

**Pacific Halibut Bycatch in IPHC Area 2A
in the 2005 Groundfish Trawl Fishery**

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August 2006

ABSTRACT

This report updates the estimates of Pacific halibut bycatch and mortality in the bottom trawl fishery through the calendar year 2005. The estimates of halibut bycatch and mortality in the bottom trawl fishery are based upon the method developed in the report for 1999 (Wallace, 2000). The current report uses halibut bycatch rates observed for the 2005 calendar year by the West Coast Groundfish Observer Program. These rates are stratified by season, depth, latitude, and amount of arrowtooth flounder catch, and then multiplied by the amount of trawl effort in each stratum determined from Oregon and Washington trawl logbooks in 2005. Estimated halibut bycatch and mortality in other gear types has not been updated for 2005. The estimate for the 2005 bottom trawl fishery is 358,000 lb net weight of total halibut bycatch mortality, of which 228,000 lb is legal-sized. The net weight is 46.0 percent higher than in 2004. As in past reports, forecast of bycatch for the current year (2006) or future years is not attempted.

GROUNDFISH FISHERY BACKGROUND

Changes in the groundfish fishery and its management affect not only the amount of groundfish fishing effort, but also its geographic and temporal distribution. Since halibut bycatch rates vary among time and area strata, changes in the amount and distribution of effort will alter the amount of halibut bycatch that is estimated for the trawl fleet. Here we briefly describe the management changes that occurred in 2005.

A new gear regulation in 2005 facilitated two other important changes in the management of the trawl fishery north of 40°10' N. Lat. between 2004 and 2005. For the first time, trawlers fishing shoreward of the Rockfish Conservation Area (RCA) were required to use selective flatfish gear. This gear utilizes a cutback head-rope design that is intended to reduce the bycatch of rockfish. Because bycatch of rebuilding rockfish species had constrained fishing opportunities for shelf flatfish in preceding years, near-shore trip limits for Dover sole and other flatfish were higher in 2005 than in 2004, between January and September. From October through December, no trawling was permitted shoreward of 250 fm in either year. Lower expected rockfish bycatch also allowed the fleet access to more near-shore fishing grounds in 2005. In 2004, the shoreward boundary of the RCA was set at 60 fm between March and June, and at 75 fm for the remaining five months through September. During the first two months of 2005, the shoreward RCA boundary was also set at 75 fm, but for the following five months, it was set at 100 fm. As a result, the near-shore area open to groundfish trawling encompassed a larger portion of the Pacific halibut depth distribution.

2005 BYCATCH ESTIMATES

Analysis of 2005 data from the West Coast Groundfish Observer Program

The WCGOP provided data for the complete calendar year of 2005 for this assessment. There were 2,749 bottom trawl tows between 48.667 and 40.667 degrees N. latitude included in this study (Figure 1). An estimated total weight of 221,609 lb of halibut was caught in those tows. Seventy one percent of these weights are 'actual weights' from the entire catch, i.e. not estimated or extrapolated. In the observer program, lengths are taken when halibut are selected as 'biological samples'. For the data used in this report, on a tow basis, halibut were selected to be a biological sample 55 percent of the time when Pacific halibut were caught in the tow. Halibut have a lower priority for biological sampling than groundfish species that have been declared overfished. Additionally, crews attempt to return halibut to the ocean as quickly as possible, in order to promote survival of the discards. As a consequence, it can be difficult for observers to obtain length measurements for all discarded halibut.

For all of the Limited-Entry groundfish trawl activity, methods similar to those in Pikitch (1998) were used to analyze the observer data and identify appropriate strata for bycatch estimation. These strata are season (Jan-Aug and Sept-Dec), depth (0-75, 75-150, 150-250, 250-700 fm), area (four latitude ranges) and catch of arrowtooth flounder (0-20 lb/hour and >20 lb/hour). Numbers

of tows, halibut catches, halibut catch rates, and the proportions of legal-sized halibut (>81 cm) are listed for each of these strata in Table 2.

