

Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries, 2002 – 2022

Kate E. Richerson¹, Kayleigh A. Somers¹, Vanessa J. Tuttle¹, Christa Colway¹, Jon T. McVeigh¹

¹ Fishery Resource Analysis Monitoring Division, Northwest Fisheries Science Center, NOAA Fisheries, 2725 Montlake Blvd. E. Seattle, WA 98112

These materials do not constitute a formal publication and are for information only. They are in a pre-review, pre-decisional state and should not be formally cited. They are to be considered provisional and do not represent any final determination or policy of NOAA or the Department of Commerce.

Summary

Pacific halibut (*Hippoglossus stenolepis*, henceforth *P. halibut*) is found in coastal waters throughout the North Pacific. Off the West Coast of the United States, it inhabits continental shelf areas (<150 fm) from Washington to central California (Clark and Hare 1998, Keith et al. 2014). *P. halibut* has long supported directed commercial fisheries 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 (IPHC & Gustafson 2019).

The objective of this report is to provide estimates of *P. halibut* bycatch in the U.S. West Coast groundfish fisheries. Bycatch estimates are required for domestic and international management of *P. halibut*. The International Pacific Halibut Commission (IPHC), a body founded through treaty agreement between the U.S. and Canada, sets the *P. halibut* annual total constant exploitation yield (TCEY) which is converted to total allowable catch (TAC) for IPHC Area 2A, the collective U.S. marine waters off the states of Washington, Oregon, and California. The TCEY is based, in part, on bycatch mortality, which takes into account potential survival after being discarded. Regulations for IPHC Area 2A are set by the IPHC and NOAA Fisheries. *P. halibut* catch in Area 2A is allocated among tribal and non-tribal fisheries, commercial and recreational fisheries, and recreational fisheries in different states (Washington, Oregon, and California). The Pacific Fishery Management Council (PFMC) describes this *P. halibut* catch allocation each year in a catch sharing plan.

P. halibut bycatch in U.S. West Coast groundfish fisheries is estimated from data collected by fisheries observers, from fish sales information, and from review of video imagery from electronic monitoring. The Northwest Fisheries Science Center (NWFSC) Fisheries Observation Science Program (FOS) has collected discard data from commercial fishing vessels since 2002². *P. halibut* mortality estimates in this report are provided for the years 2002 through 2022 from all fishery sectors observed by FOS (Table 1). This report is updated annually by FOS and presented to the PFMC and the IPHC for use in *P. halibut* management. This 2023 report represents an abbreviated version of reports from previous years, consisting of this summary and an accompanying supplemental spreadsheet. For more detailed background and methods, see Jannot et al. (2022).

² Prior to 2001, at-sea hake fisheries were observed by the Alaska Fisheries Science Center.

Table 1: P. halibut mortality estimates for 2022 and the years of observation, for fishery sectors observed by the Northwest Fisheries Science Center Fisheries Observation Science Program. Estimates include both individuals discarded at the dock and at-sea discards with mortality rates applied, where appropriate.

Sector	Years_Observed	2022 Total Discard Mortality (mt)
Individual Fishing Quota (IFQ) fisheries ¹	2011-2022	27.25
IFQ Electronic Monitoring (EM) EFP ²	2015-2022	8.89
At-sea Pacific hake	2002-2022	1.75
Non-nearshore fixed gear targeting groundfish	2002-2022	6.89
P. halibut directed	2017-2022	1.69
Nearshore fixed gear	2003-2022	4.25
Pink shrimp trawl	2004-2022	0.19
California halibut trawl	2002-2022	0

¹Does not include estimates from IFQ vessels with Electronic Monitoring, includes all gears

²EFP = Exempted Fishing Permit, includes all gears

In 2022 Individual Fishing Quota (IFQ) fisheries had the largest estimated P. halibut discard mortality of any sector (27.25 metric tons [mt] for non-EM vessels and 8.89 mt for EM vessels, Table 1).³ The IFQ total (IFQ + IFQ EM EFP: 36.15 mt) is similar to the 2021 estimate (34.30 mt) and, as in past years, below the individual bycatch quota (IBQ) allocation for P. halibut North of 40° 10' N. lat (2022 IBQ allocation = 99.64 mt⁴). As in prior years, bottom trawl gear produced the largest component of IFQ discard mortality (bottom trawl IFQ + IFQ EM = 34.71 mt), 42% of which was from bottom trawl vessels fishing between Point Chehalis, WA and 40° 10' N. lat. (14.4 mt, Supplemental Tables 9, 14 and 38). The percent of legal-sized P. halibut (> 82 cm) discard mortality, by weight (mt) in the IFQ Bottom Trawl fishery north of 40° 10' N. lat. is presented in Table 4.

As in past years, we have compared alternative methods for calculating discard mortality rates (DMRs) in the IFQ EM EFP fishery (Supplemental Table 39). Electronic monitoring does not allow for accurate assessments of P. halibut injuries and viabilities. For in-season P. halibut IBQ management, the Pacific States Marine Fisheries Commission (PSMFC), which administers the EM program, applies a time-on-deck model (PFMC 2017, Smith 2017) to estimate the mortality rate to be applied to individual P. halibut caught on bottom trawl IFQ vessels carrying EM. For final end-of-year estimates in this report, we apply a 0.90 mortality rate to all P. halibut bycatch in the IFQ EM bottom trawl fishery (Supplemental Table 38). As an alternative to the 0.90 rate, we also present mortality estimates for 2015–2022 based on observer assessed viabilities and

³ Summarized estimates presented here and in the tables might exclude small amounts of data to ensure summarized values maintain confidentiality.

