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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2001

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

This report produced by IPHC staff
and Heather Peat

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PREFACE

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

Three IPHC Commissioners are appointed by the Governor General of Canada and three by the President of the United States. Each country pays one-half of the Commission's annual expenses, as required by the Halibut Convention. 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 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:
"Kickin' Butt" by Ray Troll (1990)

Alaskan artist Ray Troll blends the latest scientific work in ichthyology and paleontology with his sense of humor in his offbeat paintings of fish.

Troll's work has been featured in museum displays at the Smithsonian and he has had solo exhibitions at Seattle's Burke Museum, the Denver Museum of Nature and Science, the Alaska State Museum in Juneau, and the Anchorage Museum of History and Art, among others. He currently has another traveling museum show touring the United States based on his latest book "Sharkabet, A Sea of Sharks from A to Z". He is also a regular contributor to Natural History magazine.

Ray Troll owns and operates the Soho Coho Contemporary Art and Craft Gallery with his wife Michelle in Ketchikan, Alaska. In addition to his gallery and his artwork, Ray enjoys fishing whenever his schedule allows.

For more information on the art of Ray Troll visit http://www.trollart.com/ on the World Wide Web.

Table of Contents

ACTIVITIES OF THE COMMISSION IN 2001

Many issues resurface regularly at the Annual Meeting of the IPHC, some more strongly than others. This year was no exception with lengthy discussions taking place regarding aquaculture, bycatch, and extensions of the Individual Quota (IQ) system to encompass the sport fishery.

Quotas and Assessments

An IQ program for the sport fishery in Areas 2C and 3A was passed by the North Pacific Fishery Management Council (NPFMC) and is now under review by the National Marine Fisheries Service (NMFS). This would put guided sport anglers under a program similar to the commercial program in these areas, however, it will likely be two years before it is possibly implemented.

Annual meeting. Photo by Robert Tobin.

There was concern that the sport fish estimate for British Columbia put forth by the Pacific Region of the Department of Fisheries and Oceans (DFO) was not being used in the stock assessment. The Commission staff is looking for a sound, scientifically based estimate, however, believing a DFO National Survey estimate was probably too high, the staff presented two different catch limits based on both the National Survey and DFO estimates. In the end, the Commission accepted the regional estimate established by DFO.

In Area 4, catch limit recommendations are under scrutiny because it is unclear how much of the Bering Sea biomass is exploited and therefore the assessment must be based on areas where there are better data. The Commission staff is looking at a possible target of 2006 to have an independent assessment in Areas 3B and 4 if the goals of the proposed tagging project are realized.

The issue of an extended season is on hold until the staff report, which investigates the biological sensibility of such a change, is released for next year's Annual Meeting. Also regarding season dates, a modified opening date for marketing purposes was discussed. However, lack of consultation with commercial fishers including native groups, among other problems, require that more time and consideration be taken for this issue.

Chalky fish

The Alaska Fisheries Development Foundation may be co-operating to facilitate further chalky halibut research.

Chalky halibut research may have a new co-operator on-board. The Alaska Fisheries Development Foundation (AFDF) expressed a willingness to facilitate further research on the subject. The AFDF has a 20-year history of food technology type investigations and has the ability to generate some matching funding for such research. A framework in cooperation with AFDF is set to be developed by the Commission staff. Project funding from IPHC was approved for one year in the $30,000-$40,000 range.

Concerns emerged about the possibility of fishers using pH meters to high-grade at sea for non-chalky halibut. There was discussion of the responsibility of the Commission in this arena, but in the end it was seen as an enforcement issue. The Commission will, however, be supportive of industry and enforcement where it can.

Bycatch

The WDFW is hopeful that a halibut excluder agreement will be in place when the 2002 pink shrimp fishery opens.

The Washington Department of Fish and Wildlife (WDFW) is hopeful that there will be a halibut excluder agreement by the time the pink shrimp fishery opens in April, 2002. Total halibut bycatch should be reduced in part by the excluder, as well as by decreased groundfish fishing opportunities in the area.

Incidental catch in the U.S. remains a concern as targets for reduction set by the Commission in the early 1990s have not been met. There has, however, been a steady decline of bycatch since 1990 and the regional Councils continue to work towards further reductions. Recently, resulting restrictions in various fisheries due to the elevation of Steller sea lions to *threatened* status under the Endangered Species Act, has caused fisheries to operate outside of their normal areas and behaviors, and it is not yet clear what effect if any this may have on halibut bycatch.

Live Penning and Aquaculture

One of the hot issues this year for the Commission was aquaculture and live penning of halibut. In other fisheries, aquaculture has had some economic impact on the wild fisheries and fishers are concerned that this might happen in the halibut fishery. Live fish landings were discussed at length. There is no live penning permitted in the U.S., however, live halibut landings have been permitted in Canada by the DFO for the past two years and will continue. DFO has adopted a monitoring procedure to satisfy IPHC concerns about accounting of fish in and out of pens.

From the industry side, the Commission has been urged to view aquaculture as a threat to the wild halibut stock and take action to protect the resource. While the Commission recognizes industry concerns, no biological threat has been indicated. The Commission is being urged to work on a year-

round fishery framework that could increase the competitiveness of the wild fishery. Consideration is on-going with respect to a year-round fishery and is under scrutiny from ecological and managerial perspectives. The Commission has agreed that it can help facilitate ongoing communication between the aquaculture parties and commercial fishers by presenting a progress report at each Annual Meeting which includes government as well as private sector operations.

Research Notes

A project proposal is on the table that would involve examination of genetic and rearing differences of halibut among areas. The hope is to be able to identify distinct nursery grounds by analyzing trace elements in otoliths of adult fish. This could help to identify what determines a large or small year-class. A second project will involve the use of pop-up satellite tags. These tags record information over a period of time and then release from the fish on a pre-determined date, float to the surface, and transmit data via satellite.

A better understanding of recruitment over the next couple of decades may be accomplished through the proposed tagging project and further regime shift work.

A check-up on aging techniques used by the Commission was suggested. Such a study would use radiocarbon-dating to corroborate the age estimates made by staff by examining rings on otoliths (ear bones) of the fish.

Ecosystem management issues are being considered as a focus for future research. To address the issue of Area 2A/B halibut and their origins, Commission staff will design a research program. A better understanding of recruitment over the next couple of decades in those areas may be accomplished through the proposed tagging project and further environmental-oriented work. The timeframe of this project has not yet been set.

Reaching Out

A committee will be formed to develop the undergraduate scholarship fund, and it will include, the IPHC Executive Director as the chair, one commissioner, and five to six members in total from the Conference Board, Processor Advisory Group, and Research Advisory Board. The fund will be named the *IPHC Scholarship Fund* and the goal is to develop the framework by high school graduation, 2002.

For the younger set, the commission staff is currently working on writing and illustrating a children's non-fiction picture book about halibut.

DIRECTOR'S REPORT

The halibut resource continued to be healthy in 2001, although it is slowly declining from the high levels of the late 1990s. Most of the changes seen in this year's stock assessment reflect changes in the methods of assessment or the data included in the assessment, rather than changes in the underlying biomass. The resumption of large-scale surveys in the mid-1990s began the creation of more comprehensive survey data sets and we are beginning to incorporate these new data into the assessment. We are also using a new method of calculating yield for Areas 2A (Washington, Oregon, and California) and 2B (British Columbia) that deals with each area more directly, rather than combining them as previously.

IPHC Director, Bruce Leaman, port sampling in Dutch Harbor. Photo by Heather Gilroy.

This year was marked by some significant steps toward more formal allocation of harvest among commercial and recreational sectors. The U.S. North Pacific Fishery Management Council approved measures that would provide specific catch sharing arrangements for commercial and guided recreational catches in large portions of Alaskan waters, where recreational fisheries are most extensive. These programs would bring the guided recreational sector into the same conservation framework as that of the commercial sector. Previously, total harvest by the recreational sector was not constrained. Under the new proposals, guided recreational harvest would be governed by halibut abundance. Such formal catch sharing among sectors has been operating in Area 2A, under the auspices of the Pacific Fishery Management Council, for many years. In British Columbia, discussions on a formal catch sharing agreement between recreational and commercial sectors are also underway and an agreement on an allocation formula is anticipated in the near future.

This year we have also initiated research programs to re-examine our understanding of some basic stock concepts within the halibut resource. In part, this re-examination has been prompted by industry wishes to have longer fishing seasons. Much of our understanding of halibut distribution

and movements is based on tagging programs conducted over the past 40 years. In reviewing this information, we have noted that while some broad trends are well demonstrated, we have limited ability to estimate specific rates of movement among areas. This includes both seasonal migrations for spawning and immigration/emigration among areas as fish age from juveniles to adults. Differences in the rates and probability with which tags are recovered and reported among areas hamper our ability to derive these specific rates. To deal with this problem, we have started the preliminary experiments necessary to establish methods and locations for use of internal tags for halibut. These tags (called PIT or Passive Integrated Transponder tags) will be applied on our assessment survey stations and recovered by dockside scanning of fish in ports. We anticipate the project will produce both estimates of fish movement as well as estimates of stock biomass that can act as a check on model-based estimates for Areas 2B-3A and our first direct estimates for Areas 3B and 4.

We are also examining our understanding of stock structure and the origin of recruitment to each regulatory area. This will be accomplished through genetic analysis of fish from spawning aggregations, as well as through examination of the elemental composition of the otoliths of halibut from both spawning and rearing areas. Halibut otoliths absorb and maintain a permanent record of specific trace elements such as barium, lithium, magnesium, manganese, and strontium from the sediments on which they live. Examination of different segments of the otoliths may help us distinguish different areas of origin of adult fish.

Although we have been conducting research on halibut for almost 80 years, it is clear that we still have much to understand. It is also clear that the environment and how the halibut react to it are not static. This means that previous understanding, even if correct, may not be appropriate for new environmental situations. Keeping our understanding in pace with these changes is one of our major challenges.

Bruce M. Leaman
Executive Director

In Loving Memory of Linda Shen
September 20, 1948 - January 10, 2001

Linda was born in China in 1948. She immigrated to the United States with her mother, father, two sisters, and two brothers. She attended high school here and in 1975 joined the Commission staff. The following year she was married to Shih-Lin Shen, also known as Mike. In 1980 their son, Jonathan Adam Shen, was born followed by their daughter, Amy Elizabeth Shen, in 1982.

Linda's sweetness and kind nature touched everyone who had the privilege to work with her. Her attention to detail and carefulness showed in her work as one of the data entry staff. When she became ill she was the one who supported her friends through her illness. She never complained and was always cheerful no matter how she felt.

Some people come into your life and leave so very quickly, Linda was one of those people. She was our friend and she is sorely missed.

"People who die are not buried in a field, they are buried in the heart."
Anonymous

THE COMMERCIAL FISHERY

"There is no mention of anything resembling reels in Dame Julian Berners' fishing treatise from the 1400s. Early English rods were large, wooden poles. If a fish proved too strong to hold onto, the rod was thrown into the water. After the fish grew too tired of towing the rod around, the angler grabbed it and landed the fish."

Wit and Wisdom of Fishing

The management of the commercial fishery utilizes regulatory boundaries in estimating biomass and setting fishing catch limits each year. These boundaries have not changed since 1990, are described briefly below, and are illustrated in Figure 1. The area of the southeastern flats in the Bering Sea, excluding Bristol Bay, remained closed in 2001 to all halibut fishing.

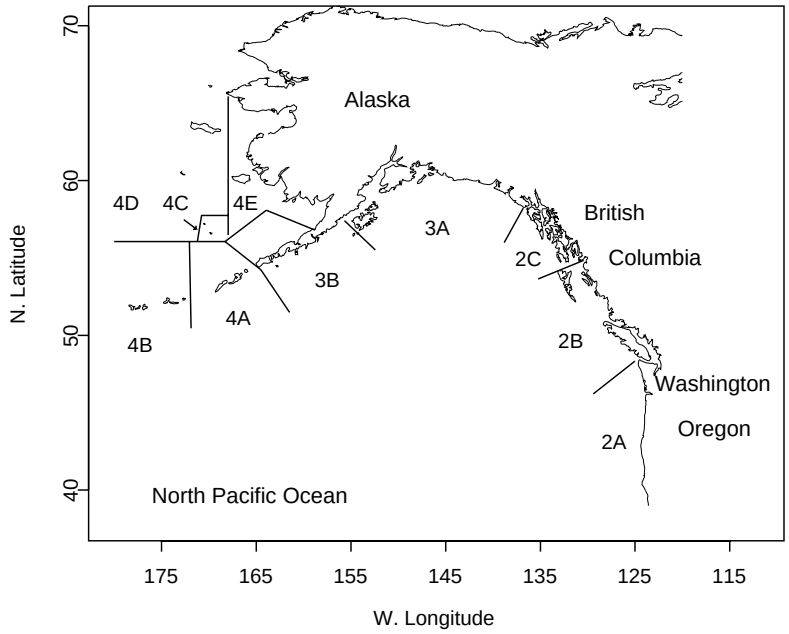


Figure 1. IPHC regulatory areas for 2001.

Area 2A - all waters off the coast of the states of California, Oregon, and Washington.

Area 2B - all waters off the coast of British Columbia.

Area 2C - all waters off the coast of Alaska, south and east of Cape Spencer.

Area 3A - all waters between Cape Spencer and Cape Trinity, Kodiak Island.

Area 3B - all waters between Cape Trinity and a line extending southeast from Cape Lutke, Unimak Island.

Area 4A - all waters west of Area 3B and the Bering Sea closed area that are south of 56°20' N and east of 172°00' W.

Area 4B - all waters in the Gulf of Alaska and the Bering Sea west of Area 4A and south of 56°20' N.

Area 4C - all waters in the Bering Sea north of Area 4A and the closed area that are east of longitude 171°00' W, south of 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.

New Rules of the Game - 2001

The regulations for the 2001 fishery were adopted at the Commission's Annual Meeting in Vancouver, British Columbia. A number of the changes in regulations in 2001 were in addition to regulations already in use. Changes encompassed the Area 2A Catch Sharing Plan, the record-keeping process for operators, clearance procedures, offloading requirements, and logbook requirements.

In the past, logbooks were required by IPHC to be kept on the vessel for five days following the offload. The regulation change for 2001 required that the logbook be kept on the vessel only until the offload was completed. Also in terms of logbooks, a new regulation required the fishing location be recorded in latitude/longitude, loran, or a direction and distance from a point of land, rather than just a general "fishing locality".

Dressing halibut. Photo by Levy Boitor.

The purposed of a regulation change for halibut vessels in the U.S. with an overall length greater than 25 feet was to allow the use of the Alaska Department of Fish and Game (ADF&G) Longline-Pot fishery logbook. These vessels now have four options in which to maintain fishing information: 1) the NMFS Catcher Vessel daily fishing logbook, 2) Alaska Hook-and-Line sablefish logbook, 3) ADF&G Longline-Pot fishery logbook, or 4) the IPHC logbook.

For vessels in the United States, a regulation change clarified that total halibut weight was to be recorded both on state and federal catch records, not just one or the other. In Alaska, it was additionally required that the total scale weight be recorded on the federal IFQ catch records.

Changes were made to allow the operators of Canadian vessels to hold the IPHC copies of their logs throughout the season, only requiring them to be submitted within seven days of their *final* halibut offload of the season. In this way, the vessel operator maintained the IPHC copy of the log sheet in their book during the season and hence the IPHC sampler could interview and collect the log sheet at anytime. In the past, the IPHC copy had to be submitted by mail within seven days of *each* offload.

Logbooks must now have fishing location recorded in latitude/ longitude, loran, or a direction and distance from a point of land, rather than just a general "fishing locality."

In regards to the possession of halibut fillets on board a vessel, the Commission adopted regulations to allow possession of fillets from legally-retained, commercially-caught halibut until 6 p.m. on the calendar day following the offload when the vessel is still in the port of offload.

The Catch Sharing Plan in Area 2A, under the management of the Pacific Fishery Management Council (PFMC), had some changes in allocation for 2001. In 2000, the courts ordered an adjustment in the halibut allocations for the years 2000 through 2007, specifically in terms of tribal fisheries. In 2001, therefore, 25,000 pounds of catch limit (based on a percentage of total Area 2 allocation) was transferred from non-tribal to tribal fisheries. Also in 2001, the Catch Sharing Plan allowed for a new component of the commercial fishery—an incidental halibut fishery. Halibut taken incidentally during the sablefish longline season north of Point Chehalis could be retained and sold within this new fishery (described further below).

New regulations allow possession of fillets from legally-retained, commercially-caught halibut until 6 p.m. on the calendar day following the offload when the vessel is still in the port of offload.

