

Pacific Halibut Bycatch in IPHC Area 2A in 2002

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ABSTRACT

This report updates the estimate of Pacific halibut bycatch and mortality in the bottom trawl fishery through the calendar year 2002. The estimate of halibut bycatch and mortality in the bottom trawl fishery is based upon the method developed in the report for 1999 (Wallace, 2000). This report uses halibut bycatch rates observed from 31 August 2001 thru 28 August 2002 in the West Coast Groundfish Observer Program. These rates are stratified by season, depth, latitude, and level of arrowtooth flounder catch, then multiplied by the amount of trawl effort in each stratum determined from Oregon and Washington trawl logbooks in 2002. Estimated halibut bycatch and mortality in other gear types has not been updated for 2002. The estimate for the 2002 bottom trawl fishery is 512,000 lbs net weight of total halibut bycatch mortality of which 286,000 lbs is legal-sized. The net weight is 64% lower than in 2001. As in past reports, forecast of bycatch for the current year (2003) or future years is not attempted.

GROUNDFISH FISHERY BACKGROUND

Changes in the groundfish fishery and its management affect the amount of groundfish fishing effort and the geographic and temporal distribution of this effort. These changes will affect the calculated halibut bycatch amount because of the differences in bycatch rate between the various time and area strata. Here we briefly describe the management changes that occurred in 2002.

The 2002 season was characterized by continued and expanded limitations on fishing opportunities for many groundfish species, in an effort to promote rebuilding of numerous species that have been declared overfished. As in 2001, the use of small footrope gear (rollers of 8" or less) was required for trips that land any shelf or nearshore rockfish species, and only minimal bycatch allowances were provided for landings of minor rockfish species. In order to reduce bycatch of darkblotched rockfish, trawling north of 40°10' N. lat. was prohibited inside of 250 fm during September, and re-opened inside of 100 fm for October through December. During this period, a differential (lower) trip limit was specified for Dover sole if small footrope gear was used by a vessel at any time during a 2-month cumulative period.

The flatfish bycatch allowance for yellowtail rockfish was continued, but mid-water opportunities for widow and yellowtail rockfish were provided only during the last two months of 2002, leading to a substantial reduction in the landings of both species from previous years. Landings of Dover sole in Oregon and Washington during 2002 fell by 28% from 2001 and 41% from 2000. Similarly, landings of arrowtooth flounder were off by 16% from 2001 and 36% from 2000. Landings of other flatfish species, combined, increased by 21% from 2001, driven by higher landings of near-shore species.

HISTORICAL BYCATCH ESTIMATES

Bottom Trawl Fishery for Groundfish

Estimated bycatch and mortality of halibut in 1987, 1992, and 1995 are summarized in Table 1. As described by Williams, et al. (1998), these halibut bycatch and mortality estimates were based upon catch rates observed during a voluntary fisheries observer program conducted during the late 1980s. Approximately 1,062 tows by bottom trawl fisheries off Oregon and Washington were observed during 1985-1987. An additional 65 tows were observed off California during 1988-1990. Catch rates were stratified by fishing strategy, depth, season, and area as described by Pikitch, et al. (1998).

Analysis of Enhanced Data Collection Program

From November 1995 through December 1998, observers quantified halibut catches on the west coast bottom trawl fisheries during the Enhanced Data Collection Program (EDCP). In addition, skippers participating in the EDCP filled out enhanced logbooks on which aggregate halibut catch information was recorded. During the program, when no observer was onboard, skippers continued to fill out the enhanced logbooks.

In the 1,825 EDCP tows from both Washington and Oregon, an estimated 11,434 halibut were caught. However, using only observed EDCP tows with complete strata information (see below), 4,816 halibut were measured by observers. The length frequency breakdown of these halibut can be seen in Table 2. Washington records in the EDCP data include individual lengths, but no individual weights. Also, since there were also some anomalies in the Oregon state landings of individual weights the 'net pounds per length interval' information in Table 2 is from a length-weight relationship for Pacific halibut (IPHC, personal communication).

Wallace (2000) used similar methods to those in Pikitch (1998) to analyze the EDCP data and identify appropriate strata for bycatch estimation. These strata are season (Jan-Aug and Sept-Dec), depth (0-100, 100-300, 300-700 fathoms), area (five latitude ranges) and catch of arrowtooth flounder (0-20 lbs per hour and >20 lbs). Numbers of tows, halibut catches, halibut catch rates, and proportion of legal-sized halibut (>81 cm) are given for each of these strata in Table 3. These methods and preliminary results were reviewed and approved by the Pacific Fishery Management Council's Scientific and Statistical Committee during the June and September 2000 meetings.

