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**ESTABLISHED BY A CONVENTION BETWEEN
CANADA AND THE UNITED STATES OF AMERICA**

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Report of the Halibut Bycatch Work Group

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List of Abbreviations

PSC	Prohibited Species Catch
LOA	Length Over All
MW	Midwater Trawl
H&L	Hook and Line gear
DAP	Domestic fishing
JV	Joint Venture fishing
Qtr	Quarter (of a year)
NPFMC	North Pacific Fishery Management Council
DFO	Department of Fisheries and Oceans (Canada)
NMFS	National Marine Fisheries Service (U.S.)
BSAI	Bering Sea-Aleutian Islands
IPHC	International Pacific Halibut Commission
GOA	Gulf of Alaska
HBWG	Halibut Bycatch Work Group

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PREFACE

This report was prepared under authority of a resolution of the International Pacific Halibut Commission. The resolution required a special meeting of the Commission to address the issue of Pacific halibut bycatch in fisheries targeting on other species. The Commissioners received the report during the special meeting held July 22-24. The report reviewed and assessed each country's effort to reduce bycatch, and considered appropriate levels of bycatch and methods of achieving bycatch reduction. The report provided the basis for the following recommendations from the Commission to the Canadian and U.S. governments:

U.S. Fisheries

- (1) The existing package of bycatch regulations should be maintained for 1991.
- (2) All groundfish fisheries off Alaska should be brought under existing bycatch limits for 1992.
- (3) A program to reduce bycatch limits by a minimum of 10 percent per year should be implemented by 1993.
- (4) Measures to address the estimation and control of bycatch off Washington-Oregon should be developed.

Canadian Fisheries

The Canadian Government should expand its observer program to cover all bottom trawl fisheries and undertake research on the viability of trawl-caught halibut. Further proposals for a bycatch reduction should be developed and presented to the Commission at its 1992 Annual Meeting.

Report of the Halibut Bycatch Work Group

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OBJECTIVES (FROM ANNUAL MEETING RESOLUTION)

At the January 1991 annual meeting of the International Pacific Halibut Commission (IPHC), the Commission passed a resolution to address Pacific halibut (*Hippoglossus stenolepis*) mortality in non-directed fisheries throughout the Commission's jurisdiction. The Commission is concerned about the high levels of halibut bycatch, compared with the mid-1980s, that are decreasing yield available to the directed halibut fishery. Through the resolution, the Commission created a bilateral technical group, hereafter called the Halibut Bycatch Work Group (HBWG), to review scientific issues pertaining to:

- (1) Review of management measures being implemented in each country to control and reduce bycatch, and advise the Commission on their adequacy;
- (2) Recommend additional measures which could be taken to reduce bycatch; and
- (3) Determine appropriate target levels for bycatch mortality reduction.

Based upon these and associated technical review, the resolution called for a special meeting of the Commission to consider:

“...an appropriate agreed level for bycatch mortality reduction, based on the biological requirements for stock rebuilding, realization of optimum yield from the fishery, and maintenance of the stock at that level.”

The meeting was scheduled for July 22-24, 1991 in Seattle, Washington.

The HBWG met six times (March 7, March 22, April 12, May 17, June 14, and July 11) to accomplish the tasks assigned to it under the Commission's resolution. Additionally, staffs of the U.S. National Marine Fisheries Service (NMFS), IPHC, and Canada Department of Fisheries and Oceans (DFO) produced and reviewed numerous documents and analyses in support of the HBWG deliberation. The following report is a summary of the HBWG discussions of bycatch issues and management measures for groundfish fisheries, and recommendations the Commission may consider when determining an appropriate level of halibut bycatch reduction.

SUMMARY OF BACKGROUND INFORMATION

A comprehensive presentation of the halibut fishery is contained in each Annual Report of the IPHC. The following information summarizes the present fishery and the historical relation of the fishery, recruitment, and bycatch mortality.

- (1) 1990 halibut bycatch mortality in all fisheries and directed harvest (in million pound, net weight¹):

Area	Bycatch	Directed Harvest
Bering Sea	10.524	5.48
Gulf of Alaska	5.874	46.90
Canada	1.630	8.50
Washington-Oregon	0.002	0.53
Total	18.030	61.41

- (2) Figure 1 — Historical trend of halibut biomass, bycatch, and recruitment.

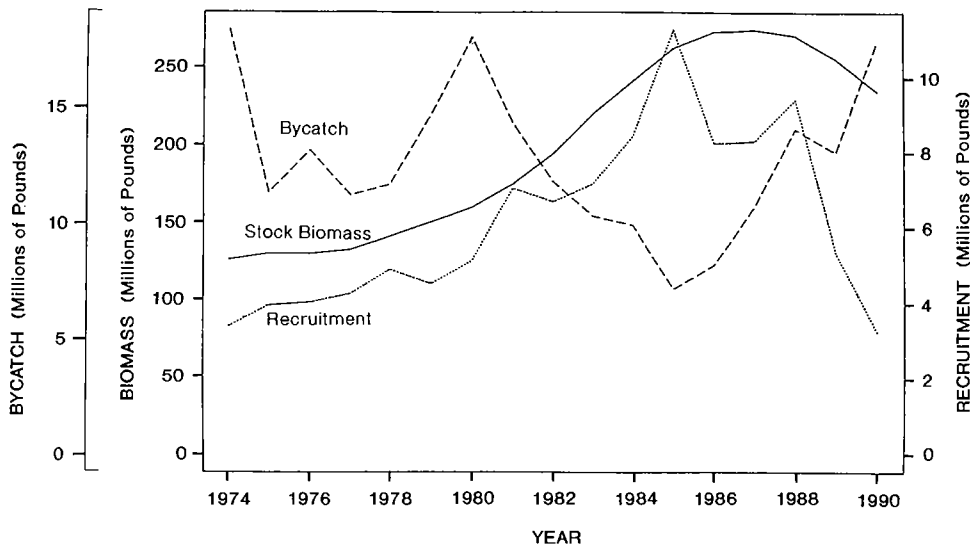


Figure 1. Historical trends in stock biomass, recruitment, and bycatch.

¹Net weight (head off and viscera removed, ice and slime removed) is 0.75 of round weight. The IPHC uses net weight in millions of pounds, while the NPFMC and NMFS use round weight in metric tons for management purposes. For this reason, we will use metric tons round weight for values generated by the Council process, and net weight for IPHC values, with conversions in parentheses.

(3) Table 1 — Historical bycatch levels of halibut by subareas.

Table 1. Estimates, in thousands of pounds (net weight), of bycatch mortality of Pacific halibut (*Hippoglossus stenolepis*) by IPHC regulatory area for groundfish and shellfish fisheries, 1962 through 1990.

Year	Areas 2A/2C	Area 2B	Area 3	Area 4	Total
1962	207	1,176	3,083	4,143	8,609
1963	206	1,077	6,102	2,038	9,423
1964	205	1,105	11,639	2,965	15,914
1965	205	1,435	16,539	3,182	21,361
1966	213	1,666	12,495	3,400	17,774
1967	439	1,652	9,528	4,718	16,337
1968	515	1,963	7,053	5,685	15,216
1969	468	2,183	4,980	7,599	15,230
1970	562	1,470	6,230	8,028	16,290
1971	539	1,745	4,341	13,095	19,720
1972	756	1,750	7,099	9,675	19,280
1973	848	1,509	7,147	8,029	17,533
1974	532	1,729	8,667	7,620	18,548
1975	639	1,909	5,231	3,650	11,429
1976	708	2,064	5,938	4,564	13,274
1977	582	1,817	5,988	2,914	11,301
1978	379	1,471	4,895	5,023	11,767
1979	822	1,852	6,715	5,419	14,807
1980	521	1,372	7,099	9,235	18,227
1981	507	1,188	6,282	6,408	14,385
1982	302	867	5,972	4,756	11,897
1983	305	943	4,892	4,269	10,408
1984	302	1,074	3,647	4,692	9,715
1985	301	1,139	1,578	4,207	7,225
1986	304	1,161	1,246	5,576	8,287
1987	303	1,649	3,113	5,738	10,803
1988	304	1,609	3,415	8,858	14,186
1989	305	1,498	4,086	7,282	13,171
1990	305	1,630	5,571	10,524	18,030

Source: compiled by IPHC, 7/11/91, from NMFS and DFO data

CURRENT BYCATCH CONTROL AND MONITORING MEASURES

The HBWG reviewed a summary of historical and current halibut bycatch management measures implemented for the Alaska groundfish fishery. Regulations specifically to control halibut bycatch in the Canadian and Washington-Oregon groundfish fisheries have not been implemented. The Canadian government has established comprehensive limited entry programs for all groundfish fisheries, and initiated an observer program for 1991.