Bottom Trawl Effort from Logbooks

Logbook data for Oregon and Washington in 2005 were obtained from PacFIN. Since ODFW collects logbook data for only 70-80 percent of the trawl deliveries during a typical year, Oregon logbook effort (hours towed) was expanded using fish tickets on a port and month basis. This approach was used in order to avoid any potential bias created by unequal collection of logbooks in the three major ports (Astoria, Newport, and Coos Bay). WDFW's "extrapolated and expanded" trawl effort was used for Washington trips.

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. Dividing aggregate catch on fish tickets by aggregate catch in the logbook data creates expansion ratios, by port and month. 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 stratified, based on the observer data analysis. A similar 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 2005 is reported in Table 2.

Halibut bycatch in each stratum was estimated by multiplying total (expanded) stratum effort by the stratum halibut bycatch rate. Bycatch by the bottom trawl fleet is estimated by summing across strata. If there was effort within a stratum, but no observer tows, the coast-wide average bycatch rate (10.947 kg per hour) was used. This value is calculated as the unweighted average of the stratum means.

Results

As in earlier years, half of the released halibut are assumed to survive capture (Gregg Williams, IPHC, personal communication). Therefore, discard mortality of halibut is assumed to be 50 percent of total discard. The proportion of legal-sized halibut (> 81cm) is estimated from the length frequencies of halibut measured in the observer data (Table 1). All 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 2). The average proportion legal (61.59% by weight, calculated as the unweighted average of the stratum means) was used when no other estimate was available.

For comparison purposes, 2005 totals are shown together with annual totals since 1998 in Table 3. All estimates from 2002 forward incorporate observation data collected by the WCGOP. Total estimated discard mortality of halibut rose by 46% between 2004 and 2005, despite an increase in overall trawl effort of only 5 percent. However, with higher near-shore trip limits and a larger near-shore area open to fishing, trawl effort in depths less than 150 fm,

where halibut bycatch rates are generally higher, increased by 46% (Table 4). And although the estimated mortality of halibut increased from 6.5 to 9.1 lb/hour, the 2005 rate remains less than any annual average from 1998 to 2002. Estimated mortalities of 'all' and of 'legal-sized' halibut since 1977 are listed in Tables 5 and 6, respectively. The percentage of discard comprised by legal-sized fish is the second lowest, eclipsed only by the low seen in 2002. Nearly 58 percent of the estimated discard of legal-sized fish occurred in eight of the 64 strata used in the analysis, i.e. both arrowtooth and all depth strata for the January-August time period in the area between 47.67° and 48.67° N. latitude. In 2004, the same eight strata had 75% of the estimated discard of legal-sized fish.

It is not possible to make a forecast for the 2006 fishery given lack of a methodology to project the distribution of effort among model strata prior to the complete availability of a year's logbook data.

REFERENCES

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- Wallace, J.R. (2000) Unpublished report. Pacific halibut discard in the EDCP Observer Program. June 2000. 18 pg.
- Williams, G. H., G. Stauffer, H. Weeks, M. Saelens, J. Scordino, D. Bodenmiller, and T. Northup (1998). Pacific halibut bycatch in Area 2A: Bycatch rates and current estimates of bycatch mortality. *Int. Pac. Halibut Comm. Rep. of Assess. and Res. Activ.* 1998: 269-282.

