] IBQ = Individual Bycatch Quota, which is used for P. halibut North of 40°10′ N. lat.

Combined, IFQ bottom trawl and LE Sablefish Endorsed longline vessels together comprised approximately 82% of the 2018 P. halibut discard mortality in observed U.S. West Coast groundfish fisheries.

In Appendix A.1, we present the second year comparing alternative methods for calculating discard mortality rates (DMRs) in the IFQ EM EFP fishery. Electronic monitoring does not yet allow for accurate estimtes of Pacific halibut viability. For in-season P. halibut IBQ management, the PSMFC applies a time-on-deck model to determine mortality rate of P. halibut caught on bottom trawl IFQ vessels carrying EM. For final end-of-year reporting, in this report, we apply a 0.90 mortality rate to all P. halibut bycatch in the IFQ EM bottom trawl fishery (Table 42). As an alternative to the 0.90 rate, we also present mortality estimates based on observer assessed viabilities and the PFMC Groundfish Management Team's Time-on-Deck model (see Appendix A.1). Small sample sizes preclude definitive conclusions from this analysis. The NWFSC Observer Program might revisit this analysis in future reports.

The Pacific halibut discard mortality estimate for the 2018 IPHC directed Pacific halibut fishery was 2.39 mt (Tables 1, 2). Observer coverage, discard ratios, fleet-wide estimates of gross discards, discard mortality, and retained P. halibut are presented in Tables 63, 64, & 66. Discard mortality estimates were calculated using the same methods as for the non-nearshore hook & line fishery, which uses observed estimates of P. halibut viability. Viabilities of observed P. halibut bycatch in the P. halibut directed fishery are given in Table 65. Observed lengths of discarded P. halibut in the directed fishery are given in Tables 67 & 68.

Pacific halibut discard in the nearshore fixed gear, pink shrimp trawl, California halibut trawl, and at-sea Pacific hake pelagic trawl fisheries combined represents a very small component of total P. halibut mortality (Table 1; Figure 1). There was zero (0) observed catch of P. halibut in the California ridgeback prawn trawl fishery (75). Estimates for the 2018 California sea cucumber trawl fishery are confidential and therefore not provided (Table 74).

Final estimates of observed fishery sectors including the IFQ EM EFP are shown in Tables 1, 2 & 78 in the report. We include in these tables (and elsewhere in the report), the small amount of P. halibut landed and subsequently discarded at the dock by IFQ bottom and midwater trawl vessels. These landed and then discarded at the dock amounts are listed by strata in Tables 12 and 13 of the report. IFQ EM EFP P. halibut catch is included in the summaries found in Tables 1, 2, 42 and 78.

In addition, we provide historical estimates of P. halibut bycatch in the Limited Entry (LE) bottom trawl fishery for the 2002-2010 period and P. halibut bycatch estimates for observed, non-IFQ vessels with an exempted fishing permit (EFP) targeting groundfish (2002-2018). For completeness, we also include the P. halibut landed catch from PacFIN fish tickets reported by non-groundfish fisheries that are not observed by the NWFSC Observer Program for the period 2002-2018.

The NWFSC Observer Program data used in this report has been updated to include the most recent data available (2002-2018). Pacific Fisheries Information Network (PacFIN) data used in this report were accessed April 2018. 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 report uses the same methods as reported in last year's report (Jannot et al. 2017).

Table 2: Pacific halibut discard mortality estimates (mt, including a small amount discarded at the dock in IFQ Bottom Trawl, Midwater Rockfish, and Midwater Hake 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 because gear specific survivorship information is not available. Rounding of values might mask very small weights in some categories and are presented here as zero (0). All weights are estimated based on whole fish (a.k.a. 'round weight', not head-&-gut). Ridgeback Prawn fishery (2017-18) and Sea Cucumber fishery (2017) had zero (0) observed P. halibut catch. * = confidential data, less than 3 vessels observed; - = no observer coverage.

	Total Discard Mortality (mt)																
		IFQ Fishery[8]						Non-Nearshore Fixed Gear									
Year	LE bottom trawl 2002-2010	Bottom Trawl [1,2,10]	LE CA Halibut [1,3]	Hook & Line	Pot [10]	Midwater Rockfish [3,4,10]	Midwater Hake [2,3,5,10]	LE Endorsed	LE Non-Endorsed	OA[6]	Nearshore Fixed Gear[3]	Pink Shrimp[3]	CA Halibut [3,7]	P.halibut Directed	At-sea Hake[3]	All sectors	Sectors w\<100% mortality rate [8]	Sectors w\100% mortality rate [9]
2002	344.82							22.76	0.00	-	-	-	0.00	-	1.14	368.72	367.58	1.14
2003	124.43							31.54	0.03	-	0.00	-	0.00	-	2.65	158.65	156.00	2.65
2004	133.12							38.82	0.00	-	1.00	0.00	0.70	-	1.13	174.77	172.64	2.13
2005	286.52							38.12	0.00	-	2.22	0.04	0.03	-	1.97	328.90	324.67	4.23
2006	242.47							107.30	0.00	-	0.53	-	0.02	-	0.83	351.15	349.79	1.36
2007	208.81							21.24	0.28	3.48	0.09	0.21	0.03	-	1.18	235.32	233.84	1.48
2008	207.81							41.65	0.48	6.45	0.35	0.00	0.31	-	3.98	261.03	256.70	4.33
2009	251.1							51.47	0.04	5.63	1.28	0.00	0.00	-	0.33	309.85	308.24	1.61
2010	180.97							22.12	0.06	5.22	0.08	0.00	0.00	-	1.57	210.02	208.37	1.65
2011		31.30	0	0.97	0.89	*	0.35	12.10	3.21	2.09	3.08	0.19	0.00	-	0.61	54.79	50.56	4.23
2012		36.13	*	2.34	0.51	0.0	0.62	24.94	0.73	1.61	2.26	0.00	0.00	-	0.64	69.78	66.26	3.52
2013		32.41	see[1]	0.48	0.21	0.0	1.34	2.94	0.00	0.07	1.37	0.00	0.00	-	1.06	39.88	36.11	3.77
2014		26.28	see[1]	0.61	0.08	0.0	1.36	30.16	0.00	0.36	0.96	0.00	0.00	-	0.37	60.18	57.49	2.69
2015		33.36	see[1]	1.52	0.38	0.0	0.70	10.37	0.02	0.46	1.45	0.01	0.00	-	0.06	48.33	46.11	2.22
2016		33.28	see[1]	1.02	0.18	0.0	0.68	16.65	0.91	2.54	3.04	0.00	0.00	-	0.15	58.45	54.58	3.87
2017		35.11	see[1]	0.66	0.78	0.0	0.51	38.17	0.03	3.75	1.79	0.00	0.00	2.22	0.55	83.57	80.72	2.85
2018		30.45	see[1]	0.74	0.29	0.0	1.34	24.93	0.61	4.33	1.60	0.01	0.00	2.39	0.66	67.35	63.74	3.61

Note:
Ridgeback Prawn (2017-18) and Sea Cucumber (2017 only) fisheries had zero (0) observed P. halibut catch. The 2018 Sea Cucumber fishery data is confidential.

[1] Starting in 2013, LE CA Halibut estimates are combined with IFQ Bottom Trawl estimates.
[2] Includes a small amount landed and discarded at the dock.
[3] 100% mortality rate
[4] from 2011-14, 'Midwater Trawl'
[5] from 2011-14, 'Shoreside Hake'
[6] Starting in 2011, this sector only includes OA CA halibut.
[7] A coast-wide discard ratio and coast-wide discard estimate could not be computed in the OA fixed gear sector for 2002-06 because the WCGOP only covered OA vessels in California during this time.
[8] LE Bottom Trawl, IFQ Bottom Trawl, IFQ hook & line, IFQ pot, LE and OA CA Halibut, Non-Nearshore Fixed Gear
[9] IFQ Midwater Rockfish, Midwater Hake, Nearshore fixed gear, Pink Shrimp, At-sea Hake
[10] Includes P. halibut catch from IFQ electronic monitoring EFP

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

Year	% legal-sized P. halibut in IFQ bottom trawl north of 40°10′ N. lat.
2011	67.11
2012	66.69
2013	64.01
2014	60.07
2015	67.68
2016	67.26
2017	75.61
2018	79.22

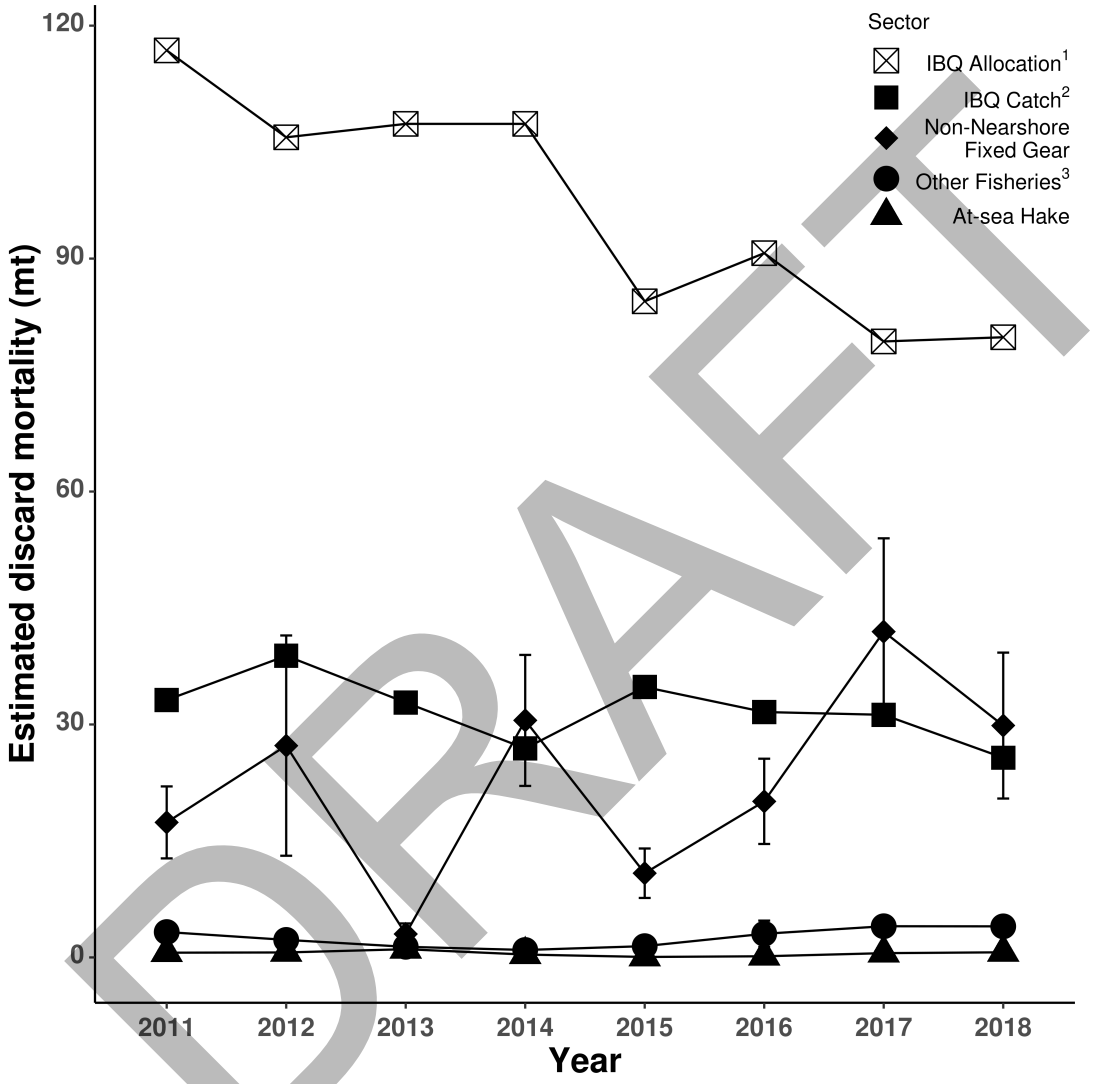

Figure 1: Total estimated P. halibut discard mortality (mt $\pm$ 1 SE, with mortality rates applied if applicable) from all sectors observed by the NWFSC Groundfish Observer Program. Estimates are not included for sectors and years where there were insufficient observer data. Values are reported in Table 2

[1]Individual Bycatch Quota (IBQ) allocated north of 40°10′ N. latitude.

[2] IBQ catch includes all Catch Shares sectors and gears except At-sea Hake which is shown separately.

[3]Other fisheries includes OR and CA Nearshore, WA, OR, and CA pink shrimp, California halibut, sea cucumber, ridgeback prawn, and IPHC P. halibut directed fisheries.

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2 INTRODUCTION

Pacific halibut (*Hippoglossus stenolepis*) is found in coastal waters throughout the North Pacific. Off the U.S. 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 2002-2018.

2.1 Observed West Coast Groundfish Fisheries

The U.S. 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 state (0-4.8 km) and federal (>4.8 km off-shore to the EEZ) waters. 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 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 (a.k.a. Pacific whiting, henceforth referred to as hake) sector which are included as part of the “At-sea hake” values included in Tables 2 and 78.

These four components can be further subdivided into sectors based on gear type, target species, permits and other regulatory factors as shown below in Tables 4, 5 and 6.

Table 4: A description of permits, gears used, target groups, vessel length range, fishing depth range,and management of fishery sectors and subsectors in federally managed and monitored U.S. West Coast groundfish catch share fisheries which use Individual Fishing Quotas (IFQ) to manage certain species. Observer coverage in these fisheries is 100%, except for vessels using electronic monitoring (EM). The IFQ program began in 2011, regulations prior to 2011 are excluded. For brevity, management descriptors are generalized and are not meant to be complete or comprehensive. Vessel lengths and fishing depths are based on observed vessels and might not represent the fleet as a whole.

Federally managed Catch Shares fisheries							
Sector	**Sub-Sector**	**Permits**	**Gears**	**Targets**	**Length (m)**	**Depths (m)**	**Management (since 2011)**
Limited Entry (LE) Trawl	LE Trawl	LE permit[1] with trawl endorsement	Bottom Trawl Hook & Line Pot	Groundfish[2]	15-40	10-1600	IFQ Some vessels use EM in lieu of 100% observer coverage
	Midwater Rockfish	LE permit[1] with trawl endorsement	Midwater Trawl	Midwater Rockfish[3]	15-33	>70	IFQ Some vessels use EM in lieu of 100% observer coverage
	Midwater Hake	LE permit[1] with trawl endorsement	Midwater Trawl	P. hake[4]	17-40	>70	IFQ Some vessels use EM in lieu of 100% observer coverage
At-Sea Hake	Mothership-Catcher Vessels (MSCV)	LE permit with MSCV endorsement[1]	Midwater Trawl	P. hake[4]	26-455[5]	53-460[5]	IFQ Some vessels use EM in lieu of 100% observer coverage
	Catcher-processors (CP)	LE permit with CP endorsement[1]	Midwater Trawl	P. hake[4]	82-115	60-570	IFQ
	Tribal	*none*	Midwater Trawl	P. hake[4]	<38	53-460	IFQ

[1] a.k.a., LE permit. All LE permits issued by NOAA.
[2] Vessels with a California halibut permit, issued by the state of California, can land CA halibut under California's CA halibut fishery regulations.
[3] *Sebastes* spp.
[4] *Merluccius productus*
[5] Average values for catcher vessels

Table 5: A description of permits, gears used, target groups, vessel length range, fishing depth range,and management of fishery sectors and subsectors in federally managed and observed U.S. West Coast groundfish non-catch share fisheries. Observer coverage on these vessels is less than 100%. For brevity, management descriptors are generalized and are not meant to be complete or comprehensive. Vessel lengths and fishing depths are based on observed vessels and might not represent the fleet as a whole.

Federally managed fisheries (non-Catch Shares)							
Sector	**Sub-Sector**	**Permits**	**Gears**	**Targets**	**Length (m)**	**Depths (m)**	**Management**
Non-Nearshore Fixed Gear	Sablefish endorsed	LE permit with fixed gear endorsement[1] and sablefish quota	Longlines, Pots	Sablefish[3]	7-32	20-1300	Sablefish tier quotas Seven month season
	Sablefish non-endorsed (a.k.a. Zero Tier)	LE permit with fixed gear endorsement[1] w/o sablefish quota	Longlines, Pots	Sablefish rockfish[4] flatfish[5]	7-32	20-1300	Trip limits
	Open Access	*none*	Longlines, Pots	Sablefish other groundfish	3-30	20-1300	Trip limits
IPHC Pacific Halibut Directed		IPHC Pacific Halibut permit[2]	Longlines	Pacific halibut[6]	3-32	40-400	10-hour fishing periods South of Pt. Chehalis, WA Legal size >82 cm Trip limits

[1] a.k.a., LE permit. All LE permits issued by NOAA.
[2] Issued by the International Pacific Halibut Commission
[3] *Anoplopoma fimbria*
[4] *Sebastes* spp.
[5] Pleuronectiformes
[6] *Hippoglossus stenolepis*

Table 6: A description of permits, gears used, target groups, vessel length range, fishing depth range, and management of fishery sectors and subsectors in state-managed, observed fisheries. Observer coverage on these vessels is less than 100%. For brevity, management descriptors are generalized for the given time period and are not meant to be complete or comprehensive. Vessel lengths and fishing depths are based on observed vessels and might not represent the fleet as a whole.

observed state managed fisheries						
Sector	**Permits**	**Gears**	**Targets**	**Length (m)**	**Depths (m)**	**Management**
Open Access (OA) California Halibut	CA Halibut permit[1]	Bottom trawl	California halibut[2]	9-22	10-200	Fish mainly within the CA Halibut Trawl Grounds Minimum mesh sizes Seven month season
Nearshore Fixed Gear[3]	CA or OR state nearshore permits and endorsements	Variety of hand lines, pot gear, stick gear, rod and reel	Rockfish[4] Cabezon[5] Greenlings[6]	3-15	<100	Federal and state regulations Area closures 2-month trip limits Minimum mesh size
Pink Shrimp	WA, OR, or CA state pink shrimp permit	Shrimp trawl	Pink shrimp[7]	11-33	60-800	State regulations Bycatch reduction devices Trip limits on groundfish landings
CA Ridgeback Prawn	Prawn permit[1]	Shrimp or Bottom trawl	Golden, Spot, Ridgeback or other prawn[8]	9-19	45-700	Oct-May season Trip limits Area restrictions Landing requirements
CA Sea Cucumber	Sea cucumber trawl permit[1]	Bottom trawl	California sea cucumbers[9]	9-12	<100	Logbook requirement Area and seasonal closures

[1] Issued by the state of California.
[2] *Paralichthys californicus*
[3] The state of Washington does not conduct a nearshore fishery.
[4] *Sebastes* spp.
[5] *Scorpaenichthys marmoratus*
[6] Hexagrammidae
[7] *Pandalus jordani*
[8] Includes: *Crangon* spp., *Lysmata californica, Pandalus danae, P. jordani, P. platyceros, Sicyonia ingentis*
[9] *Parastichopus californicus*

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 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 4.8-322 km 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 0-4.8 km state territorial zone to carry observers.

The A-SHOP has conducted observations of the U.S. West Coast at-sea hake fishery since 2001. Prior to 2001, observer coverage of the U.S. West Coast at-sea hake fishery was conducted by the North Pacific Groundfish Observer Program. Current A-SHOP program information and documentation on data collection methods can be found in the A-SHOP observer manual (NWFSC 2019b). The at-sea hake fishery has mandatory observer coverage, with each vessel over 38 meters carrying two observers. Beginning in 2011, under IFQ/Co-op Program management, all catcher vessels that deliver catch to motherships are required to carry WCGOP observers or use electronic monitoring equipment.

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 shoreside 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 non-tribal catcher-processor and mothership vessels.

2.3 Pacific Halibut Management and Fishery Interaction

The International Pacific Halibut Commission, 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 IPHC 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 2018, the LE fixed gear sablefish endorsed sector was allowed to retain and land P. halibut north of Pt. Chehalis, WA. The IFQ midwater Pacific hake fishery is a maximized-retention fishery. Under this fishery, small amounts of incidental P. halibut 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 Midwater hake fishery.

In 2011, the LE bottom trawl sector of the U.S. West Coast groundfish fishery began fishing under an 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 UIC 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 including any potential survivorship after capture. Currently, this is the only species managed under IBQ for the U.S. 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 section 3.2.1 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 on-board observer data (from the WCGOP and A-SHOP), landing receipt data (referred to as fish tickets, obtained from PacFIN) and data generated from vessels carrying electronic monitoring (a.k.a. EM) equipment. Currently only vessels in the IFQ sector fishing on an exempted fishing permit (EFP) carry EM equipment. EM data are obtained from Pacific States Marine Fisheries Commission. To date, observer data are the sole source for discard estimation in the IFQ sectors, except for vessels using EM under an EFP, as stated above. All other sectors use a combination of observer and PacFIN data to estimate discard mortality. 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 2019b). A-SHOP program information, documentation and data collection methods can be found in the A-SHOP observer manual (NWFSC 2019b).

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 2019a) 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 (see Table A-1 in Somers et al. 2019). 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 2019) and subsequently divided into various sectors of the groundfish fishery (Somers et al. 2019).

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 A.3. 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 (Data not shown to maintain confidentiality).

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 7):

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 2019b). 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 7 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 in the IFQ fishery. 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 individual fish to the observer or slow the gear retrieval.

Table 7: Data collected from P. halibut caught on IFQ vessels using different types of gear.

Gear	Years	Count	Length.Measurement	Viability
Bottom trawl	2011-present	all in the haul	actual, all or subset	yes
Midwater trawl	2011-present	all in the sample	actual, all or subset	yes
Pot	2011-present	all in the sampled portion	actual, all or subset	yes
Hook & line	2011-2016	all in sampled portion	visual, all or subset	no
Hook & line	2016-present	all in the sample	actual, all or subset	yes

Note:
Midwater trawl only applies to Catcher Processor vessels and Catcher-Only vessels delivering to Motherships. Catcher-Only vessels delivering hake or rockfish shoreside dump hauls directly into the vessel hold and any P. halibut are delivered to the dock for discard or donation.

Viability is assessed at the point of fish release when returned to sea. On vessels using "re-suscitation 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 2016; 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).

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 & 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 8: Mortality rates used for each of the condition categories (m_c) for IFQ bottom trawl vessels (Clark et al. 1992).

Bottom Trawl Mortality Rates	
m_c	**Rate**
m_{exc}	0.20
m_{poor}	0.55
m_{dead}	0.90

Table 9: Mortality rates used for each of the condition categories (m_c) for IFQ pot gear vessels (IPHC 2011).

Pot Mortality Rates	
m_c	**Rate**
m_{exc}	0.20
m_{poor}	0.55
m_{dead}	0.90

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 because of minimal fishing and 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 groundfish management line (40°10′ N. lat.) for each sector and gear type.

Despite the 100% observer coverage mandate since 2011, there were some rare occasions (e.g., observer illness, trawl net ripped) when tows or sets were only partially sampled, not sampled or data failed quality control. Data that failed quality control are treated as completely unsampled hauls. In all these cases, 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 (or data failed), 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:

$$\hat{W}_{u,s} = \sum_{u} x_{u,s} \times \frac{\sum w_{f,s}}{\sum x_{f,s}} \quad (1)$$

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). Unsampled P. halibut would only occur in NIFQ (south of 40°10′ N. lat. only), IFQM, or IFQFF unsampled categories. Thus, those are the only categories for which P. halibut is estimated. IFQM included all 2018 IFQ managed species (see 76 FR 27508 for a listing of IFQ species). NIFQ included 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.

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

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 A.4.

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 8 and 9 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
P = 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 :

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

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 sub-sample 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 2011-2018 IFQ fishery is provided in Tables 33 & 34. 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 98 in A.4). 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 'crucifier' (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 98 in Appendix A.4).

Tables 84 & 87 (Appendix A.2) provide 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.2 for further details). We have summarized the proportion of length measurements in each condition category (Excellent, Poor, and Dead) in Tables 85 and 88 (Appendix A.2) 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. In addition, we also provide a count of the number of dead individuals in each 2 cm length bin (Appendix A.2, Tables 93, 94 & 95). These values were obtained by multiplying the number of individuals in a length bin within a viability category, by the condition specific mortality rate (Tables 8 & 9) or 1.0 in the case of midwater trawl, and summed these values across viabilities to obtain

the number of dead per length bin. This method assumes there is no size-specific mortality.

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 Pt. Chehalis, WA = 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). Pt. 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 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 (Table 48). Retained weight varies by sector in this fishery and can be either sablefish or all FMP groundfish (except Pacific hake, see Table 46 for type of retained used; for list of FMP groundfish species, see: NWFSC 2019c). 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. In addition, fixed gear fish tickets without recorded sablefish 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 Pt. Chehalis) this is the only time during which they are allowed to land P. halibut. For prior years (2002-2017), we identify P. halibut directed fishery fish tickets using defintions supplied by IPHC. For the current year (2018), 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 Pt. 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 Pt. Chehalis, WA (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 Pt. Chehalis. The Pt. 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 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 43, 44 & 45). 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 46 & 48). Observed discard ratios were calculated by sector, gear type and area based on the following equation:

$$\hat{D}_s = \frac{\sum_t d_s}{\sum_t r_s} \times F_s \tag{5}$$

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.

Where FMP groundfish (excluding Pacific hake) was used to compute discard ratios, 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 matched 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 48. The discard rate multiplied by the expansion factor yielded an expanded gross P. halibut discard estimate for each stratum (Table 55). 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. 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 46).

3.3.2 Discard Mortality Rates

Once an initial gross P. halibut discard weight was estimated, this value was multiplied by a discard mortality rate (Table 55) to generate final discard mortality estimates (Tables 55 & 56, Figure 5). Discard mortality is approximated based on viabilities in a manner similar to the

approach used for IFQ bottom trawl. Observers have systematically collected viability data on hook & line vessels in the non-nearshore fixed gear sector since 2011. Current methods require observers to collect a length and viability on the first 5 P. halibut observed in each set on these vessels and to ignore any injuries incurred during landing when assessing viability. For the period 2002-2010, we used a single mortality rate for all bycatch (16%) on longline and hook & line vessels, which represents an average of DMRs over all years for the Bering Sea/Aleutian region longline fishery (Williams 2008). For the period 2011-2018, we used observer field estimates of discarded P. halibut viability on non-nearshore fixed gear vessels fishing longline or hook & line gear to estimate mortality of discarded P. halibut. (Note: Observers currently do not take viability of P. halibut caught on IFQ hook & line vessels).

Methods used to calculate discard mortality based on viability condition are almost identical to those methods currently accepted for use with IFQ bottom trawl vessels (see subsection 3.2.3). To account for the impact of fish size on survivorship, we computed an annual weighted mortality rate for P. halibut in each condition category in the LE Sablefish Endorsed fishery (Table 52). For the LE Sablefish Non-Endorsed and OA Fixed Gear sectors, sample sizes were too small to calculate an annual rate. Therefore, we calculated a five year running average of weighted mortality rate for each condition category in these two sectors (Tables 53 & 54). Length measurements associated with each viability record were converted to weight based on the IPHC length-weight table provided in Appendix A.4.

Table 10: Mortality rates used for each of the condition categories (m_c) for Non-Nearshore hook & line vessels: minor, mod = moderate, severe, dead (Trumble et al. 2000).

Non-Nearshore Hook & Line Mortality Rates	
m_c	**Rate**
m_{minor}	0.035
m_{mod}	0.363
m_{severe}	0.662
m_{dead}	1.000

The proportion of P. halibut sampled weight in a viability category multiplied by the viability category-specific mortality rate (Table 10 above):

$$DMR_{csj} = m_c \times P_{csj} \tag{6}$$

where:

s = stratum, which could include, area and sector
c = viability condition (Minor, Moderate, Severe, Dead)
j = year
m = mortality rate
P = 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 sub-sector separately :

$$\hat{F}_{sj} = \sum_{c} (B_{sj} \times DMRsj) \tag{7}$$

where:

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

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 is too small to utilize in this analysis. Consistent with past reports, we relied on DMR computed for Alaska groundfish fisheries (Williams 2008). An 18% DMR was applied to estimates for pot gear, coinciding with the DMR used for the sablefish pot fishery in Alaska.

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 57, 58, 59, 60, & 61) and the proportion of sampled P. halibut discard of legal (>82 cm) and sub-legal (<82 cm) sizes in non-nearshore fixed gear sectors (Table 62). The majority of P. halibut lengths recorded in these fisheries were visual estimates 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 sub-legal versus legal P. halibut from visually estimated lengths. Visual estimates were instead summarized in the manner in which they are recorded; with sub-legal and legal sized halibut falling within the 75-84 cm length bin.

3.4 IPHC Pacific halibut Directed Fishery

In 2017, the WCGOP began observing the Pacific halibut directed fishery and estimating fleet-wide discard mortality using WCGOP observer and fish ticket data. This fishery was defined based on using fixed gear and landing Pacific halibut within two days of the halibut directed openings (Somers et al. 2019). Prior to 2017, landings in this fishery were identified using criteria from IPHC and reported in the non-groundfish fisheries not observed by the NWFSC in previous versions of this report. No estimates of discards were calculated prior to 2017. Effort in this fishery occurs primarily in Washington and Oregon and uses only hook & line gear. Gross discard and mortality estimates for P. halibut were computed based on the same methods as described above for the non-nearshore hook & line fisheries (Section 3.3). However, for the P. halibut directed fishery, we used Pacific halibut as the retained weight for both discard rates and expansion factors. We estimated landings, discard, and total mortality in the Pacific halibut directed fishery (Tables 63, 64, & 66). Because the gear and effort in this fishery is similar to the non-nearshore hook & line fisheries, the same mortality rates based on viability (Table 10) were

applied to discarded P. halibut in the directed fishery (Table 65). We also present the number of observed vessels, trips, and sets for each opening of the fishery (Figure 8) and the observed physical and visual length frequencies of discarded P. halibut (Tables 67 & 68).

