

## Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries, 2002 - 2021 (update and correction)

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### Summary

This report contains updates and corrections to Agenda Item G.1.b, NWFSC Report 3 and 4, September 2022 (Pacific Halibut Bycatch 2002-2020). At the time of the report, 2021 video review data from the Electronic Monitoring (EM) EFP were not yet available, so we reported estimates for the EM pot and bottom trawl sectors based on the subset of the fleet that carried human observers (covering ~11% of bottom trawl landings and ~29% of pot landings). 2021 EM video review data are now available and are incorporated into the updated estimates here. Based on human observer data, we estimated 2.39 metric tons of at-sea Pacific halibut discard mortality in EM sectors. Based on video review data, we estimate 6.87 metric tons. All other estimates have been re-run with the newest observer and fish ticket data, which may result in small differences across reports.

In addition, several corrections were made. Notably:

- 1) The length-weight relationship was corrected to reflect the length-round weight conversion published by the IPHC ([IPHC-2022-AM098-INF07](#)). This impacts the estimates of mortality by size class.
- 2) Summary Table 2 and 3 were corrected to include mortality estimates from the Electronic Monitoring EFP.

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\\_2021\\_Supplemental\\_Tables.xlsx](#). Table captions are included below for reference.

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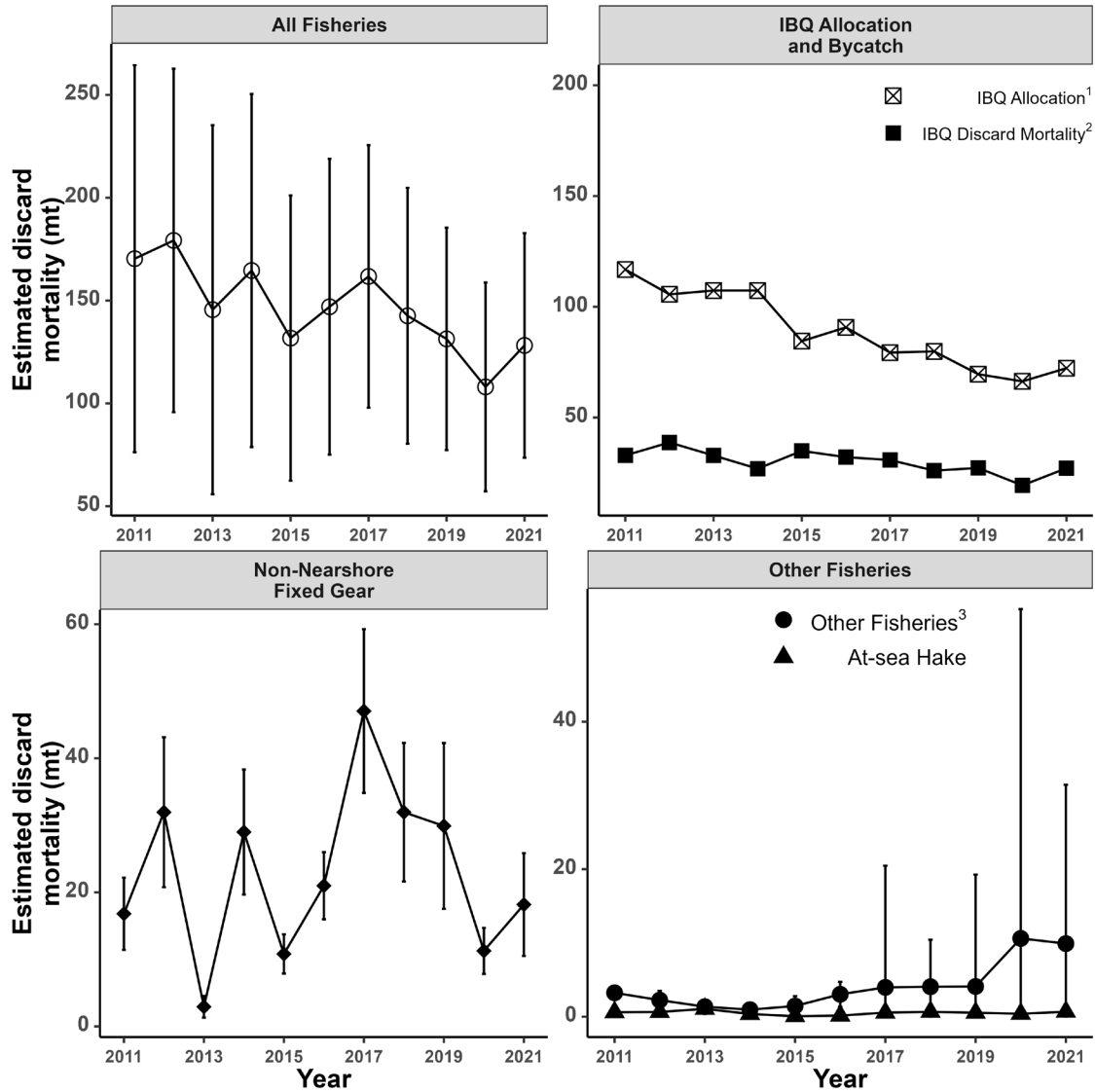


