INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
1998

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

Produced by the IPHC staff
Seattle, Washington
1999

Cover: Designed by IPHC biologist, Thomas Kong.

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 International Pacific Halibut Commission 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.

The IPHC can now be visited on the Internet. Our Homepage address is:

www.iphc.washington.edu

The following abbreviations are used throughout this report:

IPHC	International Pacific Halibut Commission
NMFS	National Marine Fisheries Service (United States)
F&O	Fisheries and Oceans (Canada)
NPFMC	North Pacific Fishery Management Council
PFMC	Pacific Fishery Management Council
ADF&G	Alaska Department of Fish and Game
WDFW	Washington Department of Fish and Wildlife
ODFW	Oregon Department of Fish and Wildlife
IFQ	Individual Fishing Quota
IVQ	Individual Vessel Quota

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75 YEARS OLD
A HISTORICAL MISSION

"Those who live by the sea can hardly form a single thought of which the sea would not be part."

Hermann Broch - Austrian novelist (1881-1951)

Go to any meeting involving fisheries management and you might hear words like "tradition" and "conservation." In fact, those words might even be used in the same breath as International Pacific Halibut Commission and its 75 years of fishery management. In 1923, Canada and the United States signed an agreement to manage the halibut fishery stocks in such a way that there would be fish for their children and grandchildren. While we've seen the fleet go from steam to diesel, the methods go from dory to single vessel, and the navigational equipment go from sextants to global positioning satellites, the fish itself is content to live in the environment it has always existed, year in and year out. The Commission has seen to its health, and although there have been times when the population size has decreased more than is comfortable for scientists and managers, prudent management actions have meant that recovery was not far behind.

By the early 1910s, the halibut fishery was thriving — in fact, there was so much fish to be had that the industry was trying to find ways to scale back the catch.

The early 1900s brought with it serious changes to many parts of the world. The industrial revolution was in full swing and a world war raged on. On the fisheries front, the East coast of North America had long been a mecca of fishing activity, but the West coast of the continent was in its fishing infancy. It didn't take long, however, to discover what the native north American cultures had known for some time — the Pacific was a place of what seemed to be limitless prosperity. Pacific halibut was first landed commercially in the 1880s and the fishery gained momentum as long-range transportation of the fish became readily available via railroad. By the early 1910s, the halibut fishery was thriving — in fact, there was so much fish to be had that the industry was trying to find ways to scale back the catch. Having too much of a good thing is not usually a persistent problem however, and so it was in the case of halibut. By the late 1910s, it was obvious to all involved that the fishery was in trouble. More and more effort was exerted to yield ever decreasing catches.

Where there's a blossoming resource, ownership disagreements are bound to follow. And indeed, the British Commonwealth and the United States tried several times through the early 1900s, unsuccessfully, to arrive at an arrangement concerning Pacific halibut. Each negotiation involved not only the resource, but stipulations about tariffs and port privileges. Two things happened to finally push a treaty through. First, Canada convinced Great Britain that it should independently enter into any treaty involving halibut, and Great Britain agreed. Second, superfluous items were dropped

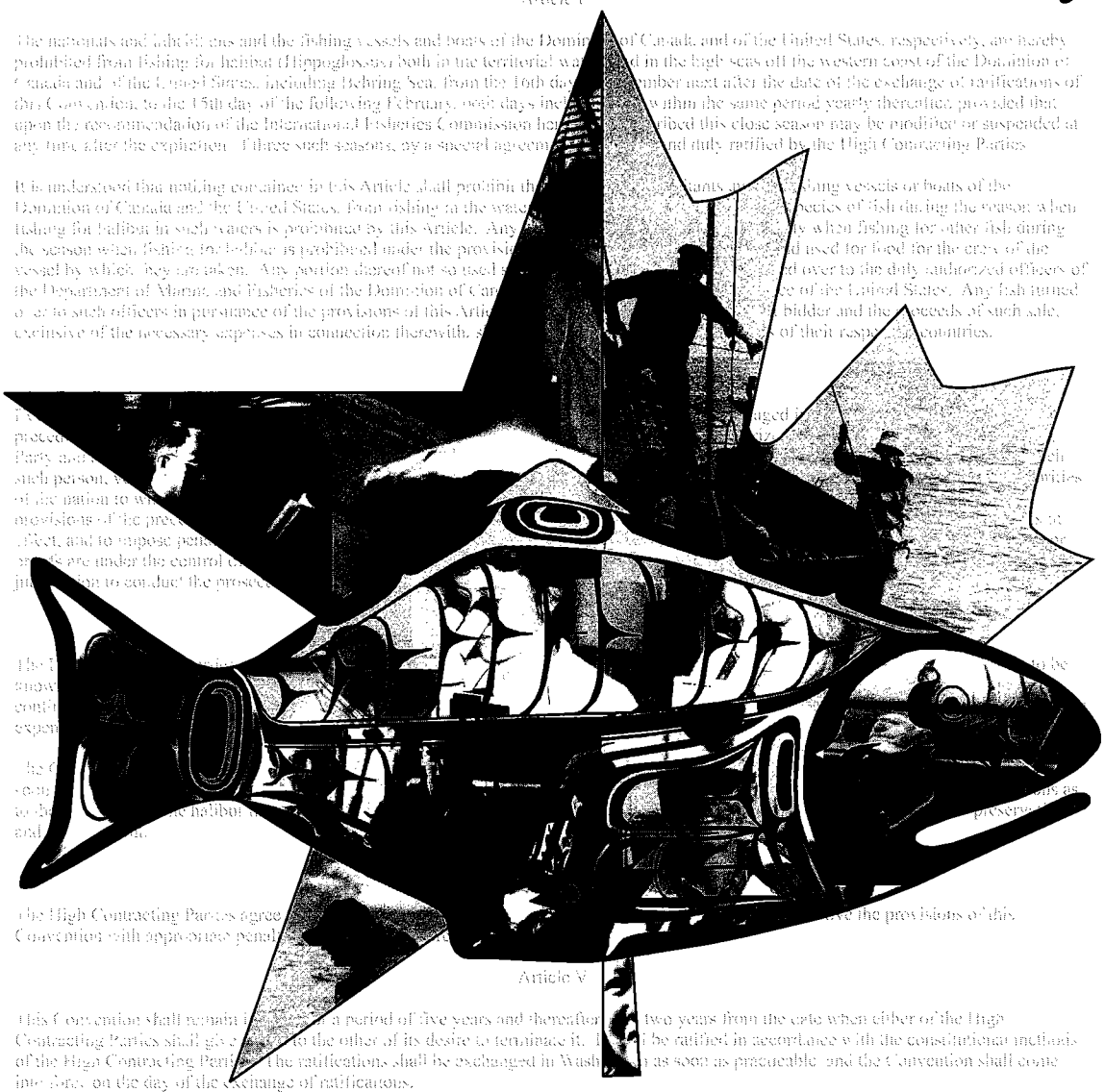
from the negotiation table so that only the fishery was involved. As a result, Canada and the United States signed the Halibut Convention of 1923, and it was ratified in 1924. The convention was updated several times through the years as the need arose for greater regulation of the fishery.