Vessels fishing in this new incidental halibut fishery in Area 2A during the sablefish season were required to obtain a commercial license from the Commission. In terms of general Area 2A licensing, all fishers had to choose between a commercial or sport charter license. As well, commercial fishers had to choose between a license for (1) retaining halibut caught incidentally during the salmon troll fishery, or (2) fishing in the directed commercial halibut fishery (south of Point Chehalis) and/or retaining halibut caught incidentally in the primary sablefish fishery (north of Point Chehalis).

On more northerly issues, Nazan Bay on Atka Island was approved as an additional port where vessels could obtain a clearance for fishing Area 4A. If no observers were on board, the vessels had to offload any Area 4B fish before a clearance could be completed. A new requirement in 2001 was that the clearance forms had to be signed. In most cases the required signature was either the vessel operator's, the person completing the form in St. Paul and St. George, or the person completing the form at Nazan Bay for vessels leaving Area 4B.

The adjusted regulations for the 2001 fishery, as adopted by the Commission, were approved in whole by the United States government and with one exception by the Canadian government. Since 1995, the Commission has adopted a regulation that requires commercially caught halibut to be offloaded from a vessel with the gills and entrails removed.

Nazan Bay on Atka Island was approved as an additional port where vessels could obtain clearances for fishing Area 4A.

This regulation was intended to improve fish quality and to address sampling concerns. This regulation also, however, prohibits live fish landing, which is of concern to the Canadian government. In British Columbia, landing of live halibut caught in British Columbia waters is permitted, and enables holding of live halibut, which can then be sold after season closure. In 2001, the IPHC staff and the Canadian government authorities met and reviewed the regulations concerning live fish landings. DFO and the Province of B.C. now have a Memorandum of Understanding (MOU) for penned groundfish, which includes additional monitoring requirements for live fish landings. The MOU has dealt with the conservation and data concerns that the Commission staff had with live halibut penning.

The 2001 Commercial Catch

The general commercial catch for 2001 was up from 2000, near the levels of the late 1990s. These numbers include commercial catch, the IPHC research catch, tribal commercial fisheries and the Metlakatla fishery. Appendix I describes the commercial catch and limits. The trends within the regulatory areas are discussed individually below.

Commercial Fishery in Area 2A

The Commission catch limit for Area 2A (Washington, Oregon, and California) totalled 1,114,000 pounds of halibut. The Catch Sharing Plan put forth by the PFMC further allocated that limit among the various user groups. The directed commercial fishery was limited to the area south of Point Chehalis, WA (46°53'18"N. latitude) as regulated by the PFMC. The incidental halibut fishery during the longline sablefish fishery was limited to waters north of Point Chehalis, WA. To the non-treaty commercial user groups, the PFMC recommended allotments of 192,926 pounds for the directed commercial fishery, 47,946 pounds for the incidental halibut fishery during the sablefish longline fishery, and 34,046 pounds to the incidental catch during the salmon troll fishery. The treaty Indian fishery was allowed 17,500 pounds for ceremonial and subsistence use and 406,500 pounds for commercial fishing. The remaining catch limit was allocated to the sport fishery and is discussed later. The allocative recommendations were adopted by the IPHC.

In 2001, 798 vessels were licensed by the IPHC for commercial or sport charter fisheries. Of these, 345 were for the incidental commercial catch during the salmon troll fishery, 320 for the directed commercial fishery and incidental halibut during the sablefish fishery, and 133 for the sport charter fishery. For incidental halibut catch during the salmon fishery, approximately 100 more licenses were issued in 2001 compared to the previous season. The new incidental halibut fishery during the sablefish longline season prompted 50 vessels to obtain this joint license.

The regulations for the incidental commercial halibut fishery during the salmon troll season operated on the basis of a ratio of halibut to chinook. In 2001, one halibut per three chinook were permitted, plus one additional

halibut over and above the ratio allowance. This ratio has increased from 1:20 (halibut:chinook) since the implementation of the program in 1995. In 2001 the regulations did not allow roll-over of catch from this incidental fishery to the direct commercial fishery so the incidental fishery closed slightly over the catch limit, on July 11 (after opening on May 1).

The directed fishery was permitted six 10-hour fishing periods in 2001with fishing period limits per vessel, allocated by vessel size (Appendix II, Table 1). The limits were generally higher in June and early July and considerably lower in August. The total directed commercial catch was within one percent of catch limits, despite two very poor fishing periods in August caused by difficult weather conditions.

Southeast Alaska port. Photo by Tracee Geernaert.

In the treaty Indian fishery, the catch was also within two percent of the catch limit for 2001. Two fishing periods were allowed during the unrestricted portion of the fishery (March 21-23, and April 19) and 321,000 pounds were landed. The restricted portion of the treaty fishery had fishing period limits of 500 pounds, and resulted in a total catch of 92,000 pounds. The ceremonial and subsistence fishery remained open until December 31.

Metlakatla Fishery in Area 2C

The Metlakatla commercial fishery in the Annette Islands Reserve, authorized by the United States government, fished thirteen, 48-hour periods between May 4 and October 22 (Appendix II, Table 2). The catch peaked in late July and the total catch for the season was 64,005 pounds. The catch was 10,000 pounds higher than last year's, although 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.

British Columbia - Quota Share Fishery

The Individual Vessel Quota (IVQ) fishery was in effect for the eleventh year in British Columbia (Area 2B). As usual, the quota for each of the vessels was calculated by DFO. The number of vessels (234) was down from 269 in the 2000 season. When the IVQ program began in 1991, 435 vessels were granted IVQs. Each of these quotas was split into two shares (blocks). In 1999, vessel owners were permitted to make unlimited permanent or temporary transfers of the IVQ, subject to minimum and maximum holdings and by 2001, 72 percent of the catch limit was transferred among vessels, of which 829,796 pounds were transferred permanently.

Transfer of IVQ among vessels has been permitted since 1999, and in 2001, 72 percent of the catch limit was transferred among vessels.

The catch limit for the region was 10.5 million pounds for the 2001 season. From the previous year's fishery there was an additional 100,848 pounds from 2000 underage program that was carried forward. The 2001 season was open from March 15 to November 15. A total of 10.2 million pounds were landed in British Columbia, 300,000 pounds under the catch limit approved by the IPHC. Several small sub-areas were closed to the halibut fishery to protect localized stocks of non-halibut species and to improve the access to food fish for the aboriginal communities.

The Native Communal Commercial Fishing Program (F licenses) had 11 active vessels in 2001, down from 13 that operated the previous year. Those vessels landed 338,615 pounds on 42 trips, compared to 238,948 pounds on 39 trips in the 2000 season.

Alaska - Quota Share Fishery

The Individual Fishery Quota (IFQ) in Alaska has operated for seven years. The 2001 quota was allocated by the NMFS to 3,506 individual fishers according to IPHC regulatory areas. The number of fishers is down considerably from the initial 4,832 people holding IFQ.

The total catch from the IFQ fishery in the waters off Alaska was up by 3.8 million pounds from the 2000 catch. This brought the catch to 58.6 million pounds, but still five percent under the catch limit. In Areas 2C, 3A, and 3B the catch was three to six percent under the catch limit, whereas in the Area 4 regions the catch was as much as 18 percent under the limit for some areas. In 2001, a NMFS enforcement waiver was given allowing QS from Areas 4E and 4D Community Development Quota to be taken in either regulatory area. Area 4E was over the catch limit by a considerable 23 percent, however, the combined 4DE catch was six percent under its limit. Area 4CDE is managed as one stock hence this is not a biological concern. The Alaska QS fishery was open from March 15 to November 15 in 2001.

Landing patterns and highlights

The 2001 ex-vessel price for halibut was down slightly from last year, at about $2.00 (U.S) per pound. Chalkiness continued to be a concern to the industry. The processors used pH meters at the unloading sites to check the

flesh for chalkiness, and docked the price to compensate for their loss in the value of the product. (See Research for further discussion of the chalkiness issue.)

Over a third of the Alaskan IFQ catch was received into just two ports—Homer (13.4 million pounds), and Kodiak (8.3 million pounds). This is an increase from a combined total of over 18 million pounds in 2000. Sitka, Petersburg, and Juneau were the busiest ports in S. E. Alaska, each receiving over two million pounds.

As was the case in Alaska, a large portion of the British Columbian catch was delivered to just a few ports. Although 20 different ports were used to land halibut from 989 commercial trips in Area 2B, Prince Rupert/Port Edward, Port Hardy, and Vancouver again received about 90 percent of the total commercial catch for the area.

The monthly catch totals show the peaks in landings for the regions, with southerly regions peaking early and the north (Area 4) not peaking until August (Appendix I, Table 2). More specifically, the landings for Area 2C in March decreased in 2001, with only nine percent of the catch being landed (compared to 11 percent in 2000). May was the busiest month for Alaska landings while April was busiest for British Columbia.

Halibut offload. Photo by Joan Forsberg.

May was the busiest time for Alaska landings while April was busiest for British Columbia.

Landings in British Columbia included 24,000 pounds of live halibut, as allowed by DFO. No fish were penned in 2001, unlike the previous season when 74,000 pounds were landed, nearly all of which were held in net pens before being sold. A fire at one of the holding sites in late 2000 was the probable cause of the diminished live landings in 2001.

Can we extend the fishing season?

The possibility of winter fishing or at least extension of the commercial fishing season has been an issue for several years. Investigations of historical data have revealed evidence to indicate that an extended season would have a large impact on management of the fishery in certain areas. The key difficulty is caused by the fact that there is migration between spawning, rearing, and feeding grounds. The size and distance of these migrations could be great enough to alter the exploitation rates in a given area.

In particular, data from past tagging operations has shown that fish from Area 2B move northward and into Area 2C in winter for spawning, and return to summer feeding in Area 2B. Likewise, there is eastward movement of fish from Area 3B into Area 3A during winter spawning season, and westward return for summer feeding. The period of vulnerability differs somewhat, depending on the area. In Areas 2B to 3B the December to February period would be most critical, whereas in Areas 2A into 2B the critical period may extend into March or April.

Given that inter-area migration occurs on a seasonal basis, extension of the commercial fishing season would cause difficulties in managing the stocks in various areas. The coastwide halibut population is divided for management purposes among regulatory areas according to where the fish are distributed on the summer feeding grounds. The stock, upon which management decisions are based, is the stock that is there during summer feeding months. Management of stocks as such cannot account for exploitation of fish on their winter spawning grounds, which may not be in the same regulatory area as their summer feeding grounds. For example, a winter fishery allowed in Area 2C would be exploiting stocks from Area 2B as well as 2C. The size of this impact would be dependent on the percentage of the quota that is taken during a winter fishing period, as well as on which months of the winter that fishing was done. Such a fishery would create a potentially higher than planned exploitation rate of stocks from Area 2B and a lower rate in Area 2C.

The key difficulty in extending the fishing season is the fact that there is migration between spawning, rearing, and feeding grounds.

The impact of extending the fishing season on biological, administrative, logistical, enforcement, data, and fishery interaction issues is considerable. The Commission has requested that staff continue to investigate the issue. Research has been proposed that is designed to determine the extent of migrations and the potential impact of a winter fishery. These studies include a large tagging operation in 2003 to clarify migration between spawning and feeding grounds, exploration of the potential of chemical analyses of otoliths to aid in monitoring fish origin, and genetic analysis of stock.

***F/V Heritage*. Photo by Lisa Thompson.**

SPORT FISHERY

"The test of an adventure is that when you're in the middle of it, you say to yourself, "Oh, now I've got myself into an awful mess; I wish I were sitting quietly at home."

T. Wilder

Sport fishers venturing after halibut in the waters of British Columbia and Alaska did not have to worry about changes in regulations from 2000. That doesn't mean that the respective agencies for each area remained silent however. In Alaska, there is a plan underway to organize an IQ program for guided sportfishing (probably several years away from implementation), while British Columbia struggles to adopt a more comprehensive sport catch estimating procedure amidst severe budget cutbacks.

Appendix III gives the breakdown of catch for this fishery.

The Ones that Didn't Get Away - Sport Catch Estimates

Washington, Oregon, & California

For Oregon, Washington and California regions (Area 2A), the Catch Sharing Plan, put forth by the PFMC, was adopted by the IPHC. This plan included regulations on allocation among user groups including sport fishers. The region of Area 2A was divided into nine sub-areas for which catch limits and open seasons for the sport fishery were set individually. Operators of vessels in this area were required to register as either charter or commercial, as halibut licenses could be held for only one category (Refer to Appendix III, Table 3 for catch by regulatory area in the years 1977-2001).

Total harvest in Area 2A was 445,655 pounds for 2001. This catch is a summation of the nine sub-areas for which estimates were provided by the Oregon Department of Fish and Wildlife (ODFW) and the Washington Department of Fish and Wildlife (WDFW) from in-season creel census estimates, excepting Washington Inside Waters which was assessed by a post-season phone survey. Several of the sub-areas were over their allotted catch limit but the balance was only one percent over the limit.

The harvest estimate for Washington Inside Waters was 58,710 pounds, two percent over the catch limit. The Washington North Coast fishery closed only 1,463 pounds above the 108,030-pound quota. The North Coast average weight of 19.3 pounds through June was slightly higher than the 18.4 pound average weight from the July fishery. The Washington South Coast fishery

(centered principally out of Westport) closed at 42,242 pounds, slightly below the catch limit, with an average fish weight of 20.6 pounds. This was nearly 2.5 pounds higher than the 2000 estimate.

The Columbia River area is fished primarily by the Washington fleet but has some catch taken in Oregon as well. This area closed early, nearly 1,700 pounds short of its catch limit due to concerns the allocation would be exceeded. The average weight of halibut caught in this area was 21.0 pounds, about a half pound higher than that of both 1999 and 2000. This weight is based, as in previous years, on a very high proportion of the catch that was sampled to provide the average weights for these Washington areas.

The average fish weight for the Washington South Coast fishery in 2001 was 20.6 pounds, nearly 2.5 pounds higher than the previous year.

Sport fishing for halibut. Photo by Stephen Kaimmer.

In the 2001 Oregon sport halibut fishery, weather was a major factor and resulted in several more open days than were expected. Quota remaining from the early season Oregon Central Coast fishery provided more fishing opportunity in August. Weather subsequently kept the catch down leading to a 2-day fishery in September. Despite these late openings, sport anglers voiced their concern to the ODFW and the PFMC about the lack of overall fishing opportunity and inequity among allocation schemes. The inherent difficulty in estimating effort and success led to catch being over quota by about 4,000 pounds for the Oregon Central and South Coast. The overall average weight for the Oregon sub-areas, was 23.0 pounds in 2001, nearly the same as in 2000.

British Columbia

For several years DFO has been developing alternate methods for estimating the sport halibut catch in British Columbia. These estimates have increased as more detailed creel census and logbook programs are implemented. The IPHC developed a catch estimate for the sport fishery in Area 2B for 1998 based on the DFO national survey. The Pacific Region of DFO developed a parallel estimate by combining the results of a number of creel survey and logbook programs. The Commission later adopted this estimate.

The DFO method used an average weight of 16.2 pounds, which the DFO Pacific Scientific Advice Review Committee (PSARC) did not endorse because it was derived from a single lodge. In order to arrive at a catch weight total, however, the IPHC used the DFO's average weight estimate of 16.2 pounds as well as accounting for Canadian halibut caught by United States anglers and landed in Neah Bay, Washington. In 2001, this adjustment amounted to 9,716 halibut caught off Swiftsure Bank in Canadian waters. The estimate for weight of harvest in BC for 2001 is 1,015,384 pounds, using the DFO weight conversion of 16.2. The process to improve the accuracy of estimates is continuing and DFO and IPHC staff believe this will happen as sampling programs become more extensive.

Southeast Alaska - Area 2C

Average halibut weight for Area 2C in 2000 was 20.2 pounds, and preliminary indications showed the average net weight to be 17.5 pounds in 2001.

Estimates for the previous year's harvest are made by ADF&G and are derived from the Statewide Harvest Survey (SWHS). Current year projections, also made by ADF&G staff for IPHC, were based on a creel survey for this area.

The updated 2000 harvest was estimated at 2.258 million pounds, net weight, and was 14 percent higher than the projected harvested biomass provided last year. Private anglers and the charter industry shared the harvest almost equally, with charters taking 1.132 million pounds. Length data were gathered in Ketchikan, Craig, Petersburg/Wrangell, Sitka and Juneau. Glacier Bay and Haines/Skagway were not sampled for length information, so Juneau average weights have been used historically as a surrogate to project their harvests. The overall average weight for Area 2C in 2000 was 20.2 pounds, net weight, and preliminary indications showed the average net weight to be 17.5 pounds in 2001.

