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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2006

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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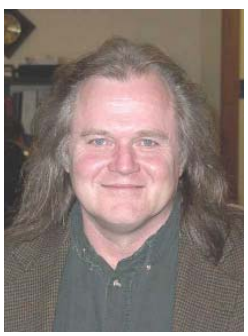
International Pacific Halibut Commission
P.O. Box 95009
Seattle, Washington 98145-2009, U.S.A.
(206) 634-1838
www.iphc.washington.edu

Jim Hale of Juneau, co-writer of this report, is a technical editor for the National Marine Fisheries Service/Alaska Region, where he has worked since 1995. A former professor of English literature, Mr. Hale also conducts technical writing workshops around Alaska and the Pacific Northwest. This is Mr. Hale's first time as co-writer of the IPHC Annual Report.



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: "Alaskan Pacific Halibut" by Linda Conrad (pen & ink pointillism and water color wash, 2006).

Linda Conrad is the mother of Jennifer Conrad, a field biologist who has worked for the International Pacific Halibut Commission for four years in Homer, Alaska. Linda was born in and studied art in southern California, but has lived 20 years in the Pacific Northwest (Idaho, Oregon, and Alaska). During those years, she has become an award winning amateur artist working in several media. One of her specialties is "pointillism" pen and ink drawings. These are drawings composed of tiny dots and a genre of art from the Impressionistic period. However, Linda takes the art to an extreme combining realism, attention to detail and with the subtle capturing of whimsical aspects of personalities of her subjects which are usually animals. The drawing of the Pacific halibut on the cover was specially done for and a gift to the IPHC in 2006. She is very honored that it is on the cover of the annual report for 2006.

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Activities of the Commission

Although established in 1923, the IPHC did not publish its first annual report until twenty-five years later. Occasional scientific reports had been published sporadically across the 1930s as the Commission's research efforts yielded new scientific information on halibut stocks and their marine environment. The last of these early reports, published in 1937, stressed the importance of keeping up scientific investigations now that the once-depleted halibut stocks were rebounding under the Commission's stewardship.

Then, two years later, World War II began. The Commission kept up its observations of the fishery, but for the next six years the world's attention was rightly diverted away from fishery research. With the end of the war in 1945, as people turned their attention back to peacetime concerns, the halibut fishery began jumping again; 1946 brought a substantial increase in the number of fishers and boats, and the Commission began new marking studies to investigate the movement of stocks across the species' range. By 1947 the value and necessity of the Commission's work had become so evident that halibut fishers, processors, and others interested in the state of the fishery began calling for more regular reports on the health of halibut stocks and on the Commission's activities.

Commissioners (*from left*) Robinson, Atleo, Richards, Balsiger, Hoard, and Lestenkof vote on the catch limits at the Annual Meeting. Photo by Robert Tobin.

So it was that in 1948, eleven years after its last publication, the Commission published its first Annual Report: "a general review of the conditions and events in the Pacific halibut fishery and of the Commission's regulatory and investigational activities in 1947." That report, the Commissioners note explicitly in their preface, "is issued at the request of halibut fishermen and vessel owners, of halibut dealers and of others interested in the success of the Commission in rebuilding the previously depleted halibut fishery." Since then, the IPHC Annual Report has become a mainstay of the halibut industry, reporting to the public on the state of the halibut stocks and the Commission's work over the previous year.

The IPHC began producing annual reports under separate cover in 1948, making this the 59th edition.

With the present publication, we issue our 59th Annual Report, a review of the fishery in 2006 and the Commission's ongoing research and management efforts to sustain a healthy Pacific halibut stock. William Shakespeare once characterized human virtue in terms of the stewardship of natural resources—to "husband nature's riches from expense." Pacific halibut are truly one of nature's

riches, and we are heartened in our work to hear one lifelong halibut fisher declare that Pacific halibut "may be the best managed fishery in the world."

The 2006 fishing year begins

As always, the halibut fishing year began not with the first line in the water, but with a decidedly drier, but no less essential event: the Commission's Annual Meeting, held in 2006 at the Westin Hotel in Bellevue, Washington, January 17 through 20. There the Commission met to set the catch limits and opening and closing dates for the upcoming fishing season, to adopt the year's fishing regulations, and to hear reports from IPHC staff and comments and proposals from the public.

The Commission's chairperson, Dr. James Balsiger, convened the meeting with opening remarks on the general good health of the halibut stocks, while acknowledging the Commission's continuing challenge to ensure that all harvests and removals within the Pacific halibut's geographic range are recorded.

Season length is always a hot discussion topic at the Annual Meeting and 2006 was no different.

How much—and when?

For 2006, the Commission set the overall catch limit at 69,860,000 pounds, a 5.37 percent decrease from the 2005 catch limit of 73,819,000 and the lowest in five years.

The reduced catch limit reflects reductions mainly in the catch limits for the Bering Sea and western Gulf of Alaska—Areas 3B, 4B, and 4CDE—where the Commission's stock assessment and survey data continue to indicate stock declines. This was the second year in a row that the Commission has lowered harvest rates for Areas 4B and 4CDE as a precautionary measure.

The season opening dates were once again discussed at length. It was noted that since 1998, a total of 61% of the time the start date has been March 5 or earlier. Points raised included large tides at the end of February that could increase gear loss and wastage, the fact that the beginning of the Catholic Lenten season on February 26 will increase the demand for fresh fish, and support as well as hesitation in reverting back to a March 15 opening date. Following further discussion and after reviewing staff information and proposals from the harvesting and processing sectors, The fishing dates of March 5-November 15 were accepted for the following fisheries: the Canadian Individual Vessel Quota (IVQ) fishery in Area 2B, and the United States Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) fisheries in Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E. The Area 2A two incidental commercial catch halibut fisheries and the treaty Indian fishery also occur within the March 5 to November 15 date range.

Other issues before the Commission

Regulations changes

The Commission approved regulations to change the sport fishery possession limits in Area 2A. The sport fishery possession limit on land was two halibut (U.S. origin) in Washington, three daily bag limits in Oregon, and two daily bag limits in California. The sport possession limit on water in Area 2A remained the same as the daily bag limits.

For the Area 2A fishery, the Commission passed a regulation requiring that the person completing the State fish ticket (first recipient, commercial fish processor, or buyer) record on the fish ticket whether the halibut weight is head-on or head-off fish, or record the corresponding product code.

For landings in Alaska, the IPHC regulations will be revised to allow the Interagency Electronic Recording System, eLandings, as an option along with State fish tickets.

The Commission removed an obsolete regulation that requires vessel operators to record personal use halibut in the vessel's logbook within 24-hours of offload. This is not required as all halibut caught is recorded in the logbook and all halibut retained is weighed and recorded on the landing documentation whether it is sold or retained for personal use. Additionally, the Commission removed another obsolete regulation that required that logbooks in Area 2B be completed no later that 24 hours after midnight local time for each day fished and prior to the offload. This was obsolete with the new fisheries management plan in Area 2B.

The Commission did some housekeeping with the regulations; obsolete regulations were taken off the books and new regulations were passed to accommodate eLanding reporting methods.

Dutch Harbor, Alaska. Photo by Paul Logan.

The IPHC regulations were changed to require the new British Columbia Integrated Fisheries logbook, replacing the Halibut Fishery logbook that had been required in Area 2B.

The Commission agreed to add the definition of net weight of halibut to the IPHC regulations. Net weight is defined as gutted, head-off, and without ice and slime. The catch limits are always in terms of net weight and this will also be stated in the regulations.

The Commission approved recognizing in IPHC regulations the First Nation's Food Fishery in Area 2B.

In the regulations adopted by the Commission, commercially caught halibut must have their gills and entrails removed before being offloaded from a vessel. As it has in past years, the Canadian government chose not to approve this regulation and, instead, allowed the landing of live halibut caught in British Columbia waters.

PIT tag returns and concerns about Area 4

At the 2006 Annual Meeting, the Commission heard concerns from various fishing groups about the absence of returns of Passive Integrated Transponder (PIT) tags in Area 4 and the lowering of the harvest rate in the area from 20 to 15 percent. The fishing groups' representatives all observed that high catch rates

suggest an apparent disconnect between the model and what fishers are actually seeing out there. The Commission also reviewed a study that concludes that the decrease in halibut biomass around the Pribilof Islands is due to directed fishing and not bycatch or temperature fluctuations. Similar conclusions were reached independently by the IPHC staff in the past. Commission staff will be scanning for PIT tags on the IPHC surveys this year in an effort to locate the tags in Area 4 that are not being recovered in the commercial fishery. Regarding the lowering of the harvest rate in Area 4, the staff commented that, in terms of harvest rate, it is important to think about what's right for the area.

F/V Big Blue **tied up at the dock in Homer, Alaska. Photo by Heather Gilroy.**

Bering Sea setline survey

The Commission also reviewed several scenarios, formulated by staff, for a Bering Sea flats setline survey. A lengthy discussion took place regarding the different scenarios and the pros and cons of each. In all scenarios, the cost is very high, with long running times between stations. Staff commented that the NMFS trawl survey misses large fish, but could work as an indicator of abundance with some comparison work with longline gear. The Commission agreed to hear what the Conference Board and Processors Advisory Group recommended.

IPHC staff worked with industry to try and come up with a feasible Bering Sea flats survey.

Farmed halibut

The Commission noted that world wide production of farmed halibut is around 1500 tons now, and many farms in Nova Scotia and elsewhere are reconfiguring from halibut to Atlantic cod. This is likely a change reflecting the high demand for cod and the relative facility with which it can be raised, rather than the viability of halibut farming.

NMFS presented the U.S. aquaculture report, where the agency noted that a specially commissioned group tasked with looking at ocean issues recommended the pursuit of aquaculture. One element of that would be to develop a regulatory framework ahead of time. NOAA's budget provides $5-6M to look at aquaculture and much of that is distributed to persons experimenting with setting up aquaculture facilities;

Live landings

The Commission also discussed a proposal to allow live landings. There was clarification that regulations allow halibut to be brought alive to the dock, but they must be dressed prior to offload. Penning halibut is different and entails halibut leaving the vessel alive. There was concern by IPHC staff, industry, and NOAA Enforcement on the ability to track the movement of live halibut within the U.S. Canada has regulations in place to track live halibut through the system. If the Commission were to allow the landing of live halibut NMFS regulations also need to change to incorporate live weight conversions. In the end, the Commission did not approve a regulation change allowing live halibut landings. However, the regulation that requires the entrails and gills to be removed prior to offloading a vessel was once again not adopted by DFO. Therefore, live halibut can be landed in British Columbia.

IPHC finances

The Commission spends ample time at both the Annual and Interim meetings discussing the best use of appropriated funds.

The Commission's discussions of its budget focused largely on the cost of research. In reviewing the projected 2008 budget, the Commission noted proposals for two large research programs to characterize the ecosystem footprint of the halibut fishery, which include pilot studies of on-board cameras in Alaska and water column profilers for all survey vessels. A lengthy discussion took place regarding whether these projects were the best use of Commission funds and what responsibility the Commission had to see particular projects through, once the total budget was presented for funding, or whether the Commission could redirect funds to other projects if the total budget was not funded. It was noted that the projects must be laid out ahead of time, but if the appropriation is less than requested, then the Commission can distribute available funds at its discretion. If the requested budget is funded in full, then the Commission will be expected to carry out the projects as outlined.

The Commission was also concerned with the large increase these two projects caused to the budget. The Commission agreed that asking the contracting parties for funding was fine, but that the projects should be considered further alongside others such as comprehensive surveys in the Bering Sea. The staff was requested to supply the Commission in the future, with a one-page summary of large research projects being considered for inclusion in future budget proposals. The representative from the U.S. State Department advised the Commission to consider these projects at this meeting because 2008 budget cycles would be considered in the next year and they should be as complete as possible.

The Canadian Department of Fisheries and Oceans representative noted the growing disparity in appropriations between the two countries and asked that appropriations be shown to cover base costs only and then the supplemental projects shown separately under separate funding. The Commission agreed to hear Processor Advisory Group and Conference Board remarks before making any further decisions on these proposals and the proposed budget.

In memoriam, Tom Grissom

Too often we are tragically reminded of the danger of working at sea. It is with sadness that we note the tragic loss of Tom Grissom, a crewmember on the *F/V Heritage. W*hile the *Heritage* was under charter for the IPHC survey this summer, Tom lost his life when a skiff capsized during a shore excursion. We would like to express our gratitude to our field samplers, Amanda Delisle and Ivan Loyola; to the vessel crew, Steve Stark, Doug Holm, and Tyler Haines; and to the US Coast Guard for their efforts that day. We extend our condolences to Tom's family and loved ones. Tom was involved with our surveys for several years, and he will be missed by those of us who worked with him.

Director's Report

The most significant events for the Commission staff in 2006 continued to be the implications of the ongoing recovery of PIT tags released in 2003 and 2004, and the estimated catch by recreational anglers in Areas 2B (Canada) and 2C (southeast Alaska), in relation to the targets established by the Canadian Department of Fisheries and Oceans (DFO), and the U.S. National Marine Fisheries Service (NMFS), respectively.

The PIT tag recovery data show a noteworthy and increasing percentage of tags recovered in Regulatory Areas 2B, 2C, and 3A that were tagged outside of the area where they were recovered. For example, over 35% of the tags recovered in Area 2B were tagged originally in other regulatory areas. Percentages in Areas 3A (22%), 3B (22%), and 2C (14%) were also relatively large. These out-of-area recoveries are very significant to our stock assessment process. The existing stock assessment is conducted for each regulatory area as if it were a closed population, or in other words that the net movement of fish in and out of the area is negligible. The tag results indicate that this is clearly not the case and the staff needed to develop an assessment approach that would either estimate the rates of migration for each area, or alternately to treat the population as one large unit so that any movements of fish do not affect the assessment. Since migration rates are known to vary by fish size and age, by year, and likely in response to densities of halibut, we do not believe that migration rates can ever be calculated with accuracy sufficient to allow us to use individual area assessments and migration rates between them. Furthermore, the results of such an assessment process would be dominated by the assumed migration rates among areas, and the exploitable biomass estimates (hence available yield) would be very sensitive to errors in

Bruce Leaman talks with Captain Dale Erikson from the *F/V Ocean Quest*. Photo by Kirsten Gravel.

those rates. Instead, the staff chose to recommend to the Commission the more prudent approach of assessing the halibut stock as a coastwide unit, so that no assumptions about migration of fish among areas are required. Once that assessment was completed, a method of partitioning the coastwide biomass into regulatory area biomass is still needed. The staff investigated several methods to apportion this biomass and chose to use the IPHC setline survey data as the most consistent and objective data source upon which to base the apportionment calculations. This method results in lower estimated biomass in the eastern portion of the stock range (Area 2), compared with that estimated from the traditional closed-area assessment.

The second issue of significant concern to the Commission is the continued increase in estimated catches by recreational fisheries, particularly in Areas 2B and 2C. In both areas, the estimated catches in 2006 exceeded the domestic targets for the fisheries established by DFO and NMFS. Lack of action to curtail these increasing harvests will hinder the Commission's ability to implement a responsible harvest policy for the halibut stock, because the catch limits for the commercial fisheries are established with the understanding that the sport allocations established by the two countries will be enforced. If those allocations are exceeded, then the total available yield from the stock will also be exceeded. We will continue to work with the domestic agencies of the two countries to improve both the estimation and control of recreational harvests of halibut. Action in both regulatory areas will be required to achieve our stock management goals.

Bruce M. Leaman
Executive Director

Narrow-scaled horse tongue?

That's the literal meaning of science's taxonomic moniker for Pacific halibut, *Hippoglossus stenolepis*. First proposed in 1904 by Russian biologist P. J. Schmidt, the name classifies Pacific halibut as a separate species, distinct from Atlantic halibut, *Hippoglossus hippoglossus*. The taxonomy serves to associate Pacific halibut with related species in the genus *Hippoglossus*, while identifying the species by one of its own distinct physical features, *stenolepis,* or narrow scales.

"Narrow-scaled horse tongue" may thus give scientists a useful name for Pacific halibut, but it's not a very appetizing description, we have to admit. Fortunately, taxonomy is not gastronomy; Pacific halibut is one of the world's most popular seafoods, and in 2006 commercial fishers kept the faith by bringing in harvests that, although down from previous years, continued near historically high levels. And the market concurred, with a strong demand for halibut and good prices to reward harvesters and others in the halibut industry for their labors.

The commercial halibut fisheries caught an overall total of 66,989,000 pounds across all regulatory areas. That catch is down from the previous year's total catch of 70,337,000 and represents the lowest harvest in nine years. The average ex-vessel price of halibut was well over $3.00 (U.S.) per pound in 2006, higher than in 2005.

The halibut market was strong in 2006, and fishers received on average well over $3.00 (U.S.) per pound.

IPHC port biologist, Levy Boitor, is ready to sample on a chilly March morning in Petersburg, Alaska. Photo by Lara Hutton.

Regulatory areas for 2006

Regulatory areas for the commercial halibut fishery have remained consistent since 1990. With the exception of Bristol Bay, the southeastern flats in the Bering Sea remained closed to all halibut fishing in 2006. The Commission's regulatory areas at present are as follows:

Regulatory area boundaries have not changed since 1990.

Area 2A - all waters off the coast 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 latitude 58°00' N., and west of longitude 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 longitude 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.

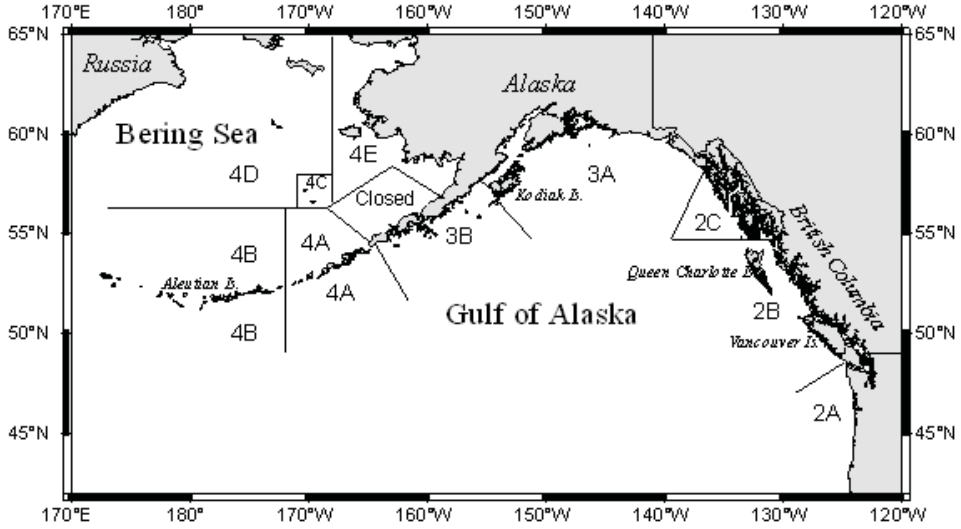


Figure 1. IPHC Regulatory Areas for the 2006 commercial fishery.