3.5 Observed State Fisheries

Pacific halibut bycatch was also observed in the following state managed fisheries:

- Oregon and California nearshore groundfish fixed gear sectors (Table 70)
- Washington, Oregon, and California pink shrimp trawl fisheries (Tables 71 & 72)
- OA California halibut trawl fishery (Table 73)
- California sea cucumber trawl fishery (Table 74)
- California ridgeback prawn trawl fishery (Table 75)

Note that the LE California halibut fishery is covered under the IFQ fishery. Bycatch estimates for these fishery sectors were computed within each fishery based on the following equation:

$$\hat{B} = \frac{\sum_t b}{\sum_t r} \times F \tag{8}$$

b = observed discard (mt) of P. halibut on set/haul t
t = observed sets
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 and state managed nearshore 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 2019c), 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 California halibut and pink shrimp fisheries due to a lack of information regarding survivorship. To maintain confidentiality, the Nearshore fisheries cannot be split out by gear type (hook & line vs. pot). For these reasons, we assumed 100% mortality in the Nearshore, Pink Shrimp, and CA halibut fisheries.

In 2017, the WCGOP began placing observers on California sea cucumber trawl and the California ridgeback prawn trawl vessels. Prior to 2017, landings in these fisheries were included in non-groundfish fisheries not observed by the NWFSC and no estimates of discards were calculated. Effort in these fisheries occurs only in California, uses shrimp and bottom trawl gears, and targets sea cucumbers or ridgeback prawns. Discard estimates for each species was computed based on the same equation as described above for the OA California halibut fishery, but utilizing sea cucumber or ridgeback prawn as the retained weight for both discard rates and expansion factors. No mortality rates were applied. In the 2017, there was no observed catch of P. halibut in the CA ridgeback prawn trawl fishery (Table 75). Confidentiality protections prevent reporting of the 2018 CA sea cucumber trawl fishery P. halibut bycatch (Table 74).

3.6 Exempted Fishing Permits

EFPs are federal permits issued by NMFS authorizing vessels to engage in fishing operations that otherwise would be prohibited by regulation (PFMC Council Operating Procedure 19). EFPs directed toward groundfish species have been required to carry WCGOP observers on 100% of trips. Thus to obtain the catch from EFPs, we sum the at-sea discards and landed P. halibut catch.

Since 2015, vessels in the IFQ fishery could elect to participate in an EM EFP. To obtain the catch from the IFQ EM EFP, we sum the P. halibut catch from the electronic monitoring data supplied to NWFSC Observer Program by the Pacific States Marine Fisheries Commission. Unlike the normal IFQ program, IFQ vessels fishing under an EM EFP are not required to carry an observer on every fishing trip because EM is used to ensure compliance with the IFQ program. The NWFSC Observer Program targets 30% of randomly selected IFQ EM trips for observer coverage for the purposes of scientific observation (e.g., biological sampling). A comparison of the discard mortality rates between the EM and non-EM IFQ vessels and between observer viability method versus the time-on-deck model are presented in Appendix A.1.

3.7 Non-groundfish Fisheries Not Observed by NWFSC

Non-groundfish fisheries that are not observed by the NWFSC Observer Program occassionally do record some P. halibut bycatch on fish tickets. Data from these fisheries are only available to the the NWFSC Observer Program from PacFIN fish ticket records. We provide a summary of landed P. halibut from these fisheries by year.

4 RESULTS

4.1 IFQ Fishery

All participating vessels carry an observer on all fishing trips under IFQ management (100% trips observed,) except those participating in the EM EFP (see below for EM EFP results). For all 2018 strata, 99% or more of the observed IFQ tows or sets were sampled (Tables 12, 13, 14 & 15). IFQ flatfish, IFQ mixed species, and unsorted catch all contributed to unsampled catch (Table 17; see NWFSC 2018b for IFQ sampling protocols). The total estimated weight of P. halibut from unsampled tows or sets in 2018 represents a small fraction (0.36 mt, or 0.7%) of the total 2018 IFQ gross discard weight of P. halibut (Tables 17, 18 & 19).

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 24). This gear-area-depth stratum accounts for 81% of the 2018 P. halibut discard mortality in the IFQ fishery. The next largest fraction (5%) of total IFQ 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 87% of the 2018 P. halibut discard mortality in the IFQ fishery (Table 24).

In terms of viability, the majority of P. halibut on IFQ vessels were classified as either excellent or dead, depending on the stratum (Tables 20, 21, 22, & 23). In 2018, the individuals caught with bottom trawl were in evenly split between excellent and dead condition in north of 40°10′ N. latitude, with the exception of the 40°10′ N. latitude to Pt. Chehalis less than 60 fathoms where a majority of individuals were in excellent condition (Table 20).

Estimated P. halibut discard mortality from all IFQ sectors and gears of the 2018 IFQ fishery is 1.54 mt less than the average for the previous 5 years (2013-17 mean = 34.19 mt, 2017 = 32.65 mt, including IFQ EM EFP).

The 2018 IFQ estimated P. halibut discard mortality for all gears is 82% less than the estimated discard morality from the 2010 LE bottom trawl fishery (Tables 2 & 78) and 85% less than the average mortality in the LE bottom trawl fishery over the years 2002-2010 (220 mt). The management change to Catch Shares in 2011 could explain this decrease in P. halibut catch. IBQs for P. halibut might have increased fisher incentives to avoid P. halibut bycatch and thereby changed fisher behavior (i.e., changing fishing grounds, gear, operations, or P. halibut handling).

Estimated bycatch weight of P. halibut from the At-sea hake component of the 2018 IFQ fishery increased slightly from 2017 (2017 = 0.55 mt, 2018 = 0.66; Tables 38 & 78). There was no fishing in the Tribal sector. At-sea hake P. halibut length frequencies are given in Table 39.

4.2 IFQ Electronic Monitoring EFP

Estimated P. halibut discard mortality from the 2018 IFQ Electronic Monitoring Exempted Fishing Permit, including fish discarded at the dock, was 5.55 mt from bottom trawl vessels, 0.18 mt from pot vessels, and 1.15 mt from midwater trawl vessels (Table 42).

Both IFQ EM bottom trawl and IFQ EM pot vessels had very slightly higher discard mortality rates than non-EM IFQ vessels when using the observer viability method (Tables 81 & 83). However, the observer viability method on IFQ EM bottom trawl vessels appears to give a lower DMR than the Time-on-Deck model (Table 81). Caution must be used in interpreting the DMRs reported in Appendix A.1 because sample sizes were very small. The number of EM vessels catching P. halibut was a small subset of the overall EM fleet and those vessels that did catch P. halibut typically caught very few P. halibut during observer sampling (Tables 80 & 82).

4.3 Non-Nearshore Fixed Gear Fishery

The 2018 estimated discard mortality of P. halibut in the longline portion of the LE sablefish endorsed sector decreased by 35% from 2017 (2017 = 38.01 mt, 2018 = 24.55 mt; Table 55) but is still well within the historical range for this fishery (2.94 - 104.45 mt; Table 55). Compared to 2017, the 2018 observed discard ratio decreased north of Pt. Chehalis (Table 48). Estimated discard of P. halibut from the pot portion of the LE sablefish endorsed sector increased compared to 2017 (2017 = 0.16 mt, 2018 = 0.37 mt; Table 55).

Discard of P. halibut among the LE sablefish non-endorsed longline vessels increased during

2018 relative to 2017 (2017 = 0.02 mt, 2018 = 0.61 mt); pot vessels in this sector had a slight decrease in P. halibut bycatch (2017 = 0.01 mt, 2018 < 0.01 mt) and remain a tiny fraction of total P. halibut discard (Table 55). P. halibut bycatch in OA hook & line ticked up slightly during 2018 (4.31 mt) but pot vessels decreased (2018 = 0.02 mt). Both OA fixed gear sectors still account for only a small portion of total fixed gear bycatch.

Landings of target species decreased for both LE and OA longline and hook & line vessels in all non-nearshore sectors by about 400 mt in 2018 (Table 48), even though observed P. halibut encounters and observer coverage were similar to 2017 levels for these vessels (Table 51 & Table 44).

Physical measurements of P. halibut length frequency from the non-nearshore fixed gear sectors can be found in Tables 57, 58, 59, & 60. Visual estimates of length frequencies in the non-nearshore fixed gear sectors can be found in Table 61.

4.4 IPHC Pacific halibut directed

The NWFSC Observer Program attained a 26% coverage rate (Table 63) in the second year of covering the IPHC P. halibut directed fishery - a substantially larger fraction than in 2017 (7%). Observer coverage was fairly evenly distributed among the three openings of the fishery in 2018 (Figure 8). The P. halibut discard ratio in this fishery was 0.13 leading to a gross discard weight of 15.1 mt (Table 64). The majority of discarded fish had only minor or moderate injuries (Table 65). Thus, despite the high discard ratio, the total discard mortality after accounting for viability was 2.4 mt. The majority of observed P. halibut discards were less than legal-size (82 cm) although a few were above that size (Tables 67 & 68).

4.5 Observed State Fisheries, EFPs and Non-Groundfish Fisheries

Very small amounts of P. halibut bycatch were recorded in state managed 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 2018 total mortality estimate for P. halibut (Tables 70, 71, 72 & 73). Zero (0) catch of P. halibut was observed in the California ridgeback prawn fishery (Table 75). Data from the 2018 California sea cucumber fishery is confidential (Table 74).

Pacific halibut bycatch by year, from non-EM EFP vessels has been zero since 2004 (Table 76). Pacific halibut landings from non-groundfish fisheries not observed by NWFSC Observer Program were 22.02 mt in 2018. (Table 77).

5 SUMMARY & CONCLUSIONS

5.1 IFQ Fishery

- Estimated P. halibut discard mortality from the 2018 IFQ non-EM vessels was 25.77 mt and from IFQ EM vessels was 6.88 mt.

- EM vessels had very slightly higher discard mortality rates than non-EM IFQ vessels. DMR on EM bottom trawl vessels was lower when using observer viabilities compared to the Time-on-Deck model. However samples sizes are still very small, complicating interpretation.
- P. halibut discard from the at-sea Pacific hake fishery in 2018 (0.66 mt) showed a slight increase relative to 2017 (0.55 mt), but remains below the historical average (2002-17: 1.07 mt).

5.2 Non-IFQ Fisheries

- The 2018 estimates of P. halibut discard morality in the LE sablefish endorsed sector (24.93 mt) decreased relative to 2017 (38.17 mt) possibly due to decreases in the discard ratio and in effort, but it is not completely clear from available data. The 2018 Pacific halibut mortality estimates on LE sablefish non-endorsed vessels increased for longline gear (0.61 mt) but decreased for pot vessels (<0.01 mt), relative to last year. P. halibut mortality increased relative to 2017 on OA fixed gear hook & line (4.31 mt) but decreased on OA pot vessels (0.02 mt) relative to last year. The increase in OA hook & line bycatch is the third year in a row of P. halibut bycatch increases for this fishery and gear type.
- In the second year of observer coverage in the IPHC P. halibut directed fishery, observer coverage was 26% and evenly distributed across the three openings. The total P. halibut discard mortality after accounting for viability was 2.4 mt.
- The California ridgeback prawn fisheries, zero (0) P. halibut catch was observed.
- Estimated P. halibut mortality in all other non-IFQ observed fisheries remained low relative to the IFQ and non-nearshore sectors, and were within the range observed in previous years.

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8 TABLES

8.1 Tables: IFQ Fishery

Table 11: Number of vessels, trips, and tows observed and metric tons of sampled Pacific halibut discarded at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ bottom trawl vessels. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For clarity, the number of hauls with unsampled catch categories is provided. Some tows are completely unsampled. See Table 42 for bottom trawl vessles fishing under the Electronic Monitoring EFP. (*) confidential data, (-) not applicable.

			Bottom Trawl												
			Number of								Unsampled categories			Sampled Rate	
Area	**Depth**	Year	Vessels	Trips	Sampled tows	Unsampled tows	Sampled tow hrs.	Unsampled tow hrs.	Discarded at sea (mt)	Discarded at dock (mt)	IFQFF	IFQM	Non-IFQ	% tows sampled	% tow hrs. sampled
N. of Pt. Chehalis	**0-60**	2011	13	46	296	3	804.25	11.25	7.28	0.00	2	5	10	99.00%	98.62%
		2012	14	66	312	5	662.80	6.80	4.35	0.00	0	1	10	98.42%	98.98%
		2013	11	94	448	1	1124.53	3.05	5.35	0.00	1	0	19	99.78%	99.73%
		2014	10	32	184	1	387.28	3.00	1.96	0.00	0	3	4	99.46%	99.23%
		2015	8	56	278	0	577.36	0.00	3.89	0.00	0	0	0	100.00%	100.00%
		2016	11	71	269	4	629.14	14.58	2.62	0.00	0	0	4	98.53%	97.74%
		2017	10	45	157	0	314.49	0.00	0.68	0.00	11	0	11	100.00%	100.00%
		2018	9	49	135	0	299.17	0.00	0.61	0.00	0	0	2	100.00%	100.00%
	>60	2011	22	145	973	5	3870.62	27.73	18.07	0.01	3	8	138	99.49%	99.29%
		2012	19	167	1292	10	4933.33	39.21	28.60	0.03	0	20	58	99.23%	99.21%
		2013	17	200	1657	4	6013.21	15.70	28.90	0.14	2	3	54	99.76%	99.74%
		2014	13	147	1195	10	4834.45	32.22	24.45	0.08	0	3	19	99.17%	99.34%
		2015	16	147	1006	1	3467.43	4.50	23.76	0.01	0	4	54	99.90%	99.87%
		2016	17	137	958	1	2988.10	5.33	14.12	0.03	0	0	13	99.90%	99.82%
		2017	19	151	1033	1	3252.60	3.75	17.32	0.07	1	0	21	99.90%	99.88%
		2018	17	155	1144	4	3848.42	15.08	15.57	0.01	0	0	18	99.65%	99.61%

Table 12: Number of vessels, trips, and tows observed and metric tons of sampled Pacific halibut discarded at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ bottom trawl vessels. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For clarity, the number of hauls with unsampled catch categories is provided. Some tows are completely unsampled. See Table 42 for bottom trawl vessles fishing under the Electronic Monitoring EFP. (*) confidential data, (-) not applicable. *(continued)*

			Bottom Trawl												
			Number of								Unsampled categories			Sampled Rate	
Area	**Depth**	Year	Vessels	Trips	Sampled tows	Unsampled tows	Sampled tow hrs.	Unsampled tow hrs.	Discarded at sea (mt)	Discarded at dock (mt)	IFQFF	IFQM	Non-IFQ	% tows sampled	% tow hrs. sampled
Pt. Chehalis to 40°10′	**0-60**	2011	21	139	1059	19	2004.60	36.72	9.71	0.00	12	2	65	98.24%	98.20%
		2012	21	152	947	8	1864.09	18.51	7.33	0.00	3	6	29	99.16%	99.02%
		2013	20	204	933	2	2167.95	5.25	8.31	0.00	0	8	23	99.79%	99.76%
		2014	19	198	1059	9	2391.97	30.43	9.92	0.00	0	17	29	99.16%	98.74%
		2015	15	190	1034	5	2241.72	17.33	10.00	0.00	0	8	30	99.52%	99.23%
		2016	18	180	1029	9	2603.97	32.67	7.08	0.01	0	1	25	99.13%	98.76%
		2017	25	155	619	1	1302.86	1.67	4.62	0.00	4	0	13	99.84%	99.87%
		2018	18	120	547	0	1044.62	0.00	2.49	0.00	0	0	2	100.00%	100.00%
	>60	2011	56	751	4984	28	25758.16	143.25	20.16	0.01	5	14	178	99.44%	99.45%
		2012	54	703	4450	26	23012.24	99.87	19.37	0.04	2	27	137	99.42%	99.57%
		2013	54	743	4883	15	24709.66	72.51	19.88	0.02	1	19	165	99.69%	99.71%
		2014	50	623	3783	10	19466.22	31.34	16.85	0.01	0	8	88	99.74%	99.84%
		2015	49	591	3685	4	17621.28	18.34	29.32	0.04	0	11	72	99.89%	99.90%
		2016	43	584	3523	2	16161.49	9.58	31.07	0.08	0	0	61	99.94%	99.94%
		2017	46	666	4024	5	18028.18	14.41	35.31	0.09	6	3	108	99.88%	99.92%
		2018	43	532	3318	9	13454.93	37.78	26.42	0.04	0	6	59	99.73%	99.72%
S. of 40°10′ N. lat.	**0-60**	2011	3	21	63	0	157.17	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	39	1	76.54	2.08	0.00	0.00	0	0	1	97.50%	97.35%
		2015‡	5	29	75	0	143.22	0.00	0.00	0.00	0	0	0	100.00%	100.00%
		2016‡	*	*	*	*	*	*	*	*	*	*	*	*	*
		2017‡	*	*	*	*	*	*	*	*	*	*	*	*	*
		2018‡	*	*	*	*	*	*	*	*	*	*	*	*	*
	>60	2011	15	240	1357	3	5838.74	12.07	0.16	0.00	3	0	34	99.78%	99.79%
		2012	13	255	1587	3	5881.45	4.08	0.75	0.00	1	1	69	99.81%	99.93%
		2013‡	14	277	1727	2	6423.88	2.75	0.88	0.00	0	2	69	99.88%	99.96%
		2014‡	14	277	1877	12	6318.95	50.11	0.56	0.00	1	0	35	99.36%	99.21%
		2015‡	11	186	1231	3	4198.51	5.80	0.33	0.00	0	0	14	99.76%	99.86%
		2016‡	7	91	616	0	1931.13	0.00	0.09	0.00	0	0	3	100.00%	100.00%
		2017‡	7	63	335	1	1421.27	3.75	0.07	0.00	0	0	2	99.70%	99.74%
		2018‡	4	38	160	0	539.79	0.00	0.00	0.00	0	0	0	100.00%	100.00%
LE CA Halibut S. of 40°10′ N. lat.	**All depths**	2011	3	63	155	0	507.17	0.00	0.00	0.00	0	0	2	100.00%	100.00%
		2012	*	*	*	*	*	*	*	*	*	*	*	*	*

‡ Combined IFQ and LE CA Halibut bottom trawl.

Table 13: Number of vessels, trips, and tows observed and metric tons of sampled Pacific halibut discarded at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ midwater trawl vessels. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For clarity the number of hauls with unsampled catch categories is provided. Some tows are completely unsampled. Note that starting in 2015, sector names have changed such that trips with P. hake comprising less than 50% of the total landings are renamed Midwater Rockfish whereas trips with P. hake greater than 50% of landings are renamed Midwater Hake. (*) confidential data, (-) not applicable.

		Midwater Trawl north of 40°10′ N. lat.												
										Unsampled categories			Sampled Ratios	
Target	Year	No. vessels	No. trips	No. sampled tows	No. unsampled tows	Sampled tow hrs.	Unsampled tow hrs.	Discarded at sea (mt)	Discarded at dock (mt)	Unsampled flatfish	Unsampled mixed IFQ	Unsampled non-IFQ	% tows sampled	% tow hrs. sampled
Hake	2011	27	914	1715	0	3971.49	0.00	0.03	0.33	0	0	2	100.00%	100.00%
	2012	24	721	1598	0	5948.46	0.00	0.00	0.62	0	0	3	100.00%	100.00%
	2013	24	942	1732	0	4621.83	0.00	0.05	1.28	0	0	2	100.00%	100.00%
	2014	25	957	1718	1	4716.14	1.25	0.11	1.25	0	0	7	99.94%	99.97%
	2015	5	126	286	0	1159.49	0.00	0.00	0.14	0	0	3	100.00%	100.00%
	2016	4	97	207	0	652.59	0.00	0.00	0.03	0	0	0	100.00%	100.00%
	2017	4	136	242	0	612.59	0.00	0.00	0.04	0	0	0	100.00%	100.00%
	2018	5	107	180	0	608.84	0.00	0.04	0.15	0	0	0	100.00%	100.00%
Rockfish	2011	2	4	15	0	23.04	0.00	0.00	0.00	0	0	0	100.00%	100.00%
	2012	4	9	35	0	72.96	0.00	0.00	0.00	0	0	0	100.00%	100.00%
	2013	6	22	77	0	137.49	0.00	0.00	0.00	0	0	1	100.00%	100.00%
	2014	9	34	133	0	268.46	0.00	0.00	0.00	0	0	0	100.00%	100.00%
	2015	7	43	146	0	243.97	0.00	0.00	0.00	0	0	1	100.00%	100.00%
	2016	3	13	42	0	84.07	0.00	0.00	0.00	0	0	0	100.00%	100.00%
	2017	11	133	279	0	547.16	0.00	0.03	0.01	0	0	0	100.00%	100.00%
	2018	13	192	382	0	820.84	0.00	0.03	0.00	0	0	1	100.00%	100.00%

Table 14: Number of vessels, trips, and sets observed and metric tons of sampled Pacific halibut discarded at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ hook & line vessels. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For clarity the number of sets with unsampled catch categories is provided. Some sets are completely unsampled. (*) confidential data, (-) not applicable.

		Hook & Line									
								Unsampled categories			
Area	Year	No. vessels	No. trips	No. sampled tsets	No. unsampled sets	Discarded at sea (mt)	Discarded at dock (mt)	Unsampled flatfish	Unsampled mixed IFQ	Unsampled non-IFQ	% tows sampled
north of 40°10′ north latitude	2011	6	21	408	1	6.03	0	0	0	0	99.76%
	2018	4	11	145	1	4.59	0	0	0	1	99.32%
south of 40°10′ north latitude	2011	6	71	212	0	0.00	0	0	0	1	100.00%
coastwide	2012	8	32	506	0	14.66	0	0	0	0	100.00%
	2013	8	29	215	0	3.00	0	0	0	0	100.00%
	2014	8	31	227	32	3.43	0	0	0	0	87.64%
	2015	5	16	185	0	9.49	0	0	0	0	100.00%
	2016	5	30	351	0	6.39	0	0	0	0	100.00%
	2017	4	13	148	4	4.12	0	0	0	0	97.37%

Table 15: Number of vessels, trips, and sets observed and metric tons of sampled Pacific halibut discarded at-sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ pot vessels. All participating vessels carry an observer on all fishing trips under IFQ management (100% observed). For clarity the number of hsets with unsampled catch categories is provided. Some sets are completely unsampled. Note in 2015, IFQ vessels using pot gear that fished north of Point Chehalis were all part of the Electronic Monitoring EFP (see Table 42 for summary of these vessels). (*) confidential data, (-) not applicable..

		Pot									
								Unsampled categories			
Area	Year	No. vessels	No. trips	No. sampled sets	No. unsampled sets	Discarded at sea (mt)	Discarded at dock (mt)	Unsampled flatfish	Unsampled mixed IFQ	Unsampled non-IFQ	% tows sampled
north of Pt. Chehalis	2011	3	12	75	0	1.03	0.00	0	0	0	100.00%
	2012	5	45	418	0	1.27	0.00	0	0	7	100.00%
	2013	3	12	167	0	0.22	0.00	0	0	1	100.00%
Pt. Chehalis to 40°10′ north latitude	2011	8	76	719	18	2.30	0.00	0	0	1	97.56%
	2012	9	60	470	0	0.62	0.00	0	0	0	100.00%
	2013	5	40	504	0	0.76	0.00	0	0	2	100.00%
	2015	6	39	363	0	1.31	0.01	0	0	0	100.00%
south of 40°10′ north latitude	2011	11	148	737	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	409	0	0.00	0.00	0	0	2	100.00%
	2015	3	18	220	0	0.00	0.00	0	0	0	100.00%
coastwide	2014	14	113	1278	0	0.32	0.00	0	0	9	100.00%
	2016	8	61	584	0	1.70	0.00	0	0	0	100.00%
	2017	6	43	573	0	1.09	0.00	0	0	0	100.00%
	2018	6	23	309	0	1.65	0.00	0	0	0	100.00%

Table 16: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ bottom trawl vessels 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 at-sea 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. Note that adding values across columns might give slightly different results because values are rounded to two decimals for reporting.

			Bottom Trawl																	
			IFQ Flatfish				Mixed IFQ spp.				Non-IFQ spp.				Unsorted catch						
Area	**Depth**	Year	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Sum Exp Dis. Wt.	Samp. wt of Dis PHLB	Total Dis-card
N. of Pt. Chehalis	**0-60**	2011	60.53	0.12	0.16	0.02	80.81	0.09	5.22	0.48	55.65	0	2.66	0	136.46	0.05	2.29	0.12	0.62	7.36	7.98
		2012	50.77	0.09	0.00	0.00	56.29	0.08	0.05	0.00	45.51	0	1.02	0	101.80	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	92.99	0	2.00	0	207.60	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	27.58	0	0.85	0	60.28	0.03	0.02	0.00	0.10	1.97	2.07
		2015	32.67	0.12	0.00	0.00	38.76	0.10	0.00	0.00	32.66	0	0.00	0	71.42	0.05	0.00	0.00	0.00	3.89	3.89
		2016	43.01	0.06	0.00	0.00	57.97	0.05	0.00	0.00	64.58	0	0.78	0	122.55	0.02	2.56	0.06	0.06	2.71	2.76
		2017	9.87	0.07	2.32	0.16	16.37	0.04	0.00	0.00	21.23	0	0.29	0	37.60	0.02	0.00	0.00	0.16	0.68	0.84
		2018	13.62	0.05	0.00	0.00	22.82	0.03	0.00	0.00	30.94	0	0.05	0	53.77	0.01	0.00	0.00	0.00	0.62	0.62
	>60	2011	114.16	0.19	1.03	0.20	142.47	0.15	1.01	0.15	207.64	0	15.03	0	350.11	0.06	4.79	0.30	0.64	21.65	22.29
		2012	84.84	0.36	0.00	0.00	122.87	0.25	2.42	0.59	268.93	0	6.84	0	391.80	0.08	24.85	1.90	2.49	30.18	32.67
		2013	185.79	0.16	0.20	0.03	227.34	0.13	1.07	0.14	241.41	0	5.38	0	468.75	0.06	1.39	0.08	0.25	29.66	29.91
		2014	192.81	0.13	0.00	0.00	233.86	0.11	0.87	0.09	293.94	0	1.81	0	527.80	0.05	29.12	0.61	0.70	24.88	25.58
		2015	108.65	0.22	0.00	0.00	134.93	0.18	2.84	0.51	129.24	0	3.76	0	264.18	0.09	0.16	0.01	0.53	24.34	24.86
		2016	114.43	0.12	0.00	0.00	157.47	0.09	0.00	0.00	204.62	0	0.94	0	362.08	0.04	0.45	0.00	0.00	14.14	14.14
		2017	140.48	0.12	0.02	0.00	193.42	0.09	0.00	0.00	219.66	0	2.74	0	413.08	0.04	0.08	0.00	0.01	17.41	17.41
		2018	166.49	0.09	0.00	0.00	245.10	0.06	0.00	0.00	275.76	0	1.33	0	520.86	0.03	9.06	0.21	0.21	15.60	15.81

Table 17: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ bottom trawl vessels 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 at-sea 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. Note that adding values across columns might give slightly different results because values are rounded to two decimals for reporting. *(continued)*