⁴ <https://www.webapps.nwfsc.noaa.gov/apex/ifq/f?p=155:1:.....>

the PFMC Groundfish Management Team's Time-on-Deck model (see Supplemental Table 39). Small sample sizes preclude definitive conclusions from this analysis.

In 2022, estimated *P. halibut* discard in the non-nearshore fixed gear vessels targeting groundfish was lower than most previous years (6.89 mt, Tables 1, 2, and 3). Nearly all of that bycatch (6.79 mt or ~99%) occurred on Limited Entry (LE) Sablefish Endorsed vessels. These vessels fish federally permitted sablefish tier quota during the primary season (April–December). Most of the LE Sablefish Endorsed bycatch occurred while fishing longline gear north of Point Chehalis, WA (4.12 mt or ~61%, Table 56). A smaller amount of *P. halibut* mortality occurred on LE sablefish endorsed vessels fishing longline gear south of Point Chehalis (2.13 mt). We report estimates north and south of Point Chehalis separately because the fishery north of Pt. Chehalis has an incidental *P. halibut* catch allocation. Limited entry endorsed pot vessels caught 0.54 mt of *P. halibut* bycatch. Open access (OA) vessels targeting non-nearshore groundfish species with hook and line gear caught 0.11 mt. Open access vessels fishing with pot gear, LE non-endorsed vessels fishing with pot gear, and LE non-endorsed vessels fishing with hook and line gear did not catch any *P. halibut* in 2022 (Table 56).

The *P. halibut* discard mortality estimate for the 2022 IPHC directed *P. halibut* fishery was 1.69 mt (Tables 1 and 3), which is lower than previous observed years. Discard mortality estimates were calculated using the same methods as for the non-nearshore hook and 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 Supplemental Table 67. Observed lengths of discarded *P. halibut* in the directed fishery are given in Supplemental Tables 68 and 69.

P. halibut discard in the nearshore fixed gear, pink shrimp trawl, California halibut trawl (combined as Other Fisheries in Figure 1), and the at-sea Pacific hake (also known as Pacific whiting) pelagic trawl fisheries combined typically represent a small component of total *P. halibut* mortality (Table 1; Figure 1). The California sea cucumber trawl fishery was not observed in 2022, and estimates for the California ridgeback prawn trawl fishery were confidential in 2022 (Supplemental Tables 77, 78); however, no *P. halibut* catch has been observed in these sectors in earlier non-confidential years.

Final estimates of discards in observed fishery sectors, including the IFQ EM EFP, are shown in Tables 1, 2, and 3. All three tables (and elsewhere in the report), include the amount of *P. halibut* landed and subsequently discarded at the dock by IFQ bottom and midwater trawl vessels. The midwater trawl vessels operate under maximized retention, so that the majority of catch is landed and sorted dockside. The amounts landed and then discarded at the dock are listed by strata in Supplemental Tables 9, 10, and 11. Summaries of *P. halibut* catch in the IFQ EM EFP are included in Table 1 and Supplemental Tables 52, 54, 55, and 56. Summarized estimates presented in both the tables and the text might exclude small amounts of data to ensure summarized values maintain confidentiality. EM midwater hake and midwater rockfish at-sea discards were not estimated because these vessels do not carry human observers and because at-sea discard in previous years has been either nonexistent or minimal in these maximized retention sectors. Landed *P. halibut* in these sectors is included in this report.

Additionally, we provide historical estimates of P. halibut bycatch in the LE bottom trawl fishery for the 2002–2010 period (Tables 2 and 3) and P. halibut bycatch estimates for observed, non-IFQ vessels with an EFP targeting groundfish (2002–2022, Supplemental Table 79). For completeness, we also include the P. halibut landed catch from Pacific Fisheries Information Network (PacFIN) fish tickets reported by non-groundfish fisheries that are not observed by FOS for the period 2002–2022 (Supplemental Table 96).

FOS data used in this report has been updated to include the most recent data available (2002–2022). PacFIN data used in this report were accessed July 2022. The estimates for all sectors and years (except LE Trawl 2002–2010) have been recalculated based on these data. For ease of data access and reporting, the majority of tables have been removed from the written report and are provided in the accompanying Microsoft Excel file ⁵.