Season dates

The fishery was opened at 12 noon local time on March 5 for the Canadian Individual Vessel Quota (IVQ) fishery in Area 2B and the United States Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) fisheries in Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E. These fisheries all closed at 12 noon local time on November 15.

Offloading the catch in Sitka, Alaska. Photo by Lara Hutton.

The halibut fishery in B.C. and Alaska opened on March 5 and closed on November 15.

The treaty Indian commercial fishery in Area 2A occurred during the same calendar period (March 5 to November 15). The non-treaty directed commercial fishery in Area 2A consisted of three 10-hour fishing periods beginning at 8:00 a.m. and closing at 6:00 p.m. local time, scheduled for June 28, July 12, and July 26, 2006. (These dates are generally set two weeks apart, except to skip the week of the 4th of July Holiday.) Fishing trip limits were set for each opening, catches were monitored after each fishing period and the fishery was closed when harvests reached the catch limit. Also in Area 2A, the commercial incidental catch in the salmon troll fishery opened on May 1 and closed on August 7 while the commercial incidental catch in the sablefish longline fishery opened on May 1 and closed on October 23.

Catch limits

The Commission adopts biologically-based catch limits for all individual regulatory areas and for Areas 4CDE combined. In Alaska, the individual catch limits adopted for Regulatory Areas 4C, 4D, and 4E are determined by a catch-sharing plan implemented by the North Pacific Fishery Management Council (NPFMC). This catch sharing plan and IPHC regulations allow Area 4D CDQ to be harvested in Area 4E and allows Area 4C IFQ and CDQ to be fished in Areas 4C or 4D.

Council based catch sharing plans are used to allocate quota among user groups in the U.S.

In waters of the U. S. Pacific Northwest, the Pacific Fishery Management Council (PFMC) allocates halibut catch limits between user groups in Area 2A, also through a catch-sharing plan. In 2000, the U.S. Federal courts ordered an adjustment in the halibut allocations for the years 2000 through 2007. Therefore, 25,000 pounds of catch limit was transferred from non-tribal to tribal fisheries in 2006, after applying the allocation percentage by tribal (35 percent) and non-tribal (65 percent) fisheries.

Allocation issues

The IPHC does not decide allocations among user groups, leaving that responsibility to each government. Currently, both the United States and Canadian governments are working on allocation plans by regulatory area or smaller local areas.

In British Columbia (Area 2B), the Canadian Department of Fisheries and Oceans (DFO) has adopted an allocation framework for the commercial and recreational sectors of the halibut fishery, where the recreational sector was allocated a 12 percent "ceiling" of the combined commercial/ recreational harvest. When managed to the allocation ceilings, both sectors' catch will fluctuate with stock abundance.

Department of Fisheries and Oceans Canada adopted a framework that divides allowable halibut catch for Area 2B between commercial and sport interests.

For 2006, the Commission adopted a combined Area 2B recreational and commercial catch limit (13.22 million pounds). An additional 20,000 pounds was added to include the projected commercial wastage, resulting in a total catch limit of 13.24 million pounds. DFO then allocated to the commercial fleet 88 percent of the total catch limit and reduced it by 20,000 pounds to account for wastage, which resulted in the commercial allocation of 11.631 million pounds. An additional 79,920 pounds was available from the 2005 underage/overage program.

The *F/V Namu* arriving in port. Photo by Kirsten Gravel.

The remaining 1.589 million pounds of the combined catch limit was designated to the recreational sector. The 2006 combined commercial and recreational catch is estimated to have exceeded the combined 13.32 million pound expanded catch limit by 4.8 percent (640,000 pounds).

Only in Area 2A does the allocation framework include all user groups including treaty, sport, and non-treaty commercial.

For Alaska, the NPFMC in 2000 adopted a Guideline Harvest Level (GHL) program for managing the harvest by sport charter vessels in Areas 2C and 3A. The National Marine Fisheries Service (NMFS) implemented this program in September, 2003. When managed to the GHL the recreational guided harvest should go down if halibut abundance declines by specified increments, but the catch should not increase above the GHL. In 2006, the GHLs in Areas 2C and 3A were estimated to have been exceeded by 37 and 9 percent, respectively.

The one area where comprehensive user group allocation occurs is off Washington, Oregon, and California (Area 2A). The Commission determines the total allowable catch for all users and the Pacific Fishery Management Council allocates the harvest among users according to a catch-sharing plan. The Commission annually adopts that plan, which determines the catch limits for the different fisheries.

There are three commercial fisheries (directed, incidental with salmon troll, and incidental with limited-entry sablefish longline), a treaty Indian fishery, and two sport divisions (with nine sub-area sport fisheries). The 2006 total catch of 1.38 million pounds by these users groups was slightly under the catch limit.

The fishing season by area

Area 2A

The PFMC allocated a little more than 59 percent of the total allowable catch to the commercial sector in Area 2A.

The Area 2A licensing regulations have remained unchanged since 2000. All fishers must choose between a commercial or sport charter vessel license. Those who choose to fish under a commercial license must further choose between a license for retaining halibut caught incidentally during the salmon troll fishery or one for fishing in the directed commercial halibut fishery (south of Point Chehalis, WA) and retaining halibut caught incidentally in the primary sablefish fishery (north of Point Chehalis). The 2006 deadline dates for mailing license applications remained the same as previous years: March 31 for the incidental halibut license for the salmon season and May 1 (as April 30 was on the weekend) for the license for the directed commercial fishery and halibut incidentally taken during the sablefish fishery.

Area 2A was managed to provide a total allowable catch of 1,380,000 pounds for all user groups. From that overall catch limit, the Pacific Fishery Management Council allocated 818,424 pounds to the treaty and non-treaty, directed and incidental commercial fisheries. The total catch came in at about 1% over that catch limit, with 829,578 pounds.

The treaty Indian commercial fishery was allocated 472,000 pounds and, under this allocation, harvested 5,047 pounds over this limit. Under the catch-sharing plan, the limited entry longline sablefish fishery north of Point Chehalis received an allocation of 70,000 pounds for incidental halibut catches, the same as the two previous years. Incidental catch under this allocation totaled 73,493—3,493 pounds over the allocation.

Allocation of the remaining non-treaty commercial catch limit was divided between the directed fishery, which received 234,960 pounds, and the incidental halibut catch in this salmon troll fishery, which received the remaining 41,464 pounds. 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 three chinook (*Oncorhynchus tshawytscha*), plus an “extra” halibut per landing. However, the total number of incidental halibut per vessel per landing could not exceed 35. The 1:3 ratio of halibut to chinook has remained the same since 2000, but had increased over the previous years, from the 1:20 ratio seen in the first year of the program (1995). The incidental commercial halibut fishery during the salmon season opened on May 1 and closed on November 15 when the commercial halibut fishery closed for the year. The halibut catch was 4 percent (1,552 pounds) under the catch limit.

The directed commercial fishery consisted of three 10-hour fishing periods with fishing period limits. The fishing period limits by vessel class remained high

for the first two openings with H-class vessels receiving 8,000 and 9,000 pounds per opening, respectively. The last fishing period had a relatively low limit with H-class vessels receiving 2,300 pounds. The total directed commercial catch was 2 percent (5,110 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. The catch was 5 percent (3,493 pounds) over the catch limit of 70,000 pounds.

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 specific tribes or tribal groups and was taken between March 5 and July 18. The remaining catch limit (25 percent) was open to all tribes, subject to daily limits of 500 pounds per vessel. The total tribal commercial catch was 1 percent (5,047 pounds) over the catch limit.

Area 2C Metlakatla fishery

The Metlakatla Indian Community was authorized by the United States government to conduct a commercial halibut fishery within the Annette Islands Reserve. Nine 48-hour fishing periods took place between June 10 and October 1, producing a total catch of 34,871 pounds, which was included in the Area 2C commercial catch. The catch was almost ten thousand pounds less than last year's catch of 45,000 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.

Quota share fisheries

The Quota Share (QS) fisheries of Area 2B and Alaska were open from March 5 to November 15. The following sections discuss the fisheries by area and landing patterns.

Area 2B

Since 1999, the number of active commercial vessels in Area 2B has ranged between 182 and 257.

The IPHC adopted a combined sport and commercial catch limit of 13,220,000 pounds for Area 2B that was to be allocated to the user groups by DFO. An additional 20,000 pounds was added to include the projected commercial wastage, resulting in a total catch limit of 13,240,000 pounds. The commercial fleet allocation of 88 percent of the total catch limit (11,651,000 pounds) was reduced by 20,000 pounds to account for wastage, resulting in an allocation of 11,631,000 pounds. An additional 79,920 pounds was available from the 2005 underage/overage program. Each vessel was allocated a fixed poundage of halibut, or an IVQ, as calculated by DFO. The Area 2B catch of 11,950,915 pounds was within three percent of the catch limit.

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 varied from year to year, ranging from a high of 257 (in 1999) to a low of 182 (in 2006). Several small sub-areas in Area 2B were closed to halibut fishing to protect localized stocks of non-halibut species and to provide improved access to food fish for the First Nations' communities.

Halibut destined for market. Photo by Kirsten Gravel.

In 2006, the DFO implemented a pilot program for a Groundfish Integrated Fisheries Management Plan to meet conservation needs, including addressing rockfish conservation concerns and improving catch monitoring. This plan was developed with consultation by the groundfish industry and other stakeholders through the Commercial Groundfish Integrated Advisory Committee (CGIAC). With the implementation of this three-year pilot program, significant changes were made to the longline groundfish fisheries, including the halibut fishery. The pilot program included IQs for all longline groundfish fisheries, transferability with limits among licence holders, 100 percent at-sea and dockside monitoring, and vessel accountability for all catch, both landed and discarded.

In 2006, DFO implemented a three year pilot project with the goal of full accounting for all catch and discards.

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 to be used to compare to the video recordings.

IPHC will be reviewing how the plan has affected the halibut fleet dynamics and fishing patterns. Data are not available to report on any changes to fishing patterns, number of active vessels landing halibut, or number of vessels and landings from within the Native Communal Commercial Fishing Program.

Alaska

Beginning in 1995, the commercial halibut fisheries in Alaska have been managed under the IFQ Program for halibut and sablefish fisheries. NMFS allocates halibut QS to recipients by IPHC Regulatory Area and permits quota share transfers with restrictions on the amount of QS a person may hold and the amount that may be fished per vessel. In early June 2006, NMFS reported that 3,237 persons held quota shares, down from the initial 4,830 persons at the start of the program.

The total 2006 catch from the IFQ/CDQ halibut fishery for the waters off Alaska was 54,219,000 pounds, two percent under the catch limit. For Areas 2C, 3B and 4A, the commercial QS catches were within three percent of the catch limits. For Area 3A, the commercial QS catches was within less than one percent of the catch limit and Area 4B's catch was within eight percent of the catch limit. The individual catch limits adopted for Regulatory Areas 4C, 4D, and 4E are determined by the catch-sharing plan implemented by the North Pacific Fishery

Juneau port sampler, Michele Drummond, makes quick work extracting otoliths for an Area 2C sample. Photo by Lara Hutton

Management Council and which allows Area 4D CDQ to be harvested in Area 4E and allows Area 4C IFQ and CDQ to be fished in Areas 4C or 4D. These two regulations are the reason why the catch in Area 4D exceeded the catch limit. The total commercial catch of 3,199,000 pounds was under the combined Area 4CDE catch limit (3,550,000 pounds).

Landing patterns and highlights

Homer again took the lion's share of halibut landings: over 9.5 million pounds.

Once again, Homer received the lion's share of halibut landings: over 9,586,000 pounds of halibut, or about 18 percent of the commercial Alaskan catch (54,219,000 pounds). Kodiak and Seward received the second and third largest landing volumes, each moving between 11 percent-15 percent of the Alaskan commercial catch. In southeast Alaska, Sitka received 3,885,000 pounds, Juneau 3,069,000 pounds, and Petersburg (with Kake) 3,038,000 pounds. Only 2.6 percent of the Alaskan QS catch was landed outside of Alaska.

Fishers in Area 2B delivered commercial harvests to 19 different ports in 2006. Several small ports (Bella Bella, French Creek, North Delta, Port McNeill, Quadra Island and Skidegate) received fewer than three deliveries each in 2006. The ports of Prince Rupert/Port Edward, Port Hardy, and Vancouver received most of the landings, about 88 percent of the Area 2B commercial catch. Port Hardy and Prince Rupert/Port Edward received about 41 and 39 percent of the B.C. commercial landings, respectively.

The 2006 QS fishery landings were spread over nine months of the year. In Alaska, May was the busiest month, as it has been for the last six years. May

landings represented 17 percent of the total catch for Alaska, an increase from 16 percent in 2005. In British Columbia, March was the busiest month for landings, as it was in 2005. In 2006, 19.3 percent of the Area 2B catch was landed in March compared with 16.6 percent of the catch being delivered during the same month last year.

Prices were also up in 2006. The average ex-vessel price for the year was well over $3.00 (U.S.) per pound, somewhat higher than in 2005, and some prices reached over $5.00 per pound late in the 2006 season.

The landing of live halibut from Area 2B was legally allowed by DFO. Live fish landings have ranged from a low of 7,900 pounds in 1998 to a high of 103,000 pounds in 1999. A total of 32,972 pounds of live fish was landed in 2006.

Electronic reporting in Alaska

IPHC, ADF&G, and NMFS staffs have been working since 2002 to develop and implement a cooperative interagency electronic fishery reporting system for commercial landing records in Alaska. The project included designing a web-based Interagency Electronic Reporting System (IERS) with a repository database in the Alaska State Office Building in Juneau.

In 2006, years of cooperative work paid off when Alaska's Interagency Electronic Reporting System became operational.

A group of CDQ fishers in Dillingham, Alaska meet with agency personnel to discuss the eLandings system. Photo by Heather Gilroy.

In May 2006, IERS became operational and was optional for statewide groundfish landings and for IFQ/CDQ halibut and sablefish. Since the program operates 24 hours a day and 7 days a week, the governmental agencies are working with an outside company to provide help desk support during non-business hours. For halibut, the system reduces duplicative reporting resulting from the current requirements of completing both ADF&G fish tickets and NMFS quota share reports.

The software application (eLandings) records data elements required by regulations, prints fish tickets, and connects with the NMFS quota share database. The appropriate data from IERS are being sent to the agencies for their internal databases. The application allows processors to import or export data into their own databases so that double entry is not necessary. Industry personnel and

agency staff have provided feedback on the operation and the application is continuously being modified to add features.

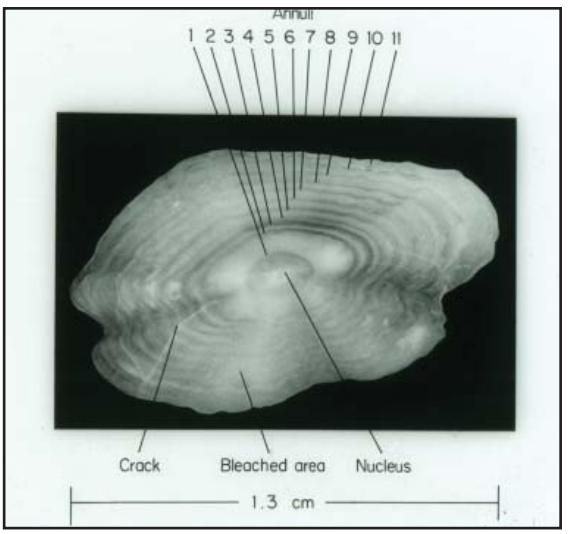
Age distribution of the commercial halibut catch

In 2006, port samplers collected 13,920 market sample otoliths Average age of samples from Areas 2A, 4A, and 4D increased in 2006 while average age of otoliths collected from Areas 2B, 3A, 4B, and 4C decreased from 2005. The average age of samples from 2C and 3B remained the same in 2005 and 2006. The average age from all areas combined increased by over half a year in 2006 relative to 2005, and overall average age in 2006 was a year and a half higher than it was in 1997.

Average size (measured fork length) of sampled halibut increased in Areas 4B and 4C in 2006 but decreased in all other areas. Average fork length for all areas combined decreased by one centimeter in 2006.

Average size, as measured by our port samplers, decreased this year in all areas except Areas 4B and 4C.

The 1995 year class (11-year-olds) accounted for the largest proportion (in numbers) of the overall commercial catch (14 percent) in 2006. The next most abundant year classes were 1994 and 1996, accounting for 12 percent and 9 percent of the catch, respectively. Eleven-year-olds were also the most abundant age class in Regulatory Areas 2B, 2C, 4A, 4B, and 4D, and the second most abundant in Area 3B. In Area 2A, the most abundant year classes were 1994 and 1995 with equal numbers of 12- and 11-year olds, together accounting for 30 percent of the 2A samples. Twelve-year-olds (1994 year class) made up the most abundant age class in Regulatory Areas 3A and 3B, while eight-year-olds (1998 year class) were the most abundant age class in Area 4C.



The age of a halibut can be determined through examination of its earbone. This earbone appears to have come from an 11-year-old. IPHC archive.

The youngest and oldest halibut in the 2006 commercial, or "market", samples were determined to be five and 47 years old, respectively. There were nine five-year-olds: four captured in Area 2B, four captured in Area 2C, and one captured in Area 3B. The 47-year-old was captured in Area 4B, and had a fork length of 124 cm. The largest halibut in the 2006 commercial samples was a 29-year-old from Area 4B, measuring 218 cm.

Halibut—A Poetic Experience

The traditional canon of English literature doesn't give us many poems about seafood, but we do have a few, and wouldn't you know that one of them would be inspired by a halibut?

Some of the verses we have scattered throughout our Report come from eighteenth-century British poet William Cowper, who knew a poetic experience when he saw one—or tasted one, rather. Over two-hundred years ago, Cowper left us a record of one particularly poetic, culinary experience in his poem, "To the Immortal Memory of the Halibut, On Which I Dined This Day, Monday, April 26, 1784."

The halibut on Cowper's plate inspired a lavish contemplation of all the dangers of the deep: the

> the *"tempests…that wrung and racked the joints of many a stout and gallant bark,"*
> the *"overbearing winds that rock'd the deep"*
> all the hazards this fish survived *"in the unexplored abyss"* before landing finally at Cowper's dinner table.

The fish may have been landed, but Cowper himself seems to go a bit overboard when he begins talking to his dinner as he lays into it:

> *"Wherever thou hast fed, you little thought that I would feed on thee."*

And he closes his poem by congratulating his halibut on its envious fate:

> *"to feed a bard and be praised in verse."*

Most of us probably don't get *that* excited over a dish of halibut, as tasty as it may be, but maybe that's why we have poets—to remind us of the value of such simple pleasures as a dish of fresh halibut.

Or maybe Cowper was just *really* hungry. In any event, he doesn't let the moment pass without sentiments we heartily endorse: a blessing on the fisherman responsible for the catch. Cowper tells his halibut,

> *Peace, and good health, and much good fish,*
> *To him who sent thee! and success, as oft*
> *As it descends into the billowy gulf,*
> *To the same line that caught thee!*

We agree: Peace and good health and much good fish to all the commercial, sport, and subsistence fishers who bring home the halibut for dinner.

