

PROCEDURE FOR DETERMINING WHEN TO IMPLEMENT BY-CATCH REGIME

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The Council has asked the GMT to review the By-catch Committee report and to provide additional analysis of problems involved in translating the report's general concepts into workable regulations. Among the problems still to be resolved are: (1) determining the best percentage retention limit for each species or management group, and (2) determining the appropriate timing for implementation of retention limits. This paper develops a possible mechanism for determining when retention limits should be imposed and demonstrates this mechanism by applying it to the Sebastes complex. It does not address the problem of what those retention limits should be.

The objective of this exercise is to time the implementation of retention limits in such a way that the HG will just be achieved at the end of the year; thus, there will be no unharvested surplus and no part of the season during which retention of Sebastes will be prohibited. In other words, the incidental retention allowance should be implemented at a point during the season when the cumulative landings from that point to the end of the year, given the retention allowance, will just equal the remaining amount of HG at the same point.

Thus, if we represent the remaining harvest guideline by RHG and the cumulative incidental catch by CIC, this condition may be stated formally as $RHG = CIC$. Since the amount of HG remaining declines as the fishing year progresses, and since the cumulative incidental catch from any point in the year declines as that point gets closer to the end of the year, both RHG and CIC are decreasing functions of the time of year.

Treating time as a discrete variable, let

$$RHG_t = HG - \sum_{i=1}^{t-1} L_i$$

where RHG_t is the remaining HG at the beginning of day t and L_i is the expected total Sebastes complex landings (from the relevant management area) on day i . Then let

$$CIC_t = \sum_{i=t}^{365} C_i$$

where CIC_t is the cumulative catch of Sebastes from the beginning of day t to the end of the year and C_i is the expected incidental catch for day i , given the retention allowance assumed to be in effect. Since the directed fishery invariably produces a catch rate higher than the incidental catch rate, the slope of the RHG function is invariably greater than that of the CIC function, with the result that they are only equal (intersect) at one point in time.

Estimation of these two functions for a particular fishing year is accomplished in much the same manner as catch projections are currently made for other inseason management changes. The following is a demonstration of how this method might have worked for the Sebastes complex in the Columbia and

Vancouver areas during the 1984 season. The numbers used are from PacFIN reports for 1982-1984. RHG is estimated from landings data through April while RHG' is estimated by the same procedure applied to landings through July.

The estimation of RHG begins with the estimates of monthly landings for the current year for as many months as are covered by the "soft data" system. Table 1 gives PacFIN landings for January through April. The remaining months are estimated by assuming that the underlying seasonal pattern of landings revealed by landings under uniform regulations, as in 1982, would also exist in 1984 if regulations were kept constant. The decreased rate of landings through April of 1984 is taken to represent a between-year shift in catch (due to regulations, markets, stock abundance, or whatever) which does not affect the seasonal pattern. Thus, the catch for August is estimated by multiplying the August 1982 catch by the ratio of 1984 January through April catch to the 1982 January through April catch. Other months are estimated in the same way. RHG is then calculated by subtracting each successive month's catch from the HG remaining at the beginning of the month.

The estimation of RHG' proceeds in the same way except that it is assumed that landings data through July are available. Thus, the 1982 monthly landings from August through December are multiplied by the ratio of 1984 January through July landings to 1982 January through July landings.

Incidental catch rates are assumed to be the landed catch during times of low trip limits. Table 2 gives landings for October through December 1983, when a 3,000 pound trip limit was in effect and landings for September through December 1984, when a 7,500 pound trip limit was in effect. On the assumption that a 3,000 pound limit in 1984 would have resulted in catches at least as low as those with the 7,500 pound limit, the projected incidental catch for each of the 4 months was set at whichever of the 2 catches was lowest. The incidental catch per day for August was assumed to be equal to that for September. The CIC was then calculated by accumulating these monthly catches starting with December and working backwards.

The 3 curves, CIC, RHG, and RHG' are shown in Figure 1. The intersection of RHG and CIC on August 8 at 1,664 mt indicates that conversion to 3,000 pound trip limits on August 8, with 1,664 mt left of the HG, would just exhaust the HG at the end of the year.