Figure 1: Total estimated P. halibut discard mortality (mt  $\pm$  1 SE, with mortality rates applied if applicable) from all sectors observed by the NWFSC Groundfish Observer Program. Estimates are not included for sectors and years where there were insufficient observer data. Values are reported in Table 2.<sup>1</sup>Individual Bycatch Quota (IBQ) allocated north of 40° 10' N. latitude. <sup>2</sup>IBQ catch includes all Catch Shares sectors and gears except At-sea Hake which is shown separately. <sup>3</sup>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.

Table 1. Pacific halibut mortality estimates for 2021 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. \* = confidential

Sector	Years_Observed	2021 Total Discard Mortality (mt)
Individual Fishing Quota (IFQ) fisheries <sup>1</sup>	2011-2021	27.37
IFQ Electronic Monitoring (EM) EFP <sup>2</sup>	2015-2021	6.87
At-sea Pacific hake	2002-2021	0.67
Non-nearshore fixed gear targeting groundfish	2002-2021	18.18
P. halibut directed	2017-2021	8.04
Nearshore fixed gear	2003-2021	1.87
Pink shrimp trawl	2004-2021	0
California halibut trawl	2002-2021	0
CA Ridgeback Prawn	2017-2021	*
CA Sea Cucumber	2017-2021	*

<sup>1</sup>Does not include estimates from IFQ vessels with Electronic Monitoring, includes all gears

<sup>2</sup>EFP = Exempted Fishing Permit, includes all gears

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 or monitored by the NWFSC Groundfish Observer Program, the At-Sea Hake Observer Program, or the Electronic Monitoring 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). Ridgeback Prawn and Sea Cucumber fisheries (both observed from 2017 to 2021) had zero (0) observed P. halibut catch. There was no fishing in the IFQ H&L fishery during 2020-2021. The 2020-2021 IFQ Pot, 2019-2021 IFQ MW hake, 2011 IFQ MW rf, and the Sea Cucumber fishery since 2018 data are confidential. \* = confidential data, less than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Year	Total discards (mt), mortality rates not applied																All sectors	All w/ <1.0 mort. <sup>9</sup>	All w/ 1.0 mort. <sup>8</sup>		
	LE BT 2002-10	IFQ BT <sup>ab</sup>	IFQ BT EM	IFQ H&L	IFQ Pot	IFQ Pot EM	IFQ MW hake <sup>bcd</sup>	IFQ MW hake EM <sup>c</sup>	IFQ MW rf <sup>bc</sup>	IFQ MW rf EM <sup>c</sup>	A-S hake <sup>c</sup>	LE sable end.	LE sable non-end.	P.hal. directed	OA FG <sup>e</sup>	NS FG <sup>c</sup>				Pink shrimp <sup>c</sup>	CA hal. <sup>cf</sup>
2002	524.41	n/a	n/a	n/a	n/a	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	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	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	n/a	n/a	n/a	n/a	1.97	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	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	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	1.51
2008	305.21	n/a	n/a	n/a	n/a	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	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	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	0.00	6.13	3.36	0.00	0.36	0.00	*	0.00	0.61	137.45	21.26	-	13.03	3.05	0.19	0.00	249.68	245.48	4.20
2012	n/a	67.05	0.00	14.79	1.90	0.00	0.62	0.00	0.00	0.00	0.64	163.42	16.25	-	23.63	2.25	0.00	0.00	290.54	287.03	3.51
2013	n/a	66.30	0.00	3.00	0.99	0.00	1.31	0.00	0.00	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	0.00	3.95	0.32	0.00	1.36	0.00	0.00	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	69.20	0.18	9.81	1.33	0.89	0.14	0.56	0.00	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	56.48	2.93	6.95	1.71	0.07	0.03	0.65	0.00	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	59.43	5.41	4.25	1.09	0.75	0.04	0.46	0.04	0.00	0.55	304.36	0.75	25.27	49.41	1.76	0.00	0.00	453.58	450.72	2.86
2018	n/a	45.83	6.16	4.93	1.65	0.99	0.19	1.15	0.03	0.00	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	48.94	4.14	3.56	3.16	1.08	*	1.05	0.02	0.02	0.54	232.19	76.51	28.98	39.77	0.57	0.00	0.00	440.52	438.32	2.20
2020	n/a	36.05	8.51	-	*	3.05	*	1.39	0.00	0.00	0.39	127.16	0.00	47.75	10.05	1.37	0.00	0.00	235.73	232.57	3.16
2021	n/a	48.42	6.14	-	*	2.98	*	0.80	0.00	0.00	0.67	133.13	1.61	33.99	19.79	1.87	0.00	0.00	249.41	246.07	3.34