THE RECREATIONAL FISHERY

Apprentice fisherman:
Master, I marvel how the fishes live in the sea.
Fisherman:
As men do on land: the great ones eat up the little ones.

--Shakespeare.

The sport fishery had another good year in 2006, with projected harvest estimates of 515,645 pounds in Area 2A; 2.262 million pounds in 2B, and 9.2 million pounds in Alaskan waters. But such harvests brought with them some serious issues for the sport fisheries, especially in Alaska.

Charter halibut issue

The 2006 projected harvest coastwide was just under 12 million pounds.

When it comes to fisheries management, Shakespeare's words above ring truer than the Bard ever intended. One of the most delicate balancing acts in resource management lies in allocating a natural resource equitably to different user groups—ensuring that no single user group's harvests encroach on the livelihood of another. As conservation of the halibut resource is the overarching goal of the IPHC, the Commission leaves the business of allocating catch limits among different user groups to the U.S. and Canadian governments.

But sometimes conservation and allocation issues collide. In Alaska, increasing guided sport (or charter) harvests of halibut in Area 2C have greatly

A group of European visitors show off their Resurrection Bay catch on the docks of Seward, Alaska. Photo by Cal Blood.

exceeded the guideline harvest levels (GHL) by which the North Pacific Fishery Management Council manages charter harvests of halibut. The allocation issue is that the increasing charter harvests leave increasingly less halibut available to be harvested by the commercial sector.

Here's how that happens: The IPHC subtracts estimates of all noncommercial removals (sport, subsistence, bycatch, and wastage) from the total Constant Exploitation Yield (CEY). The remaining CEY, after the removals are subtracted, is the maximum catch or ''fishery CEY'' for an area's directed commercial fishery. As non-commercial use of the resource increases, the commercial fishery CEY decreases.

The Commission has used bag limits to regulate the sport fishery in Alaska since 1973.

This method for determining the limit for the commercial use of halibut worked well for many years to conserve the halibut resource, as long as the other non-commercial uses of the resource remained relatively stable and small. In recent years, however, the growth in the charter vessel fishery, particularly in Area 2C, has resulted in a *de facto* re-allocation of the halibut resource away from the commercial fishery to the charter vessel fishery.

The North Pacific Fishery Management Council has tried to manage the charter halibut fishery off Alaska under guideline harvest levels (GHLs), but the guideline harvest levels are just that: guidelines. No regulations are in place to reduce charter harvests if the charter fishery exceeds the GHLs, as it has the past two years—by 36 percent in 2005 and by 40 percent in 2006.

Given the magnitude of harvests over the GHL, and with no regulations in place to restrain the charter fishery, we believe that such overharvesting also poses a conservation risk, with the potential to jeopardize the Commission's conservation and management goals for the halibut stock.

The Commission has used bag limits to regulate the sport fishery since it first adopted sport halibut fishing rules in 1973. That year, the Commission established a bag limit of three fish per day per person. In 1974, we reduced the bag limit to one fish per day, and then, the following year, raised it to two fish per day, where it has remained until present.

Other regulations

Sport fishing regulations for 2006 in Alaska and British Columbia were similar to those in 2005. Allocative regulations for sport, commercial, and treaty Indian fisheries in Area 2A are specified by the Pacific Fishery Management Council as a catch-sharing plan and adopted by the Commission. The sport fishery in Area 2A was divided into several subareas within which seasons were managed by catch limits. Charter vessels were required to obtain a license from the IPHC to possess halibut during open seasons. Vessels were also required 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.

Harvest estimations

The 2006 Area 2A sports harvests are estimated for the various subareas by the Oregon Department of Fish and Wildlife and Washington Department of Fish

and Wildlife from in-season creel census estimates. The exception to estimation via creel census was Washington Inside Waters (WIW), where sport harvests are assessed by a post-season phone survey.

The Area 2B harvest estimate in numbers was provided by the DFO and modified by the IPHC to include the Canadian catch landed at Neah Bay, Washington, and to estimate the catch in weight.

The Alaska Department of Fish and Game (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 for the IPHC, based on a creel survey in Area 2C and port sampling in Area 3A. The Area 3A estimate for 2006 was based on a linear projection of total numbers of halibut harvested during

An ADF&G biologist interviews a sport fisher in Homer, Alaska. Photo by Cal Blood.

A recent change in how Area 2C harvest projections are derived should help to remedy the problem of consistent underestimation.

the five most recent annual harvests. The resultant numbers of halibut were converted to total pounds net weight by multiplying numbers by the respective 2006 average individual fish weight (average weight) for each area.

In Area 2C, the projected number of fish harvested within each Statewide Harvest Survey (SWHS) area was also based on a linear projection of the most recent five years of harvest estimates. This change in methodology now aligns Areas 2C and 3A with respect to how the projections are conducted. The previous method used for Area 2C (a five-year average of the ratio between the SWHS and creel survey harvest data) resulted in consistent underestimation, especially of the harvest within the charter sector.

In addition, an alternative estimate was presented using charter harvest logbook data though August 16, 2006. This method produced a 2.4 percent lower estimate among charter vessels for Area 2C and an 8.1 percent higher estimate for Area 3A charter vessels, than did the estimates based upon the SWHS survey. These differences may not be significant for stock assessment purposes and the

ADF&G Sport Fish Division will continue to assess the quality and accuracy of the logbook data. In the meantime, ADF&G recommends to the IPHC that SWHS projections be used, for the following reasons: 1) the charter GHLs for Area 2C and Area 3A are based on SWHS estimates, 2) past stock assessments have been based on SWHS estimates, and 3) the quality and accuracy of the 2006 logbook data have not yet been fully evaluated.

Harvest estimates for Areas 3B and 4 were based on a linear projection of the 2001-2005 harvest estimated from the SWHS. The average weight from 2006 for Kodiak, the nearest sampled port, was applied to the projected numbers of fish harvested in each Area to generate the 2006 estimated net harvest weights. The total coastwide estimated sport landings for 2005 were the highest on record, driven primarily by Areas 2B and 3A reaching their highest ever landings.

Area 2A

The estimated harvest for Area 2A in 2006 was within two percent of the catch limit.

The estimated 2006 harvest from Area 2A was 520,876 pounds. This was about two percent under the catch limit of 525,576 pounds. The catch for Washington Inside Waters (WIW) was 63,376 pounds. The sport halibut fishery along the Strait of Juan de Fuca and Puget Sound is divided at Low Point where an early fishery takes place east of the point and a later fishery west of the point. This is the fourth year the WIW area has been partitioned into sub-regions. The Washington North Coast fishery left an estimated 13,439 pounds on the grounds relative to the 119,244 pound quota. Leaving such a large amount of poundage led to several inquiries by anglers as to how managers might allow an orderly clean-up in the future, without exceeding the quota.

The North Coast average weight of 23.2 pounds was similar to the average weight of previous years. This year's fishery closed after only seven days of fishing. The unique method of splitting the fishery into separate days of fishing, rather than running consecutively, provided no more fishing than in 2005 and left more halibut unharvested.

The Washington South Coast fishery, centered principally out of Westport, closed an estimated 4,532 pounds above the quota. The average weight of South Coast halibut was 24.6 pounds, much higher than last year's average weight of 18.5 pounds. Because of the overage, the nearshore Washington South Coast fishery could not be re-opened to allow for incidental retention of halibut while fishing for other groundfish.

The Columbia River area closed at 549 pounds over its quota. Pacific halibut caught later in the summer in the Columbia River area weighed considerably more on average on the Oregon side (22 pounds) than on the Washington side (about 16 pounds). While overall fishing days were lower than 2005, fishing extended into September. Early in the season, small halibut were much more available than larger halibut. As in previous years, a very high proportion (ranging from 30 percent of the North Washington Coast catch to 68 percent of the South Washington Coast catch) of the catch was sampled to provide the average weights for their respective areas.

The Oregon sport fishery closed closer to the catch limit than it has in recent years. Ample opportunity was provided to anglers into September, weather permitting. The spring fishery stretched into the first week of July, when anglers seemed to turn their attention to salmon (*Onchorynchus* spp.) and albacore (*Thunnus alalunga*). Oregon anglers enjoyed a brief increase to a

two-fish bag limit in September, which seemed to encourage more attention to the halibut fishery and hastened the taking of the Oregon Central Coast quota. As a result, the less-than-40 fathom fishery was shut down when the Oregon Central Coast fishery exceeded its quota. The overall average weight for the Oregon sport halibut fishery was 18 pounds in 2006, the same as it was in 2005. As in Washington, a substantial portion (50 percent) of the available harvest was measured to determine the average weight.

Area 2B

The final estimated catch in numbers of halibut for 2005, provided to the Commission by the Pacific Region of DFO, was 1.841 million pounds and exceeded the sport allocation just shy of 250,000 pounds.

The 2006 projected harvest, based on in-season estimates, was 2.262 million pounds. The previous method of projecting the catch used a linear regression to predict the catch in numbers. The catch in numbers was then expanded into pounds by the aforementioned average weights from Alaska and Washington for 2006. The Commission will update these harvest estimates using average weights from British Columbia waters when they become available.

A little over 300,000 pounds of halibut were estimated to have been caught in Canadian waters and landed in Neah Bay, Washington.

In 2006, Washington anglers caught 13,045 halibut in Canadian waters and landed them in Neah Bay, a number that is nearly 50 percent higher than the 8,816 halibut landed in 2005 and ends three consecutive years of declining catch from Canadian waters. Using the average weight of 23.2 pounds provided by WDFW, the estimated harvest was 301,992 pounds.

Area 2C

The updated 2005 Area 2C harvest was estimated to be 2.798 million pounds net weight and the 2006 projected harvest was estimated to be 3.033 million pounds. The numbers of fish harvested were identified by State-Wide Harvest Survey area and were converted to net 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. 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 2005 was 17.2 pounds net weight and preliminary indications showed the average net weight to have been 17.7 pounds in 2006.

Area 3A

The Area 3A projected harvest for 2006 was 6.088 million pounds, whereas the 2005 updated estimate was 5.672 million pounds. As in Area 2C, the 2006 catch estimate will be updated when the 2006 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 2006 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. Care was taken to properly account for harvests by the charter, private, and military recreation camps. The average weight for 2005 was 17.0 pounds. Preliminary indications suggest the average net weight in 2006 had dropped slightly, to 16.7 pounds.

Areas 3B and 4

As in Areas 2C and 3A, 2006 SWHS numbers were not yet available for Areas 3B and 4 at press time. In 2005 and 2006, the average weight obtained from ADF&G sport fish sampling on Kodiak Island was used to estimate the Areas 3B and 4 harvests in pounds. The average weight increased from 18.4 to 20.9 pounds net weight between 2005 and 2006. This may or may not reflect the actual catches. Anecdotal information gleaned from sport fish publications and conversations with local charter operators suggested that the average weight may be higher in Dutch Harbor and Unalaska than the Kodiak average weight; therefore, the harvest in Areas 3B and 4 may have been higher than reported in this document.

Sport tag recoveries

Only one conventional tag recovery of note occurred in 2006, but it was a mighty traveler. A small halibut tagged in April 2003 for the Homer Jackpot Halibut Derby was recovered this summer at the north end of the Bandon High Spot off the coast of southern Oregon. Reportedly the tag was taken off the halibut, which was then returned to the sea unharmed. Young halibut are known to migrate long distances, but this is the farthest south a Homer Jackpot Halibut Derby tagged halibut has been recovered. A few years ago a derby tag was recovered off a halibut landed by a commercial fisher in Prince Rupert.

A Homer Halibut Derby tag was recovered off southern Oregon, making it the farthest south that a Homer derby fish has traveled to date.

Also, two electronic Pop-up Archival Transmitting (PAT) tags were recovered by sport anglers. One fish was captured off Newport, Oregon only 37 days after tagging. The other was captured off Sitka after nearly 11 months at-liberty. The Oregon fish had strayed less than 30 miles (45 km) between tagging and capture, a relatively short journey and not unexpected over one month in the summer. Still, the tag return was exciting if for no other reason than the rich data this type of tag contains.

These tags record environmental data (temperature, depth and light) every minute while attached to the fish, and if recovered can tell us much about the fish's activity during the tagging interval. For example, the Alaskan fish was captured less than a mile from its tagging site, and yet from the depth data we were able to determine that the fish left the area in winter and moved to deep-water grounds on the shelf edge. From such data we are learning that halibut can return home to their summer grounds interannually, something we could never have proven from conventional tag returns. Several PAT tags have been recaptured by the commercial longline fleet, but these two were the first recovered by sport fishers.

WASTAGE IN THE 2006 HALIBUT FISHERY

You outlived tempests, such as wrung and racked
The joints of many a stout and gallant bark,
And overwhelmed them in the unexplored abyss.
—William Cowper, to the halibut on his plate

An estimated 139,000 pounds of legal-sized halibut and 2,084,000 pounds of sub-legal sized halibut were counted as wastage in 2006.

William Cowper's poem to his halibut dinner enumerates some of the dangers of the deep that his halibut must have survived when young before being caught and shipped and served for dinner. One danger Cowper could not have recognized in the eighteenth century was the modern potential for wastage in a fishery. We may not be able to know how many halibut are lost to tempests, to "the overbearing winds that rock the deep," but wastage is one danger facing halibut that we can at least account for, if not entirely control.

Wastage in the commercial fishery includes legal-sized halibut killed by lost and abandoned longline gear and sublegal-sized halibut that are released and die. Such lost fish constitute one kind of removal of Pacific halibut from the population accounted for in the Commission's annual stock assessment, along with commercial and sport catch, personal use (ceremonial and subsistence), and bycatch. Prior to 1997, wastage from the mortality of discarded sublegal halibut was deducted prior to calculating the setline constant exploitation yield (CEY). Since then, the estimate of commercial fishery wastage included in the stock assessment has represented legal-sized removals occurring from lost or abandoned gear. The estimated mortality of released sublegal halibut is accounted for when setting exploitation rates. Appendix I, Table 1 shows estimates of all removals accounted for by the Commission.

Wastage can also occur if more gear is set than is needed to obtain fishing period limits in Area 2A, individual vessel quota (IVQ) in Area 2B, and individual fishing quota (IFQ) and community development quota (CDQ) in the Alaska regulatory areas. 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 sand flea, shark, or other predation. The amount of legal-sized halibut caught in excess of quota, or catch limits, and discarded at sea is recorded during logbook interviews. Over-limit legal-sized discards are not currently included in the wastage removals.

The estimated mortality of released sublegal halibut in 2006 provides a record of annual amounts, although the current level will not be shown under total removals in the 2006 stock assessment.

Wastage from lost or abandoned gear

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 varied considerably as to the length of skates, hook size, and hook spacing but the data were standardized as an "effective skate." Gear that fished differently than the standardized effective skate was not included in the subsequent calculations.

Some log data could not be standardized because of missing data or gear fished differently. With the directed halibut IFQ fishery in Alaska, and with the incidental halibut catch during the sablefish longline fishery in Area 2A, there were mixed halibut and sablefish trips as well as trips which targeted sablefish and landed incidentally-caught halibut. Sablefish gear is considered a non-standard halibut gear that fishes differently, and therefore was 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 using the gear type used to calculate catch per unit effort (fixed hook gear in Alaska, and a combination of fixed hook and snap gear 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 result of shark and sand flea predation on hooked halibut. Photo by Ayala Knott.

Wastage from lost or abandoned gear was first calculated in 1985. Since the implementation of the quota share fisheries in 1995, the ratios have fluctuated slightly among years, but have remained lower than they were during the derby fisheries. The 2006 ratios of effective skates lost to effective skates hauled by regulatory area were as follows: Area 2A = 0.002; Area 2B = 0.003; Area 2C = 0.002; Area 3A = 0.002; Area 3B = 0.001; and Area 4 = 0.002.

To arrive at a wastage figure, log data from the commercial fleet is first standardized.

Discard mortality of sublegal halibut

Discussions at the 1999 IPHC Annual Meeting resulted in changes to calculations of estimated wastage from sublegal-sized halibut. It was suggested that the IPHC setline survey catch ratio of sublegal- to legal-sized fish did not represent that of the commercial fleet as the survey vessels catch more sublegal fish. Prior to 1999, the amount of sublegal halibut caught in the commercial fishery was estimated from the setline survey catch ratio of sublegal to legal pounds at all survey stations. The current method used to estimate sublegal catch by the commercial fleet is adjusted to calculate the sublegal/legal ratio from the setline survey stations that represent the highest one-third of the legal catch weight in each regulatory area.

The ratios of sublegal to legal pounds calculated from 2006 grid survey data are as follows: Area 2A = 0.09; Area 2B = 0.24; Area 2C = 0.17; Area 3A = 0.17; Area 3B = 0.27; and Area 4 = 0.11. These adjusted ratios result in 50 to 86

A discard mortality rate of 16 percent has been used since 1991 in Canada and 1996 in the U.S.

percent less sublegal catch than ratios calculated using all stations. In comparison to the 2005 ratios, the 2006 ratios of sublegal to legal pounds increased in Area 2B and 3B, and decreased in the other regulatory areas.

A discard mortality rate of 16 percent has been used for all U.S. areas since 1996 and for the Canadian IVQ fishery since 1991. Because of the lack of actual fishery observations, the rate was originally based on discard mortality rates derived from the 1992-1993 Bering Sea/Aleutians sablefish hook and line fishery, where the fishing pace is similar to that of the quota halibut fisheries. For the other years, a rate of 25 percent was used as the halibut fishery at the time was a derby fishery and not a quota share fishery. This rate was based on observations from the 1992-1993 Gulf of Alaska sablefish fishery which had a similar management structure.

To estimate the pounds of sublegal-sized halibut captured in the commercial halibut fishery, the Area-specific ratios of sublegal halibut from the annual IPHC setline surveys are multiplied by the estimated commercial catch in each regulatory area, for each year. The resulting poundage is then multiplied by the discard mortality rate to obtain the estimated poundage of sublegal-sized halibut killed in the commercial fishery.

PERSONAL USE

Thy lot thy brethren of the slimy fin
Would envy, could they know that you were fated
To feed a bard. . . .

Also among the removals accounted for in the Commission's annual stock assessment are halibut taken for personal use. Halibut may be taken for personal use from several sources throughout its range: from the treaty Indian ceremonial and subsistence fishery occurring in the waters off northwest Washington State; from the First Nations food fish fishery in British Columbia; and from the recently-created subsistence fishery off Alaska. Under IPHC regulations, sublegal sized halibut caught in commercial operations may also be retained for personal use in Areas 4D and 4E.

A vessel tied to the dock in St. Paul, Alaska. IPHC archive.

Estimates of the coastwide personal use harvest in 2005, the most recent year for which we have complete information, totaled 1.54 million pounds, virtually unchanged from 2004. Harvests in all areas changed very little from 2004, and the subsistence harvest in Alaska declined only slightly. No clear yearly trends have been identified in the Alaskan subsistence fishery harvest due to the newness of this fishery.

