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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2008

Established by a Convention between
Canada and the United States of America

This report produced by IPHC staff
and Jim Hale
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PREFACE

The International Pacific Halibut Commission (IPHC) was established in 1923 by a convention between Canada and the United States for the preservation of the halibut (*Hippoglossus stenolepis*) fishery of the north Pacific Ocean and the Bering Sea. The convention was the first international agreement providing for the joint management of a marine resource. The Commission's authority was expanded by several subsequent conventions, the most recent being signed in 1953 and amended by the Protocol of 1979.

Three IPHC Commissioners are appointed by the Governor General of Canada and three by the President of the United States. The commissioners appoint the Director, who supervises the scientific and administrative staff. The scientific staff collects and analyzes the statistical and biological data needed to manage the halibut fishery. The IPHC headquarters and laboratory are located on the campus of the University of Washington in Seattle, Washington.

The Commission meets annually to review all regulatory proposals, including those made by the scientific staff and industry; specifically the Conference Board and the Processor's Advisory Group. The measures recommended by the Commission are submitted to the two governments for approval. Upon approval the regulations are enforced by the appropriate agencies of both governments.

The IPHC publishes three serial publications: Annual Reports (U.S. ISSN 0074-7238), Scientific Reports—formerly known as Reports— (U.S. ISSN 0074-7246) and Technical Reports (U.S. ISSN 0579-3920). Until 1969, only the Report series was published; the numbers of that series have been continued with the Scientific Reports.

Unless otherwise indicated, all weights in this report are dressed weight (eviscerated, head-off). Round (live) weight may be calculated by dividing the dressed weight by 0.75.

On the cover

This year's cover artwork is courtesy of Jane Lee. Jane grew up in Vancouver, BC, where she currently resides. After graduating from art school, she found herself employed as a Fisheries Observer for several years until she discovered the more genteel climes of the International Pacific Halibut Commission.

Her two seasons spent working on St. Paul Island, Alaska, are reflected in this cut-paper illustration of the small day boats typical of the local halibut fleet.

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The Commissioners and Staff wish to thank all of the agencies, industry, and individuals who helped us in our scientific investigations this year. A special thanks goes to:

• The Bering Sea NMFS/RACE division in Seattle for saving us a spot on their survey;
• Jane DiCosimo (NPFMC), Jay Ginter (NMFS), Scott Meyer (ADF&G), Gary Logan (DFO), Michelle Culver (WDFW), and Phil Anderson (WDFW) for their welcome assistance in dealing with sport fish management issues;
• Dr. Robert Gerlach of ADEC;
• Kelly Ames (ODFW) for enhanced rockfish sampling development.
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• Steve Kupillas of ODFW for rockfish sampling;
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• Alaska Pacific Seafoods in Kodiak, EC Phillips and Sons in Ketchikan, JS McMillan in Prince Rupert, Icicle Seafoods, Harbor Cold Storage in Dutch Harbor, Trident Seafoods, Taku Smokers in Juneau, Ocean Beauty, Yakutat Seafoods, and Cove fisheries in Port Hardy for their assistance receiving and storing equipment and supplies needed to make the stock assessment survey a success.

Asking the right questions

Research and science: from the very start of the IPHC in 1923, these have been our tools—initially in the work of restoring the abundance of the seriously depleted Pacific halibut stocks of the early twentieth century. A main objective of this research was then, and is still today, to better understand the movement of halibut across its range. Our early investigations were driven by the conviction that, "all possible regulations must be conditioned by the movements of the fish, and if regulations are framed without regard to these movements, then a knowledge of the latter is needed to understand the results that will come" (IPHC Report #2, 1930).

As the stocks rebounded, research and science showed the way to maintaining a healthy stock and a sustainable fishery. But in order to understand the movements of halibut accurately, an important part of our investigations consists of first making sure we are asking the right questions—questioning the questions, as it were—to ensure that the answers we get accurately reflect the state of the stocks. And to this end, over the last few years the Commission has been reassessing its assumptions about fish movements when gauging the health of the halibut stocks across the species' range. For many years the Commission has assessed the stock in each regulatory area with the assumption that the stock of fish of catchable size in each area was closed to migration and relatively stable. Or—to put it another way—we assumed that the overall migration of fish between areas was negligible.

Commercial and sport vessels take a day off in Homer, AK. Photo by Tracee Geernaert.

The IPHC has been re-examining its assumptions about halibut movements.

A growing body of evidence from our annual stock assessments and from ongoing mark-recapture experiments suggested otherwise, and researchers

began to recognize a continuing eastward migration of catchable fish from Areas 3B and 4 in the western Gulf of Alaska into Area 2 in the eastern Gulf. This evidence of migration led the Commission to develop a viable replacement for the existing closed-area assessments. In 2006, in addition to the closed-area assessments, we conducted a coastwide stock assessment and in 2007 convened a public workshop to engage external peer-review scientists, halibut fishers, and the general public in discussion and evaluation of a coastwide assessment methodology.

Having accepted the coastwide assessment as the answer to the "right question" about the status of the halibut stock across its range, in 2008 the Commission also conducted outreach on methods to apportion the resulting coastwide biomass estimate into separate each regulatory area. Again we conducted a public workshop to get input from scientists, fishers, and others from the halibut industry and the general public—anyone interested in the status of the Pacific halibut stock.

Here, in the 2008 Annual Report, we once again report on the fruit of our efforts and all those involved with Pacific halibut: how the fishing went, how healthy the stock is, and what we've learned.

Beginning the 2008 halibut fishing year

The Annual Meeting includes input from the Conference Board, the Processor Advisory Group, and others.

Before the halibut boats head out to sea, before the first fishing lines hit the water, the IPHC begins each fishing year by holding its Annual Meeting. In 2008, the meeting was held at the Hilton Portland & Executive Tower in Portland, Oregon, from January 15 through 18. There, the Commission's chairperson for 2008, Dr. James W. Balsiger of Juneau, Alaska, convened the meeting to review the health of the Pacific halibut stock and set appropriate catch limits, to establish the opening and closing dates for the upcoming fishing year and adopt the year's fishing regulations. Reports and input from IPHC staff, the Conference Board (CB), Processor Advisory Group (PAG), and the public, were received.

Fishing: How much? And when?

For 2008, the Commission set an overall catch limit of 60,400,000 pounds, a 7.3 percent decrease from the 2007 catch limit of 65,170,000 pounds and the fifth year in a row that the Commission has deemed it necessary to lower the catch limit as a precautionary measure to ensure the well-being of the halibut stocks.

In its discussions on season length, the Commission received industry support for opening dates of March 1 or 15. The U.S. Conference Board recommended an opening of March 1; the Canadian Conference Board an opening of March 15; and the Processor Advisory Group recommended an opening of March 15. This was the third year that the CB did not present a united position with one recommended opening date, but all agreed that the fishery should open on a Saturday to facilitate marketing. The Commission therefore decided on a March 8th opening for individual quota fisheries in Alaska and British Columbia and for treaty Indian commercial fishing in Area 2A. The Area 2A non-treaty commercial fishing season was set as a series of 10-hour openings with fishing period limits.

Other issues before the Commission

To ensure its ability to monitor research, the Commission adopted a regulation to allow tagging of halibut by IPHC-authorized programs and state and federal agencies only. Individuals and organizations outside of state and federal agencies were required to obtain a permit from IPHC for any halibut tagging program.

The Commission also adopted a number of changes in the fishing regulations for 2008 that are described in the commercial and recreational fishing sections of this report.

On Day One of the Annual Meeting, the Commission hears industry and public comments on issues it will be considering. Photo by Robert Tobin.

Apportionment workshop and coastwide stock assessment

Over the last few years, the Commission has been reviewing a coastwide stock assessment model to assess more accurately the halibut biomass in light of our understanding of migration patterns among IPHC regulatory areas. The CB supported the coastwide assessment model but requested that the Commission conduct a workshop on apportionment methods.

At the 2008 Annual Meeting, the Commission endorsed the staff's recommended coastwide assessment approach to estimating exploitable biomass, which was a departure from the closed area assessments used previously. The staff also employed IPHC survey data and bottom area to apportion this coastwide biomass estimate into biomass estimates for individual Regulatory Areas and subsequently calculate recommended catch limits. The Commission chose to employ the survey apportionment for adopting 2008 catch limits for most Regulatory Areas but directed the staff to convene a workshop with harvesters and agency personnel to update understanding of fish movements based on tagging studies, further examine the survey-based apportionment, as well as examine alternate methods of biomass apportionment.

In an effort to examine all possible solutions to apportionment, the IPHC convened a workshop in September.

The workshop was held on September 4, 2008 in Bellevue WA, chaired by an independent scientist, and attended by approximately 110 people, including IPHC Commissioners, agency staff, processors, as well as commercial and recreational harvesters. The goals of the workshop were to explain the basis for current assessment framework and survey apportionment method, to explore merits and impacts of alternate apportionment schema, and to identify improvements to current apportionment approach.

The IPHC website contains detailed proceedings of the workshop.

Staff presentations included a review of PIT tagging results and implications, review of assessment approach and harvest policy, consideration of the necessary characteristics for candidate apportionment methods, explanation and evaluation of alternate apportionment methods, and presentation of a simulation tool for examining impacts of assumptions about harvest policy and fish movement. All workshop presentations and a summary of the workshop are available on the Commission's website: http://www.iphc.washington.edu

In addition, the workshop resulted in a number of significant comments and questions, for which the IPHC staff has compiled detailed responses. Those responses follow and are also presented on the IPHC website, and in the 2008 Report of Assessment and Research Activities.

Also, the Conference Board and the Processor Advisory Group asked the staff to host a workshop on bycatch programs and bycatch reduction strategies. The Commissioners directed the staff to assemble material reviewing bycatch reduction targets, reduction methodology, progress in other jurisdictions, and update the 1991 IPHC Bycatch Work Group results. This information will be made available and used in planning for a potential bycatch workshop in 2009.

DIRECTOR'S REPORT

Assessment and apportionment issues continued to dominate Commission activities during 2008. At the 2008 Annual Meeting, the Commission adopted the staff's recommended coastwide assessment for the halibut stock. The staff first presented this methodology in 2007 but the Commission wished to have more time to study and evaluate the method and accordingly retained the previous closed-area assessment for 2007. After conducting a public workshop in conjunction with an independent scientific peer review during 2007, the coastwide assessment was endorsed for the following year. The coastwide assessment is necessary to accommodate the revised understanding of halibut movement that resulted from the PIT tagging experiment. Results from the study indicated that halibut continue to migrate throughout their lives and the stock assessment must incorporate that knowledge.

Bruce Leaman converses with Curtis Cameron (*F/V Joann Marie*) while on a port tour in Homer, AK. Photo by Lara Erikson.

Having developed a scientifically sound assessment approach to estimating coastwide abundance, the Commission is still faced with apportioning that coastwide abundance into estimates for each Regulatory Area in order to calculate catch limits for the fishery. It is the method of achieving this apportionment that remains an area of active discussion and investigation.

Fishery management agencies worldwide use relative abundance data from fishery-independent surveys to apportion aggregate biomass into subarea biomass. The annual Commission setline survey is ideally suited to such a purpose because it is comprehensive, consistent, and highly standardized. However, Commission staff noted in the first presentation of survey-based apportionment that its use required an assumption of equal or nearly equal catchability across the entire stock range. In concept this means simply that the survey gear should obtain the same catch rate for a given density of halibut, no matter where the fishing occurs. This equal catchability assumption is the underpinning for all survey-based apportionment methods used around the world. Staff have examined the validity of this assumption

with all available data and concluded that, while the data are highly variable, there is no indication of bias associated with using survey data in this manner. Accordingly, the staff used survey-based apportionment in making catch limit recommendations for 2008. The Commission accepted these recommendations as the basis for developing its approved catch limits but also directed the staff to continue investigating both potential improvements to the survey-based method and alternate methods for biomass apportionment, in a workshop format.

The resulting Apportionment Workshop was well attended and the results are presented elsewhere in this Annual Report. Progress in investigation of improvements and alternatives was made at the workshop and the attendant online discussion forum. The Commission staff presented multiple approaches to apportionment in the 2008 stock assessment, while continuing to favour survey-based apportionment. Area 2, in particular, received strong attention because the coastwide assessment indicates that previous catch limits from closed-area assessments were set too high and the exploitation rate in this Area should be decreased. Apportionment methodology will continue to occupy staff's attention in the coming year and we are committed to a full investigation of all options.

The impacts of the revised understanding of halibut movements on harvest strategy and stock management will also be a continuing focus for staff research. Alternate technologies, such as archival tags and genetic analysis, will be employed to resolve outstanding questions about fish movements, particularly in the Bering Sea and western Aleutian Islands.

The ongoing difficulties in achieving harvest management for recreational fisheries concerned the Commission in 2008. The domestic management agencies have identified allocation targets for recreational fisheries in both countries but have been unable to constrain these fisheries to the targets. In addition, harvest groups in the U.S. have mounted legal challenges to prevent implementation of control measures designed to achieve compliance with allocation targets. Substantial overruns of the allocation targets for recreational fisheries occurred in both countries, with attendant overruns in the Commission's management targets for Regulatory Areas 2B and 2C. The success of the Commission's harvest strategy is based on reliance that the United States and Canada will achieve their stated allocation goals for both recreational and commercial fisheries. Commercial fisheries are managed effectively by both countries and efforts must be expended to bring recreational fisheries into similar compliance, if the Commission is to achieve its mandate under the Halibut Convention.

We see continued indications that recruitment from spawning in the late 1990s is strong. However, the recruits from these year classes are growing quite slowly; consequently their recruitment has been slower and at older ages than for past year classes. We expect the decline in coastwide biomass to moderate over the next several years as the stock returns to levels more similar to long-term average biomass.

Bruce M. Leaman
Executive Director

2008 Commercial fishery

All the water-world's alive when the fishing boats go out.

--Canadian poet, L. M. Montgomery

When Canadian poet Lucy Maud Montgomery published the lines above in 1916, the halibut fleet went down to the sea in ships much different from today's longline vessels. In the early days of the commercial halibut fishery, the fleet conducted its business on great sailing schooners that were as beautiful as they were efficient in harvesting halibut from nearby waters. Then, as the commercial fishery reached out into more distant waters of Alaska, the fleet began operating in larger steamers capable of greater excursions.

Although the physical look of the fleet has changed since then, the maritime scene that Montgomery paints for us in her poetry remains the same: the fishing boats setting out to sea with their holds full only with the hope for a successful catch and a triumphant return to port. And return to port triumphant they do: in 2008, commercial halibut fishers brought to the dock an overall total of 57,834,000 pounds of halibut, a decrease from the previous year's catch of 61,979,000 pounds but still near historically high levels. And the market for fresh halibut rewarded the fleet with ex-vessel prices at well over $4.00 (USD) per pound.

The 2008 commercial catch came in at just under 58 million pounds.

Chopping bait aboard the *F/V Clyde*. Photo by Ivan Loyola.

Regulatory areas for 2008

IPHC regulatory areas have remained unchanged since 1990.

The IPHC regulatory areas have remained unchanged since 1990. Since then, the southeastern flats in the Bering Sea, excluding Bristol Bay, have remained closed to all halibut fishing. The regulatory areas are illustrated in Figure 1 and are as follows:

Area 2A - all waters off the coast of the States of California, Oregon, and Washington.
Area 2B - all waters off the coast of British Columbia.
Area 2C - all waters off the coast of Alaska, south and east of Cape Spencer.
Area 3A - all waters between Cape Spencer and Cape Trinity, Kodiak Island.
Area 3B - all waters between Cape Trinity and a line extending southeast from Cape Lutke, Unimak Island.
Area 4A - all waters west of Area 3B and the Bering Sea closed area that are south of 56°20' N and east of 172°00' W.
Area 4B - all waters in the Gulf of Alaska and the Bering Sea west of Area 4A and south of 56°20' N.
Area 4C - all waters in the Bering Sea north of Area 4A and the closed area that are east of longitude 171°00' W, south of 58°00' N, and west of 168°00' W.
Area 4D - all waters in the Bering Sea north of Areas 4A and 4B, north and west of Area 4C, and west of 168°00' W.
Area 4E - all waters in the Bering Sea north and east of the closed area, east of Areas 4C and 4D, and south of 65°34' N.

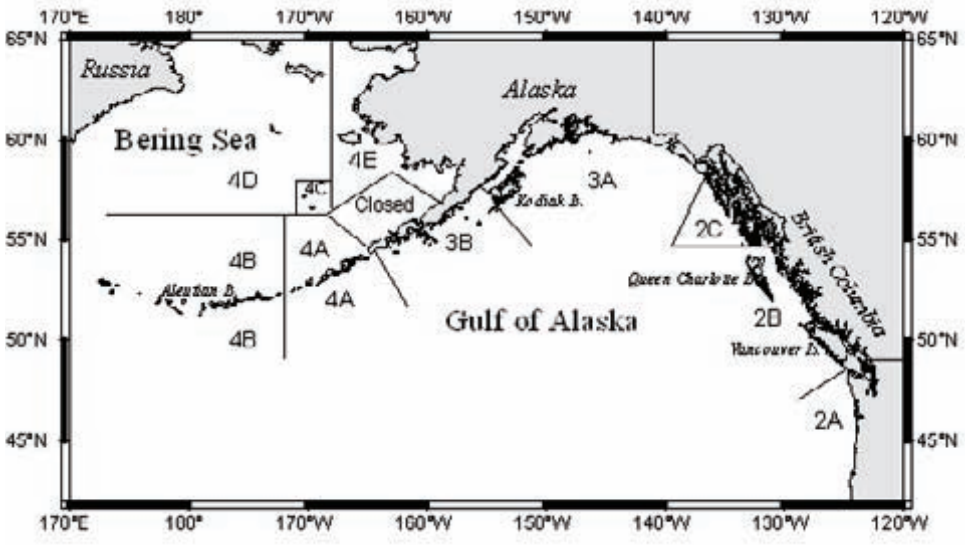


Figure 1. 2008 IPHC regulatory areas..

Changes to the regulations for 2008

The regulations for the 2008 fishery adopted at the Commission's 2008 Annual Meeting were approved by the Canadian and United States governments,

with one exception: as it has since 1999, the Canadian government allowed the landing of live halibut caught in British Columbia waters by choosing not to approve the regulation that required commercially-caught halibut to have their gills and entrails removed before being offloaded from a vessel.

Season dates

After reviewing proposals from the harvesting and processing sectors of the halibut industry, the Commission approved a season opening date of March 8, a Saturday opening to facilitate marketing, and a closing date of November 15, 2008, which applied to all Canadian Individual Vessel Quota (IVQ) fishing in Area 2B, IFQ and Community Development Quota (CDQ) fishing in waters off Alaska, and Area 2A treaty-Indian commercial fishing. Area 2A non-treaty directed commercial fishing was conducted in a series of 10-hour openings with fishing period limits.

The IPHC adopts catch limits for each area which are then further allocated by domestic governments through the Council system (U.S.) and DFO (Canada).

Catch limits

The Commission adopts biologically-based catch limits for all individual regulatory areas and for Areas 4CDE combined. As in other years, the individual catch limits adopted for 2008 in Regulatory Areas 4C, 4D, and 4E were determined by the catch sharing plan implemented by the North Pacific Fishery Management Council (NPFMC). This catch sharing plan and IPHC regulations allowed Area 4D CDQ to be harvested in Area 4E and Area 4C IFQ and CDQ to be harvested in Areas 4C or 4D.

In the U.S. Pacific Northwest, the PFMC allocates halibut catch limits among user groups in Area 2A through a catch sharing plan also. In 2008, no adjustment was made to the tribal allocation as had been done between 2000 and 2007 by U.S. Federal Court order. The allocation was by percentage to tribal (35 percent) and non-tribal (65 percent) fisheries.

The Area 2A licensing regulations have remained unchanged since 2000. All fishers must choose between a commercial or sport charter vessel license. Further, commercial fishers must choose between either a license for retaining halibut caught incidentally during the salmon troll fishery, or a license for fishing in the directed commercial halibut fishery (south of Point Chehalis, WA) and/or retaining halibut caught incidentally in the primary sablefish fishery (north of Point Chehalis). The 2008 deadline dates for mailing license applications remained the same as previous years: March 31 for the incidental halibut license for the salmon season, and April 30 for the license for the directed commercial fishery and halibut incidentally taken during the sablefish fishery. In both cases, if the deadline date fell on Saturday or Sunday, the first weekday of the next month became the deadline date.

In 2008, the Area 2A non-treaty directed commercial fishery had eight 10-hour fishing periods scheduled, beginning at 8:00 a.m. and closing at 6:00 p.m. local time: June 11, June 25, July 9, July 23, August 6, August 20, September 3, and September 17, 2008. Catches were monitored after each fishing period, and the fishery was closed when the catch limit was taken. The first fishing period had previously occurred during the last week of June; however, the Commission received a proposal from a Washington processor for a late May start date. The Commission adopted the June 11 starting date as the Oregon Department of Fish

In 2008, the IPHC approved a regulation allowing a VMS while fishing multiple regulatory areas in Area 4.

and Wildlife (ODFW) had not been able to obtain input from the industry in Oregon prior to the Annual Meeting.

Since 2004, IPHC has adopted a combined sport and commercial catch limit for Area 2B that has been allocated by DFO between commercial and sport fishers by an 88 to 12 ratio.

For weighing halibut catch, the IPHC regulations define net weight as the weight of halibut that are gutted, head-off, and without ice and slime. The Commission approved regulations requiring the use of conversion factors for halibut that are weighed with head-on and with ice and slime: a 10 percent reduction for halibut weighed with the head on and a 2 percent reduction for halibut weighed with ice and slime.

The Commission also approved adding the Washington Department of Fish and Wildlife (WDFW) voluntary sablefish logbook as an acceptable logbook, so that U.S. operators in the Area 2A commercial halibut fishery did not have to complete two logbooks.

Finally, the Commission approved a regulation that allowed fishing in multiple Regulatory Areas (4A, 4B, 4C, or 4D) with a Vessel Monitoring System (VMS) on board and if the vessel did not possess, at any time on board, more halibut than IFQ allowed for the area currently fished. This had previously been allowed only with the presence of a NMFS observer. In both cases, the halibut were required to be identifiable by regulatory area.

The fishing season by area

Area 2A

In 2008, the IPHC issued 570 Area 2A vessel licenses: 135 licenses for the incidental commercial catch of halibut during the salmon troll fishery; 296 licenses for the directed commercial fishery and the incidental halibut during sablefish fishery; and 139 licenses for the sport charter fishery (three fewer sport licenses than were issued in 2007). In the directed commercial/incidental-to-sablefish fishery, the number of licenses issued between 2007 and 2008 increased by 71; licenses for the incidental halibut during the salmon troll season decreased by 157. The large change in licenses issued for the commercial fisheries reflects the 2008 closure of the salmon troll fishery south of Cape Falcon in Oregon, which prompted salmon troll fishers to obtain licenses for the directed halibut fishery as an alternative.

Area 2A was managed to provide a total allowable catch of 1,220,000 pounds for all user groups. From that overall catch limit, the PFMC allocated 471,619 pounds to the sport fishery and 427,000 pounds to the treaty Indian fishery (30,000 pounds for ceremonial and subsistence use and 397,000 pounds for the commercial fishery). The PFMC's catch sharing plan for Area 2A fisheries stated that the primary limited entry longline sablefish fishery north of Point Chehalis, WA would be allocated part of the Washington sport allocation poundage only if the Area 2A total allocation was over 900,000 pounds. Because the Area 2A catch limit exceeded this threshold, an incidental halibut fishery was conducted with a catch limit of 70,000 pounds during this sablefish season. The remaining non-treaty commercial catch limit was 251,381 pounds, with 213,674 pounds allocated to the directed fishery and 37,707 pounds to the incidental catch in the salmon troll fishery. The directed commercial fishery was restricted

to waters south of Point Chehalis, WA (46°53’18”N), and the incidental halibut fishery during the sablefish season was restricted to waters north of Point Chehalis, under regulations promulgated by NOAA.

In the incidental commercial halibut fishery conducted during the salmon troll season, the allowable incidental catch ratio was one halibut per two Chinook salmon, plus an “extra” halibut per landing. However, the total number of incidental halibut per vessel per landing could not exceed 35. The 1:2 ratio of halibut to Chinook was new in 2008 and had been 1:3 from 2000 to 2007. These ratios have increased over the years, from the 1:20 ratio in 1995, the first year of the program. The incidental commercial halibut fishery during the salmon troll season opened on May 1 and closed on November 15 when the commercial halibut fishery closed for the year. The halibut catch was 62 percent (23,500 pounds) under the catch limit.