United States - Historical Bycatch Management Measures

Control of foreign bycatch of halibut

Regulations to control halibut bycatch in foreign fisheries for Alaska groundfish were implemented initially under bilateral fishery agreements, and subsequently under groundfish fishery management plans authorized by the Magnuson Fishery Conservation and Management Act of 1976. Limitations on foreign bycatch of halibut were regulated primarily through time/area closures and halibut bycatch limits. Of special note was the scheduled reduction of halibut bycatch rates specified for the Bering Sea/Aleutian Islands area (BSAI) foreign trawl fisheries. This resulted in a 50 percent reduction in bycatch rates between 1982 and 1985. Assuming accurate reporting of foreign bycatch amounts, the compliance of those fisheries with specified bycatch rates and allowances stemmed from the national allocation of bycatch amounts, combined with subsequent national apportionment of bycatch to fishing companies. The fishing companies monitored and controlled bycatch by individual vessels. This system of individual vessel bycatch quotas effectively created a vessel incentive program to minimize bycatch amounts.

Control of domestic bycatch of halibut prior to 1991

Regulations to control halibut bycatch in domestic groundfish fisheries were implemented initially as part of the BSAI and Gulf of Alaska (GOA) fishery management plans. These regulations reflected some of the time-area closures in effect for foreign trawl operations. The GOA fisheries were also monitored under halibut bycatch limits. Restrictions on domestic operations were relaxed and revised as the domestic groundfish fishery developed, consistent with the desire to enhance development of this fishery. Beginning in 1985, annual halibut bycatch limits were implemented for the GOA groundfish trawl fisheries, attainment of which triggered closure of the GOA to bottom trawl gear. In 1990, regulatory authority was also implemented to limit GOA halibut bycatch in fixed-gear fisheries.

Halibut bycatch limits were first imposed on BSAI domestic fisheries in 1987, to limit halibut bycatch in the U.S.-foreign joint venture fishery for flatfish. In 1989, halibut bycatch restrictions were expanded to some fully domestic bottom trawl fisheries. A 5,333 mt round weight (8.82 million pound net weight) bycatch limit was established and apportioned to specified fishery categories as bycatch allowances. Attainment of a fishery's halibut bycatch allowance triggered a closure of the BSAI to that fishery. In 1990, a mandatory domestic observer program was implemented for the BSAI and GOA groundfish fisheries to collect fishery data and monitor prohibited species bycatch rates and amounts.

United States - Current Bycatch Control Measures

Bering Sea and Aleutian Islands Area

(1) **Bycatch limits and associated time-area closures.** An annual halibut bycatch limit of 5,333 mt (8.82 million pounds) is established for trawl gear. The limit is based on all halibut caught, not adjusted for discard mortality rate. The halibut bycatch limit is annually allocated to specified trawl fisheries as fishery bycatch allowances, that may be apportioned on a seasonal basis. When a fishery attains 82.5 percent of its bycatch allowance, Zones 1 and 2H (Figure 2) are closed. The entire Bering Sea and Aleutian Island area is closed to a fishery once its specified bycatch allowance is reached.

In 1991, the 5,333 mt (8.82 million pounds) halibut bycatch limit was apportioned among four trawl fisheries² in the manner specified below. The halibut bycatch allowance apportioned to the "Other Fishery" category was further allocated on a seasonal basis to provide greater opportunity for groundfish harvests. Apportionment also allows more effective monitoring of bycatch amounts and projection of associated fishery closures. When the "Other Fishery" category reaches its halibut bycatch allowance, only the Pacific cod (*Gadus macrocephalus*) trawl and the pollock non-pelagic trawl fisheries are prohibited.

1991 BSAI Halibut Bycatch Limit Apportionments

Fishery	Halibut Bycatch (mt)
Flatfish	800
Rock sole	1,100
Greenland turbot	200
"Other Fishery"	3,233
Total	5,333

²The BSAI flatfish fishery includes yellowfin sole (*Limanda aspera*) and all other flatfish except rock sole (*Lepidopsetta bilineata*), Greenland turbot (*Reinhardtius hippoglossoides*), and arrowtooth flounder (*Atheresthes stomias*). The "Other Fishery" category includes all trawl fisheries that have not been apportioned a separate halibut bycatch allowance.

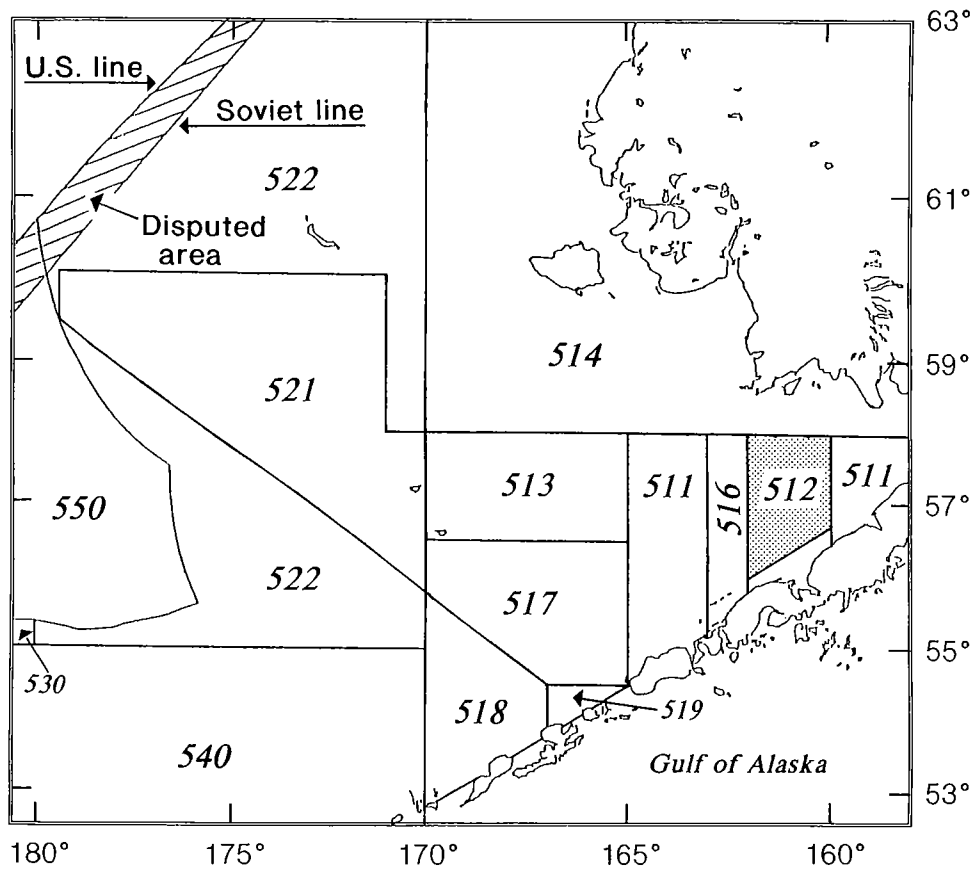


Figure 2. Regulatory areas in the Bering Sea/Aleutian Islands. Areas 511 and 516 are designated as Zone 1, and Area 517 is Zone 2H.

(2) **Season delays.** Beginning in 1991, the flatfish fisheries (yellowfin sole and other flatfish) are delayed until May 1 to reduce halibut and crab bycatch rates that are typically high in these fisheries during the first part of the calendar year. The rock sole roe fishery is exempted from the season delay; however, a separate halibut bycatch allowance is established for this fishery.

(3) **Hot-spot closure authority.** Regulations implementing this authority allow NMFS to temporarily close areas that, based on observer data, exhibit high bycatch rates of prohibited species, including halibut.

Gulf of Alaska

(1) **Bycatch limits.** Halibut bycatch mortality limits (round weight) for trawl, hook-and-line, and pot gear may be specified annually. Mortality limits specified for 1991 are 2,000 mt (3.3 million pounds) for trawl gear and 750 mt (1.2 million pounds) for hook-and-line gear. Groundfish pot gear is exempted from halibut bycatch restrictions in 1991 because (1) halibut discard mortality rate and total mortality associated with this gear type is relatively low (12 percent and 4 mt, respectively); and (2) existing pot gear restrictions are intended to further reduce halibut bycatch mortality.

(2) **Fishery apportionments of halibut bycatch limits.** Seasonal allocation of halibut bycatch limits are authorized. Their attainment will close the GOA to further fishing with the applicable gear type for the remainder of the season. Season allowances of 1991 halibut mortality limits are as follows:

**1991 GOA Halibut Bycatch Mortality Limits³
and Seasonal Apportionments**

Trawls: 2,000 mt	Hook-and-Line: 750 mt	Pot: Exempt
1st Qtr: 30% - 600 mt	Jan. 1 - May 14: 26.7% -200 mt	-
2nd Qtr: 30% - 600 mt	May 15 - Aug. 31: 66.7% -500 mt	-
3rd Qtr: 20% - 400 mt	Sept. 1 - Dec. 31: 6.7% - 50 mt	-
4th Qtr: 20% - 400 mt		

(3) **Season delays.** The opening for the 1991 hook-and-line fishery for sablefish was delayed from April 1 until May 15 when halibut bycatch rates are lower.