South Central Alaska - Area 3A

Current year projections are made annually by ADF&G staff for Area 3A and are based on port sampling. The Area 3A updated estimate of harvest biomass for 2000 was 5.035 million pounds, 15 percent higher than the preliminary estimate for 2000, made in the previous year.

The Area 3A harvest biomass was also estimated for each user group and the charter industry took 59 percent of the harvest. These calculations are made from numbers supplied by the SWHS and average weight generated from length data collected from the primary ports of sport landings. The sampled ports for 2000 included Yakutat, Whittier, Valdez, Seward, Homer, Deep Creek and Anchor Point beaches, and Kodiak. Care was taken to properly account for harvests by the charter, private, and military recreation camps. The average weight for 2000 was 18.4 pounds. Preliminary indications suggested the average net weight in 2001 was nearly the same at 18.7 pounds.

The Aleutians and the Bering Sea - Areas 3B and 4

The estimates for elsewhere in Alaska were based on a linear projection of the 1996-2000 harvest, estimated from the SWHS. The average weight for Kodiak, the nearest sampled port, was applied to the projected numbers to convert to the estimated net harvest weight.

The estimate of the 2000 sport catch in Area 3B was 13,000 pounds, and concentrated at Chignik Bay, Cold Bay, and Sand Point. The Area 4 harvest (Bering Sea and Aleutian Islands) fell about 20,000 pounds between 1999 and 2000. This harvest came primarily from Dutch Harbor. No dockside sampling took place in Dutch Harbor or Sand Point, however, large halibut over 300 pounds live weight were not uncommon in these areas, particularly Dutch Harbor.

Information from sport fish publications and conversations with local charter operators suggest that the average weight may be high in Dutch Harbor and Unalaska, hence the harvest in Areas 3B and 4 may be higher than we are reporting presently.

The 2001 harvest in Area 4A was expected to be similar to the 2000 harvest. The harvest estimates have fluctuated over time due to the small sample size, and estimates may be biased low because remote fishers may not always have obtained licenses or may have confused sport use with subsistence.

In 2001 we used the average weight obtained from ADF&G sport fish sampling on Kodiak Island to estimate the Area 3B and 4 harvests in pounds (13,000 and 81,000 pounds, respectively). Anecdotal information from sport fish publications and conversations with local charter operators suggested that the average weight may be high in Dutch Harbor and Unalaska compared to other regions, hence the harvest in Areas 3B and 4 may be higher than we are reporting presently.

WASTE IN THE COMMERCIAL FISHERY

Wastage is when fish die trapped on lost or abandoned gear or when released fish die due to stress of catch and release in the commercial fishery. In addition, wastage mortality can occur when halibut are discarded at sea due to poor fish quality caused by sand flea, shark, or other predation.

All removals of Pacific halibut from the population are included in the stock assessment and wastage is one of the removals. Since 1997, the estimated annual removals of legal-sized (>82 cm or 32 inches) halibut caused by lost or abandoned gear is the wastage that is represented in the stock assessment. Mortality of sublegal-sized halibut that are discarded is not included in the wastage estimate as this measure is already incorporated when the exploitation rate is set. The amount of legal-sized halibut caught in excess of quota or catch limits and discarded at sea is recorded during logbook interviews. At this time, these amounts are being reviewed but mortality of over-limit legal-sized discards is not currently included in the wastage removals for stock assessment purposes.

Wastage from lost or abandoned gear

The task of estimating how many halibut die because of lost or abandoned gear is no easy task. First, the amount and type of gear lost must be determined. Then, the number of fish that might be hooked on each type of gear must be estimated. Finally, an estimate of wastage from lost or abandoned gear can be made.

For the halibut longline fishery, information on the amount of gear lost or abandoned was collected through personal logbook interviews or from fishing logs received by mail. Fishery-wide estimates for gear loss are then made by extrapolating from qualified logbook catch and effort statistics. This provides the estimate of how much and what types of gear are lost or abandoned.

Because types of gear vary considerably as to length of skates, hook size, and hook spacing, the data had to be adjusted to reflect standardized gear, referred to as *effective skates*. These data are used in subsequent calculations. Some logbook entries have missing data, or the gear that was used fishes differently and cannot be standardized. Such entries are therefore not included in the calculations. In the IFQ fishery in Alaska and in the Area 2A incidental commercial fishery, there are mixed halibut and sablefish trips, as well as trips that target sablefish and land incidentally-caught halibut. Sablefish gear is considered a non-standard halibut gear that fishes differently and therefore is also not included in the calculations.

On the basis of such information, the ratio of effective skates lost to effective skates hauled is calculated. The Area 2A ratio is generally the highest due to the derby style fishery but this year it is lower than in the past. Since the implementation of the quota share fisheries, the ratios have fluctuated slightly between years, but are lower than in the derby fisheries. In 2001, the ratios ranged from 0.001 to 0.007.

An overall estimate of loss or abandonment of gear is made by multiplying these lost:hauled ratios by the total catch. Wastage from lost or abandoned gear was first calculated in 1985. The calculation is done using both fixed hook and snap gear in all areas. Prior to 1998, the gear type used for the wastage calculation was the gear type used to calculate catch per unit effort. The Area 2A catch includes the non-treaty directed commercial catch, treaty commercial catch, and incidental catch during the longline sablefish fishery. Wastage from lost or abandoned gear totalled 238,000 pounds in 2001.

Discard mortality of sublegal halibut

Undersized halibut. Photo by Hilary Emberton.

In order to estimate the amount of sublegal-sized halibut lost from the population due to the effects of discard, an estimate of the ratio of sublegal to legal sized fish must be made. As well, the likelihood that a discarded fish will die from the effects (discard mortality rate) must be determined, and these two estimates can be used to calculate losses by applying them to total catch statistics.

In the past, the ratio of sublegal to legal weights, used in wastage estimates, was estimated from catch data for the grid survey. At the 1999 Annual Meeting it was suggested that this was not representative of the commercial fleet because they catch fewer sublegal fish than do the survey vessels. Further discussions of the issue resulted in a new method for estimating wastage from sublegal-sized halibut for 2001. The revised method is to calculate the ratio (sublegal to legal) from the stations that represent the highest one-third of the legal catch weight.

The ratios of sublegal to legal pounds of halibut caught in 2001, are 71 to 97 percent as large as the ratios using the old methods. In comparison to

the 2000 ratios, the 2001 ratios of sublegal to legal pounds decreased in Areas 3A and increased in the other areas.

The discard mortality rate, used in calculations since 1995, is 16 percent for all areas. This rate is based on the bycatch discard mortality observations of 1992 to 1993 in the Bering Sea/Aleutians sablefish hook and line fishery where the pace is similar to that of the quota fisheries. The observer data from the 1996 and 1997 sablefish IFQ fishery also had a 16 percent discard mortality rate, confirming that this is an appropriate rate to use at this time. In the Canadian IVQ fishery, a 16 percent discard mortality rate has been used since 1991.

To estimate the pounds of sublegal-sized halibut in the commercial fishery, the ratios of sublegal to legal halibut caught from the subset of surveys were multiplied by the estimated commercial catch in each regulatory area. The resulting poundage was then multiplied by the discard mortality rate (16 percent) to estimate the poundage of sublegal-sized halibut killed in the commercial fishery. In 2001, it is estimated that 1,427,000 pounds of sublegal-sized halibut were killed by the commercial halibut fishery.

GO DIRECTLY TO HOME: PERSONAL USE

Personal use catch is one of the removals that is accounted for in the stock assessment. Personal use includes: (1) the sanctioned Indian food fish fishery in British Columbia, (2) sublegal halibut retained in Area 4E under IPHC regulations, (3) rod and reel catch not documented in the sport catch, (4) fish caught from illegally-set commercial gear, (5) illegally-retained bycatch in other fisheries, and (6) ceremonial and subsistence (C&S) removals in the Area 2A treaty Indian fishery. The C&S removals are included in the Catch Sharing Plan in Area 2A. Since 1995, all take-home fish from the commercial halibut fisheries has been included in the commercial catch and not under personal use. In 2001, personal use coastwide was estimated at 756,000 pounds, representing a two percent increase from 2000.

Halibut for Personal Use in Alaska

Since the implementation of the IFQ fishery in 1995 the take-home fish from commercial vessels, recorded as retained weight, has been accounted for as part of the IFQ and hence as part of the commercial fishery. Personal-use fish for Alaska therefore is only the non-commercial and non-sport halibut.

IPHC archive photo.

Personal use is difficult to estimate, however, a method was developed in 1998. This method used information from household interviews and postal surveys which were conducted by the ADF&G. The method adjusted the survey and interview results to account for some overlap in reporting of sport fishery catches, and for areas where no information was collected.

Using this method, the amount of halibut caught for personal use in all Alaska areas combined was estimated in 1998 to be 430,000 pounds. Because annual information is usually not available about personal use halibut it is only possible to estimate totals intermittently. The figure has

fluctuated slightly in recent years due to an accounting of sublegal halibut retained by the Area 4E Community Development Quota fishery.

Personal Use in British Columbia

As is the case in Alaska, take-home halibut from commercial vessels is monitored at the time of offload and is therefore included as part of the vessel's quota. The primary source of unreported personal use halibut in British Columbia is the Indian food fish fishery. DFO estimates the Indian food fish catch at 300,000 pounds. Currently, IPHC does receive some logbook and landing data for the Indian food fish fishery from DFO, however these do not account for the entire 300,000 pounds.

Personal Use in Washington, Oregon, and California

In this region (Area 2A), all halibut for personal use are accounted for in other components of the stock assessment. The catch limit is allocated by the PFMC to incidental and directed commercial catch, sport catch, and Treaty Indian catch. The personal use catch for treaty Indian tribes in 2001 was 10,500 pounds and was included in the catch-sharing plan. State regulations require that the personal use fish from the halibut fisheries be recorded on the fish tickets and so is accounted for outside of personal use. As in the case with the quota fisheries, any personal removals from the directed commercial fishery have been included in the commercial catch portion of the assessment. Personal use for Area 2A is therefore fully accounted for elsewhere and not estimated separately.

INCIDENTAL CATCH

Fisheries targeting other fish or shellfish inadvertently catch Pacific halibut at the same time, and information collected by at-sea observers has indicated that this bycatch is substantial. Regulations require that halibut be returned to the sea with no additional injury, however, some fish do die from being caught and handled. The preliminary estimate of bycatch mortality in 2001 is 12.7 million pounds, a decrease from 2000 and the lowest seen since 1987.

Bycatch mortality in 2001 has been estimated at 12.7 million pounds, a decrease from 2000 and the lowest seen since 1987.

For most fisheries, IPHC relies upon information supplied by observer programs for bycatch estimates. In the few cases where fishery observations are unavailable, research survey information is used to generate estimates of bycatch. The NMFS oversees an observer program which covers the groundfish fishery off Alaska and provides bycatch estimates in that region. Estimates of bycatch mortality in crab pot and shrimp trawl fisheries off Alaska have been made by IPHC staff in previous studies and are based on bycatch rates observed on research surveys because direct fishery observations are lacking.

For fisheries conducted off British Columbia the amount of information varies. For the trawl fishery, bycatch is managed by using an individual bycatch quota program instituted in 1996 by DFO. Fishery observers sample the catch on each bottom trawler and collect data to estimate bycatch. Halibut 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 in the shrimp trawl fishery.

In the Area 2A domestic groundfish trawl fishery the halibut bycatch is estimated using data collected from 1995-1998 by the Oregon Enhanced Data Collection Program (EDCP). The EDCP established an observer program that worked with vessel owners who agreed to take an observer on a voluntary basis. Analysis of these data during 2000 by federal and state agencies established a methodology for estimating bycatch using commercial fishery effort from logbooks, and bycatch rates from the EDCP. Shrimp trawl fishery bycatch estimates are provided by ODFW 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.

Who survives? Discard mortality rates

In order to calculate estimates of the total amount of mortality caused by incidental catch, the percent of fish that die after being discarded (the discard mortality rate - DMR) must be estimated. The DMR for each area is determined from data collected on the release viability or injury of halibut as

measured by fisheries observers. In areas with no observers, a DMR is assumed, based on the area's level of similarity to other areas where information is available.

Observer data are used to estimate DMRs in the groundfish fishery off Alaska and the NMFS manages these fisheries according to a pre-set schedule of DMRs. The Commission estimates DMRs for most other fisheries.

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 a DMR of 25 percent. The mid-water fishery for whiting is assumed to have a 75 percent rate, based on the large catches of whiting typical of this type of fishery.

Sorting the catch. Photo by Kelly Van Wormer.

In Area 2B, observers monitoring the Canadian trawl fishery examine each halibut to determine survival. Data collected by observers in the state-managed scallop fisheries in Alaska indicate a 50 percent discard mortality rate is appropriate.

Report card - Are we getting better?

Halibut bycatch mortality was relatively small until the 1960s, when it increased rapidly due to the sudden appearance of the foreign trawl fleet 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 1960s, but increased again to about 20 million pounds in the early 1970s. During the late 1970s and early 1980s, it dropped to roughly 13 million pounds. By 1985, bycatch mortality had declined to 7.2 million pounds, the lowest level since the IPHC began its monitoring nearly 25 years earlier. Bycatch mortality increased in the late 1980s, due to the growth of the U.S. groundfish fishery off Alaska, and peaked again at 20.3 million pounds in 1992 but has since declined. Most of the decrease is attributed to the introduction of IFQs in the Alaskan sablefish fishery, the Careful Release program for the Alaskan hook & line fishery, and Individual Vessel Bycatch Quotas in the Canadian trawl fishery.

Area 2

Halibut bycatch mortality in Area 2 was estimated at 1.23 million pounds for 2001, slightly lower than for 2000. This estimate reflects a new set of figures for the Area 2A groundfish trawl fishery. The most recent estimate is for 2000 and that estimate of 660,000 pounds was used for 2001. For the past few years the trawl fishery effort has been declining, therefore using the 2000 estimate for 2001 may be an overestimation. No new estimate is available for the shrimp trawl fishery, so the most recent estimate was carried forward.

In Area 2B, bycatch mortality in the trawl fishery was projected to have declined about 20 percent to 180,000 pounds from 2000.

Area 3

In both Areas 3A and 3B bycatch mortality increased in 2001, and totaled 4.66 million pounds, a six percent increase from 2000. In Area 3A, trawl fishery bycatch went up to one of the highest levels in the past seven years, while hook & line fishery bycatch dropped to the lowest since 1996. Trawl bycatch dropped due to the fishery closures inside critical habitat for sea lions, which forced vessels to fish in less productive areas. Halibut bycatch in the hook & line and pot fishery was primarily affected by lower quotas for Pacific cod. In Area 3B, trawl fishery bycatch dropped slightly, but hook & line fishery bycatch increased significantly over 2000. As in Area 3A, these changes were in response to changes in locations of prosecuted fisheries.

Area 4

Lower quotas for cod and reduced fishing opportunities in Area 4 resulted in lower bycatch in the hook & line fishery in 2001.

Bycatch mortality in Area 4 in 2001 was reduced by about eight percent from 2000 and was estimated at 6.83 million pounds. This is a continuation of a decline since the peak of 10.7 million pounds in 1992. Halibut bycatch was lower for trawl fisheries in 2001, attributed in part to lower quotas for Pacific cod (a fishery where bycatch of halibut is substantial) and some species of flatfish, and to closures of prime fishing grounds to protect Steller sea lions. Lower quotas for cod and reduced fishing opportunities also contributed to lower bycatch in the hook & line fishery in 2001. Pot fishing for cod remained at 1998 catch and bycatch levels, resulting in a low amount of mortality. The Community Development Quota (CDQ) fishery targeted mainly pollock and resulted in 125,000 pounds of bycatch mortality.

No Halibut Allowed - Testing halibut excluders

Alaska trawl fishers have successfully developed gear modifications to reduce halibut bycatch in some sole fisheries and wanted to find similar solutions in the cod fishery. In 2001 the cod trawl fishery worked with government scientists in a project to do just that. This effort included work

on five trawlers, which operated under research or experimental fishery permits as well as in the open fishery. The initial design replaced square halibut escape openings with circular. This was effective for large halibut but it was necessary to add new components to exclude small halibut and prevent clogging by skates. The system was tested in the Gulf of Alaska and released 80 percent of the halibut while retaining an average of 85 percent of the cod. Bering Sea tests encountered so few large halibut that only the skate and small halibut sections were needed. This version of the excluder released 86 percent of the halibut while retaining an average of 89 percent of the cod. It also released nearly all rock sole and pollock. While all the non-cod rates were statistically significant, small catch differences and variable catches left considerable uncertainty around the estimates of cod retention.