⁵ see NWFSC_Pacific_Halibut_Bycatch_2002_2022_Supplemental_Tables.xlsx

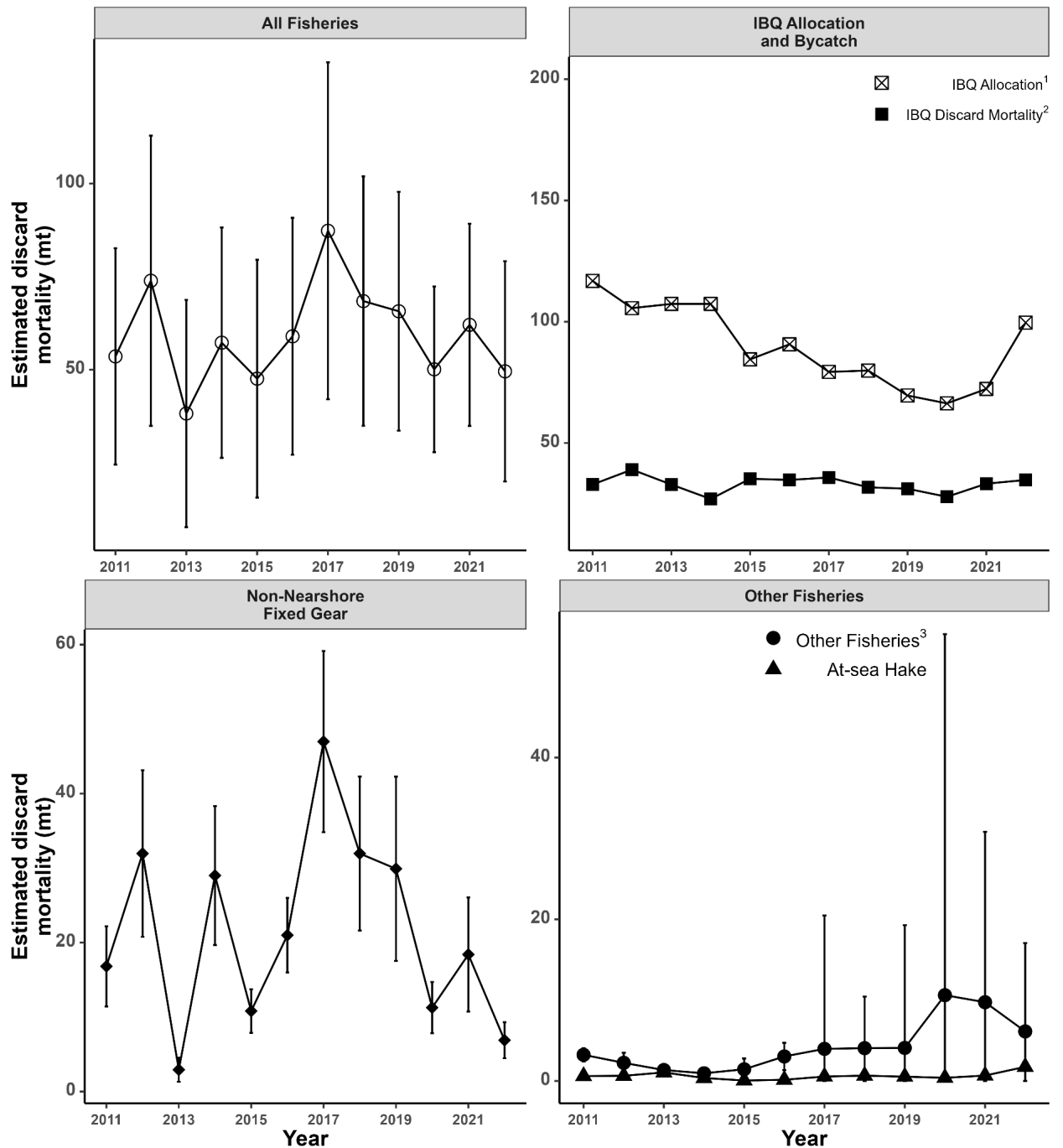


Figure 1: Total estimated *P. halibut* discard mortality (mt \pm 1 SE, with mortality rates applied if applicable) from all sectors observed by the Northwest Fisheries Science Center Fisheries Observation Science Program. Estimates are not included for sectors and years where there were insufficient observer data. Values are reported in Table 3. Note that the y-axis scales vary across panels.

¹Individual Bycatch Quota (IBQ) allocated north of 40° 10' N. latitude. ²IBQ catch includes all Catch Shares sectors and gears except At-sea Hake which is shown separately. ³Other fisheries