In 2008, the ratio of halibut to Chinook increased to 1:2, compared to 1:20 at the start of the program in 1995.

IPHC biologist, Darlene Haugan, samples the commercial halibut catch in Port Edwards, B.C. Photo by Lara Erikson.

The directed commercial fishery consisted of four 10-hour fishing periods with fishing period limits. The fishing period limits are assigned by vessel class, and for the first two openings, H-class vessels received 9,000 pounds per opening. The limits for the third fishing period also remained high, with H-class vessels receiving 8,000 pounds. The fourth and final fishing period had a significantly lower catch limit with H-class vessels receiving 1,200 pounds. The total directed commercial catch was three percent (6,800 pounds) under the catch limit.

The incidental halibut fishery during the limited-entry sablefish season opened May 1 and closed on October 31 with the closure of the sablefish season. Incidental landings of halibut in this fishery were restricted to 100 pounds (dressed weight) of halibut for every 1,000 pounds (dressed weight) of sablefish landed, and up to two “extra” halibut in excess of the 100 pounds per 1,000-pound ratio per landing. The catch was 47 percent (33,000 pounds) under

the 70,000 pound catch limit. The decrease in the incidental halibut catch was proportional to the decrease observed in sablefish catch during the 2008 season.

Since 2005, the Treaty Indian tribes have agreed upon a management plan that includes allocation levels to tribes or groups of tribes. In the tribal fishery, 75 percent of the commercial catch limit was allocated to the separately managed fishery and was taken between March 8 and June 3. The remaining catch limit (25 percent) was allocated to the restricted fishery, subject to daily limits of 500 pounds per vessel. The total tribal commercial catch was 5 percent (20,000 pounds) over the catch limit.

Area 2C Metlakatla fishery

The Metlakatla Indian Community is authorized by the United States government to conduct a commercial halibut fishery within the Annette Islands Reserve. In 2008, eleven 48-hour fishing periods took place between May 9 and October 5, producing a total catch of 41,010 pounds, which amount was included in the Area 2C commercial catch. The catch was 1,700 pounds more than last year's catch of 39,300 pounds. The total catch has varied over time from a high of 126,000 pounds in 1996 to a low of 12,000 pounds in 1998.

The quota share fisheries

Once again, the IPHC adopted a combined commercial/sport catch limit in B.C.

The Quota Share fisheries of British Columbia (Area 2B) and Alaska (Areas 2C, 3, and 4) were open from March 8 to November 15. The following sections discuss the fisheries by area and landing patterns.

Area 2B

The IPHC adopted a combined sport and commercial catch limit of 9,000,000 pounds for Area 2B that Fisheries and Oceans Canada (DFO) allocated to the different user groups. An additional 19,000 pounds was added to include the projected commercial wastage, resulting in a total catch limit of 9,019,000 pounds. The commercial fleet allocation of 88 percent of the total catch limit (7,936,720 pounds) was reduced by 19,000 pounds to account for wastage, resulting in an allocation of 7,917,720 pounds. In 2007, the underage/overage program resulted in a 337,674 pound surplus roll-over to the 2008 catch limit and an adjusted catch limit of 8,255,394 pounds. Each vessel was allocated a fixed poundage of halibut, or an IVQ, as calculated by DFO. The Area 2B catch of 7,683,000 pounds was within three percent of the catch limit. The sport fishery was allocated 12 percent of the total catch, resulting in a 1,082,000 pound allocation.

When the initial halibut IVQ program was implemented in 1991, four hundred and thirty-five vessels received IVQs. Each initial IVQ was split into two shares called blocks. Numerous changes have been made since then, including first allowing temporary block transfers (1993) and then permanent block and IVQ transfers (1999). Since 1999, the number of active vessels has decreased from a high of 257 (in 1999) to a low of 168 (in 2008). Closed to halibut fishing in 2008 were several small sub-areas in Area 2B, such as a group of 164 Rockfish Conservation Areas, to protect localized stocks of rockfish.

In 2006, DFO implemented a Groundfish Integrated Fisheries Management Plan to meet conservation needs, including addressing rockfish conservation concerns and improving catch monitoring. This plan was developed with

A quiet day in Prince Rupert, B.C. Photo by Tracee Geernaert.

consultation by the groundfish industry and other stakeholders through the Commercial Groundfish Integrated Advisory Committee. A pilot program was developed by a sub-committee of this advisory group and implemented in 2006. With the implementation of this three-year pilot program, significant changes were made to the longline groundfish fisheries, including the halibut fishery. The pilot fishery included individual quotas for all hook-and-line groundfish fisheries; transferability with limits between license holders; 100 percent at-sea and dockside monitoring; and vessel accountability for all catch, both landed and discarded.

A key component of the plan was the 100 percent monitoring through logbook recordings, video camera coverage, and dockside coverage. A newly designed logbook, which allowed the recording of all retained and discarded species, was used to compare to the video recordings. 2008 was the final year of the three-year pilot program. However, DFO has decided to continue with the plan for one more year, after which a complete review will be performed. IPHC will be reviewing how the plan has affected the halibut fleet dynamics and fishing patterns. Data are not yet available to report on any changes to fishing patterns.

Alaska

Beginning in 1995, the commercial halibut fisheries in Alaska have been managed under the IFQ Program for halibut and sablefish fisheries. NOAA's Restricted Access Management office allocated halibut QS to recipients by IPHC Regulatory Area. Quota share transfers were permitted with restrictions on the amount of QS a person could hold and the amount that could be fished per vessel. As of the end of the 2008 fishery, Restricted Access Management reported that 2,911 persons held quota shares, down from the initial 4,830 persons at the start of the program.

Alaska commercial and CDQ halibut catch amounted to about 49.5 million pounds in 2008.

The total 2008 catch from the IFQ/CDQ halibut fishery for the waters off Alaska was 49,476,000 pounds, one percent under the catch limit. For Area 2C, the commercial QS catch was within one percent of the catch limit. For Area 3A,

the commercial QS catch was less than one percent of the catch limit. For Area 3B, the commercial QS catch was within three percent of the catch limit. Area 4A's catch was within four percent and Area 4B's was within seven percent of the catch limit. The individual catch limits adopted for Regulatory Areas 4C, 4D, and 4E were determined by the NPFMC catch sharing plan. This catch sharing plan allowed Area 4D CDQ to be harvested in Area 4E and Area 4C IFQ and CDQ to be fished in Areas 4C or 4D. Because of this catch-sharing arrangement, the catch in Area 4D exceeded the catch limit, but the total commercial catch of 3,852,000 pounds in Area 4CDE was under the combined area's catch limit of 3,890,000 pounds.

Top halibut landing ports in Alaska:
Homer (18%)
Kodiak (17%)
Seward (11%)

Landing patterns and highlights

Once again, Homer dominated the halibut landings, receiving over 9,104,000 pounds of halibut, or about 18 percent of the commercial Alaskan catch (49,476,000 pounds). Kodiak and Seward received the second and third largest landing volumes, moving 17 percent and 11 percent of the Alaskan commercial catch, respectively. In southeast Alaska, Sitka received 2,839,000 pounds, Petersburg 2,130,000 pounds, and Juneau 1,945,000 pounds. Only 2.2 percent of the Alaskan QS catch was landed outside of Alaska.

Top halibut landing ports in BC:
Prince Rupert/ Port Edward (43%)
Port Hardy (40%)

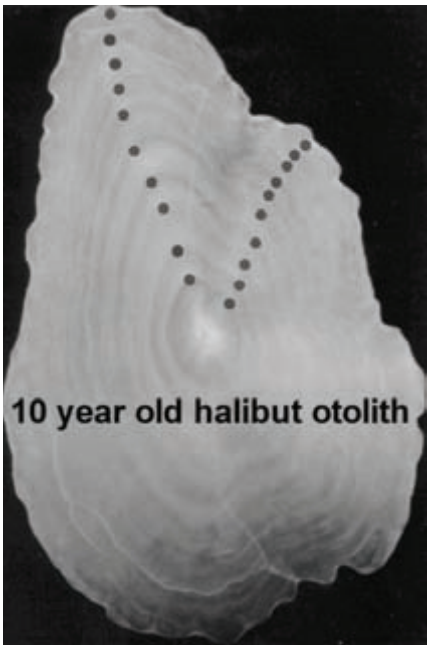
Commercial trips from Area 2B were delivered into 15 different ports in 2008. The ports of Prince Rupert/Port Edward, Port Hardy, and Vancouver were the major landing locations, receiving about 90 percent of the Area 2B commercial catch. Port Hardy and Prince Rupert/Port Edward received about 40 and 43 percent of the B.C. commercial landings, respectively.

In Alaska, May had been the busiest month for halibut landings for the previous seven years, but in 2008, August took the prize with landings amounting to 17 percent of the total catch. For landings delivered in British Columbia, April was the busiest month, with 14 percent of the Area 2B catch, also a big difference from the previous year when March was the busiest month, with 20.7 percent of the landings in B.C.

The landing of live halibut from Area 2B was legally allowed by DFO and resulted in a total landing weight of 17,769 pounds. Live fish landings have ranged from a low of 7,900 pounds in 1998 to a high of 103,000 pounds in 1999.

Electronic reporting in Alaska

Working in close collaboration, the Commission, the Alaska Department of Fish and Game (ADF&G), and NMFS have continued to refine the web-based Interagency Electronic Reporting System (IERS). In operation since May 2006, the system reduces duplicative halibut reporting resulting from the current requirements of completing both ADF&G fish tickets and NMFS quota share reports. The software application (known as *eLandings*) records data elements required by regulations, prints fish tickets, and connects with the NMFS quota share database. The appropriate data from IERS are sent to the respective agencies for their internal databases. Industry personnel and agency staff have provided feedback on the operation, and the application is continuously being modified, for example, to incorporate additional fisheries and tender landings.



Halibut otoliths are examined from the surface (above) and also sawed in half to detect rings not visible from this view. IPHC photo archive.

Age distribution of the commercial halibut catch for 2008

In 2008, port samplers collected 13,802 commercial (or *market*) sample otoliths. Fish from 5 to 50 years old were captured, with 12-year-olds making up the largest age group in the overall catch.

Average age for all areas combined was slightly higher than in 2007. The 1998 year class (10-year-olds) accounted for the largest proportion in numbers of the sampled commercial catch (11 percent) for all areas combined in 2008. The next most abundant year classes were 1996 and 1995, each accounting for slightly under 11 percent of the sampled catch for all areas combined. Ten-year-olds were the most abundant age class in Regulatory Areas 2B, 4A and 4C, and the second most abundant in Area 2A. In Areas 3B, 4B, and 4D, 12-year olds (1996 year class) made up the most abundant age class. Eleven-year-olds (1997 year class) made up the most abundant age class in Regulatory Area 2A, while 13-year-olds (1995 year class) were the most abundant age class in Areas 2C and 3A.

A five year old halibut measuring 111 cm (~44 in) was the youngest halibut sampled in the commercial catch this year.

The average size (measured fork length) of sampled halibut increased in Areas 2C, 4A, and 4B in 2008, but decreased in all other areas except for Area 2B, where average size remained the same between 2007 and 2008. Average fork length for all areas combined decreased by 1.0 cm in 2008.

Average age of fish sampled from Areas 2B, 2C, 3B, 4A, 4C, and 4D increased in 2008 relative to 2007, while average ages from Areas 2A, 3A and 4B decreased. The average age from all areas combined in 2008 was slightly higher than in 2007, and overall average age in 2008 was one year higher than it was in 1999.

The youngest and oldest halibut in the 2008 market samples were determined to be 5 and 50 years old, respectively. The 5-year-old was captured in Area 3B and measured 111 cm. The 50-year-old was captured in Area 4D, and had a fork length of 172 cm. The largest halibut in the 2008 commercial samples was a 203-cm fish from Area 4D, which was determined to be 32 years old.

Whale sightings and interactions

"Interactions"—that's a polite term for when impolite whales eat the fish off of someone else's plate, i.e., when they prey on fish already caught on a fishing line. We have known for many years that killer whales enjoy nibbling sablefish and Greenland turbot off of a longline, sometimes leaving a longliner with a

harvest composed partly of fishheads. But IPHC port samplers have been hearing more and more reports from the halibut fleet that whales—both killer whales and sperm whales—are stealing halibut from a vessel's fishing lines.

Seeking to better understand the extent of whale interactions with the halibut fleet, in 2003 the Commission staff began interviewing harvesters about any whale interactions that they felt had affected their catch. When the IPHC Research Advisory Board reviewed the information gathered from these interviews, it became evident that the information was highly subjective, and difficult to quantify. In 2007 and 2008, instead of being asked whether whales may have affected their catch, fishers in Alaska were simply asked to report for each set whether whales were sighted while hauling gear. If a whale was sighted, the species was recorded as either killer whale, sperm whale, or "other" whale species.

The IPHC is looking at ways to quantify how whales might be affecting CPUE.

Logbook data accounted for over 82 percent and 70 percent, respectively, of the 2007 and 2008 Alaska commercial catch. On more than 75 percent of these log sets, no whales were sighted while hauling gear. The results showed that, while hauling gear, fishers sighted whales most commonly in Areas 3A, 4A and 4D: sperm whales most often in Area 3A and killer whales in Areas 4A and 4D. In Area 3A, eight percent of sets had sperm whale reports in 2007 and 10 percent in 2008. Killer whale sightings (again, while fishers were hauling gear) were most common in Area 4A in 2007 (12 percent of sets) and in Areas 4A (10 percent of sets) and 4D (12 percent of sets) in 2008.

The project was again reviewed at the end of 2008 and it was determined that the logbook program was not the best method to examine whale interaction or depredation. In 2009, the Commission will examine if additional information could be collected on the stock assessment surveys to learn more about whale interactions with fishing gear.

Orca whales like this one are often seen foraging near fishing gear. Photo by Drew Barrett.

OFF TO THE FISHING GROUND

--Lucy Maud Montgomery (c. 1916)

THERE'S a piping wind from a sunrise shore
Blowing over a silver sea,
There's a joyous voice in the lapsing tide
That calls enticingly;
The mist of dawn has taken flight
To the dim horizon's bound,
And with wide sails set and eager hearts
We're off to the fishing ground.
Ho, comrades mine, how that brave wind sings
Like a great sea-harp afar!
We whistle its wild notes back to it
As we cross the harbor bar.
Behind us there are the homes we love
And hearts that are fond and true,
And before us beckons a strong young day
On leagues of glorious blue.

Comrades, a song as the fleet goes out,
A song of the orient sea!
We are the heirs of its tingling strife,
Its courage and liberty.
Sing as the white sails cream and fill,
And the foam in our wake is long,
Sing till the headlands black and grim
Echo us back our song!

Oh, 'tis a glad and heartsome thing
To wake ere the night be done
And steer the course that our fathers steered
In the path of the rising sun.
The wind and welkin and wave are ours
Wherever our bourne is found,
And we envy no landsman his dream and sleep
When we're off to the fishing ground.

The sea has always been the stuff of poetry. From the "wine dark sea" of the ancient Greek seafaring epic, *The Odyssey*, to the "whale road" of the Old English epic *Beowulf*, and up to the great modern novels of the sea, such as Melville's *Moby Dick* or Peter Mattheissen's *Far Tortuga*, writers have always seen in the mysteries of the deep--and in the lives of the men and women who go to sea-- a metaphor for life itself and its struggles and its glories.

These poetic, often romantic expressions of life at sea are not meant to mask the realities of hard and sometimes dangerous work, the realities of ice and slime, or the realities of science and economics, of regulation and management, that characterize the modern fisher's vocation. Rather, the poetry reminds us of the nobility that still characterizes the seafarer's labors, standing face to face with the natural world of the sea.

Here, briefly, in the verses scattered throughout our report and in the midst of our work of conservation, we at the Commission take a moment to acknowledge the human spirit of those men and women whose work lies at the heart of our endeavors, the fishers who—in the words of the poet of the Psalm—"go down to the sea in ships and do business on the great waters."

THE RECREATIONAL FISHERY

Swiftly the boats come homeward, over the grim bar crowding,
Like birds that flee to their shelter in hurry and affright,
Only the wild grey gulls that love the cloud and the clamor
Will dare to tempt the ways of the ravining sea to-night.
--L. M. Montgomery

The sport fishery continued to flourish in 2008, with projected harvest estimates of 0.48 million pounds taken in Area 2A, 1.54 million pounds in 2B, and 8.77 million pounds in Alaska. While the Canadian and U.S. governments have continued working to more effectively manage harvests by their respective sport charter fisheries, the Commission remains concerned about excessive charter harvests. The overarching goal of the IPHC is to conserve the halibut resource for sustainable use by all user groups, and the Commission leaves the job of allocating catch limits among user groups to their respective governments. Nevertheless, the Commission is concerned that excessive sport charter harvests over the last few years and the lack of regulations to effectively restrain those harvests may compromise the Commission's conservation goals for Pacific halibut.

A preliminary estimate of sport harvest for 2008 is just under 10.8 million pounds.

A 106-pounder caught by Mathew Blume, Newport, OR. Photo by Jered Mangini.

Regulations

Allocative regulations for sport, commercial, and treaty Indian fisheries in Area 2A, specified by the PFMC as a Catch Sharing Plan (Plan), were adopted by the IPHC at the 2008 IPHC Annual Meeting and were similar to the 2007 regulations. The sport fishery was divided into several subareas, which were each managed by seasons and catch limits. Sport charter vessels were required by the Plan to obtain a license from the IPHC to possess halibut during open seasons. Vessels were also required as part of the license to declare whether they intended to operate as a sport charter or commercial vessel; licenses could be held for only one category. Minor modifications to the Plan were implemented to facilitate management strategies. Specific area-closures were also in effect to protect certain species of rockfish (Sebastes spp.) on sport halibut fishing grounds.

For Alaska, the Commission adopted a sport regulation that no person shall possess on board a fishing vessel, including charter vessels and pleasure craft, halibut that has been filleted, mutilated, or otherwise disfigured in any manner, except that each halibut may be cut into no more than two ventral and two dorsal pieces and two cheeks, all with skin on. This change was adopted to allow enforcement officers to count the number of fish possessed by an angler. Additionally, in Area 2C the National Marine Fisheries Service (NMFS) regulation that requires charter vessels to retain halibut carcasses remained in effect unless superseded by new NMFS regulations.

Sport fishing regulations for 2008 in British Columbia (Area 2B) were markedly different than in previous years: the season opening was delayed by one month and the daily bag and possession limits were reduced from two fish to one, until June 1, when it was returned to two fish. The sport share of the combined sport and commercial catch limit is set at 12 percent by DFO allocation agreement.

Final estimations of the 2007 Southeast (2C) and central Alaska (3A) sport halibut harvests indicate that the charter sector exceeded the Guideline Harvest Level (GHL) in those areas by 34 percent and 10 percent, respectively. While an initial recommendation of a 1-fish bag limit for Area 2C for 2007 was proposed by the IPHC and subsequently rejected by the United States Department of Commerce, NOAA/NMFS, and the ADF&G worked to develop a set of management measures that would reduce the catch without seriously disrupting the charter industry. As a result, the final rule limited the harvest of halibut by sport anglers fishing from charter vessels in Area 2C to a daily limit of two halibut, except one halibut could not be larger than 32 inches (81.3 cm) as measured from the head to the middle of the caudal fin. ADF&G also instituted an emergency order that restricted charter skippers and crew from retaining any fish while paying clients were on board. These regulations became effective June 1, 2007, but in retrospect failed to achieve the desired result. For 2008, a 1-fish bag limit proposed by NMFS was successfully blocked early in the season by legal challenge from a group of sport charter operators and the 2007 regulations were reinstituted for the remainder of 2008. For 2009, NMFS has stated their intent to implement a 1-fish bag limit for Area 2C.

U.S. domestic entities are working on a variety of plans to better manage the sport fishery in Alaska.

In other actions, a catch sharing plan similar to the one governing Area 2A was adopted by the NPFMC for Areas 2C and 3A. This plan would define predetermined percentages of a combined fishery catch limit for the sport charter and commercial fisheries. One key piece of the plan would allow the sport charter fishery to proceed without in-season changes to regulations, thereby allowing the fishery to continue uninterrupted. Another feature is a provision for sport charter operators to lease commercial fishery IFQs, which could be harvested as sport fish. After more than 15 years of meetings and debate, this plan is not expected to be fully implemented until 2011 at the earliest. Prior to implementation, a moratorium for the charter fleet fishing halibut is expected to be in place in 2010.

Harvest estimations

Source of estimates

The 2008 Area 2A harvest estimates for the various subareas were provided by ODFW and WDFW from in-season creel census estimates. The exception to estimation via creel census was the Washington Inside Waters (WIW) area, which was assessed by a post-season phone survey. The 2008 Area 2B harvest estimate was provided by the Canadian Department of Fisheries and Oceans. ADF&G typically provides final harvest estimates for the previous year for Areas 2C, 3, and 4. Current-year projections are made annually by ADF&G staff.

In-season adjustments and dockside monitoring by state agencies kept the Area 2A harvest on target.

Area 2A harvest

The 2008 harvest from Area 2A was estimated to be 480,880 pounds. This was about two percent over the catch limit of 471,619 pounds. This is the sixth year the WIW area has been partitioned into sub-regions, a change that was popular with most anglers. The Washington North Coast fishery left an estimated 3,139 pounds on the grounds relative to the 109,991 pound quota. Management was accomplished by intensive dock-side monitoring by WDFW and an adjustment in the season structure that included alternate-day fishing early in the season and depth-restricted openings. The North Coast average weight ranged from 22 to 29 pounds. The 2008 fishery included three days of nearshore fishing and 10 days of all-depth fishing. The Washington South Coast fishery, centered principally out of Westport, closed roughly 4,300 pounds under the quota. The average weight of South Coast halibut was around 17 pounds, much lower than in previous years. The season and allocation between nearshore and all-depth fishing in Washington South Coast waters will be altered in 2009 to avoid leaving so many halibut unharvested. Some charter operators have expressed an opinion that interest in halibut falls off rapidly after the first openings. The Columbia River area closed at 863 pounds under its quota, as this was not enough remaining poundage to allow another full day of fishing. Pacific halibut in the Columbia River area generally weighed between 10 and 26 pounds, although larger halibut were caught in August on the Washington side. The majority of the fish were between 12 and 15 pounds.

The sport fishery in the central Oregon coast area closed 6,000 pounds under its catch limit in 2008. The underage occurred in the nearshore fishery. Ample opportunity was provided to anglers into September, weather permitting. The spring fishery stretched well into July, when anglers seemed to turn their attention to the reduced salmon (*Onchorynchus* spp.) opportunities and albacore (*Thunnus alalunga*). Albacore, in particular, has enthralled Oregon anglers in recent years. Oregon anglers were given a brief increase to a two-fish bag limit in September, which seemed to attract more attention to the halibut fishery The overall average weight for the Oregon sport halibut fishery varied between 14 and 18 pounds in 2008, similar to previous years. As in Washington, a substantial portion (33 percent) of the available harvest was measured to determine the average weight.

Area 2B

The catch in numbers of halibut for 2007 was provided by the Pacific Region branch of DFO. Average weight information is now provided by DFO rather than through the IPHC's past practice of using average weights from

adjacent Alaska and Washington sport fishery areas as proxies. The final catch estimate for 2007 was 1.556 million pounds and exceeded the sport allocation by about 175,000 pounds. Responding to this overage, DFO delayed the opening of the 2008 sport season by one month (opening March 1 rather than February 1), lowered the bag limit to one halibut prior to June 1, and imposed closed areas off the southern Vancouver Island coast. Despite these actions, the 2008 harvest from Canadian waters was 1.536 million pounds; nearly 0.500 million pounds above the sport fishery's catch limit. Purchases of commercial Individual Vessel Quota (IVQ) shares for halibut have reduced a portion of this overage, relative to the combined commercial-sport catch limit.

In 2007, WDFW reported that Washington anglers caught 9,977 halibut in Canadian waters and landed them in Neah Bay, almost 25 percent lower than the 13,045 halibut landed in 2006. That decline continued in 2008 as area-closures by DFO were partially responsible for the catch dropping considerably, to only 4,778 halibut. Some US anglers reported fishing in Canadian waters off Neah Bay to be slower than in previous years.