			Bottom Trawl																		
			IFQ Flatfish				Mixed IFQ spp.				Non-IFQ spp.				Unsorted catch						
Area	**Depth**	Year	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Samp wt.	Dis Ratio	Unsamp wt.	Est Dis-card	Sum Exp Dis. Wt.	Samp. wt of Dis PHLB	Total Dis-card
Pt. Chehalis to 40°10′	**0-60**	2011	96.63	0.11	0.97	0.11	117.73	0.09	2.40	0.21	188.16	0.00	6.76	0.00	305.90	0.03	5.71	0.20	0.52	10.48	11.00
		2012	72.35	0.11	0.45	0.05	86.10	0.09	2.35	0.21	142.99	0.00	2.56	0.00	229.09	0.03	1.95	0.07	0.33	7.73	8.06
		2013	109.66	0.08	0.00	0.00	120.95	0.07	0.86	0.06	138.52	0.00	1.84	0.00	259.47	0.03	0.41	0.01	0.07	8.47	8.55
		2014	176.72	0.06	0.00	0.00	194.49	0.05	6.19	0.32	204.19	0.00	4.48	0.00	398.67	0.03	13.96	0.11	0.42	10.05	10.48
		2015	158.17	0.06	0.00	0.00	192.63	0.05	0.35	0.02	193.08	0.00	2.01	0.00	385.71	0.03	1.71	0.05	0.06	10.16	10.22
		2016	203.22	0.04	0.00	0.00	258.27	0.03	0.05	0.00	217.24	0.00	3.05	0.00	475.52	0.02	6.73	0.10	0.10	7.22	7.32
		2017	75.56	0.06	1.21	0.07	108.64	0.04	0.00	0.00	120.00	0.00	0.97	0.00	228.64	0.02	0.91	0.00	0.07	4.63	4.71
		2018	45.49	0.05	0.00	0.00	67.83	0.04	0.00	0.00	76.37	0.00	0.03	0.00	144.20	0.02	0.00	0.00	0.00	2.49	2.49
	>60	2011	190.48	0.12	0.78	0.09	352.51	0.06	4.00	0.25	753.78	0.00	18.25	0.00	1106.30	0.02	7.54	0.15	0.49	22.02	22.51
		2012	180.33	0.11	0.06	0.01	369.70	0.05	6.92	0.37	641.16	0.00	12.38	0.00	1010.86	0.02	7.26	0.14	0.52	19.94	20.46
		2013	229.39	0.09	0.07	0.01	401.78	0.05	9.72	0.49	709.89	0.00	11.56	0.00	1111.67	0.02	9.68	0.14	0.63	20.44	21.08
		2014	335.57	0.05	0.00	0.00	501.04	0.03	3.02	0.10	506.94	0.00	4.08	0.00	1007.97	0.02	10.38	0.06	0.15	16.96	17.11
		2015	323.15	0.09	0.00	0.00	466.22	0.06	0.93	0.06	548.36	0.00	4.48	0.00	1014.58	0.03	2.95	0.02	0.08	29.67	29.75
		2016	289.10	0.11	0.00	0.00	531.95	0.06	0.00	0.00	471.32	0.00	8.21	0.00	1003.27	0.03	4.54	0.09	0.09	31.39	31.48
		2017	373.00	0.10	4.35	0.42	706.32	0.05	0.73	0.04	503.13	0.00	6.54	0.00	1209.45	0.03	4.06	0.05	0.49	35.68	36.17
		2018	311.59	0.09	0.00	0.00	610.96	0.04	1.27	0.05	387.35	0.00	5.21	0.00	998.31	0.03	2.32	0.06	0.11	26.52	26.63
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	11.75	0.01	0.01	0.00	16.79	0.01	0.00	0.00	0.00	0.17	0.17
		2012	5.93	0.00	0.00	0.00	6.75	0.00	0.00	0.00	7.95	0.03	0.06	0.00	14.70	0.02	0.00	0.00	0.00	0.22	0.23
		2013	4.55	0.00	0.00	0.00	6.65	0.00	0.00	0.00	66.93	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	4.45	0.00	0.45	0.00	6.84	0.00	0.02	0.00	0.00	0.00	0.00
		2015	6.11	0.00	0.00	0.00	17.97	0.00	0.00	0.00	7.47	0.00	0.00	0.00	25.44	0.00	0.00	0.00	0.00	0.00	0.00
		2016	4.29	0.00	0.00	0.00	5.64	0.00	0.00	0.00	4.73	0.00	0.00	0.00	10.38	0.00	0.00	0.00	0.00	0.00	0.00
		2017	3.25	0.00	0.00	0.00	3.37	0.00	0.00	0.00	2.49	0.00	0.00	0.00	5.86	0.00	0.00	0.00	0.00	0.00	0.00
		2018	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.58	0.05	0.00	0.00	1.10	0.02	0.00	0.00	0.00	0.03	0.03
	>60	2011	155.01	0.00	0.10	0.00	275.06	0.00	0.00	0.00	223.70	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	222.92	0.00	7.14	0.03	489.41	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	296.89	0.00	7.47	0.02	661.75	0.00	0.23	0.00	0.02	0.88	0.90
		2014	169.03	0.00	0.03	0.00	363.29	0.00	0.00	0.00	341.56	0.00	1.22	0.00	704.84	0.00	5.64	0.00	0.01	0.56	0.57
		2015	93.62	0.00	0.00	0.00	233.85	0.00	0.00	0.00	173.60	0.00	0.44	0.00	407.45	0.00	12.71	0.00	0.00	0.33	0.33
		2016	48.17	0.00	0.00	0.00	99.67	0.00	0.00	0.00	88.29	0.00	0.11	0.00	187.96	0.00	0.00	0.00	0.00	0.10	0.10
		2017	20.81	0.00	0.00	0.00	46.21	0.00	0.00	0.00	49.36	0.00	0.03	0.00	95.57	0.00	0.05	0.00	0.00	0.07	0.07
		2018	20.53	0.00	0.00	0.00	80.33	0.00	0.00	0.00	28.26	0.00	0.00	0.00	108.60	0.00	0.00	0.00	0.00	0.00	0.00
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	75.42	0.00	0.01	0.00	76.16	0.00	0.00	0.00	0.00	0.00	0.00
		2012	0.34	0.00	0.00	0.00	0.35	0.00	0.00	0.00	60.84	0.00	0.00	0.00	61.19	0.00	0.00	0.00	0.00	0.00	0.00

‡ Combined IFQ and LE CA Halibut bottom trawl.

Table 18: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ midwater trawl vessels 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 at-sea 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. Samp. = Sampled, Dis. = Discard, Unsamp. = Unsampled, Wt. = weight (mt), PHLB = Pacific halibut

		Midwater Trawl north of 40 °10' N. lat.																		
		IFQ Flatfish				Mixed IFQ spp.				Non-IFQ spp.				Unsorted						
Sector	Year	Samp. Wt	Dis. Ratio	Unsamp. Wt.	Est. Dis.	Samp. Wt	Dis. Ratio	Unsamp. Wt.	Est. Dis.	Samp. Wt	Dis. Ratio	Unsamp. Wt.	Est. Dis.	Samp. Wt	Dis. Ratio	Unsamp. Wt.	Est. Dis.	Sum of Exp. Discard Wt.	Samp. wt. of Dis. PHLB	Total Dis-card
Hake	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	7.24	0.00	0.27	0.00	468.03	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
	2015	0.00	0.00	0.00	0.00	43.76	0.00	0.00	0.00	4.47	0.00	0.12	0.00	48.23	0.00	0.00	0.00	0.00	0.00	0.00
	2016	0.00	0.00	0.00	0.00	59.29	0.00	0.00	0.00	1.18	0.00	0.00	0.00	60.47	0.00	0.00	0.00	0.00	0.00	0.00
	2017	0.00	0.00	0.00	0.00	110.53	0.00	0.00	0.00	1.50	0.00	0.00	0.00	112.03	0.00	0.00	0.00	0.00	0.00	0.00
	2018	0.04	1.00	0.00	0.00	144.52	0.00	0.00	0.00	51.91	0.00	0.00	0.00	196.43	0.00	0.00	0.00	0.00	0.04	0.04
Rockfish	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	0.05	0.00	0.02	0.00	0.06	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
	2015	0.00	0.00	0.00	0.00	3.79	0.00	0.00	0.00	16.37	0.00	0.05	0.00	20.15	0.00	0.00	0.00	0.00	0.00	0.00
	2016	0.09	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.01	0.00	0.00	0.00	2.37	0.00	0.00	0.00	0.00	0.00	0.00
	2017	0.03	0.98	0.00	0.00	17.00	0.00	0.00	0.00	2.55	0.00	0.00	0.00	19.56	0.00	0.00	0.00	0.00	0.03	0.03
	2018	0.67	0.04	0.00	0.00	44.35	0.00	0.00	0.00	1.96	0.00	0.11	0.00	46.31	0.00	0.00	0.00	0.00	0.03	0.03

Table 19: Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ fixed gear vessels 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 at-sea 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				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			
Hook & Line																			
North of 40°10′ N. lat.																			
2011	7.19	0.84	0.00	0.00	22.01	0.28	0.00	0.00	56.74	0.00	0.00	0.00	78.76	0.08	0.00	0.00	0.00	6.06	6.06
2018	5.70	0.81	0.00	0.00	11.67	0.40	0.00	0.00	47.49	0.00	0.14	0.00	59.15	0.08	1.40	0.04	0.04	4.61	4.65
South of 40°10′ N. lat.																			
2011	0.18	0.00	0.00	0.00	3.72	0.00	0.00	0.00	21.06	0.00	0.00	0.00	24.78	0.00	0.00	0.00	0.00	0.00	0.00
Coastwide																			
2012	19.31	0.76	0.00	0.00	36.87	0.40	0.00	0.00	97.36	0.00	0.00	0.00	134.24	0.11	0.00	0.00	0.00	14.66	14.66
2013	5.10	0.59	0.00	0.00	8.29	0.36	0.00	0.00	27.60	0.00	0.00	0.00	35.88	0.08	0.00	0.00	0.00	3.00	3.00
2014	5.37	0.64	0.00	0.00	8.41	0.41	0.00	0.00	35.36	0.00	0.00	0.00	43.76	0.08	9.85	0.38	0.38	3.43	3.80
2015	10.76	0.88	0.00	0.00	16.49	0.58	0.00	0.00	38.39	0.00	0.00	0.00	54.88	0.17	0.00	0.00	0.00	9.49	9.49
2016	8.69	0.74	0.00	0.00	18.97	0.34	0.00	0.00	61.15	0.00	0.00	0.00	80.13	0.08	0.00	0.00	0.00	6.39	6.39
2017	7.59	0.54	0.00	0.00	9.62	0.43	0.00	0.00	17.52	0.00	0.00	0.00	27.13	0.15	0.49	0.02	0.02	4.12	4.14
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	2.27	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	0.66	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	7.92	0.29	0.00	0.00	3.37	0.00	0.00	0.00	11.29	0.20	3.18	0.02	0.02	2.30	2.33
2012	1.22	0.51	0.00	0.00	3.86	0.16	0.00	0.00	6.03	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	10.90	0.00	0.00	0.00	17.67	0.04	0.00	0.00	0.00	0.76	0.76
2015	1.78	0.74	0.00	0.00	7.90	0.17	0.00	0.00	7.52	0.00	0.00	0.00	15.42	0.08	0.00	0.00	0.00	1.31	1.31
South of 40°10′ N. lat.																			
2011	0.30	0.00	0.00	0.00	6.49	0.00	0.00	0.00	6.91	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	4.59	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	3.62	0.00	0.00	0.00	6.64	0.00	0.00	0.00	0.00	0.00	0.00
2015	0.01	0.00	0.00	0.00	1.46	0.00	0.00	0.00	8.65	0.00	0.00	0.00	10.12	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	16.58	0.00	0.01	0.00	28.11	0.01	0.00	0.00	0.00	0.32	0.32
2016	2.20	0.77	0.00	0.00	6.54	0.26	0.00	0.00	5.50	0.00	0.00	0.00	12.04	0.14	0.00	0.00	0.00	1.70	1.70
2017	1.91	0.57	0.00	0.00	7.30	0.15	0.00	0.00	7.92	0.00	0.00	0.00	15.23	0.07	0.00	0.00	0.00	1.09	1.09
2018	2.34	0.70	0.00	0.00	3.82	0.43	0.00	0.00	1.04	0.00	0.00	0.00	4.86	0.34	0.00	0.00	0.00	1.65	1.65

Table 20: Pacific halibut viabilities in the U.S. West Coast groundfish IFQ bottom trawl fishery by management area, depth, 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.

	Bottom Trawl						
Area, Depth (fm)	**Number**				**Weighted Percentages**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
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%
2015	349	51	90	490	71.79%	12.54%	15.67%
2016	242	61	89	392	66.54%	14.69%	18.76%
2017	60	16	12	88	74.62%	18.98%	6.40%
2018	38	18	35	91	40.99%	16.80%	42.21%
All	2099	580	1323	4002	57.46%	14.69%	27.85%
North of Pt. Chehalis, 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%
2015	1529	404	679	2612	59.53%	14.33%	26.14%
2016	837	326	630	1793	47.79%	16.90%	35.30%
2017	1057	327	890	2274	49.07%	13.35%	37.58%
2018	773	291	852	1916	44.45%	15.01%	40.54%
All	10327	3625	7385	21337	50.73%	16.42%	32.85%
Pt. Chehalis to 40 deg. 10' N. lat., 0-60							
2011	1076	169	199	1444	80.30%	9.53%	10.17%
2012	791	174	229	1194	67.70%	13.85%	18.45%
2013	659	238	260	1157	59.12%	21.69%	19.19%
2014	1095	229	307	1631	68.69%	13.72%	17.59%
2015	778	232	426	1436	59.35%	15.05%	25.60%
2016	525	137	447	1109	49.51%	11.91%	38.58%
2017	395	42	150	587	72.18%	6.60%	21.22%

Table 20: Pacific halibut viabilities in the U.S. West Coast groundfish IFQ bottom trawl fishery by management area, depth, 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. *(continued)*

	Bottom Trawl						
Area, Depth (fm)	**Number**				**Weighted Percentages**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
2018	215	34	66	315	69.51%	11.06%	19.44%
All	5534	1255	2084	8873	65.70%	13.45%	20.85%
Pt. Chehalis to 40 deg. 10' N. lat., 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%
2015	1402	556	1513	3471	41.39%	17.07%	41.54%
2016	1319	515	1813	3647	38.09%	13.80%	48.11%
2017	1648	599	1575	3822	46.06%	15.04%	38.90%
2018	972	518	1305	2795	38.33%	19.31%	42.36%
All	8676	3955	10560	23191	39.71%	17.04%	43.25%
South of 40 deg. 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%
2015‡	0	0	0	0	0.00%	0.00%	0.00%
2016‡	*	*	*	*	*	*	*
2017‡	0	0	0	0	0.00%	0.00%	0.00%
2018‡	0	1	2	3	0.00%	42.31%	57.69%
All‡	*	*	*	*	*	*	*
South of 40 deg. 10' N. lat., 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%
2015‡	10	3	15	28	54.15%	9.94%	35.91%
2016‡	6	4	1	11	73.40%	22.25%	4.35%

Table 20: Pacific halibut viabilities in the U.S. West Coast groundfish IFQ bottom trawl fishery by management area, depth, 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. *(continued)*

Bottom Trawl							
Area, Depth (fm)	**Number**				**Weighted Percentages**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
2017‡	3	1	2	6	55.70%	22.93%	21.37%
2018‡	0	0	0	0	0.00%	0.00%	0.00%
All‡	112	39	125	276	48.32%	12.87%	38.80%
LE CA Halibut South of 40 deg. 10' N. lat., all depths							
2011	0	0	0	0	0.00%	0.00%	0.00%
2012	*	*	*	*	*	*	*
All	*	*	*	*	*	*	*

Table 21: Pacific halibut viabilities in the U.S. West Coast groundfish IFQ midwater trawl fishery by management area 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. Midwater Rockfish 2011 data is confidential and therefore not included here. (*) confidential data, (-) no estimate provided, see text for explanation.

Midwater Trawl north of 40°10' N. lat.								
		Number				**Weighted Percentages**		
Sector	Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
Hake	2011	0	1	2	3	0.00	0.33	0.67
	2012	0	0	0	0	0.00	0.00	0.00
	2013	2	0	1	3	0.67	0.00	0.33
	2014	6	2	0	8	0.75	0.25	0.00
	2015	0	0	0	0	0.00	0.00	0.00
	2016	0	0	0	0	0.00	0.00	0.00
	2017	0	0	0	0	0.00	0.00	0.00
	2018	1	0	2	3	0.33	0.00	0.67
	All	9	3	5	17	0.53	0.18	0.29
Rockfish	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
	2015	0	0	0	0	0.00	0.00	0.00
	2016	0	0	0	0	0.00	0.00	0.00
	2017	3	0	2	5	0.60	0.00	0.40
	2018	2	0	2	4	0.50	0.00	0.50
	All	5	0	4	9	0.56	0.00	0.44

Table 22: Pacific halibut viabilities in the U.S. West Coast groundfish IFQ pot fishery by management area 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. (*) confidential data, (-) no estimate provided, see text for explanation.

				Pot			
Area	**Number**				**Weighted Percentages**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
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	174	25	54	253	71.77%	10.11%	18.12%
Pt. Chehalis to 40 deg. 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%
2015	145	7	17	169	83.65%	4.47%	11.88%
All	428	28	93	549	77.71%	5.29%	17.00%
South of 40 deg. 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%
2015	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%
2016	195	3	13	211	90.04%	1.73%	8.23%
2017	52	40	27	119	40.69%	35.31%	24.00%
2018	184	8	2	194	93.48%	5.14%	1.37%
All	455	51	50	556	79.04%	10.40%	10.56%

Table 23: Pacific halibut caught in the U.S. West Coast groundfish IFQ hook & line fishery by management area and year. The viabilities are not currently obtained on IFQ vessels. (*) confidential data, (-) no data collected

Hook & Line							
Area	**Number**				**Weighted Percentages**		
Year	Exc	Poor	Dead	Total	Exc	Poor	Dead
North of 40 deg. 10' N. lat.							
2011	-	-	-	902	-	-	-
2018	-	-	-	419	-	-	-
All	-	-	-	1321	-	-	-
South of 40 deg. 10' N. lat.							
2011	-	-	-	0	-	-	-
All	-	-	-	0	-	-	-
Coastwide							
2012	-	-	-	1271	-	-	-
2013	-	-	-	404	-	-	-
2014	-	-	-	698	-	-	-
2015	-	-	-	963	-	-	-
2016	-	-	-	672	-	-	-
2017	-	-	-	690	-	-	-
All	-	-	-	4698	-	-	-

Table 24: Estimated Pacific halibut gross at-sea discard (mt) and at-sea discard mortality (mt) in the U.S. West Coast groundfish IFQ bottom trawl fishery by management area, depth, and year. Estimates were allocated to three condition categories based on information presented in Table 20. DMR=Discard Mortality Rate. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation.

Bottom Trawl									
Area, Depth (fm)	**Estimated Gross Discard (mt)**				**Estimated Discard Mortality**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	Total	
North of Pt. Chehalis, 0-60									
2011	4.58	1.13	2.27	7.98	0.92	0.62	2.04	3.58	0.45
2012	2.21	0.97	1.62	4.80	0.44	0.54	1.46	2.44	0.51
2013	2.24	0.74	2.47	5.46	0.45	0.41	2.23	3.08	0.56
2014	1.76	0.17	0.14	2.07	0.35	0.09	0.13	0.57	0.28
2015	2.79	0.49	0.61	3.89	0.56	0.27	0.55	1.37	0.35
2016	1.84	0.41	0.52	2.76	0.37	0.22	0.47	1.06	0.38
2017	0.62	0.16	0.05	0.84	0.12	0.09	0.05	0.26	0.31
2018	0.25	0.10	0.26	0.62	0.05	0.06	0.24	0.34	0.55
North of Pt. Chehalis, 60+									
2011	10.42	4.07	7.80	22.29	2.08	2.24	7.02	11.34	0.51
2012	13.19	6.80	12.68	32.67	2.64	3.74	11.42	17.79	0.54
2013	18.58	4.25	7.07	29.91	3.72	2.34	6.37	12.42	0.42
2014	13.45	4.34	7.78	25.58	2.69	2.39	7.00	12.08	0.47
2015	14.80	3.56	6.50	24.86	2.96	1.96	5.85	10.77	0.43
2016	6.76	2.39	4.99	14.14	1.35	1.31	4.49	7.16	0.51
2017	8.54	2.33	6.54	17.41	1.71	1.28	5.89	8.88	0.51
2018	7.03	2.37	6.41	15.81	1.41	1.30	5.77	8.48	0.54
Pt. Chehalis to 40 deg. 10' N. lat., 0-60									
2011	8.83	1.05	1.12	11.00	1.77	0.58	1.01	3.35	0.30
2012	5.46	1.12	1.49	8.06	1.09	0.61	1.34	3.04	0.38
2013	5.05	1.85	1.64	8.55	1.01	1.02	1.48	3.51	0.41
2014	7.20	1.44	1.84	10.48	1.44	0.79	1.66	3.89	0.37
2015	6.07	1.54	2.62	10.22	1.21	0.85	2.35	4.41	0.43
2016	3.62	0.87	2.82	7.32	0.72	0.48	2.54	3.75	0.51
2017	3.40	0.31	1.00	4.71	0.68	0.17	0.90	1.75	0.37
2018	1.73	0.28	0.48	2.49	0.35	0.15	0.44	0.93	0.37
Pt. Chehalis to 40 deg. 10' N. lat., 60+									
2011	8.46	4.55	9.50	22.51	1.69	2.50	8.55	12.75	0.57
2012	7.26	3.59	9.61	20.46	1.45	1.98	8.65	12.08	0.59

Table 24: Estimated Pacific halibut gross at-sea discard (mt) and at-sea discard mortality (mt) in the U.S. West Coast groundfish IFQ bottom trawl fishery by management area, depth, and year. Estimates were allocated to three condition categories based on information presented in Table 20. DMR=Discard Mortality Rate. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation. *(continued)*

Bottom Trawl									
Area, Depth (fm)	**Estimated Gross Discard (mt)**				**Estimated Discard Mortality**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	Total	
2013	7.29	3.91	9.88	21.08	1.46	2.15	8.89	12.50	0.59
2014	7.19	2.95	6.97	17.11	1.44	1.62	6.28	9.33	0.55
2015	12.31	5.08	12.36	29.75	2.46	2.79	11.12	16.38	0.55
2016	11.99	4.34	15.14	31.48	2.40	2.39	13.63	18.42	0.59
2017	16.66	5.44	14.07	36.17	3.33	2.99	12.66	18.99	0.52
2018	10.21	5.14	11.28	26.63	2.04	2.83	10.15	15.02	0.56
South of 40 deg. 10' N. lat., 0-60									
2011	0.00	0.00	0.17	0.17	0.00	0.00	0.15	0.15	0.90
2012	*	*	*	*	*	*	*	*	*
2013‡	0.03	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.20
2014‡	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2015‡	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2016‡	*	*	*	*	*	*	*	*	*
2017‡	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2018‡	0.00	0.01	0.02	0.03	0.00	0.01	0.01	0.02	0.75
South of 40 deg. 10' N. lat., 60+									
2011	0.08	0.01	0.08	0.16	0.02	0.01	0.07	0.09	0.54
2012	0.41	0.08	0.35	0.84	0.08	0.04	0.31	0.44	0.52
2013‡	0.29	0.14	0.47	0.90	0.06	0.08	0.42	0.56	0.62
2014‡	0.36	0.08	0.13	0.57	0.07	0.04	0.12	0.23	0.41
2015‡	0.18	0.03	0.12	0.33	0.04	0.02	0.11	0.16	0.49
2016‡	0.07	0.02	0.00	0.10	0.01	0.01	0.00	0.03	0.31
2017‡	0.04	0.02	0.02	0.07	0.01	0.01	0.01	0.03	0.43
2018‡	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LE CA Halibut South of 40 deg. 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	*	*	*	*	*	*	*	*	*

Table 25: Estimated Pacific halibut gross at-sea discard (mt) and at-sea discard mortality (mt) in the U.S. West Coast groundfish IFQ midwater trawl fishery by management area and year. Estimates were allocated to three condition categories based on information presented in Table 21. Midwater Rockfish 2011 data is confidential and not included here. DMR=Discard Mortality Rate. (*) confidential data, (-) no estimate, see text for explanation.

Midwater Trawl north of 40°10' N. lat.										
		Estimated Gross Discard (mt)				Estimated Discard Mortality				DMR
Sector	Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	Total	
Hake	2011	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.03	1.00
	2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2013	0.05	0.00	0.00	0.05	0.00	0.00	0.00	0.05	1.00
	2014	0.10	0.01	0.00	0.11	0.00	0.00	0.00	0.11	1.00
	2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2017	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2018	0.01	0.00	0.03	0.04	0.00	0.00	0.00	0.04	1.00
Rockfish	2012	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2013	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2014	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
	2017	0.02	0.00	0.01	0.03	0.00	0.00	0.00	0.03	1.00
	2018	0.01	0.00	0.01	0.03	0.00	0.00	0.00	0.03	1.00

Table 26: Estimated Pacific halibut gross at-sea discard (mt) and at-sea discard mortality (mt) in the U.S. West Coast groundfish IFQ pot fishery by management area and year. Estimates were allocated to three condition categories based on information presented in Table 22. DMR=Discard Mortality Rate. (*) confidential data, (-) no estimate, see text for explanation.

Pot									
Area	**Estimated Gross Discard (mt)**				**Estimated Discard Mortality**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	Total	
North of Pt. Chehalis.									
2011	0.86	0.02	0.15	1.03	0.00	0.02	0.15	0.17	0.16
2012	0.84	0.21	0.21	1.27	0.00	0.21	0.21	0.43	0.34
2013	0.13	0.00	0.08	0.22	0.00	0.00	0.08	0.09	0.39
Pt. Chehalis to 40 deg. 10' N. lat.									
2011	1.61	0.11	0.61	2.33	0.00	0.11	0.61	0.72	0.31
2012	0.54	0.05	0.03	0.62	0.00	0.05	0.03	0.08	0.13
2013	0.63	0.05	0.07	0.76	0.00	0.05	0.07	0.13	0.17
2015	1.10	0.06	0.16	1.31	0.00	0.06	0.16	0.21	0.16
South of 40 deg. 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
2015	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	0.26
2016	1.53	0.03	0.14	1.70	0.00	0.03	0.14	0.17	0.10
2017	0.44	0.38	0.26	1.09	0.00	0.38	0.26	0.64	0.59
2018	1.54	0.08	0.02	1.65	0.00	0.08	0.02	0.11	0.07

Table 27: Estimated Pacific halibut gross at-sea discard (mt) and at-sea discard mortality (mt) in the U.S. West Coast groundfish IFQ hook & line fishery by management area, depth, and year. A single discard mortality rate (DMR) of 0.16 is applied in this fishery. Viabilities are not used to determine discard mortality, see text for explanation. (*) confidential data, (-) no data collected.

Hook & Line									
Area	**Estimated Gross Discard (mt)**				**Estimated Discard Mortality**				**DMR**
Year	Exc	Poor	Dead	Total	m(Exc)	m(Poor)	m(Dead)	Total	
North of 40 deg. 10' N. lat.									
2011	-	-	-	6.06	-	-	-	0.97	0.16
2018	-	-	-	4.65	-	-	-	0.74	0.16
South of 40 deg. 10' N. lat.									
2011	-	-	-	0.00	-	-	-	0.00	0.00
Coastwide									
2012	-	-	-	14.66	-	-	-	2.34	0.16
2013	-	-	-	3.00	-	-	-	0.48	0.16
2014	-	-	-	3.80	-	-	-	0.61	0.16
2015	-	-	-	9.49	-	-	-	1.52	0.16
2016	-	-	-	6.39	-	-	-	1.02	0.16
2017	-	-	-	4.14	-	-	-	0.66	0.16

Table 28: 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 bottom trawl fisheries by management area, depth, and year. The proportion of legal-sized P. halibut in the non-hake IFQ bottom trawl sector north of 40°10′ N. lat. is 79.22. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation.

	Bottom Trawl			
Area, Depth (fm)	**Total**		**Estimated legal-size**	
Year	Discards (mt)	Discard mortality (mt)	Mortality (mt)	% by weight
North of Pt. Chehalis, 0-60				
2011	7.98	3.58	1.96	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	47.56%
2015	3.89	1.37	0.95	68.79%
2016	2.76	1.06	0.64	60.15%
2017	0.84	0.26	0.18	70.98%
2018	0.62	0.34	0.23	68.28%
North of Pt. Chehalis, 60+				
2011	22.29	11.34	8.00	70.52%
2012	32.67	17.79	12.31	69.19%
2013	29.91	12.42	7.96	64.07%
2014	25.58	12.08	6.46	53.50%
2015	24.86	10.77	6.96	64.63%
2016	14.14	7.16	4.30	60.06%
2017	17.41	8.88	5.75	64.81%
2018	15.81	8.48	5.97	70.46%
Pt. Chehalis to 40 deg. 10' N. lat., 0-60				
2011	11.00	3.35	2.08	62.17%
2012	8.06	3.04	1.61	53.04%
2013	8.55	3.51	2.18	62.10%
2014	10.48	3.89	1.91	49.16%
2015	10.22	4.41	2.54	57.52%
2016	7.32	3.75	2.06	55.01%
2017	4.71	1.75	1.26	71.91%
2018	2.49	0.93	0.70	75.19%
Pt. Chehalis to 40 deg. 10' N. lat., 60+				
2011	22.51	12.75	8.78	68.87%
2012	20.46	12.08	8.51	70.44%

Table 28: 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 bottom trawl fisheries by management area, depth, and year. The proportion of legal-sized P. halibut in the non-hake IFQ bottom trawl sector north of 40°10′ N. lat. is 79.22. (‡) combined IFQ and LE CA Halibut, (*) confidential data, (-) no estimate, see text for explanation. *(continued)*

	Bottom Trawl			
Area, Depth (fm)	**Total**		**Estimated legal-size**	
Year	Discards (mt)	Discard mortality (mt)	Mortality (mt)	% by weight
2013	21.08	12.50	8.81	70.48%
2014	17.11	9.33	6.90	73.89%
2015	29.75	16.38	11.84	72.32%
2016	31.48	18.42	13.43	72.95%
2017	36.17	18.99	15.39	81.06%
2018	26.63	15.02	12.72	84.67%
South of 40 deg. 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%
2015‡	0.00	0.00	0.00	0.00%
2016‡	*	*	*	*
2017‡	0.00	0.00	0.00	0.00%
2018‡	0.03	0.02	0.02	82.08%
South of 40 deg. 10' N. lat., 60+				
2011	0.16	0.09	0.09	96.93%
2012	0.84	0.44	0.38	86.31%
2013‡	0.90	0.56	0.45	80.25%
2014‡	0.57	0.23	0.21	90.96%
2015‡	0.33	0.16	0.14	88.19%
2016‡	0.10	0.03	0.03	88.20%
2017‡	0.07	0.03	0.03	91.17%
2018‡	0.00	0.00	0.00	0.00%
LE CA Halibut South of 40 deg. 10' N. lat., all depths				
2011	0.00	0.00	0.00	0.00%
2012	*	*	*	*

Table 29: 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 midwater trawl fisheries by area and year. (*) confidential data, (-) no estimate, see text for explanation.