Bering Sea/ Aleutian Islands Area and Gulf of Alaska

(1) **Gear restrictions.** Gear restrictions are specified to reduce bycatch or bycatch mortality of halibut. Restrictions include (a) requiring biodegradable panels on groundfish pots, (b) requiring halibut exclusion devices on groundfish pots, and (c) revised specifications for pelagic trawl gear that constrain the pelagic trawl fisheries for groundfish to a trawl gear configuration designed to enhance escapement of halibut.

(2) **Industry funded domestic observer program.** Regulations require operators of catcher vessels and catcher/processor vessels to obtain either 100, 30, or 0 percent observer coverage during each calendar quarter, depending on size of vessel. Shoreside and mothership processors are required to have either 100, 30, or 0 percent observer coverage during a month, depending on the weight of groundfish received during that month.

³Assumed discard mortality rates for 1991 are 50% for trawl gear, 16% for hook-and-line gear, and 12% for pot gear.

Vessel Requirements

Overall Vessel Length	No. of Permitted Vessels (1991)	% Total Groundfish Catch	Observer Coverage
0 - 59 ft.	1,435	1%	0%
60 - 124 ft.	579	19%	30%
>124 ft.	188	80%	100%

Processor Requirements

Groundfish Received During a Month	Observer Coverage
0-499mt	0%
500 - 999 mt	30%
> 999 mt	100%

Vessels less than 60 ft length over all (LOA) and mothership and shoreside processors that receive less than 500 mt groundfish during a month are not required to obtain an observer unless specifically requested to do so by NMFS.

Observer data on halibut bycatch rates are applied against industry reported groundfish catch to derive estimates of halibut bycatch amounts each week. Actual procedures used by NMFS to calculate halibut bycatch amounts may be obtained from the Fisheries Management Division, Alaska Region.

(3) Vessel Incentive Program. A vessel incentive program to reduce halibut bycatch in specified groundfish trawl fisheries became effective May 6, 1991. Under the vessel incentive program, individual trawl vessels are held accountable for their observed halibut bycatch rates when they participate in the BSAI Pacific cod fishery, the BSAI flatfish fishery, the GOA Pacific cod fishery, and the GOA bottom rockfish fishery. If a vessel's bycatch rate at the end of a month exceeds a specified bycatch rate standard, the vessel owner/operator will be subject to prosecution. Halibut bycatch rate standards are specified annually, based on criteria set forth in regulations. The bycatch rate standards specified for 1991 are listed in Table 2 and are based on average bycatch rates exhibited by vessels in 1990 and in 1991 through June.

During May of 1991, 40 vessels participated in the BSAI flatfish fishery. Of these participants, 11 vessels exhibited observed bycatch rates in excess of the 0.3 percent (3 kg halibut/mt groundfish) bycatch rate standard. As such, these vessels have been identified as potential violators of halibut bycatch rate standards specified under the incentive program. The owners of these vessels have been issued warnings that, pending verification and statistical analyses of observer data, they may be subject to subsequent citation. Successful prosecution could result in civil penalties of up to \$100,000 per violation.

Table 2. Bycatch rate standards specified for the 1991 vessel incentive program in the BSAI and GOA by fishery and calendar quarter. Halibut bycatch rate expressed as a percentage of allocated groundfish catch.

Fishery and Quarter	1991 Bycatch Standard
BSAI Pacific cod	
Quarter 1	1.35
Quarter 2	1.85
Quarter 3	2.25
Quarter 4	2.25
BSAI flatfish	
Quarter 1	1.31
Quarters 2 - 4	0.30
GOA rockfish	
Quarters 1 - 4	4.00
GOA Pacific cod	
Quarter 1	3.31
Quarter 2	4.13
Quarter 3	3.29
Quarter 4	5.15

(4) Industry Recordkeeping and Reporting Requirements. Groundfish catcher vessels and processors are required to maintain daily records of groundfish catch and discard amounts of prohibited species and groundfish. Groundfish processors are also required to record groundfish production and discard amounts, and report them to NMFS weekly. When requested to do so by NMFS, processors must also submit this information on a daily basis, to enhance in-season monitoring of groundfish quotas and/or halibut bycatch allowances.

Washington - Oregon

Halibut is a prohibited species in the groundfish fisheries off Washington and Oregon. As such, halibut cannot be retained and must be returned to the sea as soon as possible.

A domestic observer program is in place for the Pacific hake (*Merluccius productus*) fishery. Although observer data are collected on halibut bycatch and condition, this fishery is conducted with pelagic trawl gear and halibut bycatch amounts are insignificant. In 1990, halibut bycatch in the Pacific hake fishery amounted to less than 1.5 mt (2,500 pounds). As such, measures to control or reduce halibut bycatch in this fishery are considered presently to be unnecessary.

No observer program exists for other groundfish fisheries off the Washington-Oregon coast. Although no information is available on halibut bycatch in these operations, anecdotal information from some fishermen indicates that bycatch rates could be significant in spite of the relatively low abundance of halibut in this area relative to waters off Alaska or Canada.

Canada

Halibut is a prohibited species in the groundfish fisheries off Canada. However, there is presently no prohibited species catch (PSC) limit for halibut nor other halibut bycatch control measures in Canada, as is the case for Alaska. Canada has comprehensive limited entry programs for all groundfish fisheries. These programs permit a more orderly conduct of these fisheries. In addition, there have been three previous observer programs in Canadian waters (1962-1969, 1978-1980, and 1981-1982), the first conducted by IPHC and the latter two by DFO. Data from these programs have provided regular updates to the estimated rates of halibut incidence in trawl fisheries, which are used to estimate total bycatch off Canada.

ADEQUACY OF PRESENT CONTROL MEASURES

United States

Present halibut bycatch control measures implemented by the U.S. do not always control halibut bycatch within existing bycatch limits specified for trawl gear in the BSAI and trawl and fixed gear in the GOA. Not all fisheries are presently governed by PSC limits and bycatch mortality in excess of the PSC limits was recorded for 1990, when fisheries not controlled by PSC limits continued to obtain halibut. The NMFS intends to continue to enhance its capability for timely and effective in-season monitoring of bycatch amounts to allow more accurate projections of fishery closures and reduce the possibility of halibut bycatch allowances being exceeded. The adequacy of halibut bycatch management, as it pertains to groundfish harvest, would be enhanced by including all gear types under bycatch control restrictions, and implementing management measures that would force individual fishermen to fish in ways that minimize halibut bycatch.

Existing halibut bycatch restrictions off Alaska are monitored and enforced under the regulations that govern the Alaska groundfish fisheries. Existing management measures provide for full accounting and limitation of halibut bycatch mortality in the Gulf of Alaska. Management measures also provide for full accounting of halibut bycatch in the Bering Sea and Aleutian Islands Area; however, only the trawl fisheries for Greenland turbot, rock sole, yellowfin sole/ other flatfish, and Pacific cod, together with the non-pelagic trawl fishery for pollock are restricted when halibut bycatch allowances are reached. Bycatch in the "Other Fishery" category trawl fisheries contributes to the closure of the Pacific cod and non-pelagic trawl pollock fishery, but trawl fisheries in this category, other than for Pacific cod and pollock, are allowed to continue once the halibut bycatch limit is reached. The BSAI fixed gear fisheries for groundfish also remain unrestricted with respect to halibut bycatch. Management measures are being considered that would place all BSAI groundfish operations under halibut bycatch restrictions and improve the adequacy of existing regulations to limit halibut bycatch mortality to specified levels.

Table 3 lists halibut bycatch limits and actual bycatch amounts for the 1990 and 1991 Alaska groundfish fisheries. During 1990, the 2,750 mt (4.55 million pounds) halibut limit specified for the GOA groundfish fisheries was exceeded by 429 mt (0.71 million pounds). This excess was due primarily to NMFS' inability to effectively monitor small bycatch quotas in the intensive, fast-paced hook-and-line fishery for sablefish, and noncompliance by certain processors with catch reporting requirements.

The 1990 BSAI trawl fisheries exceeded the 5,333 mt (8.82 million pounds) halibut bycatch limit established for this gear type by 552 mt (0.91 million pounds). Halibut mortality by hook-and-line and pot gear operations, with 16% and 12% assumed discard mortality rates, respectively, is estimated at 337 mt (0.56 million pounds). The total 1990 BSAI halibut mortality estimate is therefore of 6,222 mt (10.29 million pounds). The 552 mt (0.91 million pounds) overage of the trawl bycatch limit was due primarily to continued halibut bycatch in trawl fisheries that were perceived to have minimal halibut bycatch and were not under restrictions, once the halibut PSC limit was reached.

In 1991, daily reporting requirements were implemented to help monitor halibut bycatch in fast-paced fisheries. In spite of this precaution, non-reporting or misreporting by groundfish processors resulted in an overage of the specified halibut bycatch allowances for the BSAI Greenland turbot and the GOA hook-and-line fisheries.

Table 3. 1990 and 1991 Pacific halibut bycatch statistics in the Alaska groundfish fisheries.

