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Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries, 2002–22

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U.S. DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest Fisheries Science Center

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Pacific Halibut Bycatch in U.S. West Coast Groundfish Fisheries, 2002–22

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Summary

P. 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 fathoms) from Washington to central California (Clark and Hare 1998, Keith et al. 2014). P. halibut has long supported directed commercial fisheries in the United States and Canada, but it is also caught as bycatch in other fisheries that target demersal species inhabiting similar depths and seafloor habitat types (IPHC and 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 P. halibut Commission (IPHC), a body founded through treaty agreement between the United States 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 IPHC and NOAA Fisheries. P. halibut catch in Area 2A is allocated among tribal and nontribal 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, fish sales information, and review of video imagery from electronic monitoring. The Northwest Fisheries Science Center's (NWFSC) Fisheries Observation Science Program (FOS) has collected discard data from commercial fishing vessels since 2002.[1]

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 PFMC and 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).

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).[2] 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 lat 40°10′N (2022 IBQ allocation = 99.64 mt[3]). As in prior years, bottom trawl gear produced the largest component of IFQ discard mortality (bottom trawl IFQ + IFQ EM = 34.71 mt), almost two-thirds of which was from bottom trawl vessels fishing south of Point Chehalis, Washington (Supplemental Tables 19 and 38). The percent of legal-sized P. halibut (>82 cm) discard mortality, by weight (mt) in the IFQ bottom trawl fishery north of lat 40°10′N is presented in Table 2.

[1] Prior to 2001, at-sea hake fisheries were observed by the Alaska Fisheries Science Center.
[2] Summarized estimates presented here and in the tables might exclude small amounts of data to ensure summarized values maintain confidentiality.
[3] https://www.webapps.nwfsc.noaa.gov/apex/ifq/f?p=155:1::::::

Table 1. Pacific 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	Total discard mortality (mt), 2022
Individual fishing quota (IFQ) fisheries[a]	2011–22	27.25
IFQ electronic monitoring (EM) EFP[b]	2015–22	8.89
At-sea Pacific hake	2002–22	1.75
Non-nearshore fixed gear targeting groundfish	2002–22	6.89
P. halibut directed	2017–22	1.69
Nearshore fixed gear	2003–22	4.25
Pink shrimp trawl	2004–22	0.19
California halibut trawl	2002–22	0.00

[a] Does not include estimates from IFQ vessels with EM; includes all gears.
[b] EFP = exempted fishing permit; includes all gears.

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 2015–22 based on observer assessed viabilities and 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, 3, and 4). 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 Pt. Chehalis (4.12 mt or ~61%; Supplemental Table 56). A smaller amount of P. halibut mortality occurred on LE sablefish endorsed vessels fishing longline gear south of Pt. Chehalis (2.13 mt). We report estimates north and south of Pt. 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.

Table 2. Percent of legal-sized P. halibut (>82 cm) mortality, by weight (mt), in the IFQ fishery for vessels fishing bottom trawl gear north of lat 40°10′N. Key: *hal* = halibut, *IFQ* = individual fishing quota, *BT* = bottom trawl.

Year	% legal-sized P. hal in IFQ BT (N of lat 40°10′N)
2011	67.4
2012	67.0
2013	64.2
2014	60.4
2015	68.0
2016	67.5
2017	75.9
2018	79.5
2019	73.7
2020	55.5
2021	53.4
2022	59.6

Table 3. Pacific halibut gross discard estimates (mt, including a small amount discarded at the dock in IFQ BBT, MW rf, and MW hake fisheries) for all sectors observed by FOS. No mortality rates were applied to these estimates. Rounding of values might mask very small weights in some categories; rounded numbers 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 2020–22. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded). Key: *LE* = limited entry, *BT* = bottom trawl, *IFQ* = individual fishing quota, *H&L* = hook-and-line, *MW* = midwater, *rf* = rockfish, *A-S* = at-sea, *sable* = sablefish, *end* = endorsed, *nonend* = nonendorsed, *hal* = halibut, *OA* = open access, *FG* = fixed gear, *NS* = nearshore, *mort* = mortality, * = confidential data (fewer than 3 vessels observed), — = no observer coverage or no fishing, *n/a* = not applicable because fishery did not exist.

Total discards (mt), mortality rates not applied																	
Year	LE BT 2002–10	IFQ BT[abc]	IFQ H&L	IFQ pot[c]	IFQ MW hake[bcde]	IFQ MW rf[bcd]	A-S hake[d]	LE sable end	LE sable nonend	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	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

[a] Starting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.
[b] Includes a small amount landed and discarded at the dock.
[c] Includes P. halibut catch from IFQ electronic monitoring exempted fishing permits (EM EFP).
[d] 100% mortality rate.
[e] Referred to as "shoreside hake" from 2011–14.
[f] A coastwide discard ratio and coastwide discard estimate could not be computed in the OA FG sector for 2002–06 because only OA vessels in CA were observed during this time.
[g] Starting in 2011, this sector only includes OA CA halibut.
[h] LE BT, IFQ BT, IFQ H&L, IFQ pot, LE sable end, LE sable nonend, P. hal directed, and OA FG.
[i] IFQ MW hake, IFQ MW rf, A-S hake, NS FG, Pink shrimp, and CA hal.