Midwater Trawl north of 40°10' N. lat.					
		Total		Estimated legal-size	
Sector	Year	Discards (mt)	Discard mortality (mt)	Mortality (mt)	% by weight
Hake	2011	0.03	0.03	0.02	76.44%
	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%
	2015	0.00	0.00	0.00	0.00%
	2016	0.00	0.00	0.00	0.00%
	2017	0.00	0.00	0.00	0.00%
	2018	0.04	0.04	0.04	100.00%
Rockfish	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%
	2015	0.00	0.00	0.00	0.00%
	2016	0.00	0.00	0.00	0.00%
	2017	0.03	0.03	0.03	87.31%
	2018	0.03	0.03	0.02	56.80%

Table 30: 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 pot fisheries by area and year. (*) confidential data, (-) no estimate, see text for explanation.

Pot				
Area	**Total**		**Estimated legal-size**	
Year	Discards (mt)	Discard mortality (mt)	Mortality (mt)	% by weight
North of Pt. Chehalis.				
2011	1.03	0.17	0.13	77.00%
2012	1.27	0.43	0.34	80.73%
2013	0.22	0.09	0.07	77.82%
Pt. Chehalis to 40 deg. 10' N. lat.				
2011	2.33	0.72	0.54	74.48%
2012	0.62	0.08	0.06	73.97%
2013	0.76	0.13	0.09	70.53%
2015	1.31	0.21	0.16	73.94%
South of 40 deg. 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%
2015	0.00	0.00	0.00	0.00%
Coastwide				
2014	0.32	0.08	0.07	84.94%
2016	1.70	0.17	0.12	72.61%
2017	1.09	0.64	0.51	79.23%
2018	1.65	0.11	0.09	81.11%

Table 31: 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 hook & line fisheries by area and year. (*) confidential data, (-) no estimate, see text for explanation.

Hook & Line				
Area	**Total**		**Estimated legal-size**	
Year	Discards (mt)	Discard mortality (mt)	Mortality (mt)	% by weight
North of 40 deg. 10' N. lat.				
2011	6.06	0.97	0.43	44.66%
2018	4.65	0.74	0.57	76.56%
South of 40 deg. 10' N. lat.				
2011	0.00	0.00	0.00	0.00%
Coastwide				
2012	14.66	2.34	1.81	76.99%
2013	3.00	0.48	0.24	49.73%
2014	3.80	0.61	0.30	49.87%
2015	9.49	1.52	0.65	42.61%
2016	6.39	1.02	0.43	42.08%
2017	4.14	0.66	0.31	46.56%

Table 32: Pacific halibut bycatch by month for vessels fishing bottom trawl gear in the 2018 IFQ fishery. We present coastwide estimates across all depths to maintain confidentiality. Note that adding values across columns might give slightly different results because values are rounded to two decimals for reporting. Monthly estimates do not include bycatch from EM vessels.

2018 Bottom Trawl PHLB Catch by Month

Month	Expanded Discard (mt)	Sampled Discard (mt)	Total Bycatch (mt)
1	0.00	2.60	2.60
2	0.00	3.79	3.79
3	0.03	6.52	6.55
4	0.00	8.66	8.67
5	0.01	8.20	8.21
6	0.02	3.14	3.15
7	0.00	5.25	5.25
8	0.01	2.60	2.61
9	0.00	4.37	4.37
10	0.63	5.20	5.83
11	0.00	3.38	3.38
12	0.03	4.76	4.79

Table 33: Physical measurements of P. halibut length (cm) in the U.S. west coast groundfish IFQ fishery (2011-2018) for vessels using bottom trawl gear. Length bins include the lower bound and exclude the upper bound.

IFQ Bottom Trawl physical lengths					
Length bin (cm)	Total No. Individuals	No. Dead Individuals	Length bin (cm)	Total No. Individuals	No. Dead Individuals
14-16	1	1	110-112	477	211
18-20	1	0	112-114	387	183
22-24	1	0	114-116	279	130
24-26	1	0	116-118	217	102
30-32	3	1	118-120	166	77
32-34	5	3	120-122	126	59
34-36	4	1	122-124	121	50
36-38	6	1	124-126	88	40
38-40	28	8	126-128	58	32
40-42	28	12	128-130	49	19
42-44	30	13	130-132	31	11
44-46	15	8	132-134	28	9
46-48	27	10	134-136	21	8
48-50	62	23	136-138	22	8
50-52	55	32	138-140	14	6
52-54	77	42	140-142	13	8
54-56	134	71	142-144	9	5
56-58	176	104	144-146	7	3
58-60	409	241	146-148	10	2
60-62	743	416	148-150	9	3
62-64	1258	679	150-152	3	2
64-66	1703	922	152-154	3	1
66-68	2088	1117	154-156	2	1
68-70	2727	1418	160-162	1	1
70-72	3171	1644	162-164	2	1
72-74	3504	1860	164-166	2	0
74-76	3563	1890	166-168	1	1
76-78	3478	1872	168-170	3	1
78-80	3488	1869	170-172	3	1
80-82	3355	1735	172-174	6	2
82-84	3288	1746	174-176	1	1
84-86	2988	1565	176-178	2	1
86-88	2576	1361	178-180	3	2
88-90	2430	1268	180-182	2	0
90-92	2359	1202	182-184	3	2
92-94	2034	1029	184-186	2	1
94-96	1645	816	186-188	2	2
96-98	1423	720	188-190	1	0
98-100	1270	635	192-194	3	1
100-102	1187	560	198-200	1	0
102-104	1003	481	212-214	1	1
104-106	808	380			
106-108	623	286			
108-110	544	265			

Table 34: Physical measurements of P. halibut length (cm) in the U.S. west coast groundfish IFQ fishery (2011-2018) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

IFQ Pot physical lengths		
Length bin (cm)	Total No. Individuals	No. Dead Individuals
44-46	1	0
46-48	1	0
50-52	3	0
54-56	4	1
56-58	3	0
58-60	4	1
60-62	14	4
62-64	13	5
64-66	12	3
66-68	8	1
68-70	28	4
70-72	52	10
72-74	66	7
74-76	61	13
76-78	58	17
78-80	85	19
80-82	112	22
82-84	130	29
84-86	115	21
86-88	94	21
88-90	78	13
90-92	89	17
92-94	59	19
94-96	58	16
96-98	49	15
98-100	25	5
100-102	31	7
102-104	20	6
104-106	18	7
106-108	16	5
108-110	11	3
110-112	7	1
112-114	4	0
114-116	8	4
116-118	5	2
118-120	3	2
120-122	2	0
122-124	3	0
128-130	1	0
130-132	2	1
134-136	1	0
136-138	1	0
138-140	1	0
166-168	1	0
200-202	1	0

Table 35: Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish IFQ fishery (2011-2018) for vessels using bottom trawl, pot, and hook & line gear. Length bins include the lower bound and exclude the upper bound. On IFQ hook & line vessels, only visual estimates are taken on P. halibut.

IFQ visual lengths, no. of individuals			
Length bin (cm)	Bottom Trawl (no.)	Pot (no.)	Hook & Line (no.)
25-34	0	1	25
35-44	2	2	177
45-54	3	1	363
55-64	11	2	986
65-74	32	4	1504
75-84	35	14	1139
85-94	41	8	714
95-104	27	8	419
105-114	8	1	234
115-124	10	2	130
125-134	6	1	32
135-144	4	0	13
145-154	4	0	2
155-164	1	0	1
165-174	0	0	2
175-184	2	0	1

8.2 Tables: At-Sea Hake Fisheries

Table 36: Coverage information and Pacific halibut bycatch in the At-sea Pacific hake catcher-processor fishery by year. 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 Catcher Processors			
Year	Fleet observer coverage	Number of observed hauls	% of hauls with P. halibut	P.halibut bycatch (mt)
Catcher-Processors				
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%	2.07
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
2015	100%	1519	0.07%	0.012
2016	100%	2205	0.05%	0.028
2017	100%	2159	0.51%	0.264
2018	100%	1971	0.36%	0.215

Table 37: Coverage information and Pacific halibut bycatch in the At-sea Pacific hake cather vessels delivering to motherships fishery by year. 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 Mothership Catcher Vessels			
Year	Fleet observer coverage	Number of observed hauls	% of hauls with P. halibut	P.halibut bycatch (mt)
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%	1.08
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
2015	100%	640	0.31%	0.049
2016	100%	1565	0.51%	0.123
2017	100%	1309	0.84%	0.289
2018	100%	1535	1.17%	0.444

Table 38: Coverage information and Pacific halibut bycatch in the Tribal At-sea Pacific hake fishery by year. Tribal At-sea P. hake fishery has not operated since 2012. 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. (*) confidential

	At-sea Pacific hake Tribal fishery			
Year	Fleet observer coverage	Number of observed hauls	% of hauls with P. halibut	P.halibut bycatch (mt)
Tribal				
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%	*	*	*

Table 39: Physical P. halibut length frequencies (cm) collected by A-SHOP observers in the At-sea hake fishery (2002-2018). Length bins include the lower bound and exclude the upper bound.

	At-sea Hake			
Length bin (cm)	**No. of Excellent**	**No. of Poor**	**No. of Dead**	**No. of Unknown**
58-60	0	0	2	0
60-62	0	1	3	0
62-64	0	0	2	0
64-66	0	2	6	0
66-68	0	0	9	0
68-70	1	0	10	0
70-72	0	1	22	0
72-74	1	0	24	0
74-76	0	1	19	0
76-78	1	1	21	1
78-80	0	0	29	0
80-82	1	0	46	1
82-84	2	0	21	0
84-86	0	1	32	0
86-88	0	2	29	0
88-90	2	0	40	2
90-92	0	0	38	1
92-94	0	0	31	0
94-96	1	2	41	0
96-98	0	0	25	0
98-100	1	0	32	0
100-102	0	4	33	0
102-104	1	1	21	0
104-106	1	1	22	0
106-108	0	0	24	0
108-110	2	1	22	1
110-112	1	0	19	0
112-114	1	0	10	0
114-116	0	0	9	0
116-118	0	1	10	1
118-120	0	0	7	0
120-122	0	0	6	0
122-124	0	0	7	0
124-126	0	0	4	0
126-128	0	1	1	0
128-130	0	0	4	0
130-132	0	0	6	0
132-134	0	0	2	0
136-138	0	0	2	0
138-140	0	0	1	0
140-142	0	0	2	0
142-144	0	0	1	0
154-156	0	0	1	0

8.3 Tables: IFQ Electronic Monitoring

Table 40: Number of vessels, trips, and tows (or sets) and gross metric tons of Pacific halibut discarded at-sea, P. halibut discarded at sea with mortality rate applied (bottom trawl = 0.90) and the P. halibut landed and discarded at the dock (mortality rate = 1.0) under the IFQ Electronic Monitoring Exempted Fishing Permit (EFP). All participating vessels carry electronic monitoring equipment on all fishing trips. Data are summarized from the EM program administered by Pacific States Marine Fisheries Commission

		Electronic Monitoring EFP (IFQ)					
		Bottom Trawl					
Area	Year	No. of vessels	No. of trips	No. of hauls	PHLB discarded at sea (gross, mt)	PHLB discard mortality (mt)	PHLB discarded at dock (mt)
north of Pt. Chehalis	2015	0	0	0	0.00	0.00	0.00
	2016	0	0	0	0.00	0.00	0.00
	2017	0	0	0	0.00	0.00	0.00
	2018	0	0	0	0.00	0.00	0.00
south of Pt. Chehalis	2015	5	23	139	0.18	0.16	0.00
	2016	7	99	574	2.93	2.63	0.00
	2017	12	150	869	5.36	4.83	0.05
	2018	10	178	1060	6.12	5.51	0.04

Table 41: Number of vessels, trips, and tows (or sets) and gross metric tons of Pacific halibut discarded at-sea, P. halibut discarded at sea with mortality rate applied (midwater trawl = 1.0) and the P. halibut landed and discarded at the dock (mortality rate = 1.0) under the IFQ Electronic Monitoring Exempted Fishing Permit (EFP). All participating vessels carry electronic monitoring equipment on all fishing trips. Data are summarized from the EM program administered by Pacific States Marine Fisheries Commission

	Electronic Monitoring EFP (IFQ)						
	Midwater Trawl north of 40°10′ N. lat.						
Target	Year	No. of vessels	No. of trips	No. of hauls	PHLB discarded at sea (gross, mt)	PHLB discard mortality (mt)	PHLB discarded at dock (mt)
Hake	2015	17	456	1178	0.00	0.00	0.56
	2016	20	648	1411	0.01	0.01	0.65
	2017	22	1104	2072	0.00	0.00	0.46
	2018	23	1020	1913	0.00	0.00	1.15
Rockfish	2015	8	24	81	0.00	0.00	0.00
	2016	6	30	74	0.00	0.00	0.00
	2017	10	53	89	0.00	0.00	0.00
	2018	12	106	161	0.00	0.00	0.00

Table 42: Number of vessels, trips, and tows (or sets) and gross metric tons of Pacific halibut discarded at-sea, P. halibut discarded at sea with mortality rate applied (pot = 0.18) and the P. halibut landed and discarded at the dock (mortality rate = 1.0) under the IFQ Electronic Monitoring Exempted Fishing Permit (EFP). All participating vessels carry electronic monitoring equipment on all fishing trips. Data are summarized from the EM program administered by Pacific States Marine Fisheries Commission

	Electronic Monitoring EFP (IFQ)						
	Pot						
Area	Year	No.of vessels	No.of trips	No.of sets	PHLB discarded at sea (gross, mt)	PHLB discard mortality (mt)	PHLB discarded at dock (mt)
north of 40°10′ N. lat.	2015	3	32	302	0.89	0.16	0
	2016	4	43	417	0.07	0.01	0
	2017	5	51	578	0.75	0.13	0
	2018	5	42	498	0.99	0.18	0
south of 40°10′ N. lat.	2015	5	26	398	0.00	0.00	0
	2016	4	27	603	0.00	0.00	0
	2017	7	30	648	0.00	0.00	0
	2018	3	26	513	0.00	0.00	0

8.4 Tables: Non-Nearshore Fixed Gear Fisheries

Table 43: 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	9	26	160	6	35	362
2004	6	13	121	13	35	205	3	13	139
2005	10	31	402	18	73	276	7	39	492
2006	9	31	291	10	34	160	7	39	289
2007	9	36	381	14	40	136	4	30	154
2008	6	17	195	13	60	345	6	24	329
2009	3	12	177	6	34	110	3	27	67
2010	5	18	251	20	127	511	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	246	13	74	249	4	16	195
2015	6	15	174	24	87	458	9	36	308
2016	4	10	212	20	87	459	7	55	596
2017	7	15	209	21	98	492	3	14	186
2018	7	22	372	24	107	467	7	36	523

Table 44: Number of observed vessels, trips, and sets by year in the LE Sablefish NonEndorsed fishery. The number of observed pot vessels in this fishery is too small to meet confidentiality and thus not reported.

	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	201
2007	36	158	304
2008	32	122	221
2009	34	138	273
2010	38	226	472
2011	38	201	426
2012	26	128	252
2013	22	124	248
2014	18	77	154
2015	21	65	144
2016	16	41	70
2017	12	34	71
2018	13	29	85

Table 45: Number of observed vessels, trips, and sets by year and gear type in the OA Fixed Gear fishery. OA Fixed Gear fishery was not observed until 2003.

	OA Fixed Gear					
	Hook & Line			Pot		
Year	vessels	trips	sets	vessels	trips	sets
2002	–	–	–	–	–	–
2003	13	41	49	7	16	50
2004	14	42	52	17	96	185
2005	10	34	37	14	43	50
2006	7	10	11	15	38	39
2007	25	51	67	21	46	75
2008	33	58	68	20	55	75
2009	34	69	104	18	30	45
2010	37	70	105	26	40	71
2011	40	69	101	29	61	85
2012	24	34	53	19	35	70
2013	14	23	30	17	25	48
2014	21	28	39	21	41	63
2015	20	38	54	17	49	64
2016	30	55	78	27	55	73
2017	43	61	79	44	85	126
2018	43	82	104	33	57	89

Table 46: 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 extitPacific 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	Pot	Sablefish	LE Sablefish Endorsed Pot
LE Sablefish Non-Endorsed	Longline	Groundfish	LE Sablefish Non-Endorsed Longline
LE Sablefish Non-Endorsed	Pot	Groundfish	OA Fixed Gear[1] Pot
OA Fixed Gear	Hook & Line	Groundfish	OA Fixed Gear[1] Hook & Line
OA Fixed Gear	Pot	Groundfish	OA Fixed Gear[1] Pot

[1] A coast-wide discard ratio and coast-wide discard estimate could not be computed in the OA fixed gear sector for 2002-06 because the WCGOP only covered OA vessels in California during this time.

Table 47: Total sablefish or groundfish landings (mt) 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 (see Table 46). North or South refers to North or South of Pt. Chehalis, WA.

	LE Sablefish Endorsed			**LE Sablefish Non-Endorsed**		**OA Fixed Gear**	
	Longline		**Pot**	**Longline**	**Pot**	**Hook & Line**	**Pot**
Year	North	South					
2002	383	409	352	623	7	387	111
2003	482	570	604	541	7	563	191
2004	665	653	620	399	11	482	186
2005	668	674	615	548	3	624	379
2006	684	717	582	467	30	486	443
2007	495	609	428	516	2	263	258
2008	403	701	433	649	3	402	248
2009	429	1012	489	757	7	645	374
2010	266	1039	504	1001	17	756	318
2011	223	937	372	1246	24	434	256
2012	206	873	286	809	9	323	126
2013	217	531	283	812	15	194	72
2014	183	564	338	717	4	226	148
2015	234	725	358	726	4	364	223
2016	295	739	359	745	12	290	206
2017	316	746	375	796	13	350	211
2018	326	683	409	776	9	313	173

Table 48: Observed discard ratios for each sector and gear type in the non-nearshore fixed gear fishery. Sablefish landings were used as the discard ratio denominator in all cases except for the LE Sablefish Non-Endorsed and the OA Fixed Gear sectors (see Table 46), where target species include a variety of groundfish species. North or South refers to North or South of Pt. Chehalis, WA.

	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook & Line	Pot
Year	North	South					
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)	0.0741 (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)	- -	0.0789 (0.02)	0.0034 (0.00)
2008	0.3715 (0.07)	0.1473 (0.03)	0.0153 (0.00)	0.0046 (0.00)	- -	0.0994 (0.04)	0.0010 (0.00)
2009	0.6497 (0.10)	0.0413 (0.01)	0.0017 (0.00)	0.0003 (0.00)	- -	0.0541 (0.02)	0.0007 (0.00)
2010	0.2522 (0.06)	0.0631 (0.01)	0.0100 (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)	0.0171 (0.01)	- -	0.0299 (0.01)	0.0003 (0.00)
2012	0.4534 (0.16)	0.0594 (0.01)	0.0209 (0.00)	0.0204 (0.01)	- -	0.0719 (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	0.8892 (0.13)	0.0177 (0.00)	0.0060 (0.00)	- -	- -	0.0152 (0.00)	0.0011 (0.00)
2015	0.3469 (0.07)	0.0560 (0.01)	0.0046 (0.00)	0.0006 (0.00)	- -	0.0278 (0.01)	0.0000 (0.00)
2016	0.4211 (0.06)	0.0596 (0.01)	0.0159 (0.00)	0.0069 (0.00)	- -	0.1467 (0.03)	0.0003 (0.00)
2017	0.8062 (0.11)	0.0527 (0.01)	0.0024 (0.00)	0.0009 (0.00)	- -	0.1361 (0.04)	0.0042 (0.00)
2018	0.4849 (0.09)	0.0780 (0.01)	0.0051 (0.00)	0.0174 (0.01)	- -	0.1319 (0.03)	0.0007 (0.00)

Table 49: Percent of observed trips that caught Pacific halibut by year, sector, gear, and area (where applicable). – No WCGOP observers were deployed for the sector-year-gear type combination.

	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook & Line	Pot
Year	North	South					
2002	95.7%	46.8%	17.4%	0.0%	–	0.0%	0.0%
2003	100.0%	50.0%	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%	–	25.5%	6.5%
2008	100.0%	78.3%	83.3%	3.3%	–	34.5%	5.5%
2009	91.7%	35.3%	33.3%	0.7%	–	37.7%	10.0%
2010	83.3%	47.2%	51.2%	1.3%	–	21.4%	2.5%
2011	88.9%	42.9%	45.5%	6.0%	–	30.4%	6.6%
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%
2015	100.0%	49.4%	61.1%	1.5%	–	34.2%	4.1%
2016	100.0%	60.9%	61.8%	7.3%	–	58.2%	7.3%
2017	93.3%	48.0%	57.1%	2.9%	–	31.1%	8.2%
2018	95.5%	43.9%	44.4%	6.9%	–	30.5%	3.5%

Table 50: Observed average, minimum and maximum annual catch of P. halibut by year, sector, gear, and area.

	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook & Line	Pot
Year	North	South					
Mean	46.3	12.1	1.8	0.3	–	1.0	0.0
Min	8.0	0.7	0.1	0.0	–	0.0	0.0
Max	118.4	36.6	5.4	1.4	–	2.3	0.1

Table 51: The percent of P. halibut catch weight discarded by year, sector, gear, and area. – No WCGOP observers were deployed for the sector-year-gear type combination.

	LE Sablefish Endorsed			LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline		Pot	Longline	Pot	Hook & Line	Pot
Year	North	South					
2002	95.7%	46.8%	17.4%	0.0%	–	0.0%	0.0%
2003	100.0%	50.0%	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%	–	25.5%	6.5%
2008	100.0%	78.3%	83.3%	3.3%	–	34.5%	5.5%
2009	91.7%	35.3%	33.3%	0.7%	–	37.7%	10.0%
2010	83.3%	47.2%	51.2%	1.3%	–	21.4%	2.5%
2011	88.9%	42.9%	45.5%	6.0%	–	30.4%	6.6%
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%
2015	100.0%	49.4%	61.1%	1.5%	–	34.2%	4.1%
2016	100.0%	60.9%	61.8%	7.3%	–	58.2%	7.3%
2017	93.3%	48.0%	57.1%	2.9%	–	31.1%	8.2%
2018	95.5%	43.9%	44.4%	6.9%	–	30.5%	3.5%

Table 52: Pacific halibut viabilities caught by longline vessels in the U.S. west coast Limited Entry Sablefish Endorsed fishery by year and area north and south of Point Chehalis, WA. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead (see Appendix in WCGOP manual), consistent with IPHC protocol. Sample sizes allowed for annual weighted percentages as described in the Methods.

	Limited Entry Sablefish																							
	no. of fish												weighted %											
Year	North of Pt. Chehalis				South of Pt. Chehalis				Coastwide				North of Pt. Chehalis				South of Pt. Chehalis				Coastwide			
	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead
2011	6039	157	95	124	2414	220	40	315	8453	377	135	439	95.6%	1.8%	1.3%	1.4%	80.1%	6.9%	1.0%	12.1%	91.2%	3.2%	1.2%	4.4%
2012	919	41	0	136	6197	798	190	461	7116	839	190	597	84.1%	3.5%	0.0%	12.4%	78.5%	11.3%	3.0%	7.3%	79.2%	10.2%	2.6%	8.0%
2013	2740	318	0	207	522	9	15	46	3262	327	15	253	83.1%	9.7%	0.0%	7.1%	90.3%	0.4%	4.0%	5.3%	84.5%	7.9%	0.8%	6.8%
2014	7238	296	144	921	1565	255	60	233	8803	551	204	1154	83.2%	3.3%	1.8%	11.6%	71.4%	12.1%	3.3%	13.2%	80.5%	5.4%	2.2%	12.0%
2015	7364	165	144	163	9602	663	304	258	16966	828	448	421	93.9%	2.0%	1.9%	2.2%	88.3%	6.1%	3.0%	2.7%	90.7%	4.3%	2.5%	2.4%
2016	7604	461	28	112	8954	1821	107	658	16558	2282	135	770	93.1%	5.3%	0.4%	1.2%	74.1%	17.4%	1.7%	6.8%	80.8%	13.1%	1.2%	4.8%
2017	9786	725	177	895	7147	742	54	471	16933	1467	231	1366	85.4%	6.2%	1.5%	6.9%	86.4%	7.4%	0.7%	5.5%	85.8%	6.7%	1.1%	6.3%
2018	10887	1002	145	411	9417	1466	145	607	20304	2468	290	1018	86.5%	7.8%	1.4%	4.3%	81.4%	12.4%	0.7%	5.4%	83.7%	10.3%	1.1%	4.9%

Table 53: Pacific halibut viabilities caught by longline vessels in the U.S. west coast Limited Entry Sablefish Non-Endorsed fishery, coastwide by year. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead (see Appendix in WCGOP manual), consistent with IPHC protocol. Sample sizes necessitated the use of a five year rolling avearge to calculate weighted percentages, as described in the Methods.

Year	Limited Entry Sablefish Non-Endorsed							
	no. of fish				weighted %			
	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead
2011	496	214	0	0	64.8%	35.2%	0.0%	0.0%
2012	374	16	0	0	97.3%	2.7%	0.0%	0.0%
2013	0	0	0	0	0.0%	0.0%	0.0%	0.0%
2014	0	0	0	0	0.0%	0.0%	0.0%	0.0%
2015	24	0	0	0	100.0%	0.0%	0.0%	0.0%
2016	59	36	0	0	56.3%	43.7%	0.0%	0.0%
2017	11	0	0	0	100.0%	0.0%	0.0%	0.0%
2018	478	0	17	0	98.4%	0.0%	1.6%	0.0%

Table 54: Pacific halibut viabilities caught by hook-&-line vessels in the U.S. west coast Open Access fixed gear fishery, coastwide by year. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead (see Appendix in WCGOP manual), consistent with IPHC protocol. Sample sizes necessitated the use of a five year rolling avearge to calculate weighted percentages, as described in the Methods.

Year	Open Access Fixed Gear							
	no. of fish				weighted %			
	Mi	Mo	Ser	Dead	Mi	Mo	Ser	Dead
2011	286	76	31	6	72.0%	17.5%	10.0%	0.5%
2012	473	37	0	18	91.1%	8.6%	0.0%	0.3%
2013	53	0	0	0	100.0%	0.0%	0.0%	0.0%
2014	110	16	0	0	80.8%	19.2%	0.0%	0.0%
2015	473	25	0	0	96.9%	3.1%	0.0%	0.0%
2016	1879	89	0	0	92.5%	7.5%	0.0%	0.0%
2017	738	39	5	19	92.8%	4.4%	0.3%	2.5%
2018	1562	198	76	49	86.7%	7.6%	3.2%	2.5%

Table 55: 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. Estimated discard mortality (mt) on longline and hook & line vessels was computed by two methods. For the 2002-2010 period, a 16 % discard mortality rate was applied to gross discard estimates because viability data was not available. Since 2011, mortality rates on longline vessels are based on the viability categories assigned to individuals. For all years, an 18% discard mortality rate was applied to gross discard estimates from pot vessels.

	LE Sablefish Endorsed				LE Sablefish Non-Endorsed		OA Fixed Gear	
	Longline			Pot	Longline	Pot	Hook & Line	Pot
Year	North	South	Coastwide					
Gross Discard Estimates								
2002	126.15	11.57	137.73	4.03	0	[0.02] *	[35.38] *	[0.23] *
2003	170.2	26.61	196.81	0.3	0.17	[0.01] *	[51.45] *	[0.40] *
2004	157.62	48.35	205.97	32.6	0	[0.02] *	[44.01] *	[0.39] *
2005	221.53	13.76	235.29	2.62	0	[0.01] *	[57.02] *	[0.79] *
2006	535.52	117.32	652.84	15.79	0	[0.06] *	[44.40] *	[0.92] *
2007	108.06	20.27	128.33	3.94	1.72	0.01	20.78	0.89
2008	149.62	103.22	252.84	6.62	2.98	0.00	40.02	0.24
2009	278.91	41.84	320.75	0.85	0.24	0.01	34.92	0.26
2010	66.99	65.58	132.56	5.04	0.37	0.03	32.06	0.50
2011	106.73	26.3	133.03	4.08	21.31	0.01	12.96	0.06
2012	93.39	51.87	145.27	5.99	16.52	0.03	23.22	0.41
2013	18.86	3.37	22.23	0	0	0.01	1.73	0.06
2014	162.77	9.98	172.76	2.03	0	0.00	3.42	0.16
2015	81.24	40.64	121.88	1.63	0.46	0.00	10.14	0.00
2016	124.22	44.08	168.3	5.72	5.11	0.00	42.55	0.05
2017	254.87	39.35	294.22	0.9	0.68	0.05	47.60	0.88
2018	157.88	53.23	211.1	2.08	13.52	0.01	41.34	0.12
Estimated Discard Mortality								
2002	20.18	1.85	22.04	0.73	0	– *	– *	– *
2003	27.23	4.26	31.49	0.05	0.03	– *	– *	– *
2004	25.22	7.74	32.96	5.87	0	– *	– *	– *
2005	35.44	2.2	37.65	0.47	0	– *	– *	– *
2006	85.68	18.77	104.45	2.84	0	– *	– *	– *
2007	17.29	3.24	20.53	0.71	0.28	0.00	3.32	0.16
2008	23.94	16.52	40.45	1.19	0.48	0.00	6.40	0.04
2009	44.62	6.69	51.32	0.15	0.04	0.00	5.59	0.05
2010	10.72	10.49	21.21	0.91	0.06	0.00	5.13	0.09
2011	6.62	4.74	11.36	0.73	3.2	0.00	2.07	0.01
2012	15.51	8.35	23.86	1.08	0.72	0.00	1.54	0.07
2013	2.56	0.38	2.94	0	0	0.00	0.06	0.01
2014	27.57	2.22	29.79	0.37	0	0.00	0.33	0.03
2015	6.05	4.03	10.08	0.29	0.02	0.00	0.46	0.00
2016	8.21	7.4	15.62	1.03	0.91	0.00	2.53	0.01
2017	33.41	4.59	38.01	0.16	0.02	0.01	3.59	0.16
2018	17.48	7.07	24.55	0.37	0.61	0.00	4.31	0.02

* 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 56: Estimated P. halibut discard mortality (mt, mortality rate applied, see text for description) from each sector of the non-nearshore fixed gear fishery by year.