Shrimp Trawl

Halibut bycatch in shrimp trawls in 1987, 1992, and 1995 was reported by Williams, et al (1998) and are presented in Table 4. For 1998, Bob Hannah (ODFW, personal communication) produced estimates of halibut bycatch in Oregon shrimp trawls for PSMFC Areas 2B-3C (Table 5). He used three data sources: 1) bycatch rates observed during 128 tows by Pikitch, et al., during 1985-87; 2) control net catch rates from 166 tows observed by Hannah, et al.; and 3) data compiled from shrimp fishing trips observed during 1996-99 by the EDCP, combined with control net catches from ODFW research charters during the same time period (for a total of 203 observed tows). The approximate number of tows in the 1998 Oregon shrimp fishery was over 10,000. The halibut bycatch estimates for this fishery are based on expanding the encounter rates (pounds of halibut per single-rig equivalent hour (sreh)) by the effort expended by vessels landing shrimp in Oregon ports only. The estimates are not stratified by depth because the depth range of the shrimp fishery is very restricted and the amount of data is very limited. The percent legal-sized (62%) and the percent survival (50%) was assumed to be the same as in the bottom trawl fishery. Given the range of estimates and the data limitations, Hannah estimates that the 1998 bycatch mortality of legal-sized halibut from Oregon is about 16,000 lbs, net weight and about 25,000 lbs. round weight. Halibut bycatch from vessels landing shrimp into Washington and California ports is not included.

UPDATED BYCATCH ESTIMATES FOR 2002

Analysis of the First Year's data from the West Coast Groundfish Observer Program

The first year of observer collected data released by the West Coast Groundfish Observer Program is from 31 August 2001 thru 28 August 2002. There were 2,812 bottom trawl tows between 40.667 and 48.667 degrees latitude (all of Washington to just north of the Oregon-California border) used for this study. An estimated total weight of 260,242 lbs of halibut were caught in those tows. The vast majority of these weights are from the entire catch, i.e. not extrapolated. However, the weight method varies and includes visual estimates. The number of halibut in a tow was also recorded, but that data was received too late to be included in this report. In the observer program, halibut lengths are taken when fish are selected as 'biological samples'. On a tow basis, halibut were selected to be a biological sample 33% of the time when Pacific halibut were caught in the tow.

Wallace (2000) used similar methods to those in Pikitch (1998) to analyze the observer data and identify appropriate strata for bycatch estimation. These strata are season (Jan-Aug and Sept-Dec), depth (0-100, 100-300, 300-700 fathoms), area (four latitude ranges) and catch of arrowtooth flounder (0-20 lbs per hour and >20 lbs). Numbers of tows, halibut catches, halibut catch rates, and proportion of legal-sized halibut (>81 cm) are given for each of these strata in Table 3. These methods and preliminary results were reviewed and approved by the Pacific Fishery Management Council's Scientific and Statistical Committee during the June and September 2000 meetings.

Bottom Trawl Effort from Logbooks

Logbook data for Oregon and Washington in 2002 were obtained from PacFIN. Trawl effort from logbooks was accumulated into each of the strata identified in the analysis of the new observer data. Port and Month were added as factors for Oregon logbooks to avoid any potential bias created by unequal collection of logbooks in the three major ports (Astoria, Newport, and Coos Bay). ODFW collects logbook data for 70-80% of the trawl deliveries during a typical year, thus the need to avoid collection bias.

Total trawl effort (hours) for the entire Oregon fleet was based on expanding the groundfish catch in logbook data by the total groundfish catch reported on fish tickets, as follows. Expansion ratios, by port and month, were derived by dividing aggregate catch on fish tickets by aggregate catch in the logbook data. These expansion ratios were applied to the tow effort (hours) to arrive at the expanded effort for Oregon's trawl fleet. The expanded effort was then combined into the strata based on the observer data analysis.

Such an effort expansion was not conducted for the Washington fleet because WDFW expands their effort, so total fleet effort is equal to reported logbook effort. The total fleet effort for each stratum in 2002 is reported in Table 6.