<sup>a</sup>Starting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.

<sup>b</sup>Includes a small amount landed and discarded at the dock.

<sup>c</sup>100% mortality rate.

<sup>d</sup>From 2011–14, referred to as "shoreside hake."

<sup>e</sup>A 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

<sup>f</sup>Starting in 2011, this sector only includes OA CA halibut.

<sup>g</sup>LE BT, IFQ BT, IFQ H&L, IFQ Pot, LE sable end., LE sable non-end., P. hal. directed, and OA FG.

<sup>h</sup>IFQ 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 or monitored by the NWFSC Groundfish Observer Program, the At-Sea Hake Observer Program, or the Electronic Monitoring 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 and Sea Cucumber fisheries (both observed from 2017 to 2021) had zero (0) observed P. halibut catch. There was no fishing in the IFQ H&L fishery during 2020-2021. The 2020-2021 IFQ Pot, 2019-2021 IFQ MW hake, 2011 IFQ MW rf, and the Sea Cucumber fishery since 2018 data are confidential. \* = confidential data, less than 3 vessels observed; - = no observer coverage or no fishing; n/a = not applicable because fishery did not exist.

Year	Total mortality (mt), mortality rates applied																				
	LE BT 2002-10	IFQ BT <sup>ab</sup>	IFQ BT EM	IFQ H&L	IFQ Pot	IFQ Pot EM	IFQ MW hake <sup>bcd</sup>	IFQ MW hake EM <sup>c</sup>	IFQ MW rf <sup>bcd</sup>	IFQ MW rf EM <sup>c</sup>	A-S hake <sup>c</sup>	LE sable end.	LE sable non-end.	P.hal. directed	OA FG <sup>e</sup>	NS FG <sup>e</sup>	Pink shrimp <sup>c</sup>	CA hal. <sup>cf</sup>	All sectors	All w/ <1.0 mort. <sup>g</sup>	All w/ 1.0 mort. <sup>h</sup>
2002	344.82	n/a	n/a	n/a	n/a	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	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	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	n/a	n/a	n/a	n/a	1.97	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	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	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	1.51
2008	207.81	n/a	n/a	n/a	n/a	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	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	n/a	n/a	n/a	n/a	1.57	22.19	0.06	-	5.22	0.08	0.00	0.00	210.10	208.44	1.65
2011	n/a	31.32	0.00	0.98	0.60	0.00	0.36	0.00	*	0.00	0.61	11.83	3.04	-	1.93	3.05	0.19	0.00	53.92	49.72	4.20
2012	n/a	35.93	0.00	2.37	0.34	0.00	0.62	0.00	0.00	0.00	0.64	29.69	0.76	-	1.51	2.25	0.00	0.00	74.10	70.59	3.51
2013	n/a	32.33	0.00	0.48	0.18	0.00	1.31	0.00	0.00	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	0.00	0.63	0.06	0.00	1.36	0.00	0.00	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	33.18	0.16	1.57	0.24	0.16	0.14	0.56	0.00	0.00	0.06	10.40	0.02	-	0.40	1.44	0.01	0.00	48.33	46.13	2.21
2016	n/a	30.83	2.64	1.11	0.31	0.01	0.03	0.65	0.00	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	30.09	4.87	0.68	0.20	0.13	0.04	0.46	0.04	0.00	0.55	43.46	0.04	2.22	3.55	1.76	0.00	0.00	88.09	85.23	2.86
2018	n/a	24.94	5.55	0.79	0.30	0.18	0.19	1.15	0.03	0.00	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	26.21	3.72	0.57	0.57	0.19	*	1.05	0.02	0.02	0.54	24.35	2.68	3.52	2.87	0.57	0.00	0.00	66.89	64.69	2.20
2020	n/a	19.56	7.66	-	*	0.55	*	1.39	0.00	0.00	0.39	10.92	0.00	9.24	0.35	1.37	0.00	0.00	51.44	48.28	3.16
2021	n/a	27.37	5.53	-	*	0.54	*	0.80	0.00	0.00	0.67	16.09	0.19	8.04	1.90	1.87	0.00	0.00	63.00	59.66	3.34