Harvest estimates took a jump in 2003 with the implementation of new subsistence fishery regulations that provided improved accounting of the removal.

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 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. 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

The IPHC began estimating the personal use harvest in Alaska in 1991, when 1.95 million pounds were estimated to have been taken. The estimate for 1992 declined by almost half, to one million pounds. In 1998, a new methodology was developed to estimate personal use from information gathered by household interviews and postal surveys conducted by the ADF&G. The resulting estimates were used for 1998-2002, with the only annual changes being the amount of sublegal poundage retained by the Area 4E Community Development Quota (CDQ) fishers.

The subsistence fishery management program established an annual survey of fishers to determine harvest.

In 2003, the North Pacific Fishery Management Council created a subsistence fishery for halibut. One provision of the subsistence fishery management program was the establishment of an annual survey of fishers to determine the annual harvest. The survey was conducted by the Subsistence Division of ADF&G. The estimates from the 2005 survey totaled 1,178,000 pounds (net weight) in Areas 2C through 4E. This represented only a slight decrease from 2004.

The ADF&G survey indicated that roughly 50 percent of the total subsistence harvest in Alaska occurred in Area 2C, with 36 percent harvested in Area 3A. The Areas comprising the Bering Sea and Aleutian Islands totaled 104,500 pounds, or 6.8 percent of the coast-wide harvest. The communities within Area 4E accounted for roughly 60 percent of the harvest in the Bering Sea/Aleutian Areas.

The Commission also adds to its annual estimates of personal use the sublegal halibut harvest by the Area 4D/4E CDQ fishery. The ADF&G subsistence survey included all registered fishers and households in all Areas, but Area 4D and 4E fishers were instructed to not include any retained sublegal halibut caught during commercial fishing. Also, fishers that 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.

British Columbia

The primary source of personal use harvest in British Columbia was the First Nations food fish fishery, whose harvests for 2006 were estimated by the DFO at 300,000 pounds. In past years the IPHC has received from DFO some logbook and landing data for this harvest, but those data have not been adequate for an independent estimate of the food fish fishery harvest. Thus, IPHC relies on the DFO estimate which has been static since 1993.

Washington, Oregon, and California

In Area 2A (Washington, Oregon, and California), the Pacific Fishery Management Council allocates the catch limit to directed and incidental commercial fisheries, sport fisheries, and treaty Indian fisheries operating off northwest Washington. During 2005, the treaty Indian tribes allocated 38,000 pounds to their ceremonial and subsistence fishery, but harvested only 36,000 pounds.

Retention of sublegal halibut in the 2005 Area 4D/4E CDQ Fishery

Since 1998, sublegal halibut (less than 32 inches) have been retained by the Area 4E CDQ commercial halibut fishery, under an exemption requested by the North Pacific Fishery Management Council and approved by the Commission. Beginning in 2002, the retention allowance was expanded to include Area 4D for only those vessels that land all of their annual catch in Areas 4D or 4E. The amount of retained halibut has grown from 3,590 pounds in 1998 to as high as 30,267 in 2001. For 2005, a total of 23,221 pounds was reported by three CDQ organizations, an increase of 43 percent from 2004.

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

The IPHC relies on three local organizations to provide information on the retention of sublegal halibut in Area 4D and 4E.

Results for 2005

Reports for 2005 were received from three organizations: Coastal Villages Regional Fund (CVRF), Bristol Bay Economic Development Corp. (BBEDC), and Norton Sound Economic Development Corp. (NSEDC). CVRF and BBEDC reported significantly higher amounts retained in 2005 compared to 2004. In contrast, the amount retained by NSEDC fishers declined slightly. Additional details are provided in the following sections.

Coastal Villages Regional Fund

The report from CVRF was received on November 28, 2006. Crews at Coastal Villages Seafoods facilities at seven ports separated undersize halibut during offloads and then weighed them separately from the legal halibut. Once this was completed, the plant's record keeper recorded on a tally sheet the name, number of halibut, and the poundage of the sublegal halibut retained by the fishers. Each plant sent the tally sheets to the Coastal Villages Seafoods headquarters on a weekly basis, where the information was entered onto a spreadsheet.

In 2005, plants in Chefornak, Hooper Bay, Kipnuk, Mekoryuk, Toksook Bay, Tununak, and Quinhagak recorded sublegal halibut during June 1-August 4. CVRF reported that 11,335 pounds were landed, a 59 percent increase from 2004. A total of 1,362 halibut were recorded, for an average weight of 8.3 pounds. Over 70 percent of the pounds were landed at Toksook Bay and Mekoryuk, similar to previous years.

Bristol Bay Economic Development Corp.

BBEDC's report was received on October 25, 2005. BBEDC fishers filled out a reporting log, which included the lengths of any 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 fish also being delivered at Naknek.

BBEDC reported that fishers retained 955 halibut for a total of 8,750 pounds, up substantially from 2004. The fish had an average size of 9.2 pounds and 29 inches (74 cm), and 81 percent of the halibut were 28-31 inches in length. Fishers reported that the fish were used for subsistence food in dried and smoked forms, and shared in general with community members. Local fishers also reported they had to constantly search for fish in 2005. They suspect several causes for this, including a late spring.

The NSEDC reported a catch of 358 halibut weighing an average of 8.8 pounds each in 2005.

Norton Sound Economic Development Corp.

NSEDC's report was received on December 1, 2006. NSEDC required their vessels, which fished in either Area 4D or 4E, to offload all halibut, legal and sublegal. The sublegal halibut were weighed and then returned to the fishers. NSEDC had landings from July 29 through October 4, and reported 358 sublegal halibut weighing 3,136 pounds net weight (head-off, no ice/slime). The fish had an average net weight of 8.8 pounds. Fish were landed only in Nome in 2005.

Incidental catch of Pacific halibut

Fisheries targeting other fish and shellfish inadvertently catch Pacific halibut. The regulations require that halibut be returned to the sea with no additional injury, but some fish do die from being caught and handled. Though unintended, this incidental harvest, or bycatch, represents the second largest removal of halibut from the biomass. The Commission has therefore kept a careful eye on incidental catch.

Bycatch mortality coastwide was estimated at 12.1 million pounds in 2006.

Bycatch mortality has ranged between 12 and 14 million pounds since the late 1990s. Estimates of the bycatch mortality in 2006 totaled 12.1 million pounds, a decrease from 2005 and the lowest since 1987. Bycatch mortality decreased in most major regulatory areas, compared to 2005. However, a decrease in Area 3A was offset by an increase in Area 3B. In Area 2A, an increase in trawl effort in nearshore areas caused bycatch mortality to increase in 2005. Bycatch mortality in Area 2B remained slightly higher than in 2003-4. Lower trawl bycatch in Area 4 was the primary reason for reduced bycatch mortality in that area.

Sources of bycatch information and estimates

The Commission relies upon information supplied by observer programs for bycatch estimates in most fisheries. We use research survey information to generate estimates of bycatch in the few cases where fishery observations are unavailable. NMFS operates observer programs covering the groundfish fisheries

Sorting through a multiple-species catch on the NMFS Eastern Bering Sea trawl survey. Photo by Cal Blood.

off Alaska and the U.S. west coast, and provides IPHC with estimates of bycatch. Estimates of bycatch off Alaska for 2006 were based on bycatch reported from fishing conducted through mid-November and projections for the remainder of the year.

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.

For fisheries conducted off British Columbia, the amount of bycatch information varies. For the trawl fishery, bycatch is managed with an individual bycatch quota program instituted 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. In 2006, a new management program that includes 100 percent at-sea monitoring (observers or video) requires 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 has been known. This new information will be included in next year's bycatch report.

In 2006, a new integrated management program was implemented in B.C. waters, requiring 100 percent accounting of removals.

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 staff 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.

Discard mortality rates and assumptions

Discard mortality rates (DMRs) are used to determine the fraction of the estimated bycatch that dies. The 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. In Alaska, NMFS manages the groundfish fisheries according to a schedule of DMRs. In Area 2B, observers monitoring the Canadian trawl fishery examine each halibut to determine survival.

Data to determine DMRs for other fisheries are not available, so IPHC researchers make assumptions on likely DMRs based on similar fisheries with known DMRs. For Area 2A, the domestic groundfish trawl and shrimp trawls are assumed to have a 50 percent mortality rate, whereas the unobserved hook-&-line fishery for sablefish is assigned an assumed DMR of 25 percent. The midwater fishery for whiting is assumed to have a 75 percent rate, 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 declined 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.

Then, in the late 1980s, with the growth of the U.S. domestic groundfish fishery off Alaska, bycatch mortality again increased and peaked at 20.3 million pounds in 1992. Bycatch mortality has since declined; preliminary estimates for 2006 total 12.1 million pounds, representing a 7.5 percent decrease from 2005 and a 40 percent decrease from the peak in 1992 of 20.3 million pounds. Bycatch mortality has ranged between 12 million and 14 million pounds since the late 1990s.

Sablefish and rockfish are often found alongside halibut. Photo by Lara Hutton.

The estimated bycatch mortality of halibut has remained within the 12-14 million pound range since the late 1990s.

Area 2

Bycatch mortality in Area 2 in 2006 was estimated at 1.06 million pounds, down slightly from 2005 and below the 10-year average of 1.25 million pounds. The primary sources for bycatch mortality in Area 2 are the groundfish trawl fisheries in 2A and 2B, and the crab pot and shrimp trawl fisheries in 2C.

NMFS estimated halibut bycatch mortality for the 2005 trawl fishery operating in Area 2A at 358,000 pounds, a 46-percent increase from 2004 despite only a five-percent increase in overall trawl effort. Trawl effort in nearshore waters increased 46 percent, the greatest increase of all areas. This had a

From 2005 to 2006, a 7.5 percent decrease in bycatch mortality was seen in Area 2B.

significant effect on bycatch, as trip limits in this area were also higher in 2005, and more area was open to trawling than in 2004. Halibut bycatch rates have been higher in nearshore areas than anywhere else. The 2005 estimate has been used for 2006, but will be updated when an actual estimate for 2006 is obtained. 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 2006.

In Area 2B, trawl fishery bycatch mortality was estimated at 0.32 million pounds, a decrease of 7.5 percent from the 0.36 million pounds estimated for 2005. The change is believed due in part to reduced fishing effort for arrowtooth flounder (*Atheresthes stomias*). The 2006 estimate is significantly above the average of 0.24 million pounds which has occurred since the Individual Bycatch Quota program began in 1996.

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 we are assuming mortality has been relatively unchanged since then.

Area 3

Bycatch mortality in Area 3 was estimated at 4.20 million pounds in 2006, a 3.3 percent decrease from 2005. The groundfish fishery continued to be affected by fishery closures inside sea lion critical habitat, which forced vessels to fish in less productive areas. The catch of Pacific cod, which typically accounts for the majority of the halibut bycatch in Area 3, was similar to 2005. Pot effort for cod, which has lower bycatch properties than other gears, continues to be quite high. The total 2005 Area 3 bycatch is only slightly below the 10-year average of 4.47 million pounds.

A decrease of 8.8 percent in Area 3A bycatch mortality was offset by a 12 percent increase in Area 3B. Most of the decrease seen in bycatch in 3A was due to lower bycatch in the trawl fishery. Trawl fishery mortality was the lowest since 2002. Hook-&-line fishery bycatch mortality, which occurs primarily in winter cod fishing, increased. The opposite pattern occurred in Area 3B, where trawl fishery bycatch increased, probably in response to a shift in effort from 3A. Hook-&-line fishery bycatch also increased in Area 3B in 2006, though it still accounts for less than 10 percent of the total bycatch mortality in the area.

Area 4

Bycatch mortality in Area 4 decreased 10.6 percent in 2006, to 6.88 million pounds. Since 1997, bycatch mortality in Area 4 has ranged from 6.8 to 7.8 million pounds annually. There was a jump up to 7.7 million pounds in 2005, but 2006 settled back down to the level seen in 2004-5.

For 2006, total bycatch mortality was lower for CDQ trawl and longline fisheries than in 2005. The open access (non-CDQ) longline fishery bycatch continued to climb, and in 2006 was the highest since 2002. Nevertheless, it was quite a bit below the halibut bycatch mortality limit in 2005. In contrast, the open access trawl fisheries took their entire bycatch limit of approximately 6.1 million pounds.

Halibut mortality in the pot fishery for cod increased four-fold but was still extremely low. The Community Development Quota (CDQ) fishery targeted primarily pollock and resulted in only 115,000 pounds of bycatch mortality, less than in 1999 when the CDQ fishery focused more on cod.

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 implemented by NMFS and the North Pacific Fishery Management Council following several years of development and, ultimately, approval by the Commission.

In 2006, shore-based catcher vessel trawlers landed 10,762 halibut collected for this program at two participating processors in Dutch Harbor. This latest contribution brings the total donations since the program's inception to 170,166 pounds. NMFS Enforcement Division has monitored the halibut donated to the program and has reported no incidents.

Final 2005 results

SeaShare collected 29,286 pounds of halibut in 2005, with two processors participating: Unisea and Alyeska. As in past years, Unisea was the leading contributor. Also as in previous years, SeaFreeze personnel conducted the processing and inspection. Recipients of the processed halibut included Food Lifeline in Seattle.

Preliminary 2006 results

Once again, only UniSea and Alyeska processors participated in 2006. As of December 1, 2006, 10,762 pounds of frozen, headed & gutted halibut had been received, 69 percent (7,415 pounds) from Unisea and 31 percent (3,347 pounds) from Alyeska. The total amount processed is down substantially from 2005, especially for Unisea. SeaShare attributed the decline to numerous potential factors, including lower bycatch rates, quality of fish, plant capacity and processing availability, and changes in distance/time to port.

As in past years, the fish were delivered to SeaFreeze in Seattle through donated shipping by Coastal Transportation. SeaFreeze weighed the halibut in the totes and estimated the net weight. The fish were then processed by Smoki Foods into steaks, sleeved, and repackaged for delivery. Through the national network of America's Second Harvest, the halibut steaks were distributed to the food banks and hunger-relief programs in Cleveland, Dallas, New York City, San Jose and Washington, D.C.

Initially adopted by the Council in 1998, the program expired on December 31, 2000. After a review of the program by NMFS and the IPHC, the North Pacific Fishery Management Council extended the program indefinitely. The extension does require, however, a regular review of the program. Accordingly, IPHC staff will be examining the program in the coming year to fulfill this requirement.

The halibut donation program was run by SeaShare with donated goods and services from several companies including the Unisea and Alyeska processing plants in Dutch Harbor, Coastal Transportation, and Smoki Seafoods. The halibut steaks were distributed to food banks in five major cities across the United States.

ASSESSING THE PACIFIC HALIBUT STOCK

Indebted to no magnet and no chart . . .
Thou wast a voyager on many coasts,
Grazing at large in meadows submarine.
--William Cowper, to his halibut.

The recent IPHC tagging study has shown us that adult halibut may migrate between regulatory areas more often than previously thought. This discovery has led to a new way of looking at the stock assessment.

In the above verses, British poet William Cowper imagines his halibut wandering at large in underwater meadows without regard to compass ("magnet") or chart—the nautical tools we humans use for finding our way around the open ocean. A growing body of evidence suggests that halibut also seem to have little regard for IPHC regulatory areas.

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 or put another way, that the net migration of fish between areas was negligible. Evidence from both the assessments and an ongoing mark-recapture experiment increasingly suggests a continuing eastward net migration of catchable fish from Areas 3B and 4 in the western Gulf of Alaska into Area 2 in the eastern Gulf.

Each year the Commission assesses the abundance and potential yield of Pacific halibut in each regulatory area. Using all available data from the commercial fishery and scientific surveys, the Commission calculates a biological target level for total removals from each regulatory area by applying a fixed harvest rate to the estimate of exploitable biomass in that area. This target level is called the "constant exploitation yield" or CEY for that area in the coming year.

The corresponding target level for catches in directed fisheries subject to allocation is called the fishery CEY and comprises the commercial setline catch in all areas plus the sport catch in Areas 2A and 2B. The fishery CEY is calculated by subtracting from the total CEY, an estimate of all unallocated removals—bycatch of legal-sized fish, wastage of legal-sized fish in the halibut fishery, fish taken for personal use, and sport catch except in Areas 2A and 2B. Staff recommendations for catch limits in each area are based on the estimates of fishery CEY but may be higher or lower depending on a number of statistical and biological considerations. Similarly, the Commission's final quota decisions are based on the staff's recommendations but may be higher or lower.

Development of a coastwide assessment

The increasing evidence of net migration from the western to the eastern Gulf of Alaska has led the Commission to question the accuracy of the closed-area assessments of past years. In 2006, therefore, in addition to the closed-area assessments, we also conducted an assessment of the entire coast and used survey data to apportion the resulting coastwide biomass estimate into biomass for each regulatory area.

The two kinds of assessments produced very similar estimates of total abundance (total exploitable biomass about 400 million pounds, total available

Checking a halibut for a PIT tag on the *F/V Pacific Sun*. Photo by Sara Wilson.

yield about 80 million pounds). But the distribution among areas was quite different, with the survey apportionment of the coastwide assessment showing more biomass and available yield in Areas 3B and 4 than the closed-area assessments and less in Area 2. Area 3A results were about the same in both assessments.

The closed-area assessments overestimate present abundance in Area 2 because in effect they include fish that are migrating to Area 2 from areas to westward. It could be fairly argued that these really are Area 2 fish, so apportioning yield on the basis of the closed-area assessments is appropriate. And it would certainly be feasible. According to the present estimates, it would mean taking 25 percent of the coastwide yield from Area 2, which contains 16 percent of the coastwide biomass. This would not be a conservation issue for the stock as a whole. The fishery has been prosecuted in that fashion for decades, and it may be sustainable, although harvest rates in the western areas (the source of the migrating fish) have been higher since 1996 than in previous years.

Although the coastwide and closed area assessments are closely matched in the estimate of overall abundance, the estimates among areas are quite different.

On the other hand, the general practice and the stated policy of the Commission is to harvest in proportion to actual abundance in each area, which means reducing the exploitation rate in Area 2 to the target level, now 20 percent. This new information will be considered by the Commission at the 2007 Annual Meeting.

Where hast thou floated, in what seas pursued
Thy pastime? when wast thou an egg new-spawned,
Lost in the immensity of ocean's waste?

--William Cowper, to his dinner.

2006 standardized stock assessment survey

The IPHC setline survey is the major fishery-independent source used in the IPHC stock assessment.

The Commission's standardized stock assessment (SSA) survey gathers catch information and biological data independent of the commercial fishery using standardized methods, bait, and gear during the summer of each year. The SSA survey represents only a small fraction of commercial effort and is conducted only in the summer, but it collects data that provide an important comparison with data collected from the commercial fishery. The commercial fishery, with its greater variety of gear and wider distribution of effort, presents a broad spatial and temporal sampling of the stock. The biological data (e.g., the size, age, and sex composition of halibut) collected on the more limited SSA surveys help us monitor changes in biomass, growth, and mortality in adult and sub-adult components of the population. In addition, records of non-target

Crewmembers, Luke Sollee and Daniel Sundstrom, of the *F/V Blackhawk* during the Area 2A survey. Photo by Cal Blood.