In 1976, each country extended its jurisdiction to 200 miles from shore. This act gave rise to many changes in the fisheries and fleets of both countries. However, both industry and the Commission adapted, and although things look somewhat different today than they did to our grandfathers, the same principles apply — conservation is the key — and both the Commission and the industry have routinely proven their allegiance to this standard.

1998 IPHC Seattle staff: *Top row (left to right)* - Gregg Williams, Bernard Vienneau, Joan Forsberg, Bruce Leaman, Daniel Randolph, Todd Barto, Richard Leickly, Steven Hare, Afshin Taheri, Robert Trumble; *Middle row* - Morris Wade, Thomas Kong, Stephen Kaimmer, Lauri Sadorus, Tracee Geernaert, William Clark, Micheal Larsen, Cynthia Doyer; *Front row* - Jin-Hwa Chon, Gerry Lariviere, Lisa Rebarchik, Christine Carr, Heather Gilroy, Linda Shen, Stephen Hoag, Aaron Ranta, Calvin Blood; *not pictured* - Donald McCaughran, Ana Parma, Phyllis Severeid, Patrick Sullivan.

International Pacific Halibut Commission

75th Anniversary



TREATY

FOR THE PROTECTION OF THE PACIFIC HALIBUT

THIS MAJESTY the King of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas, Emperor of India, and the United States of America, being equally desirous of preserving from destruction the halibut fishery in the waters of the Pacific Ocean commonly resorted to by the fishermen of Canada and of the United States, including Behring Sea, have resolved to conclude a Convention for this purpose, and have named as their plenipotentiaries:

His Britannic Majesty: The Honourable [illegible]

The President of the United States of America: [illegible]

Who, after having communicated to each other their respective full powers, found in good and due form, have agreed upon the following articles:

Article I

The nationals and inhabitants and the fishing vessels and boats of the Dominion of Canada and of the United States, respectively, are hereby prohibited from fishing for halibut (Hippoglossus) both in the territorial waters and in the high seas off the western coast of the Dominion of Canada and of the United States, including Behring Sea, from the 16th day of November next after the date of the exchange of ratifications of this Convention, to the 15th day of the following February, both days inclusive, and thereafter during the same period yearly thereafter; provided that upon the recommendation of the International Fisheries Commission hereinafter described this close season may be modified or suspended at any time after the expiration of three such seasons, by a special agreement to that effect concluded and duly ratified by the High Contracting Parties.

It is understood that nothing contained in this Article shall prohibit the nationals and inhabitants and the fishing vessels or boats of the Dominion of Canada and the United States, from fishing in the waters [illegible] species of fish during the season when fishing for halibut in such waters is prohibited by this Article. Any halibut [illegible] when fishing for other fish during the season when fishing for halibut is prohibited under the provisions of this Article shall be used for food for the crew of the vessel by which they are taken. Any portion thereof not so used shall be delivered over to the duly authorized officers of the Department of Marine and Fisheries of the Dominion of Canada or of the United States. Any fish turned over to such officers in pursuance of the provisions of this Article shall be sold to the highest bidder and the proceeds of such sale, exclusive of the necessary expenses in connection therewith, shall be paid to the fishermen of their respective countries.

[illegible]

The High Contracting Parties agree to [illegible] the provisions of this Convention with appropriate penalties.

Article V

This Convention shall remain in force for the period of five years and thereafter until two years from the date when either of the High Contracting Parties shall give notice to the other of its desire to terminate it. It shall be ratified in accordance with the constitutional methods of the High Contracting Parties. The ratifications shall be exchanged in Washington as soon as practicable, and the Convention shall come into force on the day of the exchange of ratifications.