Area	Fishery	Bycatch Mortality Allowance (mt)	Bycatch Mortality (mt)	Groundfish Catch ⁴ (mt)
1990				
BSAI	MW Pollock	-	tr	[1,220,557]
	Flatfish	567	568	64,131
	"Other"	3,966	4,517	361,001;
	Pot gear	-	3	1,418
	H&L gear	-	334	59,109
	JV Flatfish	800	800	133,320
GOA	MW Pollock	-	tr	[51,588]
	Trawl	2,000	2,139	206,681
	H&L gear	750	1,004	30,628
	Pot gear	-	36	7,410
Total		8,083	9,401	863,698 [2,135,843]
1991 - Through July 7, 1991				
BSAI	MW Pollock	-	tr	[772,674]
	Flatfish	800	148	71,705
	Rock sole	1,100	1,102	38,399
	Turbot	200	401	6,374
	"Other"	3,233	3,122	198,457
	H&L gear	-	157	35,534
GOA	Pot gear	-	tr	68
	MW Pollock	-	tr	[25,295]
	Trawl	2,000	1,438	90,110
	H&L gear	750	829	26,973
	Pot gear	N/A	4	9,474
Total		8,083	7,201	477,094 [1,275,063]

⁴Catch figures in brackets [] include midwater pollock harvests.

During 1990, halibut bycatch restrictions specified for the Alaska groundfish fisheries triggered twelve fishery closures (Table 4). Although these closures limited additional amounts of halibut bycatch in Alaska groundfish operations, they also caused forgone revenues to Alaska groundfish fishermen. The NMFS estimates the value of halibut taken as bycatch in the 1990 Alaska groundfish operations at \$42.1 million, or about one third of the ex-vessel value of the 1990 commercial halibut harvest off Alaska (\$124 million). The value of the 1990 groundfish harvest forgone as a result of halibut bycatch closures is estimated by NMFS as \$74.8 million (Table 5).

Table 4. Closures of the Alaska groundfish fisheries due to halibut bycatch, through July, 1991.

Fishery	Area	Closure Date
BSAI - 1990		
JV flatfish	Zone 2H	Feb. 27 - Dec. 31
JV flatfish	BSAI	Mar. 5 - June 24
DAP flatfish	Zones 1 & 2H	Mar. 14 - Dec. 31
DAP flatfish	BSAI	Mar. 19 - Aug. 4
DAP pollock/cod	Zones 1 & 2H	May 30 - Dec. 31
DAP pollock/cod	BSAI	June 30 - Dec. 31
JV flatfish	BSAI	July 1 - Dec. 31
DAP flatfish	BSAI	Nov. 16 - Dec. 31
GOA - 1990		
DAP H&L	GOA	May 29 - June 30
DAP Non-Pelagic Trawl	GOA	May 29 - June 30
DAP H&L	GOA	July 1 - Dec. 31
DAP Non-Pelagic Trawl	GOA	Nov. 21 - Dec. 31
BSAI - 1991		
Pollock/cod	Zones 1 & 2H	Feb. 17 - Mar. 31
Pollock/cod	BSAI	Mar. 8 - Mar. 31
Rock sole	Zones 1 & 2H	Mar. 15 - Dec. 31
Pollock/cod	Zones 1 & 2H	Apr. 19 - May 3
Pollock/cod	Zones 1 & 2H	May 3 - Dec. 31
Pollock/cod	BSAI	May 8 - July 1
Rock sole	BSAI	June 6 - Dec. 31
Pollock/cod	BSAI	July 8 - Dec. 31
GOA - 1991		
Non-Pelagic Trawl	GOA	May 8 - July 1
DAP H&L	GOA	July 1 - Dec. 31

Canada

The HBWG assessed the adequacy of the control measures (gear prohibitions on retention, limited entry programs for groundfish fisheries) in Canadian waters as minimally effective. Information on current practices is limited by a lack of recent observations. Greater savings could be realized through more active measures and effective monitoring programs.

Table 5. Estimated impacts of 1990 halibut bycatch restrictions specified for the Alaska groundfish fisheries.

Total Pounds and Value of Halibut Taken as Bycatch in the 1990 Alaska Groundfish Fisheries, Relative to the 1990 Directed Fishery		
1990 halibut bycatch mortality	9,401 mt (15.5 million pounds)	
Unit value of halibut bycatch	\$ 4,475 per mt halibut mortality	
Estimated value of halibut taken as bycatch	\$ 42.1 million	
1990 commercial halibut harvest off Alaska	31,600 mt (52.2 million pounds)	
Ex-vessel value (based on \$1.78 per lb)	\$ 124 million	
Estimated Amount and Value of 1990 Groundfish Harvest Forgone as a Result of Prohibited Species Bycatch Closures		
<u>Joint Venture BSAI</u>		
Closure of BSAI JV flatfish fishery	116,244 mt mixed flatfish	
<u>Domestic Annual Processing BSAI</u>		
Closure of BSAI flatfish fishery	11,250 mt rock sole, 0 mt flatfish, yellowfin sole	
Closure of BSAI "Other" fishery	24,000 mt Pacific cod	
<u>Domestic Annual Processing GOA</u>		
Closure of Hook & Line fisheries	1,500 mt sablefish	
Closure of Non-Pelagic trawl fisheries	6,000 mt mixed flatfish, 20,000 mt Pacific cod	
<u>Summary</u>	<u>Groundfish Left</u>	<u>Estimated Value</u>
BSAI remainder:	127,494 mt	\$ 45.9 million
GOA remainder:	27,500 mt	\$ 28.9 million
Total	154,994 mt	\$ 74.8 million

Notes to table:

- (1) The value of halibut bycatch takes into account the number, average weight, and discard mortality of halibut taken as bycatch, weight at age, natural mortality, age at recruitment, ex-vessel price, product recovery rate, and discount rates.
- (2) JV values are based on price paid to U.S. harvesting vessels; DAP values are based on first wholesale values.
- (3) The table makes the assumption that JV fisheries would have been 100% harvested.
- (4) The table requires the assumption that without halibut closures, TACs for groundfish would be 100% harvested, except for GOA flatfish.

HALIBUT BYCATCH ISSUES AND MANAGEMENT MEASURES EXAMINED BY THE HBWG

The HBWG discussed several management issues and measures that remain of concern at the current levels of halibut bycatch mortality.

IPHC Compensation for Halibut Bycatch

The HBWG reviewed IPHC staff presentations on current procedures used to adjust reproduction by the adult stock for halibut bycatch when setting annual setline quotas for the halibut fishery; how bycatch mortality affects halibut stocks in different geographic areas; and how changes in halibut biomass and abundance relate to changes in halibut bycatch rates.

Adequacy of present bycatch compensation

Recruitment to the adult halibut stock has declined substantially since the peak level of 1985 and the IPHC estimates that stock biomass will continue to decline until the mid-1990s. The 1990 recruitment is the lowest on record and historical performance of the stock offers only limited guidance on future halibut productivity at such low recruitment levels. Bycatch levels of recent years have an unknown effect at this low halibut stock level, and may pose a risk to the future productivity of the halibut resource.

The existing bycatch adjustment procedures attempt to repay the halibut stock for lost egg production. This is the only option available to the IPHC to address its conservation objectives. In practice, the weight of catch reductions required to adjust reproduction for lost egg production matches the actual weight of bycatch, but this is a consequence of the biological characteristics of the present bycatch. Markedly different size or age patterns of bycatch might lead to adjustment levels different from one-for-one.

The approach to these calculations is straightforward. The amount and size composition of bycatch in a year is estimated from monitoring information. The estimated bycatch is discounted by the expected age-specific schedule of future natural and fisheries mortality it would have suffered, had it not been taken as bycatch. This assumes the target exploitation rate of 35% will be maintained on all components of the halibut stock. The expected increase in biomass due to growth of the "survivors" is also calculated. The lifetime egg production of the projected "bycatch biomass" is calculated using age-specific fecundity estimates. The allowable harvest of a given year is reduced from the 35% harvest level by the mature biomass whose remaining lifetime egg production matches that lost due to bycatch in the preceding year. The one-for-one adjustment of bycatch by directed catch occurs because the by-caught biomass is expected to increase due to growth, but the average expected fecundity of the by-caught fish is lower than the fecundity of the adults not harvested due to adjustment. Were the age composition of the bycatch or the directed catch to alter greatly, adjustment levels other than one-for-one might be required.

The adjustment procedures do attempt to repay the stock as a whole for lost egg production. Hence, the present adjustment attempts may be fair from the point of view of the egg production of the stock. The fairness of the procedures can be viewed from

other contexts, however. Key viewpoints are realized stock biomass, national interests, and fishing fleet perspectives.

(1) Realized Stock Biomass The adjustment procedures only match lost potential egg production. They do not guarantee that future contribution to recruitment is actually realized. Also, the stock is not compensated for the pre-recruits which are actually killed as bycatch. The HBWG acknowledges the positive intent of the present adjustment procedures, but recognizes that the procedures may not actually replace the recruits lost as bycatch. They are intended to replace only the potential egg production of those recruits.