Table 1. Length frequencies 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 | 0 | 0.00 |
| 30-35 | 0 | 0.00 |
| 35-40 | 1 | 0.03 |
| 40-45 | 3 | 0.09 |
| 45-50 | 1 | 0.03 |
| 50-55 | 29 | 0.91 |
| 55-60 | 140 | 4.39 |
| 60-65 | 334 | 10.48 |
| 65-70 | 488 | 15.31 |
| 70-75 | 598 | 18.76 |
| 75-80 | 519 | 16.28 |
| 80-85 | 326 | 10.23 |
| 85-90 | 222 | 6.97 |
| 90-95 | 182 | 5.71 |
| 95-100 | 95 | 2.98 |
| 100-105 | 95 | 2.98 |
| 105-110 | 58 | 1.82 |
| 110-115 | 27 | 0.85 |
| 115-120 | 22 | 0.69 |
| 120-125 | 19 | 0.60 |
| 125-130 | 7 | 0.22 |
| 130-135 | 8 | 0.25 |
| 135-140 | 3 | 0.09 |
| 140-145 | 3 | 0.09 |
| 145-150 | 4 | 0.13 |
| 150-155 | 2 | 0.06 |
| 155-160 | 0 | 0.00 |
| 160-165 | 1 | 0.03 |
| 165-170 | 0 | 0.00 |
| 170-175 | 0 | 0.00 |
| 175-180 | 0 | 0.00 |
| 180-185 | 0 | 0.00 |
| Total | 3187 | 100.00 |

Table 2. Numbers of tows, halibut catches, halibut catch rates and effort, by strata, observed in the bottom trawl fishery by the West Coast Groundfish Observer Program. The last two columns, from 2004, are for comparison purposes. (The upper limits are inclusive for all intervals; the lower limits are not.)

SEASON: JANUARY - AUGUST

| Arrowtooth Catch (lb/h) | Latitude | Depth (Fathoms) | Number of Observed Tows | Number of Tows with ≥ 1 Halibut | Wgt. (kg., rnd) Halibut per Hour | Trawl Effort (hours) from OR & WA | Proportion Legal by Weight | Number of Observed Tows 2004 | Wgt. (kg., rnd) Halibut per Hour 2004 |
|-------------------------|-----------------|-----------------|-------------------------|--------------------------------------|----------------------------------|-----------------------------------|----------------------------|------------------------------|---------------------------------------|
| ≤ 20 | 40.667 - 42.667 | 0 - 75 | 0 | 0 | | 129 | | 1 | 17.86 |
| | | 75 - 150 | 0 | 0 | | 27 | | 0 | |