In faith whereof, the respective plenipotentiaries have signed the present Convention in duplicate, and have thereunto affixed their seals.

Done at the City of Washington, the second day of March, in the year of our Lord one thousand nine hundred and twenty-three.

(Sgd.) ERNEST LAPOINTE.

(Sgd.) CHARLES EVANS HUGHES.

THE BEAT GOES ON: ACTIVITIES OF THE COMMISSION

Oh, some can sit in their swivel chairs,
'Midst the City's rush and rumor,
And fret o'er the cares of the world's affairs,
And the woes of the poor consumer.
But I don't envy such gilded ease;
Just give me the salt-soaked ocean breeze,
The lift and surge of the white-capped seas,
And the deck of a halibut schooner.

A verse from "The Dorymen" by Larry O'Connor, printed in *Pacific Fisherman*, 1922

This verse from "The Dorymen" colorfully illustrates the differences between policy makers and fishers. Although the differences are not likely to disappear, the IPHC and industry have worked closely since the 1920s to minimize them and insure the conservation of the halibut resource.

The first regulation passed by the Commission in 1924 was a 3-month winter closure, the idea of which originated for a purpose other than conservation. Interestingly, the suggestion of a closure was first initiated a decade earlier at a time of halibut over-production as a means of curbing the amount of fish available. A 1916 Pacific Fisherman article read "This [the idea of a closure] was more for the purpose of reducing the catch than anything else, as the enormous increase in the fleet and the establishment of new cold storage plants had caused an over-supply of fish, with the result that prices dropped to a low ebb and all were losing money." Although there was some evidence that stock abundance was decreasing, the closure was first mentioned in the name of conservation as a means of gaining acceptance for it. However, in a self fulfilling prophesy, conservative measures were desperately needed by the time the closure was implemented in 1924.

Conservative measures were desperately needed by the time the first halibut fishery regulation, a winter closure, was implemented in 1924.

Although the winter closure, still in affect today, was not a subject for debate in 1998, the Commission found itself considering other issues which would ultimately impact the fishers and the fish alike.

SEVENTY-FOURTH ANNUAL MEETING

Seventy five years later at the 74th Annual Meeting in Anchorage, Alaska the Commission introduced its sixth Executive Director, Dr. Bruce Leaman. Dr. Leaman had been the Canadian scientific advisor to the Commission for over 12 years while working as a scientist for Fisheries and Oceans (F&O) in Canada. Having already worked for several months in the Seattle office, Dr. Leaman led the Commission through the issues facing them.

Commissioners conducting a public session at the 1998 Annual Meeting in Anchorage. From left: Andrew Scalzi, Ralph Hoard, Steven Pennoyer, Richard Beamish, Gregg Best, Rodney Pierce

Of continuing concern was the stock assessment model introduced the previous year.

At the public session, the Commission hears industry concerns. Of continuing concern was the stock assessment model introduced the previous year. As explained in the Stock Assessment section of this report, 1998 was a year of almost record high abundance for the halibut population. Concerned that there would be too much fish on the market and that staff recommendations could cause stocks to decline, the Conference Board (a harvesters' advisory group) and the Processor Advisory Group proposed catch limits below the staff recommendations in most areas. These recommendations as well as concerns about the limited experience with the new stock assessment model led the Commission to take a conservative approach when approving limits.

	Catch limit recommendations (millions of pounds)			
Area	**Staff**	**CB**	**PAG**	**Adopted**
2A	0.82	0.82	0.81	0.82
2B	13.46	13.00	14.38	13.00
2C	11.80	10.50	11.50	10.50
3A	29.57	26.00	28.75	26.00
3B	16.28	12.00	10.35	11.00
4A	5.64	3.50	3.38	3.50
4B	5.70	3.50	4.00	3.50
4CDE	3.00	4.00	2.97	3.50

A special IPHC fishing permit allowed the exploration of fishing grounds in the Chukchi Sea .

This year, two groups asked that the Commission grant an experimental permit to catch and retain up to 20,000 pounds of halibut in the Chukchi Sea. These grounds, although within the Commission's jurisdiction, have been as yet unspecified in the regulations. The Commission approved the fishery after assurance from the Alaska Department of Fish and Game

(ADF&G) that the project would be closely monitored and progress reported back to the Commission.

Another boundary was tested when the North Pacific Fishery Management Council (NPFMC) proposed to allow the retention of undersized halibut in the Area 4E Community Development Quota (CDQ) fisheries. Following lengthy deliberations, the Commission approved the fishery for a two-year trial period with the understanding that there would be proper accounting of all fish caught and a progress report to the Commission.

The Commission discussed and approved several other items of interest during the week-long meeting.

Subjects discussed at the 1998 Annual Meeting

- Elimination of sport charter licenses for British Columbia and Alaska because the data are collected elsewhere.
- Continuation of the five-year plan to survey the halibut grounds.
- Establishment of an official logbook for vessels greater than 25 feet in length.
- The opening to continuous transit of the closed area north of 55 degrees N latitude in Isanotski Strait to allow fishers to pass on their way to ports inside the closed area while carrying halibut.
- Re-approval of the Northwest Food Strategies proposal to process up to 50,000 pounds of trawl caught halibut for food banks.
- Establishment of season dates for all areas.

DOLLARS AND SENSE

At year's end, the appropriations from both countries remained status quo, but staff and governments were seeking a solution to accommodating operating costs and appropriations.