Alaska catch estimates will be updated when final results are in from the Statewide Harvest Survey.

Area 2C

Final catch estimates for 2007 and preliminary catch estimates for 2008 were received from ADF&G this year for all Alaskan areas. The final 2007 Area 2C harvest was estimated to be 3.049 million pounds and the 2008 harvest was projected to be 3.083 million pounds. The 2008 estimated charter harvest of 1.914 Mlb is considerably over the GHL of 0.931 Mlb, continuing the trend of overages for the past five years. The numbers of fish harvested were identified by ADF&G Statewide Harvest Survey (SWHS) area and were converted to weight using the average weight from each respective user group. Length data were gathered in Ketchikan, Klawock, Craig, Petersburg, Wrangell, Sitka, Gustavus, Elfin Cove, and Juneau, as in past years. In 2002, a catch sampling program was initiated in Gustavus and Elfin Cove so the Gustavus/Elfin Cove average weight is now applied to Glacier Bay. Neither Haines nor Skagway have been sampled for length information, so their harvests have historically been projected using Juneau average weights as a surrogate. The overall average weight for Area 2C in 2007 was 17.1 pounds net weight and preliminary indications showed the average net weight to have been 19.5 pounds in 2008.

Area 3A

The Area 3A projected harvest for 2008 was 5.629 million pounds, whereas the final 2007 estimate was 6.283 million pounds. As in Area 2C, the 2008 catch estimate for Area 3A will be updated when the 2008 SWHS catch in numbers become available. The Area 3A harvest biomass was also estimated for each user group using estimates of the numbers of fish caught by each group as supplied by the SWHS, and expanded using average weight estimated from length data collected from the primary ports of sport landings. The sampled ports for 2008 included Yakutat, Whittier, Valdez, Seward, Homer, Deep Creek and Anchor Point beaches, and Kodiak. The estimate of the charter average weight in Homer was stratified by user group to account for differences in sizes of halibut cleaned at sea and cleaned onshore. The average weight for 2007 was 15.6 pounds and continued a declining trend. Preliminary indications suggest the average net weight in 2008 is about the same, at 15.7 pounds.

Anecdotal reports indicate that the average sport-caught halibut may be bigger in Dutch Harbor/ Unalaska than in other ports to the east.

Areas 3B and 4

Final estimates for 2007 of the number of fish caught were provided by ADF&G. Harvest estimates in pounds were then generated using the average weights from the Kodiak fishery, as no size data are collected by ADF&G in Area 3B or 4 ports. The final 2007 estimates were 24,579 pounds and 43,533 pounds for Areas 3B and 4, respectively. For 2008, SWHS numbers are not yet available, so a projection of the catch in numbers of fish was made by ADF&G. The 2008 average weight in Kodiak was about the same as in 2007, at 17.3 pounds, though anecdotal information gleaned from sport fish publications and conversations with local charter operators suggest that the average weight may have been quite high in Dutch Harbor and Unalaska compared to Kodiak. In any case, the projected harvests for 2008 are 17,975 pounds for Area 3B, and 42,835 pounds for Area 4. Final estimates will be based on the numbers of fish reported through the SWHS.

WASTAGE IN THE 2008 PACIFIC HALIBUT FISHERY

In the Commission's stock assessment, along with removals of Pacific halibut from directed harvests and bycatch, we also account for wastage in the commercial fishery. Wastage includes an estimated proportion of the halibut smaller than the commercial minimum size (81.3 cm) that are returned to the sea and die, and legal-sized halibut that die from lost or abandoned gear. Prior to 1997, wastage from the mortality of legal- and sublegal-sized halibut was deducted prior to calculating the fishery constant exploitation yield. Since 1997, only commercial fishery wastage from legal-sized halibut is deducted. The Commission accounts for estimated mortality of discarded sublegal-sized halibut when setting exploitation rates.

Wastage can also occur if more gear is set than is needed to obtain fishing period limits in Area 2A, IVQ in Area 2B, and IFQ and CDQ in waters off Alaska. Wastage occurs when the halibut above these limits are discarded and die. In addition, halibut may occasionally be discarded at sea due to poor fish quality, which can result from injuries from sand fleas, sharks, or other predators. The amount of legal-sized halibut caught in excess of quota or catch limits and discarded at sea is also recorded during logbook interviews, but this mortality is not currently included in the estimates of wastage removals.

IPHC biologist, Joan Forsberg, displays a halibut that's been eaten by sand fleas. IPHC photo archive.

Wastage from lost or abandoned gear

Estimating the amount of gear lost or abandoned is accomplished by looking at logbook and skipper interview information.

Information on the amount of gear lost or abandoned in the halibut longline fishery is collected through logbook interviews or from fishing logs received via mail. Fishery-wide estimates are then extrapolated to total catch values using qualified logbook catch and effort statistics. Gear types vary considerably as to the length of skates, hook size, and hook spacing but the gear data are standardized for use in subsequent calculations.

Some log data could not be standardized because of missing data or because the

gear was fished differently than typical halibut gear, and these data are not used in the calculation of effective skates. Non-standard gear that fishes differently is found in the directed halibut IFQ fishery in Alaska and with the incidental halibut catch during the sablefish longline fishery in Area 2A, where mixed halibut and sablefish trips as well as trips that target sablefish and land incidentally-caught halibut (sablefish gear is considered a non-standard halibut gear that fishes differently); these are therefore not included in the calculation of wastage.

Wastage was calculated from the ratio of effective skates lost to effective skates hauled, multiplied by total catch, using both fixed-hook and snap gear in all areas. Prior to 1998, we calculated wastage by the gear type used to calculate catch per unit effort (fixed hook gear was used in Alaska and a combination of fixed hook and snap gear was used in B.C. and Area 2A). The Area 2A catch has always included the non-treaty directed commercial catch, treaty commercial catch, and incidental catch during the longline sablefish fishery.

The 2008 ratios of effective skates lost to effective skates hauled by regulatory area were as follows: Area 2A =0.0004; Area 2B = 0.0028; Area 2C = 0.0019; Area 3A = 0.0025; Area 3B = 0.0004; and within Regulatory Area 4 ranged from 0.002-0.006. Since the implementation of the quota share fisheries in 1995, the ratios have fluctuated slightly between years, but have remained lower than they were during the derby fisheries.

Discard mortality of sublegal-sized halibut

In 2007, sublegal-sized halibut mortality was re-estimated for all years back to 1974 using data from IPHC standard stock assessment survey (SSA) stations from catch per skate in the top third in each area, the idea being that the stations with higher catch rates would better represent commercial catches. The SSA survey ratio of sublegal- to legal-sized halibut is needed to estimate sublegal-sized halibut catch by the commercial fleet. For 2008, the average of last three year's SSA survey ratios was used. This is less variable than a ratio based on only the current year's data.

A 16 percent mortality rate has been used to calculate wastage for several years.

A mortality rate of 16 percent is applied to all discards in years since the beginning of individual quota fisheries (1991 in Canada, 1995 in Alaska). For the earlier years of derby fishing, and for all years in Area 2A, we apply a 25 percent mortality rate. The Area 2A commercial catch numbers used include the catch from the directed commercial fishery and the incidental halibut fishery during the sablefish season, but does not include catch from either the tribal fishery (as sublegal halibut are accounted for as part of the ceremonial and subsistence fishery), or from the incidental halibut during the salmon season (as it is an incidental troll fishery).

To estimate the pounds of sublegal-sized halibut captured in the commercial halibut fishery, the area-specific sublegal- to legal ratio was multiplied by the estimated commercial catch in each regulatory area, for each year. The resulting poundage was then multiplied by the discard mortality rate to obtain the estimated poundage of sublegal-sized halibut killed in the commercial fishery.

PERSONAL USE

When the bay is like to a lucent cup
With glamor and glory and glow filled up,
In the track of the sunset, across the foam,
The fisherman's boat comes sailing home.
--L. M. Montgomery

Also among the removals of Pacific halibut accounted for in the Commission's annual stock assessment are halibut taken for personal use, which does not include fish caught by sport fishers. Halibut may be taken for personal use from a variety of sources, several of which are supported by very little documented data. Personal use harvests are taken in the federal subsistence fishery in Alaska, in the sanctioned First Nations Food, Social and Ceremonial (FSC) fishery conducted in British Columbia, in ceremonial and subsistence removals in the Area 2A treaty Indian fishery, and lastly, with the sublegal-sized halibut retained in the Areas 4D and 4E commercial fishery under IPHC regulations. Estimates of these removals are summarized for 2007, the most recent year for which full information is available, in this report, as well as the data available for 2008.

Estimated harvests by area

The coastwide personal use harvest was estimated by IPHC at more than two million pounds in 1991, declined rapidly through 1995, and became relatively stable over the following two years. Harvest estimation methods

Personal use estimates have varied substantially over the years due in large part to the process of refining the estimation procedure, and not because of actual fluctuations in catch.

Fishing boats tied up to the dock in St. Paul, AK. Photo by Tom Kong.

were revised in 1998, and the resulting estimates were subsequently somewhat higher and remained fairly stable through 2002. Harvests took another jump in 2003 following the implementation of new subsistence fishery regulations in Alaska and a more comprehensive harvest estimation survey. It is important to note that many of the changes seen in the harvest estimates prior to 2003 were due primarily to changes in estimation methods and may not necessarily have reflected actual changes in harvest levels. The majority of the personal use harvest was taken from waters off Alaska.

Alaska

IPHC began estimating the personal use harvest in Alaska in 1991. Documentation of estimation methods cannot be located but the available estimates indicated that personal use in Alaska totaled 1.95 million pounds that year. The estimate for 1992 dropped in half, to one million pounds. Estimates were subsequently made for each IPHC area independently, but not necessarily annually for all areas.

A methodology developed to estimate personal use employs the halibut catch information gathered by household interviews and postal surveys conducted by the ADF&G. The surveys did not distinguish between sport and personal use harvests, so this method makes assumptions about the amount of sport and personal use in native and non-native households. The resulting estimates were used for Alaska for 1998-2002, with the annual changes being driven by the amount of poundage of fish less than 32 inches in size retained by the Area 4E CDQ fishers.

In addition to the specifically identified tribal and community subsistence catches, in 2003 the NPFMC recognized the subsistence fishery for halibut in Alaska and created a regulatory structure for it.

In 2003, the subsistence fishery for halibut off Alaska was recognized by the NPFMC, and a separate set of fishery regulations was created, which vary according to IPHC regulatory area. One provision of the subsistence fishery management program was the establishment of an annual survey of fishers to determine the annual harvest. The voluntary survey of the 2007 fishery, the fifth since the surveys began in 2003, was conducted under contract by NMFS to the Subsistence Division of ADF&G. The estimates from the 2007 survey totaled 1,032,000 pounds (net weight) in Areas 2C through 4E. This represents an 8.5 percent decrease from 2006.

The ADF&G survey indicated that roughly 51 percent of the total subsistence harvest in Alaska occurred in Area 2C, with 36 percent harvested in Area 3A. The five subareas of Area 4 totaled 87,200 pounds, or 8.4 percent of the subsistence harvest off Alaska. The communities within Area 4E accounted for 60 percent of the subsistence harvest within Area 4, which is a pattern similar to previous years.

IPHC also adds the amount of sublegal-sized halibut retained by the Area 4D/4E CDQ fishery. The CDQ organizations are required to report to IPHC the amounts retained. The ADF&G subsistence survey included all registered fishers and households in all Areas, but Area 4D and 4E fishers were instructed to exclude any retained sublegal halibut caught during commercial fishing. Also, fishers who retained sublegals as part of their Area 4D/4E commercial harvest were not required to register for the subsistence fishery and therefore should not have participated in the survey. Therefore, the sublegal harvests were added to the subsistence harvest estimates to fully account for the total 2007 personal use harvest.

British Columbia

The primary source of personal use harvest in British Columbia was the First Nations Food, Social and Ceremonial (FSC) fishery. In past years, IPHC received some logbook and landing data for this harvest from DFO but those data have not been adequate for IPHC to make an independent estimate of the fishery harvest. Thus, IPHC relies on DFO for an estimate. Through 2006, DFO estimated this harvest to be 300,000 pounds annually. Since 2007, this harvest has been estimated at 405,000 pounds. In the commercial fishery, take-home fish was considered personal use harvest prior to the implementation of the IVQ program. Currently, in the IVQ program all halibut landed by a vessel is weighed by the port monitors at the time of the offload and any take-home fish is taken from this quantity; thus, personal use is included as part of the vessel's catch.

The portion of the personal use catch that is taken during a commercial fishery operation is technically part of the commercial IQ and is not reported as a subsistence removal.

Counting up the subsistence catch in Ketchikan, AK. IPHC photo archive.

Washington, Oregon, and California

In Area 2A, the PFMC allocates the catch limit to directed and incidental commercial fisheries, sport fisheries, and treaty Indian fisheries operating off northwest Washington. The Treaty tribes further subdivide a portion of their allocation to their own ceremonial and subsistence fishery. For 2007 and 2008, the treaty tribes allocated 33,000 and 30,000 pounds, respectively, to their ceremonial and subsistence fishery.

State regulations require that personal use fish from the commercial hook and line halibut fisheries be recorded on the fish tickets. This reporting requirement causes the personal use catch to be included in the commercial catch, which is consistent with the procedure used in the quota share fisheries in other areas, and therefore are not reported here.

Retention of sublegal-sized halibut in the 2008 Area 4D/4E CDQ fishery

In 1998, the Commission approved a two-year exemption to the regulation preventing retention of sublegal halibut in Area 4E. A reporting requirement was

added for the 1999 fishery. Another two-year exemption was approved at the 2000 Annual Meeting, covering the 2000 and 2001 fishing seasons. At the 2002 Annual Meeting, the IPHC agreed to extend the allowance to CDQ operations in Area 4D, and to amend the regulation to apply only to vessels that land all of their catch in Areas 4D or 4E. The IPHC staff agreed to review the regulation at the end of 2002 to see if the exemption was still necessary under the subsistence fishery regulations being drafted at the time by the NPFMC and NMFS.

The harvests reported herein have not been included in the household survey conducted by the ADF&G for the subsistence harvest within Alaska. Survey participants are instructed to exclude any sublegal halibut retained during commercial fishing. Thus, a complete accounting of subsistence harvests should include the figures reported in this document.

CDQ fishers in Areas 4D and 4E retained an estimated 21,666 pounds of sublegal-sized halibut in 2008.

For 2007, the Commission made a minor change in the CDQ groups' reporting requirements. In previous years, the organizations were required to report their retained amounts to IPHC by November 15. This date was originally established as it coincided with the closure of the IFQ fishery, and was believed to provide sufficient time for data compilation and subsequent submission by the affected organizations. In later years it became apparent that local fishers in Areas 4D and 4E were concluding their fishing well before November. At the same time, IPHC staff found that the original reporting date did not provide sufficient time to receive and compile the reports for Commission review and consideration. At the 2007 Annual Meeting, a proposal to move the reporting date to November 1 was approved and went into effect that year.

Results for 2008

Reports for 2008 were received from three organizations: Coastal Villages Regional Fund (CVRF), Bristol Bay Economic Development Corp. (BBEDC), and Norton Sound Economic Development Corp. (NSEDC). Overall sublegal landings in 2008 totaled 21,666 pounds, up 13.7 percent from 2007. Both CVRF and NSEDC reported higher amounts retained in 2008, though CVRF was up only slightly. In contrast, BBEDC dropped significantly. Generally, these changes are a reflection of the amount of effort by the local small boat fleets and the availability of fish in their nearshore fisheries. Additional details are provided in the following sections.

Coastal Villages Regional Fund

The report from CVRF was received on August 21, 2008. Crews at Coastal Villages Seafoods facilities at seven ports separated undersized halibut during offloads and then weighed them separately from the legal-sized halibut. Once this was completed, the plant's record keeper recorded on a tally sheet the name of the fisher, the number of halibut caught, and the poundage of the sublegal halibut. Each plant sent the tally sheets to the Coastal Villages Seafoods headquarters on a weekly basis, where the information was entered onto a spreadsheet. CVRF has followed this same procedure for several years.

In 2008, plants in Chefornak, Hooper Bay, Kipnuk, Mekoryuk, Toksook Bay, Tununak, and Quinhagak recorded sublegal halibut caught between June 9 and August 10. CVRF reported that 14,362 pounds (head-on, washed) were landed. Deducting 10 percent for the head resulted in a net weight of 12,926

pounds, a 13 percent increase from 2007. A total of 1,740 halibut was recorded, for an average weight of 7.4 pounds net. Chefornak tallied the largest share of the retained sublegals at 48 percent of the total, followed by Toksook Bay (20 percent).

Bristol Bay Economic Development Corp.

BBEDC's report was received on October 27, 2008. BBEDC fishers filled out a reporting log listing the lengths of retained sublegal halibut. Lengths were tabulated by BBEDC at the conclusion of the season, converted to weights using the IPHC length/weight table, and summed to estimate the total catch. As in previous years, halibut were landed by BBEDC vessels at two primary ports (Togiak and Dillingham), with minor amounts of fish also being delivered at Naknek and Egegik.

BBEDC reported that fishers landed 232 sublegal-sized halibut for a total of 1,816 pounds, down significantly from 2007. The fish had an average size of 7.8 pounds net; 75 percent of the halibut were 28-31 inches in length.

The CDQ members submit catch reports to the IPHC by November 1 of each year.

Norton Sound Economic Development Corp.

NSEDC's report was received on October 29, 2008. NSEDC required their vessels to offload all halibut, legal and sublegal. The sublegal halibut were weighed and then returned to the fishers. Sublegals were retained from landings made during July 27 through September 28. NSEDC reported 721 sublegal halibut weighing 7,850 pounds in "head-on with slime" weight, or 6,924 pounds net weight (head-off, no ice/slime). The fish had an average weight of 9.6 pounds net. All fish were caught in the local CDQ fishery, and delivered to the Nome plant. The amount retained in 2008 was an increase of 53 percent from 2007 and represented the largest amount retained by NSEDC fishers since they entered the program in 2002.

Incidental catch of Pacific halibut

The estimated 10.7 million pounds of halibut bycatch in 2008 is substantial, but the lowest seen since 1986.

Fisheries targeting other fish and shellfish inadvertently catch Pacific halibut, and the information we have from at-sea observers indicates that this incidental catch, or bycatch, is substantial. Regulations require that halibut be returned to the sea with no additional injury. However, some fish do die from being caught and handled. The preliminary estimate of bycatch mortality in 2008 is 10.7 million pounds. The good news is that this is a decrease from 2007 and the lowest seen since 1986.

Sources of bycatch information and estimates

The Commission relies on information from observer programs for bycatch estimates in most fisheries. In the few cases where fishery observations are not available, we use research survey information to generate estimates of bycatch. NMFS operates observer programs covering the groundfish fisheries off Alaska and the U.S. west coast and provides IPHC with estimates of bycatch in those fisheries. Estimates of bycatch off Alaska for 2008 were based on bycatch reported from fishing conducted through early to mid-November and projections for the remainder of the year.

Dumping the trawl codend. Photo by Hilary Emberton.

Estimates of bycatch mortality in crab pot and shrimp trawl fisheries off Alaska have been made by IPHC staff from previous studies of these fisheries and are based on bycatch rates observed on research surveys because direct fishery observations of bycatch are lacking.

The amount of information varies for fisheries conducted off British Columbia. For the trawl fishery, bycatch is managed with an individual bycatch quota program implemented in 1996 by the DFO. Fishery observers sample the catch on each bottom trawler, collecting data to estimate bycatch. Bycatch in other fisheries, such as the shrimp trawl, sablefish pot, and rockfish hook-&-line fisheries, is largely unknown but is believed to be relatively low, particularly for the shrimp trawl fishery. A new management program in 2006, which included 100 percent at-sea monitoring (observers or video), required groundfish vessels to account for their bycatch of all non-target species, and will likely provide new information on halibut bycatch levels in many fisheries where little is known.

Halibut bycatch in the domestic groundfish trawl fishery operating in Area 2A is estimated from information collected by at-sea observers. Bycatch rates

(number per hour) are derived from the observer data, and applied to commercial fishery effort from logbooks. Shrimp trawl fishery bycatch estimates are provided by Oregon Department of Fish and Wildlife from examinations of halibut bycatch during gear experiments. The estimates are considered rough approximations given the limited amount of data available, but appear reasonable and are updated every few years. Bycatch in the hook-&-line fishery has been determined through comparisons with the Alaskan sablefish fishery but a new approach by NMFS is being evaluated.

Discard mortality rates and assumptions

Discard mortality rates are applied to the total catch to give an estimate of halibut that die during the process.

Discard mortality rates (DMRs) are used to determine the fraction of the estimated bycatch that dies, and these DMRs vary by fishery and area. Where observers are used for fishery sampling, DMRs are calculated from data collected on the release viability or injury of halibut. For areas without observers, assumed DMRs are used, which are based on the similarity of fisheries to those in other areas where data are available.

Observer data are used to estimate DMRs in fisheries in two major areas. NMFS manages the groundfish fisheries off Alaska according to a schedule of DMRs recommended by the Commission. In Area 2A, NMFS observers have been collecting release condition data on bottom trawlers for several years. These data were used to estimate mortality in 2008. In Area 2B, observers monitoring the Canadian trawl fishery examine each halibut to determine release viability.

Data to determine DMRs for other fisheries are not available, so the Commission makes assumptions on likely DMRs based on similar fisheries where DMRs are known. For example, in Area 2A the hook-&-line fishery for sablefish has been assigned an assumed DMR of 25 percent. The midwater fishery for whiting is assumed to have a 75 percent DMR, based on the large catches of whiting typical of this type of fishery.

Bycatch mortality by regulatory area

Halibut bycatch mortality was relatively small until the 1960s, when it increased rapidly due to the sudden development of the foreign trawl fisheries off the North American coast. The total bycatch mortality (excluding the Japanese directed fishery in the eastern and western Bering Sea) peaked in 1965 at about 21 million pounds. Bycatch mortality declined during the late 1960s, but increased to about 20 million pounds in the early 1970s. During the late 1970s and early 1980s, it dropped to roughly 13 million pounds, as foreign fishing off Alaska came under increasing control. By 1985, bycatch mortality had declined to 7.2 million pounds, the lowest level since the IPHC began its monitoring nearly 25 years earlier.

Bycatch mortality increased in the late 1980s, due to the growth of the U.S. groundfish fishery off Alaska, and peaked at 20.3 million pounds in 1992. Bycatch mortality has since declined; preliminary estimates for 2008 total 10.7 million pounds, representing a 12.4 percent decrease from 2007 and a 47 percent decrease from the peak in 1992 of 20.3 million pounds. Bycatch mortality has ranged between 12-14 million pounds since the late 1990s, and 2008 is the first significant drop below that range.

Area closures and redirection of effort resulted in a bycatch reduction in Area 2A.

Area 2

Bycatch mortality in Area 2 in 2008 was estimated at 0.77 million pounds, down from 2007 and well below the 10-year average of 1.14 million pounds. The primary sources for bycatch mortality in this area are the groundfish trawl fisheries in 2A and 2B, and the crab pot and shrimp trawl fisheries in Area 2C.

NMFS estimated halibut bycatch mortality for the 2007 trawl fishery at 0.257 million pounds, a 26 percent decrease from 2006 which coincides with only a minor, e.g., two percent, decrease in overall trawl effort. Total bycatch actually decreased substantially, from 0.667 to 0.350 million pounds, or 47 percent, from 2006 to 2007, but the mortality fraction increased due to a higher DMR. Trawl effort was reduced 45 percent in depths less than 150 fathoms, where halibut bycatch rates are generally higher. The effect of this reduction was enhanced by the closure, for much of the year, of the northern-most shoreward areas, where halibut bycatch rates tend to be the highest on the coast. The 2007 estimate has been used for 2008, but will be replaced when an actual estimate for 2008 is obtained, probably in late 2009. Finally, no new estimate of halibut bycatch mortality is available for the shrimp trawl fishery, so the most recent estimate has been rolled forward to 2008.

For Area 2B, trawl fishery bycatch mortality was estimated at 0.13 million pounds, a decrease of almost 60 percent from 2007. This latest estimate is significantly below the 10-year average of 0.24 million pounds, beginning with the first year of the Individual Bycatch Quota program. DFO staff attribute this decrease to a drop in trawl effort during the summer months in response to the high fuel prices. Many vessels shifted their fishing to other months. In addition, some vessels also fished for certain species more off-bottom than hard on bottom as in the past.