This projection, being made 3 months in advance of the predicted critical point (August 8), cannot be expected to be very accurate. However, as the critical point is approached, additional catch data will reduce the margin of error. A final evaluation using the soft data system made after August 1 is illustrated by RHG'. This time the critical day becomes August 27, with 1,309 mt of the HG remaining.

In actual fact, the trip limit for Sebastes was reduced to 7,500 pounds on August 1, 1984 and maintained at that level for the remainder of the year. According to the estimate of RHG', this action was premature (assuming that this amounts to a by-catch allowance) by 27 days, thus leading to the prediction that the final landings would fall short of the HG by 806 mt. As it turned out, the landings fell short of the HG by 704 mt.

APPENDIX 12
By-catch Regime

In the absence of any historical experience with an incidental catch regime, the incidental catch rate will have to be estimated in a more indirect way than shown here. Perhaps major modes of fishing which produce incidental catches could be identified by the advisory subpanel and other fishermen and average seasonal incidental landings rates identified for these modes by looking at logbook and fish ticket data. Or, the same fishermen could guess at the appropriate rates based on their experience. The total incidental rate could then be expressed as a function of the rates of these related fisheries. If the fishermen guess wrong, then they either fail to harvest the HG (if they overestimate the rates) or have the fisheries shut down before the end of the season (if they guess too low). This approach could be combined with a carryover to the next year, to correct for under or over shooting of the HG.

Table 1. Projected 1984 landings and remaining HG for the Sebastes complex in the Vancouver-Columbia area based on actual landings through April 1984.

	Landings (mt)	Remaining HG (mt)
January 1	908	10,100
February 1	394	9,192
March 1	1,033	8,798
April 1	1,377	7,765
May 1	1,458 (Projected)	6,388
June 1	1,422 (Projected)	4,930
July 1	1,402 (Projected)	3,508
August 1	1,634 (Projected)	2,106
September 1	1,483 (Projected)	472
October 1	1,018 (Projected)	- 1,011
November 1	1,083 (Projected)	- 2,029
December 1	705 (Projected)	- 3,112
Year End		- 3,817

Source for January through April landings: Pacific Coast Fisheries Information Network Report Number 013

Table 2. Projected 1984 landings and remaining HGs for the Sebastes complex in the Vancouver-Columbia area based on actual landings through July 1984.

	Landings (mt)	Remaining HG' (mt)
January 1	908	10,100
February 1	394	9,192
March 1	1,033	8,798
April 1	1,377	7,765
May 1	1,115	6,388
June 1	1,332	5,273
July 1	1,308	3,941
August 1	1,527 (Projected)	2,633
September 1	1,385 (Projected)	1,106
October 1	951 (Projected)	- 279
November 1	1,011 (Projected)	- 1,230
December 1	658 (Projected)	- 2,241
Year End		- 2,899

Table 3. Projected incidental catch of the Sebastes complex in the Vancouver-Columbia area (in mts).

	1983 Landings at 3,000 Pounds Per Trip	1984 Landings at 7,500 Pounds Per Trip	Estimated Incidental Catch Per Day	Cumulative Incidental Catch to Year End (CIC)
August	-	-	19.20 ^{a/}	1,825
September	-	576 ^{b/}	19.20	1,230
October	494	330 ^{b/}	10.65	654
November	115 ^{b/}	119	3.83	324
December	209 ^{b/}	219	6.74	209

a/ Since no data were available for August, the incidental catch per day was assumed to be the same as for September.

b/ Denotes number chosen to represent incidental catch for that month. Lowest catch for that month chosen.

Source for 1983 and 1984 Landings: Pacific Coast Fisheries Information Network Report Number 001 for 1983 and 1984.

Figure 1. Cumulative Incidental Catch (CIC) and Remaining Harvest Guideline (RHG) for Sebastes Complex in the Vancouver-Columbia Area in 1984. RHG Estimated from Data Available in May and RHG' Estimated from Data Available in August 1984.