Halibut bycatch for each stratum is estimated by multiplying total (expanded) effort by the halibut bycatch rate for that stratum. Bycatch by the bottom trawl fleet is estimated by summing across strata. If there was effort within a strata, but no observer tows, the coast wide average¹ bycatch rate was used: 15.777 kg per hour for weight.

As in earlier years, half of the released halibut are assumed to survive capture (Gregg Williams, IPHC, personal communication). Therefore, bycatch mortality of halibut is assumed to be 50% of total bycatch. The proportion of legal-sized halibut (> 81cm) is estimated from the length frequencies of halibut measured in the observer data. Measurements of fish lengths were converted to fish weight based on a length-weight relationship for Pacific halibut (IPHC, personal communication), and the proportion of legal-sized fish (by weight) was computed for each stratum (Table 3). The coastwide average¹ proportion legal was used when no other estimate was available: 81.96% by weight.

Updated results for 2002 are presented in Table 7 and added to the long-term time series in Tables 8 and 9. Total discard mortality of halibut during 2002 is estimated to be 36% lower than in 2001. This decrease is largely due to the reduction in trawl effort (22%), but also to new restrictions on fishing locations and the inclusion of new observer bycatch data.

It is not possible to make a forecast for the 2003 fishery given lack of a methodology to project the distribution of effort prior to availability of the entire year's logbook data.

¹Calculated as the unweighted average of the stratum means. This value (82%) is considerably higher than than the coastwide average where the strata means are weighted by the poundage in each strata (56%).

REFERENCES

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Table 1. Halibut bycatch and mortality in the bottom trawl fisheries for groundfish off the west coast, estimated from Pikitch et al., (1998) and reported by Williams et al., (1998).

Year	Trawl Effort (hours)	Estimated Halibut Bycatch (numbers)	Estimated Halibut Bycatch (kg., round)	Estimated Halibut Bycatch (lbs, net)	Estimated Total Halibut Mortality (lbs, net)	Estimated Legal-Sized Halibut Mortality (lbs, net)
1987	135,075	78,765	372,911	616,702	308,351	191,178
1992	182,155	89,756	465,595	769,979	384,989	238,693
1995	72,295	113,702	663,262	1,096,870	548,435	340,030

Note: For 1995, bycatch estimates for Areas 1B-2A off California are not included. Mortality estimated at 50% of bycatch. Legal-sized mortality (>81 cm) estimated at 62%, by weight, of total mortality. 1 kg, round = 1.65375 lbs, net weight.

Table 2. Length frequency for Pacific halibut from the West Coast Groundfish Observer Program data. (The upper limits on the length intervals are inclusive, the lower limits are not.)

Length Interval (cm)	Length Freq.	Percent Length Freq.
25-30	1	0.05
30-35	1	0.05
35-40	0	0.00
40-45	4	0.21
45-50	7	0.37
50-55	15	0.80
55-60	73	3.88
60-65	188	9.99
65-70	321	17.06
70-75	302	16.05
75-80	207	11.00
80-85	160	8.50
85-90	116	6.16
90-95	116	6.16
95-100	92	4.89
100-105	74	3.93
105-110	69	3.67
110-115	43	2.28
115-120	32	1.70
120-125	20	1.06
125-130	15	0.80
130-135	17	0.90
135-140	5	0.27
140-145	2	0.11
145-150	1	0.05
150-155	0	0.00
155-160	0	0.00
160-165	0	0.00
165-170	1	0.05
Total	1882	100.00

Table 3. Numbers of tows, halibut catches, and halibut catch rates, by strata, observed in the bottom trawl fishery by the West Coast Groundfish Observer Program. Where the strata are the same, the last column shows the 2001 halibut catch rates for comparison purposes. (The upper limits on all intervals are inclusive, the lower limits are not.)