In Area 2C, crab pot fishing and shrimp trawling occur in various locations and harvests have held steady over the years. Pot fishing for brown king crab (*Lithodes aequispina*) occurs in the deep waters of Chatham Strait during the winter months, and beam trawling occurs for shrimp and flounders in the inside waters of southeast Alaska. These fisheries have not been reviewed since the early 1990s, but these fisheries are small scale in nature, with low bycatch. We assume that mortality has been relatively stable since first examined.

Area 3

Bycatch mortality in Area 3 was estimated at 4.3 million pounds in 2008, an 8.7 percent increase from 2007. Slight decreases in trawl bycatch mortality were offset by increases in hook-&-line fishery bycatch mortality. The Rockfish Pilot Program, a study which permits a portion of the rockfish trawl fishery to operate as fishery cooperatives, continued in 2008. Vessels participating in the rockfish cooperatives were able to fish more off-bottom and at a slower pace offered by the cooperative structure. The Rockfish Pilot Program consisted of two catcher/processor cooperatives and five catcher vessel cooperatives, with each cooperative allocated its own halibut bycatch limit. The two catcher/processor coops had a total of 55 mt (91,000 lbs net) for their halibut mortality cap, while the catcher vessels coops were allocated 115 mt (190,000 lbs net). These halibut bycatch allocations were a part of the Gulf of Alaska trawl fishery bycatch limit of 2,000 mt. In other fisheries, pot effort for cod, which has lower bycatch properties than other gears, continues to be high. Within Area 3B, trawl and

hook-&-line fishery bycatch both increased from 2007. The total 2008 Area 3 bycatch mortality is slightly below the 10-year average of 4.5 million pounds.

Area 4

Bycatch mortality in Area 4 was estimated at 5.6 million pounds, a drop of 23 percent from 2007. Since 1999, bycatch mortality in this area has ranged from 6.7 to 7.7 million pounds annually, averaging 7.1 million pounds. This year's estimate is significantly below the long-term average. This drop is attributed to the new fishery cooperatives allowed by Amendment 80, a program recently approved by the NPFMC. As with the Rockfish Pilot Program, the Amendment 80 cooperative program structure allowed for a slower pace and greater flexibility in the conduct of the bottom trawl fishery.

For 2008, a 32 percent decrease in trawl fishery bycatch was offset by increases in bycatch by the hook-&-line fisheries. Driven by cod fishing, bycatch by hook-&-line gear increased markedly, even with lower cod quotas, although total hook-&-line fishery bycatch was well below the bycatch limit for the sector.

A decrease in trawl bycatch in Area 4 was offset by an increase in hook and line bycatch.

Halibut bycatch limits in the 2008 Alaska groundfish fishery

Bycatch of Pacific halibut in the groundfish fisheries off Alaska has been managed with Prohibited Species Catch limits. In 2008, the limits totaled 2,300 tons (3.80 million pounds) in the Gulf of Alaska and 4,575 tons (7.58 million pounds) in the Bering Sea, unchanged from 2007. The limits are set annually by the NPFMC, and are subdivided by gear type, target fishery, time period, and within several other management programs. In contrast to other bycatch species, the halibut limits are set as estimated mortality rather than total catch.

Bycatch occurs in the trawl groundfish fishery, but also with other gears such as longline. Photo by Hilary Emberton.

The NPFMC adopts halibut bycatch mortality limits for the Alaskan groundfish fisheries during its annual specification process in the fall of each year. The limits are set differently for each region. For the Gulf of Alaska fisheries, the bycatch limit is determined through a framework procedure, such that the limit can change annually based on a set of criteria. Limits for the Bering Sea/Aleutian Islands fisheries are fixed in regulation and can only be changed through a lengthy, formal plan amendment. The regulations allow the Council to apportion the trawl and fixed gear limits into seasonal or quarterly amounts, so that the groundfish fisheries can be efficiently prosecuted.

Gulf of Alaska

For the Gulf of Alaska (GOA), the Council used a framework approach to set the trawl limit of 2,000 tons (3.3 million pounds). As in previous years, the GOA trawl limit was divided between the fisheries for shallow water and deep water complexes by specific season. However, the fifth seasonal apportionment (October 1 through December 31) was not divided between the complexes.

Bycatch management in the GOA fixed gear fisheries in 2008 was similar to previous years. The bycatch limit was set at 300 tons (0.5 million pounds, net) for all fixed gear fisheries, which was the same amount as in past years. The fixed gear fisheries targeted primarily on Pacific cod in the central and western GOA during the winter, and rockfish in the eastern GOA in the spring. All pot and jig gear fisheries, as well as the sablefish IFQ fishery, were exempted from any closure due to reaching the mortality limits.

Several special programs exist in the GOA for which the Council has allocated specific halibut bycatch limits within the overall limit. In the first, the Rockfish Pilot Program was established to isolate trawling for certain rockfish species from other fisheries, with the rockfish trawling conducted under very restrictive rules. The Rockfish Pilot Program operates as a cooperative to which NMFS allocates a portion of the trawl halibut bycatch limit. The bycatch limit in the program is further divided between catcher/processors and catcher vessels. The limits are designed to keep bycatch to historic levels, and are in effect only in July, when the fishery is conducted.

Cooperatives have been established as a result of Ammendment 80 to allow vessel groups to better manage their bycatch.

Another program for halibut bycatch management in the Gulf of Alaska applies to vessels that participate in the Best Use cooperative created as a result of Amendment 80 to the BSA Fishery Management Plan. Briefly, Amendment 80 allows certain vessels to form a fishery cooperative to more efficiently conduct their fisheries. Importantly, the amendment does not require vessels to fish for a cooperative, and some of the eligible vessels have chosen to remain independent. The Amendment 80 trawl vessels, which do not fish in the Rockfish Pilot Program, are excluded from directed fishing for Pacific ocean perch, pelagic shelf rockfish, and northern rockfish in the BSA. These excluded vessels are subject to limitations on their catch of other groundfish species and the associated halibut bycatch. This measure was adopted to protect the interests of fishers, who do not directly benefit from Amendment 80, from expansion into their fisheries by Amendment 80 participants. To limit the catches by this group, the Council created limits, or sideboards, on their catches. The halibut bycatch mortality sideboard limits for Amendment 80 vessels are based on historic use of halibut bycatch by those vessels in the shallow-water and deep-water fisheries from 1998-2004.

The final apportionment of halibut bycatch in the GOA is a consequence of the American Fisheries Act (AFA). The AFA specified that certain trawl catcher/processors fishing for pollock in the BSA were prohibited from fishing for certain other groundfish species in the GOA. The AFA also specified limits on the amounts of other groundfish species those vessels were allowed to catch; these limits are termed sideboards. To support directed fishing for the groundfish sideboards, the Council set up halibut bycatch sideboards. These sideboards, as with the Amendment 80 program previously described, are also necessary to protect the non-AFA fleet and processors by, in effect, limiting the activities of the AFA vessels. The halibut bycatch mortality sideboard limits are based on the aggregate retained groundfish catch by the AFA catcher vessels in the shallow-

water and deep-water categories, from 1995-1997, divided by the retained catch of all vessels in that fishery category for the same period.

Bering Sea/Aleutians

The primary halibut bycatch mortality limits for the 2008 Bering Sea and Aleutian Islands trawl and fixed gear fisheries were fixed in regulation, as previously stated, and then apportioned among fisheries based on "need", as recommended by industry representatives and adopted by the Council. The bycatch limits for each fishery were then apportioned by quarter or season, as requested by industry. When a limit was reached, the entire Bering Sea/Aleutian Islands region was closed to further fishing until the next season, or for the remainder of the year. Bycatch limits for most trawl fisheries in 2008 were unchanged from 2007.

As in past years, the BSA fixed gear fisheries were initially allocated a total bycatch limit of 900 tons but 7.5 percent (67 tons) was reassigned to CDQ fisheries, leaving a total of 833 tons. This total was then divided between the hook-&-line fishery for Pacific cod and all other fisheries, with the cod fishery limit further divided between catcher/processors and catcher vessels. All pot and jig fisheries were exempted from halibut mortality closures. The sablefish IFQ hook-&-line fishery was also exempted from the bycatch limit.

Trawl fisheries were provided an initial total bycatch mortality limit of 3,675 tons in 2008. By regulation, a fixed amount of 275 tons is reallocated to CDQ fisheries, leaving 3,400 tons for all other trawl fisheries. With the passage of Amendment 80 to the Bering Sea/Aleutian Islands Fishery Management Plan, trawling is now separated into an Amendment 80 fleet, with the remainder termed a Limited Access fleet. The latter group includes the pollock cooperatives created by the AFA. Within the amendment's fleet, the bycatch limit is subdivided between the Best Use cooperative and those vessels which did not join the cooperative, i.e., limited access.

In addition, the Council created bycatch limit sideboards for the AFA vessels to ensure their activities in non-AFA fisheries do not dilute the benefits to the non-AFA fleet in those fisheries.

The CDQ programs were allocated 10 percent of the pollock TAC and 7.5 percent of all other groundfish TACs.

In 2008, the CDQ program operated throughout the year. Under the program, 10 percent of the pollock TAC and 7.5 percent of all other groundfish TACs were allocated to the six CDQ programs. Ten percent of the trawl bycatch limit and 7.5 percent of the hook-&-line bycatch limit were allocated to the CDQ program and then subdivided among the six CDQ programs in relation to their groundfish allocations.

The Bering Sea Prohibited Species Donation Program

Since 1998, SeaShare of Bainbridge Island, Washington has operated a program that acquires unintentionally-landed halibut bycatch in Alaska for donation to hunger relief programs. The program is conducted under a Prohibited Species Donation program adopted by NMFS and NPFMC following several years of development and, ultimately, approval by the IPHC.

The initial program was adopted by the NPFMC in 1998 for a three year pilot period. Following a review by NMFS and IPHC, the program was extended. The extension contains no sunset provision but does require a review every three

years. Although limited to shore-based trawl catcher vessels that land in Dutch Harbor, there is neither a limitation on the amount that can be donated nor a requirement that the halibut bycatch originates from specific fisheries.

In 2008, halibut collected for this program totaled 24,191 pounds (a preliminary estimate) and were landed by shore-based catcher vessel trawlers at two participating processors in Dutch Harbor. Since the program's inception, donations in the program have totaled 254,648 pounds net. NOAA's Office of Law Enforcement has monitored the halibut donated to this PSD program and has reported no incidents.

Final 2007 results

The amount of halibut collected by SeaShare in 2007 was 34,619 pounds, with two participating processors. As in past years, Unisea was the leading contributor, followed by Alyeska. Processing and inspection was conducted by SeaFreeze personnel, the Seattle processor, as in previous years. Food Lifeline in Oakland, CA was one of the recipients of the processed halibut.

Unisea and Alyeska processing plants in Dutch Harbor along with Coastal Transportation and SeaFreeze made it possible to donate more than 24,000 pounds of halibut to foodbanks in 2008.

Preliminary 2008 results

As in past years, two Dutch Harbor processors, UniSea and Alyeska, participated in 2008. As of December 8, 2008, a total of 24,191 pounds (net weight) of frozen, headed and gutted halibut had been received: 78 percent from Unisea and 22 percent from Alyeska. The total amount processed decreased 30 percent from 2007, primarily due to a large decrease by Unisea.

Handling of fish was similar to past years. The fish were delivered to SeaFreeze in Seattle through shipping that was donated by Coastal Transportation. SeaFreeze weighed the halibut in the totes, and the net weight was estimated. The fish were processed in Seattle into steaks, then sleeved, and repackaged for delivery. Halibut steaks were distributed by Food Lifeline to food banks in Seattle, WA and Oakland, CA.

Assessing the Pacific halibut stock

With the first red sunlight on mast and spar
A ship is sailing beyond the bar,
Bound to a land that is fair and far;
And those who wait and those who go
Are brave and hopeful, for well they know
Fortune and favor the ship shall win
That crosses the bar when the dawn comes in.

--L. M. Montgomery

Each year the Commission staff assesses the abundance and potential yield of Pacific halibut using all available data from the commercial fishery and scientific surveys. For many years we assessed the stock in each regulatory area, under the assumption that the stock of fish of catchable size in each area remained relatively stable, that there was a negligible migration of fish between areas.

However, a growing body of evidence from our annual stock assessments and from ongoing mark-recapture experiments indicated otherwise: the data showed a continuing eastward migration of catchable fish from Areas 4 and 3B into Area 2 in the eastern Gulf of Alaska. This evidence led the Commission to question the accuracy of the closed-area assessments, and in 2006 we began conducting a coastwide stock assessment and to use survey data to apportion the resulting coastwide biomass estimate into separate estimates for each regulatory area.

With the new knowledge that halibut migration is not finished by age 8, the Commission staff has turned to a coastwide assessment.

Sitka port sampler, Amy Schmitt, hoists a halibut onto the measuring cradle. The commercial catch is sampled throughout the season, and the data become part of the stock assessment. Photo by Lara Erikson.

To obtain an unbiased estimate of the coastwide stock, in the 2006 assessment the Commission built a coastwide data set and fitted the model to it. Since last year's acceptance of a coastwide stock assessment model, much of the focus is now on how the Commission apportions the coastwide estimate of exploitable biomass among regulatory areas. The assessment model for 2008 is identical to that used for the 2007 assessment. This model has been essentially unchanged since 2003. It has been thoroughly described in an IPHC Scientific Report and was subjected to an external peer review by two external scientists from the Center for Independent Experts.

Exploitable biomass in each regulatory area was estimated by partitioning, or apportioning, the total in proportion to an estimate of stock distribution derived from the setline survey catch rates (catch per unit of effort, or CPUE). Specifically, an index of abundance in each area was calculated by multiplying survey CPUE (running 3-year average) by total bottom area between 0 and 300 fathoms. The logic of this index is that survey CPUE can be regarded as an index of density, so multiplying it by bottom area gives a quantity proportional to total abundance. This year an adjustment was applied to the index for each area, derived on the basis of hook competition.

Harvest policy

The Commission employs a precautionary approach of slow up, fast down, when deciding annual catch limits.

The Commission has developed, refined and utilized a constant harvest rate policy since the 1980s. Stated succinctly, the policy is to harvest 20 percent of the coastwide exploitable biomass when the spawning biomass is estimated to be above 30 percent of the unfished level. The harvest rate is linearly decreased towards a rate of zero as the spawning biomass approaches 20 percent of the unfished level. This combination of harvest rate and precautionary levels of biomass protection have, in simulation studies, provided a large fraction of maximum available yield while minimizing risk to the spawning biomass.

Since the early 2000s, and in common with many fisheries management agencies, the harvest policy has incorporated a measure designed to avoid rapid increases or decreases in catch limits, which can arise from a variety of factors including true changes in stock level as well as perceived changes resulting from changes in the assessment model. The adjustment, termed "Slow Up/Fast Down," results in a target harvest rate of 20 percent but a realized rate usually a bit different. The Slow Up/ Fast Down approach is somewhat different from approaches by other agencies in that it is asymmetric around the target value, i.e., the catch limit responds more strongly to estimated decreases in biomass than to estimated increases. This occurs for two reasons: first, the assessment generally has a better information base for estimating decreasing biomass compared with increasing biomass; and second, such an asymmetric policy follows the Precautionary Approach.

Apportioning the coastwide biomass among regulatory areas

With the change to a coastwide assessment approach, the issue then became how to apportion the biomass among areas. On September 4, 2008 in Bellevue WA, the Commission held an apportionment workshop chaired by

IPHC staff member, Aregash Tesfatsion, enters data to be used in the stock assessment. Photo by Heather Gilroy.

an independent scientist and attended by approximately 110 people, including IPHC Commissioners, agency staff, processors, as well as commercial and recreational harvesters. The goals of the workshop were to explain the basis for current assessment framework and survey apportionment method; to explore merits and impacts of alternate apportionment approaches; and to identify improvements to current apportionment approach. Not a decision-making forum, the workshop simply provided a chance to gain information and engage in discussion.

How to apportion the coastwide catch limit is a challenge. Visit the IPHC website for a full accounting of what's been done so far.

The Commission's staff presented several alternative apportionment methods presented by staff, noting that the chosen method must address the needs of stockwide management, be consistent across all regulatory areas, be sensitive to stock changes and provide feedback for ongoing apportionment, protect area-specific spawning contributions, be precautionary, and be robust to uncertainties about stock structure and status. Full descriptions of the alternatives presented, as well as other background material, is available on the Commission's website.

The staff believes that survey CPUE-based apportionment is the most objective and consistent method of estimating the biomass distribution among areas and therefore the best distribution of total CEY, if the aim is proportional harvest. The validity of the survey CPUE apportioning requires that survey catchability – the relationship between density and CPUE – be roughly equal among areas. In 2007, several checks for area differences in catchability were made, but researchers found little compelling evidence suggesting significant differences. The exception was in Area 2A where a preliminary analysis suggested that uneven station distribution, in relation to bottom depth, resulted in a 40 percent lower catchability. The other factor that indicated potential area differences concerned hook competition and whether areas had different catchabilities as a result of fewer baited hooks being available to halibut. Both of those factors have been reconsidered for this year.

Effect of the 2008 data on abundance estimates

Coastwide survey CPUE declined by nine percent and commercial CPUE declined by eight percent from 2007 to 2008. As a result, the 2008 coastwide model fit is revised downwards, by about 20 percent, from the estimate of abundance at the beginning of 2008 made in the 2007 assessment. At the same

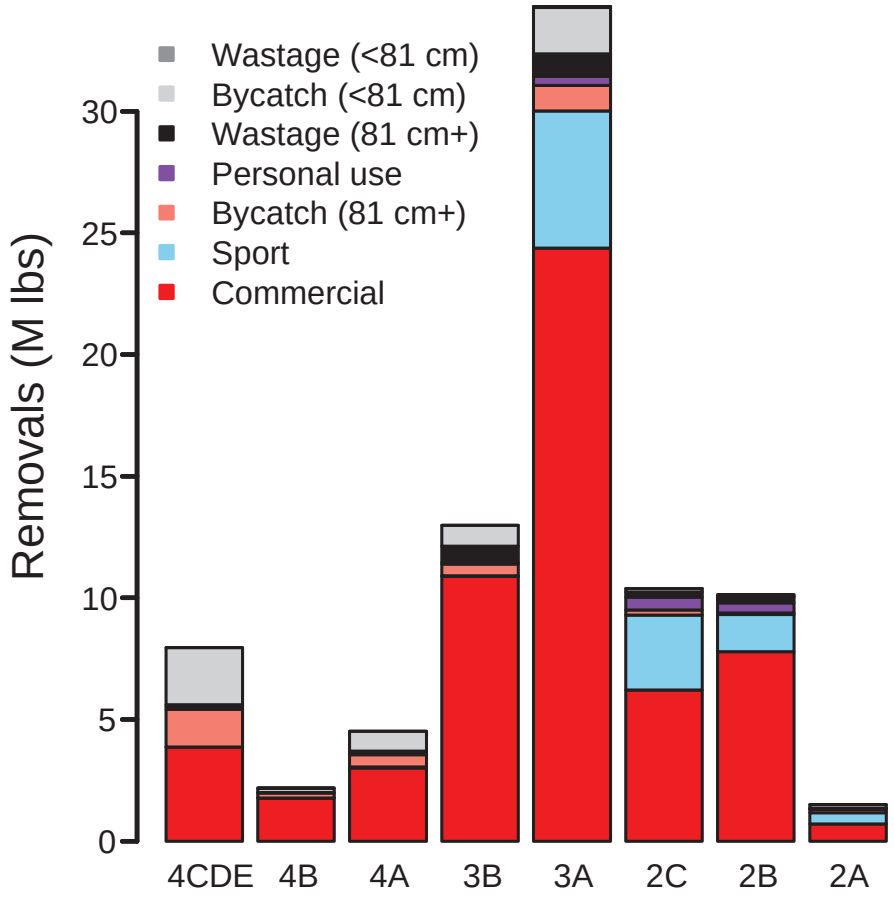


Figure 2. 2008 total removals by area.

Estimates show that exploitable biomass of halibut has declined 50 percent over the past 10 years.

time the 2008 fit shows an increase in abundance, of about 12 percent, between the beginning of 2008 and the beginning of 2009. The net result is an estimated decline of 10 percent between the 2008 beginning of year exploitable biomass and the 2009 beginning of year exploitable biomass.

Area summaries

The coastwide assessment indicates that the exploitable biomass of halibut has declined approximately 50 percent over the past decade. This declining trend is seen almost all of the area-specific survey and commercial CPUE indices. But the breadth and reasons behind the declines vary by area. Figure 2 illustrates the removals for each area, and the following is a region by region discussion of the trends and prospects for each.

Area 2

Between 1997 and 2006, total removals were stable in Areas 2A, 2B and 2C, averaging 1.6 million pounds in Area 2A, 13.5 million pounds in Area 2B and 12.4 million pounds in Area 2C. Removals declined sharply in 2007 and 2008, in response to the revised view of relative halibut abundance in Area 2. Sublegal bycatch, and subsequent lost yield to the sport and commercial fisheries, is

estimated to be rather low, though legal-sized bycatch in Area 2A still represents a sizable portion of total removals. Surplus production estimates suggest that removals have exceeded surplus production in Area 2 for most of the past decade. Commercial effort has steadily increased in Area 2A for almost a decade but was relatively level in Areas 2B and 2C, and in fact declined over the past two years. Indices of abundance all suggest a steady decline in biomass in all three areas, though the Area 2B survey setline CPUE increased nearly 50 percent in 2008. All three areas saw declines of more than 50 percent in survey CPUE between 1996 and 2007, and declines continued for 2A and 2C. As is the case with the coastwide estimate of abundance, a small increase in exploitable biomass is projected for the beginning of 2009. The age structure of fish caught in Area 2 is noticeably younger than in Areas 3 and 4. Mean age is around 11 years of age, with little difference between males and females.

The 1987-88 year classes which dominated the catch for many years, are now much older and contribute much less to the exploitable biomass.

All the indices are consistent with a picture of a steadily declining exploitable biomass in Area 2. The reasons for the decline are likely twofold. The first is the passing through of the two very large year classes of 1987 and 1988. Every assessment over the past decade has shown that those two year classes were very strong in comparison to the surrounding year classes. Now that those two year classes are 20 years old, their contribution to the exploitable biomass and catches has sharply declined and the drop in biomass is to be expected as they are replaced by year classes of lesser magnitude. Removals have been generally larger than surplus production and this prevents rebuilding of regional stocks. Our present view of Area 2 is that harvest rates have been much higher than the target rate of 0.20 over the past decade and are not sustainable, particularly with the passage of the 1987 and 1988 year classes. There are signs that two or three large year classes are set to enter the exploitable biomass; however, the exploitable biomass will not increase as long as harvest rates remain high. Finally, Area 2 presently accounts for 28 percent of total removals coastwide but contributes just 17 percent to the female spawning biomass, a byproduct of the young age of halibut in this Area.

Area 3

While Areas 3A and 3B occupy the central area of distribution of the halibut stock at present, they have substantially different exploitation histories over the past 10-20 years. Area 3A removals, both the total as well as the individual components (commercial, sport, bycatch) have been very stable over the past 10 years. Commercial effort has also seen relatively little variation. The CPUE indices show a slow decline with a drop of 20 percent in the commercial and 33 percent in the survey between 1998 and 2008. Removals have been very close to estimated surplus production when averaged over the past seven years, although there has been large annual variation in the proportion of the surplus production removed. The coastwide assessment estimates a decline of 16 percent in the exploitable biomass over the past 10 years. Area 3B saw a large increase in removals beginning in 1996 which peaked in 2002 and has dropped sharply since. Commercial fishing effort more than tripled in the seven years after 1996 and then declined modestly over the past four years before increasing again in 2008. We estimate that removals greatly exceeded surplus production between 1998 and at least 2006. Commercial and survey CPUE both dropped by a bit more than 50 percent between 1998 and 2008. The coastwide assessment suggests biomass dropped by 55 percent between 1998 and 2008. Area 3A has a

Average age of fish caught in Area 3 is 13 and 16 years for females and males, respectively.

much broader spectrum of ages in the population than is seen in Area 2. Average age for females in survey catches is 13 and for males is 16 years of age. Area 3B, however, is more similar to Area 2 in age distribution than to Area 3A.