	Estimated Discard Mortality (mt)			
Year	LE Sablefish Endorsed	LE Sablefish Non-Endorsed	OA Fixed Gear	All Sectors
2002	22.76	0.00	0.00	22.76
2003	31.54	0.03	0.00	31.57
2004	38.82	0.00	0.00	38.82
2005	38.12	0.00	0.00	38.12
2006	107.30	0.00	0.00	107.30
2007	21.24	0.28	3.48	25.00
2008	41.65	0.48	6.45	48.57
2009	51.47	0.04	5.63	57.15
2010	22.12	0.06	5.22	27.40
2011	12.10	3.21	2.09	17.39
2012	24.94	0.73	1.61	27.28
2013	2.94	0.00	0.07	3.01
2014	30.16	0.00	0.36	30.52
2015	10.37	0.02	0.46	10.84
2016	16.65	0.91	2.54	20.10
2017	38.17	0.03	3.75	41.95
2018	24.93	0.61	4.33	29.86

Table 57: Physical measurements of P. halibut length (cm) from the U.S. west coast LE Sablefish Endorsed fishery (2002-2018) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

LE Sablefish Endorsed Hook & Line, physical lengths						
Length bin (cm)	Total No.	Dead No.		Length bin (cm)	Total No.	Dead No.
38-40	2	0		96-98	273	30
40-42	1	0		98-100	202	25
42-44	3	0		100-102	163	23
44-46	3	0		102-104	174	26
46-48	5	1		104-106	140	23
48-50	5	0		106-108	109	15
50-52	10	1		108-110	97	18
52-54	12	0		110-112	74	10
54-56	10	0		112-114	63	13
56-58	30	3		114-116	49	5
58-60	27	2		116-118	41	6
60-62	39	3		118-120	25	2
62-64	68	5		120-122	22	4
64-66	95	9		122-124	13	2
66-68	118	15		124-126	18	2
68-70	204	26		126-128	14	3
70-72	278	31		128-130	7	1
72-74	340	38		130-132	3	1
74-76	426	50		132-134	5	0
76-78	476	54		134-136	2	1
78-80	523	62		136-138	3	0
80-82	488	67		140-142	4	0
82-84	493	58		142-144	1	0
84-86	495	62		148-150	1	0
86-88	456	62		152-154	1	0
88-90	383	54		158-160	2	0
90-92	374	43				
92-94	380	42				
94-96	339	45				

Table 58: Physical measurements of P. halibut length (cm) from the U.S. west coast LE Sablefish Endorsed fishery (2002-2018) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

LE Sablefish Endorsed Pot, physical lengths					
Length bin (cm)	Total No.	Dead No.	Length bin (cm)	Total No.	Dead No.
42-44	1	1	90-92	62	11
44-46	1	0	92-94	43	8
46-48	1	1	94-96	45	7
48-50	1	0	96-98	47	10
50-52	1	0	98-100	27	8
52-54	3	0	100-102	19	5
58-60	5	0	102-104	17	5
60-62	5	1	104-106	10	3
62-64	4	1	106-108	7	0
64-66	13	2	108-110	10	1
66-68	17	4	110-112	8	2
68-70	25	2	112-114	1	0
70-72	37	6	114-116	1	0
72-74	51	9	116-118	5	2
74-76	74	9	118-120	3	0
76-78	79	13	120-122	1	0
78-80	79	15	122-124	6	2
80-82	89	19	130-132	1	0
82-84	96	21	146-148	1	0
84-86	94	14			
86-88	89	19			
88-90	77	13			

Table 59: Physical measurements of P. halibut length (cm) from the U.S. west coast LE Sablefish Non-Endorsed fishery (2002-2018) for vessels using hook & line gear. The WCGOP does not cover vessels fishing pot gear in this fishery. Length bins include the lower bound and exclude the upper bound.

LE Sablefish Non-Endorsed Hook & Line, physical lengths		
Length bin (cm)	Total No.	Dead No.
66-68	2	1
68-70	3	0
70-72	1	0
72-74	6	1
74-76	7	0
76-78	7	0
78-80	4	0
80-82	9	1
82-84	5	1
84-86	3	0
86-88	8	1
88-90	9	0
90-92	7	1
92-94	6	1
94-96	3	0
96-98	3	0
98-100	6	1
100-102	1	0
102-104	4	0
104-106	3	0
106-108	3	0
110-112	1	0
112-114	4	1
118-120	2	0
122-124	1	0
134-136	1	0

Table 60: Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2018) for vessels using hook & line or pot gear.

	OA Fixed Gear, physical lengths			
	Hook & Line		Pot	
Length bin (cm)	Total (no.)	Dead (no.)	Total (no.)	Dead (no.)
34-36	1	0	0	0
40-42	1	0	0	0
44-46	3	1	0	0
48-50	1	0	0	0
50-52	2	0	0	0
52-54	2	0	0	0
54-56	2	0	0	0
56-58	2	0	0	0
58-60	5	1	0	0
60-62	7	1	0	0
62-64	8	0	1	0
64-66	11	2	1	1
66-68	10	0	1	1
68-70	20	2	1	0
70-72	18	1	3	0
72-74	29	3	0	0
74-76	32	2	2	0
76-78	26	2	1	0
78-80	28	2	2	0
80-82	31	1	2	1
82-84	33	3	0	0
84-86	46	3	1	0
86-88	34	5	2	0
88-90	22	2	1	0
90-92	22	1	0	0
92-94	26	2	2	1
94-96	18	1	1	0
96-98	16	1	0	0
98-100	10	0	0	0
100-102	11	1	0	0
102-104	5	0	0	0
104-106	10	1	0	0
106-108	8	0	0	0
108-110	9	2	2	0

Table 60: Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2018) for vessels using hook & line or pot gear. *(continued)*

	OA Fixed Gear, physical lengths			
	Hook & Line		**Pot**	
Length bin (cm)	Total (no.)	Dead (no.)	Total (no.)	Dead (no.)
110-112	6	0	1	0
112-114	6	0	0	0
114-116	7	1	0	0
116-118	2	0	0	0
118-120	3	0	0	0
120-122	1	0	0	0
122-124	2	0	0	0

Table 61: Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish Non-Nearshore fixed gear fisheries (2002-2018) for vessels using hook & 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 & Line	No. Pot	No. Hook & Line	No. Hook & Line	No. Pot
25-34	28	0	0	1	0
35-44	88	1	0	7	0
45-54	373	2	2	23	0
55-64	2707	8	11	64	0
65-74	7095	11	28	160	0
75-84	9447	28	37	194	2
85-94	7656	13	26	108	1
95-104	4908	6	15	55	0
105-114	1378	0	8	21	0
115-124	424	0	9	7	0
125-134	95	0	4	2	0
135-144	25	0	0	0	0
145-154	6	0	0	0	0
155-164	4	0	0	1	0

8.5 Tables: Legal-Sublegal P. halibut Lengths

Table 62: 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 (2011-2018), Non-Nearshore fixed gear fisheries (LE sablefish endorsed, LE non-endorsed, OA fixed gear; 2002-2018), and the At-sea Hake sectors (2002-2018). 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	3941	41.8%
Non-Nearshore Fixed Gear	actual	82.0>	5478	58.2%
Non-Nearshore Fixed Gear	visual	0-74.0	3315	9.4%
Non-Nearshore Fixed Gear	visual	75.0-84.0	9708	27.7%
Non-Nearshore Fixed Gear	visual	82.0>	22066	62.9%
Catch Shares	actual	0-82.0	30751	52.9%
Catch Shares	actual	82.0>	27326	47.1%
Catch Shares	visual	0-74.0	1573	26.3%
Catch Shares	visual	75.0-84.0	1188	19.9%
Catch Shares	visual	82.0>	3211	53.8%
At-Sea Hake	actual	0-82.0	205	27.7%
At-Sea Hake	actual	82.0>	534	72.3%

8.6 Tables: IPHC P. halibut directed Fishery

Table 63: Observer coverage information for the Pacific halibut directed fishery by year. The WCGOP began observing the Pacific halibut directed fishery in 2017 at the request of the International Pacific Halibut Commission.

P. halibut directed Fishery									
		Observed						Fleet-wide	
		Number of:							
Year	Gear	Vessels	Trips	Sets	Lost Hooks	Total Hooks	Retained (mt)	Retained (mt)	Coverage
2017	Hook & Line	13	22	62	2269	973150	10.21	135.02	8.0%
2018	Hook & Line	13	27	81	7040	2110679	29.62	116.17	26.0%

Table 64: Discard ratio and gross discard estimate of P. halibut for the P. halibut directed fishery. LCL = lower confidence limit; UCL = upper confidence limit

P. halibut directed Fishery						
		Observed			Fleet-wide	
Year	Gear	Discard (mt)	Retained (mt)	Ratio (LCL-UCL)	Retained (mt)	Gross discard (mt, LCL-UCL)
2017	Hook & Line	1.9	10.2	0.19 (0.1 - 0.3)	135.0	25.4 (9.3-41.4)
2018	Hook & Line	3.8	29.6	0.13 (0.1 - 0.2)	116.2	15.1 (9-21.1)

Table 65: Pacific halibut viablities from the Pacific halibut directed fishery. The injury status of sampled discarded P. halibut was identified as minor, moderate, and serious injuries or dead (see Appendices in WCGOP manual), consistent with International Pacific Halibut Commission protocol.The number of fish in each category was weighted based on the length-weight relationship as described in the Methods.

P. halibut directed Fishery									
		Number				% Weighted			
Year	Gear	Minor	Moderate	Serious	Dead	Minor	Moderate	Serious	Dead
2017	Hook & Line	102	8	2	2	89.0%	7.0%	2.0%	2.0%
2018	Hook & Line	173	27	4	13	79.0%	12.0%	2.0%	8.0%

Table 66: Pacific halibut mortality from the Pacific halibut directed fishery. The injury status of sampled discarded P. halibut was identified as minor, moderate, and serious injuries or dead (see Appendices in WCGOP manual), consistent with International Pacific Halibut Commission protocol.The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Mortality rates (Table 10) were applied to each injury category. LCL = lower confidence limit; UCL = upper confidence limit

P. halibut directed Fishery							
		Gross (mt, LCL-UCL)	Discard Mortality (mt, LCL-UCL)				
Year	Gear	Discards	Minor	Moderate	Serious	Dead	Total
2017	Hook & Line	25.4 (9.3-41.4)	0.8 (0.3-1.3)	0.6 (0.2-1)	0.3 (0.1-0.5)	0.5 (0.2-0.8)	2.2 (0.8-3.6)
2018	Hook & Line	15.1 (9-21.1)	0.4 (0.2-0.6)	0.7 (0.4-0.9)	0.2 (0.1-0.3)	1.1 (0.7-1.6)	2.4 (1.4-3.4)

Table 67: Physical length measurements of discarded P. halibut from the Pacific halibut directed fishery. Length bins include the lower bound and exclude the upper bound.

P. halibut directed Fishery Hook & Line physical lengths		
Length bin (cm)	Total No. Individuals	No. Dead Individuals
44-46	1	0
54-56	1	0
60-62	2	0
62-64	6	1
66-68	5	1
68-70	10	0
70-72	19	2
72-74	25	2
74-76	43	4
76-78	54	4
78-80	80	11
80-82	53	7
82-84	20	3
84-86	5	2
86-88	2	1
88-90	3	2
90-92	1	1
110-112	1	0

Table 68: Visual length estimates of discarded P. halibut from the Pacific halibut directed fishery. Length bins include the lower bound and exclude the upper bound.

P. halibut directed Fishery Hook & Line visual estimates	
Length bin (cm)	Total No. Individuals
45-54	12
55-64	85
65-74	272
75-84	227
85-94	26
95-104	6
125-134	1

8.7 Tables: Observed State Fisheries

Table 69: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Oregon nearshore fixed gear groundfish fisheries by state and year. The WCGOP began observing 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.

		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 95% CI (mt)	Bycatch upper 95% CI (mt)
Oregon											
2002	*not observed*	–	–	–	–	–	–	279.95	–	–	–
2003	*not observed*	–	–	–	–	–	–	208.9	–	–	–
2004	4.88%	210	1.90%	0.05	10.26	0.00	0.00	210.32	1.002	0.440	1.564
2005	6.56%	170	0.59%	0.03	11.84	0.00	0.00	180.39	0.495	0.398	0.593
2006	11.86%	385	1.30%	0.06	19.63	0.00	0.00	165.55	0.530	0.274	0.786
2007	8.94%	248	0.40%	0.01	16.23	0.00	0.00	181.49	0.087	0.072	0.101
2008	7.73%	185	0.54%	0.03	14.63	0.00	0.00	189.26	0.352	0.289	0.415
2009	6.24%	225	2.22%	0.08	13.95	0.01	0.00	223.32	1.283	0.747	1.820
2010	7.84%	213	0.47%	0.01	13.46	0.00	0.00	171.64	0.078	0.065	0.092
2011	8.18%	244	2.05%	0.09	15.88	0.01	0.00	194.25	1.096	0.400	1.791
2012	10.57%	290	1.38%	0.11	20.71	0.01	0.00	196.01	1.064	0.322	1.806
2013	7.78%	264	0.76%	0.02	16.08	0.00	0.00	206.74	0.291	0.197	0.384
2014	8.22%	197	2.03%	0.08	16.64	0.00	0.00	202.29	0.958	0.550	1.367
2015	8.47%	237	1.69%	0.12	18.43	0.01	0.00	217.53	1.446	0.099	2.793
2016	12.13%	265	4.53%	0.37	21.87	0.02	0.00	180.38	3.045	1.349	4.740
2017	10.68%	237	3.80%	0.19	24.77	0.01	0.00	232.02	1.794	1.125	2.463
2018	8.65%	255	3.53%	0.14	21.27	0.01	0.00	245.93	1.595	1.058	2.133

Table 70: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the California nearshore fixed gear groundfish fisheries by state and year. The WCGOP began observing the California nearshore fishery in 2003. 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.

		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 95% CI (mt)	Bycatch upper 95% CI (mt)
California											
2002	*not observed*	–	–	–	–	–	–	382.36	–	–	–
2003	3.17%	204	0.00%	0.00	8.10	0.00	0.00	255.53	0.000	0.000	0.000
2004	7.96%	434	0.00%	0.00	23.25	0.00	0.00	292.2	0.000	0.000	0.000
2005	4.62%	219	0.91%	0.08	13.01	0.01	0.00	281.8	1.721	0.003	3.596
2006	3.20%	161	0.00%	0.00	8.34	0.00	0.00	260.71	0.000	0.000	0.000
2007	4.26%	227	0.00%	0.00	11.82	0.00	0.00	277.23	0.000	0.000	0.000
2008	2.25%	89	0.00%	0.00	6.68	0.00	0.00	296.76	0.000	0.000	0.000
2009	2.57%	123	0.00%	0.00	6.71	0.00	0.00	260.84	0.000	0.000	0.000
2010	3.22%	117	0.00%	0.00	7.06	0.00	0.00	219.55	0.000	0.000	0.000
2011	3.90%	214	0.47%	0.08	8.44	0.01	0.00	216.78	1.984	1.549	2.418
2012	5.92%	239	1.26%	0.07	11.90	0.01	0.00	201.11	1.193	0.175	2.212
2013	5.28%	194	1.55%	0.06	11.70	0.00	0.00	221.48	1.078	0.565	1.591
2014	4.63%	183	0.00%	0.00	11.45	0.00	0.00	247.36	0.000	0.000	0.000
2015	6.85%	277	0.00%	0.00	22.84	0.00	0.00	333.39	0.000	0.000	0.000
2016	5.30%	156	0.00%	0.00	13.23	0.00	0.00	249.47	0.000	0.000	0.000
2017	5.65%	163	0.00%	0.00	12.21	0.00	0.00	215.97	0.000	0.000	0.000
2018	4.70%	135	0.00%	0.00	10.59	0.00	0.00	225.4	0.000	0.000	0.000

Table 71: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Washington and Oregon state pink shrimp fisheries by state and year. The WCGOP began observing the OR state pink shrimp fishery in 2004, but was unable to observe it 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 estimated. Coverage rate in the pink shrimp fisheries is defined as the proportion of pink shrimp landings that were observed. (*) = Confidential data; (–) = not observed; LCL/UCL = lower/upper 95% confidence limit.

	Observed								Estimated		
Year	Coverage rate	No. of sets	% sets w/P. halibut	P. halibut bycatch (kg)	Shrimp retained (kg)	Bycatch rate	SE	Shrimp landings (mt)	P. halibut bycatch (mt)	LCL	UCL
Washington											
2010	9.30%	341	0.00%	0.00	399484	0.00000	0.00000	4296	0.00	0.00	0.00
2011	16.17%	578	0.17%	7.66	697238	0.00001	0.00000	4312	0.05	0.04	0.05
2012	14.77%	522	0.00%	0.00	625952	0.00000	0.00000	4239	0.00	0.00	0.00
2013	10.18%	386	0.00%	0.00	626823	0.00000	0.00000	6158	0.00	0.00	0.00
2014	7.03%	401	0.00%	0.00	976192	0.00000	0.00000	13876	0.00	0.00	0.00
2015	11.45%	1454	0.00%	0.00	2139754	0.00000	0.00000	18682	0.00	0.00	0.00
2016	17.32%	973	0.00%	0.00	1107926	0.00000	0.00000	6396	0.00	0.00	0.00
2017	19.49%	915	0.00%	0.00	592624	0.00000	0.00000	3041	0.00	0.00	0.00
2018	16.27%	720	0.14%	1.82	624039	0.00000	0.00000	3835	0.01	0.01	0.01
Oregon											
2002	*not observed*	–	–	–	–	–	–	18896	–	–	–
2003	*not observed*	–	–	–	–	–	–	9322	–	–	–
2004	7.72%	765	0.00%	0.00	427212	0.00000	0.00000	5537	0.00	0.00	0.00
2005	5.63%	533	0.19%	2.27	402886	0.00001	0.00000	7159	0.04	0.04	0.05
2006	*not observed*	–	–	–	–	–	–	5532	–	–	–
2007	7.12%	929	0.22%	15.26	649983	0.00002	0.00001	9129	0.21	0.03	0.39
2008	5.81%	785	0.00%	0.00	672491	0.00000	0.00000	11576	0.00	0.00	0.00
2009	7.48%	672	0.00%	0.00	751198	0.00000	0.00000	10049	0.00	0.00	0.00
2010	11.94%	1233	0.00%	0.00	1706840	0.00000	0.00000	14290	0.00	0.00	0.00
2011	13.63%	1892	0.11%	19.33	2985964	0.00001	0.00000	21915	0.14	0.05	0.24
2012	13.52%	2122	0.00%	0.00	3014219	0.00000	0.00000	22292	0.00	0.00	0.00
2013	10.74%	1403	0.00%	0.00	2313243	0.00000	0.00000	21538	0.00	0.00	0.00
2014	9.64%	1445	0.00%	0.00	2272045	0.00000	0.00000	23573	0.00	0.00	0.00
2015	9.38%	1984	0.00%	0.00	2275792	0.00000	0.00000	24274	0.00	0.00	0.00
2016	14.33%	2469	0.00%	0.00	2309357	0.00000	0.00000	16116	0.00	0.00	0.00
2017	13.91%	1623	0.00%	0.00	1454896	0.00000	0.00000	10459	0.00	0.00	0.00
2018	13.10%	2284	0.00%	0.00	2124356	0.00000	0.00000	16212	0.00	0.00	0.00

Table 72: Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the California state pink shrimp fisheries by state and year. The WCGOP began observing the CA state pink shrimp fishery in 2004, but was unable to observe it in 2006. Mortality rates are not applied to P. halibut bycatch in this fishery because mortality rates for pink shrimp trawl gear have not been estimated. Coverage rate is defined as the proportion of pink shrimp landings that were observed. (*) = Confidential data; (–) = not observed; LCL/UCL = lower/upper 95% confidence limit.

	Observed								Estimated		
Year	Coverage rate	No. of sets	% sets w/P. halibut	P. halibut bycatch (kg)	Shrimp retained (kg)	Bycatch rate	SE	Shrimp landings (mt)	P. halibut bycatch (mt)	LCL	UCL
California											
2002	*not observed*	–	–	–	–	–	–	1849	–	–	–
2003	*not observed*	–	–	–	–	–	–	974	–	–	–
2004	*	*	*	*	*	*	*	992	*	*	*
2005	*	*	*	*	*	*	*	859	*	*	*
2006	*not observed*	–	–	–	–	–	–	63	–	–	–
2007	*	*	*	*	*	*	*	289	*	*	*
2008	*	*	*	*	*	*	*	945	*	*	*
2009	*	*	*	*	*	*	*	1183	*	*	*
2010	14.99%	134	0.00%	0.00	265531	0.00000	0.00000	1771	0.00	0.00	0.00
2011	12.62%	203	0.00%	0.00	420595	0.00000	0.00000	3333	0.00	0.00	0.00
2012	12.46%	175	0.00%	0.00	347598	0.00000	0.00000	2791	0.00	0.00	0.00
2013	9.19%	188	0.00%	0.00	359770	0.00000	0.00000	3915	0.00	0.00	0.00
2014	15.54%	337	0.00%	0.00	597530	0.00000	0.00000	3845	0.00	0.00	0.00
2015	9.69%	335	0.30%	0.91	334660	0.00000	0.00000	3453	0.01	0.01	0.01
2016	22.75%	405	0.00%	0.00	311723	0.00000	0.00000	1370	0.00	0.00	0.00
2017	16.01%	257	0.00%	0.00	241800	0.00000	0.00000	1510	0.00	0.00	0.00
2018	15.96%	492	0.00%	0.00	365187	0.00000	0.00000	2288	0.00	0.00	0.00

Table 73: 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 estimated. Coverage rate in the CA halibut fishery is defined as the proportion of CA halibut landings that were observed. CHLB = California halibut

		Observed							Estimated		
Year	Fleet observer coverage rate	Number of observed hauls	% of hauls with P. halibut	P.halibut bycatch (mt)	CHLB retained (mt)	P.halibut bycatch rate	SE bycatch rate	Total fleet catch of CHLB (mt)	P.halibut bycatch (mt)	Bycatch lower 95% CI (mt)	Bycatch upper 95% CI (mt)
LE CA Halibut											
2002	3.31%	52	0.00%	0.000	3588	0.00000	0.00000	108	0.000	0.000	0.000
2003	18.06%	207	0.00%	0.000	19093	0.00000	0.00000	106	0.000	0.000	0.000
2004	23.06%	171	0.58%	3.493	31488	0.00011	0.00001	137	0.015	0.012	0.018
2005	16.16%	235	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	29.29%	81	1.23%	8.119	5447	0.00149	0.00023	19	0.028	0.019	0.036
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
2011-2018					Observed under IFQ fisheries, see Table 24						
LE & OA CA Halibut											
2010	7.12%	153	0.00%	0.000	8796	0.00000	0.00000	124	0.000	0.000	0.000
OA CA Halibut											
2003	7.68%	110	0.00%	0.000	1975	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	11.52%	362	0.00%	0.000	7431	0.00000	0.00000	65	0.000	0.000	0.000
2006	*not observed*	–	–	–	–	–	–	55	–	–	–
2007	7.01%	227	0.00%	0.000	2745	0.00000	0.00000	39	0.000	0.000	0.000
2008	5.14%	199	0.00%	0.000	2666	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
2010 *combined with LE 2010 above*											
2011	15.58%	204	0.00%	0.000	12445	0.00000	0.00000	80	0.000	0.000	0.000
2012	6.40%	78	0.00%	0.000	3541	0.00000	0.00000	55	0.000	0.000	0.000
2013	6.24%	81	0.00%	0.000	4305	0.00000	0.00000	69	0.000	0.000	0.000
2014	22.41%	145	0.00%	0.000	18139	0.00000	0.00000	81	0.000	0.000	0.000
2015	33.28%	339	0.00%	0.000	30614	0.00000	0.00000	92	0.000	0.000	0.000
2016	30.52%	500	0.00%	0.000	27326	0.00000	0.00000	90	0.000	0.000	0.000
2017	26.17%	556	0.00%	0.000	24290	0.00000	0.00000	93	0.000	0.000	0.000
2018	25.68%	546	0.00%	0.000	18584	0.00000	0.00000	72	0.000	0.000	0.000

Table 74: Observer coverage information for the Sea Cucumber fishery by year. The WCGOP began observing the Sea Cucumber fishery in 2017. * = confidential

Sea Cucumber Fishery									
		Observed					Fleet-wide		
Year	Gear	No. of Vessels	No. of Trips	No. of Sets	Cucumber Retained (mt)	P. halibut (mt)[1]	Cucumber Landed (mt)	Total Landed (mt)	Coverage
2017	Bottom Trawl	3	22	52	1.95	0	13.83	13.92	14.0%
2018	Bottom Trawl	*	*	*	*	*	*	*	*

[1] includes both discarded and retained

Table 75: Observer coverage information for the Ridgeback Prawn fishery by year. The WCGOP began observing the Ridgeback Prawn fishery in 2017.

Ridgeback Prawn Fishery									
		Observed					Fleet-wide		
Year	Gear	No. of Vessels	No. of Trips	No. of Sets	Prawn Retained (mt)	P. halibut (mt)[1]	Prawn Landed (mt)	Total Landed (mt)	Coverage
2017	Shrimp Trawl	9	67	297	17.01	0	170.50	217.98	10.0%
2018	Shrimp Trawl	5	22	132	5.10	0	165.05	212.61	3.0%

[1] includes both discarded and retained

8.8 Tables: Other EFP fleet and PHLB catch summaries

Table 76: Metric tons of Pacific halibut discarded at sea and landed and discarded at the dock on observed Exempted Fishing Permit (EFP) vessels. Note: This does not contain the Catch Shares Electronic Monitoring EFP data, see Table 42 for those data.

		Exempted Fishing Permits (non-EM)				
		Observed				
Year	Gear	No.of vessels	No.of trips	No.of hauls	PHLB discarded (mt)	PHLB landed (mt)
2002	Bottom & Midwater Trawl	7	38	279	53.36	0
2003	Bottom & Midwater Trawl	12	156	1491	50.79	0
2004	Bottom & Midwater Trawl	6	59	427	30.68	0
2005	–	0	0	0	0.00	0
2006	Bottom & Midwater Trawl	9	48	80	0.00	0
2007	–	0	0	0	0.00	0
2008	Fixed Gears	3	29	162	0.00	0
2009	Fixed Gears	5	83	141	0.00	0
2010	Fixed Gears	6	136	389	0.00	0
2011	–	0	0	0	0.00	0
2013	Fixed Gears	2	5	166	0.00	0
2014	Fixed Gears	3	11	21	0.00	0
2015	Fixed Gears	1	3	4	0.00	0
2016	Fixed Gears	1	3	3	0.00	0
2017	Fixed Gears	4	18	27	0.00	0
2018	Fixed Gears	5	55	69	0.00	0

Table 77: Metric tons of Pacific halibut landed in non-groundfish fisheries that are not observed by the NWFSC Observer Program. Data are summarized from the PacFIN fish tickets and do not include any P. halibut landed under the IPHC P. halibut directed fishery.

	Unobserved Fisheries	
Year	Sector	PHLB landings (mt)
2002	Other Fisheries	24.85
2003	Other Fisheries	28.33
2004	Other Fisheries	26.63
2005	Other Fisheries	26.39
2006	Other Fisheries	20.73
2007	Other Fisheries	14.95
2008	Other Fisheries	9.14
2009	Other Fisheries	7.07
2010	Other Fisheries	17.21
2011	Other Fisheries	14.21
2012	Other Fisheries	17.99
2013	Other Fisheries	18.35
2014	Other Fisheries	21.33
2015	Other Fisheries	17.29
2016	Other Fisheries	15.42
2017	Other Fisheries	22.76
2018	Other Fisheries	22.02

Table 78: Discard estimates for all fishery sectors observed by the NWFSC Groundfish Observer Program, 2002-2018. Total discard mortality estimates are also provided where discard mortality rates were applied. Estimates include individuals discarded at the dock (100% mortality). Ridgeback Prawn (2017-18) and Sea Cucumber (2017 only) fisheries had zero (0) observed P. halibut catch. The 2018 Sea Cucumber fishery data is confidential.