SEASON: JANUARY - AUGUST

Arrow-tooth Catch (lbs/h)	Latitude	Depth (Fathoms)	Number of Observed Tows	Number of Tows with ≥ 1 Halibut	Wgt. (kg., rnd) Halibut per Hour	Proportion Legal by Weight	2001 Wgt. (kg., rnd) Halibut per Hour
≤ 20	40.667 - 42.667	0 - 100	155	41	3.59	0.873	
		100 - 300	110	12	0.50	0.928	
		300 - 700	146	1	0.01	1.000	
	42.667 - 46.667	0 - 100	533	214	3.52	0.756	5.25
		100 - 300	168	60	2.23	0.949	8.12
		300 - 700	117	2	0.08	0.921	0.03
	46.667 - 47.667	0 - 100	217	153	13.70	0.500	32.65
		100 - 300	16	11	3.99	1.000	6.47
		300 - 700	18	2	0.10	1.000	0.11
	47.667 - 48.667	0 - 100	343	266	41.02	0.319	16.41
		100 - 300	63	51	20.13	0.811	26.71
		300 - 700	20	2	0.14	1.000	4.05
> 20	40.667 - 42.667	0 - 100	21	7	3.02	0.936	
		100 - 300	8	2	5.68	0.950	
		300 - 700	0	0			
	42.667 - 46.667	0 - 100	38	20	7.61	0.889	14.15
		100 - 300	59	28	5.75	0.944	13.07
		300 - 700	0	0			1.10
	46.667 - 47.667	0 - 100	21	15	19.39	0.573	21.24
		100 - 300	13	7	3.58	0.972	70.71
		300 - 700	0	0			7.00
	47.667 - 48.667	0 - 100	140	132	96.54	0.263	68.60
		100 - 300	111	100	73.91	0.825	114.68
		300 - 700	11	6	12.44	0.901	

Table 3. Continued.

SEASON: SEPTEMBER - DECEMBER

Arrow-tooth Catch (lbs/h)	Latitude	Depth (Fathoms)	Number of Observed Tows	Number of Tows with ≥ 1 Halibut	Wgt. (kg., rnd) Halibut per Hour	Proportion Legal by Weight	2001 Wgt. (kg., rnd) Halibut per Hour
≤ 20	40.667 - 42.667	0 - 100	105	14	0.78	1.000	
		100 - 300	13	2	0.21		
		300 - 700	10	0	0.00		
	42.667 - 46.667	0 - 100	119	38	2.60		2.48
		100 - 300	49	25	3.63		12.48
		300 - 700	46	0	0.00		0.04
	46.667 - 47.667	0 - 100	16	0	0.00		7.02
		100 - 300	0	0	15.78		3.03
		300 - 700	3	0	0.00		0.46
	47.667 - 48.667	0 - 100	54	9	2.02	0.540	18.68
		100 - 300	6	5	59.99		36.85
		300 - 700	0	0			3.73
> 20	40.667 - 42.667	0 - 100	1	1	6.10		
		100 - 300	0	0	15.78		
		300 - 700	0	0			
	42.667 - 46.667	0 - 100	24	14	7.46		1.89
		100 - 300	23	15	67.69		8.00
		300 - 700	0	0			
	46.667 - 47.667	0 - 100	0	0			2.97
		100 - 300	0	0			
		300 - 700	0	0			
	47.667 - 48.667	0 - 100	6	3	48.56		14.75
		100 - 300	9	6	51.99		
		300 - 700	0	0			

Table 4. Halibut bycatch and mortality in the bottom trawl fishery for pink shrimp off the west coast, reported by Williams et al. (1998).

Year	Trawl Effort (hours)	Estimated Halibut Bycatch (numbers)	Estimated Halibut Bycatch (kg., round)	Estimated Halibut Bycatch (lbs, net)	Estimated Total Halibut Mortality (lbs, net)	Legal-sized Bycatch Mortality (lbs, net)
1987	193,69	20,536	98,983	163,693	81,847	50,745
1992	107,01	10,244	51,671	85,450	42,725	26,490
1995	----	----	----	100,000	50,000	31,000

Note: For 1995, bycatch estimates for Areas 1B-2A off California are not included. Mortality estimated at 50% of bycatch. Proportion of legal-sized mortality (>81 cm) is assumed to be 62% by weight. 1 kg, round = 1.65375 lbs, net weight.

Table 5. Estimated 1998 halibut bycatch and mortality in the bottom trawl fishery for pink shrimp (landings into Oregon ports only). (Bob Hannah, personal communication, October 8, 1999 memo). The data sources numbered 1-3 are described in the text.

Data Source	Single-rig Equivalent Hours (sreh) Observed	Bycatch Rate (lbs/sreh)	Fishing Effort (sreh) in Oregon Landings	Bycatch Estimate (kg., round)	Bycatch Mortality (lbs, net)	Legal-sized Bycatch Mortality (lbs, net)
1 - Pikitch	---	1.22	34,543	19,155	15,839	9,820
2 - Hannah	236.5	2.60	34,543	40,824	33,756	20,929
3 - EDCP	551.1	2.12	34,543	33,287	27,524	17,065

Note: Mortality estimated at 50% of bycatch. Proportion of legal-sized mortality (>81 cm) is assumed to be 62% by weight, as in the bottom trawl fishery. 1 kg, round = 1.65375 pounds, net weight.