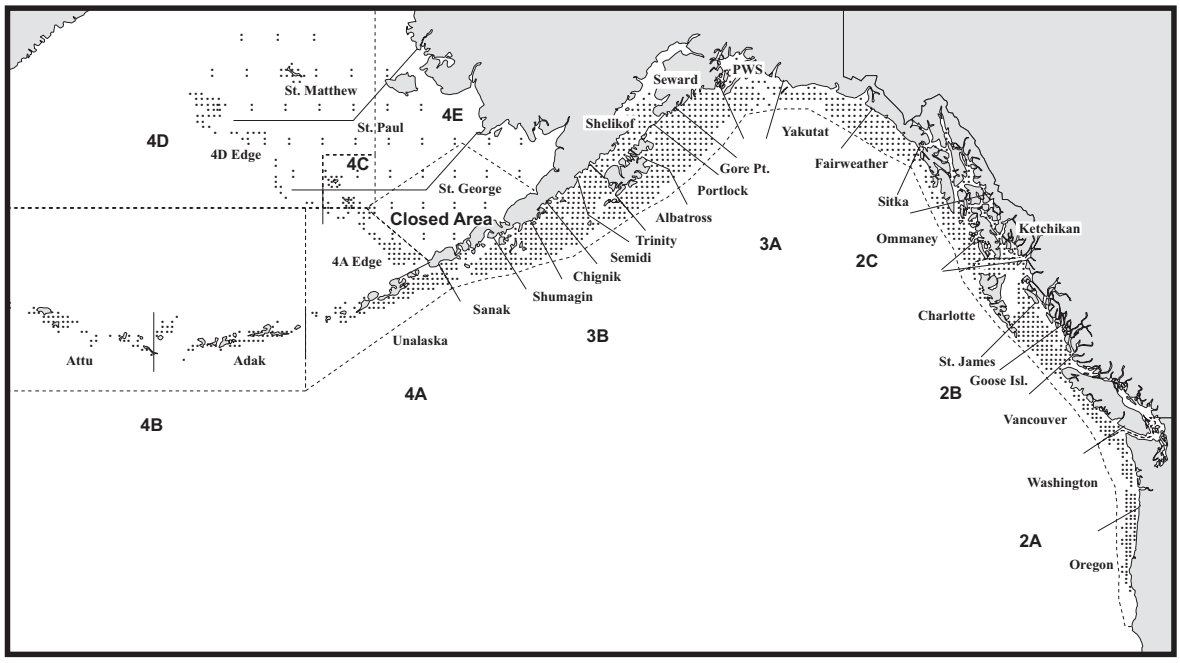


Figure 2. IPHC survey stations fished in 2006.

Additional stations were added in the Bering Sea to get a better idea of biomass in the area.

species caught during survey operations provide insight into bait competition, rate of bait attacks, as well as an index of abundance over time, all of which are necessary for the assessment, management, and avoidance of bycatch species. The standardized setline surveys have been conducted in selected areas in most years since 1963 (with a break from 1987 to 1992). The current base survey station design and most sampling protocols have remained the same since 1998.

The 2006 survey encompassed all offshore waters of Oregon, Washington, British Columbia, southeast Alaska, Gulf of Alaska, Aleutian Islands, and the Bering Sea, divided into 30 regions, each requiring between 15 and 43 charter days to complete. Most stations are located at the intersections of a 10 nmi by 10 nmi square grid within the depth range occupied by Pacific halibut; however, stations in the newly added Eastern Bering Sea charter regions—St. George, St. Matthew, and St. Paul—and the rockfish index stations in the Washington charter region are laid out in a different pattern.

The Commission chartered thirteen commercial longline vessels, seven Canadian vessels and six U.S., for survey operations in 2006. During a combined 78 trips and 680 charter days, these vessels surveyed 30 charter regions covering halibut habitat from Oregon to the island of Attu in the Aleutian Islands, Alaska, completing all of the 1,369 planned stations. Of these, 1,361 (99.0 percent) were considered successful for stock assessment analysis. Approximately 989,458 pounds of halibut, 126,148 pounds of Pacific cod, and 45,923 pounds of rockfish were landed from the standardized survey stations. Compared to the 2005 survey, halibut catch per unit effort (CPUE) decreased in IPHC Regulatory Areas 2A, 2B, 2C, 3A, 3B, 4A and 4D. The CPUE increased in 4B.

In 2006, IPHC and Washington Department of Fish and Wildlife (WDFW) received funding from the Pacific States Marine Fish Commission (PSMFC) to conduct a joint project with industry. To take a closer look at rockfish populations, the IPHC Area 2A charter was expanded to include 25 rockfish

index stations in the Washington survey region. WDFW located stations with the intent of targeting more rocky-bottom habitat than the standard survey stations. Sampling activities at these stations were identical to those on standard IPHC stations, however effort was limited to three skates on these stations.

For the eastern Bering Sea, this year we conducted a standardized grid survey in an effort to better characterize the biology, relative abundance, and range of halibut in the area. The surveyed area stretched from the shelf edge eastward to inner Bristol Bay and from the Alaskan Peninsula northward to 60 nmi north of St. Matthew Island (55° 20' N to 61° 30' N and from 159° 33' W to 177° 23' W). To survey such a vast area efficiently, the systematic station layout was altered to enable completion of these charter regions in a time frame comparable to that of the standard survey. Additionally, in the interests of efficiency, trip length restrictions as well as requirements for fish retention were altered. For the majority of the area covered, paired stations, 10 nmi apart, were placed at 60 nmi by 60 nmi intervals. One station of each pair corresponds to a trawl station on NMFS's annual Eastern Bering Sea trawl survey, thereby enabling comparison between the two surveys. Forty-one station pairs (comprising 82 stations) were completed using that configuration. An additional 29 stations were placed on the standard 10 nmi by 10 nmi configuration of our traditional surveys around St. Matthew (nine stations), St. Paul (10 stations), and St. George (10 stations) Islands. The entire area was split into three regions for bidding purposes, each containing stations from both design layouts.

A portion of the Bering Sea stations coincided closely with NMFS trawl survey stations to enable comparisons between the two gears.

Key pieces of information are collected for the stock assessment during the surveys including otoliths for aging. Photo by Colleen Duifhuis.

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 chum salmon (*Oncorhynchus keta*) weighing between 0.25 to 0.33 pounds each. Each vessel set one to four stations daily beginning at first light or around 0500 and let the gear soak a minimum of five hours before hauling. The vessel fishing rockfish index stations was permitted to fish up to five stations a day (as there were only three skates on each of those stations). Soaking the gear at night was avoided whenever possible. Data from soaks in excess of 24 hours were not used. Sets were deemed ineffective for stock assessment if pre-determined 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 in turn 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 recorded the exact number of hooks per skate, noted bait lost, and evaluated the performance of the bird avoidance devices.

During gear retrieval, 20 consecutive hooks of each skate were monitored and the hook status (e.g., the species present on the hook, returning bait, broken gangion, etc.) was recorded for each hook. Samplers targeted the first 20 consecutive hooks of the skate for this sample and completed samples always involved 20 consecutive hooks. However, the demands of processing of fish from previous skates, particularly in areas with high catch rates, sometimes affected where the sample was taken from the 100-hook sequence of the skate.

Samplers recorded the lengths of all halibut caught with the corresponding skate number. Vessel crew dressed all legal-sized halibut and then passed them to an IPHC sampler, who collected a suite of data: sex and maturity, age structure (otolith), prior-hooking injury severity, sand flea activity, and presence 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. When the maturity stage of either sex was difficult to determine, the sampler coded the maturity stage as unidentified. The sex and maturity of legal-sized halibut were recorded only if a fish was randomly selected for otolith collection. Samplers collected age structures (otoliths) from a random sample of all halibut caught. Individuals were selected by using a pre-determined random sampling table. Those sublegal fish not selected for otolith collection were measured and released alive. The presence and virulence of amphipods (genus *Anonyx*, commonly referred to as sand fleas) were documented for each halibut. Samplers also scanned all halibut captured for the presence of a PIT tag.

At the conclusion of hauling, samplers recorded the presence and abundance of seabirds 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.

The IPHC chartered thirteen commercial vessels in 2006. They were F/Vs:
Blackhawk
Bold Pursuit
Clyde
Free to Wander
Heritage
Kema Sue
Pacific Sun
Pender Isle
Predator
Proud Venture
Star Wars II
Styrian Knight
Waterfall

Special projects

The SSA survey presents the opportunity to collect information on halibut biology and to conduct other experiments not associated with halibut stock assessment. The following special projects were conducted during the 2006 SSA survey.

A water column profiler that measures temperature, depth, salinity, and dissolved oxygen was deployed from the *F/V Pender Isle* for four trips between May 29 and June 6, in the Vancouver and Goose Island regions. The profiler was then transferred to another survey vessel, the *F/V Star Wars II*, to be deployed during four trips in the Charlotte and Ketchikan regions from July 9 to August 6. Successful casts were made at 152 of the 168 survey stations fished.

A crewman from the *F/V Styrian Knight* chops bait for another day of fishing. IPHC archive.

A total of 78 halibut were tagged with Pop-up Archival Transmitting tags in Areas 2A and 2B to try and get a better handle on migration and intercept rates.

A total of 102 adult halibut were tagged with Pop-up Archival Transmitting (PAT) tags off the coasts of Oregon and Washington, in the Gulf of Alaska, and in the southeastern Bering Sea. Twelve halibut were tagged near the continental shelf break in Area 4D and another 12 were tagged in Area 4A just north of Unimak Pass. See PAT Tagging Studies in this report for results of this project.

Previous deployments have occurred at St. Paul Island in Area 4C, and at Atka and Attu Islands in Area 4B. This year's deployments complete a five-site design that essentially encircles the southeast Bering Sea, as envisioned at the experiment's inception.

In a study designed to examine dispersal of halibut in late winter and early spring, eighteen halibut were tagged in Area 2A and another 60 were tagged in Area 2B. These tags were partitioned into a series of pop-up dates in 2007 between February 1 and March 15. The series of dates was chosen to bracket recent fishery openings in order to obtain information about possible out-of-regulatory area interception rates associated with specific opening dates. The data will also help determine timing of migration to deep water in the fall and potentially the subsequent return to shallow water in the spring.

IPHC samplers collected halibut flesh samples as part of an ongoing study of environmental contaminants in Alaskan fish that the Alaska Department of Environmental Conservation (ADEC) is conducting.

All survey vessels in Canada carried a third sampler, under contract to the DFO and funded by the Pacific Halibut Management Association, to study bycatch. These samplers recorded hook-by-hook data for all hooks (as opposed to the standard 20-hook count at the start of each skate) and collected age, sex, and maturity data for a subsample of rockfish (*Sebastes* spp. and *Sebastolobus* spp.). This was the fourth year of extensive bycatch sampling in Canada, and continued collaboration is anticipated.

Finally, an IPHC intern from the University of Victoria investigated halibut aggregations by size and gender during two trips in the Unalaska charter region.

Fish sales

Legal-sized halibut caught during the survey are retained and sold to offset costs of the survey program. Survey vessels also retain rockfish and Pacific cod (*Gadus macrocephalus*) landed as bycatch, because, upon landing, rockfish and cod are generally dead or dying from distended swim bladders.

In 2006, fish sales were awarded based on the objectives of obtaining a fair market price and distributing sales among buyers and ports. IPHC chartered vessels delivered fish to 22 different ports during the 2006 SSA survey. When awarding sales, the Commission considered the price offered, the number of years that buyers 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 in settlements following deliveries.

Survey fish were sold in 22 different ports in 2006.

Obtaining fair market value was the main consideration in awarding fish sales, but sales were awarded to buyers with slightly lower prices when some of the other factors were considered, thereby assuring distribution of sales among as many qualified buyers as possible. Landings rotated among the different buyers in a port in order to distribute the deliveries, where practical. Sales arrangements were evaluated after each event to ensure that each buyer was meeting appropriate 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 tolerable 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.

Compared to the 2005 results, CPUE increased slightly (12 percent) in Regulatory Area 4B. All other regulatory areas saw CPUE drop compared to the 2005 results. The largest drops in CPUE were seen in Area 2A (down 43 percent) followed by 4D (down 22 percent). Downward trends have been seen in Areas 3B and 4A for the last eight years and in Area 4D for the past five years. The Unalaska and 4D Edge regions saw a downward trend in CPUE from 2005, while a slight increase was observed in the 4A Edge region. In the Aleutian chain regions as a whole CPUE appears to have leveled off. Interestingly, there was an increase in CPUE in Shumagin, but decreases in all other regions in 3B. Similarly, in 2C the Ketchikan charter region had a slight increase in CPUE for the second year in a row, while the other 2C charter regions experienced a continued decline in CPUE. The Attu region (Area 4B) saw CPUE levels increase by 41 percent. As expected, in the Bering Sea average CPUE was higher around the island stations and lower on the flats.

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 varied by area, but overall a total of 115 unique species were caught. Commonly encountered were sablefish, Pacific cod and sharks.

Bycatch

At least 115 unique species of fish and invertebrates were caught as bycatch during the survey. Neither seabirds nor marine mammals were caught in 2006.

The most common bycatch in Area 2C was sablefish. Most common bycatch in Areas 2A, 2B, and 3A was sharks. The most frequent bycatch in Areas 3B, 4A, 4B, 4C, and 4D was Pacific cod. In area 4B, although the most frequently encountered bycatch species was Pacific cod, the 'other species' group, composed primarily of yellow Irish lord sculpins (*Hemilepidotus jordani*), predominated the area.

Dogfish were the largest component of the shark species category in Area 2A (93 percent), Area 2B (99 percent), Area 2C (96 percent), Area 3A (96 percent), and 4B (100 percent). Sleeper sharks (*Somniosus pacificus*) made up the largest component of the shark species category in Area 3B (67 percent), Area 4A (97 percent), and 4D (100 percent). Only two sharks were captured in Area 4C: one sleeper shark and one spiny dogfish. In 2006, IPHC survey vessels encountered blue sharks in Areas 2A, 2B and 2C; in 2005, blue sharks were not encountered north of 2A.

Seabirds

In total, 1,364 seabird counts were conducted on thirteen charter vessels between May 29 and September 8, 2006. During 192 of the counts, birds were absent from within a 50-meter radius of the stern. On the remaining counts, 66,723 birds were observed. Twenty unique species were identified and nine unidentified bird categories were used. The number of unique species increased this year from 16 in 2005 to 20 in 2006. It is possible that the number of unique species reported has increased because of sea samplers' improved identification ability.

Short tailed albatross. Photo by Dan Rafla.

Black-footed albatross were seen in all regulatory areas surveyed but were most abundant in Area 3A. The Laysan albatross were seen primarily west of Kodiak Island and were observed at highest density in the central Aleutian Islands. One Laysan albatross was also observed in Oregon. Because of their listing as an endangered species, all short-tailed albatross sightings are recorded. Thirty short-tailed albatross were seen during the seabird counts; they were present in Areas 3A, 3B, 4A, and 4B. Short-tailed albatross sightings during surveys totaled 50, which is up from 27 sightings in 2005.

Otolith collection

The otolith collection goal for the 2006 survey was 2,000 otoliths per regulatory area, with a minimum target of 1,500 per area. In Areas 2A and 4D we did not attain the minimum target. Because of lower catch rates and fewer stations than other areas, it is not unusual to collect fewer than 1500 otoliths in Areas 2A and 4D despite sampling all fish caught.

F/V Proud Venture **fished part of the B.C. grid around Cape St. James. IPHC archive.**

Length distribution

The median length of all halibut caught on survey stations in 2006 was 84 cm, representing a 0.5 cm decrease from 2005. The largest median lengths were found in Areas 4B (95 cm) and 4D (94 cm).

Sex ratio of the catch

The genders of all legal-sized halibut are recorded unless a fish's gonads were lost on deck or missing due to predation. Because gender determination requires 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 as a result of capture.

The sex composition for mature halibut from the survey catches showed considerable variation across most areas, ranging from 34.8 percent to 81.4 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, 4B, and the Closed Area) had lower percentages of females in the catch. It is interesting to note that these areas have had the lowest historical exploitation rates; in fact, the rarest occurrence of females was in the Closed Area, which has not experienced commercial halibut fishing since 1967. Area 4C had the highest percentage of females in the catch. Most female halibut caught in the summer months, when the surveys are conducted, are in the ripening stage and are expected to spawn in the coming fall and winter.

The lowest percentage of females in the survey catch was in the halibut Closed Area —a region that has not been commercially fished since 1967.

Age composition of the catch

Eleven-year-olds (the 1995 year class) accounted for the largest proportion (in numbers) of sampled halibut for all areas and sexes combined in 2006. The next most abundant age classes were eight- and seven-year-olds (1998 and 1999), respectively.

Eight-year-olds were the most abundant age class for female halibut sampled in Regulatory Areas 2B and 4A as well as for females from all areas combined. The second and third most abundant age classes for sampled females were 11- and seven-year-olds, respectively.

Halibut from the survey that were aged ranged from 4 to 48 years old.

The 1995 year class was the largest for male halibut from Areas 2A, 2C, 3B and 4A and from all areas combined. The second and third most abundant age classes for sampled males were 12- and eight-year-olds, respectively.

Average age was higher and average fork length was lower for males than females in all regulatory areas in 2006. Average length was calculated only from halibut that were aged.

The youngest and oldest halibut in the 2006 setline survey samples were determined to be four and 48 years old. There were five four-year-olds: four females measuring between 48 and 67 cm, and one male measuring 66 cm. There was a single 48-year-old: a male from Area 4B with a fork length of 115 cm. The largest halibut in the 2006 setline survey otolith collection was a 223-cm female from Area 4B, which was determined to be 29 years old. The smallest halibut sampled in 2006 measured 47 cm in length. There were two 47-cm fish captured in 2006: a female from Area 4A aged at five years and a male from Area 4C aged at seven years.

Future work

The IPHC plans to continue most of the standardized stock assessment surveys into the foreseeable future but survey operations are dependent upon the ability of the project to remain self-funding. Although the surveys are designed to fulfill scientific needs, station densities and fishing effort are such that our ability to conduct the surveys on budget can withstand limited variation in price or CPUE. However, if halibut prices or CPUE fall significantly in the future, the Commission will need to find alternate sources of funding to collect this important data.

For 2007, we anticipate conducting SSA work in all traditional regions (i.e. excluding the eastern Bering Sea regions) with the addition of the higher density cluster stations located around St. Matthew, St. Paul, and St. George islands. Current plans involve fishing five standardized skates per station. The number of regions surveyed is subject to change dependent on decisions made at the annual meeting.

Prior hook injuries: Results of the 2006 SSA survey

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. To understand this problem, in 1997 the

SSA Survey began collecting data on the occurrence of prior hook injuries (PHI) on halibut caught on survey lines.