| | | 150 - 250 | 2 | 0 | 0.00 | 232 | | 16 | 0.00 |
| | | 250 - 700 | 17 | 1 | 0.07 | 738 | 0.250 | 43 | 0.00 |
| 42.667 - 46.667 | | 0 - 75 | 316 | 143 | 5.83 | 4084 | 0.876 | 523 | 1.78 |
| | | 75 - 150 | 95 | 35 | 5.59 | 1186 | 0.877 | 19 | 1.51 |
| | | 150 - 250 | 65 | 24 | 2.70 | 1471 | 0.702 | 84 | 2.11 |
| | | 250 - 700 | 152 | 12 | 0.27 | 3087 | 0.778 | 191 | 0.07 |
| 46.667 - 47.667 | | 0 - 75 | 294 | 162 | 5.35 | 1914 | 0.628 | 245 | 4.47 |
| | | 75 - 150 | 21 | 18 | 37.24 | 98 | 0.593 | 3 | 2.69 |
| | | 150 - 250 | 26 | 17 | 6.04 | 403 | 0.852 | 11 | 0.38 |
| | | 250 - 700 | 31 | 7 | 1.95 | 621 | 0.521 | 18 | 0.00 |
| 47.667 - 48.667 | | 0 - 75 | 157 | 124 | 71.00 | 1702 | 0.539 | 266 | 30.66 |
| | | 75 - 150 | 197 | 107 | 48.45 | 1203 | 0.588 | 23 | 46.25 |
| | | 150 - 250 | 36 | 14 | 40.18 | 590 | 0.415 | 18 | 6.78 |
| | | 250 - 700 | 22 | 1 | 0.07 | 694 | 0.687 | 19 | 1.07 |
| > 20 | 40.667 - 42.667 | 0 - 75 | 0 | 0 | | 0 | | 0 | |
| | | 75 - 150 | 0 | 0 | | 1 | | 0 | |
| | | 150 - 250 | 9 | 5 | 5.56 | 202 | | 4 | 1.43 |
| | | 250 - 700 | 6 | 0 | 0.00 | 189 | 0.476 | 2 | 0.00 |
| 42.667 - 46.667 | | 0 - 75 | 152 | 95 | 6.71 | 1925 | 0.842 | 71 | 2.04 |
| | | 75 - 150 | 119 | 78 | 24.04 | 927 | 0.703 | 4 | 0.40 |
| | | 150 - 250 | 211 | 118 | 4.90 | 3142 | 0.759 | 245 | 4.24 |
| | | 250 - 700 | 126 | 29 | 2.40 | 1867 | 0.634 | 115 | 1.67 |
| 46.667 - 47.667 | | 0 - 75 | 52 | 40 | 8.61 | 602 | 0.365 | 48 | 6.97 |
| | | 75 - 150 | 11 | 5 | 16.67 | 106 | | 12 | 18.16 |
| | | 150 - 250 | 30 | 18 | 4.14 | 308 | 0.803 | 57 | 7.68 |
| | | 250 - 700 | 16 | 8 | 6.74 | 223 | 0.439 | 8 | 1.57 |
| 47.667 - 48.667 | | 0 - 75 | 79 | 64 | 46.04 | 710 | 1.000 | 123 | 53.55 |
| | | 75 - 150 | 97 | 68 | 23.49 | 798 | 0.819 | 25 | 106.81 |
| | | 150 - 250 | 23 | 11 | 7.99 | 503 | 0.000 | 123 | 40.50 |
| | | 250 - 700 | 23 | 11 | 15.61 | 308 | 0.495 | 19 | 94.85 |