	IFQ Fishery[7]							Non-Nearshore Fixed Gear								
Year	LE bottom trawl 2002-2010	Bottom Trawl [1,2,7]	LE CA Halibut [1,3]	Hook & Line	Pot [7]	Midwater Rockfish [3,4,7]	Midwater Hake[2,3,5,7]	LE Endorsed	LE Non-Endorsed	OA	Nearshore Fixed Gear[3]	Pink Shrimp[3]	CA Halibut [3,6]	P.halibut Directed	At-sea Hake[3]	Total
Gross Discard Estimates (mt)																
2002	524.41							141.76	0.00	-	-	-	0.00	-	1.14	667.31
2003	186.65							197.11	0.17	-	0.00	-	0.00	-	2.65	386.58
2004	212.43							238.57	0.00	-	1.00	0.00	0.70	-	1.13	453.83
2005	460.35							237.90	0.00	-	2.22	0.04	0.03	-	1.97	702.51
2006	390.91							668.62	0.00	-	0.53	-	0.02	-	0.83	1060.91
2007	294.38							132.27	1.73	21.66	0.09	0.21	0.03	-	1.18	451.55
2008	305.21							259.46	2.99	40.25	0.35	0.00	0.31	-	3.98	612.55
2009	385.24							321.60	0.25	35.18	1.28	0.00	0.00	-	0.33	743.88
2010	265.08							137.60	0.39	32.56	0.08	0.00	0.00	-	1.57	437.28
2011		64.14	0	6.06	3.36	*	0.35	137.11	21.31	13.03	3.08	0.19	0.00	-	0.61	249.24
2012		67.13	*	14.66	1.89	0.0	0.62	151.25	16.55	23.63	2.26	0.00	0.00	-	0.64	278.63
2013		66.08	see[1]	3.00	0.98	0.0	1.34	22.23	0.01	1.79	1.37	0.00	0.00	-	1.06	97.86
2014		55.89	see[1]	3.80	0.32	0.0	1.36	174.79	0.00	3.58	0.96	0.00	0.00	-	0.37	241.07
2015		69.27	see[1]	9.49	2.21	0.0	0.70	123.51	0.46	10.14	1.45	0.01	0.00	-	0.06	217.30
2016		58.85	see[1]	6.39	1.77	0.0	0.68	174.02	5.11	42.60	3.04	0.00	0.00	-	0.15	292.61
2017		64.77	see[1]	4.14	1.84	0.0	0.51	295.12	0.74	48.48	1.79	0.00	0.00	25.35	0.55	443.29
2018		51.79	see[1]	4.65	2.64	0.0	1.34	213.18	13.53	41.46	1.60	0.01	0.00	15.06	0.66	345.92
Total Discard Mortality (mt)																
2002	344.82							22.76	0.00	-	-	-	0.00	-	1.14	368.72
2003	124.43							31.54	0.03	-	0.00	-	0.00	-	2.65	158.65
2004	133.12							38.82	0.00	-	1.00	0.00	0.70	-	1.13	174.77
2005	286.52							38.12	0.00	-	2.22	0.04	0.03	-	1.97	328.90
2006	242.47							107.30	0.00	-	0.53	-	0.02	-	0.83	351.15
2007	208.81							21.24	0.28	3.48	0.09	0.21	0.03	-	1.18	235.32
2008	207.81							41.65	0.48	6.45	0.35	0.00	0.31	-	3.98	261.03
2009	251.1							51.47	0.04	5.63	1.28	0.00	0.00	-	0.33	309.85
2010	180.97							22.12	0.06	5.22	0.08	0.00	0.00	-	1.57	210.02
2011		31.30	0	0.97	0.89	*	0.35	12.10	3.21	2.09	3.08	0.19	0.00	-	0.61	54.79
2012		36.13	*	2.34	0.51	0.0	0.62	24.94	0.73	1.61	2.26	0.00	0.00	-	0.64	69.78
2013		32.41	see[1]	0.48	0.21	0.0	1.34	2.94	0.00	0.07	1.37	0.00	0.00	-	1.06	39.88
2014		26.28	see[1]	0.61	0.08	0.0	1.36	30.16	0.00	0.36	0.96	0.00	0.00	-	0.37	60.18
2015		33.36	see[1]	1.52	0.38	0.0	0.70	10.37	0.02	0.46	1.45	0.01	0.00	-	0.06	48.33
2016		33.28	see[1]	1.02	0.18	0.0	0.68	16.65	0.91	2.54	3.04	0.00	0.00	-	0.15	58.45
2017		35.11	see[1]	0.66	0.78	0.0	0.51	38.17	0.03	3.75	1.79	0.00	0.00	2.22	0.55	83.57
2018		30.45	see[1]	0.74	0.29	0.0	1.34	24.93	0.61	4.33	1.60	0.01	0.00	2.39	0.66	67.35

Note:
Ridgeback Prawn (2017-18) and Sea Cucumber (2017 only) fisheries had zero (0) observed P. halibut catch. The 2018 Sea Cucumber fishery data is confidential.

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

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

[3] 100\% mortality rate

[4] from 2011-14, 'Midwater Trawl'

[5] from 2011-14, 'Shoreside Hake'

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

[7] Includes P. halibut catch from IFQ electronic monitoring EFP

9 FIGURES

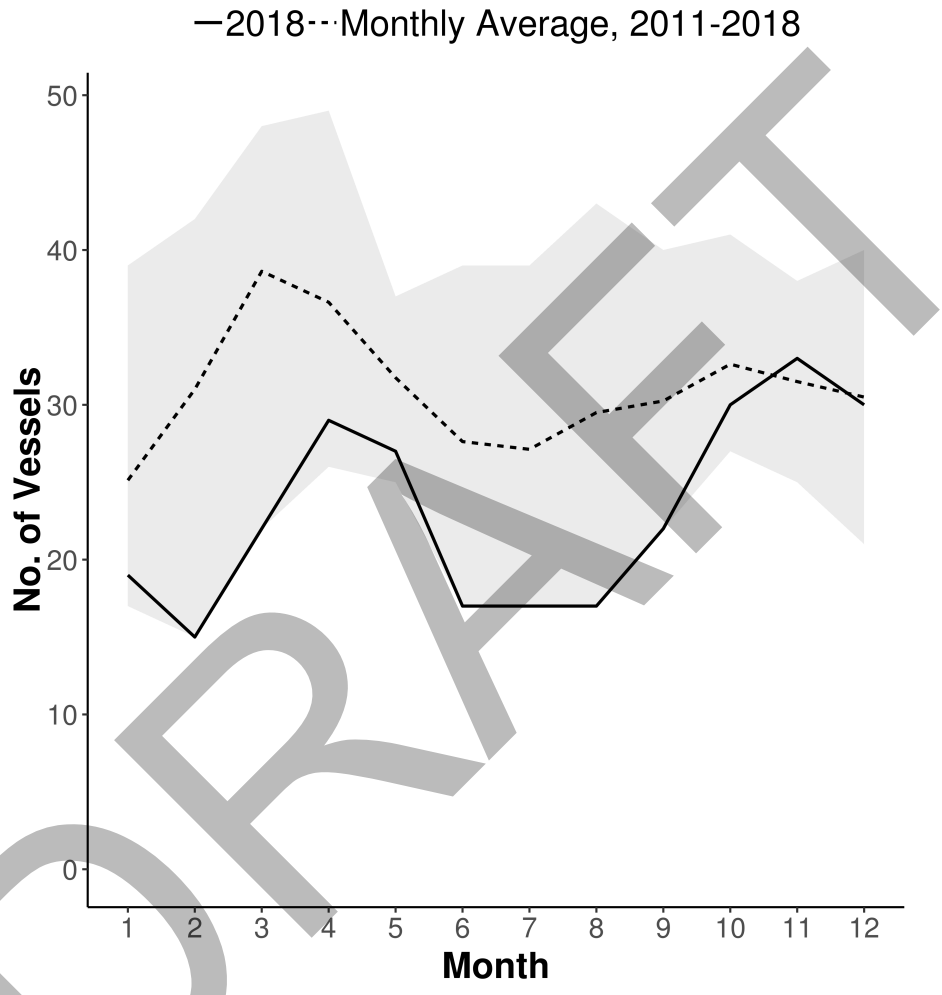


Figure 2: Number of vessels by month for IFQ bottom trawl vessels in 2018 (solid line) and averaged over the 2011–18 period (dotted line). Grey ribbon represents the monthly maximum and minimum across 2011-2018. Data from vessels using EM is not included.

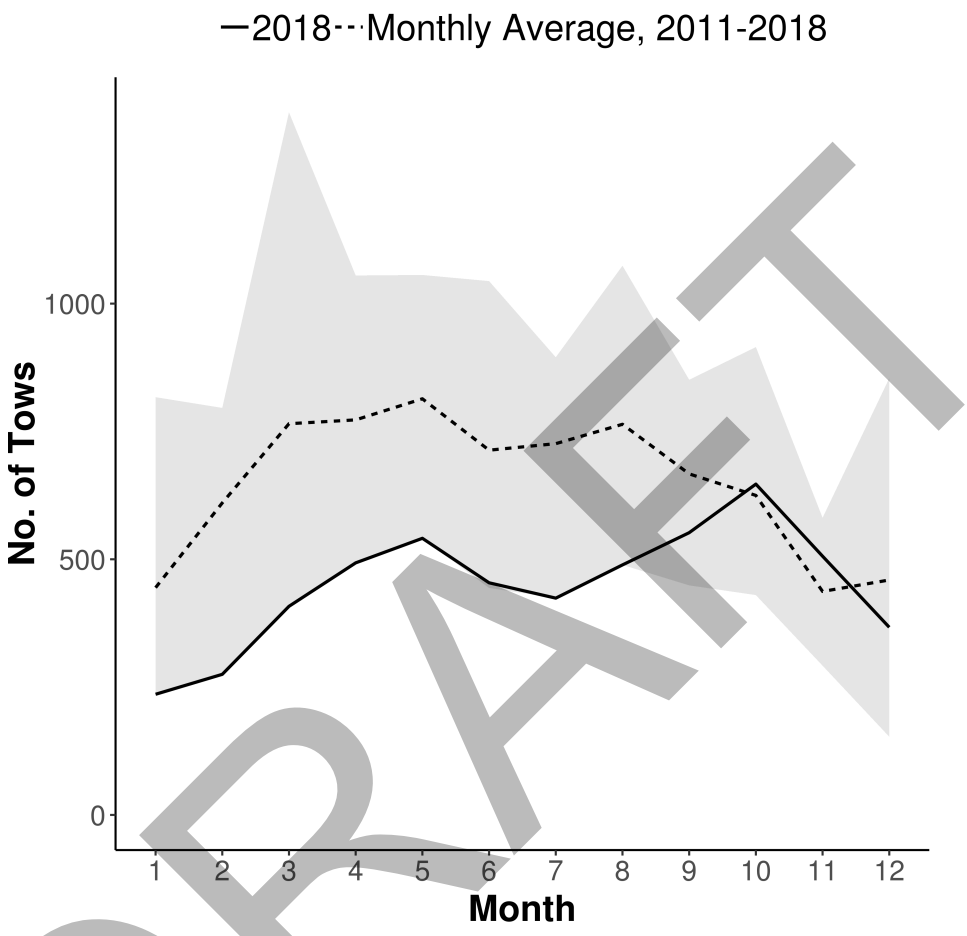


Figure 3: Number of tows by month for IFQ bottom trawl vessels in 2018 (solid line) and averaged over the 2011–18 period (dotted line). Grey ribbon represents the monthly maximum and minimum across 2011-2018. Data from vessels using EM is not included.

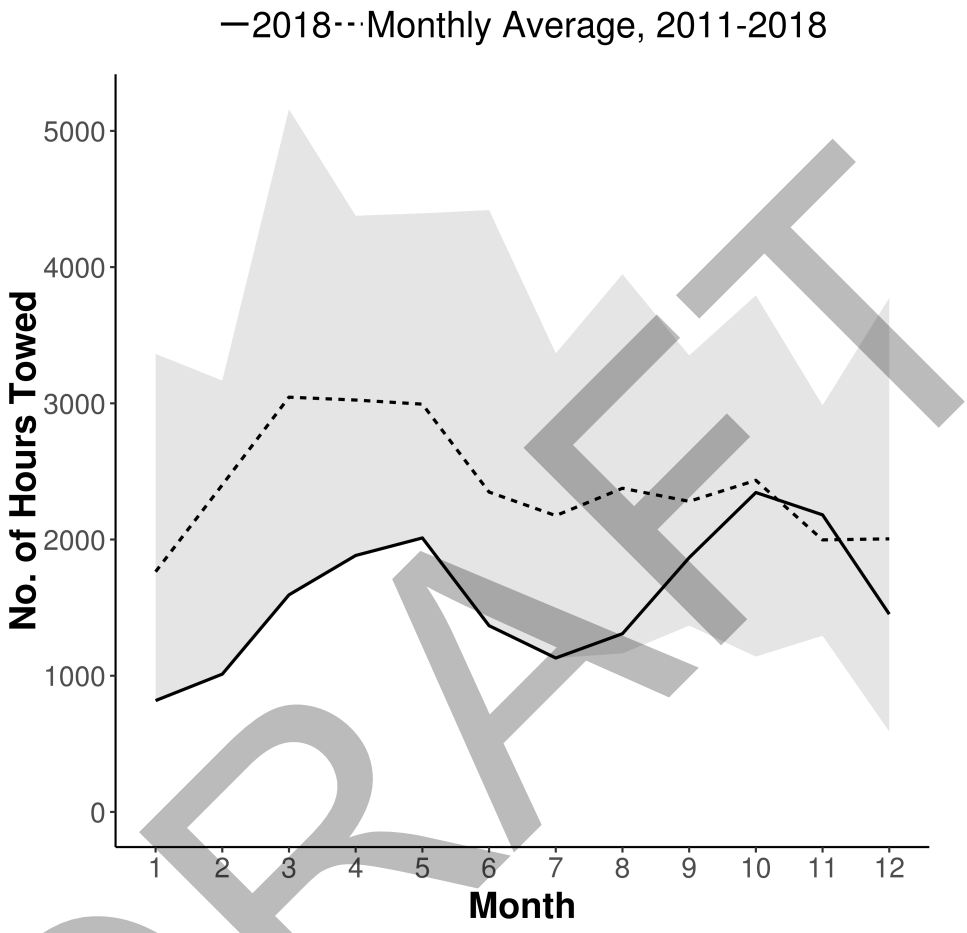


Figure 4: Tow hours by month for IFQ bottom trawl vessels in 2018 (solid line) and averaged over the 2011–18 period (dotted line). Grey ribbon represents the monthly maximum and minimum across 2011-2018. Data from vessels using EM is not included.

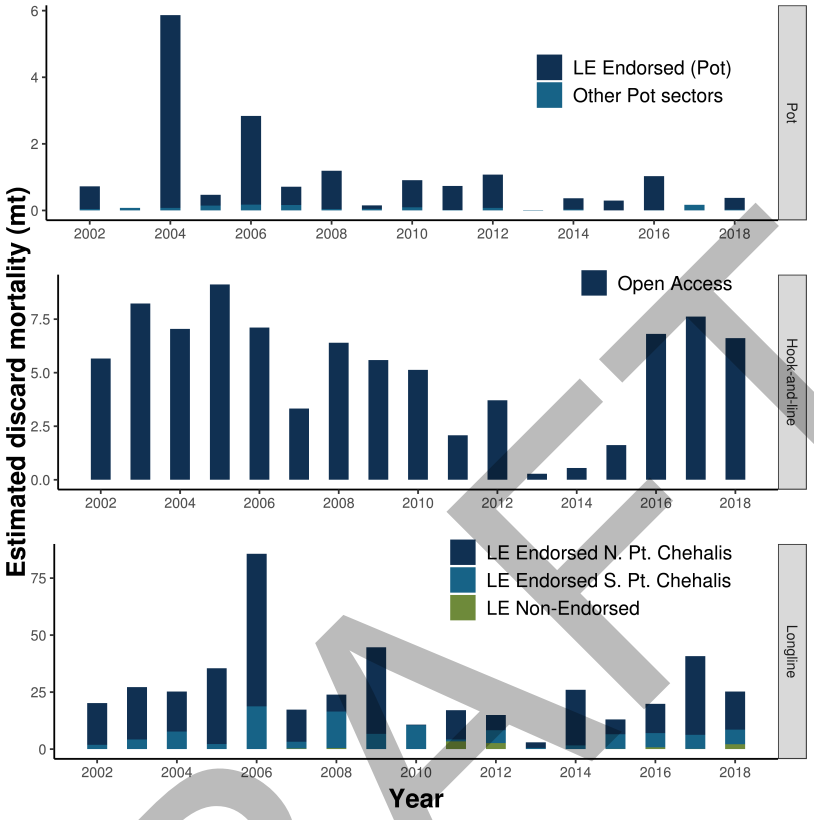


Figure 5: Estimated discard mortality of P. halibut in the non-nearshore fixed gear fishery by sector and year. We apply a fixed average discard rate from 2007-08 data to generate 2002-06 discard estimates for the OA sector because only a portion of the fishery was observed 2002-06. The 'Other fixed 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 (LL) gear, during years with very small bycatch.

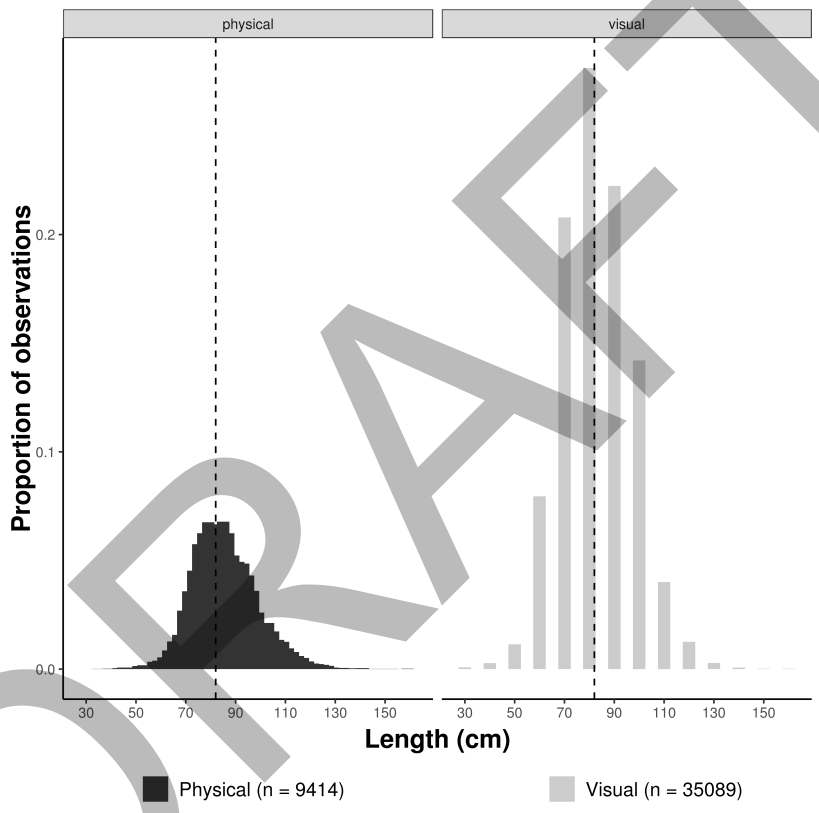


Figure 6: Length frequency distribution of discarded Pacific halibut on WCGOP observed non-nearshore fixed gear limited entry (LE) and open access (OA) groundfish vessels from September 2003 through December 2018. The majority of P. halibut lengths collected in this fishery were visual estimates (grey bars) which are only estimated in 10 cm bins. The sublegal-legal size cut-off (82 cm) is indicated by a vertical dashed line.

Figure 7: Spatial distribution of Pacific halibut bycatch (mt/km^2) observed by West Coast Groundfish Observer Program (2002-2018), 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 (200 sq. km) with less than 3 vessels were omitted from the map to maintain confidentiality.

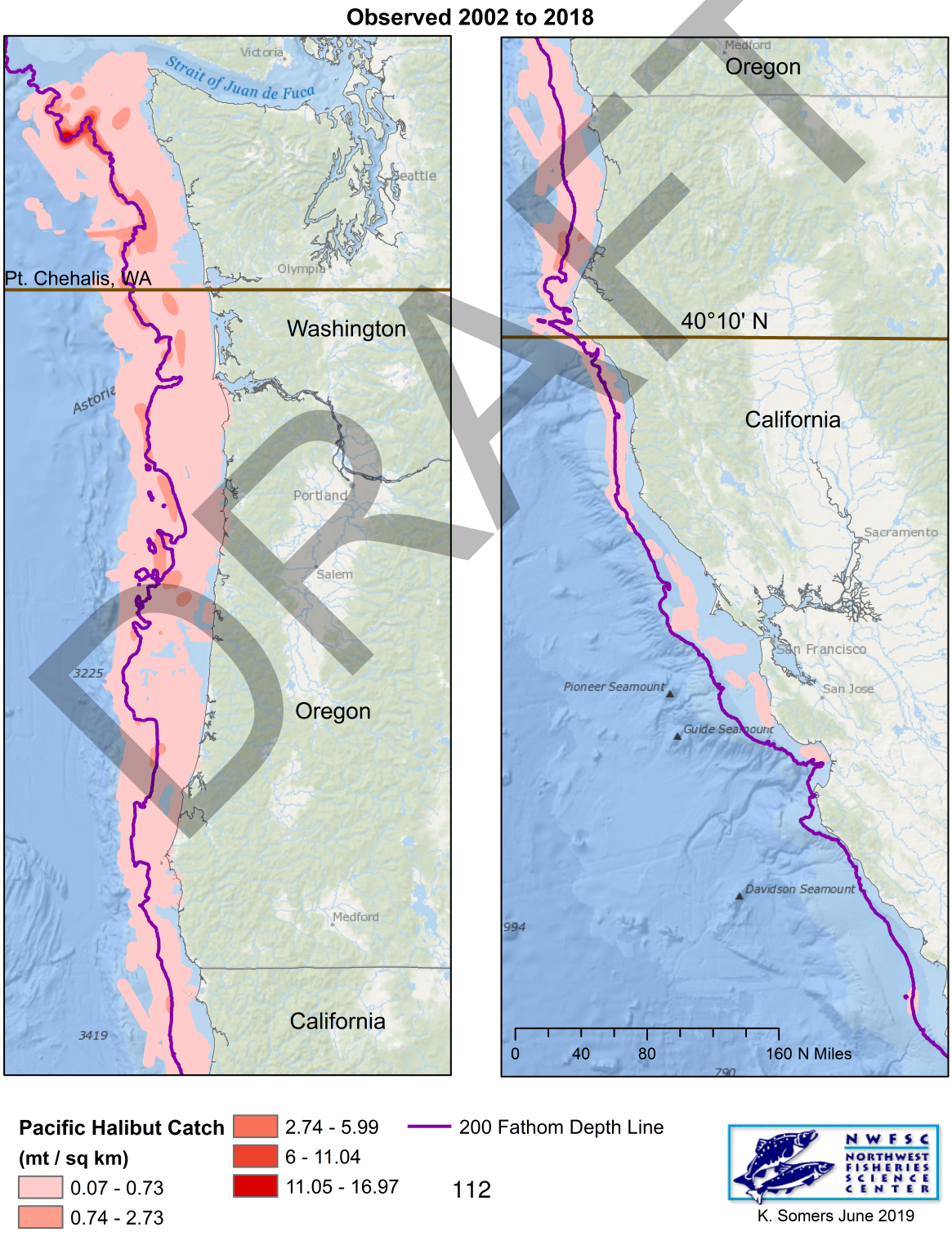


Table 79: Dates for IPHC P. halibut directed commercial (non-tribal) fishery in area 2A.

P. halibut Directed Fishery		
Year	Month	Day
2017	June	28
2017	July	12
2017	July	26
2018	June	27
2018	July	11
2018	July	25

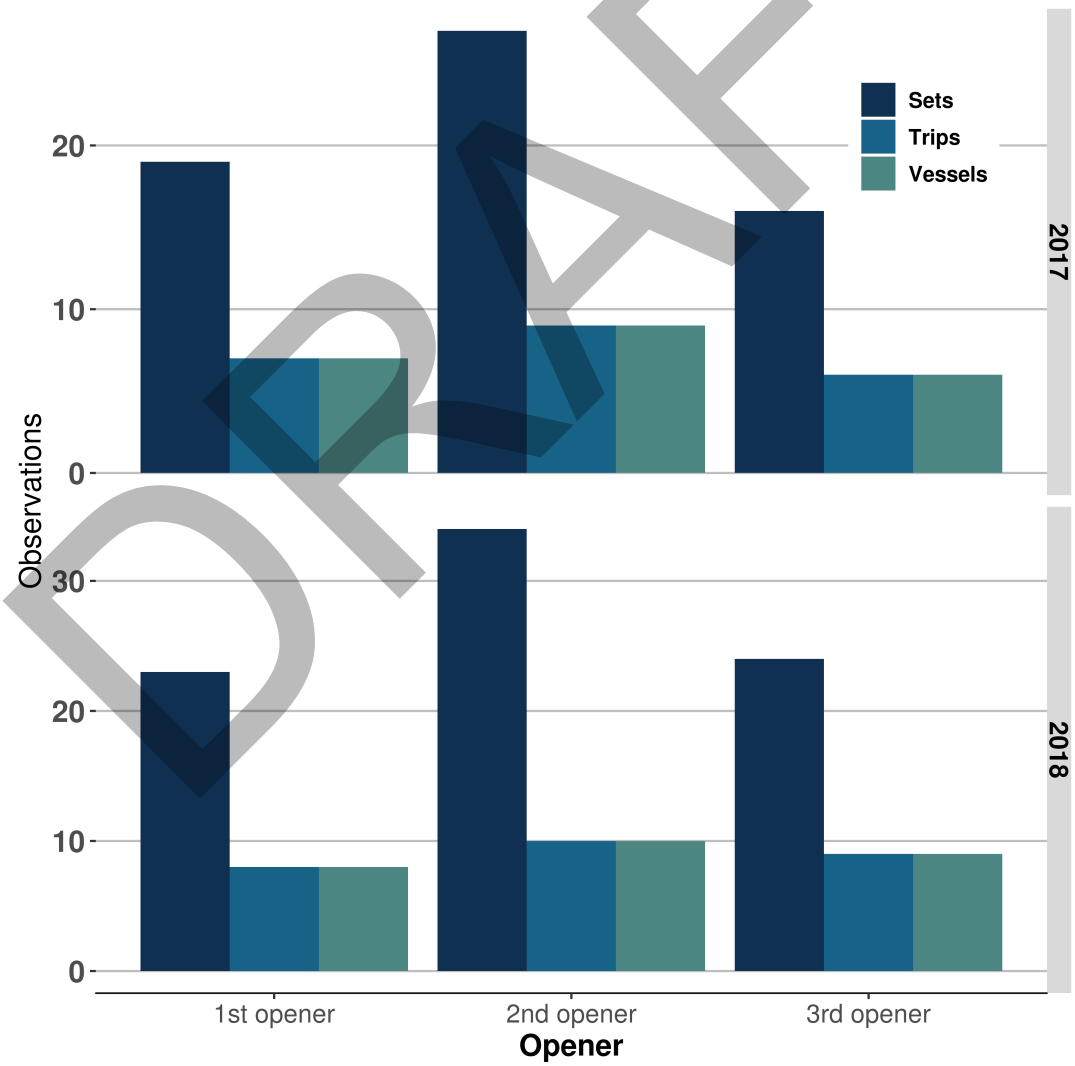


Figure 8: Number of sets, trips, and vessels by opening day for the P. halibut directed fishery

A Appendicies

A.1 IFQ Electronic Monitoring DMR comparison

PFMC staff, the NOAA Western Regional Office, and IPHC have requested a comparison of discard mortality rates (DMR) for bottom trawl and pot vessels in the IFQ program that carry electronic monitoring (EM) equipment versus those that carry observers on 100% of the fishing trips. When notified, EM vessels are required to carry observers for scientific observation, including collection of Pacific halibut viabilities. The WCGOP aims to observe approximately 30% of EM fishing trips. DMRs for EM vessels were calculated and compared using two methods:

1. Obesrver Viability Method
2. Time on Deck Model

The Observer Viability Method used human observer data collected on EM vessels. These data were stratified to match, as closely as possible, the current stratification used in the IFQ fishery while meeting confidentiality requirements. Confidentiality of EM data required combining strata across years, depths and areas. Mortality data from non-EM IFQ vessels is also shown for comparison purposes. Other than slight modification of stratification to maintain confidentiality, the observer viability method is identical to the method described in Section 3.2.1.

The Time-on-Deck model was developed in a collaborative process between PSMFC and the PFMC's Groundfish Management Team (GMT). The model measures the time each fish spends out of the water which correlates with P. halibut viability: the less time a fish spends out of the water the higher probability of the fish being in 'excellent' viability condition and therefore lower mortality rate. The Time-on-Deck model substitues for a viability assessment on EM vessels when fisheries observers are not present on the vessel to assess viabilities. The model and discussion are detailed in a PSMFC report and a PFMC GMT report.

The comparison below is for informational purposes only. Due to low sample sizes the NWFSC Observer Program cautions against using these estimates for management purposes. Data from EM pot vessels were obtained 2015-2018 on pot vessels, but only from 2016-2018 on bottom trawl EM vessels. The corresponding non-EM data (i.e., 2015-2018 pot; 2016-2018 bottom trawl) were used to allow direct comparison between vessels with and without EM. Confidentiality in the EM fleet precluded the use of the full stratification currently used in the Catch Shares fishery (see Tables 20 & 22).