Halibut excluders tested in the Gulf of Alaska released 80 percent of the halibut while retaining an average of 85 percent of the cod. In the Bering Sea, modified excluders released 86 percent of the halibut while retaining an average of 89 percent of the cod.

Keeping the small ones in Area 4E

Retention of sublegal halibut (<82 cm or 32 inches) in the CDQ fishery of Area 4E has been allowed since 1998, under an exemption by the Commission. Through an oversight in the original two-year approval of the exemption, there was no requirement in the IPHC regulations for reporting the amount retained. The organizations, Coastal Villages Regional Fund (CVRF) and Bristol Bay Economic Development Corporation (BBEDC), fully cooperated in submitting information that resulted in an estimate of 3,590 pounds for 1998. Following the addition of a reporting requirement for the 1999 season, a total of 7,901 pounds was reported for 1999, 13,390 pounds in 2000, and 30,267 pounds in 2001. The program sunsets on December 31, 2001, unless extended by IPHC.

The CVRF require plants that operated for them in 2001 to keep records of the retained sublegal halibut. These plants were located at Mekoryuk, Cherfornak, Toksook Bay, Tununak, and Quinhagak, although the latter reported no sublegal landings. The CVRF reported 19,494 pounds of sublegal halibut landed in 2001 (2,148 fish averaging 9.1 pounds each), which was a doubling in harvest from the previous year.

BBEDC licenses each fisher involved in the CDQ fishery and one requirement of the license is the completion of a reporting log that includes information about retained sublegal halibut (e.g., numbers and lengths). This information is used by BBEDC to estimate the total catch. Halibut were landed by BBEDC vessels at four locations: Dillingham, Togiak/Twin Hills, Naknek, and Egegik, and 23 of 30 licensed fishers participated in the 2001 fishery. Based on their reports about retained sub-legals, BBEDC reported a total of 1,155 halibut weighing 8,766 pounds. This is a six percent increase from 2000.

This increase is likely due to three principle factors, according to the BBEDC, the most significant being the reopening of the Togiak Fisheries Inc. plant by North Pacific Processors. Plant managers were quite active in buying halibut in 2001, unlike previous years. Strong price was also a factor, as it inspired local fishers to reach the full quota. In addition, recent regulatory changes by the North Pacific Fishery Management Council

(NPFMC), which allowed Area 4D CDQ halibut quota to be caught in Area 4E, further enticed local fishers out onto the grounds.

Useful Accidents - Prohibited Species Donation Program

Since 1998, Northwest Food Strategies 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 (PSD) program adopted by NMFS and the NPFMC. This program took several years to develop but is now approved by the Commission. NMFS Enforcement Division has monitored the halibut donated to this PSD program and has reported no incidents.

The halibut collected for this program are landed at one of the three participating processors in Dutch Harbor by shore-based trawlers that are unable to sort their catch at sea. Donations in 2001 totaled 43,579 pounds, nearly two and a half times that of 2000.

STOCK ASSESSMENT

"Don't bless the fish until it gets to land."

Irish Proverb

Because biologists cannot possibly count every fish in the entire population, computer modeling programs are used to estimate the number of fish in an area, and hence how many fish can be taken during the season. A computer modeling program uses actual measures from a small portion of the whole, takes into consideration the variables particular for the area, and makes an estimate of what the whole population looks like.

Halibut abundance was estimated at about 105 million pounds coastwide in 2001, up from 95 million pounds in the previous year.

Each year the IPHC staff assesses the abundance and potential yield of Pacific halibut using all available data from the commercial fishery and scientific surveys. The calculations vary with the area because of the history of fishing in the area. If an area has been fished for many years, there is more information on any one year class, which can therefore be used in assessments of abundance. As well, some areas have been surveyed over many years and so there are more data to use in computer-based estimations of population sizes and fluctuations.

Regardless of how the initial abundance estimate is made, the steps taken to determine the biological target level for catch limits are the same. First an *exploitable biomass* is calculated from the total biomass (abundance) estimates. A constant harvest rate of 20 percent is applied to the exploitable biomass, along with other variables that account for age, size and other dynamics, and results in the *constant exploitable yield* (CEY). The CEY is the estimated amount of biomass that can be harvested from the population without harming the long term health of the halibut population. To determine the amount of biomass that is available for commercial fisheries (setline CEY), the previous year's removals including sport catches, bycatch of legal-sized fish, wastage of legal-sized fish in the halibut fishery, and fish taken for personal use are subtracted from the CEY.

Counting landed halibut. Photo by Levy Boitor.

An easy catch?

Fish differ greatly in their catchability and the exploitable biomass is the portion of total biomass that is reasonably "catchable". That is, if a fish is small, it is much less likely to be caught and is therefore not really accessible to the fishery, not exploitable. The relative likelihood that a fish is catchable depends on its age and size–younger and smaller halibut are not as catchable as older and larger ones—and that likelihood is called the ***selectivity*** for that age and size group of fish. The selectivity can be thought of as the percentage of fish in an age category that are catchable. For each age group, the exploitable biomass is calculated by multiplying its total biomass by its selectivity. The exploitable biomass of the whole stock, including all ages of fish, is therefore the sum of exploitable biomass for each age category; it is composed of the catchable biomass of this mix of partly and fully vulnerable fish (dependent on age and size) in the stock in a given year.

Staff recommendations for catch limits in each area are based on the estimates of setline CEY but may be higher or lower depending on a number of statistical, biological, and policy considerations.

Selectivities differ among areas, and change over time. Commercial selectivity is estimated year by year and exploitable biomass is calculated accordingly. In Alaska, the selectivity of younger fish has decreased substantially because size at a given age has decreased.

Exploitable biomass in Areas 2B, 2C, and 3A is estimated by fitting a detailed population model to the data from that area. In Areas 3B and 4, exploitation rates were low until very recently and no surveys were done before 1996, hence such an analytical assessment is not feasible. Instead, exploitable biomass in Areas 3B and 4 is estimated relative to that in Area 3A, using information from recent surveys and scaling estimates of abundance in Area 3A. In the same way, exploitable biomass in Area 2B is scaled to estimate that of Area 2A. Total and setline CEY for those areas are then calculated as explained above.

Staff recommendations for catch limits in each area are based on the estimates of setline CEY but may be higher or lower depending on a number of statistical, biological, and policy considerations. Similarly, the Commission's final quota decisions are based on the staff's recommendations but may be higher or lower.

The assessment continues to rely on commercial and survey catch rates and age compositions to estimate historical and present stock sizes. Yield recommendations are again based on a model fit in which age-specific survey catchability and selectivity are held constant. Commercial catchability and selectivity are allowed to change gradually over time to account for changes in fishing practices and halibut growth rates. Because of the minimum size limit, age-specific commercial selectivity is strongly affected by growth changes. This is not true for survey data, which include all fish caught.

Results for Areas 2A and 2B

Areas 2A and 2B have been combined for assessment purposes since the beginning of model-based analytical assessments in the early 1980s. The model has been fitted to the combined data from both areas to estimate total abundance. The abundance was then divided between the two areas on the basis of total bottom area, and an average of the last three setline survey results in each area. The estimated proportion in Area 2A was 11 percent of the total for 2000. With the addition of the 2001 survey results it is 12 percent for 2001. In years when surveys were done in both areas, the biomass in Area 2A as a percentage of biomass in 2AB ranged from 8 percent in 1995 to 15 percent in 2001.

In the 2000 assessment, the model fit for the combined Area 2AB assessment was inadvertently run using the Area 2B data file. This meant that the abundance estimates reported for Area 2AB were actually the abundance estimates for Area 2B. As a result of this error, the 2AB abundance estimate was incorrectly low by about 5 percent last year. The setline CEY estimate was low by about 70,000 pounds in Area 2A and 700,000 pounds in 2B. Using the correct data file naturally resulted in an increase of about 5 percent in the 2A and 2B estimates for 2001.

It would be difficult to evaluate Area 2A on its own because there is no survey data before 1995, only spotty age composition data, uncertainty about the level of bycatch, and sparse and highly variable commercial CPUE data for the area.

Biologically, it makes sense to combine Areas 2A and 2B because there is clearly a seasonal migration of halibut between the two areas. There are also indications from tagging data that there is greater mixing between these two than between other contiguous areas. Biology aside, it would be difficult to evaluate Area 2A on its own because there are no survey data before 1995, only spotty age composition data, uncertainty about the level of bycatch, and sparse and highly variable commercial CPUE data for the area. Combining these two areas for analytical purposes alleviates the difficulties posed by the poor data for Area 2A.

On the other hand, a standalone assessment of Area 2B would be completely possible. The data for Area 2B are the best on the coast, with a long history of full commercial utilization, good commercial and survey data series, and less change in growth than in Alaska. While there may be some migration of older fish from 2A into 2B, the numbers cannot be large enough to have any practical effect on the estimation of abundance in 2B.

The analytical estimate of exploitable biomass in Area 2B is 95 percent of the analytical estimate for Area 2AB combined. This is well above the 85-92 percent seen in the surveys. This difference in estimates indicates that the analytical assessment is underestimating abundance in Area 2A. For management purposes, it therefore makes most sense to do a standalone assessment of abundance in 2B, and to use that value along with the survey results to estimate present biomass in 2A. This was the method used in the 2001 assessment for these areas.

Estimated abundance in Area 2B (from the standalone 2B assessment) is about 11 percent higher in 2001 than 2000, due to the combined effects of correcting the data error, separating 2A and 2B, and adding the 2001 data. Estimated abundance in Area 2A is calculated as 14 percent of 2B abundance

(equivalent to 12 percent of total abundance in the two areas). This is 24 percent higher than last year because it is proportional to Area 2B and both the 2B value and the proportion value are larger.

Total CEY values change in proportion to estimated abundance but setline CEY's may not because of differences among areas and years in the deductions for other removals (sport catch, bycatch, etc.). Relative to last year's assessment, setline CEY is up by 12 percent in 2B (to 11.75 million pounds from 10.51 million pounds) and by 15 percent in 2A (to 1.31 million pounds from 1.14 million pounds).

Assessment data and results for Area 2C

Estimated abundance in 2B (from the standalone 2B assessment) is about 11 percent higher in 2001 than 2000, due to the combined effects of correcting the data error, separating 2A and 2B, and adding the 2001 data.

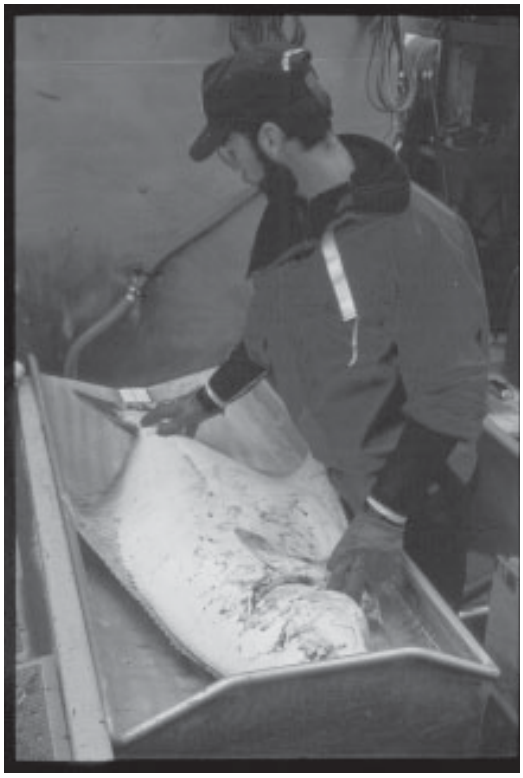
In Area 2C, there are survey stations in both inside and outside waters. Prior to 1996, the inside stations were intentionally distributed on known commercial grounds rather than being placed systematically as were the stations in outside waters. Prior to this year, only survey stations in the outside waters of Area 2C were used in the assessment even though inside stations were fished on all surveys. This was intended to avoid the bias created by the inside stations not being systematically located. It is, however, preferable to use both inside and outside stations so as to have a more comprehensive index of abundance. In 2001, the data were evaluated in both ways (with and without the inside stations) and there was no difference in CPUE trends between the two. Hence, the 2001 estimates were made using inside and outside stations.

When the 2000 assessment was re-run using both the inside and outside stations, the estimated abundance was about 15 percent lower than when the older method was used. This was surprising given that the change in method did not have significant effect on estimations of CPUE. When the 2001 data were added and projections made to 2002, the net difference between estimated exploitable biomass in 2001 and projected estimate of exploitable biomass in 2002 is a decrease of only about 5 percent. It is clear, however, that the change in how the survey data were incorporated had a substantial negative effect on estimates of exploitable biomass.

In Area 2C there were fewer surveys than in Areas 2B and 3A, and the survey data are variable among years. The commercial CPUE series, however, is complete and very consistent from year to year. This enabled us to check on the appropriateness of the change in survey data and to see whether the new fit agrees better or worse with the commercial data. Model fits that essentially ignore the survey data produce estimates very close to the value obtained with the survey CPUE series when all stations were used. This implies that the lower estimate of CPUE in 2C (made using the inside and the outside stations) appears to be the right one. With the new biomass estimate, setline CEY in 2001 was down by 3 percent from the previous year (decreased to 8.50 million pounds from 8.78 million pounds).

Area 3A Assessment

Before 1996, the setline survey in Area 3A covered only the shelf west of 148º W (just west of Prince William Sound). The eastern part of the shelf (Yakutat region) was added in 1996, and stations in Shelikof Strait, Cook Inlet, and Prince William Sound in 1998. Prior to 2001, only stations in the western part of 3A that were surveyed in all years were used in the assessment. That provided a consistent CPUE series but, just as in 2C, it is preferable to use all stations in the assessment so as to have a comprehensive CPUE series. In Area 3A, the added stations are also numerous (total number fished is about 360 now vs 120 in 1995) so using all stations provides a less variable average CPUE. The 2001 estimate of exploitable biomass in 3A is 11 percent higher than last year's. Setline CEY is up by 10 percent (to 24.14 million pounds from 21.94).



Sampling a halibut in Area 3A. Photo by Daryl Lee.

A comparison of the partial and complete survey data since 1996 for Area 3A showed that the stations added in the east generally have a lower CPUE than the stations in the west.

Extrapolation of Area 3A estimate to Areas 3B and 4

Exploitable biomass estimates for Areas 3B and 4 are made by extrapolating the analytical estimate of abundance for Area 3A. The estimate for the areas is scaled using the measures of total bottom area, and the average of the last three survey catch rates. Specifically, an index (survey index) of total biomass in each area (including 3A) is calculated as the product of setline survey CPUE and total bottom area. An absolute biomass estimate is then obtained by scaling the absolute 3A estimate by the ratio of the indices. For example, 4A biomass is estimated as the absolute 3A estimate multiplied by the ratio of the 4A to the 3A survey index.

In past years "total bottom area" was defined as the area between 0 and 500 fm, but in fact the survey goes down to only 275 fm and halibut densities below 300 fm are probably very low in the summer when the surveys are conducted. This year the total bottom area used for calculating the survey-based index was redefined as the area between 0 and 300 fm. In most places the change is inconsequential because there is little bottom area between 300 and 500 fm, but in Area 4B the measure of total bottom area is reduced by about 30 percent.

For the eastern Bering Sea shelf (Area 4CDE), a setline survey index cannot be computed directly because no setline survey is done there. NMFS conducts a trawl survey there every year, and a setline survey CPUE is predicted from the average trawl CPUE and the ratio of setline to trawl CPUE in areas of overlap in 4A and 4D. For the last few years the predicted CPUE value was 30 pounds/skate. An update this year produced a prediction of 40 pounds/skate, which has the effect of increasing the 4CDE scaling factor from 37 to 47 percent.

"When I was your age..." Recent trends in weight at age

It seems that youngsters are not what they used to be, even in the halibut world. Between the late 1970s and the late 1990s there was a dramatic decrease in the average weight of individual halibut in commercial landings. At the most common age of 12 years, average weight declined by about 50 percent in Area 3A, and by 40 percent in Area 2B. In recent years weight at age has stabilized in Areas 2 and 3A, but is still declining farther west.

Age, forks, and fish ears: how does your halibut grow?

Age estimation of halibut relies on microscopic inspection of bony deposits found in the halibuts' inner ears (otoliths). Rings develop on an annual basis with the winter growth zones being narrow and translucent, and summer growth zones wider and more opaque. These rings are counted to estimate the age of the fish (similar to counting the growth rings of a tree). Otoliths from commercial and survey catches of halibut are collected each year for age determination.

Fork lengths of sampled halibut are also recorded and can be used to estimate fish weight.