Table 2. Continued.

SEASON: SEPTEMBER - DECEMBER

| Arrowtooth Catch (lb/h) | Latitude | Depth (Fathoms) | Number of Observed Tows | Number of Tows with ≥ 1 Halibut | Wgt. (kg., rnd) Halibut per Hour | Trawl Effort (hours) from OR & WA | Proportion Legal by Weight | Number of Observed Tows 2004 | Wgt. (kg., rnd) Halibut per Hour 2004 |
|-------------------------|-----------------|-----------------|-------------------------|--------------------------------------|----------------------------------|-----------------------------------|----------------------------|------------------------------|---------------------------------------|
| ≤ 20 | 40.667 - 42.667 | 0 - 75 | 0 | 0 | | 14 | | 0 | |
| | | 75 - 150 | 0 | 0 | | 1 | | 0 | |
| | | 150 - 250 | 0 | 0 | | 36 | | 2 | 5.62 |
| | | 250 - 700 | 30 | 1 | 0.02 | 734 | 1.000 | 7 | 0.00 |
| 42.667 - 46.667 | | 0 - 75 | 16 | 7 | 5.06 | 945 | 0.255 | 72 | 0.55 |
| | | 75 - 150 | 8 | 1 | 0.50 | 509 | 0.195 | 0 | |
| | | 150 - 250 | 12 | 5 | 23.79 | 248 | 0.594 | 22 | 5.14 |
| | | 250 - 700 | 57 | 2 | 0.10 | 1823 | 0.731 | 170 | 0.25 |
| 46.667 - 47.667 | | 0 - 75 | 27 | 6 | 2.06 | 197 | 0.000 | 2 | 0.00 |
| | | 75 - 150 | 1 | 1 | 2.91 | 11 | | 0 | |
| | | 150 - 250 | 1 | 0 | 0.00 | 14 | | 1 | 0.00 |
| | | 250 - 700 | 9 | 0 | 0.00 | 280 | 0.409 | 34 | 0.24 |
| 47.667 - 48.667 | | 0 - 75 | 14 | 14 | 64.18 | 243 | | 12 | 5.73 |
| | | 75 - 150 | 7 | 4 | 3.42 | 176 | | 1 | 2.32 |
| | | 150 - 250 | 1 | 1 | 14.70 | 14 | | 1 | 4.31 |
| | | 250 - 700 | 23 | 6 | 2.40 | 305 | 0.587 | 20 | 0.52 |
| > 20 | 40.667 - 42.667 | 0 - 75 | 0 | 0 | | 0 | | 0 | |
| | | 75 - 150 | 0 | 0 | | 0 | | 0 | |
| | | 150 - 250 | 1 | 1 | 2.66 | 36 | | 3 | 0.00 |
| | | 250 - 700 | 5 | 0 | 0.00 | 111 | 1.000 | 1 | 0.00 |
| 42.667 - 46.667 | | 0 - 75 | 24 | 12 | 2.41 | 825 | | 37 | 0.42 |
| | | 75 - 150 | 52 | 31 | 8.83 | 626 | 0.246 | 0 | |
| | | 150 - 250 | 22 | 14 | 8.50 | 557 | | 78 | 6.96 |
| | | 250 - 700 | 22 | 6 | 1.92 | 1003 | 0.879 | 44 | 0.90 |
| 46.667 - 47.667 | | 0 - 75 | 0 | 0 | | 58 | | 0 | |
| | | 75 - 150 | 0 | 0 | | 11 | | 0 | |
| | | 150 - 250 | 3 | 1 | 0.53 | 84 | 0.641 | 12 | 4.87 |
| | | 250 - 700 | 2 | 0 | 0.00 | 18 | 0.840 | 3 | 0.00 |
| 47.667 - 48.667 | | 0 - 75 | 11 | 9 | 12.75 | 137 | 1.000 | 1 | 12.85 |
| | | 75 - 150 | 13 | 7 | 9.43 | 260 | | 2 | 0.00 |
| | | 150 - 250 | 0 | 0 | | 8 | | 15 | 18.87 |
| | | 250 - 700 | 3 | 3 | 5.44 | 100 | | 7 | 3.29 |

Table 3. Halibut bycatch and mortality in the Oregon and Washington bottom trawl fisheries for groundfish off the west coast. Estimates from 2002 forward are based on observations by the West Coast Groundfish Observer Program. All estimates in this table (except the last column) are derived from a sum over strata cells; see the text for details.

| Year | Trawl Effort (hours) | Estimated Halibut Bycatch (numbers) | Estimated Halibut Bycatch (kg, round) | Estimated Halibut Bycatch (lb, net) | Estimated Total Halibut Mortality (lb, net) | Est. Mortality (lb) per Trawl Hour | Estimated Legal-Sized Halibut Mortality (lb, net) | Estimated Legal-Sized divided by Total Halibut Mortality |
|------|----------------------|-------------------------------------|---------------------------------------|-------------------------------------|---|------------------------------------|---|--|
| 1998 | 92,294 | 164,961 | 1,259,374 | 2,082,690 | 1,041,345 | 11.3 | 691,755 | 0.6643 |
| 1999 | 81,420 | 147,995 | 1,144,236 | 1,892,280 | 946,140 | 11.6 | 638,091 | 0.6744 |
| 2000 | 70,363 | 122,234 | 944,120 | 1,561,338 | 780,669 | 11.1 | 523,097 | 0.6701 |
| 2001 | 67,199 | 124,969 | 962,348 | 1,591,482 | 795,741 | 11.8 | 532,912 | 0.6697 |
| 2002 | 52,168 | NA | 618,913 | 1,023,527 | 511,764 | 9.8 | 286,221 | 0.5593 |
| 2003 | 58,339 | NA | 558,544 | 923,693 | 461,847 | 7.9 | 366,745 | 0.7941 |
| 2004 | 37,495 | NA | 296,225 | 489,882 | 244,941 | 6.5 | 171,754 | 0.7012 |
| 2005 | 39,377 | NA | 432,806 | 715,752 | 357,876 | 9.1 | 228,049 | 0.6372 |