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

Year	Total discards (mt), mortality rates not applied																All w/ <1.0 mort. ^g	All w/ 1.0 mort. ^h
	LE BT 2002-10	IFQ BT ^{abc}	IFQ H&L	IFQ Pot ^c	IFQ MW hake ^{bcd}	IFQ MW r ^{bcd}	A-S hake ^d	LE sable end.	LE sable non-end.	Phal. directed	OA FG ^e	NS FG ^d	Pink shrimp ^d	CA hal. ^{df}	All sectors			
2002	524.41	n/a	n/a	n/a	n/a	n/a	1.14	146.90	0.01	-	-	-	-	0.00	672.46	671.32	1.14	
2003	186.65	n/a	n/a	n/a	n/a	n/a	2.65	198.89	0.18	-	-	0.00	-	0.00	388.38	385.73	2.65	
2004	212.43	n/a	n/a	n/a	n/a	n/a	1.13	238.98	0.01	-	-	1.00	0.00	0.70	454.25	451.42	2.83	
2005	460.35	n/a	n/a	n/a	n/a	n/a	1.96	240.47	0.01	-	-	2.21	0.04	0.03	705.07	700.83	4.24	
2006	390.91	n/a	n/a	n/a	n/a	n/a	0.83	677.68	0.00	-	-	0.53	-	0.02	1069.98	1068.60	1.39	
2007	294.38	n/a	n/a	n/a	n/a	n/a	1.18	132.81	1.72	-	21.66	0.09	0.21	0.03	452.08	450.58	1.50	
2008	305.21	n/a	n/a	n/a	n/a	n/a	3.98	260.74	2.95	-	40.25	0.35	0.00	0.22	613.70	609.15	4.55	
2009	385.24	n/a	n/a	n/a	n/a	n/a	0.33	322.91	0.24	-	35.18	1.28	0.00	0.00	745.19	743.58	1.61	
2010	265.08	n/a	n/a	n/a	n/a	n/a	1.57	138.07	0.39	-	32.56	0.08	0.00	0.00	437.75	436.10	1.65	
2011	n/a	64.25	6.13	3.36	0.36	*	0.61	137.45	21.26	-	13.03	3.05	0.19	0.00	249.68	245.48	4.20	
2012	n/a	66.47	14.79	1.90	0.62	0.62	0.64	163.42	16.25	-	23.63	2.25	0.00	0.00	290.57	286.45	4.12	
2013	n/a	66.30	3.00	0.99	1.31	0.00	1.06	22.27	0.01	-	1.79	1.35	0.00	0.00	98.09	94.36	3.73	
2014	n/a	55.96	3.95	0.32	1.36	0.00	0.37	179.89	0.00	-	3.58	0.95	0.00	0.00	246.39	243.71	2.69	
2015	n/a	69.38	9.81	2.23	0.70	0.00	0.06	124.41	0.46	-	10.13	1.44	0.01	0.00	218.62	216.41	2.21	
2016	n/a	59.41	6.95	1.78	0.68	0.00	0.15	179.06	5.16	-	42.68	3.04	0.00	0.00	298.91	295.04	3.87	
2017	n/a	64.84	4.25	1.84	0.50	0.04	0.55	304.36	0.74	25.27	48.59	1.76	0.00	0.00	452.74	449.88	2.86	
2018	n/a	51.99	4.93	2.64	1.34	0.03	0.66	231.39	13.07	15.60	41.70	1.57	0.01	0.00	364.93	361.32	3.61	
2019	n/a	53.08	3.56	4.23	*	0.04	0.54	232.19	76.51	28.98	39.79	0.57	0.00	0.00	439.49	438.34	1.15	
2020	n/a	44.56	-	*	*	0.00	0.39	127.16	0.00	47.75	9.99	1.37	0.00	0.00	231.23	229.46	1.77	
2021	n/a	54.56	-	3.34	*	0.00	0.67	136.39	1.61	33.26	19.85	1.88	0.00	0.00	251.54	248.99	2.55	
2022	n/a	57.45	-	1.71	*	0.03	1.75	45.40	0.00	14.49	3.01	4.25	0.19	0.00	128.28	122.06	6.22	

^aStarting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.

^bIncludes a small amount landed and discarded at the dock.

^cIncludes P. halibut catch from IFQ EM EFP.

^d100% mortality rate.

^eA coastwide discard ratio and coastwide discard estimate could not be computed in the OA FG sector for 2002–06, because WCGOP only covered OA vessels in CA during this time

^fStarting in 2011, this sector only includes OA CA halibut.

^gLE BT, IFQ BT, IFQ H&L, IFQ Pot, LE sable end., LE sable non-end., P. hal. directed, and OA FG.

^hIFQ MW hake, IFQ MW rf, A-S hake, NS FG, pink shrimp, and CA halibut.

Table 2: Pacific halibut gross discard 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 Northwest Fisheries Science Center Fisheries Observation Science Program. No mortality rates were applied to these estimates. Rounding of values might mask very small weights in some categories and are presented here as zero (0). All landed weights are estimated based on whole fish (a.k.a. ‘round weight,’ not head-and-gut). There was no fishing in the IFQ H&L fishery during 2020–2022. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded).