Age distribution

For the 2001 season, a total of 14,449 otoliths was collected from the commercial catch and aged. Average age of 2001 commercial or "market" samples, from all areas except Area 2C, increased compared to those for 2000. The average age from all areas combined was 14.2 years, an increase of 0.4 years from 2001. Overall average age in 2001 was two years higher than it was ten years ago (in 1992). Average size (measured fork length) of sampled halibut increased in Areas 2, 3, and 4D in 2001 but decreased in Areas 4A, 4B, and 4C. Average fork length for all areas combined increased slightly from 2000.

As it has for the last five years, the 1987 year class (14-year-olds) accounted for the largest proportion (in numbers) of the overall commercial catch (20 percent) in 2001. The next most abundant were the 13- and 12-year olds (the 1988 and 1989 year classes), which accounted for 17 percent and 11 percent of the catch, respectively. Fourteen-year-olds were also the most abundant age class in Areas 3 and 4. The 13-year-olds were the most

abundant in Area 2 and the second most abundant in Areas 3 and 4. Fourteen-year-olds were the second most abundant in Areas 2B and 2C, while 12-year-olds were the second most abundant in Area 2A.

The youngest halibut in the 2001 market samples were five years old and there were five of them, all caught in Areas 2B and 2C. The oldest was a 42-year-old from Area 4B that had a fork length of 113 cm. The largest halibut in the 2001 commercial samples was a 218-cm fish from Area 3A that was determined to be just 27 years old!

A total of 15,287 otoliths was collected on the 2001 setline surveys; 14,731 of which were aged. Of the setline survey samples, which include sublegal fish (<82 cm or 32 inches in length), 14-year-olds were the largest age group (in numbers) for all areas combined. Fourteen-year-olds comprised the largest age group in Areas 2C, 3B and 4 and were the second largest age group in Area 3A. Thirteen-year-olds were the most abundant age group in Areas 2A, 2B, and 3A and the second most abundant group in Areas 2C, 3B and 4. Twelve-year-olds were the second largest age group in 2A and 11-year-olds were the second most abundant age group in 2B setline samples. Ages of setline survey fish ranged from three to 46 years old with an average age of 13.6 years. The average age and length by sex for setline survey halibut in 2001 was 13.1 years and 102.4 cm for females, and 14.1 years and 86.9 cm for males.

In addition, 945 otoliths from the 2001 NMFS trawl survey in the Bering Sea were collected, 882 of which were aged. Ages of Bering Sea trawl survey halibut ranged between two and 23 years old with an average age of 5.7 years and average length of 49.0 cm. Three thousand, one hundred and seventy-one halibut otoliths from the 2001 NMFS Gulf of Alaska (GOA) trawl survey were also collected, 2072 of which were aged. Ages of GOA trawl survey halibut ranged between one and 28 years old, with an average age of 6.1 years and average fork length of 52.8 cm.

	Age		Length		Avg.	Largest
	Min.	Max.	Min.	Max.	age	age-group
Commercial	5	42	65	218	14.1	14
Setline survey	3	46	49	240	13.6	14
Bering Sea trawl survey	2	23	14	140	5.7	3
Gulf of AK trawl survey	1	28	12	175	6.1	3

Recruitment and Growth: Why Does Your Halibut Grow?

The productivity of the Pacific halibut stock depends, like all others, on the numbers of new fish (recruitment) and how fast the existing ones grow. These two things have varied greatly over the last century. The 1930s and early 1940s were good years for spawning fish and hence the year classes were strong. After that, however, the year-class strength dropped off and there were lower numbers of new fish. It remained this way from the 1940s

Positive regimes of the Pacific Decadal Oscillation clearly enhance the recruitment of Pacific halibut, which spawn and rear mainly in Alaska waters.

until the late 1970s when year-class strength recovered to record levels and remained generally high.

Over the past century, growth rates have also varied widely. Rates were low in the 1920s, rose to a peak around 1970, and declined again into the 1990s to levels similar to the 1920s. This decrease in growth rate has meant that fish of a particular age weighs less today than in previous years. Specifically, fish today weigh only about one third of what fish of the same age did 20 years ago!

We have investigated how changes in climate and stock size may have influenced these major shifts in growth and recruitment. Climate has been a suspect in these changes because there have been major fluctuations in North Pacific climate caused by an environmental pattern called the Pacific Decadal Oscillation (PDO). The climate of this region has alternated on a decadal scale between a positive and a negative regime, which are opposite in some important features. During positive regimes (1925 through 1946, and 1977 through at least the late 1990s), the Aleutian Low is usually strongly developed, Alaska coastal surface waters are warm, central North Pacific surface waters are cool, and productivity tends to be high in the Alaska Gyre and low in the California Current region. During the last negative regime (1947-1976) all those conditions were usually reversed. Positive regimes clearly enhance the productivity of Pacific salmon (*Oncorhynchus* spp.) stocks in Alaska and the recruitment of Pacific halibut, which spawn and rear mainly in Alaskan waters.

Big fish. Photo by Kevin Redslob.

These regime shifts are identified through the analysis of patterns in physical and biological measures over time (e.g. air and sea surface temperatures, sea level pressure, annual tree ring growth, salmon stock sizes). Many different variables must be analyzed because there is a lot of variation among years for any given measure over the course of decades. For our analysis we use the positive/negative regime classification to represent persistent climate type, with shifts in 1925, 1947, and 1977. These shifts have been identified in several independent studies

The weather in a particular year may be what matters most for the Pacific halibut that spawned in that year. For our analyses we used the annual PDO index, defined to represent the weather for a given year. The

annual PDO index is an inclusive descriptor that explains the largest amount of variation in gridded monthly north Pacific sea surface temperatures in winter. These gridded temperatures for winter are temperatures that are averaged from November of the previous year through March and then standardized over years.

Climate, Climate, Climate...

That would be the short answer if asked what the most important three things are in Pacific halibut recruitment. Variation in growth rates is in turn mostly dependent on the density of the halibut stock.

The recruitment of Pacific halibut is strongly influenced by climatic regime and weather in the year of spawning. Our analysis has shown that better fits to the pattern (and the computer model) can be made if the annual PDO index is included, and if there is allowance made for unexplained differences among the periods around and including the 1960s.

Although recruitment varies in relation to spawning biomass, computer models with and without spawning biomass considered, produce the same predictions of recruitment. This means that for the range of spawning biomass that occurs in our historical data, recruitment seems to be unaffected by the size of the spawning stock. At some sufficiently low level, spawning biomass would presumably limit recruitment, but it seems unlikely that spawning biomass will ever fall that low under the present management regime. The lowest values in our recorded history—in the 1970s—resulted from a combination of unfavorable environmental conditions, high bycatch, and heavy directed fishing in the 1960s. The present IPHC management strategy is to apply a constant, moderate rate of fishing mortality, chosen in part to maintain spawning biomass above the historical minimum. Other research has shown that even a long run of environmentally unfavorable years and the resulting low recruitment would not be expected to lead to spawning biomass levels as low as those reached in the 1970s.

The importance of environmental conditions in the year of spawning suggests that factors that most effect year class strength occurs in that year.

The importance of environmental conditions in the year of spawning suggests that factors that most affect year-class strength occur in that year. Year class strength, therefore, likely depends either on variable transport of eggs and larvae to nursery grounds by ocean currents, or on planktonic production that varies strongly with climate and weather. The response of the Gulf of Alaska zooplankton community to ocean climate variability has been documented in several studies. Observed changes from other studies have included: a doubling of total zooplankton biomass following the 1976-77 regime shift; an earlier and shorter developmental period for a dominant copepod species (*Neocalanus plumchrus*) in response to warmer surface waters; and extreme changes in zooplankton community composition.

Our analyses are unable to explain the decline in average recruitment that has occurred in southern areas (Areas 2A and 2B), nor the large increase that occurred in the north (Area 3A) during the twentieth century. During this period, average sea surface temperatures increased, particularly in the last quarter of the century, regardless of the regime shifts. Given this, it is possible that there has been a northward shift in the center of abundance.

Pacific halibut recruitment is essentially established within the first year of life and is strongly influenced by climatic regime and weather in that year.

The fact that growth rates have fluctuated over the long term has been recognized by others, but only through the use of computer modeling were we able to understand the reasons behind the fluctuations. We fit a computer model and ran a time series estimate of weight at age eight and the annual increment thereafter. From this we were able to discern that growth rates are closely related to abundance but unrelated to environmental conditions (at least as measured by the annual PDO index).

It is not clear how Pacific halibut density affects growth, but it has been widely observed that flatfish growth rates tend to increase under more intensive fishing. Before 1910, the Pacific halibut fishery was small scale, but it added larger vessels and expanded rapidly in the following two decades. Fishing effort tripled between 1910 and 1930, and commercial catch rates fell by 70-90 percent between 1915 and 1930. Pacific halibut were very abundant before 1920 and the stocks were rapidly depleted thereafter, so the small sizes for a given age in the first samples from the 1920s, followed by an increase in growth rates, is consistent with the notion of density-dependent growth. This idea also fits with the most recent decline in growth rates.

AT-SEA TO SEE: SURVEYS

To assess the state of the Pacific halibut stock the Commission needs information about the biology and the catchability of halibut. Some of these data are obtained from the commercial fishery. It is a good source of data in that it is season-long and broad of magnitude. Variability in fishing effort distribution over years and in the type of gear used, however, makes it difficult to compare over years and between areas. To complement data from the commercial fishery and better survey the stocks, IPHC has conducted a standardized stock assessment survey (SSA) each summer (most years since 1963 except 1987 to 1992), during which data are collected using standard methods and gear. Biological data collected on the surveys (i.e., the size, age, and sex composition of halibut) are used to monitor changes in biomass, growth, and mortality in adult and sub-adult portions of the population. In addition, records of other species caught during survey operations provide insight into bait competition, rate of bait attacks, as well as an index of abundance over time for these bycatch species. The information gathered on bycatch species is of value to their assessment and management.

Preparing for the survey. Photo by Lynn Mattes.

During a combined 73 trips and 647 days under charter, survey vessels successfully completed 27 separate charter regions covering halibut habitat from Oregon to the island of Attu in the Aleutian Islands, Alaska.

In 2001, fourteen commercial longline vessels (eight Canadian and six U.S.) were chartered for survey operations. During a combined 73 trips and 647 days under charter, these vessels successfully completed 27 separate charter regions covering halibut habitat from Oregon to the island of Attu in the Aleutian Islands, Alaska. A total of 1,235 grid stations were completed of which, 1,183 (96 percent) were considered successful for stock assessment analysis. Approximately 1,236,185 pounds of halibut, 94,394 pounds of Pacific cod, and 47,911 pounds of rockfish were landed from the standardized survey stations.

Survey Design

A new grid design was implemented in 1998 to improve scientific value through higher station density and increased survey efficiency, and to make

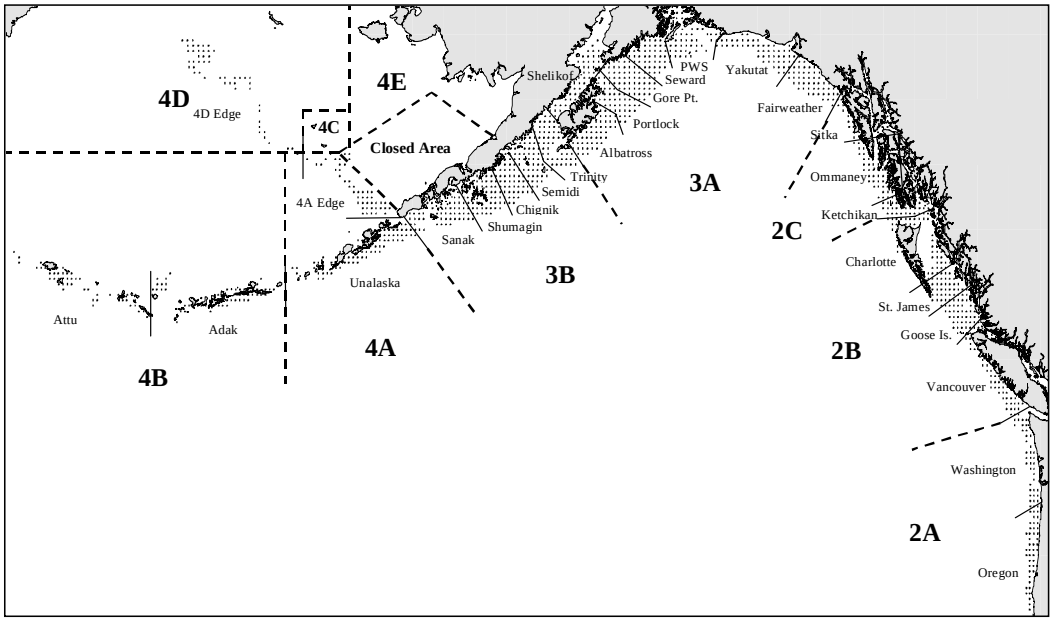


Figure 2. Stations for the 2002 stock assessment survey.

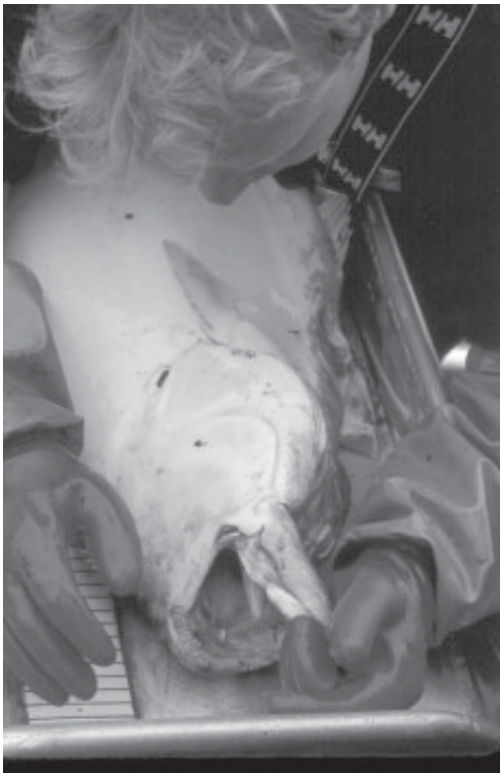
the surveys financially self-supporting over a range of biomass levels. The current design encompasses all offshore waters of Oregon, Washington, British Columbia, southeast Alaska, Gulf of Alaska, Aleutian Islands, and the northeast Bering Sea. These areas are divided into 27 separate regions, each requiring a minimum of 20 to 40 charter days to complete. Stations are located at the corners of a 10 nautical mile by 10 nautical mile square grid. Stations that fell in unfishable areas or depths less than 20 fathoms or deeper than 275 fathoms at the center of the set were eliminated.

Vessel	Home Port	Stations Completed
Angela Lynn	Vancouver, BC	92
Blackhawk	Fort Bragg, CA	84
Bold Pursuit	Comox, BC	91
Free to Wander	Vancouver, BC	130
Heritage	Kodiak, AK	97
Kristiana	Seattle, WA	91
Norska	Kodiak, AK	45
Pacific Sun	San Francisco, CA	66
Pender Isle	Vancouver, BC	85
Star Wars II	Vancouver, BC	85
Trident	Adak, AK	90
Viking Joy	Vancouver, BC	69
Viking Spirit	Vancouver, BC	70
Waterfall	Ladysmith, BC	140
Totals		**1,235**

Measures Made

The fork lengths of all halibut landed from survey stations were recorded to the nearest centimeter. Each length was converted to weight in pounds using a standard formula. This estimated weight was 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 (>81 cm) by the number of standardized skates hauled for each station and averaging these values for each area (statistical, charter, or regulatory). In previous reports, the CPUE calculations and effective stations may have excluded experimental or random stratified stations, which are not used in stock assessment calculations. We have included these in this report, to accurately reflect the true CPUE for all stations surveyed in any given year.

All legal-sized halibut and a percentage of sub-legal halibut were sampled to determine their sex and stage of maturity. Males were coded as either mature or immature and females were assessed as either immature, mature, spawning, or resting. The majority of males large enough to be caught on survey gear were mature.



Examining for prior hooking injuries. Photo by Daryl Lee.

Age-identifying structures (otoliths) were collected from a sample of all halibut caught, using a pre-determined random number table. The sex and maturity of halibut less than 82 cm was recorded only if the fish was randomly selected for otolith collection.

Special Projects

The opportunity is often taken during the SSA survey to collect information on halibut biology or to complete other experiments not associated with halibut stock assessment. In 2001 two additional projects were completed concurrently with standard survey procedures aboard all vessels: 1) a study of the incidence of prior hook injuries in halibut; and 2) a collection of paired otoliths for a crystallized otolith study.