Note: The first column labeled '2002' is for January-August, the second is for September-December.

Note: The first column labeled '2002' is for January-August, the second is for September-December.

Table 7. Halibut bycatch and mortality in the Oregon and Washington bottom trawl fisheries for groundfish off the west coast. The new 2002 data are estimated from bycatch rates (Table 3) observed by the West Coast Groundfish Observer Program and applied to annual total groundfish bottom trawl effort (Table 6).

Year	Trawl Effort (hours)	Estimated Halibut Bycatch (numbers)	Estimated Halibut Bycatch (kg., round)	Estimated Halibut Bycatch (lbs, net)	Est. Total Halibut Mortality (lbs, net)	Estimated Legal-Sized Halibut Mortality (lbs, net)
1998	92,294	164,961	1,259,374	2,082,690	1,041,345	691,755
1999	81,420	147,995	1,144,236	1,892,280	946,140	638,091
2000	70,363	122,234	944,120	1,561,338	780,669	523,097
2001	67,199	124,969	962,348	1,591,482	795,741	532,912
2002	52,168	NA	618,913	1,023,527	511,764	286,221

Note: Halibut bycatch by California bottom trawl fishery is not included. Mortality estimated at 50% of bycatch. Proportion of legal-sized mortality (>81 cm) estimated from length frequencies of fish measured by the West Coast Groundfish Observer Program. 1 kg, round = 1.65375 pounds, net weight.

Table 8. Summary of total estimated bycatch mortality of Pacific halibut, in thousands of pounds, net weight, by fishery in 2A. Bycatch mortality estimates for 1977-1997 are reported from Table 6 in Williams, et al. 1998.

Year	Foreign, JV & Catcher-Proc.	Groundfish Trawls	Shrimp Trawls	Hook & Line	TOTAL
1977	3	308	82	16	409
1978	2	308	82	16	408
1979	1	308	82	16	407
1980	1	308	82	16	407
1981	Trace	308	82	16	406
1982	Trace	308	82	16	406
1983	1	308	82	16	407
1984	Trace	308	82	16	406
1985	Trace	308	82	16	406
1986	1	308	82	16	407
1987	1	308	82	16	407
1988	1	308	82	16	407
1989	2	308	82	16	408
1990	2	308	82	16	408
1991	2	308	82	16	408
1992	0	385	43	16	444
1993	0	385	43	16	444
1994	0	385	43	16	444
1995	0	548	50	16	614
1996	0	548	50	16	614
1997	0	548	50	16	614
1998	0	1,041	25	---	---
1999	---	946	---	---	---
2000	---	781	---	---	---
2001	---	796	---	---	---
2002	---	512	---	---	---

Note: Bycatch mortality by groundfish trawls in 1998-2002 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.

Table 9. Summary of estimated mortality of legal-sized Pacific halibut, in thousands of pounds, net weight, by fishery in 2A. The bycatch mortality estimate for legal-sized halibut for 2002 is from this report. (Sums across fisheries may not always equal the TOTAL due to rounding.)

Year	Foreign, JV & Catcher-Proc.	Groundfish Trawls	Shrimp Trawls	Hook & Line	TOTAL
1977	2	191	51	10	254
1978	1	191	51	10	253
1979	0.6	191	51	10	252
1980	0.6	191	51	10	252
1981	Trace	191	51	10	252
1982	Trace	191	51	10	252
1983	0.6	191	51	10	252
1984	Trace	191	51	10	252
1985	Trace	191	51	10	252
1986	0.6	191	51	10	252
1987	0.6	191	51	10	252
1988	0.6	191	51	10	252
1989	1	191	51	10	253
1990	1	191	51	10	253
1991	1	191	51	10	253
1992	0	239	27	10	275
1993	0	239	27	10	275
1994	0	239	27	10	275
1995	0	340	31	10	381
1996	0	340	31	10	381
1997	0	340	31	10	381
1998	0	692	16	---	---
1999	---	638	---	---	---
2000	---	523	---	---	---
2001	---	533	---	---	---
2002	---	286	---	---	---

Note: Bycatch mortality by groundfish trawls in 1998-2002 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.