Table 4. Pacific halibut discard mortality estimates (mt, including a small amount discarded at the dock in IFQ BBT, MW rf, and MW hake fisheries) for all sectors observed by FOS. Mortality rates of less than 100% were applied in the BT fisheries (LE, IFQ), IFQ H&L, IFQ pot, and non-IFQ, non-NS FG 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; rounded numbers 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 2020–22. Total discards in sectors with and without PFMC-approved discard mortality rates are shown (confidential sectors excluded). Key: *LE* = limited entry, *BT* = bottom trawl, *IFQ* = individual fishing quota, *H&L* = hook-and-line, *MW* = midwater, *rf* = rockfish, *A-S* = at-sea, *sable* = sablefish, *end* = endorsed, *nonend* = nonendorsed, *hal* = halibut, *OA* = open access, *FG* = fixed gear, *NS* = nearshore, *mort* = mortality, * = confidential data (fewer than 3 vessels observed), — = no observer coverage or no fishing, *n/a* = not applicable because fishery did not exist.

	Total discards (mt), mortality rates not applied																
Year	LE BT 2002–10	IFQ BT[abc]	IFQ H&L	IFQ pot[c]	IFQ MW hake[bcde]	IFQ MW rf[bcd]	A-S hake[d]	LE sable end	LE sable nonend	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

[a] Starting in 2011, LE CA halibut estimates are combined with IFQ BT estimates.
[b] Includes a small amount landed and discarded at the dock.
[c] Includes P. halibut catch from IFQ electronic monitoring exempted fishing permits (EM EFP).
[d] 100% mortality rate.
[e] Referred to as "shoreside hake" from 2011–14.
[f] A coastwide discard ratio and coastwide discard estimate could not be computed in the OA FG sector for 2002–06 because only OA vessels in CA were observed during this time.
[g] Starting in 2011, this sector only includes OA CA halibut.
[h] LE BT, IFQ BT, IFQ H&L, IFQ pot, LE sable end, LE sable nonend, P. hal directed, and OA FG.
[i] IFQ MW hake, IFQ MW rf, A-S hake, NS FG, Pink shrimp, and CA hal.

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 nonendorsed vessels fishing with pot gear, and LE nonendorsed vessels fishing with hook-and-line gear did not catch any P. halibut in 2022 (Supplemental Table 56).

The P. halibut discard mortality estimate for the 2022 IPHC directed P. halibut fishery was 1.69 mt (Tables 1 and 4), 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 represents a small component of total P. halibut mortality (Table 1, Figure 1).

Final estimates of discards in observed fishery sectors, including the IFQ EM EFP, are shown in Tables 1, 3, and 4. 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 2002–10 period (Tables 3 and 4) and P. halibut bycatch estimates for observed, non-IFQ vessels with an EFP targeting groundfish (2002–22; Supplemental Table 79). For completeness, we also include the P. halibut landed catch from Pacific Fisheries Information Network (PacFIN) fish tickets reported by nongroundfish fisheries that are not observed by FOS for the period 2002–22 (Supplemental Table 96).

FOS data used in this report have been updated to include the most recent available (2002–22). PacFIN data used in this report were accessed July 2022. The estimates for all sectors and years (except LE trawl 2002–10) have been recalculated based on these data. For ease of data access and reporting, the majority of tables ("Supplemental Tables") have been removed from the written report and are provided in the accompanying Microsoft Excel file, available in this report's NOAA Institutional Repository record by following the "Supporting Files" link.[4]