In 2006, the incidence of PHIs decreased in Areas 2A, 3B, 4A-Aleutians, and 4B; and increased in Areas 2B, 2C, 3A, 4A-Bering Sea, and 4D. PHI rates remain very high in Areas 4A-Bering Sea and especially in Area 4D, and have risen to high levels this year in Areas 2B and 2C. Overall, the coastwide average (6.5 percent) has risen since 2005 (up from 5.7 percent) Sublegal PHI rates have decreased in Area 2A and 4A-Aleutians, but have risen dramatically in Areas 2B and 4A-Bering Sea since 2005. The rate of sublegal PHI in the other Bering Sea areas is relatively unchanged from 2005. PHI rates collected during Bering Sea trawl surveys were less than half those observed in previous years.

Data collection procedures

All halibut captured during the 2006 IPHC grid survey were examined for the presence of PHIs. We examined fewer fish during 2006 than during 2005; the decrease was due primarily to fishing less gear at each survey station. Prior hooking injuries were defined as injuries that occurred when the fish was being released during a previous capture by hook-and-line gear. The fish may have been hooked recently, in which case the injury should be easily noticed, or the injury may have happened some time in the past and the injury would be scarred over. Some difficulty for the vessel samplers was expected, as fresh injuries could be mistakenly attributed to the current capture, whereas old injuries may have been healed sufficiently so as to actually mask or hide the injury. Injuries are observed primarily to the jaw, but may occur to the eye and eye socket, either alone or in conjunction with a jaw injury.

Results

Overall, the incidence of PHI increased from 2005, but varied among individual areas.

Approximately 84,000 halibut were examined during the 2006 IPHC SSA surveys. Of those, 5,428 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 4.0 percent (Area 4A-Aleutians) to a high of 19.8 percent (Area 4D) and averaged 6.5 percent coastwide. The 2006 coastwide PHI rate was higher than that of either 2005 (5.7 percent) or 2004 (5.9 percent). The incidence of prior hook injuries on the 2006 surveys decreased in Areas 2A, 3B, 4A-Aleutians, and 4B and increased in all other areas, markedly so in Areas 2B (12.0 percent up from 3.9 percent), 2C (11.0 percent from 7.0 percent) and 4D (19.8 percent from 16.4 percent). A notable decrease was seen in Area 4B (6.2 percent down from 10.7 percent). Comparing across areas, the highest 2006 PHI rates were in Areas 2B (12.0 percent), 2C (11.0 percent), 4A-Bering Sea (12.6 percent), and 4D (19.8 percent).

Looking at just the sublegal halibut (fork length less than 32 inches or 82 cm), the overall incidence of PHI also increased, from 2.9 percent in 2005 to 3.8 percent in 2006. By area, sublegal PHI levels increased in Areas 2B, 2C, 3A, 3B, and 4A-Bering Sea, and PHI levels for sublegals decreased in Areas 2A, 4A-Aleutians, 4B and 4D. The highest occurrences of sublegal PHI were seen in Areas 2B (10.3 percent, increased from 2.3 percent in 2005), and 4D (12.3 percent, down from 13.1 percent in 2005).

In 2006, the proportion of moderate injuries in Areas 4B and 4D has returned to the pattern that we saw prior to 2005, when the injury distribution

in the Bering Sea areas, particularly Area 4D, had relatively more moderate and fewer minor injuries.

Since we started collecting PHI data, the incidence of PHIs in the Gulf of Alaska areas has ranged from four to eight percent, and has not exceeded 10 percent. This data notwithstanding, the widespread nature of high PHIs is demonstrated by localized PHI rates of 25 percent or more from some individual stations in these areas, including stations off the Washington and British Columbia coasts, off southeastern Alaska, and below Kodiak Island. Stations with PHI rates between 15 and 25 percent are widespread over the entire survey range.

Overall values in the Bering Sea regions have recently been eight percent or more, and in Area 4D the value has exceeded 20 percent for three of the past five years. A high rate of severe injury continues to occur at many of the stations sampled throughout the survey range. In 2006, the occurrence of severe PHIs in the stations along the 4D edge again increased, with severe PHIs being noted at many of the survey stations.

The overall rate of PHI occurrences increased by almost two percent in 2006 (up to 6.5 percent from 5.7 percent in 2005). The high PHI rates observed on IPHC surveys in the Bering Sea and Aleutians reflect the interception of halibut by the Pacific cod groundfish fisheries in those areas.

The impact of halibut PHI goes beyond the injured fish that are observed. The PHI observations provide an accounting of only those fish that survived hooking injuries. Our own studies have shown that moderate and severe injuries often kill fish, and that fish that do survive either stop growing or grow at a much-reduced rate. There has to be a direct connection between the PHI rate (the tally of those fish that have survived catch and release) and bycatch mortality, but the understanding of that connection still eludes us.

Interpreting the PHI data is difficult because increased incidence can mean either that halibut are encountering fishing gear more often, or alternatively, that hooked fish are experiencing a higher rate of survival.

We have two contrasting interpretations of these data. The first is that an increase in the number of observed PHIs reflects poor handling by fisheries that catch and then release the halibut, with an associated increase in halibut mortality. The alternate theory holds that the presence of more halibut with prior injuries reflects a higher survival rate of those fish that are caught and released, and a resulting lower overall mortality to the stocks. A high rate of PHI, especially severe PHI, indicates that the fishers are releasing fish in a non-lethal way, while a very low number of severe injuries would indicate that fish are dying after the hooking event.

The available data could support either interpretation. PHI occurrence rates among sublegal halibut tend to be about half the rate seen when we consider all halibut caught. This suggests that the infliction of these injuries does not happen just to smaller-sized halibut, but that injuries continue to accumulate within the stock as the fish survive year to year. NMFS observer data from the Bering Sea fisheries indicate steady or decreasing rather than increasing halibut mortality from these fisheries over the last decade. The halibut mortality is a function of both PHI incidence and the severity of individual PHIs. Our survey data indicate that, particularly in the last few years, many of the halibut caught in Area 4 are accumulating a higher proportion of PHIs relative to other areas.

Cruise report for the 2006 NMFS Bering Sea trawl survey

In 2006 the IPHC participated in the annual NMFS Bering Sea shelf trawl survey for the ninth straight year. The survey is a continuation of a time series started in 1975 and continued annually since 1979. Each of the two participating vessels was staffed by six scientific crew, including one IPHC staff biologist aboard one vessel whose objective was to collect halibut data and assist the NMFS in attaining survey goals.

Survey area, vessels, and itinerary

The 2006 survey took place from May 30 to July 28 and 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 Arcturus* and *F/V Northwest Explorer.* An IPHC biologist was aboard the *Arcturus* for the duration of the charter to collect length, otoliths, gender, maturity, prior hooking injuries, and PIT tag information from halibut.

NMFS biologists aboard the *F/V Arcturus*, sort through the catch on the Bering Sea trawl survey. Photo by Cal Blood.

Four hundred and five 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. The vessels occupied stations on alternate north/south columns of a sampling grid and in areas surrounding St. Matthew and the Pribilof Islands. Additional stations were added to better assess blue king crab (*Paralithodes platypus*) concentrations.

Results

The *F/V Arcturus* sampled 221 stations over the course of the summer. In total, 2,955 halibut were captured and sampled: of those sampled, 1,488 were female and 1,467 were male. Of the females sampled, 99.5 percent were immature, and 78.5 percent of the males were immature.

Prior hooking injuries were found on about one percent of the fish; 24 showed minor damage, 13 showed moderate damage, and one was severely damaged. The percentage of halibut with prior hooking injuries is lower than in recent years for this survey, but is likely due to a few very large hauls of small halibut. These small halibut are not yet vulnerable to longline gear and thus would not have prior hooking injuries.

A total of 495 halibut (all halibut greater than 55 cm in length) were scanned for PIT tags and none were located.

Nearly all of the female halibut encountered were coded immature compared to a little more than 78 percent of the males. This is not surprising given that the average length overall was 34 cm.

IPHC Research

Tagging studies

Question: What can make a halibut researcher's heart go "pitter patter"?

Answer: PITs and PATs.

The IPHC relies on tagging studies to provide information on a range of subjects.

—or more precisely, Passive Integrated Transponder (PIT) tags and Pop-up Archival Transmitting (PAT) tags. These two kinds of tags are the centerpieces of two tagging experiments currently being conducted by the Commission. The PIT tagging study, begun in 2001, is a large-scale mark/recapture experiment where the fish is caught, tagged, and released, and—with a little luck—caught again at a later time. PAT tags, first used by the IPHC in 2002 and presently the focus of two separate studies, are electronic tags that collect environmental data (temperature, depth and light) while attached to the fish, and do not require that the fish be recaptured. The PAT tag attaches to the fish by a leader and a thin

Port Hardy port sampler, Rhonda Miller, and Director Bruce Leaman scan for PIT tags. Photo by Tracee Geernaert

metal wire. On a programmed date, an electrical current causes the metal wire to break, thus releasing the tag. The tag then floats to the surface and transmits a signal to a passing satellite that uploads the accumulated data and determine's the tag's final position.

Since we began tagging halibut in 1925, over 450,000 tagged halibut have been released. To date, more than 47,000 of these releases have been recovered. Halibut are tagged to study migration, utilization, age, growth, and mortality. This year, six wire-tagged halibut were recovered, including one that had been at large for 22 years. Most of the wire tag recoveries were from a 1995 trawl mortality study. Fifteen passive integrated transponder (PIT) tags were recovered from demonstration charters, as well as 153 recoveries from double-tagging (wire and PIT) experiments.

The IPHC did not release any PIT or wire tags in 2006, but did release several dozen PAT tags.

Recoveries from experiments using wire tags only

In 2006, harvesters returned six tags from experiments which employed wire tags only. Four of these fish were recovered in or near their area of release; recovery location was not obtained for the other two. Overall, recovery rates from the most recent wire tag experiments vary from four percent in the trawl mortality experiment conducted in 1995 to 47 percent in the 1988 Sitka Spot Experiment. The highest recovery rates occurred in the older experiments, from which fish have been available for capture the longest.

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

Two double-tag experiments were conducted by the IPHC. In August 2001, two hundred and eighty-one halibut were tagged with both a wire tag and a PIT tag inserted in the "old" tag site (on the dark side of the head anterior to the eye). In September 2003, another double-tag experiment was conducted using both wire and PIT tags. In the 2003 double-tagging study, the PIT tags were inserted in the site used for the main PIT tag experiment (under the skin and over the interopercular bone).

A 2003 double tagging study was implemented to look at the shedding rate of PIT tags. To date, the shedding rate is about two percent.

In 2006, we recovered four tags from the 2001 double-tag experiment in 2006. None of the heads were scanned to determine if the PIT tags were working. We also recovered 149 tags from the 2003 double-tag experiment.

The purpose of the 2003 double-tagging experiment was to determine the *in situ* PIT tag shedding rate. Of the 578 fish recovered from the double-tag study, 558 were scanned to determine whether their PIT tags were working. Eleven PIT tags were found to have shed, and an additional two were present but broken for a combined shedding/breakage rate of two percent.

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 578 recovered double-tagged fish, three heads were not examined for the presence of a wire tag. Wire tags were found to have shed from 29 recovered double-tagged fish, for a shedding rate of five percent.

Recoveries from PIT tagging experiments only

Prior to the primary coastwide releases in 2003, several pilot studies were undertaken to find the ideal insertion location for PIT tags in halibut. "Demonstration" charters using the final PIT tag site were conducted in October 2002 and April 2003 to test the tagging protocol and data capture software prior to the primary experiment releases in the summer of 2003.

In 2003, the Commission tagged 43,999 halibut with PIT tags, and an additional 23,437 in 2004. In 2006, the Commission conducted scanning for passive integrated transponder (PIT) tags in the coastwide commercial halibut catch in 2006. Scanning took place over an eight and a half month period. The goal of achieving a minimum 25 percent scanning rate by regulatory area was exceeded in all areas; portside samplers scanned a total of 1,232,370 halibut and recovered 715 PIT tags between March 5 and November 15.

Over an 8-month period, samplers scanned more than 1.2 million halibut looking for PIT tags.

Sampler, Lynn Collier, scans halibut in Juneau, Alaska. Photo by Lara Hutton.

Scanning took place in major ports, with scan samplers instructed to scan as many fish as possible in their port on their scheduled workdays.

Data collected

An individual vessel (or packer) delivery was the sample unit. For each sample, the port, dealer, vessel, vessel number, delivery date, regulatory area fished, number of fish scanned, and number and ID of tags detected (if any) were recorded. Samplers were instructed to sample whole trips when possible, however partial offloads were also scanned (e.g., when there were simultaneous deliveries at different sites and the sampler arrived after the start of the offload). For vessels fishing multiple regulatory areas, each area was treated as a separate delivery with a separate piece count and tag tally kept for each regulatory area.

Port staffing

In Alaska and British Columbia (BC), 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 5 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 with the exception of the southeast Alaska ports (Southeast). Because halibut landings in Southeast are relatively low during July and August, samplers in those ports were deployed on survey vessels or temporarily assigned to another port. Scan sampling was conducted in St. Paul, AK between June 6 and August 26 in 2006. The Petersburg scan sampler scanned in St. Paul from July 4 through July 30, and the St. Paul port sampler did both scanning and port sampling for the months of June and August.

Scan samplers worked in the same ports as occupied by IPHC port samplers. In addition, St. Paul and Adak were staffed for a portion of the summer. This ample coverage resulted in a scanning rate which exceeded the 25 percent target in all areas.

The port of Adak was staffed between July 30 and August 31 in 2006 in order to increase the scanning rate of Area 4B fish, which was below target in 2005. The Sitka port sampler was assigned to Adak in August and performed both scanning and port sampling duties during that time.

Scan sampling in Area 2A in 2006 began in March with the Washington tribal commercial fishery. The Washington tribal commercial fishery was sampled during March and April in the ports of Neah Bay, Taholah, and Bellingham by Makah Fisheries Management, Quinault Fisheries, and IPHC staff, respectively. Non-tribal commercial scan sampling in Area 2A took place in Newport, Oregon for all four fishing periods that occurred between late 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 2005, the Oregon Department of Fish and Wildlife staff scanned Area 2A sport-caught halibut between May and October in the Oregon ports of Newport, Depoe Bay, Garibaldi, and Charleston. Scanning of the Washington 2A sport fishery was conducted by Washington Department of Fish and Wildlife staff in the ports of Ilwaco, Westport, La Push, and Neah Bay, also between May and September.

Scanning results

The fourth year and third full season of the PIT scan sampling program went smoothly with continued good cooperation from processors. Altogether, 1,232,370 halibut were scanned between March 5 and November 15 this year. Scanning rates were greater than 25 percent in all areas with an overall average of 45 percent. Estimated pounds scanned were calculated for each area by multiplying the pieces scanned for that area by the average weight of halibut in the 2006 commercial catch for that area. Average weights by regulatory area for the 2006 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 2006 Washington and Oregon sport fisheries.

Seventy-three percent of scanned halibut were scanned 'head-on' or whole. Samplers detected 715 PIT tags over the season: 427 were releases from the primary experiment conducted on the 2003 setline survey; 254 were recoveries of tags released in 2004; 15 were recoveries of tags from demonstration charters conducted in 2002 and 2003; and an additional 19 recoveries were tags released in a 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 Areas 2A-C, May was the busiest month for Area 3A, June was the busiest month for Areas 3B and 4B, July was the busiest month for Area 4C, and August was the busiest month for Areas 4A and 4D. The months with the most fish scanned corresponded to the months with most pounds landed in all regulatory areas except for 2B, 3B, and 4C.

In 2006, scanning was also conducted on all IPHC setline survey vessels as well as the NMFS trawl survey vessel that had an IPHC biologist aboard.

PAT tagging studies

Because PAT tags collect environmental data while attached to the host fish and the fish do not need to be recaptured for their location to be known, PAT tags can be used to study several characteristics of halibut behavior and migration that we cannot study using conventional or PIT tags. The daily depth data collected by the tag allows us to reconstruct of depth profiles for each fish throughout its time at liberty. Plots of daily mean depth can be used to assess when individual fish are present in shallow shelf waters or have emigrated to the slope, and determine the timing and duration of residence in deep water. The ability to program the tag to report back to the office on any chosen date allows us to study migration as times when no fishery is in operation to recapture tagged fish (such as in winter) and ensures that every fish is found no matter where it has gone. The light data can be used to generate longitude estimates for the period at liberty, giving us more than simply the fish's start and

PAT tags record depth, enabling us to map a halibut's movements over a period of time.

This halibut on the *F/V Pacific Sun* receives a PAT tag. Photo by Lynn Mattes.

end positions, giving us an ability to infer large-scale east-west movement while the fish was at large.

IPHC researchers are using PAT tags to study a number of processes, including timing of seasonal migration, homing to summer feeding grounds, early-season dispersion of halibut in Areas 2A and 2B, and seasonal migration and putative spawning location of adult Pacific halibut in the southeast Bering Sea.

Prior to the adoption of quota management systems in Alaskan and Canadian waters, the Commission achieved control of effort and total harvests of halibut primarily through adjustments to season length. Traditionally, the fishery lasted months, but increases in fleet power and economic incentives in the late 1970s and early 1980s resulted in continually shrinking seasons. By 1990 the Canadian commercial halibut season had been reduced to just ten days, and to just two or three days in the remainder of the Gulf of Alaska and much of the southeast Bering Sea. In 1991, an Individual Vessel Quota (IVQ) system was adopted in Canada, that allowed the season to be increased to 213 days. In 1995, a similar plan, the Individual Fishing Quota (IFQ) Program was implemented for the Alaskan commercial halibut fishery and resulted in a fishery 245 days in length. The Alaskan and Canadian fisheries have remained at between 245 and 262 days over the last decade, but recent economic concerns have prompted industry to request that the IPHC examine the possible merit of a longer season, or potentially one that lasts the entire year.

We have known for some time that in the winter, halibut move off the continental shelf to deeper water to spawn, but there is now evidence to suggest that they may also migrate long distances along the shelf before heading for deeper water.

While we believe that winter fishing would have negligible biological impact to the stock as a whole, we are concerned that biomass distributions may be substantially different in winter than summer. Spawning occurs during winter in relatively deep water along the shelf break, but rather than simply moving offshore to spawn, halibut may move considerable distances adjacent to shore during their seasonal migration. As a result, winter distribution patterns are likely different than those upon which quotas are largely based. In particular, extended seasons increase the likelihood that migrating fish will be intercepted before they have reached the IPHC Regulatory Area of their "origin", here defined as the region in which they would be surveyed if captured during the IPHC's summer stock assessment survey and to which the current area-specific catch limits apply. While a general northward movement in autumn is apparent, we do not fully understand when fish begin their migrations or whether migration timing varies with location. Using PAT tags, we hope to be able to define "winter" more precisely and more in keeping with actual fish behavior by refining our understanding of when fish begin to move in the fall, of when the majority appear to have reached their deep-water spawning grounds, and of when they initiate and complete their return-migrations in the spring.