Although operating costs have been inching up for some time while the appropriations budget has remained relatively static, the situation intensified this year. The Commission has historically been able to conduct needed research even under budget constraints because the sale of legal-sized catch of halibut from these research cruises has offset their cost. However, in 1998 the price received for the research fish was well below even our most conservative budget estimates, causing the Commission to alter its activities to accommodate current revenues.

The commissioners met several times throughout the year to discuss the potential operating deficit and receive the Director's recommendations on measures to prevent it. Commission expenses and staff were reduced. Research vessel operations were shifted to off-season periods, where practical, so that revenues could be maximized in the course of answering important scientific questions. At the end of 1998, the appropriations remained at $800,000 (U.S.) per country, but the Commission staff and the two governments were seeking a longer-term solution to accommodating operating costs and appropriations.

NETWORKING NEIGHBORS: A JOINT MEETING

This year the Commission reiterated its commitment to see bycatch decreased. Although it is harder to draw attention to bycatch when halibut abundance is high, the IPHC met jointly with the NPFMC to discuss this problem and others. Planning for solutions such as vessel bycatch accounts, halibut management protection areas, and individual bycatch quotas was encouraged to continue. Preliminary results testing of a halibut excluder device for trawls, developed by an industry group called Groundfish Forum, are encouraging and the Commission looks forward to further results.

The IPHC and the Council exchanged information regarding several items of mutual interest.

The IPHC and the Council exchanged information regarding several other items of mutual interest including a possible weighmaster program (a program in which all deliveries are monitored), retention of undersize halibut in Area 4E, joint logbook agreement between NMFS and the IPHC, harvest limits for the sport charter industry, and an ADF&G charter logbook.

Although regulatory policies are not made at these joint meetings, both the IPHC and the Council find them helpful and plan to continue meeting annually.

IN THE INTERIM...

The November Interim Meeting is a time for the commissioners to gain knowledge about issues facing them at the next Annual Meeting and to learn the results of research performed over the past year.

The survey design was changed from that used in 1997 to reduce costs and improve the statistical basis of the survey. However, changes in design could possibly have contributed to some of the decline in catch rates that were observed in 1998. Therefore, the staff indicated that an experiment to compare the two designs would be beneficial. Experimental surveys yielded interesting results about bait and actually created more questions than answers - the staff is hoping to follow-up in the coming year. At the time of the meeting, the IPHC was conducting its first winter experimental charter since 1983 to conduct several tasks including the gathering of DNA samples from the aggregations of fish on the spawning grounds. Scientists are trying to find out if there are stocks of halibut distinct to certain areas and if so, whether they mix on the spawning grounds.

At the time of the Interim Meeting, the IPHC was conducting its first winter experimental charter since 1983.

The new stock assessment continued to undergo refinement. Stock assessment biologists spent the better part of the Interim meeting explaining the one significant change in 1998 - a decrease in the natural mortality rate. All models showed a high relative abundance of fish. Staff recommendations for 1999 catch limits were presented to the Commission during a December conference call.

DIRECTOR'S REPORT

It would be an understatement to say that 1998 was a challenging year for the Commission. The combination of a large industry inventory of frozen halibut at the end of 1997 and a small increase in catch limits for 1998 served to depress dock prices for halibut during most of the year. Both business plans by industry and budgeting by the Commission were strongly affected by a decline in dock prices of over 45% from those in 1997. Most (about 65%) of the revenue that is used to fund Commission activities, including surveys and research, comes from sales of fish captured during our stock assessment surveys. The surveys are an important component of our assessment framework and they provide the major verification of changes estimated through our analytic stock assessment. On average, the surveys should be financially self-supporting and have increasingly been the only source of funding for research, however the revenue from them was insufficient for both of these purposes in 1998.

Bruce Leaman conversing with John Deboer, *F/V Ingot*, while port sampling in Petersburg, Alaska.

The Commission took immediate measures to cope with these financial changes. Some surveys had to be cancelled, including Areas 2A, southern 2B, and 4D. We delayed some of our field experiments until after the fishing season closed, in hopes of obtaining better prices for any fish caught during these research cruises. The Commission also reduced its expenditures and its staff. Much of my time in 1998 was spent on issues associated with Commission finances. I am happy to report that we were successful in dealing with this financial difficulty and the Commission is grateful for the cooperation we received from industry. I also wish to thank the governments of Canada and the United States for their assistance and cooperation during this period. At year's end, the Commission and the governments were working on improvements to the Commissions appropriations, which have been approximately level since 1985.

The highlight of my first full year as Director was the time I spent in the ports. Although I was not able to visit every port, I was fortunate enough to meet harvesters and processors at eight Alaskan ports, from southeast to Dutch Harbor, as well as the three major ports in British Columbia. These

visits were extremely important in helping me understand the unique concerns of each area, particularly for those ports from which few people may participate in our annual meetings.

The halibut resource continues to be at high levels although our perception of stock distribution has changed somewhat as a result of our more comprehensive setline surveys in Areas 3B and 4. The surveys have shown greater abundance of halibut in these areas than believed previously. Areas 3B and 4 have also experienced an accumulation of fish due to lower historical exploitation rates than in Areas 3A and 2. However, Areas 3B and 4 are also the areas where we have the least knowledge about stock status, so the Commission has been cautious in assigning catch limits for them. Abundance in these western areas is therefore likely to remain relatively higher over the next several years. The major influence on biomass in the central and southern areas has been the decline in mean weights over the past decade. Although estimates of incoming recruitment are declining for these areas, they are still at levels above the long-term average for the stock. The abundance of halibut in these areas over the next several years will be influenced largely by recruitment of new year classes, whose strength is not yet known.