\*Starting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.

<sup>a</sup>Includes a small amount landed and discarded at the dock.

<sup>b</sup>100% mortality rate.

<sup>c</sup>From 2011–14, referred to as "shoreside hake."

<sup>e</sup>A 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

<sup>f</sup>Starting in 2011, this sector only includes OA CA halibut.

<sup>g</sup>LE BT, IFQ BT, IFQ H&L, IFQ Pot, LE sable end., LE sable non-end., P. hal. directed, and OA FG.

<sup>h</sup>IFQ MW hake, IFQ MW rf, A-S hake, NS FG, pink shrimp, and CA halibut.

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.

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%

## Table captions

Table 1. Pacific halibut mortality estimates for 2021 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. \* = confidential

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 or monitored by the NWFSC Groundfish Observer Program, the At-Sea Hake Observer Program, or the Electronic Monitoring 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). Ridgeback Prawn and Sea Cucumber fisheries (both observed from 2017 to 2021) had zero (0) observed P. halibut catch. There was no fishing in the IFQ H&L fishery during 2020-2021. The 2020-2021 IFQ Pot, 2019-2021 IFQ MW hake, 2011 IFQ MW rf, and the Sea Cucumber fishery since 2018 data are confidential. \* = 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 all sectors observed or monitored by the NWFSC Groundfish Observer Program, the At-Sea Hake Observer Program, or the Electronic Monitoring 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 and Sea Cucumber fisheries (both observed from 2017 to 2021) had zero (0) observed P. halibut catch. There was no fishing in the IFQ H&L fishery during 2020-2021. The 2020-2021 IFQ Pot, 2019-2021 IFQ MW hake, 2011 IFQ MW rf, and the Sea Cucumber fishery since 2018 data are confidential. \* = 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. 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 state, management area, depth, year, sector and gear. 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.

Table 15. 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 targeting P. hake 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 state, management area, depth, year, sector and gear. 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.

Table 16. 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 targeting rockfish 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 state, management area, depth, year, sector and gear. 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.

Table 17. Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ pot 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 state, management area, depth, year, sector and gear. 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.

Table 18. Values used to calculate the expanded weight of Pacific halibut (PHLB) from each unsampled category on U.S. West Coast groundfish IFQ hook & line 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 state, management area, depth, year, sector and gear. 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.

Table 19. 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 20. 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 21. 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 22. 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 23. 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 24. 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 25. 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 26. 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 27. 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 28. 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 & line vessels by management area, depth, and year. (\*) confidential data, (-) no estimate, see text for explanation

Table 29. Pacific halibut bycatch discarded at-sea (no mortality rate applied) by month for vessels fishing bottom trawl gear in the 2021 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.

Table 30. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ bottom trawl vessels (2011-2021). Length bins include the lower bound and exclude the upper bound.

Table 31. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ midwater trawl vessels targeting P. hake (2015-2021). Length bins include the lower bound and exclude the upper bound.