Area 3A has the appearance of being the most stable of the IPHC regulatory areas. The area has been fully exploited for many decades and there is a wealth of data detailing its population dynamics. The area also sits at the current center of halibut distribution and it appears that emigration is roughly equal to immigration resulting in an effectively closed population. Like Area 2, Area 3A benefited from the very large year classes of 1987 and 1988 and the slow decline in exploitable biomass is the result of those year classes dying off. The biomass remains in a healthy state and should continue to support removals of the magnitude seen over the past 2-3 decades. The situation in Area 3B is different. Area 3B was relatively lightly fished until the mid 1990s. With the introduction of a regular survey, quotas were incrementally increased from 4 million pounds to a high of 17 million pounds. Predictably, catch rates declined steadily. Our view of Area 3B is that the area had an accumulated "surplus" biomass that could be (and was) taken but the level of catches was not sustainable. The area has now been fished down and the average annual yield will be somewhere in between the low levels of the mid 1990s and the high levels of 5-6 years ago. As the area is also centrally located, we apply the dynamics of Areas 2 and 3A and believe that a constant harvest rate of 0.20 is appropriate for the region. The coastwide assessment suggests that harvests have been in the 0.15 to 0.20 range over the past six years.

A harvest rate of 0.20 appears to be appropriate for the area.

Area 4

Area 4A, 4B and 4CDE have roughly similar commercial exploitation histories over the past decade and show similar trends. In these areas, commercial catches increased from around 1.5 million pounds to around 4-5 million pounds between 1996 and 2001. Catches have since declined, most strongly in Areas 4B and 4CDE where a lower target harvest rate of 0.15 was applied the past few years. Commercial effort mirrored the rise in removals from 1996-2001, however the drop in effort was not nearly as sharp as the drop in catches, and the drop in commercial CPUE is evident in the time series. Survey CPUE in Area 4A has declined around 70 percent over the past decade while Area 4B is down 50 percent over the same time period; the decline in Area 4D survey CPUE is around 40 percent (there is no survey index for 4C or 4E). The coastwide assessment indicates an exploitable biomass decline of 61 percent for Area 4A, 68 percent for Area 4B, and 43 percent for Area 4CDE.

The situation in Area 4 is somewhat like Area 3B only more exaggerated. Area 4 was very lightly exploited up until the mid 1990s. With the onset of surveys, quotas were quickly increased and the accumulated surplus biomass quickly removed. Catches of 4-5 million pounds in each area are clearly not sustainable, as was stated by the IPHC staff when higher catch limits were recommended. In Area 4B, where catch limits were dropped most strongly, there is evidence of a reversal in the strong biomass decline. Over the past three years, the CPUE indices have actually increased slightly and the two assessments estimate a level time trend in exploitable biomass. The target harvest rate was reduced to 0.15 in Area 4CDE in 2004 and in Area 4B in 2005. While Area 4CDE still shows continuing signs of decline, the situation in Area 4B is much more promising. The Area 4B survey CPUE increased for the fourth consecutive

year and total removals now appear to be less than surplus production.

This year, staff is recommending lowering the target harvest rate for Area 4A to 0.15, in line with the rest of Area 4. Sublegal bycatch remains very large relative to removals and lost annual yield to the commercial fishery is on the order of 1.5 million pounds. Additionally, Area 4A is a net exporter of fish, likely receiving little immigration from the rest of Area 4 while emigration has been seen to be quite large. Yield per recruit calculations for Area 4A, based on estimated average recruitment suggest sustainable yield is no greater than 3 million pounds; an F40 harvest policy for Area 4A gives a recommended harvest rate of 0.15. All of these factors together suggest that removals continue to be too high in Area 4A and a lower target harvest rate is required. The hope is that Area 4A will respond as Area 4B has and the stock will curtail its steep decline and begin to increase, perhaps with assistance from the anticipated large 1999 and 2000 year classes and removals will then increase commensurately.

Analysis of PIT tag recoveries through 2008

In 2003, the Commission staff marked with PIT tags and released all fish caught on three skates of gear at all setline survey stations coastwide, totaling almost 44,000 fish. The release was repeated in 2004 in Areas 2B and 3A, totaling another 23,000 fish. In each year from 2003 to 2007, samplers in the ports scanned a substantial part of the landings to recover tags.

The primary purpose of this large project is to estimate the harvest rate of fully selected halibut by the commercial fishery, but the tag-recovery data also permit estimates of length-specific selectivity schedules, rates of migration among regulatory areas, and, in principle, the rate of natural mortality.

In 2008. a total of 422 tags were recovered, with 261 from the 2003 releases and 161 from the 2004 releases. The overall pattern of recoveries is similar to 2007. In particular, very few 4A tags are now recovered in Area 4A, largely because the releases have now migrated eastward. Total Area 2B recoveries were again low compared to years prior to 2007, and are now comparable to recoveries of 4D tags, an area with similar scanning rates but far fewer releases.

Eastward migration from Area 4A is estimated at 15 percent per year.

Net migration

The tag-recovery modelling leads to estimates of annual rates of emigration from each regulatory area. We can estimate net annual migration by applying the migration estimates from the model to estimates of the number of legal-sized fish. Using population estimates from the 2008 stock assessment and a single migration matrix, we obtain the net migration rates. We estimate strong net eastward migration from Area 4A at a rate of 15 percent per year, while Area 2B receives the greatest percentage of migrants relative to its population, with an estimate of almost 7 percent annual inward migration. Other net migration estimates are smaller, with values reflecting a combination of emigration and immigration.

Over the course of this study, recoveries of tagged fish out of release area have shown that migration is an ongoing process not restricted to small, younger fish. This is supported by the results of our tag-recovery modelling, which show continued migration of fish greater than 90 cm in length at estimated rates of up to 10 percent per year for each regulatory area. Rates of migration are estimated to be even greater for smaller fish in western areas. The recovery data are too

While there appears to be substantial migration out of areas in the west, there is little or no migration from areas in the east.

sparse for most regulatory areas to permit a more detailed look at the relationship between halibut size and migration probability, but the raw data imply this relationship varies greatly among areas.

As in 2007, the best fitting model of those we considered was one which showed little or no movement of fish out of areas in the eastern Gulf of Alaska after the first year following releases of the tags. The 2008 data continue to show support for the possibility that while migration is an important and ongoing process eastward from Areas 4A and 3B, there is little or no migration from areas to the east.

Setline and trawl survey catch rates in the eastern Bering Sea

Every year the Commission carries out a setline survey of the entire shelf except for the eastern Bering Sea. The catch-per-unit-effort (CPUE) of the setline survey is predicted from the annual NMFS trawl survey, scaled by the observed ratio of setline and trawl CPUE in 2006 when the only setline survey of the eastern Bering Sea was conducted. The coastwide stock assessment is then conducted using the predicted setline CPUE in the eastern Bering Sea and the observed setline CPUE in other areas. Likewise the survey apportionment of the coastwide total is done using predicted values for the eastern Bering Sea (Areas 4CDE) and real data elsewhere.

Before the adoption of the coastwide assessment, exploitable biomass in Area 4CDE was estimated by applying the fixed commercial setline selectivities to the mean of the most recent three swept-area estimates of total abundance at length from the trawl survey. (The trawl survey was taken as non-selective with a catchability of one for fish above 80 cm. The total estimates were reduced by

The IPHC conducts an annual survey of the fishing grounds as part of the stock assessment. Here the chartered *F/V Bold Pursuit* gears up for the survey. Photo by Ayala Knott.

10 percent to account for the portion in Area 4A.) In 2004-2006 these estimates for Area 4CDE were all 50-55 million pounds, whereas the 2006 coastwide assessment produced an estimate of 41 million pounds. It seemed unlikely that the trawl survey was overestimating the biomass, so it was stated at that time that the 2006 survey for whatever reason may have produced a low CPUE. Since then the 2007 trawl survey estimate came in at 34 million pounds, while the 2007 coastwide assessment produced an estimate of 36 million pounds. So there is at the moment less of a discrepancy. Still the three-year running average of the trawl survey estimates for Area 4CDE is 46 million pounds.

The setline and trawl surveys have overlapped in some places over the years, and those data might shed some more light on the relationship between trawl and setline survey catch rates and therefore on the question of whether the shelfwide 2006 data were somehow aberrant.

It is clear that the overlapping setline and trawl survey data apart from the 2006 shelfwide surveys are too sparse and too variable to provide any real improvement on the working value of 18 hectares per skate (the number of hectares that have to be trawled to catch as much fish as a skate of setline gear) based on the 2006 data. Nor can we expect much help from the few overlapping stations in future years. And yet it is still quite possible that the working value is low. If the estimate is in fact low, the end result is that we are acting in a precautionary manner as we refine our understanding of productivity in the Bering Sea.

One possible option would be to tweak the working value in order to bring the coastwide estimate for Area 4CDE up to the trawl survey estimate. A second option is to continue using the 2006 trawl data to scale the 4CDE biomass estimate until a second Bering Sea shelf setline survey is conducted. Plans to conduct such a survey in 2008 fell through due to a lack of viable survey bids. It is anticipated that a shelf wide survey will be conducted in the next year or two. Given all the other changes and questions surrounding the assessment, it is likely best to maintain current practice to facilitate understanding of 4CDE interannual changes.

The current center of halibut abundance is located around Kodiak Island in Area 3A.

Exploring effects of fishing and migration on the distribution of Pacific halibut

Halibut abundance changes along its geographic range, with the current center of abundance located around Kodiak Island (Area 3A) in the Gulf of Alaska. There are also seasonal changes in halibut distribution resulting from spawning migrations. During summer, halibut are distributed on the continental shelf, but during the winter mature halibut migrate to spawning grounds located in deeper waters. Recent archival tagging has identified winter spawning migrations as long as 1200 km as well as some degree of site fidelity to summer areas. After spawning, halibut eggs and larvae are carried by prevailing currents north and westward towards the western Gulf of Alaska and the Bering Sea. Juvenile halibut undertake an eastward-southward migration that counters the drift of eggs and larvae. Until recently, it was assumed that this migration was completed by age six-seven when halibut become vulnerable to the fishery. However, recent passive integrated tagging (PIT) data have provided evidence of continuing ontogenetic halibut migration beyond age eight.

The counterclockwise (northward-westward) drift of eggs and larvae and the clockwise (eastward-southward) migration of juvenile and adult halibut is a type of "compensatory emigration" or "migratory circuit." This process is expected to have evolved along with other biological traits of Pacific halibut on an evolutionary time scale, and has strong implications for the population abundance and distribution.

Another process affecting the abundance and distribution of Pacific halibut is fishing. Understanding the effect of the fishery on population structure, abundance, and distribution of halibut was identified as a crucial topic for halibut management early on the history of halibut research. From a conservation point of view, it was recognized early that the quantitative distribution of the species must be considered since all possible sources of eggs and young are important, whether at the limit of the species range or at the center.

The IPHC harvest policy is designed to preserve the relative distribution of halibut along its geographic range.

The IPHC harvest policy uses the same target harvest rate for all areas (except areas of special concern) with the goals of altering as little as possible the relative distribution of halibut along its geographic range, and to have halibut encounter the same exploitation rate wherever they might be fished. For several years this harvest policy was implemented using closed-area assessments under the assumption of no net migration of legal-sized fish between regulatory areas. In 2006, the IPHC staff and an external scientific peer review recognized the biases of the closed-area approach in light of the evidence of continuing migration of legal-size halibut, and moved to a coast-wide assessment approach. The coast-wide assessment estimated recent coast-wide realized harvest rates near the target harvest rate. However, realized harvest rates on an area basis are estimated to have been more than twice the target in eastern areas, and less than the target in western areas.

On-going work

Preliminary explorations of a simulation model suggest that the current distribution of halibut abundance differs from that expected under no fishing conditions. Simulations under the assumptions described in this work project higher abundances in the eastern part of the stock (particularly in Area 2B) in the absence of fishing. This is consistent with early estimates of relative distribution of halibut abundance during the development of the fishery. Lower abundances and smaller percentages of older fish in the eastern areas are consistent with higher historical exploitation rates estimated by the coast-wide assessment approach. A common fishing mortality rate for all areas results in only marginal departures from the relative distribution of unfished spawning biomass under alternative migration patterns within the range of moderate migration rates of halibut and the target harvest rate levels used historically in its fishery. Varying exploitation rates in the western areas have little effect on the dynamics of eastern areas, if exploitation rates in the east remain as high as estimated by the coast-wide assessment.

SURVEYING THE WATERS

Lo! the sea is fair,
Smooth as the flow of a maiden's hair.
--L. M. Montgomery

IPHC setline survey

The Commission's standardized stock assessment (SSA) survey provides catch information and biological data that are independent of the commercial fishery. These data, which are collected using standardized methods, bait, and gear during the summer of each year, provide an important comparison with data collected from the commercial fishery. The survey fishing effort, however, is a small fraction of the commercial effort and takes place only during the summer. The commercial fishery is more variable in its gear composition and distribution of fishing effort over time but presents a broad spatial and temporal sampling of the stock. Biological data collected on the surveys (e.g., the size, age, and sex composition of halibut) are used to monitor changes in biomass, growth, and mortality in adult and sub-adult components of the population. In addition, records of non-target species caught during survey operations provide insight into bait competition, rate of bait attacks, and other characteristics of bycatch species.

The IPHC setline survey provides a fishery-independent sampling of the halibut stock.

The rollerman on the *F/V Bold Pursuit* pulls a halibut aboard during the 2008 survey. Photo by Drew Barrett.

The Commission has conducted standardized setline surveys in selected areas during most years since 1963 (with a break from 1987 to 1992). The current base survey station design and most sampling protocols have been the same since 1998, with some additional stations added in 2006 around the Pribilof islands.

The 2008 survey design encompassed all offshore waters of Oregon, Washington, British Columbia, southeast Alaska, Gulf of Alaska, Aleutian Islands, and the Bering Sea continental shelf edge. These areas were divided into 27 regions, each requiring between 13 and 46 charter days to complete. Stations were located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut during summer months (25-275 fm). Additional stations looking at rockfish abundance where fished in cooperation with both WDFW and ODFW and are further described in the Special Projects section below. The rockfish index stations in the Washington charter region, however, are arranged in a different pattern (described in Special Projects in this section of the report). At the end of 2007, it was anticipated that the Eastern Bering Sea shelf area would be surveyed in 2008; however, no suitable vessels were found to complete this work at reasonable cost.

IPHC chartered twelve commercial longline vessels, six Canadian and six U.S., for SSA grid survey operations in 2008 (see table below). All twelve vessels had previously been chartered for IPHC research work. Five skates were fished at each station in all charter regions except for the rockfish index stations in the Oregon and Washington charter regions, where fishing effort was limited to three skates per station to allay concerns about exceeding permitted yelloweye rockfish catch.

The 12 fishing vessels that were chartered to conduct the survey in 2008, have all worked with the IPHC in the past.

The standards for gear, bait, set, and soak times employed on the setline surveys are consistent among years. Standard survey gear consists of fixed-hook, 1,800-foot skates with 16/0 circle hooks spaced 18 feet apart. The gangion length ranges from 24 to 48 inches. All hooks were baited with pieces of Alaska Seafood Marketing Institute (ASMI) grade No. 2 semi-bright or better chum salmon (Oncorhynchus keta) weighing between 0.25 to 0.33 pounds each. Each vessel set up to four stations daily (or up to five stations if fishing rockfish index stations) beginning at first light or around 0500 and let the gear soak a minimum of five hours before hauling. Soaking the gear at night was avoided

Survey F/V	Charter region(s)	Stations
Bernice	Washington	61
Blackhawk	Oregon	61
Bold Pursuit	Prince William Sound, Sitka, Yakutat	137
Clyde	Chignik, Semidi	91
Free to Wander	Sanak, Shumagin, Unalaska	156
Kema Sue	4A Edge, 4D Edge	125
Pacific Sun	Adak, Attu	87
Pender Isle	Ketchikan, Ommaney	81
Predator	Shelikof, Portlock, Albatross	136
Proud Venture	Vancouver, Goose Island, Fairweather	133
Star Wars II	Charlotte, St. James	86
Waterfall	Gore Point, Seward, Trinity	140
Total stations fished		1,294

whenever possible. Data from soaks in excess of 24 hours were not used. Sets were deemed ineffective for stock assessment if predetermined limits for lost gear, snarls, predation, or station displacement were exceeded. The fork lengths of all halibut landed from survey stations were recorded to the nearest centimeter. Each length was converted to weight using a standard formula, which was then used to generate the catch per unit effort (CPUE) data. Average CPUE, expressed as pounds per skate, is calculated by dividing the catch in pounds (net weight) of legal-sized halibut (greater than 81 cm) by the number of standardized skates hauled for each station and averaging these values for each area (statistical, charter, or regulatory).

Sampling protocols

While the gear was being set, IPHC samplers evaluated the performance of the bird avoidance devices and recorded the exact number of baits lost and hooks per skate. During gear retrieval, samplers recorded hook status (e.g., empty, returned bait, species captured).

Standard sampling included not only halibut vital statistics, but also bird counts, species counts, and various other tasks.

Traditionally, samplers in all areas targeted the first 20 consecutive hooks of each skate for monitoring hook status; however, processing needs for fish from previous skates, particularly in areas with high catch rates, sometimes affected where in the 100-hook sequence of the skate the sample was taken. In 2008, sea samplers collected sequential whole-haul hook tally data in the northern part of the Washington charter region, all regions in Regulatory Areas 2B and 2C, as well as the Fairweather charter region in eastern 3A. Samplers recorded the lengths of all halibut caught with the corresponding skate number. Vessel crew dressed all halibut greater than 81 cm and then passed them to an IPHC sampler, who collected a suite of information from the fish including sex and maturity, age structure (otolith), prior-hooking injury severity, evidence of depredation, and presence/absence of a passive integrated transponder (PIT) tag. Males were coded as either mature or immature, and females were assessed as immature, mature, spawning, or spent/resting. The sex and maturity of halibut less than 81 cm were recorded only if a fish was randomly selected for otolith collection or died during capture.

At the conclusion of hauling, samplers recorded the presence and abundance of seabird species or species groups within a 50-m radius of the vessel's stern. Seabird occurrence data will be used to determine the spatial and temporal variation in the abundance of seabirds.

Special projects

The SSA survey facilitates the collection of information about halibut biology along with experiments that are not directly associated with halibut stock assessment yet which are valuable to other agencies and researchers. In 2008, IPHC sea samplers participated in a number of special projects, such as collecting a range of data from rockfish for projects in conjunction with various state agencies; deploying water column profilers in Regulatory Areas 2A and 2B; collecting flesh samples for heavy metal and persistent organic pollutant analysis by Alaska's Department of Environmental Conservation; and collecting Pacific cod length frequencies along the Bering Sea shelf edge for NMFS – Alaska Fisheries Science Center Pacific cod assessment team.

Rockfish sampling in Regulatory Area 2A

IPHC sea samplers retained all rockfish caught on the 2A surveys, marked them with a tag, and recorded the station and skate of capture. After the rockfish were offloaded, state biologists from WDFW or ODFW collected additional data from each fish, which could be associated with the skate of capture and thereby location and depth via the tag numbers.

Both ODFW and WDFW contracted with the IPHC to monitor additional stations for rockfish.

In 2008, the vessels contracted for the 2A charter regions fished rockfish index stations in addition to the standard SSA stations. This was the third consecutive year that WDFW funded the joint project focused on rockfish off Washington, while Oregon initiated collaboration with IPHC on a similar rockfish project, funded by the ODFW Restoration and Enhancement Program. For WDFW's project, the same 18 rockfish index stations from 2007 were fished again in 2008; while for ODFW's project, 20 rockfish index stations were added to the set of standard survey stations off the Oregon coast. Both ODFW and WDFW selected the index station locations with the intent of targeting more rocky-bottom habitat than the standard SSA survey stations. At each of the rockfish index stations, fishing effort was reduced to three skates from five to limit impacts on rockfish populations. Halibut sampling at rockfish index stations was modified to reduce halibut mortality since these stations were not part of the SSA survey. Halibut captured on rockfish index stations were measured and released alive without removing otoliths or examining gonads for gender and maturity. The IPHC has been approached by both state agencies to continue the index station work subject to working budgets and ongoing design considerations. IPHC intends to continue collaborating with state agencies to collect detailed data about rockfish captured on the standard survey grid stations in Regulatory Area 2A.

Rockfish sampling in Regulatory Area 2B

In cooperation with DFO, IPHC samplers aboard survey vessels working in Regulatory Area 2B recorded sex, maturity, length, and collected otoliths from all Sebastes spp. according to the sampling criteria in the 2008 Bycatch Sampling Manual. In 2008, IPHC samplers in Area 2B sampled 2,578 rockfish (representing 13 different species) for length, sex, and maturity, and collected 2,571 otolith pairs. These data were then shared with DFO. This project is expected to continue in future years.

Yelloweye rockfish sampling in Alaska

A total of 881 yelloweye rockfish were sampled in Alaska in cooperation with ADF&G.

IPHC biologists also sampled incidentally-captured yelloweye rockfish according to ADF&G protocol. Samplers recorded length, weight, sex, and removed both otoliths from all yelloweye rockfish encountered by survey vessels working in Area 2C and in the Fairweather charter region in eastern 3A. Eight-hundred-eighty-one yelloweye rockfish were sampled in 2008 in Alaska, from which otoliths were collected.

Pacific cod length frequencies

NMFS's Alaska Fisheries Science Center requested and received data from Pacific cod captured on IPHC surveys to bolster data currently used by NMFS to assess the Bering Sea and Aleutian Islands Pacific cod stock. Samplers on the

IPHC survey vessel working the Bering Sea shelf edge in the 4A Edge and 4D charter regions collected Pacific cod length frequency data on all stations. In 2008, samplers aboard the *F/V Kema Sue* collected 5,093 Pacific cod lengths. This project is anticipated to continue in 2009 and will be modified based on experience gained in 2008.

Fish sales

Legal-sized halibut caught on SSA survey stations were retained and sold to offset costs of the survey program. Halibut caught on rockfish index stations are released after measuring and not retained for sale. Survey vessels also retained and sold incidentally captured rockfish (*Sebastes* and *Sebastolobus* spp.) and

Offloading the halibut catch at Ressurection Bay Seafoods in Seward, AK. Photo by Drew Barrett.

Pacific cod (*Gadus macrocephalus*). Rockfish and cod were retained because they are generally dead or dying from distended swim bladders when they are brought aboard the vessel. The IPHC does not retain proceeds from the sale of incidentally captured rockfish; instead, proceeds are split between the vessel and the state agency to offset costs of additional work. IPHC-chartered vessels delivered fish to 24 different ports during the 2008 SSA survey. Fish sales were awarded based on the objectives of obtaining a fair market price and distributing sales among buyers and ports. When awarding sales, the Commission considered the price offered, the number of years that a buyer had been buying and marketing halibut, how fish were graded at the dock (including the determination of No. 2 halibut and chalky fish), and the promptness of settlements following deliveries.

Proceeds from the sale of rockfish are directed back to the state agencies and the vessels to offset costs of the addtional work.

Obtaining fair market value was the main consideration in awarding fish sales. However, sales were awarded to buyers offering slightly lower

prices when some of the other factors were considered, thereby meeting the goal of distributing sales among as many qualified buyers as possible. Sales arrangements were evaluated after each event to ensure that each buyer was meeting IPHC's standards.

Catch per unit effort

As the SSA covers commercial as well as non-commercial grounds, the average CPUE for all regulatory areas surveyed remained below that of the commercial fleet. Not all of the CPUE data included in this report are used in the analytical stock assessment. Several of the SSA stations fall outside of the analytical boundaries for Area 4A, and some of the inside stations in southeast Alaska occur at a different density than the acceptable level for the analytical model. In addition, four stations in the Charlotte charter region listed in this report as Area 2B fall under Area 2C for the analytical assessment.

Survey CPUE declined in several Gulf areas and increased in Area 4.

Compared to the 2007 results, CPUE decreased in Regulatory Areas 2C (-22 percent), 3A (-11 percent), and 3B (-35 percent), remained unchanged in Regulatory Area 2A, and increased in Regulatory Areas 2B (58 percent), 4A (24 percent), 4B (20 percent), 4C (48 percent), and 4D (17 percent). Downward trends have been seen in Area 2C for the last five years and in Area 3A for the last four years, while 4A ended a five-year downward trend this year.