(2) National Interests To maintain the target exploitation rate on all stock components, catch reductions must be applied according to the distribution of the adult biomass which will provide the reproductive adjustment. Hence, countries forgo catch in proportion to the sizes of their stocks, not the levels of their bycatches. Young halibut (the predominant ages taken as bycatch) show net movement south and east as they grow. This means fisheries must forgo directed catch for bycatch taken by more northerly fisheries, often by fisheries of the other country.

(3) Fishing Fleet Perspectives Within each country the majority of the bycatch mortality occurs in fisheries other than the directed halibut fishery. However, catch reductions to adjust for the bycatch must be taken from the directed catch of the fleet not responsible for the bycatch.

Aside from the adjustment procedures among fleets and between Canada and the U.S., the HBWG also considered some questions about the scheduling of adjustment for bycatch. When immature fish are taken as bycatch, the potential egg production lost is that which would have occurred over a period of years, starting sometime in the future. The adjustment is made immediately with mature fish, already part of the spawning population. The calculations assure that the numbers of eggs are matched, but not the times at which they would have been produced. Indeed, the mature fish which supply these additional eggs will have largely passed out of the population, by the time at which the bycaught fish should have produced their own eggs. The current practice assumes that eggs in all years are equivalent, and that this mismatch in times of reproductive output is not significant. Were it possible to forecast future recruitment accurately (which, at present, it is not) it could be argued that a one-for-one trade of "extra" eggs now for eggs lost from future spawning is inappropriate.

The IPHC staff is aware of all of these concerns, and was working on the problems even before the HBWG was constituted. The HBWG had no proposals for immediate modification of the adjustment procedures which would ameliorate any of the inter-country or inter-fleet inequities, yet still maintain the primary objectives of the adjustment for lost reproduction and the 35% exploitation rate across the entire stock. Nonetheless, there were suggestions for more detailed analyses of the scheduling of repayment of eggs, for finer-scale analyses of migration patterns of ages of halibut taken as bycatch, and for analyses of bycatch as an escapement problem. The IPHC will continue to explore the adjustment procedures as a routine component of their work. In the short term, however, there is no reason to expect major changes in the adjustment procedure.

The IPHC currently considers amounts of halibut waste off the Washington-Oregon coast that result from lost or abandoned setline gear or sub-legal releases in the halibut setline fishery when recommending target harvest levels for the halibut setline

fisheries. The IPHC does not account for halibut bycatch mortality in the Washington-Oregon groundfish fisheries, other than for trace amounts of halibut bycatch observed in the pelagic trawl gear fishery for Pacific hake. Bycatch amounts in the Washington-Oregon bottom trawl fisheries are presumed to be low relative to amounts taken off Alaska, although there have been no observer programs in the Washington-Oregon area. Bycatch rates in this area are likely to be similar to rates occurring in adjacent Canadian waters, due to the similarity of the two trawl fisheries. The IPHC intends to initiate consideration of these bycatch amounts when recommending 1992 setline quota amounts.

Halibut Bycatch vs. Juvenile Abundance

The IPHC and NMFS have conducted periodic bottom-trawl surveys in the Bering Sea, which cover most areas of juvenile halibut abundance. The HBWG investigated whether the index of juvenile halibut abundance derived from these surveys was correlated with bycatch in BSAI trawl fisheries. Previous analysis of these data by IPHC staff had showed little relationship of bycatch to the abundance of juveniles, as measured in biomass. However, the HBWG examined the abundance of juveniles, measured in numbers, and found a positive relationship between changes in juvenile abundance and changes in bycatch. The strongest correlation was found for bycatch in a given year and juvenile abundance (in numbers) measured the previous year. The surveys may therefore provide an advance warning of incoming strong year classes of halibut, and consequent opportunities to optimize contribution of these juveniles to the adult halibut stock. The 1987 year class is indicated as relatively strong by the 1990 survey, and is presently vulnerable to trawl bycatch.

Halibut Bycatch Mortality in Groundfish Operations

The HBWG reviewed historical reports, and examined recent observer data to determine and compare levels of halibut bycatch mortality in different groundfish operations. Members of the HBWG also met with representatives of the U.S. and Canadian trawl industries to discuss management measures that could be implemented to reduce trawl bycatch mortality.

In summary, numerous variables affect halibut bycatch mortality in groundfish operations, including gear type, target species, tow length, size of trawl catch, size composition of incidentally caught halibut, the length of time incidentally caught halibut are retained on deck, and how a vessel's crew handle halibut once they are brought up on deck. NMFS currently manages halibut bycatch in the GOA under an assumed mortality rate of 50 percent in trawl operations, 16 percent mortality in hook-and-line operations, and 12 percent mortality in groundfish pot operations.

In the BSAI, NMFS assumes a 100 percent mortality rate in BSAI trawl operations. The observer program in the BSAI has been collecting condition factor data on bycaught halibut which may be used to estimate survival, based on an IPHC study of discard mortality conducted off Canada. Using these condition factor data, observations from the 1990 Bering Sea Pacific cod trawl fishery indicate that halibut larger than 80 cm may incur only a 60 percent mortality rate, while those less than 80 cm may suffer about an 80 percent mortality. Discussions with trawl industry members also support less than a 100 percent mortality assumption in BSAI trawl operations, which could be further reduced if fishermen are provided with effective incentives to reduce

halibut bycatch mortality. Once the 1990 observer data on halibut bycatch mortality in other groundfish trawl and fixed gear operations become available (late summer, 1991), refined mortality assumptions for U.S. groundfish operations could be developed. If viability of bycatch, as assessed by condition factor, is similar to that off Canada, these mortality rates could be incorporated in the IPHC's bycatch mortality compensation procedure used to determine annual halibut setline fishery quotas. Revised mortality assumptions for BSAI trawl operations would also be used by NMFS for its monitoring and management of halibut bycatch limits.

Mortality of trawl caught halibut in the groundfish trawl fisheries off Canada is estimated at 50 percent, based on a detailed tagging study conducted by IPHC during the 1960-1970 period. The Canadian trawl industry believes that bycatch mortality rates are lower than 50 percent, as a result of improved handling practices and fishing techniques used currently. The Canadian longline industry believes that bycatch mortality is higher than estimated.

The IPHC staff presented recommendations for a research plan to reduce bycatch discard mortality, to improve observer data on halibut discard mortality rates, and methods to reduce the mortality rate of longline-caught halibut in the Alaskan groundfish fishery. The development of a quantitative, objective, index of halibut viability and associated mortality in different groundfish operations will be a vital element in any incentive programs developed to reward individual fishermen who take action to reduce halibut bycatch mortality.

MANAGEMENT PHILOSOPHY FOR BYCATCH REDUCTION

United States

The fisheries management process in the U.S., especially that off Alaska, devoted much attention to protecting halibut while harvesting other species, particularly groundfish, and established halibut bycatch limits for the BSAI and GOA groundfish fisheries. Without these limits, bycatch amounts of halibut would be at levels higher than those currently exhibited by the U.S. groundfish fleet. Once halibut bycatch limits were established, the management process has focused on:

- (1) an accurate and timely accounting of halibut bycatch;
- (2) controlling halibut bycatch to amounts within the established limits; and
- (3) developing management measures that will permit the groundfish fisheries to harvest more of their allocated quotas while staying within halibut (and other prohibited species) bycatch limits.

Based upon the discussion of current bycatch controls and monitoring measures identified in the **Current Bycatch Control and Monitoring Measures** section of this report, it is apparent that substantial efforts and improvements have been made to items (1), (2), and (3) above. Despite these measures, however, Alaska groundfish fisheries have yet to exhibit an ability to harvest all the allocated groundfish quotas under existing halibut bycatch restrictions. This situation will continue under the existing bycatch management regime until sufficient incentives are provided to groundfish fishermen to fish cleaner, so as to prolong their fisheries.

The present management philosophy in the U.S. is to develop individual incentive programs to control prohibited species bycatch amounts. The objective is to minimize halibut bycatch rates at the individual vessel level, and work towards a reduction of the overall halibut bycatch limit that would permit full utilization of the groundfish quota. The U.S. groundfish industry generally endorses this objective and has expressed the desire to reduce halibut bycatch to minimum levels consistent with harvest of groundfish quotas. The fisheries management process is working towards the development of a comprehensive, effective incentive program that would provide the industry with the enabling measures that would allow this.

While actual reductions in the overall bycatch limits have not been achieved and not all fisheries are governed by bycatch limits, sustained progress in containing the bycatch problem has been made.

Canada

Detailed monitoring and estimation of bycatches have not been achieved in Canada. There have been three previous observer programs in Canadian waters (1962-1969, 1978-1980, and 1981-1982), the first conducted by IPHC and the latter two by DFO. Data from these programs have provided regular updates to the estimated rates of halibut incidence in trawl fisheries, which are used to estimate total bycatch off Canada.