Bruce M. Leaman
Director

BOUNTIFUL HARVEST: THE 1998 COMMERCIAL FISHERY

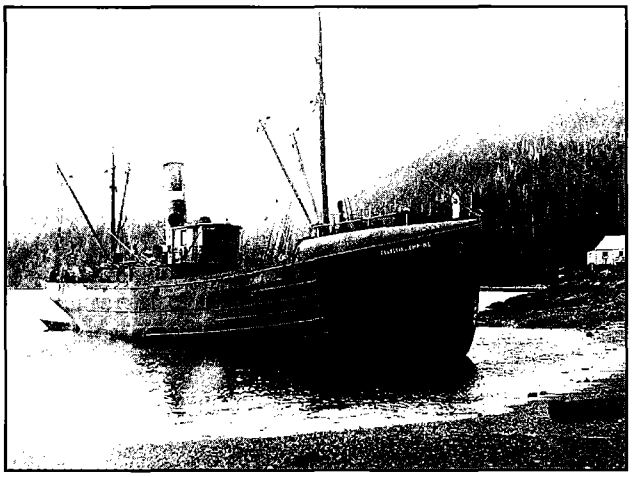
Pilot House Log

Date: May 13th, 1911 *Steamer:* Celestial Empire *Voy.* No. 3

Sailing from: On fishing grounds

TIME BY CLOCK	NAME OF HEADLAND OR PLACE	PILOT HOUSE COMPASS	WEATHER AND REMARKS
3:00	Stopped engines and sounded 27 fath. Steered ExN. 1 1/2 hours, sounded again 50 fath		
6:45	Dory's all out 3 skates gear. NE edge Goose Isld grounds, wind NW moderate. Weather fine and clear.		
10:20	Dorys all on board		
10:24	Full speed ahead - south		
12:26	Change course - SE		
13:30	Set 2 skates gear - SE edge Goose Island ground		
16:55	Dory's all on board - total fish for the day 612. Weather fine and clear fresh Westerly breeze.		
"	Left for Vancouver SExE		

A typical pilot house log from today's commercial fishing vessel might read somewhat differently from this one. In 1911, the fishery was completely unregulated and very prosperous for the time. The December 1911 issue of Pacific Fisherman magazine estimated the annual catch at 50 million pounds fetching an average price of 5 1/2 cents per pound. The halibut supply seemed limitless, but within a decade there were signs that the halibut population was in trouble. This year, the catch limits were at near record high levels, but the big difference is that the commercial fishery is now fully regulated.



Steamer *Celestial Empire* circa 1910. Photo supplied by Frank A. Clapp.

STAYING WITHIN THE LINES

To help manage the stock over its broad distribution, the halibut fishing grounds are broken down into 12 regulatory areas. Areas 4CDE are managed as one area in terms of stock assessment, but the quota is divided according to the NPFMC catch sharing plan. Figure 1 shows the regulatory areas used in the 1998 fishery. The specific boundaries are described below:

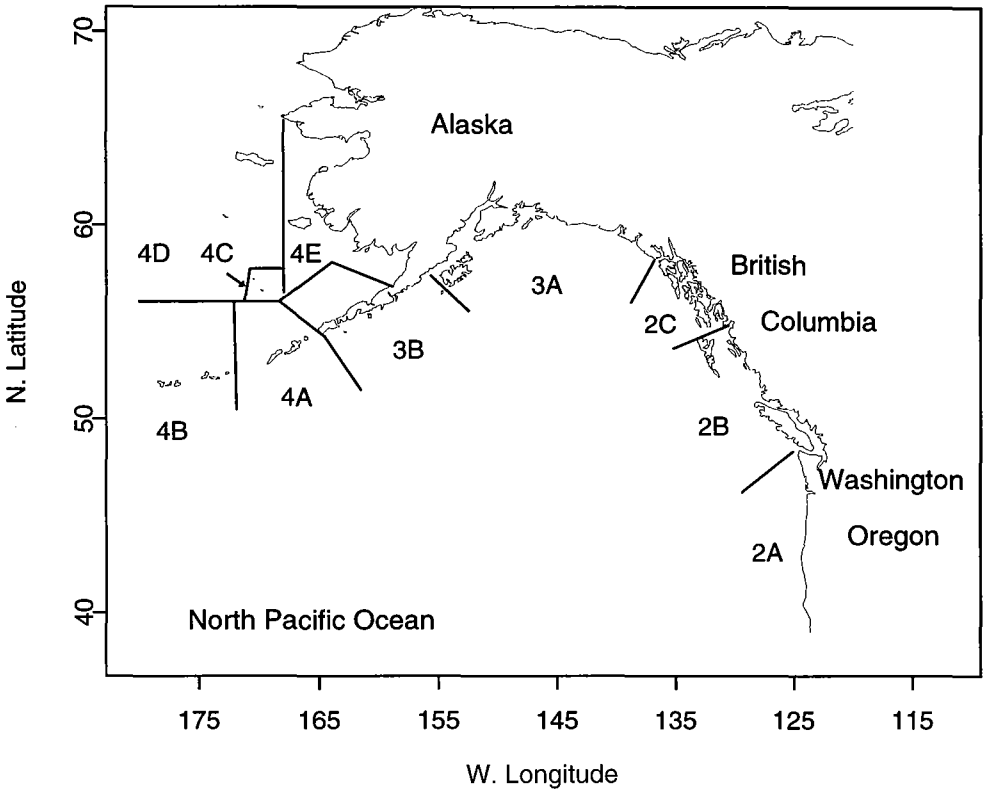


Figure 1. IPHC regulatory areas in 1998.