IPHC sea samplers in Areas 2A, 2B, 3A, 4A, and 4D collected halibut flesh samples for analysis of their stable isotopic composition and determination of where halibut fits in the food chain (*i.e.*, who's eating whom). This was part of a multi-year study and the results of this research will be published at a later date.

In addition, two survey vessels were used as research platforms for IPHC interns. Two reports were generated from this research: 1) Seabird Interactions with Halibut Longline Gear: Sources of Variation in Abundance and Behavior (see Biological Research - Bycatch from the Air); and 2) The 82-cm Phenomenon.

During two trips on the *F/V Free to Wander*, a University of Washington graduate student investigated the feasibility of performing sleeper shark research (*Somniosus pacificus*) aboard IPHC research vessels. Reports from this research are not yet available.

Bait and Banking

The Commission staff arranges for bait early to take advantage of pre-season bait prices for a considerable savings. The majority of bait (No. 2 semi-bright Chum salmon) came from a U.S. supplier (201,984 pounds), the remainder from Canada (80,000 pounds pre-season and 8,951 pounds in-season). On the revenue side of things, all legal-sized halibut retained by IPHC survey vessels were sold to offset costs of the survey program. Survey vessels also retained rockfish and Pacific cod landed as bycatch because they are generally dead or dying from distended swim bladders when landed.

Salmon used for bait on the survey. IPHC photo archive.

In recent years, the Commission has sold fish through a competitive bidding process at ports where multiple buyers were able to participate. In 2001, the Commission entered into a variety of direct sales arrangements with buyers in an effort to obtain a fair price and distribute sales among more buyers and ports. The change from an auction to direct sales was a result of suggestions received from the halibut industry. Buyers submitted proposals for direct sales agreements prior to the survey. The agreement secured the buyer the opportunity to receive fish, and outlined landing/

settlement details and requirements and profit sharing systems (if applicable). Landings were rotated among the different buyers in a port in a manner that distributed deliveries as best as possible. Direct sales arrangements were evaluated after each event to ensure that each buyer was meeting appropriate standards. Most vessel contracts provided the vessel with a 10 percent share of the halibut proceeds, and a 50 percent share of the allowable bycatch proceeds.

What We Saw

Average CPUE values were generally lower in 2001 than 2000, but higher in Areas 2A and 2C.These results, however, should be used with caution as the survey design and grounds included within each of those two regulatory areas are not necessarily comparable between years. The average CPUE for those areas represented consistently in the survey time series (1993-2001) are used in the stock assessment. In general the CPUE values by regulatory area for all stations fished on surveys show few differences from those included in the standard stock assessment series.

	Survey CPUE (lbs/skate)			
Area	**1998**	**1999**	**2000**	**2001**
2A	-	37	-	41
2B	94	88	103	101
2C	224	201	226	234
3A	281	241	273	255
3B	436	441	378	365
4A	293	368	276	200
4B	216	204	218	171
4C	-	-	-	
4D	-	-	213	201

Halibut catch-per-unit-effort decreased (between 2-21 percent) in all areas except Areas 2A and 2C, according to the most recent surveys.

Approximately 92 separate species of fish and invertebrates and one seabird (Laysan Albatross) were caught as bycatch during the 2001 survey. The most common bycatch in Areas 2B, 2C and 3A was sharks, primarily (91 percent) dogfish (*Squalus acanthias*). Sablefish (*Anoplopoma fimbria*) was common in Areas 2A, 2B, 2C, and 3A. Rockfishes (*Sebastes* spp.) were notable in Areas 2A, 2B, and 2C. Common bycatch west of Kodiak Island in Areas 3B, 4A, 4B, and 4D was Pacific cod (*Gadus macrocephalus*).

The otolith collection goal for the 2001 survey was 2,000 otoliths per regulatory area, with a minimum target of 1,500 per area. Area 2A was the only area in which we did not attain the minimum target, despite effectively sampling all fish caught. For specific age and length results, see the Stock Assessment section in this report.

The most common length of all halibut caught on survey stations in 2001 was 88.5 cm. The largest most common length was found at the

extreme northern and western ends of the halibut range, in Areas 4B (94.5 cm) and 4D (98.5 cm).

Once again this year the sex ratio for mature halibut from the survey catches showed considerable variation across most areas, ranging from 38.2 to 67.3 percent female. In general, the regions to the west of the central Gulf of Alaska (Areas 3B, 4A, and 4D) tended to have lower percentages of females in the catch. Coincidentally, these areas have had the lowest historical exploitation rates. Most female halibut caught during the time surveys are conducted (summer months), are in the ripening stage and are expected to spawn later in the fall and winter.

Deck shack used by samplers on the survey. Photo by Matt LaCroix.

If halibut prices or CPUE fall significantly in the future, the Commission will need to find alternative funding for this necessary data collection.

The Future

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 have been selected to withstand limited variation in price or CPUE. However, if halibut prices or CPUE fall significantly in the future, the Commission will need to find alternative funding for this necessary data collection. Conversely, if the Commission receives additional funding from the Governments, the amount of halibut sold from the surveys will be reviewed.

The Seacat Gets Wet - Water Column Profiler

After a year of exploratory use of the Seacat SBE-19 water column profiler in 2000, it was ready for full deployment. Logistical wrinkles had been ironed out and a pump was added to stabilize the salinity profiles. The profiler records conductivity (salinity), temperature, and depth

twice a second, while passing through the water column. The unit was deployed once at each station from those vessels conducting stock assessment survey work around Kodiak Island. This region was selected because NOAA was conducting a great deal of fishery-marine mammal interaction work in the area, and physical oceanographic measurements contributed to the research.

The profiler was aboard the *F/V Viking Spirit* for two trips and aboard the *F/V Kristiana* for seven trips. A total of 100 usable (of 126) salinity-temperature-depth profiles were made, for a success rate of 79 percent. This was lower than the 92 percent success in the first year, in large part because one entire cruise was missed due to difficulties with the sampler power supply. The intent for 2002 is to increase the number of profilers deployed for the field season in order to expand our data gathering capabilities.

Gulf trawl survey: Cruise report for 2001

The IPHC participated again in 2001 in the NMFS Gulf trawl survey, a continuation of a series started in 1984. This was a triennial survey until 1999 when it became biennial. The survey spanned a geographical area from the Islands of Four Mountains (170° W longitude) to Montague Island (147° W longitude) in depths ranging from 15 m to 500 m. While two vessels took part in the survey, the IPHC sampler was aboard the *F/V Vesteraalen* for the duration of the survey. The main objective of the NMFS survey was to gather data as part of a longer time series for monitoring trends in distribution and abundance of various groundfish species in the north Pacific. The Commission sampler, however, was aboard primarily to collect Pacific halibut data, and help out NMFS personnel where possible.

Aboard the trawl survey. Photo by Hilary Emberton.

All halibut caught by the *F/V Vesteraalen* were sampled for length, otoliths, gender, maturity, and prior

hooking injuries. Fish longer than 50 cm were also subject to four additional morphometric measurements. The gender and maturation of each sampled fish was identified. Female fish were assessed with four stages of maturity in mind: immature, ripening, ripe/spawning, and spent/resting. Males had only two maturity stages: immature and mature. Immature for both genders meant that the fish would not participate in the upcoming spawning season, while the other stages all assume that the fish will participate.

Of the 528 standard survey tows attempted, 489 tows, ranging in depth from 20 m to 448 m, were successfully completed. A total of 1,440 female (45 percent), 1,734 male (55 percent), and two unsexed halibut were caught. Otoliths from 3,171 halibut were collected for aging, but five were broken or lost. Length and age results can be found in the stock assessment section of this report.

Bering Sea trawl survey: Cruise report for 2001

For the fourth consecutive year, an IPHC biologist participated in the NMFS Bering Sea shelf trawl survey, an annual survey since 1979 that was started in 1975. This survey, utilizing two vessels, was intended to meet objectives related to stock assessment and year-class strength estimation for several species. The survey spanned the area 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. The survey consisted of 426 stations positioned on a 20 nmi x 20 nmi grid along the continental shelf in the Bering Sea in depths ranging from 0-200 m (several stations at <30 m were included to better sample yellowfin sole). An additional 25 stations were added to the standard grid this year in the area north of the northernmost stations already existing.

All halibut caught by the *F/V Arcturus* were sampled for length, otoliths, gender, maturity, and prior hooking injuries. As in the Gulf trawl survey, fish 50 cm or over were subject to four additional morphometric measurements. Flesh samples from one third of the halibut were also sampled for use in a stable isotope study. Hooking injuries were assessed in an on-going study to determine what level of injury can occur while still allowing the fish to survive.

We sampled halibut from 171 standard, 10 shallow, and 14 northern tows performed by the *F/V Arcturus*. From these tows, a total of 1,002 halibut were captured and sampled, and 973 otoliths were successfully collected. A total of 495 female and 507 male halibut were caught during the survey. Of the females caught, 477 (96 percent) were immature, 12 (3 percent) were ripening, and six (1 percent) were spent/resting. There were no fish actively spawning. Of the males sampled, 310 (61 percent) were considered immature, and 197 (39 percent) were mature. These maturity rates were consistent with samples from recent years.

More than one way to measure a halibut

As part of the morphometric measurements made on the two NMFS trawl vessels, IPHC samplers measured body depth, thickness, and two separate head measurements on halibut ≥ 50 cm in length. Over a three-month period (May-July), a total of 1,692 halibut were measured in the Gulf of Alaska and 428 from the Bering Sea.

The four measurements did not differ between the sexes. There was, however, a difference in the measurements in relation to body length. The larger a fish was, the greater the proportion of head length to body length.

A comparison between areas is of great interest because the halibut from these geographically separate areas are presently treated by IPHC as though they are a single stock, with presumably interchangeable physical characteristics. To ensure that the samples from each area were as consistent as possible in terms of length and proportion of catch, the 60-90 cm fish were chosen for the comparison. The means of the two groups suggested that the Gulf of Alaska halibut had larger heads and were slightly thicker, but the Bering Sea fish tended to have a larger depth.

Measurement results suggested that the Gulf of Alaska halibut had larger heads and were slightly thicker, but the Bering Sea fish tended to have a larger depth.

What Does Chalky Mean to you

The halibut industry has been grappling with the chalkiness issue for a number of years and research continues to enhance our understanding of the problem and how we can deal with it. The first issue was to define chalkiness, which has been accomplished, and the second is to identify chalky fish at landing so that markets can be optimized for both the chalky and the non-chalky fish.

Previous work by the IPHC has determined that the pH range of the flesh of normal fish is about 6.2 or above, whereas fish that have flesh of pH below 6.0 are always chalky.

By standards of the U.S. Food and Drug Administration, "chalky" is an abnormal, undesirable condition and refers to a fillet that is partially or wholly characterized by a dry, chalky, granular appearance and fiberless structure. The Canadian Food Inspection Agency defines chalky as having "chalky texture: dry and powdery, leaving the sensation of a chalky solution in the mouth". The question is, how do we know at offload which fish are going to leave that dry and powdery feeling in your mouth once it's cooked and on your plate.

PH meter. Photo by Stephen Kaimmer.

Previous work by the IPHC has determined that the pH range of the flesh of normal fish is about 6.2 or above, whereas fish with flesh of pH below 6.0 are always chalky. Those fish with pH between 6.0 and 6.2 are less predictable as to their chalkiness. The next step was to find out how best to apply this knowledge to combine it with mobile technology and help minimize the negative impacts of chalkiness on the commercial fishery.

Our observations on these fish indicate that pH screening should be very useful when conducted 24 hours or more after the fish are caught and killed.

Several members of the Halibut Association of North America, an industry marketing group, used pH meters during 2001 to screen landings for chalky halibut. These users were surveyed at the beginning and the end of the 2001 season as to the utility and performance of the pH meters. During 2001, a total of 14 meters were purchased by six different companies, for use at seven locations in the U.S. and Canada. Early survey respondents generally agreed that the meters were easy to calibrate and use, and gave quick and accurate readings of flesh pH. One respondent, however, felt that

there was not always a good correlation between the flesh pH ranges earlier published by the IPHC and chalkiness in the fillet.

The Physiology of Chalkiness

The stress of capture and struggling on the hook demand more energy than aerobic respiration can provide, resulting in the activation of anaerobic metabolism. This causes lactic acid buildup (lowering the pH). Temperatures outside the normal range experienced by the species can also cause metabolically disruptive stress.

If that stressed fish remains alive, waste products created by muscular activity are removed via the bloodstream. After death, fish metabolism continues for some time. This results in additional anaeorbic metabolism that produces lactic acid, and is most likely the direct cause of the immediate drop in pH in *post-mortem* flesh. In combination, pH decreases caused by struggling, temperature changes, and *post-mortem* anaerobic metabolism, seem to be the general cause of chalkiness, or loss of muscle texture in captured halibut.

How does pH change in halibut flesh over time

We were loaned two Argus X pH meters with LanceFet probes (an upgraded version of the meter used in last year's trials) by Sentron, Inc, and used them for all pH and temperature measurements. Although the probe design allows stabbing into meat products, we used a knife to make a small cut through the skin for easier probe insertion. Visual observations of chalkiness could then be made through the same cut.

All pH and chalky observations were made on the white side of the fish, which fits well the industry practice of storing and handling iced halibut on vessels or in fish plants with the white side up. Flesh temperatures at capture were around 11°C while temperatures in iced fish were around 1°C. Readings of pH were almost instantaneous, but the probe calibrates the pH reading with a temperature sensor. It took one to two minutes for the probe to equilibrate from a cold room temperature to the temperature of the fish stored on ice, but once the probe was at fish temperature, it could be rinsed and inserted into another fish without noticeable change in the probe temperature. This allowed multiple readings from different fish quickly.

Chalkiness was visually estimated into one of four categories: none, slight, moderate, and excessive. The moderate and excessive categories were chosen to coincide with U.S. FDA definitions. In most cases, a non-chalky fish was used to provide a contrast to fish being examined for chalkiness, and determination of slight and moderate grades was felt to be very subjective.

Initial observations of flesh temperature, pH, and chalkiness were made through a transverse cut across the top of the tail as soon as each fish was landed. Sex and landing time were also recorded. Fish were eviscerated and cleaned soon after capture and held in an insulated fish tote until the set was completed. Repeat measurements were made on the morning of day two and in the evening prior to offloading. After offload, all fish were iced into an insulated tote and moved to indoor space donated by the Fish Factory, Homer, AK, for further observations.

Once fish were ashore, observations consisted of temperature and pH measurements at three locations on the fish: tail, dorsal, and pectoral. The dorsal observation was made through a cut just below and behind the origin of the dorsal fin, while the pectoral cut was made just beside the pectoral fin. These cuts were enlarged as necessary when determining visual signs of chalkiness. On the second through the fifth days, daily observations were made in early morning and early evening. On the sixth day, observations were made only in the late morning. Following that, the remaining food-quality fish (about 200 pounds) was filleted, vacu-packed, and donated to the Homer Food Bank. The Fish Factory and Alaska Custom Seafoods donated filleting and vacu-packing services.

Eleven of the 32 fish showed some signs of chalkiness, ten in the tail area, nine in the dorsal region, and nine in the pectoral area (nine were chalky in all three areas, one in the tail and dorsal only, and one fish in the dorsal only). The degree of chalkiness ranged from slight to moderate in some cases and from moderate to excessively chalky in others.

Visually, chalkiness was not noted in any fish until at least 18 hours after death, and in some cases until the third day.

For all fish, the highest pH was seen immediately after capture and pH generally decreased over the first 24-36 hours to a low of about 0.5 to 1.0 pH units below the initial reading. There was a major difference in this progression between fish that eventually went chalky and those that did not. In fish that did not go chalky, after a pH decrease in the first 1-2 hours, there was a pH increase about seven hours post mortem. This rise in pH was seen in all fish but it was most dramatic in those fish that did not go chalky. Following the increase, there were similar patterns of gradual decline in pH for all fish. However, the fish which had exhibited the pH "bump" started at a higher pH, and these eventually non-chalky fish finished at a higher final pH (lower acidity) than the chalky fish. The observed pH for all fish combined ranged from 5.89 to 7.36.

Visually, chalkiness was not noted in any fish until at least 18 hours after death, and in some cases until the third day. Most chalky fish did, however, show some signs of chalkiness within the first 24-36 hours. Severe chalkiness was not apparent until 72 hours *post mortem*. In comparing the three locations for measurement (started 40 hours after landing), the pH varied very little among the three locations on any given fish, implying that any of these location could do for that purpose. Visually, however, the tail and dorsal seemed to show the most consistent indications of chalkiness whereas the pectoral area showed delayed chalkiness. Processors have reported to us that buyers see the cut in the flesh as an indication of quality, signaling that the fish has been checked for chalkiness at the plant.