* = confidential data, fewer than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Total mortality (mt), mortality rates applied																	
Year	LE BT 2002-10	IFQ BT ^{abc}	IFQ H&L	IFQ Pot ^c	IFQ MW hake ^{bcd}	IFQ MW rf ^{bcd}	A-S hake ^d	LE sable. end.	LE sable. non- end.	P.hal. directed	OA FG ^f	NS FG ^d	Pink shrimp ^d	CA hal. ^{dg}	All sectors	All w/ <1.0 mort. ^h	All w/ 1.0 mort. ⁱ
2002	344.82	n/a	n/a	n/a	n/a	n/a	1.14	23.59	0.00	-	-	-	-	0.00	369.55	368.41	1.14
2003	124.43	n/a	n/a	n/a	n/a	n/a	2.65	31.83	0.03	-	-	0.00	-	0.00	158.94	156.29	2.65
2004	133.12	n/a	n/a	n/a	n/a	n/a	1.13	38.90	0.00	-	-	1.00	0.00	0.70	174.85	172.02	2.83
2005	286.52	n/a	n/a	n/a	n/a	n/a	1.96	38.53	0.00	-	-	2.21	0.04	0.03	329.29	325.05	4.24
2006	242.47	n/a	n/a	n/a	n/a	n/a	0.83	108.76	0.00	-	-	0.53	-	0.02	352.62	351.23	1.39
2007	208.81	n/a	n/a	n/a	n/a	n/a	1.18	21.33	0.28	-	3.48	0.09	0.21	0.03	235.40	233.90	1.50
2008	207.81	n/a	n/a	n/a	n/a	n/a	3.98	41.85	0.47	-	6.45	0.35	0.00	0.22	261.13	256.58	4.55
2009	251.10	n/a	n/a	n/a	n/a	n/a	0.33	51.68	0.04	-	5.63	1.28	0.00	0.00	310.07	308.46	1.61
2010	180.97	n/a	n/a	n/a	n/a	n/a	1.57	22.19	0.06	-	5.22	0.08	0.00	0.00	210.09	208.44	1.65
2011	n/a	31.32	0.98	0.60	0.36	*	0.61	11.83	3.04	-	1.93	3.05	0.19	0.00	53.92	49.72	4.20
2012	n/a	35.59	2.37	0.34	0.62	0.62	0.64	29.69	0.76	-	1.51	2.25	0.00	0.00	74.38	70.25	4.12
2013	n/a	32.33	0.48	0.18	1.31	0.00	1.06	2.86	0.00	-	0.07	1.35	0.00	0.00	39.65	35.92	3.73
2014	n/a	26.22	0.63	0.06	1.36	0.00	0.37	28.71	0.00	-	0.29	0.95	0.00	0.00	58.60	55.91	2.69
2015	n/a	33.34	1.57	0.41	0.70	0.00	0.06	10.40	0.02	-	0.40	1.44	0.01	0.00	48.34	46.13	2.21
2016	n/a	33.47	1.11	0.32	0.68	0.00	0.15	17.22	1.07	-	2.70	3.04	0.00	0.00	59.76	55.89	3.87
2017	n/a	34.96	0.68	0.33	0.50	0.04	0.55	43.46	0.04	2.22	3.49	1.76	0.00	0.00	88.03	85.17	2.86
2018	n/a	30.49	0.79	0.47	1.34	0.03	0.66	26.95	0.59	2.48	4.42	1.57	0.01	0.00	69.80	66.19	3.61
2019	n/a	29.93	0.57	0.76	*	0.04	0.54	24.35	2.68	3.52	2.87	0.57	0.00	0.00	65.84	64.69	1.15
2020	n/a	27.22	-	*	*	0.00	0.39	10.92	0.00	9.24	0.35	1.37	0.00	0.00	49.50	47.73	1.77
2021	n/a	32.90	-	0.60	*	0.00	0.67	16.30	0.19	7.87	1.90	1.88	0.00	0.00	62.32	59.77	2.55
2022	n/a	34.71	-	0.31	*	0.03	1.75	6.79	0.00	1.69	0.11	4.25	0.19	0.00	49.82	43.60	6.22

^aStarting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.

^bIncludes a small amount landed and discarded at the dock.

^cIncludes P. halibut catch from IFQ EM EFP.

^d100% mortality rate.

^eFrom 2011–14, referred to as "shoreside hake."

^fA coastwide discard ratio and coastwide discard estimate could not be computed in the OA FG sector for 2002–06, because WCGOP only covered OA vessels in CA during this time

^gStarting in 2011, this sector only includes OA CA halibut.

^hLE BT, IFQ BT, IFQ H&L, IFQ Pot, LE sable end., LE sable non-end., P. hal. directed, and OA FG.

ⁱIFQ MW hake, IFQ MW rf, A-S hake, NS FG, pink shrimp, and CA halibut.

Table 3: 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 Northwest Fisheries Science Center Fisheries Observation Science 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 and gut). There was no fishing in the IFQ H&L fishery during 2020–2022. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded).

* = confidential data, fewer than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Year	% legal-sized P. halibut in IFQ bottom trawl north of 40 deg. 10 min. N. lat.
2011	67.4%
2012	67%
2013	64.2%
2014	60.4%
2015	68%
2016	67.5%
2017	75.9%
2018	79.5%
2019	73.7%
2020	55.5%
2021	53.4%
2022	59.6%

Table 4: Percent of legal-sized P. halibut (> 82 cm) mortality, by weight (mt) in the IFQ fishery for vessels fishing bottom trawl gear north of 40° 10' N. lat.

Acknowledgements

The authors gratefully acknowledge the hard work and dedication of observers from the Northwest Fisheries Science Center's Fisheries Observation Science Program, Jim Fellows (NWFSC) for data acquisition assistance, and all the NWFSC FOS staff for their hard work and dedication. We thank our partners at PSMFC who provide us with data from the IFQ Electronic Monitoring EFP and landings data from PacFIN and specifically Aileen Smith for providing us with the data to compare DMRs in the EM fishery. Finally, we thank NOAA Fisheries and IPHC staff for providing feedback on this report.

References

- Clark, W. G., and S. R. Hare. 1998. Accounting for bycatch in management of the Pacific halibut fishery. *Journal of Fisheries Management* 18:809–821.
- Clark, W. G., S. H. Hoag, R. J. Trumble, and G. H. Williams. 1992. Re-estimation of survival for trawl caught halibut released in different condition factors. *International Pacific Halibut Commission, Report of Assessment and Research Activities* 1992:197-206.
- International Pacific Halibut Commission (IPHC), and K. Gustafson. 2019. IPHC annual report 2018. IPHC, Seattle, Washington, USA.
- Jannot, J. E., K. E. Richerson, K. A. Somers, V. J. Tuttle, C. M. Colway, and J. T. McVeigh. 2022. Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries, 2002–20. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-173.
- Keith, S., Kong, T., Sadorus, L., Stewart, I., and Williams, G. 2014. *The Pacific Halibut: Biology, Fishery, and Management*. IPHC Tech. Rep. No. 59. 60 p.
- Somers, K. A., K. E. Richerson, V. J. Tuttle, and J. T. McVeigh. 2023. Estimated Discard and Catch of Groundfish Species in the 2021 U.S. West Coast Fisheries. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-182.
- Trumble, R. J., S. M. Krimmer, and G. H. Williams. 2000. Estimation of discard mortality rates for Pacific halibut bycatch in groundfish longline fisheries. *North American Journal of Fisheries Management* 20:931-939.