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.

RULES OF THE GAME

IPHC discontinued licensing sport charter operators in Alaska and British Columbia in 1998, because the information is collected elsewhere.

Each year, the Commission meets to pass regulations for the coming season, and there were several changes in 1998. Probably the most significant from a staff point of view was the discontinuation of licenses for Alaska and British Columbia sport charter operators. The IPHC license database did not accurately represent active vessels and there was no way to cross reference licenses and landings. At the same time, ADF&G, the Commercial Fisheries Entry Commission, and F&O were implementing either logbook or licensing programs which better reflected the active fleet.

A more stringent logbook policy for commercial vessels was implemented in the U.S. Although IPHC regulations have always required that vessels 26 feet and over maintain log records, they did not specify where. As a result, log records were kept on anything from an official logbook to napkins from the galley. The new regulation defined "logbook" to better facilitate data collection and enforcement.

Area 4E Community Development Quota (CDQ) fishers were allowed to retain, for personal use, undersized halibut (< 82 cm or 32 inches) caught on commercial gear. This regulation was an effort to assist the NPFMC in allocation decisions and did not pose an enforcement or conservation concern.

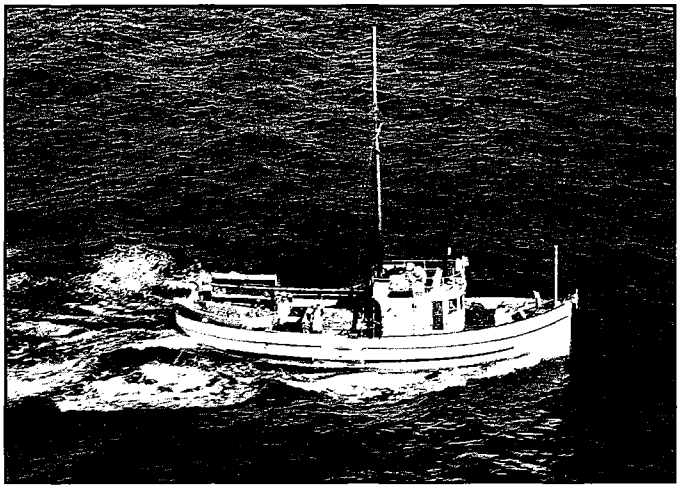
The Bering Sea closed area was redefined to allow vessels transit through Isanotski Strait while carrying halibut. The area was still closed to fishing, but allowed local fishers from False Pass to reach their home port with halibut aboard.

Live fish landings in British Columbia sparked controversy in both countries.

The current IPHC regulations stipulate that all commercially caught halibut must be dressed (eviscerated) at offload to ensure both good quality and the availability of fish for scientific sampling. The majority of the industry agreed with the original intent of the regulation and followed it even before implementation. A discrepancy between the F&O and IPHC regulations was discovered in 1998, and about 9,000 pounds of live fish landings occurred in British Columbia this year. Some of the fish were sold immediately to consumers while other fish were penned, not fed, and sold at a later date. The landings sparked controversy in both Canada and the U.S., especially with interest groups both for and against aquaculture. The IPHC and F&O plan to resolve the issue in the coming year.

Good Afternoon, Officer...

Enforcement is a vital piece of the puzzle when it comes to managing the halibut fishery. Many agencies work together in enforcement and toward the same goal of obtaining accurate catch statistics. The task of enforcing the quota share fisheries falls on the NMFS and the Coast Guard in the U.S., and to F&O in British Columbia.



Aerial surveillance photo taken of the *F/V Hoover* by the U.S. Coast Guard in 1954.

At the beginning of 1998, the IPHC wrote letters to both the United States Coast Guard and NMFS enforcement agencies in Washington D.C. expressing concern that the target levels of enforcement were not being met in the U.S. quota share fisheries. Only 10% (by weight) of the landings were monitored this year — that's half of the enforcement goal of 20% monitored landings.

Innovative ideas - The December, 1980 issue of Pacific Fishing magazine reported that the U.S. Coast Guard had congressional approval to purchase a blimp to be used on ocean patrol duty. The blimp could cruise at 50 mph and stay in the air for long periods of time filling the gap between cutters which could spend long periods at sea but were relatively slow, and airplanes, which were fast but could only stay on patrol a few hours. The Coast Guard was hoping to purchase 50 more blimps in the future.

An idea called the weighmaster program has been discussed in recent years which would put dockside monitors at the plants, to ensure the collection of accurate catch statistics. General industry opinion is that the weighmaster program should be considered only after NMFS has fully staffed the enforcement positions dedicated to individual quota fisheries and evaluated the resulting levels of landings coverage. The issue will continue to be discussed at the NPFMC level.