On Board Computers - PIT tags in Pacific Halibut

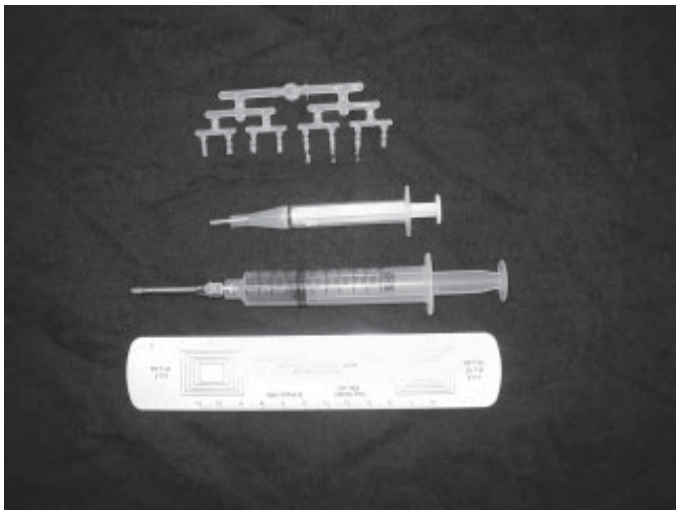
Passive Integrated Transponder (PIT) tags have been used for monitoring fish (mostly salmonids) since 1987. These tags are about 2 by 10 mm and encased in glass. They are inserted into the flesh of a fish using a clean hypodermic syringe and needle. An electronic reader, which emits radio frequency waves, is used to scan the fish for tags. The tags themselves have no power source (hence Passive) and so are not limited by battery life. When a PIT-tagged fish is scanned, the waves from the reader excite the tag and cause it to transmit its unique code (one of 35 billion) back to the reader. We have been experimenting with techniques for using these PIT tags on halibut to improve our estimates of abundance and mortality of the stock.

Studies on Chinook salmon have shown no adverse effects of PIT tags on growth and survival.

Commission staff undertook sequential experiments in 2001 to determine the best methods for tagging halibut. These experiments involved three vessel charters, a number of special projects conducted during existing grid charters, and three in-plant detection studies. During the course of these experiments, leaping fish, lopping fishers, clogging pumps, and drooping batteries all conspired to steepen the learning curve for IPHC staff. In the end, however, the steep curve took us higher than expected and many unforeseen difficulties in tagging protocols were solved.

Effective Tagging in Halibut - Tag placement

The first task in successfully using PIT tags in the halibut industry was to find a location on the fish that would minimize the impact on the fish and maximize its utility to IPHC. The goal was to have the tag in the head of the fish to enable recovery from the commercial fishery, making sure the tag would not be shed by the fish or be damaged in the normal course of catching, landing, and stunning.



Equipment used to PIT tag halibut. Photo by Steve Wischniowski.

Initially, we chose the white muscle area just ahead of the dorsal fin and above the eye for tag placement. Any heads that were cut without the dorsal eye would not be included in a plant scanning. Following two trips on board

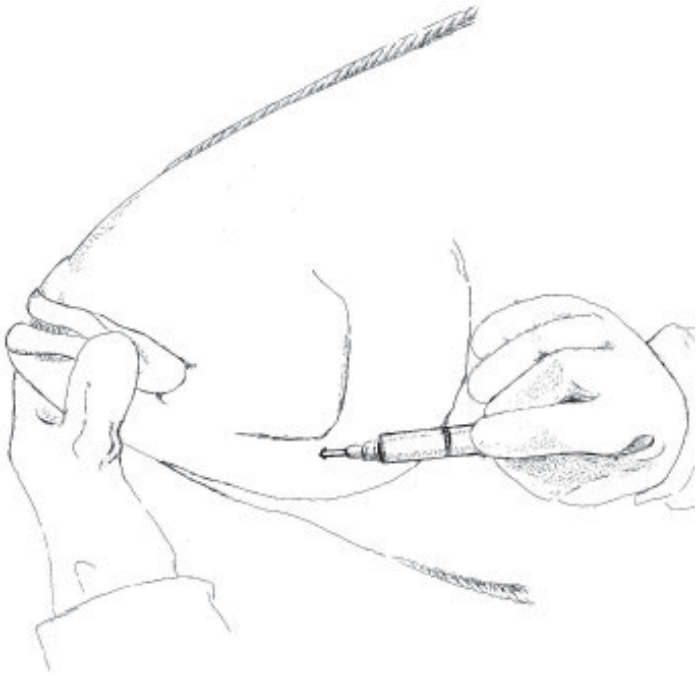


Figure 3. PIT tag site. Artwork by Joan Forsberg.

the *F/V Star Wars II* in Area 2B, we determined that insertion from the front of the head back to just above the dorsal eye alleviated this difficulty and potentially decreased the shedding rate as well.

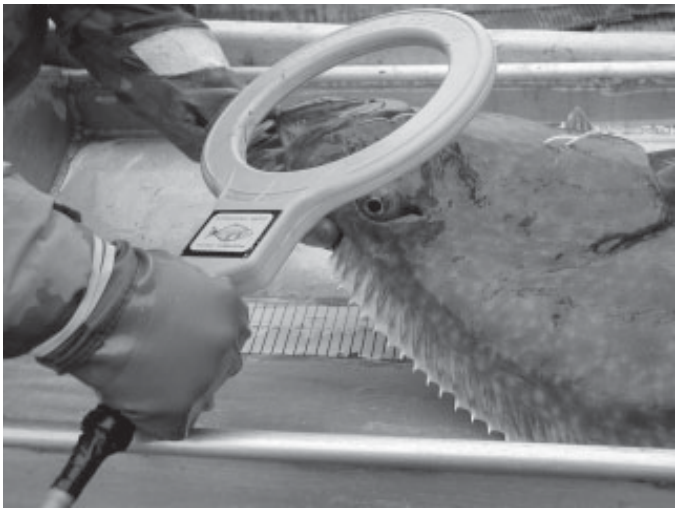
Another problem with locating tags in the head was potential damage during the stunning of fish following landing. We used simulated stunning on tagged heads, as well as a six day refrigerated holding period, to determine that the tags were durable and stunning was not problematic, given our chosen tagging location. In a later study launched from the *F/V Free to Wander* in early August, the durability of the tag in the head was tested through the complete landing, stunning, and plant handling processes that included running through a metal detector (intended to locate hooks on heads). Of the 27 tags tested, all but two endured the process; one of the two was left with the body in the heading process and the other was damaged by the head removal chop.

Our tagging methods were further developed in a study based at a NMFS facility in Washington state. From this work we added the use of 'BioBond' sleeves to our protocol. These sleeves slip over the end of the tag and are intended to reduce migration of the tag within the fish. As well, we found better glues and changed our equipment to push the tag in beyond the needle tip and potentially angle the tag to reduce the possibility that it could return out of the insertion hole.

The final adjustment of tag placement protocol in 2001 was made to insert tags in the opercular flap of the non-eyed side, just ahead of the opercular groove.

Effective Tagging in Halibut - Tag detection

A study conducted off the *F/V Star Wars II* was intended to test the ability to detect tags in the unloading plant. In the hold, 83 dead fish were randomly chosen and tagged. Only 57 of the 83 fish tagged, or 68 percent, were identified during the scanning. This low recognition rate was in part due to low battery conditions in the scanners during part of the experiment. Several tags were lost during the grading and heading process on the first trip, when the machete cut through the insertion hole. This left the tags with the body and us with poor scan results. On this basis we altered the tag location. Our third tag location had tags inserted into the opercular groove of the white side. Fish destined for sale were also tagged and held in the hold. Of these tagged dead fish, only 148 of 174, or 85 percent, were identified during the scanning. Part of the problem here was likely due to low battery conditions in the scanners during part of the project. We also identified one tag that was broken and did not scan and several tag insertion holes missing their tags. At this particular offload, the fish were handled many times during the grading and heading process and we suspect that tag loss from tags backing out through the injection hole played some part in the poor scanning rate. This should not be a problem with fish that would be released live with tags in place, since healing should prevent tag migration during later processing and handling.



PIT tag detection equipment. Photo by Matt LaCroix.

Effective Tagging in Halibut - Tag shedding

An important component of any tag release and recovery program is understanding tag loss through shedding, mortality to the tagged fish, or loss of tag function. A tag-retention experiment was run by holding 142 captive halibut at the Seward Marine Center from May to July of 2001. This helped us to determine what glues (if any) would minimize short-term loss of tags from the fish, as well as to further develop our placement techniques. Subsequent biweekly scanning demonstrated that, after initial tag loss before healing of insertion, tag loss was minimal. We intended to continue this

testing for a 6-month period, however a clogged intake pump caused fatalities and the experiment was unfortunately ended after two months.

Another tag retention study was done on the *F/V Free to Wander* in early August and, in a series of three groups, a total of 287 fish were tagged and held overnight before release. In this study the tags were inserted from the anterior orientation into the area just above the dorsal eye. All tags were retained in the short-term holding. These halibut were released with a highly visible neon green spaghetti tag attached to the operculum in hopes that later recovery by the sport or commercial fisheries will enable verification of the longer-term operation of PIT tags. The fish were released in two locations; 189 on August 1 and 2 off Montague Island outside of Prince William Sound, and 98 on August 3 near Bear Glacier in Resurrection Bay. The IPHC is **offering a $100 reward** for return of the heads with the wire tag attached so we can determine if the PIT tag is still in place and can be activated. Tag posters were distributed to our port samplers, and throughout Seward and Whittier. A vessel on charter to the IPHC captured one of these tagged fish on August 15 and the tag was operating normally at that time.

The larger tagging project slated for 2002 has been postponed in lieu of further research into tagging methods and shedding.

In the final shedding studies of the season, 77 of 80 tags inserted into the opercular flap of the non-eyed side just ahead of the opercular groove were retained in an overnight holding, as well as another group of 124. A late fall study of 124 fish held at the Seward Marine Center showed this tag location to be relatively successful. However, there was a shedding rate of one per month over the four month study and the shedding seemed to follow a pattern. Hence, the larger tagging project slated for 2002 was postponed in favor of further research into tagging methods and shedding.

Checking In: Tagging studies

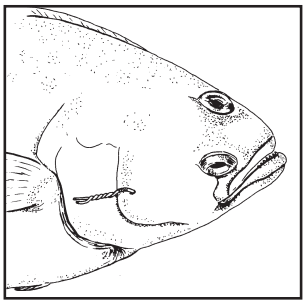
The IPHC has been tagging halibut since 1925, releasing over 380,000 halibut and receiving over 46,000 reported recoveries. Halibut are tagged to study migration, utilization, age, growth, and mortality. The last major tagging project took place in 1995 as part of a study on halibut mortality in the trawl fishery. In 2001, a total of 392 tags were released and 74 were recovered. Forty-eight tag recoveries occurred in Area 3A, where the most recent tagging experiments have taken place.

Tag releases in 2001 totaled 392. Of these, 105 occurred in the sport fishery. The largest release of tagged halibut occurred in the annual Homer halibut derby. The remaining were the 287 tags released in conjunction with the PIT tag project. These fish were wire tagged with both an external neon green spaghetti tag and a PIT tag. Later recovery of these externally-tagged halibut by the sport or commercial fisheries will enable verification of the durability of PIT tags.

Tag recoveries were down in 2001 from last year, a continuation of the trend of the past few years. There were 74 tags redeemed this year, compared to 92 in 2000. The most tags were redeemed in Kodiak and Seward. Several tags were recovered in Vancouver from truck deliveries that carried fresh fish from Homer. Recoveries by regulatory area showed the largest number

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. **Fishermen should retain all 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 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 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

of tags were recovered from Area 3A, where the most recent tag experiments have taken place.

Tagged fish are usually recovered in or near their area of release. The longest distance between release and recovery in 2001 was a fish tagged in 1987 on the Bering Sea flats north of the Pribilof Islands, then subsequently recovered off Langara Island, B.C. This female, released at 58 cm during small fish studies on the *F/V Pat San Marie*, had grown to 137 cm. Most of the tagged fish recovered in 2001 were from the 1993-94 longline mortality study, and many of them were caught close to their release site. One of the recoveries this year was at large for 20 years after being released off the Trinity Islands in 1981 by the *F/V Nore-Dick*. The recovery was made approximately 60 nautical miles from its release site.

Overall, recovery rates from the most recent experiments vary from three to 47 percent. The highest rates occurred in the older experiments where fish have been available for capture the longest. Nearly half the tagged fish released in the 1988 Sitka Spot experiment have now been

recovered. The 1989 central Oregon study, with 627 recoveries, has a recovery rate of 30 percent. The longline mortality experiments in 1993 and 1994 have recovery rates of seven and nine percent, respectively. The most recent project was the 1995 trawl mortality experiment aboard the *F/V Forum Star*. To date, the recovery rate for this experiment is only three percent.

All four bird species observed feeding on baited hooks were more vulnerable to capture in rougher weather conditions, however, the effect of weather on abundance varied by species.

Seabird Interactions with Halibut Longline Gear

Due to increasing awareness of the incidental mortality of seabirds by north Pacific longline fisheries and the occurrence of the endangered short-tailed albatross (*Phoebastria albatrus*) on halibut fishing grounds, the Commission is interested in exploring gear and operational changes that would decrease seabird bycatch. We conducted a study near Unalaska Island, AK, (near Area 4A) to examine interactions of different species of birds with halibut longline gear and assess the vulnerability of individual species. We also monitored the effects of weather and time of day to find out what conditions were related to increased risk of incidental capture.

Bird counts were conducted during both gear setting and gear hauling operations, and the abundance and feeding behavior of each bird species was recorded. Northern fulmars (*Fulmarus glacialis*) were the most abundant species present during setting (51 percent) but displayed little feeding activity, seldom taking strikes at the gear. Hence, this species is considered to be at a relatively low risk of incidental capture. Laysan albatross (*Phoebastria immutabilis*) was moderately abundant (27 percent), however, it was the most aggressive species, taking 86 percent of the observed strikes at the gear. The Laysan albatross were shown to be the most vulnerable species to incidental capture. Both black-footed albatross (*P. nigripes*) and shearwaters (*Puffinus* spp.) were observed at low abundance during setting operations (six and two percent, respectively).

Weather conditions at the time of setting influenced both the abundance and behavior of ship-following seabirds. All four species observed feeding on baited hooks were more vulnerable to capture in rougher weather conditions, however, the effect of weather on abundance varied by species. This variation could have been a result of inter-species competition and dominance, or observer bias.

Contradictory to previous studies, the time of day at which the gear was set did not appear to have an effect on abundance or behavior. While it is possible that time of day does not affect the feeding activity of seabirds in this area, it seems more likely that the lack of a trend is due to the failure of the study design to account for variations in light levels among days.

APPENDICES

The tables in Appendix I provide catch information for the 2001 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 2001 seasons, and Appendix III shows 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.

Appendix II.

Appendix III.

Appendix I.

Table 1. The 2001 total removals of Pacific halibut by regulatory area (thousands of pounds, net weight) .

	Area						
Removal	**2A**	**2B**	**2C**	**3A**	**3B**	**4**	**Total**
Commercial[1]	680	10,288	8,403	21,541	16,336	13,451	70,699
Sport[2]	446	1,015	1,733	5,016	13	81	8,304
Bycatch Mortality[2]:							
Legal-sized fish	540	110	220	1,700	480	3,380	6,430
Sublegal-sized fish	165	70	121	1,401	1,083	3,445	6,285
Personal Use	17[3]	300	170	74	20	192[4]	773
Wastage:							
Legal-sized fish	3	46	37	32	32	88	238
Sublegal-sized fish	3	247	155	390	448	184	1,427
Total	**1,854**	**12,076**	**10,839**	**30,154**	**18,412**	**20,821**	**94,156**

[1] Commercial catch includes IPHC research catch.
[2] Preliminary
[3] Treaty Indian ceremonial and subsistence fish authorized in the catch sharing plan.
[4] Includes 30,000 pounds of sublegal halibut retained in the Area 4E Community Development Quota.

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), 1993 - 2001.