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 4. Trawl effort (hours) in the 2004 and 2005 bottom trawl fisheries off Oregon and Washington

| Arrowtooth Catch (lb/h) | Latitude | Depth (fathoms) | Trawl effort (hours) | | % change from 2004 to 2005 |
|-------------------------|-----------------|-----------------|----------------------|--------|----------------------------|
| | | | 2004 | 2005 | |
| | | | | | |
| ≤ 20 | 40.667 - 42.667 | 0 - 150 | 282 | 171 | -39% |
| | | 150 - 700 | 1,969 | 1,740 | -12% |
| | | | | | |
| | 42.667 - 46.667 | 0 - 150 | 4,370 | 6,724 | 54% |
| | | 150 - 700 | 9,281 | 6,629 | -29% |
| | | | | | |
| | 46.667 - 47.667 | 0 - 150 | 2,856 | 2,220 | -22% |
| | | 150 - 700 | 1,494 | 1,318 | -12% |
| | | | | | |
| | 47.667 - 48.667 | 0 - 150 | 2,856 | 3,324 | 16% |
| | | 150 - 700 | 1,473 | 1,603 | 9% |
| | | | | | |
| Total | | 0 - 150 | 10,364 | 12,439 | 20% |
| | | 150 - 700 | 14,216 | 11,292 | -21% |
| | | All depths | 24,579 | 23,733 | -3% |
| | | | | | |
| > 20 | 40.667 - 42.667 | 0 - 150 | 18 | 1 | -93% |
| | | 150 - 700 | 175 | 538 | 206% |
| | | | | | |
| | 42.667 - 46.667 | 0 - 150 | 1,081 | 4,303 | 298% |
| | | 150 - 700 | 6,842 | 6,569 | -4% |
| | | | | | |
| | 46.667 - 47.667 | 0 - 150 | 620 | 777 | 25% |
| | | 150 - 700 | 928 | 633 | -32% |
| | | | | | |
| | 47.667 - 48.667 | 0 - 150 | 1,261 | 1,905 | 51% |
| | | 150 - 700 | 1,992 | 919 | -54% |
| | | | | | |
| Total | | 0 - 150 | 2,980 | 6,986 | 134% |
| | | 150 - 700 | 9,937 | 8,659 | -13% |
| | | All depths | 12,917 | 15,644 | 21% |
| | | | | | |
| Total | Total | 0 - 150 | 13,343 | 19,425 | 46% |
| | | 150 - 700 | 24,152 | 19,950 | -17% |
| | | All depths | 37,495 | 39,377 | 5% |

Table 5. 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 3 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 | --- | --- | --- |
| 2003 | --- | 462 | --- | --- | --- |
| 2004 | --- | 245 | --- | --- | --- |
| 2005 | --- | 358 | --- | --- | --- |

Note: Bycatch mortality by groundfish trawls in 1998-2004 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.

Table 6. Summary of estimated mortality of legal-sized Pacific halibut, in thousands of pounds, net weight, by fishery in Area 2A. The bycatch mortality estimate for legal-sized halibut for 2005 is from this report. (Sums across fisheries may not 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 | --- | --- | --- |
| 2003 | --- | 367 | --- | --- | --- |
| 2004 | --- | 172 | --- | --- | --- |
| 2005 | --- | 228 | --- | --- | --- |

Note: Bycatch mortality by groundfish trawls in 1998-2004 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.