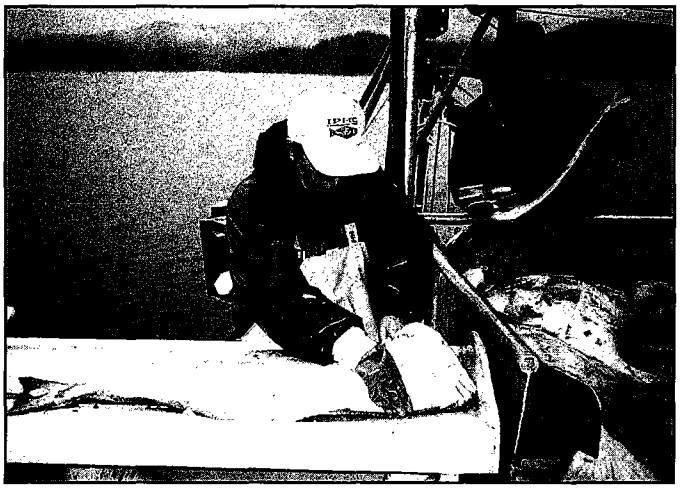
In British Columbia, offloads are validated and enforcement is notified if there is a concern. There is also a tagging program so that each fish can be tracked back to the specific vessel of origin.

BOTTOM LINE: 1998 CATCH STATISTICS

Landing Patterns and Value of the Catch

Individual quota share (IQ) fisheries continued in both British Columbia and Alaska in 1998 and season length was 245 days long. Area 2A operated within several 10-hour openings throughout the summer. A noticeable change in the fishery coastwide this year was the lower ex-vessel price of $1.20 per pound compared to $2.25 per pound in 1997. The dramatic difference may have been caused by the large supply of frozen halibut still available from last year.

For the first time, the leading U.S. port was Homer with landings representing 15% of the coastwide catch.



IPHC port sampler, Darlene Haugan, takes an otolith from a halibut in Port Edward, British Columbia.

For the first time, the leading U.S. port was Homer with landings representing 15% of the coastwide catch. Kodiak has been the leading landing port since 1986 but received only 13% of the catch this year. Homer has the advantage of a road system to the southern states and was possibly able to give a better price for fish than ports elsewhere. It also uniquely has a public ice-producing facility.

The top three landing ports in Canada were again Prince Rupert/Port Edward, Port Hardy, and Vancouver, receiving about 90% of the IVQ landings by weight. Prince Rupert/Port Edward also received about 0.6 million pounds (<1%) of Alaskan IQ catch.

A significant advantage of the IQ systems is the ability to spread landings out over a longer period of time. This benefits the consumer by having access to fresh fish for many months of the year as well as the fisher who receives higher prices for fish going to the fresh market. In Canada, the landings were spread somewhat evenly over time with 9-15% of the catch

taken each month. Alaskan catch was not spread out quite as evenly with the busiest fishing months for Area 2C being May and June, for Area 3A being May and August, and the busiest for the Bering Sea occurring June through August. The Alaska patterns were similar to those seen in 1997 except for Area 3B where the top fishing took place in August. For comprehensive information about the catch this year, see Appendices I and II in this book.

One of the largest catches on record, albeit unsubstantiated, was in 1904 by the Steamer New England, under Captain Freeman. The vessel was fishing off Cape George in Dixon Entrance, when in one day, her crew caught 160,000 pounds of halibut. [Reported in Pacific Fisherman magazine, June 1904].

Washington, Oregon, and California

Since 1988, Washington, Oregon, and California (collectively known as Area 2A) has been given an overall catch limit for commercial, sport, and tribal uses. The catch is then divided according to the Pacific Fishery Management Council (PFMC) catch sharing plan. This year, a total of 820,000 pounds of halibut was available to all users. The sport industry, one of the three user groups fighting for a piece of the pie, was given the largest allocation of 364,039 pounds (for more information - see sport fishery information in the next section).

The non-treaty commercial catch limit was 168,961 pounds with 143,617 pounds allocated to fishers targeting directly on halibut. This fishery consisted of four 10-hour fishing periods. Based on its length, each vessel was given a maximum amount of fish that it could harvest within each fishing period. It is difficult for managers to predict how many vessels will participate as many vessels receive licenses but do not actively fish. The total commercial catch was under the catch limit at the end of July so both the directed and incidental fisheries had openings starting in August. The directed commercial fishery catch was 151,500 pounds, bringing the total commercial catch under the catch limit by 4,000 pounds. The remaining 25,344 pounds of the catch limit was allocated for incidental catch in the salmon troll fishery, of which fishers took 13,400 pounds.

The 1998 catch of 295,600 pounds was the highest catch for the treaty tribes in Area 2A taken in the shortest amount of time since the initial allocation by the PFMC.

The treaty Indian fishery was given 287,000 pounds; 15,000 pounds for subsistence and ceremonial use and 272,000 pounds for the treaty commercial fishery. The actual catch of 295,600 pounds exceeded the catch limit by 22,600 pounds. This is the highest catch for the treaty tribes, and was taken in the shortest amount of time, since the initial allocation by the PFMC.