There is presently no PSC limit for halibut nor other halibut bycatch control measures in Canada as is the case for Alaska. Canada has implemented a comprehensive limited entry program for all groundfish fisheries since the mid-1970s. These programs permit a more orderly conduct of these fisheries which in part, would limit bycatches.

Bycatch mortality of halibut and other species remains of concern to Canada. The Canadian groundfish industry has expressed a strong desire to minimize halibut mortality and ensure that accurate information on bycatch mortality is obtained. To that end, it has supported a voluntary observer program being enacted during 1991. These data will be used to refine incidence rates and examine the potential for reductions, based on specific time-area rates, and the requirement for bycatch mortality limits. In addition, Canada is developing proposals to manage groundfish species as naturally-occurring assemblages, in order to minimize wastage of all species encountered by trawl gear.

POTENTIAL MEASURES FOR BYCATCH REDUCTION

The HBWG considered many measures for bycatch mortality reduction and attempted to evaluate them as to their practicality and potential for implementation. We did not apply any value judgements concerning their relative costs and benefits. The HBWG believed that potential measures fall into two categories: reduction measures and enabling measures. Reduction measures are those which, if implemented successfully, would actually yield reductions in bycatch mortality. On the other hand, enabling measures provide vehicles to enhance implementation and compliance of the more direct reduction measures. Taken individually, the enabling measures would have little power to reduce bycatch, although they would permit greater realization of groundfish yields. A combination of several or all of these measures will be required to achieve significant reductions in bycatch mortality.

Direct Reduction Measures

Reduce PSC limits in the U.S.

A reduction in the PSC limits would provide immediate and direct reduction in bycatch mortality. Advantages of this measure are that the mechanisms for monitoring and implementation of these limits already exist, they could be enacted without regulatory changes, and they would not require legal validation of individual observations and fishing practices to be used for enforcement/management. The problematical aspects are that they could be strongly opposed by some industry sectors and that, in the absence of incentive programs, they would lead to additional forgone harvest of groundfish. Two mechanisms have been proposed to reduce these PSC limits:

(1) Floating PSC limits, to adjust allowable bycatch levels to correspond with changes in halibut stock abundance. This mechanism can be justified as a conservation measure. It is based on the thesis that the levels of PSC limits are set for the long-term average condition, but bycatch is particularly unacceptable when the stock is low or recruitment is weak. In those cases the halibut themselves are relatively scarce. Although the potential egg production of bycatch is adjusted for, the adjustment is with eggs which may become fish someday, whereas the immediate waste is real, scarce halibut. If this is thought to be a poor trade, then it is necessary to reduce the limits when overall stock status or recruitment is lower than average. A single strong year-class (e.g. 1987 cohort) after several weak ones is particularly important. For example, the present prognosis for the near-term halibut spawning stock status is pessimistic because of the succession of poor year-classes. A strong year-class represents the potential to mitigate the decline of the spawning biomass; potential which may be lost due to bycatch. Floating limits appear attractive as a conservation tool during periods of poor recruitment. The reasoning behind floating limits might convince industry to accept them when recruitment is weak, and pre-recruits of weak year-classes would be conserved. At times of high recruitment, however, if the same reasoning were to be applied, the limits could be raised. The value from which the bycatch limits float must be carefully selected to provide as low a limit as is consistent with reasonable harvest of the groundfish.

(2) Ratcheting mechanism to enact a stepwise reduction in bycatch limits. This is based on the thesis that the PSC limits must be reduced, regardless of stock status, but industry's ability to adjust to lower limits is constrained. An ambitious target reduction in bycatch limits would be set, and divided into steps. These steps would be brought in on a (perhaps annual) schedule. As each step is brought in, industry has the opportunity to adjust operations to accommodate the moderately more stringent constraints. The approach assumes implicitly that industry can operate in ways which cause lower bycatch mortality, but needs time to adopt and perfect those methods. It has been suggested that each step be invoked only when industry has accommodated to the previous step. This minimizes disruption to the industry, but also gives little incentive to meet each step quickly. A rigid schedule of steps allows little flexibility when dealing with problems industry may encounter in meeting lower limits, but assures the overall target will be reached in a timely manner.

Enhance monitoring

In some areas and fleets, observer coverage is low or nonexistent. In these cases halibut bycatch mortalities are simply estimated from reports of catches of target species and bycatch rates. Halibut bycatch mortalities may be higher than the estimates. If so, and if observers were present to record the true bycatch levels, then the reported bycatch mortalities would reach the enforcement limits sooner. Consequently, the fleet operations and resultant bycatch would be curtailed, so the actual bycatch mortality would be reduced through reduced fishing effort. Possibly, the presence of observers changes the operation of vessels in ways which decrease bycatch mortality. Wider deployment would then lead to more vessels fishing in ways which lowered bycatch mortality.

It is also possible that, for some fleets, the present estimates of bycatch levels and/or mortalities are too high, given changes in fishing practices. In those cases observers would document the true level of bycatch as lower than the estimated levels. The fleets would be rewarded for their improved practices by receiving greater opportunity to fish before the PSC limits are reached. The goodwill of the groundfish industry would also be gained. In the long run this could be of great benefit for reducing bycatch mortality of halibut.

Monitoring programs would require regulatory changes in some jurisdictions. The HBWG regards adequate monitoring of bycatch as an important element of all reduction programs, and is particularly important when programs depend on the activities of individual fishermen, such as for incentive programs.

Enabling Measures

Change handling methods to improve halibut survival

Improved handling methods would lead to a lower mortality of those halibut caught incidentally in other fisheries. Where PSC limits apply to catch levels, higher survival would reduce halibut mortality. However, this measure would require standardization of existing monitoring and condition assessment procedures, and thorough documentation of existing practices, in order to evaluate the potential benefits. In addition, there would be a need to demonstrate that the changes in handling methods result in greater viability and survival. This aspect of such a program would need to be developed in conjunction with IPHC staff.

Modify fishing gear and practices

Data from the large-scale observer program in Alaskan fisheries are becoming available for analysis. When the data bases are fully available and analyses completed, researchers will have much better information on levels of bycatch and mortality associated with fishing practices. If specific practices produce high (or low) levels of bycatch mortality consistently, fishing plans and regulations can be changed to prevent (or encourage) those practices. Some results may be available soon, but full analyses of comprehensive data bases may require a few years. Even if analyses in the next few months identify practices as desirable, regulation changes may be necessary to encourage those practices. The situation is the same for regulation changes to discourage

practices, if any are identified as undesirable. In the absence of an incentive program, it would also require actions by individuals in order to obtain benefits for a particular gear sector. Measures based on such altruism have been unsuccessful in the past. The HBWG therefore believes such measures must be embodied in an incentive program.

Reduce fishing effort

A reduction in fishing effort via limited entry, individual vessel quotas/individual transferable quotas (IVQ/ITQ), or vessel reduction programs would provide a more rational framework for groundfish harvest. The "Olympic" nature of the U.S. groundfish fisheries encourages participants to catch fish as quickly as possible, even if the methods are wasteful of non-target species. Industry may now know of practices that would produce lower halibut bycatch mortality, but individual vessels cannot use these practices and remain competitive with vessels fishing faster but less carefully. If so, ITQ/IVQ or limited entry programs might reduce the competitive nature of harvesting, and not punish careful harvesters. If halibut or other species bycatch remains limiting on attainment of groundfish yield, individual quotas for bycatch might be necessary. ITQ/IVQ programs would be a mechanism for reducing bycatch directly. Limited entry programs would allow "cleaner" fishing indirectly, if the capacity allowed to enter was all required to harvest the target quotas. This could require a substantial reduction in fleet capacity.

Such programs might also require large regulatory and management changes, generate opposition by some gear sectors, take significant time to implement, and require intensive monitoring.

Modify distribution (time/area) of effort

Altering the time/area distribution of fishing effort carries a potential benefit in reducing the high-bycatch mortality from harvest of groundfish. This would result in more groundfish being harvested within the specified PSC limits. Previous observations of the time/area/target species association of bycatch indicate relatively high inter-annual variation. This means that in-season observation and analysis of bycatch rates would be necessary to effect meaningful redistribution of effort. Such flexible, in-season closures may have unpredictable effects on the prosecution of other groundfish fisheries.

Incentive programs

If an effective, comprehensive incentive program could be developed, industry should operate in ways which cause low bycatch mortality. Then, other control measures become unnecessary. Generally an incentive plan would give greater opportunity to fish for target species to individual fleet sectors with low or declining levels of halibut bycatch. The greater opportunity might come through higher individual quotas, earlier openings, longer seasons, access to more areas, or other mechanisms. In each case, though, the incentives would be relative to fleet sectors with higher bycatch rates. Those sectors with high halibut bycatch mortalities would be required to forgo opportunities to fish for other species.

Incentive programs may require significant changes in regulations and improvements to monitoring programs in some areas. The HBWG regards incentive programs

as having great promise to gain industry cooperation in initiatives to reduce halibut bycatch.