Compared to 2007 results, charter regions on the edges of halibut range (Attu, 4D Edge, PWS, and Oregon) all experienced an increase in CPUE in 2008. In the Aleutian chain charter regions as a whole, CPUE appears to be leveling off; the Adak and Unalaska charter regions' CPUE was only slightly lower in 2008 and the Attu charter region experienced a slight increase in CPUE. The 4A Edge and 4D Edge charter regions' CPUE has leveled off over the last few years and experienced a slight rebound, coincident with reduced commercial harvest limits in those areas.

All five charter regions in Area 3B showed decreased CPUE in 2008. Within Area 3A, it is interesting to note that the easternmost charter regions on average experienced an increase in CPUE while the westernmost regions all saw a decrease in CPUE.

In Area 2C, the Ketchikan and Ommaney charter regions showed decreased CPUE while Sitka showed an increase. In 2B, CPUEs increased in all charter regions, with the largest increases in the northern half. In 2A, CPUE dropped in the Washington charter region while rising slightly in the Oregon charter region. As a whole, the rockfish index stations in Area 2A had higher CPUE than the region as a whole, an anticipated result because most of the rockfish index stations are near standard grid stations with the highest CPUE.

Stations clustered around the Pribilof Islands and St. Matthew Island, which were part of the Eastern Bering Sea survey in 2006, have been incorporated into the standard grid survey. Of these clusters of stations, the St. George Island cluster had the highest CPUE, as well as the highest CPUE for a single station in these clusters.

The distribution of sublegal- and legal-sized halibut by depth was consistent with previous surveys showing higher abundance of sublegal-sized fish in shallow waters and a wide variation in depth occurrence for legal-sized fish.

Bycatch

At least 100 unique species of fish and invertebrates were caught as bycatch during the survey. Despite vigilant deployment of bird avoidance devices, one black-footed albatross was taken in 2008.

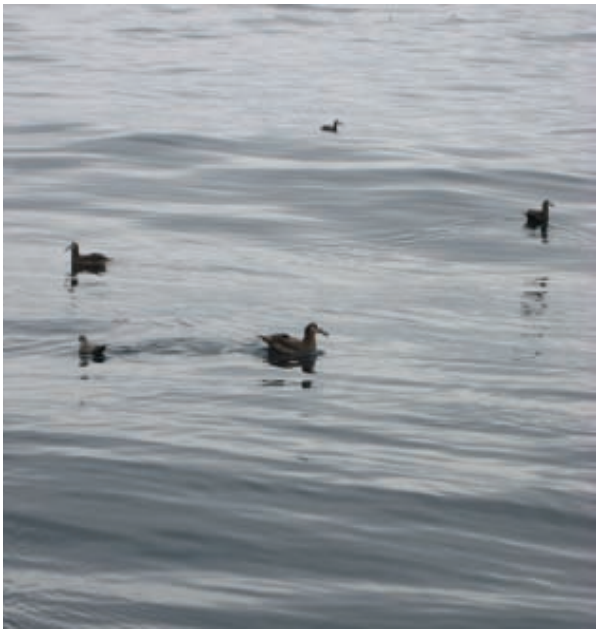
The most frequently encountered incidentally captured species on 2008 surveys was Pacific cod, followed by spiny dogfish. Most common bycatch in Areas 2A, 2B, 2C, and 3A was sharks, primarily spiny dogfish. The most frequent bycatch in Areas 3B, 4A, 4B, 4C, and 4D was Pacific cod. Although the most frequently encountered bycatch species in Areas 4B and 4C was Pacific cod, the 'other species' group, composed primarily of white-blotched skates (*Bathyraja maculata*), Alaska skates (*Bathyraja parmifera*), and yellow Irish lord sculpins (*Hemilepidotus jordani*), was also abundant in these Areas.

The most frequently encountered bycatch on the survey was Pacific cod and spiny dogfish.

Dogfish were the largest component of the shark species category in Area 2A (92 percent), Area 2B (99.8 percent), Area 2C (97 percent), Area 3A (95 percent), and Area 4B (87 percent). Sleeper sharks (Somniosus pacificus) made up the largest component of the shark species category in Area 3B (59 percent), Area 4A (64 percent), and 4D (100 percent). No sharks were captured in Area 4C. In 2008, IPHC survey vessels encountered blue sharks, sixgill sharks, and soupfin sharks in Areas 2A and 2B. Salmon sharks were encountered in Area 2C.

Seabirds

IPHC sea samplers conducted 1,293 seabird counts on twelve charter vessels between May 28 and August 31, 2008. During 178 of the counts, birds were absent from within a 50-meter radius of the stern. On the remaining counts, 57,082 birds were observed. Nineteen unique species were identified and seven unidentified bird categories (e.g., unidentified gull species) were used. Northern fulmars made up 77 percent of the total number of individual bird species seen. The center of their abundance was Area 3B. The second most abundant species was the glaucous-winged gull, of which 6,609 individuals were recorded. Glaucous-winged gulls were seen in all areas surveyed and were most numerous in Area 4B.



Albatrosses and other seabirds are often sighted near the survey vessels. Photo by Drew Barrett.

Black-footed albatross were next most abundant overall, with most being recorded in Area 3A. Laysan albatross were observed primarily west of Kodiak Island and were at their highest density in the western Aleutian Islands, where 484 individuals were counted. Because of their listing as an endangered species,

all short-tailed albatross sightings were recorded. Forty-five short-tailed albatross were seen during the seabird counts (30 inside the count area and 15 outside); they were observed in all our survey regions except Areas 2A and 4C. Four short-tailed albatross were recorded outside of the hauling events (while vessels were steaming or drifting). Typically, bird species seen outside the count area are the same as inside, but in different abundances. This was true in 2008 except for bald eagles, two of which were seen in Area 2C and three arctic terns that were seen in Area 3A. Both of these species were recorded only outside of the 50-meter count circle. There were two species new to the bird counts recorded this year: three south polar skuas were seen in Area 3A (two inside the count area and one outside) and two parakeet auklets were recorded in Area 2B off Prince Rupert.

Otolith collection

The otolith collection goal for the 2008 survey was 2,000 otoliths per regulatory area, with a minimum target of 1,500 per area. In Areas 2A, 4C, and 4D we did not attain the minimum target. Because of lower catch rates and fewer stations than other areas, it is common to collect fewer than 1,500 otoliths in Areas 2A, 4C, and 4D, despite sampling every fish caught. In 2B, where higher than anticipated catch rates were encountered, otolith collection exceeded the target number by nearly one-third.

The median length of halibut caught dropped 2 cm from 2007.

Length distribution

The median length of all halibut caught on survey stations in 2008 dropped to 81 cm, which is below the legal size limit and represents a 2-cm decrease from 2007. Areas 2B, 2C, 3B, 4A, and 4C all had average lengths below the legal size limit. The largest median lengths were found in Areas 4B (93 cm) and 4D (88 cm). In comparison to median lengths for each regulatory area in 2007, the median lengths from 2008 decreased in Area 2A, 2C, 3A, 3B, 4A, and 4D and increased in Areas 2B and 4B.

Sex ratio of the catch

The gender of every legal-sized halibut was recorded, except if its gonads were lost on deck or were missing due to predation. Because sex determination on survey vessels is accomplished by the removal and examination of the gonads, samplers recorded the gender of only those sublegal-sized halibut that were selected for otolith removal as well as those that died during capture.

The sex composition for halibut from the survey catches showed considerable variation across most areas, ranging from 36 percent to 80 percent females. These figures are consistent with previous years' results. In general, the regions to the west of the central Gulf of Alaska (Areas 3B, 4A, and 4B) had lower percentages of females in the catch. It is interesting to note that these areas have had the lowest historical exploitation rates. Area 4C again had the highest percentage of females in the catch. Most female halibut caught in the period during which surveys are conducted (i.e., summer months) are in the ripening stage and are expected to spawn in the coming fall and winter.

The 1999 year class accounted for the largest numbers of halibut sampled.

Age distribution of the setline survey

The 1999 year class (nine-year-olds) accounted for the largest proportion (in numbers) of sampled halibut for all areas and sexes combined in 2008. The

next most abundant year classes were 1998 and 2000 (10- and eight-year-olds) respectively.

Of female halibut sampled, nine-year-olds were the most abundant age class in Regulatory Areas 2, 3B, 4A, and 4B as well as for females from all areas combined. The second and third most abundant age classes for sampled females were 10- and eight-year-olds, respectively.

The 1999 year class (nine-year-olds) was the largest for male halibut from Areas 2A, 2B, 2C, and from all areas combined. The second and third most abundant age classes for sampled males were 10- and 13-year-olds, respectively.

Not unexpected, average age was higher and length lower in males versus females.

Average age was higher and average fork length was lower for males than females in all areas for all years with the exception of Area 4C in 2008, where average age was slightly lower for males than females.

The youngest and oldest halibut in the 2008 setline survey samples were determined to be five and 47 years old. There were 16 five-year-olds: 10 females measuring between 48 and 62 cm, and six males measuring between 39 and 59 cm. The oldest fish was a 47-year-old male from Area 4D with a fork length of 127 cm. The largest halibut in the 2008 setline survey otolith collection was a 203-cm female from Area 4D, which was determined to be 26 years old. The smallest halibut sampled in 2008 measured 39 cm in length and was a five-year-old male from Area 4A.

Cruise report for the 2008 NMFS Bering Sea trawl survey

In 2008 the Commission participated in NMFS's annual Bering Sea shelf trawl survey for the eleventh straight year. The survey is a continuation of a time series started in 1975, and continued annually since 1979. Two chartered fishing vessels were each staffed by six scientific crew who carried out objectives related to stock assessment and year-class strength for numerous species. An IPHC biologist was aboard one vessel for the duration.

NMFS biologists, Claire Armistead and Alison Vijgen, sort the catch aboard the *F/V Arcturus*. Photo by Cal Blood.

The 2008 survey spanned a geographical region from the eastern Bering Sea continental shelf from inner Bristol Bay to the shelf break, and between Unimak Pass to north of St. Matthew Island. Two vessels were chartered by NMFS: *F/V Aldebaran* and *F/V Arcturus*. An IPHC biologist was aboard the *Aldebaran* for the duration of the charter.

The scientific crew boarded the *Aldebaran* on May 30 and concluded on July 24. A total of 376 stations were fished during the survey by both vessels. The stations were positioned on a 20 nmi x 20 nmi grid on the continental shelf in the eastern Bering Sea, in depths ranging from 30-200 m. In areas surrounding St. Matthew and the Pribilof Islands, grid block corners were also sampled to better assess blue king crab (*Paralithodes platypus*) concentrations. Survey sampling began in Bristol Bay and progressed westward toward the EBS outer shelf along alternate grid columns.

Halibut on board the trawl survey (where there is an IPHC sampler), are scanned for PIT tags, but none have been found on this survey to date.

Halibut sampling

Halibut were sampled for length on all standard survey tows aboard both vessels. Halibut 55 cm or larger from tows aboard the *F/V Aldebaran* were additionally sampled for otoliths, gender, maturity, prior hooking injuries, and scanned for PIT tags. Halibut caught in tows at the corner crab stations, the duplicate tows, and all tows aboard the *F/V Arcturus* were excluded from the individual specimen sampling but were measured and scanned, then discarded alive if possible. All assessment standards for maturity and PHI were the same as used in the IPHC setline survey. From the 207 standard tows fished by the Aldebaran, 1,711 halibut were captured and sampled. Of those, 51 percent were female and 49 percent were male. No PIT tags were detected.

Prior hook injuries

In the mid-1990s, halibut fishers began to notice increasing rates of hook injuries from previous captures. Although groundfish and halibut longline harvesters in Alaska are required to practice careful release techniques for all halibut intended for return to the sea, it was suspected that either the regulations were not being observed by all fishers, or that careful release procedures were inflicting worse damage than expected. The IPHC standardized stock assessment surveys provide a means of examining geographic and size trends in hook removal injuries across the entire range of halibut in the northeastern Pacific Ocean and Bering Sea.

In 1997, prior hook injury data were collected during the IPHC coastwide survey for the first time. The collection method proved to be successful and allowed us to continue the research of prior hook injury incidence in 1998 and subsequent years. In 1998, the prior hook injury categories were expanded to more closely reflect those used by NMFS observers. These new classifications provided more details about the severity of an individual injury.

Data collection procedures and results

All halibut captured during the 2008 IPHC grid survey were examined for the presence of PHIs which totalled approximately 75,000 halibut. Of those, 5,121 halibut were found to have a prior injury. On a regulatory area basis, the

percentage of halibut with a prior injury ranged from a low of 3.9 percent (Area 3A) to a high of 23.4 percent (Area 4D) and averaged 7.1 percent coastwide. The 2008 coastwide prior hook injury rate was higher than that of either 2007 (6.6 percent) or 2006 (6.5 percent). The incidence of prior hook injuries on the 2008 surveys decreased in Areas 2C, 3B, 4A-Aleutians, 4A-Bering Sea and 4B. The decrease was marked in Area 4A-Aleutians (4.5 percent from 13.4 percent). Prior hook injury rates increased in Areas 2A, 3A, 4C and 4D, markedly so in Areas 4C (15.1 percent up from 8.1 percent) and 4D (23.4 percent up from 15.3 percent). Rates remained relatively unchanged in Area 2B. Comparing across areas, the highest 2008 PHI rates were in Areas 4C (15.1 percent) and 4D (23.4 percent).

The incidence of PHI varied widely from 3.9 to 23.4 percent.

IPHC samplers on board NMFS trawl surveys in the Bering Sea region also gathered PHI data. In the 2008 Bering Sea trawl survey, 1,711 halibut were inspected and PHI rates were 2.4 percent, about the same as the 2.2 percent seen in 2007.

In 2008, the rates have increased markedly in Area 4D, and notably in Areas 2A and 3A. Rates have fallen markedly in Area 4A- Aleutians. Also in 2008, the proportion of moderate injuries in Areas 2A, 3A, and 4D increased relative to the minor injuries. The distribution in other areas remained relatively unchanged.

The overall rate of prior hook injuries in 2008 remained at about the same high level as seen in recent years. The high prior hook injury rates observed on IPHC surveys in the Bering Sea and Aleutians most likely reflect the interception of halibut by the Pacific cod groundfish fisheries in those areas.

The 2008 survey team including Seattle staff and sea samplers. IPHC photo archive.

PIT and wire tagging

The IPHC uses various types of tags to examine migration, survival, and harvest rates.

In 2003, the Commission undertook a large-scale mark/recapture experiment using passive integrated transponder (PIT) tags. A PIT tag is about the size of a grain of rice and is composed of an integrated circuit chip and antenna coil encapsulated in glass. Each tag has a unique alphanumeric code that can be transmitted and read in situ when the tag is energized by an electronic reader. The experiment will provide the IPHC with unbiased estimates of exploitation rates independent from the assessment model. A secondary objective of the program is to provide information on migration.

IPHC PIT-tagged and released 43,999 halibut coast-wide on longline surveys between late May and early September 2003 in what is referred to as the primary experiment. An additional 23,437 PIT tags were released in 2004 in IPHC Regulatory Areas 2B and 3A. Several pilot studies for evaluating tag insertion sites were also conducted by the IPHC in 2001 and 2002. Prior to large-scale deployment, two demonstration charters using the primary experiment protocol were conducted, and to evaluate PIT tag shedding rate in situ, a double-tagging study (using both external wire and PIT tags) took place in 2003. Recoveries from the pilot studies, demonstration charter, and double-tag experiments are also reported in this document.

IPHC scan sampler, Theresa Vavrina, looks for PIT tags during an offload in Seward, AK. Photo by Lara Erikson.

Except for a few of the early pilot study releases, halibut were PIT tagged in the white side of the head on the opercular plate, just below the preopercular groove. Scanning equipment was selected and portside scanning protocols were developed in 2002.

Port staffing

In Alaska and British Columbia, scan samplers were deployed in the same ports staffed by IPHC port samplers, with the addition of Ucluelet and Tofino in BC. Sampled ports received a major portion of the commercial catch.

As in previous years, IPHC hired seasonal employees for Alaska, while BC ports were sampled under a contract with Archipelago Marine Research (AMR). The start of portside commercial scan sampling was concurrent with the start of the fishing season, with sampling beginning March 8 in the Alaskan ports of Petersburg, Sitka, Juneau, Seward, Homer, Kodiak, and Dutch Harbor, and in the BC ports of Port Hardy, Vancouver, Prince Rupert, Ucluelet, and Tofino. Sampling in these ports was continuous through November 15. Scan sampling was conducted in St. Paul, AK between July 1 and August 30 in 2008. A scan sampler was hired for a two-month contract in St. Paul in 2008. In previous years, St. Paul was staffed by rotating one of the southeast Alaska scan samplers in for one or two months during the summer.

In Area 2A, the sport catch is also scanned for PIT tags because is comprises a large portion of the total catch in the area.

Scan sampling in Area 2A in 2008 began in March with the Washington tribal commercial fishery. The Washington tribal commercial fishery was sampled from March through April in the ports of Neah Bay and Westport by Makah Fisheries Management and Quinault Fisheries staff, respectively. Non-tribal commercial scan sampling in Area 2A took place in Newport, Oregon for all four fishing periods that occurred between mid-June and late July. Halibut landed as incidental catch in the Washington sablefish fishery were sampled in Bellingham from May through October.

Area 2A is the only regulatory area where scanning is done on sport catch, because a relatively large portion (38 percent) of the 2A quota is allocated to the sport fishery. As in 2007, scanning of Area 2A sport-caught halibut was conducted in the Oregon ports of Newport, Depoe Bay, Garibaldi, and Charleston by ODFW staff between May and October. Scanning of the Washington sport fishery was conducted by WDFW staff in the ports of Ilwaco, Westport, La Push, and Neah Bay between May and August.

Commercial and sport landing scanning results

The sixth year and fifth full season of the PIT scan sampling program went smoothly with continued good cooperation from processors. Scanning was conducted from March 8 through November 15 in 2008 and 998,014 halibut were scanned during that time. Scanning rates were calculated by dividing the estimated pounds scanned by landed weight for each regulatory area. The overall coastwide scanning rate was 40 percent and scanning rates were greater than 25 percent in all areas except Area 4B. Estimated pounds scanned were calculated for each area by multiplying the pieces scanned for that area by the average weight of halibut in the 2008 commercial catch for that area. Average weights by regulatory area for the 2008 commercial catch were estimated from commercial catch samples. Estimated poundage scanned for the Area 2A sport fishery was calculated by multiplying the number of fish scanned by the average weight of halibut in the 2008 Washington and Oregon sport fisheries.

Seventy-four percent of scanned halibut were scanned 'head-on' or whole. Samplers detected 430 PIT tags over the season: 261 were releases from the primary experiment conducted on the 2003 setline survey; 162 were recoveries of tags released in 2004; seven were recoveries of tags from demonstration charters conducted in 2003; and an additional recovery was a tag released in the 2003 double-tag experiment.

May was the busiest month for scanning for all ports combined, followed closely by June. In terms of numbers scanned, April was the busiest month for Area 2C, May was the busiest month for Areas 2A and 3A, June was the busiest month for Area 4B, August was the busiest month for Areas 3B, 4A, 4C, and 4D, and October was the busiest month for Area 2B. The months with the most fish scanned corresponded to the months with most pounds landed in all regulatory areas except for 2B, 2C, 3B, and 4B.

Scanning takes place on the IPHC setline survey and a total of 55 tags were detected. Of those, 48 were found within the statistical area of release.

Survey vessel scanning results

A total of 73,333 halibut were scanned on the summer setline surveys in 2008 and 55 PIT tags were recovered. Of the 55 tagged fish recovered, 38 were captured on the station of release and 48 were recovered within the statistical area of release. Four of the 55 recovered tagged fish were caught in a different regulatory area than the one they were released in.

Scanning of some survey deliveries was conducted in 2003 and 2004 either as part of the pre-scanning process during PIT tagging operations or in conjunction with portside seeded detection tests.

Sea samplers onboard NMFS trawl surveys were instructed to scan all halibut >55 cm beginning in 2006. A total of 375 halibut (363 on regular groundfish tows and 12 on crab tows) was scanned in 2008 on the Eastern Bering Sea (EBS) survey. Twenty-three halibut fitting the scanning criteria were not scanned because of equipment failure. Since scanning began on these surveys, no PIT tags have been detected.

No wire tags from experiments employing only that tag type were found in 2008.

Wire tag recoveries in 2008

Recoveries from experiments using wire tags only

The IPHC has not conducted experiments which employed wire tags exclusively since 1995, therefore recoveries from these experiments are becoming increasingly rare. No tags from experiments using wire tags only were recovered in 2008.

Recoveries from experiments using both wire and PIT tags ("double-tag" experiments)

A double-tag experiment using both wire and PIT tags took place during September 2003 in Hecate Strait, BC. The purpose of the experiment was to determine the *in situ* PIT tag shedding rate. A total of 2,661 fish was tagged with both a wire and PIT tag.

There were 35 recoveries from the 2003 double-tag experiment in 2008. Of the 697 fish recovered to date from the double-tag study, 674 were scanned to determine whether their PIT tags were working. Fourteen PIT tags were found to have shed and an additional two were present but broken for a combined shedding/breakage rate of 2%.

In some cases, only the PIT tag was found from the double-tagged fish. Generally, if a PIT tag is found during scanning, the scan sampler examines both sides of the head. In some cases, the PIT tag was found in the memory of the hand-held scanner after the offload, so the head was not examined for the presence of a wire tag. Of the 697 recovered double-tagged fish, three heads were not examined for the presence of a wire tag. Wire tags were found to have shed from 38 recovered double-tagged fish, for a shedding rate of 6%.

Through 2008, over 98% of the recoveries from the 2003 double-tag experiment have taken place in BC waters. Nine double-tagged fish have been recaptured in southeast Alaska, one was recovered in Washington and one in Oregon.

Archival tagging to study halibut migration and behavior

In 2002 the IPHC began an electronic archival tagging program designed to investigate seasonal movements of halibut. This program has five main goals: 1) quantify migration distances between summer and winter grounds, 2) identify winter spawning areas in poorly-studied regions such as the Bering Sea, 3) examine basin-specific proportions of interannual site fidelity and straying, 4) define seasonal migration periods and seasonal depth-specific habitat use, representing the stock's transition between shallow-water summer distribution and deep-water winter distribution, and 5) define active spawning periods on a regional basis as evidenced by short-period vertical migratory behavior.

Archival tags come in several forms including a pop-up variety that doesn't require recapture of the fish as well as internal and external tags that stay with the fish, but can be attached to smaller animals.

To date, these processes have been examined through the use of electronic Pop-up Archival Transmitting (PAT) tags that allow us to study movements and behavior without the need to recapture fish. The IPHC has deployed 316 PAT tags on halibut in both the Gulf of Alaska (GOA) and eastern Bering Sea. GOA deployments have confirmed a pattern of northern winter aggregation, but have also indicated that a potentially large proportion of the population may remain at southern grounds during the winter. Bering Sea deployments have indicated very limited movement and potential local population structure along the Aleutian Islands. In addition to studying putative spawning migrations, PAT tagging has been used to identify active homing to summer feeding grounds and characterize seasonal migratory and active spawning periods.

While PAT tags have proven valuable for studying a variety of processes, deployments of more than a year are inadvisable due to tag loss and battery-life limitations and the tags' relatively large size has prevented us from extrapolating the results across population components.

The long-term objectives of the present program are to obtain data on seasonal depth distribution, vertical migration, putative spawning behavior, and light-based longitudinal estimates for halibut over a broad range of sizes that includes those too small to tag using PAT tags, and in situations where multi-year data are desirable. In particular, we wish to better define seasonal migratory and active spawning periods on a regional basis, determine at what age halibut begin regular forays to deep water for the winter months, whether individual fish display consistent behaviors from year-to-year, and whether male and female fish differ in their behavioral patterns. Archival tags, including the types used in the studies described below, have been proven an effective tool for studying behavior and environmental conditions experienced by a variety of marine fish species.

This halibut has been fitted with an external archival tag. Photo by Tim Loher.

We have begun studying the utility of long-term archival tags as a tool for studying halibut behavior with two experiments: one to test whether tags can be successfully implanted into the gut cavity of halibut, and a pilot field experiment in which externally-mounted tags were deployed on fish captured off the coast of British Columbia.

Twenty four halibut were captured to test how well the archival tags function while attached to a moving fish.