Table 80: Observed number of IFQ Electronic Monitoring bottom trawl vessels, trips, and sets that caught Pacific halibut and the number of P. halibut in each viability category. Exc = Excellent

	IFQ EM Bottom Trawl					
	Observed Number					
Year	Vessels	Trips	Sets	Exc	Poor	Dead
South of Pt. Chehalis						
2016	5	13	28	16	14	51
2017	3	4	6	7	4	9
2018	6	18	30	31	13	53

Table 81: P. halibut observed weight (Obs), estimated total at-sea gross weight of discards (Grs), and estimated total discard weight (Dis) with the mortality rate applied based on observer viability, in each viability category from IFQ bottom trawl vessels. Discard mortality rates (DMR) are shown for the observer viability method (Obs) and the Time-on-Deck model (ToD) as applied by the Pacific States Marine Fisheries Commission. The ToD Discard is the weight of each fish multiplied by the mortality rate based on the time-on-deck model and summed across all individuals. Electronic Monitoring (EM) vessels carried electronic monitoring equipment. Viabilities on both EM and non-EM vessels were obtained by at-sea human observers. EM vessels only fished south of Pt. Chehalis. Values north of Pt. Chehalis represent non-EM vessels and are presented for comparison purposes only. All weights are metric tons (mt). Exc = Excellent = 0.10 mortality rate; Poor = 0.55 mortality rate; Dead = 0.90 mortality rate; All = all years combined

		Bottom Trawl													
		Exc (mt)			**Poor (mt)**			**Dead (mt)**			**Total (mt)**		**Observer**		**ToD**	
	Year	Obs	Grs	Dis	Obs	Grs	Dis	Obs	Grs	Dis	Obs	Grs	Dis	DMR	Dis	DMR
South of Pt. Chehalis																
EM	2016	0.17	0.66	0.13	0.14	0.53	0.29	0.46	1.74	1.56	0.77	2.93	1.99	0.68	–	–
	2017	0.09	2.31	0.46	0.03	0.90	0.50	0.08	2.15	1.94	0.20	5.36	2.89	0.54	2.99	0.7
	2018	0.44	2.29	0.46	0.16	0.82	0.45	0.58	3.01	2.71	1.18	6.12	3.62	0.59	3.81	0.69
	All	0.70	4.74	0.95	0.33	2.25	1.24	1.12	7.59	6.83	2.15	14.59	9.02	0.62	–	–
Non-EM	2016	14.64	15.71	3.14	4.88	5.24	2.88	16.74	17.96	16.16	36.26	38.90	22.18	0.57	–	–
	2017	18.36	20.16	4.03	5.24	5.75	3.16	13.70	15.04	13.54	37.30	40.95	20.73	0.51	–	–
	2018	11.28	11.96	2.39	5.11	5.42	2.98	11.09	11.76	10.59	27.48	29.15	15.96	0.55	–	–
	All	44.28	65.42	13.08	15.23	22.50	12.38	41.53	61.36	55.22	101.04	149.29	80.68	0.54	–	–
North of Pt. Chehalis																
	2016	7.55	8.64	1.73	2.44	2.79	1.54	4.78	5.47	4.93	14.77	16.90	8.19	0.48	–	–
	2017	8.03	9.14	1.83	2.18	2.48	1.36	5.82	6.63	5.97	16.03	18.25	9.16	0.50	–	–
	2018	6.62	7.28	1.46	2.25	2.48	1.36	6.06	6.67	6.00	14.93	16.43	8.82	0.54	–	–
	All	22.20	38.99	7.80	6.87	12.06	6.63	16.67	29.28	26.35	45.74	80.33	40.78	0.51	–	–

Table 82: Observed number of IFQ Electronic Monitoring pot vessels, trips, and sets that caught Pacific halibut and the number of P. halibut in each viability category. Exc = Excellent

	IFQ EM Pot					
	Observed Number					
Year	Vessels	Trips	Sets	Exc	Poor	Dead
Coastwide						
2015-18	3	19	39	40	8	31

Table 83: P. halibut observed weight (Obs), estimated total at-sea gross weight of discards (Grs), and estimated total discard weight (Dis) with the mortality rate applied based on observer viability, in each viability category from IFQ pot vessels. Total discard mortality rates (DMR) are shown for the observer viability method (Obs). Electronic Monitoring (EM) vessels carried electronic monitoring equipment. Viabilities on both EM and non-EM vessels were obtained by at-sea human observers. All weights are metric tons (mt). Exc = Excellent = 0.10 mortality rate; Poor = 0.55 mortality rate; Dead = 0.90 mortality rate; All = all years combined

		Pot											
		Exc (mt)			**Poor (mt)**			**Dead (mt)**			**Total (mt)**			
	Year	Obs	Grs	Dis	Obs	Grs	Dis	Obs	Grs	Dis	Obs	Grs	Dis	DMR
Coastwide														
EM	All	0.31	1.37	0	0.06	0.28	0.28	0.24	1.05	1.05	0.61	2.70	1.33	0.49
Non-EM	All	4.29	4.62	0	0.51	0.55	0.55	0.53	0.57	0.57	5.33	5.75	1.13	0.20

A.2 Catch Shares Weighted Length Frequencies

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:

$$n_{w_l} = n_l \times \frac{W_{st}}{\sum_l w_{stl}} \times \frac{\sum_t W_{st}}{W_{st}} \times \frac{\hat{W}_s}{\sum_t W_{st}} = n_l \times \frac{\hat{W}_s}{\sum_l w_{stl}} \quad (9)$$

where:
s = stratum
t = tow
l = length bin
n = number of measured fish
w = total weight of fish, as determined through the IPHC length-weight relationship (Table 98 in Appendix A.4)
W = total observed discard weight of Pacific halibut
$\hat{W}$ = estimated total discard weight of P. halibut

Table 84: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using bottom trawl 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							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0370	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
18	0.0065	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	0.0109	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	0.0135
26	0.0000	0.0000	0.0000	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	0.0000
30	0.0000	0.0076	0.0037	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.0000	0.0061	0.0030	0.0028	0.0000	0.0016	0.0000	0.0000
34	0.0000	0.0101	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.0000	0.0043	0.0000	0.0000	0.0009	0.0008	0.0000	0.0000
38	0.0000	0.0109	0.0000	0.0000	0.0027	0.3872	0.0011	0.0000
40	0.0014	0.0054	0.0019	0.0014	0.0091	0.3255	0.0009	0.0000

Table 84: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using bottom trawl 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. *(continued)*

	Bottom Trawl							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
42	0.0023	0.0110	0.0000	0.0000	0.0057	0.0068	0.0025	0.0040
44	0.0000	0.0024	0.0000	0.0000	0.0061	0.0022	0.0007	0.0000
46	0.0003	0.0073	0.0006	0.0004	0.0023	0.0028	0.0013	0.0000
48	0.0029	0.0064	0.0028	0.0011	0.0044	0.0101	0.0026	0.0042
50	0.0034	0.0071	0.0032	0.0000	0.0030	0.0044	0.0047	0.0007
52	0.0046	0.0072	0.0048	0.0021	0.0010	0.0035	0.0045	0.0038
54	0.0079	0.0057	0.0482	0.0044	0.0052	0.0082	0.0104	0.0111
56	0.0074	0.0062	0.0074	0.0050	0.0069	0.1125	0.0105	0.0179
58	0.0194	0.0148	0.0474	0.0141	0.0120	0.0119	0.0152	0.0293
60	0.0324	0.0294	0.0562	0.0305	0.0186	0.0151	0.0179	0.0375
62	0.0441	0.0428	0.0553	0.0551	0.0334	0.0272	0.0260	0.0460
64	0.0565	0.0529	0.0848	0.0740	0.0472	0.0273	0.0240	0.0468
66	0.0589	0.0542	0.0710	0.0776	0.2292	0.0427	0.0276	0.0422
68	0.0571	0.0623	0.1653	0.2307	0.0770	0.0734	0.0545	0.0472
70	0.0762	0.0711	0.1995	0.1719	0.0817	0.0712	0.0484	0.0510
72	0.0737	0.0708	0.1645	0.0848	0.2100	0.1733	0.0624	0.0439
74	0.0858	0.0678	0.1020	0.1820	0.1822	0.0680	0.0658	0.5887
76	0.0669	0.0629	0.1228	0.1326	0.1239	0.0659	0.0621	0.0495
78	0.0561	0.0536	0.1091	0.0591	0.1132	0.0687	0.0712	0.0539
80	0.0571	0.0486	0.1213	0.0760	0.0538	0.0587	0.3426	0.0459
82	0.0478	0.0469	0.1003	0.1693	0.0528	0.0528	0.0676	0.0481
84	0.0460	0.0376	0.0695	0.0821	0.1522	0.0703	0.0573	0.0524
86	0.0309	0.0302	0.0610	0.1364	0.1048	0.0374	0.0471	0.0393
88	0.0284	0.0255	0.0505	0.0822	0.0948	0.0315	0.0471	0.0425
90	0.0258	0.0237	0.0487	0.0912	0.0267	0.0265	0.2364	0.0392
92	0.0213	0.0214	0.0579	0.0162	0.0496	0.0432	0.0320	0.0298
94	0.0167	0.0160	0.0429	0.0117	0.0665	0.0340	0.1988	0.2726
96	0.0134	0.0110	0.0499	0.0408	0.0116	0.0131	0.0211	0.2465
98	0.0096	0.0097	0.0156	0.0077	0.0109	0.0101	0.1695	0.0198
100	0.0086	0.0084	0.0138	0.0075	0.0526	0.0263	0.0142	0.0161
102	0.0070	0.0075	0.0228	0.0421	0.0072	0.0077	0.0121	0.0125

Table 84: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using bottom trawl 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. *(continued)*

	Bottom Trawl							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
104	0.0054	0.0043	0.0102	0.0165	0.0258	0.0049	0.0088	0.0105
106	0.0039	0.0036	0.0180	0.0025	0.0043	0.0043	0.0058	0.0093
108	0.0030	0.0034	0.0118	0.0020	0.0205	0.0038	0.1117	0.0059
110	0.0025	0.0033	0.0063	0.0312	0.0182	0.0025	0.1044	0.0055
112	0.0021	0.0021	0.0180	0.0104	0.0024	0.0024	0.0029	0.0040
114	0.0017	0.0015	0.0124	0.0009	0.0160	0.0010	0.0018	0.0026
116	0.0011	0.0012	0.0043	0.0005	0.0146	0.0111	0.0014	0.0022
118	0.0009	0.0007	0.0007	0.0004	0.0009	0.0008	0.0010	0.0013
120	0.0005	0.0008	0.0066	0.0003	0.0248	0.0006	0.0008	0.0007
122	0.0005	0.0005	0.0005	0.0073	0.0006	0.0006	0.0005	0.0006
124	0.0006	0.0003	0.0002	0.0136	0.0113	0.0003	0.0004	0.0007
126	0.0003	0.0004	0.0028	0.0063	0.0002	0.0003	0.0002	0.0002
128	0.0003	0.0000	0.0001	0.0002	0.0003	0.0074	0.0000	0.0001
130	0.0001	0.0000	0.0000	0.0057	0.0002	0.0001	0.0001	0.0001
132	0.0002	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002
134	0.0000	0.0000	0.0001	0.0053	0.0000	0.0001	0.0000	0.0000
136	0.0001	0.0000	0.0000	0.0000	0.0001	0.0001	0.0000	0.0001
138	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0001
140	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
142	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
144	0.0001	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
146	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000
148	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000

Table 85: Percentage of weighted length measurements in each viability category, for IFQ bottom trawl vessels 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																							
	Excellent								Poor								Dead							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
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%	100.0%	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%	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%
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%	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%
32	0.0%	50.0%	0.0%	100.0%	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%	50.0%	100.0%	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%	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%
38	0.0%	82.7%	0.0%	0.0%	92.7%	100.0%	0.0%	0.0%	0.0%	15.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.2%	0.0%	0.0%	7.3%	0.0%	100.0%	0.0%
40	0.0%	82.2%	22.2%	0.0%	32.3%	88.3%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	38.4%	0.0%	0.0%	0.0%	0.0%	17.8%	77.8%	100.0%	29.3%	11.7%	100.0%	0.0%
42	47.9%	68.0%	0.0%	0.0%	56.6%	100.0%	0.0%	0.0%	52.1%	23.6%	0.0%	0.0%	19.7%	0.0%	69.1%	0.0%	0.0%	8.5%	0.0%	0.0%	23.7%	0.0%	30.9%	100.0%
44	0.0%	46.8%	0.0%	0.0%	50.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	53.2%	0.0%	0.0%	35.1%	0.0%	100.0%	0.0%
46	0.0%	83.4%	0.0%	0.0%	83.1%	82.9%	0.0%	0.0%	0.0%	16.6%	0.0%	0.0%	16.9%	0.0%	100.0%	0.0%	100.0%	0.0%	100.0%	100.0%	0.0%	17.1%	0.0%	0.0%
48	24.9%	96.4%	34.3%	100.0%	78.4%	86.2%	0.0%	30.6%	24.9%	0.0%	29.0%	0.0%	21.6%	13.8%	61.1%	50.0%	50.1%	3.6%	36.7%	0.0%	0.0%	0.0%	38.9%	19.4%
50	29.9%	66.0%	20.7%	0.0%	2.8%	54.5%	30.9%	100.0%	0.0%	10.4%	22.1%	0.0%	0.0%	8.5%	18.8%	0.0%	70.1%	23.6%	57.2%	0.0%	97.2%	37.1%	50.2%	0.0%
52	23.1%	52.4%	29.7%	30.1%	100.0%	80.9%	0.0%	29.0%	42.3%	15.3%	22.4%	11.6%	0.0%	14.0%	9.2%	26.0%	34.6%	32.3%	48.0%	58.3%	0.0%	5.1%	90.8%	45.0%
54	15.6%	59.9%	40.3%	50.8%	55.2%	67.9%	34.4%	26.9%	43.2%	29.4%	18.2%	0.0%	34.6%	5.6%	13.9%	0.0%	41.2%	10.7%	41.5%	49.2%	10.3%	26.5%	51.7%	73.1%
56	21.0%	44.2%	54.8%	35.4%	38.1%	60.6%	19.8%	8.9%	45.5%	13.9%	1.9%	0.8%	17.6%	17.0%	27.9%	14.3%	33.5%	41.9%	43.2%	63.8%	44.3%	22.4%	52.4%	76.8%
58	19.8%	41.0%	36.5%	32.9%	38.4%	57.2%	26.6%	24.8%	31.2%	10.0%	23.0%	31.3%	23.4%	10.8%	5.9%	12.6%	48.9%	49.0%	40.5%	35.8%	38.2%	32.0%	67.4%	62.6%
60	32.8%	36.8%	39.5%	38.7%	52.4%	40.6%	36.8%	21.5%	24.3%	21.8%	8.3%	23.6%	9.5%	14.3%	11.4%	17.2%	42.9%	41.4%	52.1%	37.7%	38.1%	45.1%	51.9%	61.3%
62	37.8%	40.0%	43.4%	43.4%	52.1%	34.2%	33.0%	27.8%	22.7%	20.9%	18.7%	20.1%	13.4%	20.7%	25.4%	10.9%	39.6%	39.2%	37.9%	36.5%	34.6%	45.1%	41.6%	61.3%
64	39.6%	32.2%	46.1%	45.0%	47.9%	41.8%	36.8%	26.5%	18.7%	20.9%	17.6%	19.7%	12.4%	14.8%	14.9%	15.1%	41.7%	46.9%	36.3%	35.3%	39.7%	43.4%	48.3%	58.4%
66	36.7%	35.9%	45.1%	48.9%	44.1%	32.5%	34.5%	19.5%	21.0%	22.3%	14.3%	23.7%	20.3%	18.0%	17.8%	15.6%	42.3%	41.9%	40.6%	27.5%	35.6%	49.5%	47.7%	65.0%
68	42.6%	35.1%	50.5%	46.7%	47.7%	46.3%	43.6%	40.3%	12.0%	21.5%	12.3%	20.8%	16.3%	12.9%	14.1%	14.3%	45.3%	43.4%	37.2%	32.5%	35.9%	40.8%	42.3%	45.4%
70	41.6%	39.6%	45.2%	53.6%	46.1%	37.6%	44.7%	26.8%	20.8%	19.5%	17.1%	17.8%	16.5%	13.9%	15.4%	19.4%	37.7%	40.9%	37.7%	28.6%	37.4%	48.5%	39.9%	53.8%
72	38.6%	32.2%	48.6%	50.7%	49.3%	35.2%	39.9%	31.3%	20.9%	18.8%	16.9%	18.4%	14.0%	17.7%	19.5%	15.7%	40.5%	49.0%	34.5%	30.8%	36.7%	47.1%	40.6%	53.0%
74	40.0%	32.5%	47.4%	53.7%	52.4%	36.3%	39.3%	29.3%	17.4%	21.9%	19.1%	14.8%	14.2%	15.4%	14.0%	15.4%	42.6%	45.7%	33.5%	31.6%	33.5%	48.3%	46.7%	55.3%
76	45.5%	36.9%	45.0%	44.0%	47.1%	35.9%	36.8%	32.6%	17.0%	17.2%	17.8%	18.2%	13.2%	17.4%	18.4%	16.3%	37.5%	45.9%	37.2%	37.7%	39.7%	46.7%	44.8%	51.1%
78	41.1%	33.3%	44.6%	52.3%	47.0%	35.8%	42.7%	31.6%	19.0%	24.6%	16.0%	17.9%	17.0%	12.2%	15.8%	12.4%	39.9%	42.1%	39.5%	29.8%	35.9%	52.0%	41.6%	56.0%
80	45.7%	38.8%	53.9%	50.1%	47.4%	39.9%	37.8%	35.3%	16.0%	18.5%	13.1%	16.6%	16.7%	14.3%	18.8%	15.7%	38.3%	42.7%	33.0%	33.3%	35.9%	45.8%	43.4%	49.1%
82	45.8%	36.6%	45.4%	50.6%	46.3%	34.6%	43.2%	31.6%	19.9%	20.9%	18.3%	11.3%	13.5%	15.8%	16.5%	21.3%	34.3%	42.5%	36.3%	38.1%	40.3%	49.6%	40.3%	47.2%
84	50.1%	38.5%	50.6%	45.6%	45.4%	39.5%	39.0%	33.7%	14.8%	18.9%	14.5%	13.3%	14.3%	14.3%	15.7%	20.6%	35.1%	42.6%	34.9%	41.1%	40.3%	46.2%	45.3%	45.7%
86	44.6%	36.4%	55.6%	48.8%	42.0%	35.2%	42.1%	33.7%	14.6%	21.7%	15.5%	18.1%	20.1%	12.3%	18.5%	18.7%	40.8%	41.8%	28.9%	33.2%	37.8%	52.5%	39.3%	47.6%
88	41.7%	39.2%	52.9%	43.5%	51.2%	36.8%	48.1%	34.4%	16.1%	21.5%	15.2%	22.0%	14.8%	14.4%	11.6%	15.6%	42.2%	39.3%	31.9%	34.5%	34.0%	48.8%	40.3%	49.9%
90	48.3%	40.9%	57.9%	43.1%	46.9%	35.1%	47.3%	45.2%	17.0%	18.9%	13.8%	18.7%	16.6%	15.0%	12.0%	18.9%	34.7%	40.1%	28.4%	38.2%	36.6%	49.9%	40.7%	35.9%
92	46.6%	41.0%	58.4%	50.6%	49.1%	32.1%	45.8%	42.1%	17.3%	20.2%	14.7%	14.0%	19.5%	18.7%	19.0%	20.3%	36.1%	38.9%	26.9%	35.4%	31.3%	49.1%	35.2%	37.6%
94	51.2%	46.4%	54.6%	49.4%	44.5%	42.2%	50.1%	43.8%	20.1%	14.3%	15.6%	17.6%	17.3%	15.4%	12.0%	19.6%	28.7%	39.3%	29.8%	33.1%	38.2%	42.4%	37.9%	36.5%
96	49.4%	40.5%	58.5%	57.5%	50.5%	36.7%	48.8%	40.1%	14.6%	16.9%	12.5%	14.6%	12.4%	15.2%	10.8%	12.7%	36.0%	42.6%	29.0%	27.9%	37.1%	48.1%	40.4%	47.2%
98	50.0%	39.7%	52.5%	43.5%	50.5%	41.8%	49.1%	35.6%	18.2%	17.8%	19.6%	23.2%	16.8%	14.7%	14.4%	25.0%	31.8%	42.4%	27.9%	33.3%	32.7%	43.5%	36.5%	39.5%
100	53.8%	43.8%	60.9%	57.3%	60.4%	41.7%	49.0%	43.7%	18.2%	21.0%	14.8%	5.6%	13.0%	12.9%	13.1%	23.6%	28.0%	35.2%	24.3%	37.2%	26.6%	45.3%	38.0%	32.8%
102	47.3%	51.1%	58.6%	52.2%	46.7%	48.0%	52.6%	50.2%	16.1%	16.5%	14.3%	13.3%	16.9%	14.3%	8.2%	22.5%	36.7%	32.4%	27.1%	34.5%	36.4%	37.8%	39.2%	27.3%
104	53.0%	44.5%	55.6%	60.8%	54.6%	43.0%	50.9%	48.5%	18.9%	10.3%	14.3%	17.8%	12.1%	12.7%	16.3%	16.3%	28.1%	45.2%	30.1%	21.4%	33.3%	44.3%	32.8%	35.2%
106	54.2%	39.6%	71.7%	66.2%	50.6%	54.9%	59.5%	47.9%	18.4%	26.6%	12.7%	9.2%	19.4%	7.1%	13.8%	12.0%	27.3%	33.8%	15.6%	24.6%	30.0%	38.0%	26.7%	40.0%
108	53.4%	44.3%	58.5%	62.6%	45.3%	35.7%	60.3%	41.5%	20.3%	16.4%	14.1%	23.2%	18.9%	20.1%	7.9%	18.2%	26.3%	39.3%	27.4%	14.2%	35.8%	44.2%	31.8%	40.3%
110	56.5%	51.4%	56.2%	60.9%	62.0%	33.2%	57.0%	58.1%	11.2%	14.2%	26.9%	16.0%	12.9%	19.3%	6.7%	16.3%	32.3%	34.4%	16.9%	23.1%	25.1%	47.5%	36.3%	25.6%
112	56.6%	54.4%	58.0%	53.5%	30.3%	40.5%	58.3%	45.5%	22.5%	22.4%	20.7%	14.9%	26.9%	8.0%	20.9%	24.0%	20.9%	23.2%	21.3%	31.6%	42.8%	51.5%	20.8%	30.5%
114	49.8%	43.9%	68.4%	64.7%	52.7%	23.2%	60.8%	52.5%	25.2%	22.7%	12.7%	12.9%	12.0%	17.6%	9.6%	13.8%	25.0%	33.4%	18.9%	22.3%	35.3%	59.3%	29.6%	33.7%

Table 86: IFQ bottom trawl vessels. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. *(continued from Table 85)*

	Bottom Trawl																							
	Excellent								Poor								Dead							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
116	60.6%	42.8%	59.7%	42.6%	57.3%	52.7%	47.0%	40.2%	13.5%	20.0%	20.0%	37.1%	15.2%	11.0%	22.2%	12.8%	25.9%	37.1%	20.2%	20.3%	27.5%	36.3%	30.9%	47.0%
118	55.8%	58.4%	62.9%	62.3%	54.5%	25.4%	48.4%	56.9%	9.6%	6.4%	17.3%	29.2%	21.4%	35.9%	18.5%	6.1%	34.5%	35.2%	19.8%	8.5%	24.2%	38.7%	33.1%	37.0%
120	47.8%	20.3%	79.4%	81.7%	58.1%	42.3%	67.3%	46.2%	28.1%	16.5%	18.8%	0.0%	16.4%	0.8%	14.6%	19.3%	24.3%	63.2%	1.8%	18.3%	25.4%	57.0%	18.1%	34.6%
122	54.3%	58.9%	59.0%	80.1%	56.7%	52.0%	76.8%	53.0%	8.0%	31.2%	14.5%	0.0%	7.6%	16.1%	17.6%	30.9%	37.7%	9.9%	26.5%	19.9%	35.7%	31.9%	5.6%	16.0%
124	39.8%	39.0%	47.7%	73.5%	29.7%	82.7%	62.5%	39.6%	21.8%	48.5%	16.1%	16.0%	35.1%	0.0%	12.4%	24.5%	38.4%	12.5%	36.1%	10.5%	35.1%	17.3%	25.1%	35.9%
126	42.1%	29.4%	100.0%	0.0%	34.9%	31.2%	64.1%	38.8%	19.0%	30.6%	0.0%	37.8%	0.0%	0.0%	35.9%	0.0%	38.9%	40.1%	0.0%	62.2%	65.1%	68.8%	0.0%	61.2%
128	52.6%	96.4%	49.5%	85.0%	84.6%	67.9%	0.0%	38.2%	35.7%	0.0%	50.5%	0.0%	3.9%	20.7%	0.0%	39.1%	11.7%	3.6%	0.0%	15.0%	11.5%	11.4%	0.0%	22.7%
130	75.4%	0.0%	77.8%	100.0%	82.5%	79.0%	53.7%	52.0%	24.6%	0.0%	0.0%	0.0%	0.0%	0.0%	46.3%	4.2%	0.0%	100.0%	22.2%	0.0%	17.5%	21.0%	0.0%	43.8%
132	45.2%	100.0%	22.2%	100.0%	100.0%	100.0%	52.4%	66.4%	18.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.6%	36.2%	0.0%	77.8%	0.0%	0.0%	0.0%	47.6%	0.0%
134	79.3%	100.0%	67.0%	100.0%	25.6%	61.6%	0.0%	0.0%	20.7%	0.0%	33.0%	0.0%	0.0%	26.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	74.4%	11.9%	100.0%	0.0%
136	25.2%	100.0%	100.0%	100.0%	100.0%	74.7%	100.0%	33.1%	49.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.9%	25.2%	0.0%	0.0%	0.0%	0.0%	25.3%	0.0%	33.1%
138	0.0%	8.2%	0.0%	0.0%	0.0%	90.3%	0.0%	100.0%	100.0%	55.9%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	35.9%	0.0%	0.0%	100.0%	9.7%	0.0%	0.0%
140	49.7%	0.0%	0.0%	0.0%	4.4%	0.0%	86.9%	0.0%	50.3%	0.0%	0.0%	0.0%	46.5%	0.0%	13.1%	0.0%	0.0%	0.0%	0.0%	0.0%	49.0%	100.0%	0.0%	0.0%
142	25.1%	0.0%	0.0%	0.0%	10.3%	0.0%	0.0%	0.0%	24.8%	100.0%	0.0%	0.0%	59.5%	0.0%	0.0%	0.0%	50.1%	0.0%	0.0%	0.0%	30.1%	0.0%	0.0%	0.0%
144	59.4%	0.0%	0.0%	59.9%	0.0%	50.6%	0.0%	0.0%	40.6%	0.0%	0.0%	40.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	49.4%	0.0%	0.0%
146	100.0%	100.0%	0.0%	0.0%	100.0%	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%
148	50.2%	0.0%	0.0%	0.0%	100.0%	69.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	49.8%	0.0%	0.0%	0.0%	0.0%	31.0%	0.0%	0.0%
150	0.0%	0.0%	0.0%	0.0%	45.5%	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%	54.5%	0.0%	0.0%	0.0%
152	0.0%	100.0%	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%	0.0%	0.0%	100.0%	0.0%
154	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	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%
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%	100.0%	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%	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%
164	0.0%	0.0%	0.0%	0.0%	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%
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%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
168	0.0%	0.0%	0.0%	0.0%	91.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.0%	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%	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%
172	0.0%	0.0%	0.0%	0.0%	91.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.2%	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%	100.0%	0.0%	0.0%	0.0%
176	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%	100.0%	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%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	50.0%	0.0%	0.0%
180	0.0%	0.0%	0.0%	0.0%	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%
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%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%
184	0.0%	0.0%	0.0%	0.0%	45.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	54.9%	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%	100.0%	0.0%	0.0%	0.0%
188	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%	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%	100.0%	31.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	69.0%	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%	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%
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%	0.0%	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%
204	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
206	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
208	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
210	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
212	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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%
214	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
216	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
218	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
220	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
222	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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 87: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using 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.