Awareness program

An awareness program was viewed as a passive measure to make individual operators aware of the need for conservation of bycatch, in their own interests. It is conceived as an approach to promote action by individuals, to the benefit of particular fleets, as well as to provide a vehicle and focus for peer pressure to reduce wasteful practices. Such a program might have benefits, but would be most effective only in combination with active programs to directly reduce bycatch.

BYCATCH CONTROL AND REDUCTION MEASURES UNDER CONSIDERATION BY THE UNITED STATES

1992 Bycatch Management Measures

The North Pacific Fishery Management Council (Council) has adopted a number of proposed halibut bycatch management measures for development and analysis during 1991. The analyses are scheduled for Council review at the Council's September 1991 meeting, with final Council action on the proposed bycatch management measures scheduled for its December 1991 meeting. The bycatch management measures adopted by the Council will be submitted to the Secretary of Commerce for review and implementation in 1992. The Council is anticipated to recommend emergency rule implementation of many of these measures to provide for an early 1992 effective date.

The Council's ad hoc Bycatch Committee considered 35 separate measures to control or reduce prohibited species bycatch in the Alaska groundfish fisheries. Time, data, and staff constraints required the Council to select only the most practical and high priority measures for implementation in 1992. Many other measures are scheduled for consideration and development during 1992 for implementation in 1993 or beyond.

During a July 3, 1991 conference call, the Council selected the following bycatch management measures for implementation during 1992:

(1) Hot-spot closure authority. This measure would provide in-season management authority to temporarily close groundfish fisheries in areas that exhibit high prohibited species bycatch rates. A timely hot-spot closure authority would be dependent on weekly observer data and comprised of the following elements:

- (a) **Pre-season specification of threshold bycatch rates.** During the Council's September - December specification process, the Council would review prohibited species bycatch rates, and recommend annual threshold rates of prohibited species which would trigger hot spot closures. The recommended rates would be published for public comment and implemented with annual fishery specifications.
- (b) **Designation of time-area closures.** Weekly data are reported by the industry and observers by Federal reporting area. Although observer and vessel operators record actual haul positions (latitude/longitude), this informa-

tion is recorded only in logbooks or in observer reports that are submitted later in the fishing year. As a result, most in-season closures based on weekly data would close whole reporting areas unless NMFS had information to support smaller, pre-determined area closures. Areas smaller than reporting areas could be published for public comment and implemented with annual fishery specifications.

The duration of hot-spot closures must be specified in regulations. Because hotspot problems appear to be of short duration, a two-week closure period will be proposed.

- (c) **In-season triggers of hot-spot closures.** To implement a hot-spot closure within a 1-2 week period, NMFS would be forced to base closures on only one week's worth of observed bycatch rates. When the average weekly rate in a reporting area exceeds the Council's threshold rate, the area would be closed for the time period specified in regulations.

(2) **Enhancement of the vessel incentive program.** With respect to halibut, the Council recommended that the mid-water pollock fishery be included in the vessel incentive program and that a minimal halibut bycatch rate standard be specified for this fishery. The intent of this measure is to dissuade pelagic trawl fishermen from fishing on the bottom with an attendant high bycatch rate of halibut.

The existing incentive program will include the 1992 Pacific cod trawl fisheries, the BSAI flatfish fishery, and the GOA bottom rockfish fishery. During 1990, these fisheries accounted for 55 percent of the halibut bycatch mortality.

(3) **Delay opening dates for fisheries to maximize groundfish harvests and minimize halibut bycatch.** Proposed season delays adopted by the Council for analysis include: (a) a general delay of the BSAI and GOA groundfish fisheries from January 1 to either January 15 or February 1; and (b) a delay of GOA trawl rockfish fishery from January 1 to either a mid-year date or after the conclusion of the Central and Western GOA sablefish fisheries.

(4) **Include all BSAI groundfish fisheries under halibut bycatch restrictions.** The intent of this proposed measure is to establish a halibut bycatch allowance for fixed gear and certain trawl fisheries that are currently exempted from halibut bycatch restrictions. Although the Council has the option of setting the fixed gear halibut bycatch limit outside the 5,333 mt cap specified for trawl gear, it could choose to include fixed gear bycatch limits within the existing cap. This action would limit the BSAI halibut bycatch mortality to 5,333 mt, which would represent a 14.3 percent decrease from the 6,222 mt mortality estimated for 1990. Including fixed gear under the existing halibut bycatch limit will be controversial because reduced amounts of halibut will be made available to trawl fishermen before fishery closures are triggered.

Bycatch Management Measures Under Consideration for 1993 and Beyond

The National Marine Fisheries Service will continue to improve its capability to monitor bycatch in the Alaska groundfish fisheries. Feasibility studies are being undertaken to gauge the practicality of requiring volumetric or other calibrated measurements of total catch on board vessels. NMFS has also taken steps to test the

use of satellite communications equipment to facilitate the timely transfer of catch information and enhance the ability of NMFS to monitor quota amounts and project fishery closures.

A wide range of bycatch management measures have been proposed for 1993 that would further control and reduce halibut bycatch, including time-area closures, prohibition of night trawling, preferential gear allocations of Pacific cod to fixed gear, and floating and/or reduced bycatch limits. The Council has noted, however, that many of these measures would become unnecessary if individual fishermen were made fully accountable for their halibut bycatch. This accountability could only be generated through a comprehensive, effective individual incentive program that monitored amounts of halibut allocated to individual fishermen, rather than halibut bycatch rates. As such, the Council has generally agreed that the development of an individual bycatch accounting program is of high priority and should be initiated during 1992 for Council consideration as soon as possible. The Council further recognizes that the complexities of individual transferable bycatch quotas will likely delay the implementation of such a program until 1994 or beyond. Until then, the Council cited its general support for enhancement of the existing rate-based incentive program as the most effective means to control and eventually reduce halibut bycatch amounts.

APPRAISAL OF MANAGEMENT MEASURES

The HBWG reviewed the suite of halibut bycatch management measures that have been implemented. It also discussed measures for halibut bycatch management under consideration for 1992 and beyond. The HBWG's comments on current and future halibut bycatch management measures follow:

(1) While significant progress has been made in the U.S. to control and monitor bycatch within established bycatch limits, there is still need to continue to improve the processes and lower overall bycatch mortality levels.

Of the suite of bycatch management procedures under consideration by the U.S., it is apparent that no single procedure can be effective in controlling and reducing bycatch. A good mix of procedures, as discussed below, will be necessary.

- (a) The individual vessel incentive program is the most effective means of bringing accountability and responsibility for bycatch down to the fishermen level. At individual vessel levels, there will be more incentive to fish "cleaner"; thus avoiding the "Olympic-style" manner of fishing when bycatch amounts were assigned to the collective group. The HBWG encourages the development of this concept and urges that the concept be applied to all vessels that take halibut as bycatch.
- (b) Along with a vessel incentive program, there must be adequate observer amounts monitoring of bycatch. The U.S. already has 100% coverage of the large vessels and 30% coverage of the smaller vessels. The HBWG endorses maintenance of these percentage coverage amounts and urges the U.S. to continue improvement in its bycatch monitoring and estimation, including expansion of observer coverage, where needed to promote incentive program implementation. The HBWG also encourages Canada to implement an observer program that will obtain the data necessary for development of bycatch reduction measures.

- (c) The HBWG notes that the industry record keeping and reporting requirements for the groundfish fisheries off Alaska are substantial and designed to provide real-time data of the catches, including halibut bycatch.
 - (d) The HBWG suggests that halibut bycatch discard mortality rates should be monitored. When it can be established, the actual halibut discard mortality caused by a fishery should be considered by the IPHC staff when adjusting the yield of the halibut resource, prior to setting annual halibut setline quotas.
 - (e) The HBWG believes that the fishing industry should develop fishing practices, including the use of gear types, that would reduce bycatch and bycatch mortality. While the data are still preliminary, it appears that shorter trawl tows and shorter sort-release time of halibut, once on board, would improve survival of halibut. The HBWG places high priority on additional research to identify and improve such fishing practices, coupled with the development of incentives or other regulatory measures that would allow the effective incorporation of these practices into daily fishing operations.
 - (f) The hot-spot closure authority that is being implemented in the U.S. can be another effective tool for reducing halibut bycatch. The HBWG encourages active, in-season application of this authority. In reality, a hot-spot closure will involve a large statistical reporting area instead of a small "localized" area, thus increasing the chances of reducing halibut bycatch.
 - (g) Finally, the HBWG believes that the present overall bycatch limits set for the Bering Sea-Aleutians region, and for the Gulf of Alaska need to be re-evaluated with the view of lowering them. This need is more urgent because the halibut resource has experienced a period of rapidly declining recruitment, and a relatively strong cohort of juveniles is presently vulnerable to the trawl fishery. In addition, fisheries whose bycatch amounts are exempt from the limits, should be brought under the limit.
- (2) Canada has not established a halibut bycatch limit for its groundfish fisheries, but has started a pilot observer program that will monitor bycatches and update incidence rates estimated by previous observer programs. This program should be expanded.