Regulatory Area	Commercial Catch[1]								
	1993	1994	1995[2]	1996[2]	1997	1998[2]	1999[2]	2000[2]	2001
2A[3]	504	370	297	296	413	460	450	482	680
2B	10,628	9,911	9,623	9,545	12,420	13,172	12,705	10,811	10,288
2C	11,290	10,379	7,766	8,872	9,920	10,196	10,143	8,445	8,403
3A	22,738	24,844	18,336	19,693	24,628	25,698	25,316	19,288	21,541
3B	7,855	3,860	3,125	3,662	9,072	11,161	13,835	15,413	16,336
4A	2,561	1,803	1,617	1,699	2,907	3,418	4,369	5,155	5,015
4B	1,962	2,017	1,680	2,069	3,318	2,901	3,571	4,692	4,466
4C	831	715	668	680	1,117	1,256	1,762	1,737	1,647
4D	836[4]	711[4]	643	706	1,152	1,308	1,891	1,931	1,844[5]
4E	64[6]	120[6]	127	120	251	188	264	351	479[5]
Total	59,269	54,730	43,882	47,342	65,198	69,758	74,306	68,305	70,699
Regulatory Area	Commercial Catch Limits								
	1993	1994	1995	1996	1997	1998	1999	2000	2001
2A[3]	361	355.3	278	275	374.2	440.9	412.5	468.1	681.4
2B	10,500	10,000	9,520	9,520	12,500	13,000	12,100	10,600	10,510
2C	10,000	11,000	9,000	9,000	10,000	10,500	10,490	8,400	8,780
3A	20,700	26,000	20,000	20,000	25,000	26,000	24,670	18,310	21,890
3B	6,500	4,000	3,700	3,700	9,000	11,000	13,370	15,030	16,530
4A	2,020	1,800	1,950	1,950	2,940	3,500	4,240	4,970	4,970
4B	2,300	2,100	2,310	2,310	3,480	3,500	3,980	4,910	4,910
4C	800	700	770	770	1,160	1,590	2,030	2,030	2,030
4D	800[4]	700[4]	770	770	1,160	1,590	2,030	2,030	2,030
4E	120[6]	100[6]	120	120	260	320	390	390	390
Total	54,101	56,755.3	48,418	48,415	65,874.2	71,440.9	73,712.6	67,138.1	72,721.4

[1] Commercial catch includes IPHC research catch and in Area 2C, the Metlakatla fishery catch.
[2] Poundage figures have been updated from previous publications.
[3] Does not include treaty Indian ceremonial and subsistence fish.
[4] Includes Subarea 4D-N: 1993 = < 1,000 pounds; 1994 = 18,000.
[5] Areas 4D and 4E CDQ could be fished in either area regardless of quota share designation by NMFS enforcement waiver.
[6] Area 4E includes Area 4E-SE (Bristol Bay fishery) and Area 4E-NW (Nelson Island fishery).

Table 3. The total catch (thousands of pounds, net weight) from the 2001 commercial fishery, including IPHC research, of Pacific halibut by regulatory area and month.

Reg Area	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Total
2A	223	171	25	61	160	13	21	6	-	680
2B	1,109	1,511	1,223	1,233	1,038	931	1,399	1,060	784	10,288
2C	765	1,542	1,423	1,246	696	857	1,005	672	197	8,403
3A	2,661	3,051	4,422	2,865	1,891	2,008	1,993	1,764	886	21,541
3B	212	1,463	2,896	3,148	1,704	2,433	1,940	1,697	843	16,336
4A	9	116	460	800	1,186	1,455	660	311	18	5,015
4B	-	123	218	771	1,058	1,231	673	262	130	4,466
4C	-	-	-	177	782	589	87	12	-	1,647
4D	-	-	13	230	348	579	481	143	50	1,844
4E	-	-	19	175	166	76	30	13	-	479
Alaska Total	3,647	6,295	9,451	9,412	7,831	9,228	6,869	4,874	2,124	59,731
Monthly Total	4,979	7,977	10,699	10,706	9,029	10,172	8,289	5,940	2,908	70,699

Appendix I.

Table 4a. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2001 commercial fishery for Area 2B, Alaska, and the Alaskan regulatory areas.

Overall Vessel Length	Area 2B		Alaska	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	12	332	65	723
0 to 25 ft.	0	0	282	540
26 to 30 ft.	- [1]	-	149	1,227
31 to 35 ft.	7 [1]	115	258	4,896
36 to 40 ft.	69	1,700	238	3,134
41 to 45 ft.	65	2,219	207	4,916
46 to 50 ft.	28	1,675	165	5,884
51 to 55 ft.	23	1,575	72	3,181
56 + ft.	44	2,672	299	35,230
Total	248	10,288	1,735	59,731

Overall Vessel Length	Area 2C		Area 3A	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	37	91	18	231
0 to 25 ft.	83	124	45	77
26 to 30 ft.	52	233	39	155
31 to 35 ft.	110	893	111	1,523
36 to 40 ft.	138	1,107	102	1,463
41 to 45 ft.	102	1,193	128	2,149
46 to 50 ft.	96	1,699	92	2,214
51 to 55 ft.	42	850	45	1,221
56 + ft.	111	2,213	228	12,508
Total	771	8,403	808	21,541

Overall Vessel Length	Area 3B		Area 4	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	- [2]	-	13	277
0 to 25 ft.	5 [2]	154	155	338
26 to 30 ft.	0	0	60	838
31 to 35 ft.	30	722	55	1,758
36 to 40 ft.	30	529	- [3]	-
41 to 45 ft.	38	1,031	9 [3]	579
46 to 50 ft.	44	1,481	- [4]	-
51 to 55 ft.	20	855	12 [4]	744
56 + ft.	162	11,564	83	8,917
Total	329	16,336	387	13,451

For reasons of confidentiality

[1] 26 to 30 ft vessels were combined with 31 to 35 ft vessels in Area 2B

[2] 0 to 25 ft vessels were combined with unknown length vessels in Area 3B

[3] 36 to 40 ft vessels were combined with 41 to 45 ft vessels in Area 4

[4] 46 to 50 ft vessels were combined with 51 to 55 ft vessels in Area 4

Appendix I.

Table 4b. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2001 fishery for Area 2A commercial fisheries not including the treaty Indian commercial fishery.

Overall Vessel Length	Area 2A Directed Commercial	
	No. of Vessels	Catch (000's lbs.)
Unk. Length	1	n/a
0 to 25 ft.	4	1.0
26 to 30 ft.	1	n/a
31 to 35 ft.	2	n/a
36 to 40 ft.	25	31.0
41 to 45 ft.	28	47.8
46 to 50 ft.	9	16.2
51 to 55 ft.	14	28.9
56 + ft.	22	82.0
Total	106	209.6

Overall Vessel Length	Area 2A Incidental Commercial (Salmon)		Area 2A Incidental Commercial (Sablefish)	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	0	0.0	1	n/a
0 to 25 ft.	4	n/a	0	0.0
26 to 30 ft.	4	n/a	0	0.0
31 to 35 ft.	18	2.4	0	0.0
36 to 40 ft.	36	7.5	5	1.9
41 to 45 ft.	31	14.9	7	6.9
46 to 50 ft.	19	5.5	8	3.1
51 to 55 ft.	6	3.2	3	n/a
56 + ft.	2	n/a	11	9.7
Total	120	34.1	35	23.2

Appendix I.

Table 5. Fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2001 Pacific halibut commercial fishery.

Regulatory Area	Fishing Period	No. Of Days	Catch Limit	Commercial Catch	Research Catch	Total
2A treaty Indian	3/21 – 3/23	2.5				
	4/19-20	1				
	Restricted: 3/15-4/15	32				
	Restricted: 4/25-5/11	17				
Treaty Indian total			406.5	413.2		413.2
2A Commercial						
Incidental in salmon fishery	May 1 – July 11	72	34.1	34.1		34.1
Incidental in sablefish fishery	Aug 15- Oct 31	78	47.9	23.2		23.2
Directed	June 27[1]	10-hrs		38.3		
	July 11[1]	10-hrs		84.0		
	July 25[1]	10-hrs		56.0		
	Aug 8[1]	10-hrs		2.2		
	Aug 22[1]	10-hrs		1.4		
	Sept 5[1]	10-hrs		11.7		
			192.9	193.6	16	209.6
Commercial total			274.9	250.9	16	266.9
2A total			681.4	664.1	16	680.1
2B	3/15 – 11/15	245	10,510[2]	10,207[3]	81	10,288
2C	3/15 – 11/15	245	8,780[4]	8,273[5]	130	8,403
3A	3/15 – 11/15	245	21,890[4]	21,100	441	21,541
3B	3/15 – 11/15	245	16,530[4]	15,993	343	16,336
4A	3/15 – 11/15	245	4,970[4]	4,915	100	5,015
4B	3/15 – 11/15	245	4,910[4]	4,388	78	4,466
4C	3/15 – 11/15	245	2,030[4]	1,647		1,647
4D	3/15 – 11/15	245	2,030[4]	1,800[6]	44	1,844
4E	3/15 – 11/15	245	390	479[6]		479
Alaska total			61,530	58,595	1,136	59,731
Total			72,721.4	69,466	1,233	70,699

[1] Fishing period limits by vessel class.
[2] An additional 90,848 pounds available as carryover from 2000.
[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 = 226; 3A = 226; 3B = 140; 4A = 54; 4B = 102; 4C = 63; 4D = 31.
[5] Includes 64,005 pounds taken by Metlakatla Indians during additional fishing within reservation waters.
[6] Areas 4D and 4E CDQ could be fished in either area regardless of quota share designation by NMFS enforcement waiver.

Appendix I.

Table 6. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port, country of origin and IPHC research catch for 2001.

Port Region	Canada	United States	IPHC Research	Total
California & Oregon		186	7	193
Seattle		24		24
Bellingham	1	2,025	9	2,035
Misc. Washington		456		456
Vancouver	1,695		3	1,698
Port Hardy	3,088		41	3,129
Misc. Southern BC	779		5	784
Prince Rupert & Port Ed.	4,386	52	207	4,645
Misc. Northern BC	258			258
Ketchikan, Craig, Metlakatla		1,098	4	1,102
Petersburg, Kake		2,241	11	2,252
Juneau		2,345	37	2,382
Sitka		2,545	10	2,555
Hoonah, Excursion, Pelican		1,645		1,645
Misc. Southeast Alaska		1,228		1,228
Cordova		1,380	5	1,385
Seward		6,122	138	6,260
Homer		13,439	40	13,479
Kenai		165		165
Kodiak		8,268	333	8,601
Misc. Central Alaska		4,601	83	4,684
Akutan & Dutch Harbor		6,651	222	6,873
Bering Sea		4,788	78	4,866
Grand Total	10,207	59,259	1,233	70,699

Appendix I.

Table 7. Commercial halibut fishery catch (thousands of pounds) in 2001 by country, statistical area, and regulatory area.

Stat Area Group	Catch			Regulatory Area	Catch for Reg. Area
	Commercial	Research	Grand Total		
00-03	179	5	184	2A	680
04	122	1	123		
05	363	10	373		
06	278	3	281	2B	10,288
07	216	1	217		
08	547	3	550		
09 - I	254	9	263		
09 - O	196	2	198		
10 - I	1,398	18	1,416		
10 - O	1,095		1,095		
11 - I	1,384	20	1,404		
11 - O	140		140		
12 - I	300	5	305		
12 - O	170		170		
13 - I	3,312	12	3,324		
13 - O	917	8	925		
14 - I	427	21	448	2C	8,403
14 - O	308	19	327		
15 - I	1,307	17	1,324		
15 - O	542	25	567		
16 - I	1,362	9	1,371		
16 - O	1,320	20	1,340		
17 - I	483	5	488		
17 - O	810	8	818		
18S - I	837	1	838		
18S - O	877	5	882		
18W	1,371	9	1,380	3A	21,541
19	735	17	752		
20	1,196	25	1,221		
21	591	17	608		
22	954	15	969		
23	801	17	818		
24	3,889	40	3,929		
25	3,216	75	3,291		
26	3,232	91	3,323		
27	2,565	69	2,634		
28	2,550	66	2,616		
29	6,830	47	6,877	3B	16,336
30	3,022	75	3,097		
31	1,478	73	1,551		
32	2,610	65	2,675		
33	1,197	50	1,247		
34	856	33	889		
35	707	24	731	4	13,451
36	1,164	6	1,170		
37	146	9	155		
38	461	21	482		
39	29	2	31		
40	559	4	563		
41	432	5	437		
42+	1,379	43	1,422		
Bering Sea	8,352	108	8,460		
Total	**69,466**	**1,233**	**70,699**		**70,699**

Appendix II.

Table 1. The fishing period limits (net weight) by vessel class used in the 2001 directed commercial fishery in Area 2A.

Vessel Class		Fishing Periods (Pounds)					
Letter	Feet	June 27	July 11	July 25	Aug 8	Aug 22	Sept 5
A	0-25	335	295	225	200	200	200
B	26-30	420	370	285	200	200	200
C	31-35	670	590	455	200	200	200
D	36-40	1,850	1,620	1,250	280	415	415
E	42-45	1,990	1,745	1,345	300	450	450
F	46-50	2,385	2,085	1,610	360	535	535
G	51-55	2,660	2,330	1,795	400	600	600
H	56+	4,000	3,500	2,700	600	900	900

Table 2. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2001.

Fishing Period Dates	Number Of Vessels	Catch (Pounds)
May 4 - 6	7	4,498
May 18 - 20	7	2,780
June 1 - 3	13	5,065
June 15 - 17	10	7,689
June 29 - July 1	10	5,344
July 13 - 15	10	8,140
July 27 - 29	13	9,966
August 10 - 12	8	5,475
August 24 - 26	8	4,878
September 7 - 9	9	4,829
September 21 - 23	4	2,534
October 5 - 7	5	1,920
October 20 - 22	3	887
13 Fishing Periods		64,005

Appendix III.

Table 1. Fishing dates, opportunity, size limits, and bag limits for the 2001 Pacific halibut sport fishery.

Area	Fishing Dates	Fishing Days	Days Open	Size Limit	Bag Limit
2A					
WA Inside Waters (east of Sekiu River)	5/17-7/22	49	5 (Thur-Mon)	No	1
WA North Coast (Sekiu River to Queets River)	5/1-6/1	29	5 (Tues-Sat)	No	1
	6/16		1 (Saturday)		
	7/1 & 7/4		4 (Sun-Wed)		
WA South Coast (all depths) (Queets River to Leadbetter Point)	5/1-5/24	18	5 (Sun-Thur)	No	1
	6/6		1 (Wed)		
WA South Coast (near shore)	5/1-5/24	131	7	No	1
	6/6		1 (Wed)		
	6/17-9/30		7		
Columbia River (Leadbetter Point to Cape Falcon)	5/1-6/14	45	7	First @ 32”.	1
OR Central Coast (all depths) (Cape Falcon to Siuslaw River)	5/11-5/12	4	2 (Fri-Sat)	First @ 32”	1
	5/18-19		2 (Fri-Sat)		
OR South Coast (all depths) (Siuslaw River to Humbug Mt.)	5/11-5/12	5	2 (Fri-Sat)	First @ 32”	1
	5/18-19		2 (Fri-Sat)		
	6/8		1 (Friday)		
OR Coast (<30 fathoms)(Cape Falcon to Humbug Mountain)	5/1-9/30	153	7	First @ 32”	1
OR Coast (all depths) (Cape Falcon to Humbug Mountain)	8/3-4	5	2 (Fri-Sat)	First @ 32”	1
	8/17		1 (Friday)		
	9/21-22		2 (Fri-Sat)		
OR/CA (south of Humbug Mt.)	5/1-9/30	153	7	First @ 32”	1
2B, 2C, 3 and 4	2/1-12/31	334	7	No	2

Appendix III.

Table 2. 2001 harvest allocations and estimates (in pounds, net weight) by subarea within Regulatory Area 2A.

Sub Area	Allocation	Catch Estimate	Over/Under
WA Inside Waters	57,393	58,710	+1.317
WA North Coast	108,030	109,493	+1,463
WA South Coast (all depths)[1]	42,739	42,242	-197
WA South Coast (near shore)		0	0
Columbia River	10,487	8,808	-1,679
OR Central Coast (all depths)	135,866	117,499	-18,367
OR South Coast (all depths)	12,656	14,568	+1,912
OR Coast (<30 fathoms)	17,150	2,387	-14,763
OR Coast[2]	49,951	85,139	+35,188
OR/CA (south of Humbug Mt.)	6,809	6,809	0
Total	441,081	445,655	+4,574

[1] The Washington South Coast all depth fishery was restricted to near shore waters when the harvest was insufficient for an off shore fishery

[2] After accounting for underages and overages in previous openings from Cape Falcon to Humbug Mountain, about 66,446 pounds remained to be harvested. Additionally, 12,000 pounds were re-allocated from the <30-fathom fishery to allow the August-September all depth fishery to occur.

Table 3. Harvest by sport fishers (millions of pounds, net weight) by regulatory area, 1977-2001.

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[1]	0.446	1.015	1.733	5.016	0.013	0.081	8.303

[1] Only Area 2A is current data; all other areas are projected harvests. These projections will be updated when data become available.

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 2001 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.

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