Fish collection

A total of 24 halibut ranging from 65-90 cm FL (26-35 in) were collected aboard the *F/V Heidi Sue* (homeport: Newport, OR) on July 31, 2006. Retained fish were landed at the port of Newport and trucked to the Oregon Coast Aquarium in Newport, OR in insulated fish totes containing sea water aerated with pressurized oxygen. The fish were transferred to a 9.1 m (30 ft) diameter pool filled to a depth of 0.9 m (3 ft) with circulating seawater maintained at 10-11° C (50-52° F) and held for a period of 80-81 days prior to tag implantation. Three fish died shortly after transfer to the holding facility, apparently from capture and transport stress. A fourth fish was euthanized in October due to a very heavy load of trematode ectoparasites that presented a health risk to the other fish. The remaining 20 halibut were randomly assigned to four treatment groups, representing each of the three tag-types plus a control group in which fish were handled identically to the other treatments but upon which surgery was not conducted. All fish were given three months to recover from capture stress, after which the fifteen experimental fish were implanted with archival tags. After another 14 months of captivity, fish were removed from the pool, their growth evaluated, and some of the fish were dissected in order to inspect the tags and gut cavities for physiological interactions.

Holding experiment

Of particular concern at the outset of this experiment was the possibility that the fish may have been able to expel the tags over time. Although to our knowledge the possibility of tag expulsion has never been examined in pleuronectids, it has been demonstrated in salmonids and in channel catfish (*Ictalurus punctatus*). No tag expulsion was observed here for Pacific halibut after more than a year of post-surgical holding. Thus, it appears that halibut implanted with archival tags will have a high probability of retaining the tags for periods on the order of years, allowing considerable opportunity for tag recovery. However, we did observe physiological interactions, including deposition of protein and bony material on the tag surfaces, and encapsulation of tags in either the body wall or intestines. These observations create an important logistical caveat: considering that halibut are eviscerated at sea, encapsulation of tags in any form of tissue will reduce the probability of tag detection upon recapture.

Canadian tag releases

Given the results of the holding experiment, our first archival field release utilized an external tag mount that was deemed easier to detect than internally-implanted tags. The method was developed by Norwegian researchers who are studying Greenland halibut (*Reinhardtius hippoglossoides*), and involves mounting the tags to a plastic cradle that is then fixed to the halibut's dark side using wires threaded through the dorsal musculature and attached to a backing plate that rests on the fish's white side. A total of 162 halibut (an equal number of males and females, ranging from 71-151 cm) were tagged during August-September, 2008, in three regions: 42 off northern Vancouver Island, 60 off the southern Queen Charlotte Islands, and 60 off the northern Queen Charlottes. Four fish (all female; 74-108 cm FL) were tagged with internally-implanted tags. At time of writing, five of the externally-mounted tags had been recovered: four by the longline fleet and one by a commercial bottom trawl vessel. All recovered tags were from the northern Queen Charlotte Islands group, and all were recovered relatively close to their tagging locations. Displacement between tag and recapture ranged from 1-31 km (0.5-19.4 mi).

Veterinary ultrasound may prove to be an effective way to determine sex of tagged halibut prior to release.

In addition to deploying a considerable number of archival tags, the 2008 field work clearly demonstrated the utility and accuracy of veterinary ultrasound for non-invasive sexing of halibut of all legal sizes, as well as those considerably smaller. Although it may also be possible to visually assess sex using external characteristics, this technique requires practice, its accuracy is somewhat sampler-dependent, and is difficult or impossible for small fish. Ultrasound has been proven effective for evaluating sex and maturity in numerous flatfish species, including winter flounder (*Pseudopleuronectes americanus*), yellowtail flounder (*Limanda ferruginea*), and Atlantic halibut (*Hippoglossus hippoglossus*), and so it is unsurprising that we found it highly effective for Pacific halibut, as well. Unlike using external characteristics to evaluate sex, ultrasonic sexing also allows us to capture image files and video that can be archived for future reference. Should there ever be questions regarding determinations made in the field, these files can be reviewed, provided that the images were taken along standard scanning axes so that the diagnostic features of the gonads are clearly visible. The technique developed during this study has clear application in tagging programs: the sex of all fish can be determined at the time of tagging,

IPHC research scientist, Tim Loher, experiments with veterinary ultrasound as a means to determine sex of live halibut. Photo courtesy of Tim Loher.

target tagging goals can be incorporated into experimental designs and adhered to in the field, and sex-specific *post hoc* data analyses can be conducted. The latter have been largely elusive to date due to the lack of sex information obtained from commercially-recaptured halibut. Additionally, there is little logistical reason why the method could not be used to obtain sex data for untagged halibut that are normally returned to the sea alive, such as sublegal fish captured on survey that fall outside of otolith subsampling guidelines. The method is fairly rapid, taking a similar amount of time as that required to scan for PIT tags.

PAT tags to study dispersal and migration timing in Area 4

When a satellite tag pops to the ocean surface, location can be determined via satellite to within 50 meters.

During the summer of 2008, a PAT-tagging project was initiated in order to investigate why so few PIT tags were recovered from halibut tagging in the Bering Sea and Aleutian Islands region. One hypothesis for low recovery rates is potential movement of fish into areas where they would exhibit relatively low catchability, such as dispersing over the broad eastern Bering Sea shelf or moving into the Bristol Bay closed area. Of particular relevance to the present study is the fact that PAT tags do not need to be physically recaptured in order to generate accurate endpoint locations. On a pre-determined date, the tags release from the host fish, float to the surface, and emit signals; the Doppler shifts of the tags' broadcast signals are used to determine their location to within as little as 50 meters, no matter where the fish are located at tag release. The resulting recovery data are free from spatial recapture biases arising from variance in fishery-based catchability, reporting, or tag detection. At the same time, the satellite uploads the depth and temperature data collected by the tags while they were on the fish.

In addition to its relevance to analysis of PIT tagging results, the study is linked with genetic work and summer-to-winter PAT deployments investigating the hypothesis that deep Aleutian passes serve to reduce east-west dispersal rates. According to this hypothesis, the Near and Rat Island groups would be most isolated and most likely to support independently-operating subpopulations, with intermediate isolation in the Andreanof group relative to the remainder of the eastern Bering Sea shelf. Furthermore, archived depth summaries broadcast

by satellite can be used to assess when individual fish are resident on shallow summer feeding grounds and deepwater winter spawning grounds and determine the timing and duration of migratory phases between shallow and deep-water habitats, and detailed short-period depth data downloaded from physically-recovered tags can be used to define periods of putative spawning.

This information may be useful for assessing match or mismatch between timing of commercial fishery season opening and closing dates relative to seasonal redistribution periods and the active spawning season and represents a geographic extension of prior studies conducted in the Gulf of Alaska (GOA) and US Pacific Northwest and recent Area 2B archival tag deployments. While archival tag data from the GOA have begun to refine our understanding of seasonal processes within the halibut population, there is reason to believe that migration- and spawn-timing vary between ocean basins and along longitudinal gradients, as has been observed in the GOA for flathead sole (*Hippoglossoides elassodon*).

The work represents a single coherent project, but will address four separate sub-questions within the BSAI: 1) the relative fates of Area 4 fish located north versus south of the AI Chain, 2) the fate of 4B fish, with emphasis on potential differences in dispersal between the Andreanof Island section and the Near-Rat islands section, 3) the fate of fish along the 4D Edge and the major island systems of the southeast Bering Sea shelf (i.e., St. Matthew and the Pribilof islands), 4) timing of onshore-offshore migration throughout the BS/AI region.

Progress in 2008

PAT tags are unique in appearance. The body of the tag is shaped much like a microphone, and contains light, depth (pressure), and temperature sensors, as well as programming circuitry and a satellite transmitter. The tags were attached to the fish via an 18 cm (7”) leader constructed of monofilament line and were secured to the fish using a titanium dart embedded through the pterygiophores, roughly 4 cm medial to the dorsal fin, on the eyed-side of the halibut where the body begins to taper towards the tail. The leader was attached to the tag body via a thin metal wire, and on the programmed date, an electrical current will be induced that causes the metal to rapidly corrode, the tag to release and float to the surface, and data transmissions to begin. Data will be transmitted to the US National Oceanic and Atmospheric Administration’s (NOAA) polar-orbiting satellites, administered by the Advanced Research and Global Observation System (ARGOS). Summarized temperature and depth data, depth-temperature profiles and light-based geoposition estimates will be broadcast. The tag’s endpoint position will be determined from the Doppler shift of the transmitted radio frequency in successive uplinks received during one satellite pass. If fish are captured and the tag retrieved before the pop-up date, the full archival record can be accessed, from which highly detailed environmental data and daily geoposition estimates may be obtained.

Although the tags record a reading every 30 seconds, the satellite summary is condensed to 8-hour blocks.

The tags were programmed to record temperature (0.1° C resolution) and depth (4 m resolution) every 30 seconds and ambient light levels every minute. However, detailed depth and temperature data will not be provided in satellite transmissions. Data will be transmitted as summaries within consecutive 8-hr blocks, within user-defined depth and temperature intervals and as depth-temperature profiles. Complete data can be retrieved only if the tag is recovered. Release was programmed for 01:00 hr Coordinated Universal Time (UTC), 365

days following the deployment date. Each tag's internal software should have begun a 365 day countdown as soon as the tag reached 10 m water depth.

A total of 115 adult halibut were tagged by IPHC sea samplers during the 2008 IPHC summer setline survey, aboard three survey vessels in four charter regions. A total of ten tags were obtained for deployment at St. Matthew Island, but low catch rates at the survey stations precluded deployment of all tags and survey specifications did not contain a provision to fish additional gear in order to complete the tagging. Thus, only five tags were deployed in 2008; the remaining tags were returned to Seattle and will be deployed in 2009. Unlike previous PAT tag studies, fish of all commercial sizes were tagged. Previously, only fish smaller than 105 cm (43.5 in) have been deemed appropriate for tagging based on the results of behavioral studies of captive halibut. However, tagging and observation of an 86 cm FL captive halibut in 2006 indicated that modifications to the tags' leader-length and attachment orientation could alleviate the size constraints and allow broader tag application. Halibut tagged in 2008 ranged in length from 82-171 cm.

On July 31, one tag was recaptured by the commercial fishery at St. Matthew Island; the fish was recaptured approximately 8 km (5 mi) from its tagging location. In addition, through the end of November, 2008, a total of 14 tags had released prematurely from their host fish, leaving a total of 100 tags still in the water. There appeared to be no relationship between fish size and tag retention: premature release occurred on fish ranging from 84-139 cm FL.

The Didson sonar is one possible method to help determine selectivity on the setline survey.

Estimating halibut hooking success using DIDSON sonar

The purpose of this study continues to be the verification, by direct observation, of the hooking success curve for halibut on setlines. In 2007, we collected observations using 16/0 circle hooks. During 2008, we collected additional video using 16/0 hooks, as well as what we hope to be a complete set of observations on 14/0 hooks. Halibut hooking success is an important component of the length-specific selectivity which is used in the Commission's stock assessment model. This selectivity has most recently been estimated using multiple marking experiments as being dome shaped: increasing from a low value for small halibut to a peak at some forklength around 110 to 140 cm, then dropping off again. The halibut hooking success curve was previously estimated from direct camera observations of 42 shallow-water hook attacks which resulted in 21 halibut captures. The 2007 and 2008 projects were designed to generate a larger set of observations and operate in deeper, more appropriate depths. This was possible by using the DIDSON (Dual frequency IDentification SONar) acoustic camera, which uses sound (sonar) rather than light to generate images.

Experimental design

We planned for minimum gear deployment times of one hour, with each deployment observing four baited hooks. We expected to observe 100 to 200 hook attacks. Hooking success is defined as the number of halibut bites which result in a halibut capture. Halibut size was determined using DIDSON techniques. Estimated sizes were verified by comparison with actual measurements of fish which were hooked and brought to the vessel on gear retrievals.

IPHC research biologist, Steve Kaimmer, uses DIDSON sonar to look at halibut activity on the gear. Photo courtesy of Steve Kaimmer.

Results

A 12-day experiment was conducted 11-27 May, 2008 from the 17.7-meter fishing vessel *F/V Free to Wander* in IPHC Regulatory Area 3A. Fishing locations were based on local knowledge of the vessel crew and a review of catches at IPHC survey grid stations during the previous three years. In 2008 we returned to the area off the Kodiak shelf where we had very good fishing success with this gear in 2007.

DIDSON camera and frame

The DIDSON acoustic camera provided continuous high-resolution imagery of approaches to the gear, entry into pot funnels, and escapes despite conditions of darkness and high turbidity. Fish inside and near the fish pot were also observed. The DIDSON provides multiple, high-resolution images per second across a 29º fan-shaped sector with a beam depth of 12º. The resolution is sufficient to show the body shapes of adult fish, while the update rate of eight frames per second allowed each individual fish to be tracked through the image. The 12º depth of the acoustic beams limits images to acoustically reflective objects that pass within a distance equal to 10 percent of the range above or below that fanshape, while the view provided is integrated into a single plane. Because better range resolution (limited by 256 range bins) was more important than showingthe small wedge of area within a few meters of the camera, we set the near edge of the image to 3.0 m. Objects in the resulting null area close to the camera were not directly imaged, but could produce shadows in the image. The camera was mounted so that its viewing angle could be adjusted in the vertical dimension. The main beam was above the view of the camera. A buoyed rope bridle was attached to each end of the main box beam. Deployment and retrievals were made using a 366 meter (1,200 foot) length of 1,43 cm (9/16”) American Ultra-blue line, which was then buoyed to the surface.

A hooking success of 36.2 percent was experienced during the experiment.

Results from the 2007 study

We made 68 gear deployments from August 13 to August 22, 2007. Data from six of the deployments were not available due to technical problems. From the remaining 62 gear sets, we saw 132 halibut and 130 hook attacks by halibut. Those attacks resulted in 47 captures, for an overall hooking success of 36.2

percent. The size of observed halibut ranged from 54 to 141 cm. The hooking success curve is very close to the selectivity curve predicted from survey grid tag releases and recoveries, which would suggest that most, if not all, of the halibut selectivity is due to hooking success, at least in the central north Pacific.

Fishing locations and fish catches in 2008

The vessel deployed the apparatus 105 times in total. Deployments averaged about 40 minutes in duration and were made between the hours of 6 AM and 10 PM. As in 2007, the first deployments were conducted in shallow water from the anchored vessel in order to configure the DIDSON and frame. The remaining days were spent primarily in the outside waters around Portlock Bank where catches were more favorable. As many as four halibut were caught on many of these deployments, with the catch overall averaging 1.13 halibut per set. Soak times ranged from 25 to 70 minutes (average 38 minutes) and depths ranged from 19 to 108 fathoms (average 60 fathoms). We performed cursory video file reviews after most downloads. A total of 119 halibut were caught on the 105 gear sets: 94 on 68 sets with 14/0 hooks and 25 on 37 sets with 16/0 hooks. Final detailed review and documentation of the 2008 data will be conducted during the winter of 2008 and into 2009. For each gear deployment, behaviors will be classed into one of the following categories: 1) approach or first observation; 2) lying on the seafloor; 3) biting the hook; 4) darting while hooked; and 5) successful escape.

IPHC Oceanographic monitoring in 2008

The IPHC setline survey is the largest consistent sampling program of any research agency in the north Pacific. In the late 1990s, the IPHC sought proposals on how this sampling program could be used for other scientific investigations without affecting the core survey activities. One obvious project was the collection of oceanographic data. The IPHC already recorded bottom temperature at one-quarter to one-half of the survey stations; however, the potential existed to sample other water properties as well as sample throughout the entire water column. Looking at oceanographic observations with estimates of production from the IPHC setline survey is an obvious next step to increasing the understanding of what drives the abundance and distribution of our natural resources.

The profiler program will be expanded in 2009 to include all survey vessels.

IPHC sea sampler, Tucker Soltau, prepares to deploy the profiler. Photo by Cal Blood.

Results to date

In 2008, two water column profilers were deployed coincident with survey stations off Oregon, Washington, and British Columbia. One was deployed first from the *F/V Proud Venture* in the Vancouver and Goose Island regions and then subsequently moved to the *F/V Star Wars II* for the St. James and Charlotte survey regions. The first cast was made on May 28 and the last was made on August 12. A total of 170 profiles were possible and 162 were completed successfully. The other profiler was deployed in the Washington region from the *F/V Bernice* and the Oregon region from the *F/V Blackhawk*. A total of 122 stations were possible and 119 were profiled successfully.

Future plans

In late summer 2008, the IPHC received confirmation of a large grant from NOAA for the purchase of 14 Seabird SBE19plus V2 model profilers equipped with auxiliary sensors to measure dissolved oxygen, pH, and chlorophyll *a* concentrations. The IPHC will be equipping every survey vessel with a profiler in 2009, and is working cooperatively with NOAA's Pacific Marine Environmental Laboratory to process the data in a timely manner and make it publically available via the National Ocean Data Center website.

Comparison of halibut catches on swivel gear

The Commission conducted a comparison of swivel and non-swivel gear in Regulatory Area 2B during 2008. Perlon gear with swivels on the hook eyes was tested against a non-swiveled, nylon gangion gear. No significant difference was found in the catch rates in pounds of halibut, although it appears that the non-swivel gear caught slightly more fish in numbers of both the legal and sublegal-sized halibut.

Because swivel gear has become more popular in recent years, the IPHC tested to see if there was a difference in halibut catch rates.

IPHC port samplers collect information on the type of gear used to catch halibut. Especially in Area 2B, more and more harvesters are reporting that their gear has some type of swivel as part of the gear construction. In 2001, 18 percent of the trips used swivel snap gear in B.C. (Regulatory Area 2B). This number rose to 37 percent in 2002, to 39 percent in 2003, and has reached 53 percent in a preliminary estimate of 2008 effort. As a percentage of skates hauled, swivel gear has risen from 10 percent in 2001 to almost 42 percent in 2008. This study was designed to determine the effect of using swivels on the catch rates of species subject to longline gear in Area 2B.

During August and September of 2008, we chartered the *F/V Van Isle* to conduct research fishing in IPHC Regulatory Area 2B. This was a dual purpose fishing charter, serving two experimental needs. The first experiment was a comparison of halibut fishing gear configured with and without swivels, to examine the effect of swivels on halibut and other species catch rates. The second experiment involved tagging halibut with archival tags in three survey regions of Area 2B: Charlotte, Cape St. James, and Vancouver.

The swivel experiment required 288 skates of gear, set in pairs of swivel and non-swivel gear. This gear was fished as 8-skate sets, with four pairs of skates per set. Approximately equal amounts of gear were fished in each of three IPHC survey regions: Charlotte, St. James, and Vancouver.

Fishing was conducted from August 20 through September 12, 2008. In total, 977 legal-sized halibut (22,958 pounds) were caught with an average catch

rate of 79.7 lbs/skate, and 1,250 sublegal-sized halibut were caught. All saleable bycatch was retained and sold.

Harvesters report higher retention of fish, especially during haulback, and less broken gangions when using swivels. While there was no direct evidence of this for halibut, there are a couple of factors which may have influenced results as compared to the reports from harvesters. Firstly, the swivel was located at the hook eye. While this is a common location for swivels in commercial gear, it results in a loss of the front-threaded hook orientation which we have found to increase halibut catch by as much as 30-40 percent. Having the loose swivel on the hook eye removes any positive orientation effect that the stiff gangion gives to the hook during the hooking event. Secondly, there are other possible locations for the swivel. Many snap gear harvesters have the swivel between the gangion and the snap. There are some harvesters fishing gangion gear with the swivel tied into the middle of the gangion. Neither of these orientations were tested.

The experiment did not test all swivel/ gangion orientations used in the fishery.

Halibut gear. Photo by Ivan Loyola.

Examination of genetic population structure in spawning adults of Pacific halibut: laboratory work conducted in 2008

Despite the importance of Pacific halibut, there has been little investigation of the genetic population structure of the species. Presently, the eastern Pacific halibut resource is managed under the assumption that a single fully mixed population exists from California through the eastern Bering Sea. This rests largely upon tagging studies and analyses of larval distribution indicating northwest larval drift, throughout the Gulf of Alaska and into the Bering Sea, balanced by migration of juveniles and adults to the southeast, over broad geographic expanses.

In 2002 the IPHC embarked on an effort to examine genetic population structure in halibut, using markers (nuclear microsatellites) that are theoretically more powerful than those previously employed, and seeking to remedy sampling problems that have hampered historical studies. The initial phase of the project was completed in 2003, intended simply to optimize laboratory protocols for future work. Samples collected from commercial landings at St. Paul Island (AK), Adak Island (AK) and Newport (OR) were tested for evidence of genetic

differentiation. This study provided some evidence for low-level differentiation among populations, but was limited by unsuitable sampling. These samples were collected in summer, and therefore represented individuals in non-spawning condition, potentially far away from their spawning groups.

We subsequently extended the scope of the project using samples collected from spawning aggregations near the Queen Charlotte Islands (BC), Kodiak Island (AK) and the southeast Bering Sea (AK). In addition, two historical collections from spawning populations near the Queen Charlotte Islands and Kodiak were made available, and new winter charters were conducted to obtain, for the first time, a spawning sample from the central Aleutian Islands.

As part of a longer term look at genetic populations of halibut, analysis continued on samples collected from various sites in BC and Alaska.

In addition to the increased geographic range, we also conducted preliminary mitochondrial DNA (mtDNA) sequencing experiments. MtDNA is maternally inherited, and so in species with male biased gene-flow may provide more accurate insights into population patterns. Additionally, mtDNA sequences can provide insights into demographic changes in relation to global climate change during past glaciations. The latter could be relevant to harvest policy considerations, in the context of predicting likely population-level responses to regime shifts and long-term changes in ocean temperature, in light of the indication that halibut recruitment trends may be largely climate-driven.

The work completed late in 2007 added considerably to the robustness of the nuclear DNA analysis by markedly increasing sample sizes within treatment groups, accounting for temporal issues, and expanding the geographic scope into the eastern Aleutian Islands. Still, strong evidence of geographic genetic differentiation was not found. The preliminary mitochondrial DNA analysis also provided no evidence for population structure. Although potentially more powerful analyses have not yet been applied to the mtDNA data, even at this stage the high diversity of closely related mtDNA haplotypes seems surprising. This is usually a sign of recently expanded populations, and may be the result of extremely small effective population sizes in the past, possibly during the last glaciation. We hope to investigate further by comparing patterns of genetic diversity between Pacific halibut and related flatfish species in the Atlantic and Pacific oceans.

Total mercury levels in Alaskan Pacific Halibut

Since 2002, the Commission has collected halibut muscle tissue samples during setline surveys from locations within Alaska for the Alaska Department of Environmental Conservation, as part of a larger study on environmental contaminants in fish. Summaries of the total mercury levels in samples collected from the first six years of this study show an average total mercury content of 0.340 ppm, with a trend of higher mercury levels in the western Aleutian Islands.

In recent years, reports from health officials and the media have raised the profile of mercury contamination in fish. In 2002, the Alaska Department of Environmental Conservation (ADEC), in conjunction with the U.S. Environmental Protection Agency (EPA), launched an environmental contamination study looking into levels of organochlorine pesticides, dioxins, furans, polybrominated diphenyl ethers, PCB congeners, methyl mercury (meHg), and heavy metals (arsenic, selenium, lead, cadmium, nickel, chromium) in 13 Alaskan fish species, including Pacific halibut. The Commission has

collected halibut muscle tissue samples from various locations within Alaska for ADEC every year since the inception of the study. Samples collected in 2002 and 2003 were analyzed for both total mercury (THg) and meHg (the bioactive (toxic) component of THg). Due to the cost of analysis, all samples from 2004 forward have only been analyzed for THg.

Between 2002 and 2007, a total of 981 samples were tested for THg. In 2007, the average commercially landed halibut in Alaska was 34 lbs round weight. The average THg for halibut in the 20 to 40 lb size class (most similar to the average size in Alaskan commercial landings) is 0.263 ppm (or 0.224 meHg).

As seen in previous studies, THg levels in Pacific halibut tend to increase with size and age. Additionally, the data show that for similar sized fish, males tend to have higher THg levels than females, which would be expected as males are slower growing than females.

The data also show higher levels of THg in fish collected in the Aleutian Islands chain (Attu and Adak charter regions), with mean levels in Attu of 0.501 ppm and in Adak of 0.476 ppm. The initial results from fish collected in Attu in 2005 were high enough to prompt us to collect more samples in 2007. Rather than showing a 'hot spot' of activity, this region seems to be generally high compared to other regions tested. Of interest is the rather low THg levels from the area around St. Paul Island.