A note about tables:

Tables 1–4 have been typeset and included in this summary. They are also available, together with all the other mentioned tables (5-95), in the accompanying Excel file: NWFSC_Pacific_Halibut_Bycatch_2002_2022_Supplemental_Tables.xlsx. Table captions are included below for reference.

Table Captions

Table 1. Pacific halibut mortality estimates for 2022 and the years of observation, for 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.

Table 2. Pacific halibut gross discard estimates (mt, including a small amount discarded at the dock in IFQ Bottom Trawl, Midwater Rockfish, and Midwater Hake fisheries) for sectors observed by the NWFSC Groundfish Observer Program. No mortality rates were applied to these estimates. 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). There was no fishing in the IFQ H&L fishery during 2020-2022. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded).

* = confidential data, less than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Table 3. 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 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). There was no fishing in the IFQ H&L fishery during 2020-2022. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded).

* = confidential data, less than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Table 4. Percent of legal-sized P. halibut (> 82 cm) mortality, by weight (mt) in the IFQ fishery for vessels fishing bottom trawl gear north of 40 deg. 10 min. N. lat.

Table 5. Data collected from P. halibut caught on IFQ vessels using different types of gear.

Table 6. Mortality rates used for each of the viability categories for IFQ bottom trawl vessels (Clark et al. 1992).

Table 7. Mortality rates used for each of the viability categories for IFQ pot gear vessels (IPHC 2011).

Table 8. Mortality rates used for each of the injury categories for Non-Nearshore hook & line vessels (Trumble et al. 2000).

Table 9. 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. (*) confidential data, (-) not applicable.

Table 10. 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. (*) confidential data, (-) not applicable.

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 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. (*) confidential data, (-) not applicable.

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 pot 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. (*) confidential data, (-) not applicable.

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 hook & line 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. (*) confidential data, (-) not applicable.

Table 14. Pacific halibut viabilities, weighted percent in each viability category, estimated gross at-sea discard (mt), and at-sea discard mortality (mt) for U.S. West Coast groundfish IFQ bottom trawl vessels by management area, depth, and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead, consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Estimates were allocated to the condition categories based on the weighted percent. In addition, all years combined are also shown. After 2012, LE CA Halibut is combined with IFQ. DMR = discard mortality rate, (*) confidential data, (-) no estimate provided, see text for explanation.

Table 15. Pacific halibut viabilities, weighted percent in each viability category, estimated gross at-sea discard (mt), and at-sea discard mortality (mt) for U.S. West Coast groundfish IFQ midwater trawl vessels targeting P. hake by management area, depth, and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead, consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Estimates were allocated to the condition categories

based on the weighted percent. In addition, all years combined are also shown. DMR = discard mortality rate, (*) confidential data, (-) no estimate provided, see text for explanation.

Table 16. Pacific halibut viabilities, weighted percent in each viability category, estimated gross at-sea discard (mt), and at-sea discard mortality (mt) for U.S. West Coast groundfish IFQ midwater trawl vessels targeting rockfish by management area, depth, and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead, consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Estimates were allocated to the condition categories based on the weighted percent. In addition, all years combined are also shown. DMR = discard mortality rate, (*) confidential data, (-) no estimate provided, see text for explanation.

Table 17. Pacific halibut viabilities, weighted percent in each viability category, estimated gross at-sea discard (mt), and at-sea discard mortality (mt) for U.S. West Coast groundfish IFQ pot vessels by management area, depth, and year. The condition of sampled P. halibut was identified as Excellent (Exc), Poor, or Dead, consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Estimates were allocated to the condition categories based on the weighted percent. In addition, all years combined are also shown. DMR = discard mortality rate, (*) confidential data, (-) no estimate provided, see text for explanation.

Table 18. Pacific halibut viabilities, weighted percent in each viability category, estimated gross at-sea discard (mt), and at-sea discard mortality (mt) for U.S. West Coast groundfish IFQ hook & line vessels by management area, depth, and year. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (S) or Dead (D), consistent with IPHC protocol. The number of fish in each category was weighted based on the length-weight relationship as described in the Methods. Estimates were allocated to the condition categories based on the weighted percent. In addition, all years combined are also shown. DMR = discard mortality rate, (*) confidential data, (-) no estimate provided, see text for explanation.

Table 19. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight for U.S. West Coast groundfish IFQ bottom trawl vessels by management area, depth, and year. After 2012, LE CA Halibut was combined with IFQ. (*) confidential data, (-) no estimate, see text for explanation

Table 20. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight for U.S. West Coast groundfish IFQ midwater trawl vessels targeting P. hake by management area, depth, and year. (*) confidential data, (-) no estimate, see text for explanation

Table 21. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight for U.S. West Coast groundfish IFQ midwater trawl vessels targeting rockfish by management area, depth, and year. (*) confidential data, (-) no estimate, see text for explanation

Table 22. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight for U.S. West Coast groundfish IFQ pot vessels by management area, depth, and year. (*) confidential data, (-) no estimate, see text for explanation

Table 23. Estimated Pacific halibut discard (mt), discard mortality (mt), legal-sized (82 cm) mortality (mt), and percent of legal-sized discard by weight for U.S. West Coast groundfish IFQ hook and line vessels by management area, depth, and year.