Canada has established a limited entry program for groundfish fisheries where halibut bycatch occurs. Administratively, it may be easier for Canada to implement bycatch control measures, such as time-area closures, that would alleviate bycatch problems.

WORK GROUP RECOMMENDATIONS FOR RESEARCH

The HBWG reviewed research plans to improve our understanding of the sources of halibut bycatch mortality. Some projects are currently underway. We recommend priorities for the projects under the concept of doing those first which provide the most information with efficient use of resources, and using results from projects to determine design of subsequent projects. Some lower priority projects may be completed

before high priority projects, depending on staff availability and time needed to complete projects.

High Priority

- (1) Time-area-species evaluation of observer data for potential time-area closures. This project is scheduled for IPHC staff analysis.
- (2) Develop in-season individual vessel incentive plan. National agencies must take the lead for this project, with IPHC staff assistance.
- (3) Gear research with underwater camera. This project is underway with IPHC and NMFS staff.
- (4) Obtain more and better condition factor data from observers to improve estimates of mortality. Detailed proposals have been exchanged between scientists of IPHC and the national sections.
- (5) Evaluate fishing activities affecting condition factors. Some data are available, but more are needed. This work, in conjunction with number 4 above, will rely heavily on observer data but may also include directed scientific projects.

Medium Priority

- (1) Examine variability and distribution of bycatch data to determine “reasonable” rates. IPHC staff is planning to start this project after the time-area-species evaluation.
- (2) Analyze tagging data from longline experiments. IPHC staff has this project on its planning list.
- (3) Relate discard mortality to fishing practices for development of incentives. This project will follow evaluation of mortality rates and condition factors.
- (4) Examine bycatch rates in the 1991 Bering Sea Pacific cod trawl fishery.
- (5) Develop physiological measurements to estimate discard mortality. Other agencies should begin development of background information, but we recommend delaying the start of field projects.
- (6) Estimate mortality with a “smart” tag. Substantial development and field testing of such tags will be required. Neither IPHC nor the national sections are presently conducting such research.

**TARGET LEVELS FOR REDUCTION OF HALIBUT BYCATCH
IN THE GROUND FISH FISHERIES
AND RECOMMENDATIONS TO THE COMMISSION**

General

In making the following recommendations, the HBWG considered carefully the objectives given it by the Commission. These objectives address current management measures' adequacy, additional measures needed to reduce bycatch, and appropriate targets for bycatch reduction. Given these objectives, we recommend measures that are needed to reduce halibut bycatch mortality in the groundfish fisheries of the U.S. and Canada. The HBWG was clearly aware that measures which reduce halibut bycatch mortality may have significant impacts on the prosecution of other fisheries. Therefore, we attempt to avoid recommending measures which we believe to be clearly impractical. For example, if we were to consider only the halibut setline fishery, we could simply state that the optimum bycatch level in other fisheries should be zero. Advice of that nature, however, would do little for the Commission or the halibut resource since it is not economically, socially, or politically feasible to reach that endpoint. Any effective program for the management of bycatch in the groundfish fisheries of the U.S. and Canada, would be best served by laying out realistic, achievable, and measurable programs that allow the two countries to manage the complex fisheries that exist in their zones at some optimal level while minimizing halibut bycatch mortality.

Accordingly, the HBWG adopted as its primary goal the design of a program to identify and work toward restriction of halibut bycatch in groundfish fisheries to levels that would allow each nation to reasonably harvest its groundfish resources while minimizing halibut bycatch mortality. The HBWG recognizes that the Commission could choose to recommend that even greater steps be taken to reduce halibut bycatch mortality. Such steps might impose significant costs on groundfish fisheries. This is a political/allocative decision and beyond the scope of the HBWG, although many of the same considerations, procedures, data needs, etc., outlined here would apply to such a program.

The HBWG recognized that many uncertainties, research needs, and data gaps exist regarding how bycatch occurs, its effects on stocks, the levels of past and present bycatches, mortality mechanisms, and a host of other issues. Many of these are highlighted and prioritized in this report. Nevertheless, action on bycatch cannot wait until the last data gap is bridged. As can be seen from the summary of measures already taken or being considered by the governments for implementation, bycatch control programs are ongoing. However, the HBWG believes that additional focus and direction is needed. The U.S. has taken major steps to limit and control bycatch in groundfish fisheries off Alaska, and to improve accounting of bycatch so that existing limits are as effective as possible. Nonetheless, bycatch has continued to increase. Comparable measures are not implemented for groundfish fisheries off Canada, Washington, or Oregon. Some additional areas of control are suggested below, but it is clear that existing measures do not force governments or industry toward a reduction in current bycatch levels. We propose what we consider to be a reasonable goal against which to judge the efforts of the parties, a series of actions/management measures to approach that goal, a timetable for action against which progress can be monitored, and highlight some necessary programmatic improvements.

Bycatch Reduction Goals

During foreign fisheries domination of the harvests off Alaska, the estimates of halibut bycatch mortality varied from a high of 15,000 mt round weight (25 million pound net weight) down to 4,000 mt (7 million pounds). These data, particularly for early years, are not verifiable, and early bycatches by some estimates may have been as high as 24,000 mt (40 million pounds) in the early 1960s. The trend of these estimated bycatches was generally downward—reaching a low of 4,000 mt (7 million pounds) in 1985, under a system of comprehensive regulation and enforcement. These bycatches exhibited considerable annual variation. Enforcement actions suggest that a significant amount of uncertainty exists surrounding the accuracy of the estimates. Nevertheless, the trend is apparent and, from 1983 -1986, the coast-wide bycatch mortality is estimated to have been as low as 4,000 mt (7 million pounds) and averaged about 5,400 mt (9 million pounds), as opposed to the 11,000 mt (18 million pounds) taken by the domestic fleet in 1990.

During these years the foreign fisheries generally were able to harvest amounts and species composition of groundfish similar to that being taken by the domestic fleet today. It seems reasonable to use these levels as an initial goal for halibut bycatch mortality reduction. The timetable to achieve such a goal, an appraisal of its realism, and the methods by which it could be achieved require an understanding of how it may have been achieved by the foreign fleets. Foreign fishing was regulated by a series of time and area fishing restrictions, but it is our assessment that the key to their success was their ability to set quantitative bycatch limits for individual companies and vessels and remove the vessels from the fishery when limits were exceeded. This provided the incentive for individual operators to fish at times, areas, and in manners to minimize bycatches and maximize their groundfish catch.

Rate driven incentive programs are currently being developed for fisheries off Alaska. These may be effective in reducing bycatch, but their evolution into an individual vessel bycatch quota program may be the best approach. The rate program and the vessel quota program are being tested and developed. This will continue in 1992, but full implementation may not be feasible until 1993.

Recommended Actions

We endorse initiatives by the North Pacific Fishery Management Council to reduce halibut bycatch mortality. The HBWG notes the low recruitment to the halibut stock in recent years, the potential for bycatch to equal or exceed the directed fishery harvest in the near future with dramatic impacts on the viability of this fishery, and the uncertainties regarding the bycatch mortality compensation procedures currently utilized by the IPHC staff. The HBWG believes further action to immediately reduce bycatch mortality levels is warranted and recommends that the Commission support the following programs:

U.S. Fisheries

- (1) Bring all groundfish fisheries off Alaska under existing caps in 1992 and ensure that all fisheries adhere to specified bycatch controls.
- (2) Support development and expansion of incentive programs in 1992.

- (3) Promote a downwards ratcheting of caps starting in 1993 at 10 percent per year based on a rate or vessel quota incentive program. The goal would be to reduce mortality as far as possible over time consistent with the need to harvest the groundfish resources. The foreign fishery levels achieved in the mid-1980s shall provide an initial yardstick for monitoring success.
- (4) Measures to address the estimation and control of bycatch off the Washington-Oregon coast should be developed, but as of this time, no data exist on which to base bycatch management measures. We therefore recommend that the IPHC develop procedures for estimation of bycatch in this area, using the best available information, and incorporate these estimates into yield estimation.
- (5) Pending analysis of the 1990 observer data, incorporate revised mortality assumptions, rather than total bycatch amounts, for the BSAI trawl fisheries in the IPHC staff procedure used to develop annual setline catch quotas.

Canadian Fisheries

- (6) The HBWG recommends that the Canadian observer program be expanded to cover all bottom-trawl fisheries and that DFO undertake research to examine the viability of trawl caught halibut in Canadian waters. Further, that the results of the observer program, and relevant U.S. experience, be used to develop and implement a bycatch control and reduction program for Canadian waters.

General

- (7) Continue the HBWG and develop a schedule, with review and check points, to track progress of the issues and solutions. The progress would then be reported to the Commission during its "interim" and "annual" meetings.
- (8) Support the research recommendations of the HBWG.
- (9) Recognizing the uncertainties associated with present bycatch compensation procedures, the HBWG recommends that the IPHC continue its research into the adequacy of present procedures and develop alternative methodology where necessary.