	Pot							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 87: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using 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. *(continued)*

	Pot							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.0000	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	0.0000
26	0.0000	0.0000	0.0000	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	0.0000
30	0.0000	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	0.0000
34	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.0000	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	0.0000
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
44	0.0248	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
46	0.0000	0.0000	0.0556	0.0000	0.0000	0.0000	0.0000	0.0000
48	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
50	0.0000	0.0000	0.0000	0.0000	0.0255	0.0419	0.0000	0.0000
52	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
54	0.0129	0.0000	0.0882	0.0000	0.0212	0.0000	0.0000	0.0000
56	0.0054	0.0000	0.0000	0.0000	0.0000	0.0273	0.0000	0.0182
58	0.0151	0.0000	0.0000	0.0000	0.0337	0.0000	0.0000	0.0000
60	0.0672	0.0000	0.0148	0.0934	0.0151	0.0459	0.0000	0.0000
62	0.0538	0.0000	0.0000	0.0000	0.0264	0.0203	0.0000	0.0139
64	0.0217	0.0377	0.0000	0.0000	0.0238	0.0184	0.0000	0.0000
66	0.0136	0.0113	0.0052	0.0000	0.0443	0.0162	0.0000	0.0000
68	0.0215	0.0308	0.0531	0.0000	0.0584	0.0609	0.0000	0.0098
70	0.0745	0.0239	0.0792	0.0000	0.0628	0.1038	0.0153	0.0644
72	0.0908	0.0608	0.2634	0.0546	0.0980	0.1387	0.0292	0.0592
74	0.0541	0.0595	0.2056	0.2002	0.0598	0.0750	0.0651	0.0757
76	0.0183	0.0295	0.1398	0.0918	0.0964	0.0477	0.1319	0.0701
78	0.0744	0.0907	0.1474	0.0421	0.1261	0.0391	0.1217	0.0716
80	0.1017	0.0891	0.1285	0.2270	0.1052	0.0675	0.1638	0.0894
82	0.0631	0.1473	0.2159	0.1407	0.0862	0.0911	0.0752	0.1044

Table 87: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using 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. *(continued)*

	Pot							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
84	0.0543	0.1230	0.0940	0.1990	0.1490	0.1379	0.0782	0.0874
86	0.0411	0.0636	0.0759	0.2435	0.1113	0.0572	0.0724	0.0662
88	0.0372	0.0659	0.0992	0.0550	0.1027	0.0199	0.0452	0.0570
90	0.0473	0.0399	0.0716	0.0000	0.0476	0.0488	0.0831	0.0736
92	0.0217	0.0337	0.0377	0.0238	0.0591	0.0285	0.0907	0.0381
94	0.0187	0.0260	0.0300	0.0461	0.0345	0.0430	0.1096	0.0924
96	0.0153	0.0259	0.0470	0.0416	0.0161	0.0074	0.0284	0.0800
98	0.0123	0.0016	0.0000	0.0201	0.0091	0.0093	0.0215	0.0187
100	0.0163	0.0062	0.0094	0.0188	0.0112	0.0396	0.0150	0.0088
102	0.0025	0.0085	0.0206	0.1038	0.0027	0.0062	0.0137	0.0055
104	0.0024	0.0054	0.0085	0.0000	0.0200	0.0096	0.0132	0.0025
106	0.0000	0.0137	0.0340	0.0000	0.0023	0.0000	0.0082	0.0049
108	0.0035	0.0012	0.0000	0.0000	0.0090	0.0017	0.0152	0.0046
110	0.0014	0.0011	0.0090	0.0277	0.0042	0.0000	0.0000	0.0021
112	0.0013	0.0010	0.0000	0.0000	0.0000	0.0030	0.0000	0.0000
114	0.0028	0.0020	0.0000	0.0123	0.0000	0.0015	0.0000	0.0019
116	0.0005	0.0000	0.0000	0.0233	0.0000	0.0000	0.0000	0.0036
118	0.0011	0.0009	0.0028	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0029	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
128	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
130	0.0004	0.0000	0.0000	0.0000	0.0012	0.0000	0.0000	0.0000
132	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
134	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
138	0.0003	0.0000	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
142	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
144	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
146	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
148	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 87: Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using 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. *(continued)*

	Pot							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
150	0.0000	0.0000	0.0000	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
154	0.0000	0.0000	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	0.0000
158	0.0000	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	0.0000
162	0.0000	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	0.0000
166	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
168	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
170	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
172	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
176	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
178	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
180	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
182	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
184	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
186	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
188	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
190	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
192	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
194	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
196	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
198	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
200	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 88: Percentage of weighted length measurements in each viability category, for IFQ pot vessels 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.

	Pot																							
	Excellent								Poor								Dead							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
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%	0.0%	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%	0.0%	0.0%	0.0%	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	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%
46	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%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
48	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	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%
52	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	100.0%	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%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
56	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	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%	0.0%	0.0%
58	68.0%	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%	32.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
60	57.3%	0.0%	100.0%	100.0%	100.0%	76.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	42.7%	0.0%	0.0%	0.0%	0.0%	24.0%	0.0%	0.0%
62	38.1%	0.0%	0.0%	0.0%	100.0%	100.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	61.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
64	34.6%	100.0%	0.0%	0.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	65.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
66	50.0%	100.0%	100.0%	0.0%	100.0%	100.0%	0.0%	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%	0.0%	0.0%	0.0%	0.0%
68	69.8%	100.0%	36.2%	0.0%	66.4%	100.0%	0.0%	100.0%	0.0%	0.0%	63.8%	0.0%	33.6%	0.0%	0.0%	0.0%	30.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
70	62.3%	100.0%	77.9%	0.0%	86.1%	100.0%	100.0%	100.0%	3.4%	0.0%	10.8%	0.0%	0.0%	0.0%	0.0%	0.0%	34.3%	0.0%	11.3%	0.0%	13.9%	0.0%	0.0%	0.0%
72	77.3%	85.9%	96.9%	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%	14.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.7%	0.0%	3.1%	0.0%	0.0%	0.0%	0.0%	0.0%
74	69.2%	93.6%	64.1%	100.0%	100.0%	100.0%	0.0%	100.0%	9.1%	6.4%	12.0%	0.0%	0.0%	0.0%	59.8%	0.0%	21.7%	0.0%	23.9%	0.0%	0.0%	0.0%	40.2%	0.0%
76	43.1%	49.7%	50.0%	100.0%	100.0%	100.0%	44.9%	90.2%	0.0%	37.8%	33.1%	0.0%	0.0%	0.0%	36.8%	9.8%	56.9%	12.4%	16.9%	0.0%	0.0%	0.0%	18.2%	0.0%
78	59.1%	63.3%	100.0%	100.0%	90.2%	87.3%	64.1%	100.0%	7.8%	14.6%	0.0%	0.0%	0.0%	0.0%	8.9%	0.0%	33.1%	22.2%	0.0%	0.0%	9.8%	12.7%	27.0%	0.0%
80	57.6%	100.0%	95.5%	65.8%	88.7%	86.5%	50.8%	100.0%	1.7%	0.0%	0.0%	0.0%	0.0%	0.0%	24.9%	0.0%	40.7%	0.0%	4.5%	34.2%	11.3%	13.5%	24.4%	0.0%
82	86.4%	54.9%	61.6%	100.0%	87.5%	90.9%	62.3%	94.8%	5.6%	9.6%	16.8%	0.0%	0.0%	4.6%	25.0%	5.2%	8.0%	35.5%	21.6%	0.0%	12.5%	4.5%	12.7%	0.0%
84	59.3%	73.6%	100.0%	100.0%	79.8%	100.0%	55.5%	100.0%	6.0%	13.2%	0.0%	0.0%	6.8%	0.0%	33.6%	0.0%	34.7%	13.2%	0.0%	0.0%	13.4%	0.0%	10.9%	0.0%
86	85.3%	76.6%	87.9%	25.2%	75.0%	87.6%	44.5%	92.7%	7.4%	7.6%	0.0%	0.0%	8.4%	6.3%	33.2%	7.3%	7.4%	15.8%	12.1%	74.8%	16.6%	6.1%	22.3%	0.0%
88	92.4%	79.3%	91.4%	100.0%	75.5%	100.0%	50.0%	92.4%	0.0%	6.8%	0.0%	0.0%	8.2%	0.0%	50.0%	7.6%	7.6%	13.9%	8.6%	0.0%	16.4%	0.0%	0.0%	0.0%
90	70.5%	68.2%	100.0%	0.0%	75.4%	93.8%	65.9%	88.9%	0.0%	21.4%	0.0%	0.0%	0.0%	0.0%	17.1%	5.4%	29.5%	10.5%	0.0%	0.0%	24.6%	6.2%	17.1%	5.6%
92	55.8%	59.0%	100.0%	0.0%	100.0%	100.0%	28.6%	100.0%	22.1%	23.5%	0.0%	0.0%	0.0%	0.0%	57.0%	0.0%	22.1%	17.4%	0.0%	100.0%	0.0%	0.0%	14.3%	0.0%
94	52.1%	100.0%	88.9%	50.0%	79.6%	87.4%	22.5%	92.4%	23.9%	0.0%	0.0%	0.0%	0.0%	0.0%	33.7%	7.6%	23.9%	0.0%	11.1%	50.0%	20.4%	12.6%	43.8%	0.0%
96	45.5%	80.2%	47.1%	0.0%	80.3%	100.0%	19.6%	100.0%	13.4%	13.2%	0.0%	0.0%	19.7%	0.0%	19.6%	0.0%	41.1%	6.7%	52.9%	100.0%	0.0%	0.0%	60.8%	0.0%
98	53.1%	100.0%	0.0%	100.0%	100.0%	50.0%	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	24.6%	0.0%	0.0%	46.9%	0.0%	0.0%	0.0%	0.0%	25.4%	0.0%	0.0%
100	77.6%	100.0%	100.0%	100.0%	100.0%	78.0%	33.7%	66.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.7%	0.0%	22.4%	0.0%	0.0%	0.0%	0.0%	22.0%	32.6%	33.7%
102	100.0%	34.1%	100.0%	100.0%	100.0%	100.0%	0.0%	50.8%	0.0%	33.0%	0.0%	0.0%	0.0%	0.0%	66.7%	49.2%	0.0%	33.0%	0.0%	0.0%	0.0%	0.0%	33.3%	0.0%
104	100.0%	0.0%	100.0%	0.0%	74.6%	79.8%	0.0%	100.0%	0.0%	50.0%	0.0%	0.0%	25.4%	0.0%	66.3%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	20.2%	33.7%	0.0%
106	0.0%	45.4%	76.4%	0.0%	100.0%	0.0%	50.8%	100.0%	0.0%	54.6%	23.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	49.2%	0.0%
108	18.4%	100.0%	0.0%	0.0%	100.0%	100.0%	50.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	0.0%	81.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
110	100.0%	100.0%	23.1%	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%	0.0%	76.9%	0.0%	0.0%	0.0%	0.0%	0.0%
112	100.0%	100.0%	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%	0.0%	0.0%	0.0%	0.0%
114	57.4%	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%	42.6%	100.0%	0.0%	100.0%	0.0%	100.0%	0.0%	0.0%
116	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	49.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.7%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
118	0.0%	0.0%	100.0%	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%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
120	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%
122	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%
124	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	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%
130	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%	100.0%	0.0%	0.0%	0.0%

Table 89: IFQ pot vessels. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. *(continued from Table 89)*

	Pot																							
	Excellent								Poor								Dead							
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018	2011	2012	2013	2014	2015	2016	2017	2018
132	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	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%
136	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%
138	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%
140	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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%	0.0%	0.0%	0.0%	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%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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	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%
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	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%
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%
204	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
206	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
208	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
210	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
212	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
214	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
216	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
218	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
220	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
222	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	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 90: 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 91: 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 92: Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. *(continued from Table 91)*

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%

Table 93: Number of dead P. halibut in each length bin, summed across viability categories, for IFQ bottom trawl vessels 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. This analysis assumes that there is no size-dependent mortality within viability categories.

Bottom Trawl																		
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
10	0	0	0	0	0	0	0	0	114	24	27	60	11	34	14	15	20
12	0	0	0	0	0	0	0	0	116	13	22	19	7	22	26	15	19
14	0	0	0	0	0	1	0	0	118	15	14	9	4	14	10	10	11
16	0	0	0	0	0	0	0	0	120	7	18	16	4	13	10	7	7
18	1	0	0	0	0	0	0	0	122	9	7	8	10	11	7	4	6
20	0	0	0	0	0	0	0	0	124	10	6	6	12	8	4	4	8
22	0	1	0	0	0	0	0	0	126	7	8	2	3	5	7	2	3
24	0	0	0	0	0	0	0	1	128	4	3	3	2	4	7	0	2
26	0	0	0	0	0	0	0	0	130	2	1	2	2	4	2	1	2
28	0	0	0	0	0	0	0	0	132	4	1	2	1	1	1	2	1
30	0	1	1	0	0	0	0	0	134	1	1	2	2	2	3	1	0
32	0	2	1	1	0	1	0	0	136	3	1	1	1	1	2	1	2
34	0	1	0	0	0	0	0	0	138	1	2	1	0	1	2	0	1
36	0	1	0	0	1	1	0	0	140	1	0	0	0	6	1	2	0
38	0	3	0	0	2	4	1	0	142	3	1	0	0	3	0	0	0
40	1	2	2	1	5	5	1	0	144	1	0	0	1	0	2	0	0
42	1	5	0	0	4	2	2	2	146	1	1	0	1	1	1	1	0
44	0	3	0	0	5	1	1	0	148	2	0	0	0	1	2	0	0
46	1	3	1	1	3	2	1	0	150	0	1	0	0	2	0	0	0
48	3	4	3	1	4	5	4	3	152	0	1	0	0	0	1	1	0
50	6	7	5	0	7	6	7	1	154	0	0	0	0	1	1	0	0
52	7	9	8	3	1	5	11	5	156	0	0	0	0	0	0	0	0
54	12	11	13	5	5	9	16	14	158	0	0	0	0	0	0	0	0
56	13	14	13	10	12	15	22	26	160	0	0	0	0	1	0	0	0
58	44	39	49	26	23	18	35	46	162	0	0	0	0	1	1	0	0
60	70	77	144	57	44	36	35	60	164	0	0	0	0	1	1	0	0
62	103	115	136	109	83	68	55	78	166	0	0	0	0	0	0	0	1
64	146	173	328	160	129	80	61	85	168	0	0	0	0	1	0	0	0
66	175	188	208	176	245	131	73	92	170	0	0	0	0	1	1	0	0
68	173	236	492	746	239	215	143	95	172	0	0	0	0	2	1	0	0
70	240	270	1124	572	271	244	129	124	174	0	0	0	0	1	0	0	0
72	262	310	1260	257	394	696	179	113	176	0	0	0	0	0	1	0	1
74	334	325	391	602	327	259	212	198	178	0	0	0	0	1	2	0	0
76	256	295	722	363	370	274	214	150	180	0	0	0	0	1	1	0	0
78	236	277	664	232	511	311	247	172	182	0	0	0	0	2	1	0	0
80	255	251	568	395	244	283	324	147	184	0	0	0	0	2	0	0	0
82	218	264	990	864	264	280	266	164	186	0	0	0	0	2	0	0	0
84	223	237	532	674	494	383	243	181	188	0	0	0	0	0	1	0	0
86	172	204	262	616	478	214	212	155	190	0	0	0	0	0	0	0	0
88	170	187	358	436	236	186	216	178	192	0	0	0	0	1	2	0	0
90	155	177	620	298	171	177	287	150	194	0	0	0	0	0	0	0	0
92	137	167	316	114	241	287	169	131	196	0	0	0	0	0	0	0	0
94	105	126	456	85	262	177	255	160	198	0	0	0	0	1	0	0	0
96	97	100	344	174	92	103	118	246	200	0	0	0	0	0	0	0	0
98	74	95	116	68	85	78	201	107	202	0	0	0	0	0	0	0	0
100	68	77	156	70	194	149	92	88	204	0	0	0	0	0	0	0	0
102	66	71	152	159	71	60	84	66	206	0	0	0	0	0	0	0	0
104	51	55	96	70	102	45	55	60	208	0	0	0	0	0	0	0	0
106	37	44	126	25	44	35	39	61	210	0	0	0	0	0	0	0	0
108	31	46	100	20	75	38	74	47	212	0	0	0	0	0	1	0	0
110	29	41	44	36	35	27	56	31									
112	23	26	66	23	34	27	23	28									

Table 94: Number of dead P. halibut in each length bin, summed across viability categories, for IFQ pot vessels 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. This analysis assumes that there is no size-dependent mortality within viability categories.

	Pot																	
Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018	Length bin (cm)	2011	2012	2013	2014	2015	2016	2017	2018
40	0	0	0	0	0	0	0	0	124	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	126	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	128	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	130	0	0	0	0	1	0	0	0
48	0	0	0	0	0	0	0	0	132	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	134	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	136	0	0	0	0	0	0	0	0
54	1	0	0	0	0	0	0	0	138	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	140	0	0	0	0	0	0	0	0
58	1	0	0	0	0	0	0	0	142	0	0	0	0	0	0	0	0
60	3	0	0	0	0	1	0	0	144	0	0	0	0	0	0	0	0
62	5	0	0	0	0	0	0	0	146	0	0	0	0	0	0	0	0
64	3	0	0	0	0	0	0	0	148	0	0	0	0	0	0	0	0
66	1	0	0	0	0	0	0	0	150	0	0	0	0	0	0	0	0
68	1	0	1	0	2	0	0	0	152	0	0	0	0	0	0	0	0
70	7	0	2	0	1	0	0	0	154	0	0	0	0	0	0	0	0
72	5	1	1	0	0	0	0	0	156	0	0	0	0	0	0	0	0
74	4	1	3	0	0	0	5	0	158	0	0	0	0	0	0	0	0
76	4	3	3	0	0	0	6	1	160	0	0	0	0	0	0	0	0
78	8	5	0	0	1	1	4	0	162	0	0	0	0	0	0	0	0
80	12	0	1	1	2	2	4	0	164	0	0	0	0	0	0	0	0
82	3	12	6	0	2	2	3	1	166	0	0	0	0	0	0	0	0
84	8	6	0	0	3	0	4	0	168	0	0	0	0	0	0	0	0
86	2	3	2	3	3	2	5	1	170	0	0	0	0	0	0	0	0
88	1	3	2	0	3	0	3	1	172	0	0	0	0	0	0	0	0
90	6	3	0	0	3	1	2	2	174	0	0	0	0	0	0	0	0
92	4	4	0	1	0	0	10	0	176	0	0	0	0	0	0	0	0
94	4	0	1	1	1	1	7	1	178	0	0	0	0	0	0	0	0
96	4	2	3	1	1	0	4	0	180	0	0	0	0	0	0	0	0
98	3	0	0	0	0	2	0	0	182	0	0	0	0	0	0	0	0
100	2	0	0	0	0	2	2	1	184	0	0	0	0	0	0	0	0
102	0	2	0	0	0	0	3	1	186	0	0	0	0	0	0	0	0
104	0	2	0	0	1	1	3	0	188	0	0	0	0	0	0	0	0
106	0	3	1	0	0	0	1	0	190	0	0	0	0	0	0	0	0
108	2	0	0	0	0	0	1	0	192	0	0	0	0	0	0	0	0
110	0	0	1	0	0	0	0	0	194	0	0	0	0	0	0	0	0
112	0	0	0	0	0	0	0	0	196	0	0	0	0	0	0	0	0
114	1	1	0	1	0	1	0	0	198	0	0	0	0	0	0	0	0
116	1	0	0	0	0	0	0	1	200	0	0	0	0	0	0	0	0
118	1	1	0	0	0	0	0	0									
120	0	0	0	0	0	0	0	0									
122	0	0	0	0	0	0	0	0									

Table 95: Number of dead P. halibut in each length bin for Shoreside Hake vessels 2011-14. Length bins are inclusive of the bin value (lower) and exclude the upper value, e.g., 10 = lengths 10.0 to 11.99 cm. This analysis assumes 100% mortality of all individuals because viability has not been determined for P. halibut caught with midwater trawl nets. Starting in 2015, Shoreside Hake trips were sorted into Midwater Hake or Midwater Rockfish depending on landing amount of P. hake.

Shoreside Hake Midwater Trawl									
Length bin (cm)	2011	2012	2013	2014	Length bin (cm)	2011	2012	2013	2014
72	0	0	1	0	106	0	0	0	1
73	0	0	0	0	107	0	0	0	0
74	0	0	0	1	108	0	0	0	0
75	0	0	0	0	109	0	0	0	0
76	0	0	0	0	110	0	0	0	1
77	0	0	0	0	111	0	0	0	0
78	0	0	0	0	112	0	0	0	0
79	0	0	0	0	113	0	0	0	0
80	1	0	0	1	114	0	0	0	0
81	0	0	0	0	115	0	0	0	0
82	0	0	0	0	116	0	0	0	0
83	0	0	0	0	117	0	0	0	0
84	0	0	0	0	118	0	0	0	0
85	0	0	0	0	119	0	0	0	0
86	1	0	0	0	120	0	0	0	0
87	0	0	0	0	121	0	0	0	0
88	0	0	0	0	122	0	0	0	0
89	0	0	0	0	123	0	0	0	0
90	0	0	0	0	124	0	0	0	0
91	0	0	0	0	125	0	0	0	0
92	0	0	0	0	126	0	0	0	0
93	0	0	0	0	127	0	0	0	0
94	0	0	0	1	128	0	0	0	1
95	0	0	0	0	129	0	0	0	0
96	0	0	0	0	130	0	0	0	0
97	0	0	0	0	131	0	0	0	0
98	1	0	0	0	132	0	0	0	0
99	0	0	0	0	133	0	0	0	0
100	0	0	0	1	134	0	0	0	0
101	0	0	0	0	135	0	0	0	0
102	0	0	0	0	136	0	0	1	0
103	0	0	0	0	137	0	0	0	0
104	0	0	1	1					
105	0	0	0	0					

Table 96: Number of dead P. halibut in each length bin for Midwater Rockfish vessels 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. This analysis assumes 100% mortality of all individuals because viability has not been determined for P. halibut caught with midwater trawl nets.

Midwater Rockfish					
Length bin (cm)	2017	2018	Length bin (cm)	2017	2018
72	1	0	84	2	1
74	0	0	86	0	1
76	0	1	88	0	0
78	0	0	90	1	0
80	0	1			
82	1	0			

A.3 Pacific Halibut IBQ Expansions for In-Season Management, Special Cases

A.3.1 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 97 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.

A.3.2 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 98 in Appendix A.4). The total weight of P. halibut in the haul is calculated as:

$$W = \frac{w}{n} \times N \tag{10}$$

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:

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

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 8)

A.3.3 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 98 in Appendix A.4). 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:

$$W = \left(\frac{w}{n} \times N \right) \times \left(\frac{P}{p} \right) \tag{12}$$

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:

$$W_{IBQ} = \sum_c \left(\frac{w_c}{\sum_c w_c} \times W \times m_c \right) \tag{13}$$

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 9)

A.3.4 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 98 in Appendix A.4). 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:

$$W_{IBQ} = \left(\frac{H}{h} \times w\right) \times 0.16 \tag{14}$$

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

A.3.5 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.

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

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.

$$W_{IBQ} = \left(\frac{\sum_t w}{\sum_t d}\right) \times D \times 0.90 \tag{16}$$

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.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g}\right) \times G \tag{17}$$

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.

$$W_{IBQ} = \left(\frac{\sum_t w_{IBQ}}{\sum_t g}\right) \times G \times 1.0 \tag{18}$$

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

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, has 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 97: 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.

Scenarios	Calculations
1,3,4	$\hat{w}_{IBQ_u} = \left(\frac{\sum_{h,v}\left(l_{h,v} \times r_v\right)}{\sum_h c_h}\right) \times c_u$
2	$\hat{w}_{IBQ_u} = \left(\frac{\sum_{h,v} l_{h,v}}{\sum_h l_h} \times r_v\right) \times \left(\frac{\sum_f l_f}{\sum_f c_f}\right)$
6,7	$\hat{w}_{IBQ_u} = \left[\left(\frac{\sum_f l_f}{\sum_f c_f} \times r_v\right) \times \frac{\sum_h c_h}{h}\right] \times \left(\frac{\sum_{h,v} l_{h,v}}{\sum_h l_h}\right)$
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 8 & 9
h = sampled hauls
u = unsampled hauls
f = individual sampled P. halibut
t = tow time

p = predated fish

A.4 IPHC Length-Weight Table

Table 98: IPHC length-weight conversion table for Pacific halibut.

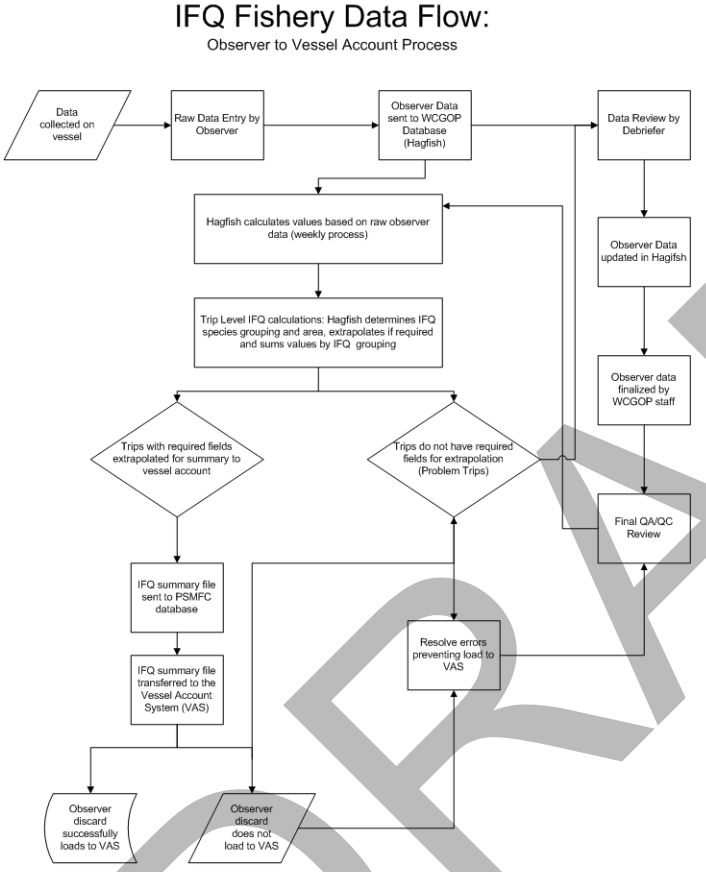
Centimeters	Pounds	Centimeters	Pounds	Centimeters	Pounds	Centimeters	Pounds
10	0.02	72	9.61	132	68.48	194	238.45
11	0.02	73	10.05	133	70.17	195	242.44
12	0.02	74	10.49	134	71.89	196	246.5
13	0.04	75	10.98	135	73.66	197	250.6
14	0.04	76	11.44	136	75.44	198	255.74
15	0.07	77	11.95	137	77.25	199	258.93
16	0.07	78	12.46	138	79.08	200	263.17
17	0.09	79	12.99	139	80.95	201	267.46
18	0.11	80	13.51	140	82.87	202	271.79
19	0.13	81	14.07	141	84.79	203	276.17
20	0.15	82	14.64	142	86.75	204	280.6
21	0.18	83	15.23	143	88.76	205	285.1
22	0.20	84	15.83	144	90.79	206	289.62
23	0.24	85	16.45	145	92.84	207	294.21
24	0.26	86	17.09	146	94.93	208	298.84
25	0.31	87	17.75	147	97.05	209	303.51
26	0.35	88	18.41	148	99.21	210	308.25
27	0.40	89	19.09	149	101.39	211	313.03
28	0.46	90	19.8	150	103.62	212	317.86
29	0.51	91	20.53	151	105.87	213	322.73
30	0.57	92	21.25	152	108.16	214	327.67
31	0.62	93	22.02	153	110.5	215	332.65
32	0.71	94	22.8	154	112.83	216	337.7
33	0.77	95	23.59	155	115.24	217	342.79
34	0.84	96	24.41	156	117.66	218	347.93
35	0.93	97	25.24	157	120.13	219	353.13
36	1.01	98	26.08	158	122.62	220	358.38
37	1.10	99	26.96	159	125.16	221	363.69
38	1.21	100	27.87	160	127.71	222	369.05
39	1.32	101	28.77	161	130.32	223	374.45
40	1.43	102	29.7	162	132.96	224	379.92
41	1.59	103	30.67	163	135.65	225	385.45
42	1.68	104	31.64	164	138.36	226	391.03
43	1.81	105	32.63	165	141.12	227	396.67
44	1.94	106	33.64	166	143.9	228	402.36

Table 98: IPHC length-weight conversion table for Pacific halibut. *(continued)*

Centimeters	Pounds	Centimeters	Pounds	Centimeters	Pounds	Centimeters	Pounds
45	2.09	107	34.68	167	146.72	229	408.09
46	2.25	108	35.74	168	149.54	230	413.91
47	2.43	109	36.84	169	152.49	231	419.76
48	2.58	110	37.94	170	155.45	232	425.69
49	2.76	111	39.07	171	158.42	233	431.66
50	2.95	112	40.21	172	161.44	234	437.68
51	3.15	113	41.38	173	164.51	235	443.76
52	3.35	114	42.59	174	167.6	236	449.91
53	3.57	115	43.81	175	170.75	237	456.13
54	3.79	116	45.06	176	173.92	238	462.39
55	4.01	117	46.32	177	177.14	239	468.72
56	4.25	118	47.62	178	180.4	240	475.09
57	4.52	119	48.94	179	183.71	241	481.55
58	4.76	120	50.29	180	187.06	242	488.05
59	5.05	121	51.65	181	190.46	243	494.6
60	5.31	122	53.07	182	193.87	244	501.24
61	5.62	123	54.48	183	197.36	245	507.92
62	5.93	124	55.93	184	200.86	246	514.66
63	6.24	125	57.41	185	204.43	247	521.48
64	6.57	126	58.91	186	208.03	248	528.36
65	6.90	127	60.43	187	211.67	249	535.28
66	7.25	128	61.99	188	214.71	250	542.29
67	7.61	129	63.56	189	218.5		
68	7.98	130	65.17	190	222.89		
69	8.38	131	66.82	191	226.7		
70	8.77			192	230.56		
71	9.19			193	234.48		

A.5 Data flow

Figure 9: 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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