Also, the paradigm that fish return to roughly the same summer grounds each year is based primarily upon date-specific analysis of conventional tagging data, and the fact that many tagged fish are captured close to their tagging location after many years at liberty. While these lines of evidence provide good support for a model of winter emigration followed by summer return, our understanding would be greatly strengthened by data that actually confirm a seasonal emigration-homing process. This requires that the location of individual fish be known at least three times: at tagging, during the subsequent winter, and again the following summer. While conventional tags provide only two points (mark and recapture), PAT tags can tell us whether the fish have truly gone

offshore and returned, or have simply stayed where they were tagged. PAT tags allow us to distinguish homing (departing the tagging site and then returning the following summer) from long-term site fidelity.

Using PAT tags to study migration-timing and homing

Tag deployments and recoveries

In this study, a total of 48 adult halibut were tagged throughout the Gulf of Alaska in the summer of 2005 with PAT tags programmed to release exactly 365 days after deployment to ensure a full year's vertical migration history, and to allow an assessment of summer-to-summer homing behavior by re-sampling each fish's location at exactly the same time of year as when it was tagged. Twelve tags were recovered by the fleet prior to their programmed pop-up date: five during the 2005 commercial fishing season and seven during the first half of the 2006 season. Thirty one tags popped up and transmitted useful data, but eight of those tags had prematurely released from their host fish, as evidenced by records of zero-depth well prior to broadcast. Although the reason for premature release cannot be determined, it is most probable that the darts either fell out of the fish or were pulled out by an external force. Six tags were lost; they were neither recaptured nor did they broadcast to the satellites.

Depth profiles

Migration to spawning grounds in winter may be more complex than previously thought.

Transmitted environmental data have not yet been fully converted and compiled precluding formal analysis at this time. However, archived data from physically recovered tags are available which demonstrate the nature of the proposed analyses. Plots of average depth often exhibit a clear deep-water winter phase separated from the shallow-water summer phase by fall and spring transitions. Fish differ with respect to the rapidity and precise timing of their vertical migration, and profiles suggests that the winter phase may involve a certain degree of complexity: some fish display a two-phase distribution in which they spend the first 2-3 months of winter at about 300 m (165 fm) and in February moved to depths in excess of 500 m (275 fm). Using detailed data from recovered tags and the more coarse-scale transmitted data, we will aim to quantitatively estimate attributes such as mean transition length and timing, and proportion of fish that are in their transitional phases on specific dates.

Location data and homing rates

For halibut that escaped the fishery to broadcast reliable final location data after one full year at liberty or that were recaptured by the fleet no less than 10 months after tagging, 60% were located within 10 km (6 nmi) of their tagging location and 80% within 20 km (13 nmi). Depth records indicate that most of those fish had departed their sites and then returned the following spring: in all, 60% of the tagged fish displayed active homing behavior versus 20% displaying apparent site fidelity, and only 20% displayed long-distance dispersal. The present results suggest that seasonal homing, potentially coupled with a substantially lower rate of long-term site fidelity, may be more prevalent than broad-scale dispersal, at least in the Gulf of Alaska.

One might hypothesize that PAT tag data are not necessarily representative of the population as a whole because the tags are deployed exclusively on large

fish that are most likely female. Males and smaller fish may be able to conduct more extensive migrations and engage in energetically risky behavior, such as moving among spawning and feeding grounds over the course of their lifetimes. However, dispersion of Passive Integrated Transponder (PIT) tags recovered during the 2006 SSA survey was nearly identical: of the 82 PIT tags recovered 2-3 years after deployment, 79% were captured on the same station as they had been deployed. This included fish as small as 74 cm FL and approximately 30 percent were male. Taken together, these results support the hypothesis that homing and long-term site fidelity are general characteristics of the fishable population and represent interannually persistent behavior for individuals.

Using PAT tags to assess early-season dispersion of halibut in Areas 2A and 2B

Both PIT and PAT results showed similar characteristics of homing and site fidelity in halibut.

This research is very closely linked to the migration-timing project, also serving to help the Commission as it debates the merits of season extension. The aim of the study is to gain a better understanding of the dispersion (i.e., geographic spread over time) of halibut in the eastern Gulf of Alaska during late winter and early spring. Specifically, the project is designed to examine the relative proportion of Area 2B summer resident halibut that are likely to be found in Alaskan waters on three different possible season opening dates: February 1, February 15, and March 1. Additionally, it examines the location of Area 2A summer residents on two dates: February 1, February 15; the late pop-up date (March 1) was eliminated because the primary objective in this region is to gain a better understanding of likely spawning locations for Area 2A summer residents, which are better assessed using February pop-ups.

During the IPHC's 2006 summer setline survey a total of 78 PAT tags programmed with winter/spring 2007 pop-up dates were deployed in Areas 2A and 2B. In Area 2B, an equal number of tags was programmed to release (pop up) from the host fish on each of the aforementioned dates, with the distribution of tags chosen to coarsely match the pattern of abundance that had been observed over the last three survey years. In 2A, six tags were deployed in each of three general locations: 1) northern Washington west of Cape Flattery, 2) from Grays Harbor to the Columbia River, Washington, and 3) near Heceta Bank, Oregon.

A total of seven tags were physically recovered during 2006. Five tags were recovered by the commercial fleet in Canada and one tag deployed on Heceta Bank was recovered by a sport fisher operating from Newport, Oregon. One tag deployed in northern Washington prematurely detached from its host fish and was found awash at Long Beach, Washington. The tag's internal log indicated that it had not malfunctioned, suggesting that the implantation dart either fell out of the fish or was pulled from the fish by an external force. Full location data and study results will be available when the tags pop up in 2007.

Other research

Assessing seasonal migration and putative spawning location of adult Pacific halibut in the southeast Bering Sea using PAT tags

In 2002 the IPHC, in collaboration with the University of Alaska, Fairbanks, began an electronic tagging study designed to investigate fall migration timing and likely spawning areas for eastern Bering Sea halibut. Adult halibut were

tagged with PAT tags at St. Paul Island in 2002 and at Atka and Attu Islands in 2004. In 2006, the originally-proposed five-site deployment design was completed. Twelve fish were tagged at Middle Canyon on the 4D Edge and another twelve at Bering Canyon on the 4A Edge. Fish ranged from 110-140 cm fork length (FL). All tags are programmed to release from their host fish on February 1, 2007, and at time of writing no tags had been recovered by the fleet.

Use of internal electronic archival tags to study migration and behavior of male and pre-recruit Pacific halibut: Phase I, development of surgical techniques

In 2006 the IPHC began investigating the possibility of implanting internal electronic archival tags into halibut that have traditionally been considered too small to carry PAT tags. Our long-term objectives are to obtain data on seasonal depth distribution, vertical migration, and light-based longitudinal estimates for small halibut and in situations where multi-year data are desirable. The objectives of the present project component are modest and represent preliminary work required to initiate field-based studies:

Commission scientists are experimenting with a new tag that is similar to a PAT tag, but can be used on smaller fish.

1) develop surgical techniques required for implantation of archival tags;
2) assess and document physical recovery following tag-implantation;
3) compare the relative performance of three specific models of archival tags; and
4) determine the effectiveness of ultrasound as a non-invasive technique for identifying gender.

On July 31 a total of 24 halibut ranging in size from 65-90 cm FL (26-35 in) were captured by longline and delivered live to the Oregon Coast Aquarium, Newport, Oregon. After an acclimation period of 80 days, fish were anesthetized, and surgery was conducted to implant fifteen of the fish with temperature-depth recorders and temperature-depth-light recorders. No mortalities were inflicted in tagging, and the tagged fish resumed normal feeding and swimming behavior within days of tag implantation. The fish will be held and monitored until all surgical wounds have healed. They will then be sacrificed and dissected to determine whether the tags have caused physiological interactions with the organs or body wall, and to test whether veterinary ultrasound can be used to reliably determine their sex in a non-invasive manner.

Examining the behavior of rockfish and halibut around pots

During the summer of 2006, the Commission conducted a pilot fishing experiment using a high-frequency acoustic camera to observe fish behavior around a fish pot. This study, designed to investigate halibut and rockfish behaviors, might aid development of strategies for catching halibut without catching rockfish. The experiment tried different pot modifications to determine their effects on the catch of these species. Although we encountered some halibut and many rockfish, very low catch rates for both species precluded using entrance and escape behaviors to evaluate pot modifications.

Launching the DIDSON from the deck of the *F/V Ocean Pearl*. Photo by Steve Wischniowski.

The Didson camera was used to observe fish behavior in conditions of darkness and turbidity.

DIDSON camera and frame

The DIDSON (Dual-frequency IDentification SONar) 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 fan shape, while the view provided is integrated into a single plane. Because better range resolution (limited by 256 range bins) was more important than showing the 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 beam and pot frame top were above the view of the camera. A buoyed rope bridle was attached to each end of the box beam. A buoy

line was attached to an eye on this bridle, and led to a floats and a flag on the surface.

The DIDSON is designed to both archive data onto an internalized hard drive, and output a live NTSC broadcast signal.

Fishing locations and fish catches

The vessel deployed the apparatus 37 times. Deployments were between the hours of 6 AM and 10 PM, and as many as four deployments were made per day. Deployment time ranged from 59 minutes to 3 hours 55 minutes. Average bottom time was 1 hour 59 minutes, for a total of 73 hours 26 minutes observation time over all sets.

The first deployment was unsuccessful due to a faulty connection between the DIDSON and the battery case. Of the 37 deployments, no fish were observed in two deployments; fish were observed at all of the other 34 sets. In ten sets, fish of some species were observed within the first minute after the gear reached the seafloor. Over half of all sets had fish appearances within the first four minutes after gear hit the seafloor. The longest time observed before the first fish appearance was 48 minutes. In both the control and the experimental pots, we caught a total of 10 fish: five quillback, and one each of dogfish (*Squalus acanthias*), halibut, lingcod, and redbanded and yelloweye rockfish.

While the capture rate was too low to provide definitive results for the gear modification experiment, the Didson sonar performed excellently and will likely be used for future studies.

The DIDSON revealed eleven halibut around the observed pot in seven of the deployments. Of these seven deployments, one had three halibut, two had two halibut each, and the other four sets had one halibut each. None of the halibut approaching the observed pot were captured. The period of time before each observed halibut was first detected ranged from 21 to 102 minutes and averaged 61 minutes. On average, each halibut spent 25 minutes under observation. In four cases, halibut were still around the pot when it was hauled.

Typical halibut behavior included approaching the pot upcurrent, and settling downcurrent from the pot with the head directed towards the pot, touching or nearly touching the pot frame. Since no observed halibut were subsequently captured, all halibut lengths were determined using DIDSON measuring software. The unobserved, control pot captured one 82-cm halibut.

We observed one escape of a rockfish which entered via the entrance tunnel, and escaped via an escape ring prior to gear retrieval. One rockfish escaped through an escape ring during gear retrieval, which compares to five rockfish that were captured in and did not escape from the DIDSON pot.

As a pilot, this project had many successes, not the least of which was the excellent performance of the DIDSON sonar. However, neither capture rate was sufficient to allow tracking possible rate changes from gear modifications. The failure of this experiment to achieve its primary goals was in part the result of faulty assumptions underlying the experimental design, particularly with respect to the number of fish we expected to capture with the pot gear. Rockfish bycatch will continue to be an important concern for halibut harvesters in British Columbia, and research into alternate gears to reduce this bycatch should be continued. Follow-up work should be in the form of either lab-based behavior studies to improve the efficiency of halibut capture in pots, or demonstrations by industry members who can show practical applications of pots for catching halibut.

A one-dimensional spatial analysis of Pacific halibut on longline gear: testing for aggregation based on sex and length

Field experiments were conducted on Pacific halibut (*Hippoglossus stenolepis)* at thirty-one IPHC survey stations to test the hypotheses that halibut are aggregated based on sex and/or length, using longline fishing gear as a sampling tool. Inventories of the 600 hooks fished at each station were taken along with sex and length data that corresponded with sequentially numbered tail tags on the hooked halibut. Applying different analyses, a varying percentage of statistically significant aggregations were observed when testing the following events: (1) being a halibut, (2) being a legal-sized halibut (82 cm or larger), (3) being a sublegal-sized halibut (smaller than 82cm), (4) being a female halibut, or (5) being a male halibut. Survey catches that showed aggregations were more likely to be characterized by length than by gender.

A study of halibut behavior supported what many fishers already know; that at least some of the time, halibut aggregate based on size and gender.

The strongest aggregation trend to emerge, at 58 percent of the stations surveyed, was the event that the halibut were greater than 82 cm in length. Sublegal halibut aggregations occurred at 42 percent of the stations, while male and female aggregations occurred at 36 percent and 30 percent of the stations, respectively. Halibut in general, compared to empty hooks and bycatch, showed aggregation at only 19 percent of the stations.

Knowing that aggregations are significantly present on longline gear may add important information to our stock assessments. If halibut exhibit extensive social behaviors, size-dependent hierarchies, and aggregation based on length and indirectly by sex, then halibut abundance when estimated from the stock assessment surveys may yield disproportionate estimates of larger halibut and underestimate abundance of smaller fish, relative to the total population.

Veteran IPHC sampler, Bruce Biffard, gives a few pointers between sets to intern, Jessica Hobden. Photo by Jessica Hobden.

APPENDICES

The tables in Appendix I provide catch information for the 2006 commercial and tribal fisheries. The areas specified are the IPHC Regulatory Areas, depicted in Figure 1 of this report. Appendix II shows the fishing period limits used during the 2006 seasons, and Appendix III 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 2006 total removals of Pacific halibut by regulatory area (thousands of pounds, net weight).

Table 2. Commercial catch (including IPHC research catch) and catch limits of Pacific halibut by IPHC regulatory area (thousands of pounds, net weight), 1997 - 2006.

Table 3. The total catch (thousands of pounds, net weight) from the 2006 commercial fishery, including IPHC research catch, of Pacific halibut by regulatory area and month.

Table 4. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2006 commercial fishery; a) for Area 2B, Alaska, and the Alaskan regulatory areas, and b) Area 2A commercial fisheries not including the treaty Indian commercial fishery.

Table 5. Commercial fishing periods, number of fishing days, catch limit, commercial, research, and total catch (thousands of pounds, net weight) by regulatory area for the 2006 Pacific halibut commercial fishery.

Table 6. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port, country of origin and IPHC research catch for 2006.

Table 7. Commercial halibut fishery catch (thousands of pounds, net weight) in 2006 by country, statistical area, and regulatory area.

Appendix II.

Appendix III.

Appendix I.

Table 1. The 2006 removals of Pacific halibut by regulatory area (thousands of pounds, net weight).

Area	2A	2B	2C	3A	3B	4	Total
Commercial[1]	829	12,005	10,492	25,714	10,792	8,149	67,981
Sport	516	2,262	3,033	6,088	11	63	11,973
Bycatch Mortality:							
Legal-sized fish	235	151	216	1,246	452	2,555	4,855
Sublegal-sized fish	163	169	125	1,693	812	4,321	7,283
Personal Use[2]	38[3]	300	598	429	46	128	1,539
Wastage:							
Legal-sized fish	2	36	21	51	11	18	139
Sublegal-sized fish	4	466	286	712	472	144	2,084
Total	**1,787**	**15,389**	**14,771**	**35,933**	**12,596**	**15,378**	**95,854**

[1] Commercial catch includes IPHC research catch.

[2] Figures include final 2006 estimates for Areas 2A and 2B, and 2005 subsistence harvest for Alaskan areas.

[3] Treaty Indian ceremonial and subsistence harvest authorized in the Catch Sharing Plan.

[4] Includes 23,200 pounds of sublegal halibut retained in the 2005 Area 4DE Community Development Quota fishery.

Appendix I.

Table 2. Commercial catch (including IPHC research catch) and catch limits of Pacific halibut by IPHC regulatory area (in thousands of pounds, net weight), 1998 - 2006.

Reg. Area	Commercial Catch[1]								
	1998	**1999**	**2000[2]**	**2001**	**2002**	**2003[2]**	**2004**	**2005**	**2006**
2A[3]	460	450	482	680	851	819	884	803	829
2B	13,172	12,705	10,811	10,288	12,074	11,789	12,162	12,331	12,005
2C	10,196	10,143	8,445	8,403	8,602	8,410	10,233	10,625	10,492
3A	25,698	25,316	19,288	21,541	23,131	22,748	25,168	26,033	25,714
3B	11,161	13,835	15,413	16,336	17,313	17,231	15,460	13,171	10,792
4A	3,418	4,369	5,155	5,015	5,091	5,024	3,562	3,404	3,332
4B	2,901	3,571	4,692	4,466	4,080	3,863	2,719	1,975	1,590
4C[4]	1,256	1,762	1,737	1,647	1,210	886	954	534	493
4D[4,5]	1,308	1,891	1,931	1,844	1,753	1,965	1,655	2,578	2,368
4E[5,6]	188	264	351	479	555	415	314	369	366
Total	69,758	74,306	68,305	70,699	74,660	73,150	73,111	71,823	67,981
Reg. Area	Commercial Catch Limits[7]								
	1998	1999	2000	2001	2002	2003	2004	2005	2006
2A[3]	440.9	412.5	468.1	681.4	817.9	817.9	890.4	788.6	818.5
2B	13,000	12,100	10,600	10,510	11,750	11,750	12,550	11,658	11,631
2C	10,500	10,490	8,400	8,780	8,500	8,500	10,500	10,930	10,630
3A	26,000	24,670	18,310	21,890	22,630	22,630	25,060	25,470	25,200
3B	11,000	13,370	15,030	16,530	17,130	17,130	15,600	13,150	10,860
4A	3,500	4,240	4,970	4,970	4,970	4,970	3,470	3,440	3,350
4B	3,500	3,980	4,910	4,910	4,180	4,180	2,810	2,260	1,670
4C	1,590	2,030	2,030	2,030	2,030	2,030	1,720	1,815	1,610
4D	1,590	2,030	2,030	2,030	2,030	2,030	1,720	1,815	1,610
4E	320	390	390	390	390	390	345	359	330
Total	**71,440.9**	**73,712.5**	**67,138.1**	**72,721.4**	**74,427.9**	**74,427.9**	**74,665.4**	**71,685.6**	**67,709.5**

[1] Commercial catch includes IPHC research catch, in Area 2C, the Metlakatla fishery catch and in Area 2B, other research.
[2] Poundage figures have been updated from previous publications.
[3] Does not include treaty Indian ceremonial and subsistence fish.
[4] Area 4C CDQ and IFQ could be fished in Area 4D as of July 22, 2005.
[5] Area 4D CDQ could be fished in Area 4E by NMFS enforcement waiver (2001) and IFQ regulation (since 2002).
[6] Area 4E includes research catch in Closed Area.

Appendix I.

Table 3. The total catch (thousands of pounds, net weight) from the 2006 commercial fishery, including IPHC research catch, of Pacific halibut by regulatory area and month.