Table 32. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ midwater trawl vessels targeting rockfish (2015-2021). Length bins include the lower bound and exclude the upper bound.

Table 33. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ pot vessels (2011-2021). Length bins include the lower bound and exclude the upper bound.

Table 34. Physical measurements of P. halibut length (cm) for U.S. west coast groundfish IFQ hook & line vessels (2011-2021). Length bins include the lower bound and exclude the upper bound.

Table 35. Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish IFQ fishery (2011-2021) 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 36. 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.

Table 37. Percentage of weighted length measurements in each viability category, for IFQ 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.

Table 38. 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 39. Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using midwater 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.

Table 40. Percentage of weighted length measurements in each viability category, for IFQ 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.

Table 41. 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 42. Weighted length frequency distributions for Pacific halibut in the IFQ fishery for vessels using midwater 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.

Table 43. Percentage of weighted length measurements in each viability category, for IFQ 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.

Table 44. 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 45. 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.

Table 46. Percentage of weighted length measurements in each viability category, for IFQ 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.

Table 47. 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 48. 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 49. 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 50. 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 51. Physical measurements of P. halibut length frequencies (cm) collected by A-SHOP observers in the At-sea hake fishery (2002-2021). Length bins include the lower bound and exclude the upper bound.

Table 52. 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 53. 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 54. 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 55. 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 56. 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 57. Number of observed vessels, trips, and sets in the Limited Entry Sablefish hook & line fishery.

Table 58. Number of observed vessels, trips, and sets in the Limited Entry Sablefish pot fishery.

Table 59. 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 60. 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 61. Number of observed vessels, trips, and sets in the OA Fixed Gear pot fishery. The OA Fixed Gear fishery was not observed until 2003.

Table 62. Expansion factors and WCGOP observed discard rate by gear type for limited entry (LE) and open access (OA) non-nearshore fixed gear sectors used to expand discard estimates of Pacific halibut to the entire fleet.

Table 63. 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.

Table 64. 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 65. 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 66. 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 67. The observed percent of P. halibut catch weight discarded by year. – No WCGOP observers were deployed for the sector-year-gear type combination.

Table 68. 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 69. 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 70. 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 71. 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 72. 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 73. 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 74. Physical measurements of P. halibut length (cm) from the U.S. west coast Limited Entry Sablefish fishery (2002-2021) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 75. Physical measurements of P. halibut length (cm) from the U.S. west coast Limited Entry Sablefish fishery (2002-2021) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

Table 76. Physical measurements of P. halibut length (cm) from the U.S. west coast LE Fixed Gear DTL fishery (2002-2021) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 77. Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2021) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 78. Physical measurements of P. halibut length (cm) from the U.S. west coast OA Fixed Gear fishery (2002-2021) for vessels using pot gear. Length bins include the lower bound and exclude the upper bound.

Table 79. Visual estimates of P. halibut lengths (cm) from the U.S. West Coast groundfish Non-Nearshore fixed gear fisheries (2002-2021) 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 80. Dates for IPHC P. halibut directed commercial (non-tribal) fishery in area 2A.

Table 81. 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.

Table 82. Discard ratio and gross discard estimate of P. halibut for the P. halibut directed fishery. SE = standard error; ci = confidence interval

Table 83. 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 84. Physical measurements of P. halibut length (cm) from the U.S. west coast Directed P Halibut fishery (2002-2021) for vessels using hook & line gear. Length bins include the lower bound and exclude the upper bound.

Table 85. 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 86. 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 (2011-2021), Non-Nearshore fixed gear fisheries (LE sablefish endorsed, LE non-endorsed, OA fixed gear; 2002-2021), the At-sea Hake sectors (2002-2021) and the Directed P. halibut fishery (2017-2021). Note that visual length estimates are not taken in the At-sea Hake sectors.

Table 87. 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 88. 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 89. 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 90. Coverage information, bycatch rates, and bycatch estimates for Pacific halibut in the Oregon pink shrimp trawl fishery. The WCGOP began observing the Oregon pink shrimp fishery in 2004. Coverage rate in the Oregon pink 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 91. 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 92. 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; (-) = not observed; lcl/ucl = lower/upper 95% confidence limit.

Table 93. 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 94. 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 95. 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 96. 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 97. 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 98. 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 99. 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 100. 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  $b = 3.287$