The Food and Drug Administration (FDA) and EPA both have issued limits (levels of concern) for meHg in tissue (1.00 ppm and 0.50 ppm respectively) above which they recommend limits on consumption. The discrepancy in the levels arises from different methods of calculating and interpreting risk assessments. This joint study with ADEC shows that mean levels of THg and meHg in Alaskan Pacific halibut are below levels of concern of both the FDA and EPA. While the mean value for both THg and meHg is below these reference levels, there remain concerns for consumers (particularly recreational and subsistence users) who consume many meals from one large animal. In October 2007, the Alaska Division of Public Health released new fish consumption guidelines (using a reference level of 0.4 ppm.) for women who can become pregnant, nursing mothers, and children under the age of 12. The advisory has a graduated number of meals (one meal is considered a 6 oz piece of flesh, roughly equivalent to the size of a deck of cards) based on the size of the animal being consumed.

Continued collaboration with ADEC is expected over the next several years.

The Alaska Division of Public Health continues to encourage everyone else, including adult men, adult women who cannot become pregnant, and teenage boys to eat as much fish (including Pacific halibut) from Alaskan waters as they would like.

Continued collaboration with ADEC is expected on this project over the next several years. Samples from Fairweather in 2007, and from the Sitka, Prince William Sound, and Upper Shelikof (Cook Inlet) collected in 2008 have not yet been analyzed.

APPENDICES

The tables in Appendix I provide catch information for the 2008 fisheries. The areas specified are the IPHC Regulatory Areas, depicted in Figure 1 of this report. Appendix II reports on the most current sport fishing statistics.

All of the weights used are dressed (eviscerated), head off. Round weight can be calculated by dividing the dressed weight by a factor of 0.75.

Appendix I.

Table 1. The 2008 total removals of Pacific halibut by regulatory area (thousands of pounds, net weight).

Table 2. The Area 2B Pacific halibut catch limits allocated by the Canadian Department of Fisheries and Oceans and the catch estimates (thousand of pounds, net weight), 2007 - 2008.

Table 3. Estimated sport charter halibut harvest and North Pacific Fishery Management Council's Guideline Harvest Level (GHL) (thousands of pounds, net weight) for 2003-2008.

Table 4. Summary of the Area 2A 2008 catch limits specified by the Pacific Fishery Management Council's Catch Sharing Plan and estimated catches (pounds, net weight).

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2008 commercial fishery, including IPHC research catch, by regulatory area and month.

Table 6. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2008 commercial fishery for Area 2B, Alaska, and the Alaskan regulatory areas, and b) for Area 2A commercial fisheries, not including the treaty Indian commercial fishery.

Table 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2008 Pacific halibut commercial fishery.

Table 8. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2008.

Table 9. Commercial halibut catch (thousands of pounds, net weight) in 2008 by statistical area and regulatory area.

Appendix II.

Appendix I.

Table 1. The 2008 total removals of Pacific halibut by regulatory area (thousands of pounds, net weight).

Area	2A	2B	2C	3A	3B	4	Total
Commercial	675	7,683	6,145	24,166	10,617	8,548	57,834
Sport	481	1,536	3,083	5,629	18	43	10,790
Bycatch Mortality:							
Legal-sized fish	141[1]	67	216	1,058	485	2,259	4,226
Sublegal-sized fish	157[1]	64	128	1,906	853	3,329	6,437
Personal Use[2]	30[3]	405	525	372	48	106[4]	1,486
Wastage:							
Legal-sized fish	<1	22	12	61	4	33	132
Sublegal-sized fish	15	262	212	924	681	243	2,337
IPHC Research	7	73	61	355	131	106	733
Total	**1,506**	**10,112**	**10,382**	**34,471**	**12,837**	**14,667**	**83,975**

[1] Area 2A bycatch is the 2007 estimate as the 2008 estimate will not be available until 2009.
[2] Figures shown for Alaskan areas are for 2007, the latest data available.
[3] Treaty Indian ceremonial and subsistence fish authorized in the 2008 catch sharing plan.
[4] Includes 19,000 pounds of sublegal halibut retained in the 2007 Area 4DE Community Development Quota.

Appendix I.

Table 2. The Area 2B Pacific halibut catch limits allocated by the Canadian Department of Fisheries and Oceans and the catch estimates (thousand of pounds, net weight), 2007 - 2008.

Fishery	2008		2007	
	Allocation	Catch	Allocation	Catch
Commercial fishery	7,918	7,683	10,089	9,694
Sport fishery	1,082	1,536	1,381[1]	1,556
Total allocation/ catch	9,000	9,219	11,470	11,250
IPHC research catch		73		78
Previous year carryover[2]	338		-37	
Total	9,338	9,292	11,433	11,328

[1] Quota shares transfer of 145,000 pounds from the sport fishery to the commercial fishery as of Dec 17.

[2] Adjustment for carryover/overage amount from commercial fishery

Table 3. Estimated sport charter halibut harvest and North Pacific Fishery Management Council's Guideline Harvest Level (GHL) (thousands of pounds, net weight) for 2003-2008.

	Area 2C		Area 3A	
Year	GHL	Harvest	GHL	Harvest
2003	1,432	1,412	3,650	3,382
2004	1,432	1,750	3,650	3,668
2005	1,432	1,952	3,650	3,689
2006	1,432	1,804	3,650	3,664
2007	1,432	1,918	3,650	4,002
2008	931	1,914	3,650	3,603

Table 4. Summary of the Area 2A 2008 catch limits specified by the Pacific Fishery Management Council's Catch Sharing Plan and estimated catches (pounds, net weight).

Area and Fishery	Catch Limit	Catch
Non-treaty directed commercial	213,674	206,900
Non-treaty incidental commercial with salmon troll fishery	37,707	14,200
Non-treaty incidental commercial with sablefish fishery	70,000	36,800
Treaty Indian commercial	397,000	417,200
Treaty Indian ceremonial and subsistence	30,000	30,000
Sport - North of Columbia River	220,238	240,027
Sport - South of Columbia River	251,381	240,853
Total	**1,220,000**	**1,185,980**
IPHC research catch		**7,000**
Grand Total	**1,220,000**	**1,192,980**

Appendix I.

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2008 commercial fishery, including IPHC research catch, by regulatory area and month.

	March	April	May	June	July	August	September	October	November	Total
2A	241	113	64	151	91	9	7	6	-	682
2B	1,077	1,098	995	562	924	993	1,048	601	458	7,756
2C	938	741	961	986	583	845	773	227	152	6,206
3A	2,676	3,474	4,002	3,257	2,605	3,069	2,747	2,017	674	24,521
3B	77	490	1,553	2,213	2,062	2,095	993	828	437	10,748
4A	-	16	235	352	665	789	497	346	115	3,015
4B[1,2]		63	153	321	394	434	213	185		1,763
4C	-	-	-	37	253	364	70	-	-	724
4D[3]	-	-	-	421	586	811	734		-	2,552
4E	-	-	-	215	131	144	107	3	-	600
AlaskaTotal	3,691	4,784	6,904	7,802	7,279	8,551	6,134	3,606	1,378	50,129
GrandTotal	5,009	5,995	7,963	8,515	8,294	9,553	7,189	4,213	1,836	58,567

Forconfidentialityreasons:
[1]Area4B-AprilincludesMarchlandings
[2]Area4B-OctoberincludesNovemberlandings
[3]Area4D-SeptemberincludesOctoberlandings

Appendix I.

Table 6a. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2008 commercial fishery for Area 2B, Alaska, and the Alaskan regulatory areas.

Overall Vessel Length	Area 2B		Alaska	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	28	576	24	41
0 to 25 ft.[1]			269	503
26 to 30 ft.[1]			122	930
31 to 35 ft.[1]	9	174	224	4,817
36 to 40 ft.	31	785	148	1,918
41 to 45 ft.	46	1,444	158	4,202
46 to 50 ft.	26	1,384	148	4,616
51 to 55 ft.	26	1,217	68	3,418
56+ ft.	36	2,176	263	29,684
Total	202	7,756	1,424	50,129

Overall Vessel Length	Area 2C		Area 3A	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length[2]	21	41		
0 to 25 ft.[2]	65	90	39	124
26 to 30 ft.	37	212	31	134
31 to 35 ft.	102	910	87	2,408
36 to 40 ft.	87	583	62	1,006
41 to 45 ft.	84	785	78	2,481
46 to 50 ft.	86	1,057	73	2,134
51 to 55 ft.	40	757	42	1,883
56+ ft.	107	1,771	196	14,351
Total	629	6,206	608	24,521

Overall Vessel Length	Area 3B		Area 4	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length[2]	0	0		
0 to 25 ft.[2,3]			168	289
26 to 30 ft.[3]	4	23	54	561
31 to 35 ft.	33	674	42	825
36 to 40 ft.	23	264	4	65
41 to 45 ft.	34	763	7	173
46 to 50 ft.	32	915	10	510
51 to 55 ft.	17	608	4	170
56+ ft.	142	7,501	70	6,061
Total	285	10,748	359	8,654

For confidentiality reasons:

[1]Vessels 0 to 30 ft. in the Area 2B fishery were combined with 31 to 35 ft. vessels

[2]Unknown length vessels in Areas 3A and 4 were combined with 0 to 25ft. vessels

[3]Vessels 0 to 25 ft. in the Area 3B fishery were combined with 26 to 30 ft. vessels

Appendix I.

Table 6b. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2008 commercial fishery for Area 2A commercial fisheries, not including the treaty Indian commercial fishery.

	Area 2A	
	Directed Commercial	
Overall Vessel Length	No. of Vessels	Catch (000's lbs.)
Unk. Length	0	0.0
0 to 25 ft.	0	0.0
26 to 30 ft.[1]		
31 to 35 ft.[1]	6	2.8
36 to 40 ft.	16	24.9
41 to 45 ft.	25	27.1
46 to 50 ft.	19	38.6
51 to 55 ft.	14	26.6
56+ ft.	16	86.9
Total	96	206.9

	Area 2A Incidental Commercial (Salmon)		Area 2A Incidental Commercial (Sablefish)	
Overall Vessel Length	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	0	0.0	0	0.0
0 to 25 ft.[2]			0	0.0
26 to 30 ft.[2]	5	0.8	0	0.0
31 to 35 ft.	4	0.8	0	0.0
36 to 40 ft. [3]	8	2.5		
41 to 45 ft. [3]	12	6.4	8	11.5
46 to 50 ft.[4]	6	3.7	6	9.1
51 to 55 ft.[4]				
56+ ft.	0	0.0	10	16.2
Total	35	14.2	24	36.8

For confidentiality reasons:

[1] Vessels 26 to 30 ft. in the Area 2A Directed Commercial fishery were combined with 31 to 35 ft. vessels.

[2] Vessels 0 to 25 ft. in the Area 2A Incidental Commercial (Salmon) fishery were combined with 26 to 30 ft. vessels.

[3] Vessels 36 to 40 ft in the Area 2A Incidental Commercial (Sablefish) fishery were combined with 41-45 ft vessels.

[4] Vessels 51 to 55 ft. in the Area 2A Incidental Commercial (Salmon and Sablefish) fisheries were combined with 46 to 50 ft. vessels.

Appendix I.

Table 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2008 Pacific halibut commercial fishery.

Area	Fishing Period	Catch Limit	No. of Days	Commercial Catch	Research Catch	Total Catch
2A						
treaty Indian	March 8 – June 3		88			
	Restricted:					
	Mar 17 – Apr 15		30			
Total		397.0		417.2	0	417.2
Commercial						
Incidental in Salmon fishery	May 1 – Nov 15	37.7	199	14.2	0	14.2
Incidental in Sablefish fishery	May 1- Oct 31	70.0	184	36.8	0	36.8
	June 11[1]		10-hours	66.0		
	June 25[1]		"	67.0		
Directed	July 9[1]		"	52.0		
	July 23[1]		"	22.0		
Total		213.7		207.0	7	214.0
2A Total		718.4		675.2	7	682.2
Area	**Fishing Period**	**Catch Limit**	**Adjusted Catch Limit[2]**	**Commercial Catch**	**Research Catch**	**Total Catch**
2B	3/08 – 11/15	7,918.0	8,255	7,683.0[3]	73	7,756.0
2C	3/08 – 11/15	6,210.0	6,432	6,145.0[4]	61	6,206.0
3A	3/08 – 11/15	24,220.0	24,415	24,166.0	355	24,521.0
3B	3/08 – 11/15	10,900.0	10,995	10,617.0	131	10,748.0
4A	3/08 – 11/15	3,100.0	3,170	2,973.0	42	3,015.0
4B	3/08 – 11/15	1,860.0	1,886	1,723.0	40	1,763.0
4C	3/08 – 11/15	1,769.0	1,825	718[5]	6	724.0
4D	3/08 – 11/15	1769.0	1,809	2,534.0[5, 6]	18	2,552.0
4E	3/08 – 11/15	352.0	352	600.0[6]	0	600.0
Alaska Total		50,180.0	50,884	49,476	653	50,129
Grand Total		**58,816.4**	**59,857.4**	**57,834.2**	**733**	**58,567.2**

[1] Fishing period limits by vessel class.
[2] Includes adjustments from the underage and overage programs.
[3] Includes the pounds that were landed by Native communal commercial licenses (FL licenses).
[4] Includes pounds taken by Metlakatla Indians during additional fishing within reservation waters.
[5] Area 4C IFQ and CDQ can be fished in Area 4D by NMFS and IPHC regulations.
[6] Area 4D CDQ can be fished in Area 4E by NMFS and IPHC regulations.

Appendix I.

Table 8. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2008.

Port Region	Canada	United States	IPHC Research	Grand Total
CA & OR	-	182	3	185
Seattle	-	14	-	14
Bellingham	-	1,184	4	1,188
WA	-	422	-	422
Vancouver	520	-	-	520
Port Hardy	3,072	-	10	3,082
Southern BC	524	-	6	530
PrinceRupert & PortEd.	3,296	-	98	3,394
Northern BC	271	-	-	271
Ketchikan, Craig, Metlakatla	-	518	5	523
Petersburg, Kake	-	2,130	11	2,141
Juneau	-	1,945	7	1,952
Sitka	-	2,839	33	2,872
Hoonah, Excursion, Pelican	-	949	-	949
Southeast AK	-	846	-	846
Cordova	-	1,318	-	1,318
Seward	-	5,366	71	5,437
Homer	-	9,104	111	9,215
Kenai	-	71	-	71
Kodiak	-	8,302	83	8,385
Central AK	-	6,882	178	7,060
Akutan & Dutch Harbor	-	4,718	68	4,786
Bering Sea	-	3,361	45	3,406
Grand Total	7,683	50,151	733	58,567

Appendix I.

Table 9. Commercial halibut catch (thousands of pounds, net weight) in 2008 by statistical area and regulatory area.

Stat Area Group	Catch			Regulatory Area	Catch for Reg. Area
	Commercial	Research	Total		
00-03	184	3	187		
04	92		92	2A	682
05	399	4	403		
06	432	4	436		
07	42	2	44		
08	164	1	165		
09-I	477	7	484		
09-O	187	2	189		
10-I	1,204	18	1,222		
10-O	705	1	706	2B	7,756
11-I	1,115	16	1,131		
11-O	120	2	122		
12-I	363	4	367		
12-O	54	-	54		
13-I	2,345	11	2,356		
13-O	475	5	480		
14-I	300	11	311		
14-O	151	8	159		
15-I	807	8	815		
15-O	505	8	513		
16-I	1,300	5	1,305	2C	6,206
16-O	996	7	1,003		
17-I	554	6	560		
17-O	370	4	374		
18S-I	594	2	596		
18S-O	568	2	570		
18W	1,090	11	1,101		
19	1,241	17	1,258		
20	1,287	24	1,311		
21	1,017	16	1,033		
22	1,001	24	1,025		
23	678	20	698	3A	24,521
24	4,219	24	4,243		
25	4,713	35	4,748		
26	3,494	70	3,564		
27	2,677	61	2,738		
28	2,749	53	2,802		

Appendix I.

Table 9. continued.

29	4,154	37	4,191	3B	10,748
30	1,849	33	1,882		
31	1,416	25	1,441		
32	2,077	17	2,094		
33	773	12	785		
34	348	7	355		
35	426	5	431	4	8,654
36	288	2	290		
37	52	3	55		
38	242	4	246		
39	51	2	53		
40	100	1	101		
41	35	2	37		
42+	690	19	709		
BeringSea	6,664	68	6,732		
GrandTotal	57,834	733	58,567		58,567

Appendix I.

Table 10. The fishing period limits (net weight) by vessel class used in the 2008 directed commercial halibut fishery in Area 2A.

Vessel Class		Fishing Periods (Pounds)			
Letter	Feet	June 11	June 25	July 9	July 23
A	0-25	755	755	670	200
B	26-30	945	945	840	200
C	31-35	1,510	1,510	1,345	200
D	36-40	4,165	4,165	3,705	560
E	41-45	4,480	4,480	3,985	600
F	46-50	5,365	5,365	4,770	715
G	51-55	5,985	5,985	5,320	800
H	56+	9,000	9,000	8,000	1,200

Table 11. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2008.

Fishing Period Dates	Number Of Vessels	Catch (Pounds)
May 9 - 11	7	1,699
May 23 – 25	12	5,964
June 6 – 8	13	7,224
June 20 – 22	10	5,182
July 11 – 13	7	5,222
July 25 – 27	7	5,237
August 8 – 10	6	2,022
August 22 – 24	4	2,231
Sept. 5 – 7	7	3,955
Sept. 19 –21	4	958
October 3 - 5	3	1,316
11 Fishing Periods		41,010

Appendix II.

Table 1. Summary of the 2008 Pacific halibut sport fishery: Fishing dates and days, and bag limits. No size limits unless otherwise noted.

Area & Region	Fishing dates	Fishing days	Days open	Daily Bag limit
Area 2A – Washington, Oregon, California				
WA Inside Waters (east of Low Point)	Apr 10-Jun 13	46	5 (Th-Mon)	1
WA Inside Waters (Low Point to Sekiu River)	May 22-Jul 21	43	5 (Th-Mon)	1
WA North Coast (Sekiu River to Queets River)	May 13, 15, 17	3	3 (Tu, Th, Sat)	1
	May 20	1	1(Tu)	1
	May 29, 31	2	2 (Th, Sat)	1
	Jun 14	1	1 (Sat)	1
	Jun 17, 19, 21	3	3 (Tu, Th, Sat)	1
	Jun 28	1	1 (Sat)	1
	Jul 26	1	1 (Sat)	1
	Aug 29	1	1 (Fri)	1
WA South Coast (Queets River to Leadbetter Point)				
All depths	May 1-Jun 17	15	2 (Sun, Tu)	1
Nearshore	Jun 27-Aug 23	20	2 (Fri-Sat)	1
Columbia River (Leadbetter Point to Cape Falcon)	May 1-Jun 1	32	7	1
	Aug 1, 2, 22, 23	4	2 (Fri-Sat)	1
	Aug 29	1	1 (Sat)	1
OR Central Coast (Cape Falcon to Humbug Mt.)				
All depths	May 8-Jul 26	24	3 (Th-Sat)	1
	Aug 1-Sep 7	18	3 (Fri-Sun)	1
	Sep 13-14, 20-21	4	2 (Sat-Sun)	2
	Sep 27	1	1 (Sat)	1
Less than 40 fathoms	May 1-Sep 20	143	7	1
OR/CA (south of Humbug Mt.)	May 1-Oct 31	184	7	1
Area 2B – British Columbia	Mar 1-May 31	92	7	1
	Jun 1-Oct 31	153	7	2
Area 2C – Alaska	Feb 1- May 31	121	7	2[a]
	Jun 1-10	10	7	1
	Jun 11-Dec 31	204	7	2[a]
Areas 3 and 4 – Alaska	Feb 1-Dec 31	335	7	2

[a] Two fish daily bag limit, with one fish no greater than 32 inches in total length.

Appendix II.

Table 2. Summary of 2008 sport fishery catch limits and harvest estimates (in pounds, net weight) by subarea within Regulatory Area 2A.

Subarea	Catch limit	Harvest estimate	Over/under Pounds	Over/under Percent
WA Inside Waters	59,354	83,305	23,951	40.4%
WA North Coast	109,991	106,852	-3,139	-2.9%
WA South Coast	44,700	40,398	-4,302	-9.6%
Columbia River	18,762	17,899	-863	-4.6%
OR Central Coast	231,271	224,885	-6,386	-2.8%
OR (south of Humbug Mt.)/CA	7,541	7,541	0	0.0%
Total	**471,619**	**480,880**	**9,261**	**2.0%**

Table 3. Estimated harvest by sport fishers (millions of pounds, net weight) by IPHC Regulatory Area, 1977-2008.

Year	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	Total
1977	0.013	0.008	0.072	0.196	-	-	0.289
1978	0.010	0.004	0.082	0.282	-	-	0.378
1979	0.015	0.009	0.174	0.365	-	-	0.563
1980	0.019	0.006	0.332	0.488	-	-	0.845
1981	0.019	0.012	0.318	0.751	-	0.012	1.112
1982	0.050	0.033	0.489	0.716	-	0.011	1.299
1983	0.063	0.052	0.553	0.945	-	0.003	1.616
1984	0.118	0.062	0.621	1.026	-	0.013	1.840
1985	0.193	0.262	0.682	1.210	-	0.008	2.355
1986	0.333	0.186	0.730	1.908	-	0.020	3.177
1987	0.446	0.264	0.780	1.989	-	0.030	3.509
1988	0.249	0.252	1.076	3.264	-	0.036	4.877
1989	0.327	0.318	1.559	3.005	-	0.024	5.233
1990	0.197	0.381	1.330	3.638	-	0.040	5.586
1991	0.158	0.292	1.654	4.264	0.014	0.127	6.509
1992	0.250	0.290	1.668	3.899	0.029	0.043	6.179
1993	0.246	0.328	1.811	5.265	0.018	0.057	7.725
1994	0.186	0.328	2.001	4.487	0.021	0.042	7.065
1995	0.236	0.887	1.759	4.511	0.022	0.055	7.470
1996	0.229	0.887	2.129	4.740	0.021	0.077	8.084
1997	0.355	0.887	2.172	5.514	0.028	0.069	9.025
1998	0.383	0.887	2.501	4.702	0.017	0.096	8.585
1999	0.338	0.859	1.843	4.228	0.017	0.094	7.379
2000	0.344	1.021	2.258	5.305	0.015	0.073	9.017
2001	0.446	1.015	1.925	4.675	0.016	0.029	8.106
2002	0.399	1.260	2.090	4.202	0.013	0.048	8.011
2003	0.404	1.218	2.258	5.427	0.009	0.031	9.348
2004	0.487	1.613	2.937	5.606	0.007	0.053	10.703
2005	0.484	1.841	2.798	5.672	0.014	0.050	10.860
2006	0.516	1.773	2.526	5.337	0.014	0.046	10.212
2007	0.504	1.556	3.049	6.283	0.025	0.044	11.461
2008	0.481	1.536	3.083	5.629	0.018	0.043	10.790

PUBLICATIONS

The IPHC publishes three serial publications - Annual reports, Scientific reports, and Technical Reports - and also prepares and distributes regulation pamphlets and information bulletins. Items produced during 2008 by the Commission and staff are shown below and a list of all Commission publications is shown on the following pages. In addition, a listing of articles published by the Commission staff in outside journals is available on our website at www.iphc.washington.edu.

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You caught a tagged halibut

Now What?

Fishers should retain all tagged halibut regardless of gear type used, time of year caught, size of halibut, or type of tag!

Instructions:

- Leave the tag on the fish until landed.
- Notify the IPHC by telephone. If there is an IPHC port sampler in that port, they will redeem the tag, as well as take measurements and an otolith from the halibut. If there is no sampler in the area, a staff member will instruct you on safe removal of the tag and how to redeem your reward.

Reward offered for every tag returned!

1. Traditional wire tags

- Threaded through the operculum on the dark side of the body
- The reward is $5 cash or an IPHC tag hat

2. Pop-up archival transmitting tags

- Attached near the dorsal by a metal dart and leader*
- A $500 reward is offered for the return of any tag body
- A $50 reward is offered for the return of the leader and metal dart only
- A $5 cash or IPHC tag hat reward is offered for the return of the leader only

*Note that these tags may be recovered while attached to a halibut, found free floating, or washed up on a beach.

3. Electronic archival tags

- Attached near the dorsal via a plastic “cradle” and wires
- A $500 reward is offered for the return of the tag body

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