Reg. Area	Mar	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
2A	83	229	108	138	217	25	23	6	0	829
2B	2,312	1,880	1,385	1,173	1,338	1,295	874	1,214	534	12,005
2C	1,193	1,494	1,618	1,748	1,033	1,516	848	783	259	10,492
3A	3,304	3,312	5,253	3,687	2,129	2,820	2,147	2,217	845	25,714
3B	341	671	2,158	1,624	1,972	1,936	940	847	303	10,792
4A			218[1]	543	539	1,097	591	250	94	3,332
4B		42[2]	143	367	379	399	165	70	25	1,590
4C				52	194	203	44[3]			493
4D				186[4]	518	751	638	275		2,368
4E[5]			18	133	135	50	19	11		366
Alaska Total	4,838	5,519	9,408	8,340	6,899	8,772	5,392	4,453	1,526	55,147
Grand Total	**7,233**	**7,628**	**10,901**	**9,651**	**8,454**	**10,092**	**6,289**	**5,673**	**2,060**	**67,981**

For confidentiality reasons:
[1] Area 4A – May includes April landings
[2] Area 4B – April includes March landings
[3] Area 4C – September includes October landings
[4] Area 4D – June includes May landings
[5] Area 4E – Includes IPHC research catch in the Closed Area

Table 4a. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2006 commercial fishery for Area 2B, Alaska, and the Alaskan regulatory areas.

	Area 2B		Alaska	
Overall Vessel Length	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	12	478	801	231
0 to 25 ft.[1]	-	-	221	450
26 to 30 ft.[1]	-	-	133	850
31 to 35 ft.[1]	10	208	241	5,378
36 to 40 ft.	40	1,117	178	2,895
41 to 45 ft.	53	2,464	167	4,482
46 to 50 ft.	28	2,290	154	5,201
51 to 55 ft.	33	2,338	70	4,211
56 + ft.	38	3,110	271	31,449
Total	214	12,005	2,236	55,147
	Area 2C		**Area 3A**	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	404	113	430	28
0 to 25 ft.	64	137	37	118
26 to 30 ft.	54	371	30	157
31 to 35 ft.	104	1,340	104	2,523
36 to 40 ft.	107	1,145	71	1,358
41 to 45 ft.	91	1,372	85	2,289
46 to 50 ft.	95	1,818	80	2,328
51 to 55 ft.	42	1,244	44	1,798
56 + ft.	110	2,952	204	15,115
Total	1,071	10,492	1,085	25,714
	Area 3B		**Area 4**	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	207	40	99	50
0 to 25 ft.	3	18	117	177
26 to 30 ft.	0	0	52	322
31 to 35 ft.	31	622	49	893
36 to 40 ft.	23	316	4	76
41 to 45 ft.	35	718	5	103
46 to 50 ft.	31	826	7	229
51 to 55 ft.	18	619	5	550
56 + ft.	149	7,633	71	5,749
Total	497	10,792	409	8,149

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

Appendix I.

Table 4b. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel class in the 2006 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.	0	0.0
31 to 35 ft.	3	1.0
36 to 40 ft.	14	29.0
41 to 45 ft.	24	48.0
46 to 50 ft.	20	44.0
51 to 55 ft.	8	25.0
56 + ft.	20	93.0
Total	89	240.0

	Incidental Commercial (Salmon)		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.[1]	-	-	0	0.0
26 to 30 ft.[1]	11	2.6	0	0.0
31 to 35 ft.	10	2.2	0	0.0
36 to 40 ft.[2]	29	4.5	-	-
41 to 45 ft.[2]	19	19.9	11	21.0
46 to 50 ft.	19	9.2	5	7.9
51 to 55 ft.[3]	4	1.4	-	-
56 + ft.[3]	0	0.0	11	44.5
Total	92	39.8	27	73.4

For confidentiality reasons:

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

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

[3] Vessels 51 to 55 ft. in the Area 2A Incidental Commercial (Sablefish) fishery were combined with 55+ ft. vessels.

Appendix I.

Table 5. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2006 Pacific halibut commercial fishery.

Area	Fishing Period	No. of Days	Catch Limit	Catch		
				Commercial	Research	Total
2A treaty Indian	3/5 – 7/18	136	472.0	364		
	Restricted:					
	3/22 – 7/18	119		112		
treaty Indian total				476		476
2A Commercial Incidental in Salmon fishery	May 1 – Nov 15	199	41.5	40		40
Incidental in Sablefish fishery	May 1 – Oct 31	184	70.0	73		73
Directed	June 28[1]	10-hours	235	78		
	July 12[1]	"		109		
	July 26[1]	"		44		
Directed total				231	9	240
2A Total			818.5	820	9	829
2B	3/5 – 11/15	256	11,631[2]	11,950[3]	55	12,005
2C	3/5 – 11/15	256	10,630	10,397	95	10,492
3A	3/5 – 11/15	256	25,200	25,238	476	25,714
3B	3/5 – 11/15	256	10,860	10,565	227	10,792
4A	3/5 – 11/15	256	3,350	3,278	54	3,332
4B	3/5 – 11/15	256	1,670	1,542	48	1,590
4C	3/5 – 11/15	256	1,610	486	7	493
4D	3/5 – 11/15	256	1,610	2,349	19	2,368
4E	3/5 – 11/15	256	330	364	2	366
Alaska Total			**55,260**	**54,219**	**928**	**55,147**
Total			**67,709.5**	**66,989**	**992**	**67,981**

[1] Fishing period limits by vessel class.
[2] Additional 79,920 pounds available as carryover from 2005.
[3] Includes the pounds that were landed by Native communal commercial licenses (F licenses).
[4] Additional net carryover pounds (thousands) from the underage/overage program were 2C = 267; 3A = 250; 3B = 192; 4A = 55; 4B = 31; 4C = 51 and for 4D a negative balance of 25.
[5] Includes 34,8971 pounds taken by Metlakatla Indians during additional fishing within reservation waters.
[6] Area 4C CDQ and IFQ can be fished in Area 4D since 2005.
[7] Area 4D CDQ can be fished in Area 4E since 2002.
[8] Area 4E includes research catch in Closed Area.

Appendix I.

Table 6. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port, country of origin and IPHC research catch for 2006.

Port Region	Canada	United States	IPHC Research	Grand Total
CA & OR	-	188	4	192
Seattle	-	99		99
Bellingham	-	1,439	5	1,444
Misc. Washington	-	512		512
Vancouver	868	-	-	868
Port Hardy	4,948	-	16	4,964
Misc. Southern BC	748	-	5	753
Prince Rupert & Port Ed.	4,667	-	91	4,758
Misc. Northern BC	719	-	-	719
Ketchikan, Craig, Metlakatla	-	848	9	857
Petersburg, Kake	-	3,038		3,038
Juneau	-	3,069	24	3,093
Sitka	-	3,885	38	3,923
Hoonah, Excursion, Pelican	-	1,220		1,220
Misc. Southeast AK	-	1,439		1,439
Cordova	-	1,407	15	1,422
Seward	-	5,965	157	6,122
Homer	-	9,586	71	9,657
Kenai	-	130		130
Kodiak	-	8,209	198	8,407
Misc. Central AK	-	6,954	230	7,184
Akutan & Dutch Harbor	-	4,708	99	4,807
Bering Sea	-	2,343	30	2,373
Grand Total	11,950	55,039	992	67,981

Appendix I.

Table 7. Commercial halibut catch (thousands of pounds, net weight) in 2006 by statistical area and regulatory area.

Stat Area Group	Catch			Regulatory Area	Catch for Reg. Area
	Commercial	Research	Total		
00-03	206	2	208	2A	829
04	123	-	123		
05	491	7	498		
06	587	5	592	2B	12,005
07	168	3	171		
08	519	2	521		
09 - I	408	4	412		
09 - O	144	3	147		
10 - I	2,899	15	2,914		
10 - O	1,434	-	1,434		
11 - I	1,486	12	1,498		
11 - O	95	-	95		
12 - I	328	2	330		
12 - O	71	-	71		
13 - I	3,245	6	3,251		
13 - O	566	3	569		
14 - I	439	16	455	2C	10,492
14 - O	175	13	188		
15 - I	1,491	16	1,507		
15 - O	965	13	978		
16 - I	1,857	13	1,870		
16 - O	1,760	11	1,771		
17 - I	851	5	856		
17 - O	608	4	612		
18S - I	1,230	1	1,231		
18S - O	1,021	3	1,024		
18W	1,315	8	1,323	3A	25,714
19	968	17	985		
20	1,695	21	1,716		
21	1,078	14	1,092		
22	872	11	883		
23	1,377	22	1,399		
24	4,551	38	4,589		
25	3,583	81	3,664		
26	3,840	108	3,948		
27	3,589	87	3,676		
28	2,370	69	2,439		

Appendix I.

Table. 7. continued

29	3,708	45	3,753	3B	10,792
30	1,717	54	1,771		
31	1,444	54	1,498		
32	2,183	31	2,214		
33	990	26	1,016		
34	523	17	540		
35	448	10	458	4	8,149
36	429	2	431		
37	87	5	92		
38	327	5	332		
39	66	1	67		
40	506	1	507		
41	77	2	79		
42+	448	26	474		
Bering Sea	5,631	78	5,709		
Grand Total	**66,989**	**992**	**67,981**		**67,981**

Appendix II.

Table 1. The fishing period limits (net weight) by vessel class used in the 2006 directed commercial fishery in Area 2A.

Vessel Class		Fishing Periods (pounds)		
Letter	Feet	June 28	July 12	July 26
A	0-25	670	755	200
B	26-30	840	945	240
C	31-35	1,345	1,510	385
D	36-40	3,705	4,165	1,065
E	41-45	3,985	4,480	1,145
F	46-50	4,770	5,365	1,370
G	51-55	5,320	5,985	1,530
H	56+	8,000	9,000	2,300

Table 2. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2006.

Fishing Period Dates	Number of Vessels	Catch (Pounds)
June 10 – 12	9	6,347
June 23 – 25	11	4,683
July 7 – 9	6	2,266
July 21 – 23	8	4,485
August 4 – 6	7	8,298
August 18 – 20	9	5,589
September 1 – 3	5	2,231
September 15 – 17	3	972
September 29 – Oct. 1	0	0
9 Fishing Periods		34,871

Appendix III.

Table 1. Fishing dates, opportunity, size limits, and bag limits for the 2006 Pacific halibut sport fishery.

Area	Fishing dates	Fishing days	Days open	Size limit	Bag limit
2A					
WA Inside Waters (east of Low Point)	April 9-June 18	51	5 (Th-Mon)	None	1
WA Inside Waters (Low Point to Sekiu River)	May 25-Aug 5	53	5 (Th-Mon)	None	1
WA North Coast (Sekiu River to Queets River)	May 9, 11, 13	3	5 (Tu, Th, Sat)	None	1
	May 16, 18	2	(Tu-Thurs)	None	1
	June 22, 24	2	(Th, Sat)	None	1
WA South Coast (all depths; Queets River to Leadbetter Point)	May 1-17	13	5 (Sun-Thur)	None	1
South Coast (nearshore fishery)	May 1-17	17	7	None	1
Columbia River (Leadbetter Point to Cape Falcon)	May 1-May 27	27	7	None	1
	Aug 4-27	15	3 (Fri-Sun)	None	1
	Sept 1-3	3	3 (Fri-Sun)	None	1
OR Central Coast (Spring, all depths; Cape Falcon to Humbug Mt.)	May 11-27	6	3 (Th-Sat)	None	1
	June 1-24	7	3 (Th-Sat)	None	1
	July 6-8	8	3 (Th-Sat)	None	1
OR Central Coast (Summer/Fall, all depths; Cape Falcon to Humbug Mt.)	August 4-18	6	3 (Fri-Sun)	None	1
	Sept 1-17	9	3 (Fri-Sun)	None	1
OR Coast (<40 fathoms; Cape Falcon to Humbug Mtn.)	May 1-Sept 21	144	7	None	1
OR/CA (south of Humbug Mt.)	May 1-Oct 31	184	7	None	1
2B, 2C, 3 and 4	Feb 1-Dec 31	335	7	None	2

Appendix III.

Table 2. 2006 catch limits and harvest estimates (in pounds, net weight) by subarea within Regulatory Area 2A.

Subarea	Catch limit	Harvest estimate	Over/under
WA Inside Waters	68,607	63,376	-5,231
WA North Coast	119,244	105,805	-13,439
WA South Coast	53,952	58,484	+4,532
Columbia River	21,170	21,719	+549
OR Central Coast (all depths)	175,474	183,689	+8,215
OR Coast	58,491	65,860	+7,369
OR Coast (<40 fathoms)	20,345	8,419	-11,926
OR/CA (south of Humbug Mt.)	8,293	8,293	0
Total	525,576	515,645	-9,931

Table 3. Estimated harvest by sport fishers (millions of pounds, net weight) by IPHC Regulatory Area, 1977-2006.

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[1]	0.516	2.262	3.033	6.088	0.011	0.063	11.973

[1] Only Area 2A is current; all other areas are projected harvests.

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 2006 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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Pop-up Archival Transmitting tag research and reward information

The International Pacific Halibut Commission (IPHC) has tagged halibut throughout the northeast Pacific Ocean, using Pop-up Archival Transmitting (PAT) tags. A total of 96 tags were at large as of Fall, 2006. These tags are unique in appearance (see below): the body of the tag is shaped like a microphone approximately 6½ inches (17 centimeters) long, and attaches to the fish by a seven inch (18 centimeter) leader, secured by a titanium dart embedded below the dorsal fin.

Electronic satellite tags record the temperature and depth experienced by the fish. The tags are programmed to release from the fish on a pre-determined date, float to the surface, and emit a satellite signal that indicates their position and transmits data to a land-based facility. The result is a record of the fish's final location and environmental data during the time at liberty. The leader remains on the fish after the tag body has released, serving as a conventional "spaghetti" tag. Both tag bodies and leaders bear information directing fishers to return them to the IPHC.

Rewards are offered for all returned PAT tags and leaders. A **$500** reward will be given for the return of each satellite tag body. An IPHC tagging program baseball cap (or $5) will be offered for returning catch information and the leader from any halibut that no longer carries the tag body. Any vessel that does not hold halibut IFQ can land and retain a PAT-tagged fish, as long as the halibut with the tag leader still attached is reported to IPHC at landing. In addition, fishers who hold IFQ should be aware that **the weight of PAT-tagged fish should NOT be deducted from the fisher's halibut IFQ**. The presence of the dart may prompt the buyer to "#2" the fish, but the fisher may sell it without quota penalty, provided that the fisher possesses halibut IFQ.

PAT tag recovery information

When you catch a satellite-tagged halibut:

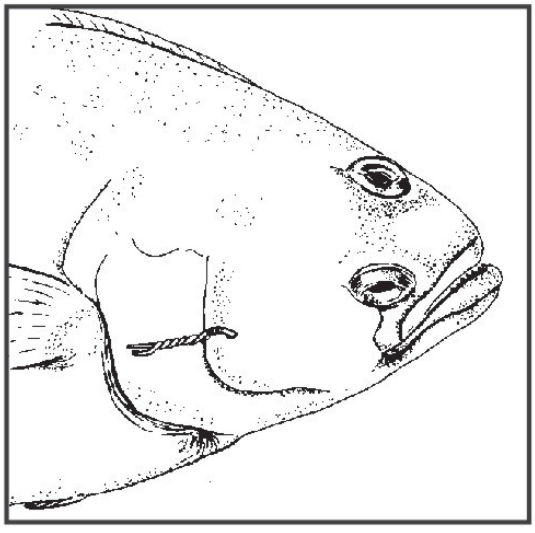
1. Record the date, capture location, sex, and the fork-length of the halibut.
2. Ideally, otoliths (earbones) from the fish should be removed in order to determine its age. If the fish is being landed at a port staffed by an IPHC port sampler, please present the fish to the port sampler during offload so that the otoliths can be removed. The IPHC has port samplers at the following ports during the commercial halibut fishing season: Newport, OR; Bellingham, WA; Vancouver, Port Hardy, and Prince Rupert, BC; Petersburg, Sitka, Juneau, Seward, Homer, Kodiak, Dutch Harbor, Adak, and Saint Paul, AK.
3. *If you do not possess halibut IFQ:* If the fish carries a tag body, remove the tag by cutting the leader about 1½" (4 cm) below the point at which the leader attaches to the tag body; **do not pull on the tag**. Retain the tag body so it may be turned in. Do not remove the leader from the fish until after it has been landed and reported to IPHC. Leave the leader attached to the fish and report the capture at time of landing to IPHC at **(206) 634-1838** or to an **IPHC port sampler.**
4. *If you possess halibut IFQ:* Remove the tag by removing the metal dart from the halibut's flesh or by cutting the nylon leader at skin-level; **do not pull on the tag**. Removing the entire metal dart is preferred, since the dart should not remain in the fish when it is processed.
5. Retain the tag and/or leader, and contact the IPHC at **(206) 634-1838**. Or, turn in the tag and information (and fish, if possible) to an **IPHC Port Sampler**.

The PAT tags are used to study seasonal migrations and to learn more about the physical conditions that fish typically experience during the tagging period. In particular, the Commission is examining the location of Bering Sea spawning grounds, and the timing of seasonal migration in British Columbia and the US Pacific Northwest.

For further information, please contact Dr. Tim Loher at (206) 634-1838 (ext. 212), or via email at tim@iphc.washington.edu.

TAGGED HALIBUT

The INTERNATIONAL PACIFIC HALIBUT COMMISSION attaches plastic-coated wire tags to the cheek on the dark side of the halibut, as in the diagram below. All Commission tags bear the letters "IPHC".
Fishermen should retain all Commission-tagged halibut, regardless of gear type used, time of year caught, or size of the halibut.



REWARD

$5.00 or a baseball cap with tag reward logo will be paid for the return of each tag.

The IPHC also pays a reward for the return of Halibut Sport Tags:

1. A plastic-tipped dart tag inserted into the back just below the dorsal fin.
2. A metal-tipped tag inserted into the flesh behind the head.

WHEN YOU CATCH A COMMISSION-TAGGED HALIBUT:

1. Record tag numbers, date, location and depth .
2. Leave the tag on the fish until landed.
3. If possible, mark the fish with a gangion or flagging tape around the tail.

WHEN YOU LAND A COMMISSION-TAGGED HALIBUT:

1. Report fish to a Commission representative or government officer

   or

2. Forward tags to address below and enclose recovery information (see above), your name, address, boat name, gear, fish length, and, if possible, the ear bones. Tags should be completely removed from the fish. Plastic-tipped and metal-tipped tags may need to be cut out of the fish.

FINDER WILL BE ADVISED OF MIGRATION AND GROWTH OF THE FISH.

International Pacific Halibut Commission
P.O. Box 95009
Seattle, WA 98145-2009
Phone: (206) 634-1838

THANK YOU!

The Commissioners and Staff wish to thank all the agencies, industry, and individuals who helped us in our scientific investigations this year including:

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- Steve Kupillas of ODFW for rockfish sampling;
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- WDFW and ODFW for scanning of sport caught fish in Washington and Oregon;
- Makah and Quinault samplers for scan sampling in Area 2A tribal fisheries;
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A special thank you goes to the United States Coast Guard in Alaska and the *F/V Heritage*.