Table 24. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ bottom trawl vessels (2011-2022). Length bins include the lower bound and exclude the upper bound.

Table 25. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ midwater trawl vessels targeting P. hake (2015-2022). Length bins include the lower bound and exclude the upper bound.

Table 26. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ midwater trawl vessels targeting rockfish (2015-2022). Length bins include the lower bound and exclude the upper bound.

Table 27. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ pot vessels (2011-2022). Length bins include the lower bound and exclude the upper bound.

Table 28. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ hook & line vessels (2011-2022). Length bins include the lower bound and exclude the upper bound.

Table 29. Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish IFQ fishery (2011-2022) 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.

Table 30. Observed 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.

Table 31. Observed number of dead P. halibut in each length bin, summed across viability categories, for IFQ midwater 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. This analysis assumes that there is no size-dependent mortality within viability categories.

Table 32. Observed number of dead P. halibut in each length bin, summed across viability categories, for IFQ midwater 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. This analysis assumes that there is no size-dependent mortality within viability categories.

Table 33. Observed 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.

Table 34. Coverage information and Pacific halibut bycatch in the At-sea Pacific hake Catcher Processors 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.

Table 35. Coverage information and Pacific halibut bycatch in the At-sea Pacific hake Catcher Vessels delivering to Motherships 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.

Table 36. Coverage information and Pacific halibut bycatch in the At-sea Pacific hake Tribal 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. Tribal At-sea P. hake fishery has not operated since 2012. (*) confidential.

Table 37. Physical measurements of P. halibut length frequencies (cm) collected by A-SHOP observers in the At-sea hake fishery (2002-2022). Length bins include the lower bound and exclude the upper bound.

Table 38. Number of vessels, trips, and tows 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.

Table 39. P. halibut observed weight, estimated total at-sea gross weight of discards, and estimated mortality (mt ,with the mortality rate applied based on observer viability), in each viability category from IFQ bottom trawl vessels carrying both EM and a human at-sea observer. Discard mortality rates are shown for the observer viability method and the Time-on-Deck model as applied by the Pacific States Marine Fisheries Commission. Electronic Monitoring (EM) vessels carried electronic monitoring equipment. Viabilities on EM vessels were obtained by at-sea human observers. EM vessels only fished south of Pt. Chehalis. All weights are metric tons (mt). Exlnt = Excellent = 0.10 mortality rate; Poor = 0.55 mortality rate; Dead = 0.90 mortality rate; -- = not applicable.

Table 40. Number of vessels, trips, and 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.

Table 41. Number of vessels, trips, and tows 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.

Table 42. Number of vessels, trips, and tows 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.

Table 43. Number of observed vessels, trips, and sets in the Limited Entry Sablefish hook & line fishery.

Table 44. Number of observed vessels, trips, and sets in the Limited Entry Sablefish pot fishery.

Table 45. Number of observed vessels, trips, and sets in the LE Fixed Gear DTL hook & line fishery. The number of observed pot vessels in this fishery is too small to meet confidentiality and thus not reported.

Table 46. Number of observed vessels, trips, and sets in the OA Fixed Gear hook & line fishery. OA Fixed Gear fishery was not observed until 2003.

Table 47. Number of observed vessels, trips, and sets in the OA Fixed Gear pot fishery. OA Fixed Gear fishery was not observed until 2003.

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, where target species include a variety of groundfish species.

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

Table 50. Observed average, minimum and maximum annual catch of P. halibut catch weight discarded by year. -- No WCGOP observers were deployed for the sector-year-gear type combination.

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

Table 52. Injury assessment of Pacific halibut caught by hook & line vessels in the U.S. west coast, Limited Entry Sablefish fishery by year and area. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead, consistent with IPHC protocol. Sample sizes allowed for annual weighted rates as described in the Methods. Injury assessments were not used by NWFSC in mortality estimates until 2011; injury data prior to 2011 is shown for informational purposes only.

Table 53. Injury assessment of Pacific halibut caught by hook & line vessels in the U.S. west coast, LE Fixed Gear DTL fishery by year and area. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead, consistent with IPHC protocol. Sample sizes allowed for annual weighted rates as described in the Methods. Injury assessments were not used by NWFSC in mortality estimates until 2011; injury data prior to 2011 is shown for informational purposes only.

Table 54. Injury assessment of Pacific halibut caught by hook & line vessels in the U.S. west coast, OA Fixed Gear fishery by year and area. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead, consistent with IPHC protocol. Sample sizes allowed for annual weighted rates as described in the Methods. Injury assessments were not used by NWFSC in mortality estimates until 2011; injury data prior to 2011 is shown for informational purposes only.

Table 55. Estimated gross discard (mt) in the limited entry (LE) sablefish endorsed, LE sablefish non-endorsed, and open access (OA) fixed gear sectors. Note that coastwide discards are calculated as the sum of the north and south area discards.

Table 56. Estimated 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. Note that coastwide mortalities are calculated as the sum of the north and south area mortalities.

Table 57. 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.

Table 58. Physical measurements of P. halibut length (cm) from the U.S. west coast Limited Entry Sablefish fishery (2002-2022) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 59. Physical measurements of P. halibut length (cm) from the U.S. west coast Limited Entry Sablefish fishery (2002-2022) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

Table 60. Physical measurements of P. halibut length (cm) from the U.S. west coast LE Fixed Gear DTL fishery (2002-2022) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 61. Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2022) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 62. Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2022) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

Table 63. Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish Non-Nearshore fixed gear fisheries (2002-2022) 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.