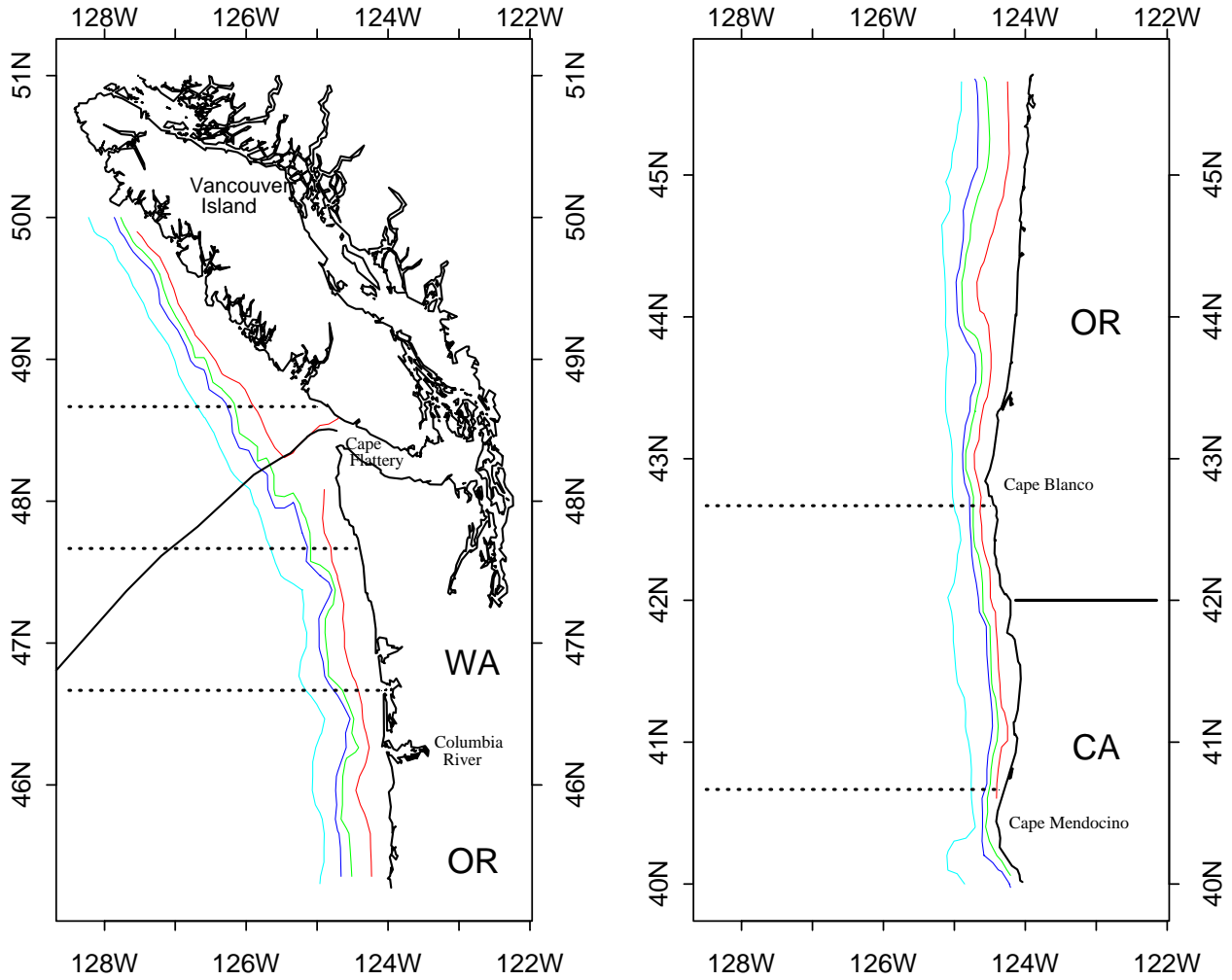


Figure 1. A map of IPHC area 2A with the latitudinal strata demarcated by dotted lines. In the most northerly strata only the area east of the EEZ line is covered by this report. The bathymetry strata splits (75, 150, 250, 700 fathoms) are shown off the coast.