[4] https://repository.library.noaa.gov/

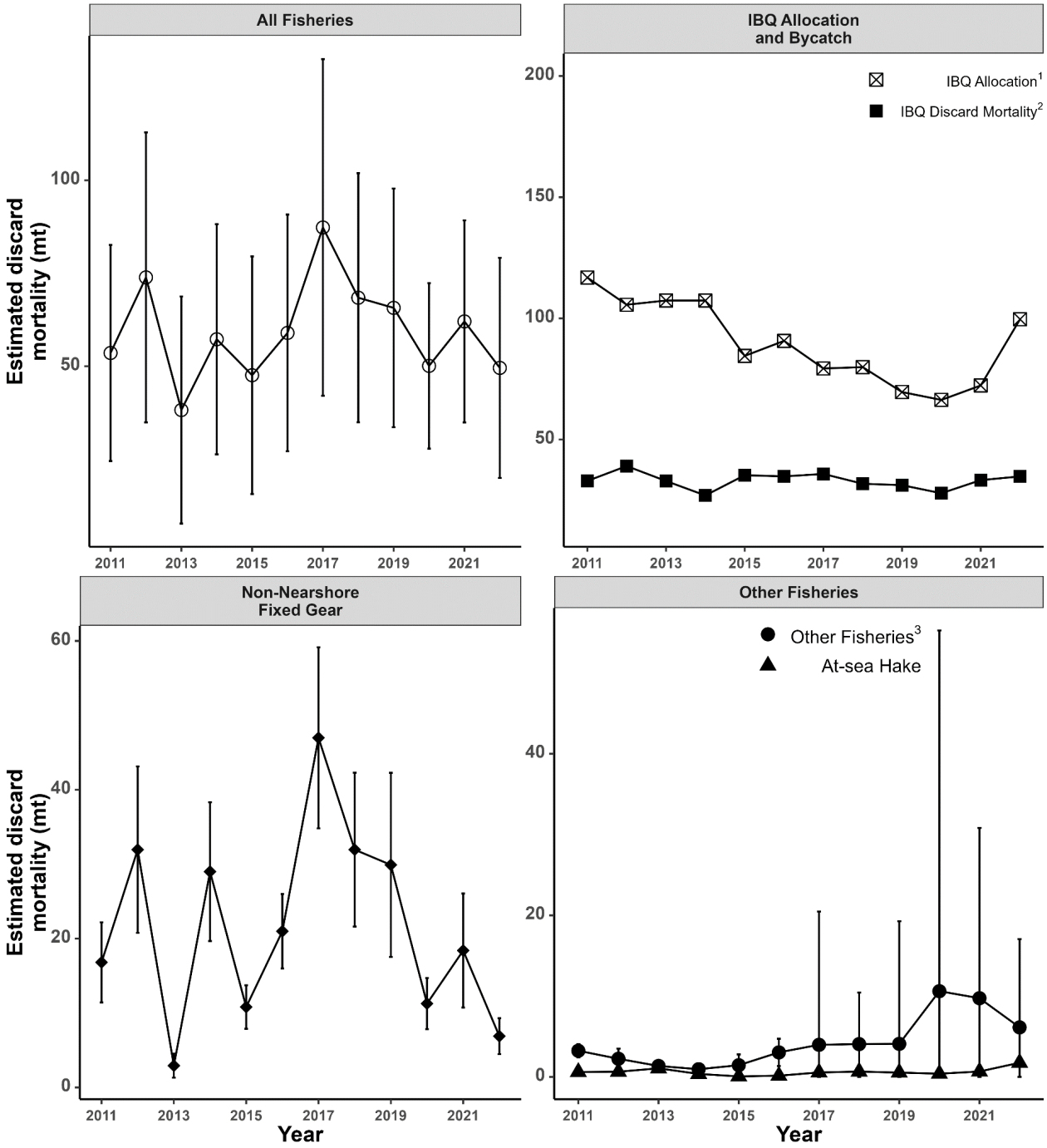

Figure 1. Total estimated P. halibut discard mortality (mt ±1 SE, with mortality rates applied if applicable) from all sectors observed by FOS. Estimates are not included for sectors and years where there were insufficient observer data. Values are reported in Table 3. Note that the y-axis scales vary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

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

[2]IBQ catch includes all catch share sectors and gears except at-sea hake (shown separately).

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

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Table Headings

Tables 1–4 have been typeset and included in this summary. They are also available, together with all the other mentioned tables (5–84), in the accompanying Excel file, available from this report's NOAA Institutional Repository record by following the "Supporting Files" link.[5] All table headings are included below for reference.

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.

Table 2. Percent of legal-sized P. halibut (>82 cm) mortality, by weight (mt), in the IFQ fishery for vessels fishing bottom trawl gear north of lat 40°10′N.

Table 3. P. halibut gross discard estimates (mt, including a small amount discarded at the dock in IFQ BBT, MW rf, and MW hake fisheries) for all sectors observed by FOS.

Table 4. P. halibut discard mortality estimates (mt, including a small amount discarded at the dock in IFQ BBT, MW rf, and MW hake fisheries) for all sectors observed by FOS.

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 (Williams and Chen 2003).

Table 8. Mortality rates used for each of the injury categories for non-nearshore hook-and-line vessels (Trumble et al. 2000).

Table 9. Number of vessels, trips, and tows observed and metric tons of sampled P. halibut discarded at sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ bottom trawl vessels.

Table 10. Number of vessels, trips, and tows observed and metric tons of sampled P. halibut discarded at sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ midwater trawl vessels.

Table 11. Number of vessels, trips, and tows observed and metric tons of sampled P. halibut discarded at sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ midwater trawl vessels.

Table 12. Number of vessels, trips, and tows observed and metric tons of sampled P. halibut discarded at sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ pot vessels.

Table 13. Number of vessels, trips, and tows observed and metric tons of sampled P. halibut discarded at sea and the P. halibut landed and discarded at the dock (from PacFIN fish tickets) on IFQ hook-and-line vessels.

Table 14. P. 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.

[5] https://repository.library.noaa.gov/

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