Table 64. Dates for IPHC P. halibut directed commercial (non-tribal) fishery in area 2A.

Table 65. Number of observed vessels, trips, and sets in the Directed P Halibut hook & line fishery. The WCGOP began observing the Pacific halibut directed fishery in 2017 at the request of the IPHC.

Table 66. Discard ratio and gross discard estimate of P. halibut for the P. halibut directed fishery. SE = standard error; ci = confidence interval

Table 67. Injury assessment of Pacific halibut caught by hook & line vessels in the U.S. west coast, Directed P Halibut fishery by year and area. The condition of sampled P. halibut was identified as Minor (Mi), Moderate (Mo), Serious (Ser) or Dead, consistent with IPHC protocol. Sample sizes allowed for annual weighted rates as described in the Methods. Injury assessments were not used by NWFSC in mortality estimates until 2011; injury data prior to 2011 is shown for informational purposes only.

Table 68. Physical measurements of P. halibut length (cm) from the U.S. west coast Directed P Halibut fishery (2002-2022) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 69. Visual length estimates of discarded P. halibut from the Pacific halibut directed fishery. Length bins include the lower bound and exclude the upper bound.

Table 70. Pacific halibut physically measured lengths and visual estimates of lengths approximating legal (> 82 cm) versus sublegal definitions (IPHC), collected by the WCGOP in the IFQ fishery (2011-2022), Non-Nearshore fixed gear fisheries (LE sablefish endorsed, LE non-endorsed, OA fixed gear; 2002-2022), the At-sea Hake sectors (2002-2022) and the Directed P. halibut fishery (2017-2022). Note that visual length estimates are not taken in the At-sea Hake sectors.

Table 71. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Oregon nearshore fixed gear fishery. The WCGOP began observing the Oregon nearshore fishery in 2004. Coverage rate in the Oregon nearshore fixed gear fishery is defined as the proportion of P. halibut to nearshore species landings that were observed. Nearshore species are listed in the WCGOP Data Processing Appendix. Gear specific mortality rates cannot be applied to P. halibut bycatch in this fishery because of confidentiality issues. Washington does not allow a state nearshore fishery. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 72. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the California nearshore fixed gear fishery. The WCGOP began observing the California nearshore fishery in 2003. Coverage rate in the California nearshore fixed gear fishery is defined as the proportion of P. halibut to nearshore species landings that were observed. Nearshore species are listed in the WCGOP Data Processing Appendix. Gear specific mortality rates cannot be applied to P. halibut bycatch in this fishery because of confidentiality issues. Washington does not allow a state nearshore fishery. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 73. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Washington pink shrimp shrimp trawl fishery. The WCGOP began observing the Washington pink shrimp fishery in 2010. Coverage rate in the Washington pink shrimp shrimp trawl fishery is defined as the proportion of P. halibut to pink shrimp (mainly *Pandalus jordani*) landings that were observed. Mortality rates are not applied to P. halibut bycatch in these fisheries because mortality rates for shrimp trawl gear have not been estimated. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 74. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Oregon pink shrimp shrimp trawl fishery. The WCGOP began observing the Oregon pink shrimp fishery in 2004. Coverage rate in the Oregon pink shrimp shrimp trawl fishery is defined as the proportion of P. halibut to pink shrimp (mainly *Pandalus jordani*) landings that were observed. The OR pink shrimp fishery was not observed in 2006. Mortality rates are not applied to P. halibut bycatch in these fisheries because mortality rates for shrimp trawl gear have not been estimated. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 75. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the California pink shrimp shrimp trawl fishery. The WCGOP began observing the California pink shrimp fishery in 2003. Coverage rate in the California pink shrimp trawl fishery is defined as the proportion of P. halibut to pink shrimp (mainly *Pandalus jordani*) landings that were observed. The CA pink shrimp fishery was not observed in 2006. Mortality rates are not applied to P. halibut bycatch in these fisheries because mortality rates for shrimp trawl gear have not been estimated. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 76. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the California halibut bottom trawl fishery. The WCGOP began observing the California halibut

fishery in 2002. Coverage rate in the California halibut bottom trawl fishery is defined as the proportion of *P. halibut* to California halibut (**Paralichthys californicus**) landings that were observed. The WCGOP recognizes two sectors; a limited entry (LE) sector and an open access (OA) 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. (*) = Confidential data; (â€œ) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 77. Observer coverage information and *P. halibut* bycatch and landings for the Ridgeback Prawn fishery by year. The WCGOP began observing the Ridgeback Prawn fishery in 2017. * = confidential.

Table 78. Observer coverage information and *P. halibut* bycatch and landings for the Sea Cucumber fishery by year. The WCGOP began observing the Sea Cucumber fishery in 2017. * = confidential.

Table 79. 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.

Table 80. 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.

Table 81. 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.

Table 82. 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.

Table 83. 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.

Table 84. Length-weight conversion table for Pacific halibut. This length frequency table was updated to reflect length-weight relationships in IPHC Area 2A by IPHC in 2022. In analyses we used the relationship $W = a \times L^b$, where W is weight in kg, L is length in cm, $a = 3.251 \times 10^{-6}$, and $b = 3.287$