Area 2C Metlakatla Fishery

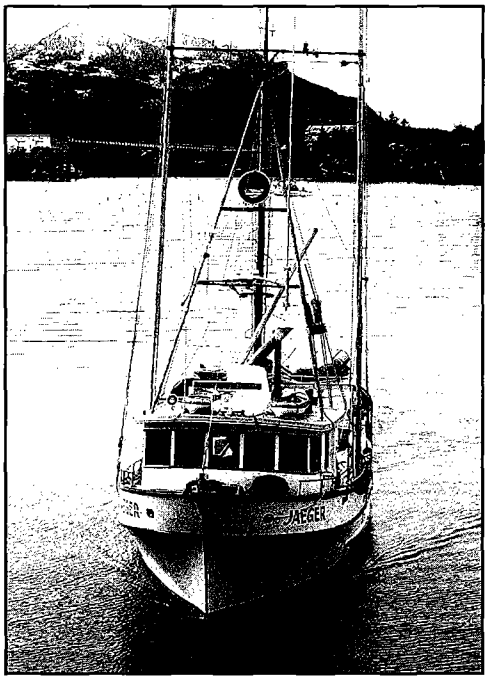
The Metlakatla catch of 11,587 pounds was a sharp drop from catches in 1996 and 1997.

The Metlakatla Indian community, located in Southeast Alaska, was authorized in 1990 to conduct a commercial halibut fishery within the Annette Island Reserve. The IPHC has no direct control over the fishery or its seasons, but it closes for the year when the larger Area 2C catch limit has been reached. Tribal biologists provide the Commission scientists with catch statistics for use in the stock assessment.

In 1998, a total of nine, 48-hour fishing periods took place between April and September producing a total catch of 11,587 pounds. This catch represents a sharp decline from 1996 and 1997 when the catches were 126,000 pounds and 88,000 pounds, respectively. Low ex-vessel price and difficulty finding fish are probable causes of the lower catch rates.

Quota Share Fisheries

Both in British Columbia and Alaska, the halibut fishery is governed by an individual quota system. In Canada, the vessel is given the IQ whereas the IQ is given to individual fishers in Alaska. At each Annual Meeting the IPHC decides on the area catch limits. The respective management agency then figures the total poundage of each share and the shares are given to the vessel or fisher based on pre-determined qualifications. In 1998, both fisheries were open from March 15 to November 15, and fishers could harvest their catch at any time during that eight-month opening.



F/V *Jaeger* in Sitka, Alaska.

British Columbia

The IVQ share calculations may change in the future as F&O is considering an alternative allocation plan.

The Individual Vessel Quota (IVQ) fishery was in its eighth year in 1998. When the IVQ was first implemented, 435 vessels received quota shares. Initial quota for each vessel was divided into two shares called blocks, and when the shares became transferable in 1993, one vessel was allowed to fish up to four blocks. After it became legal to buy and sell blocks of quota, the fleet steadily decreased and has remained around 280 vessels for the past three years. The share calculations may change in the future as F&O is considering a plan where the maximum amount allocated to any one vessel would be calculated by percentage of the Area 2B catch limit and not by blocks.

This year, British Columbia was given a catch limit of 13 million pounds. There was also 33,000 pounds of un-fished quota from 1997 which rolled over into the 1998 catch limit through the overage/underage plan. The total commercial catch was 12.895 million pounds - about 105,000 pounds below the catch limit.

The First Nations Communal commercial fishing program (otherwise known as "F" licenses) was started in 1996 as part of the IVQ system. Seven vessels participated in the fishery in 1998, catching an estimated 209,151 pounds.

Alaska

About 3,800 fishers now actively fish their quota share in Alaska, down from 5,000 when the IFQ program first started in 1995.

The Individual Fishing Quota (IFQ) system saw its fourth year in 1998. When first implemented in 1995, nearly 5,000 individual fishers received initial quota share. After several years of transfer opportunities and consolidation of shares, an estimated 3,800 fishers now actively fish their quota.

This year, the total Gulf of Alaska/SE Alaska catch limit was 47.5 million pounds, and only about 44 million was caught. The total catch limit in the Bering Sea and Aleutian Islands was 10.5 million pounds and about 8.8 million pounds was caught. The underages in each area ranged from 5% in Area 3B to 41% in Area 4E. It is interesting to note that although about 4.6 million pounds of quota was left in the water, the total commercial catch was still 2.9 million pounds higher than in 1997.

OUT OF BOUNDS: THE CHUKCHI SEA EXPERIMENTAL FISHERY

A total of 26 halibut were caught by two groups during an experimental fishery in the Chukchi Sea.

At the 1998 Annual Meeting the Commission gave the go-ahead for an experimental commercial fishery in the Chukchi Sea, an area north of the Bering Sea. Two separate groups were given a collective catch limit of 20,000 pounds which they split evenly. The goal was to explore the feasibility of establishing a commercial halibut fishery in the area.

One group decided to conduct a comprehensive trawl survey instead, fishing a grid of stations in the Bering Strait from Cape Prince of Wales north to Point Hope, and east to the Russia/United States border. Only three halibut were caught and released in good condition, but the survey gathered important information on many exploitable stocks in the area.

The second group concentrated on halibut in the waters off the village of Wales, and whether the availability was enough to sustain a commercial longline fishery. They experienced several logistical problems along with rough weather and were only able to set gear eight times, catching 23 halibut which collectively weighed 833 pounds. Both groups hope to continue their investigations in 1999.

FEAR OF FEATHERS

The Fish and Wildlife Service issued a biological opinion in 1996 that groundfish longline fishing in Alaskan waters threatened the survival of the Short-tailed albatross.

Sea-birds sometimes attack baited hooks on longlines deployed from longline vessels and a small fraction get hooked and dragged under. International conservation efforts are underway around the world to reduce seabird bycatch by longlines. In the northeast Pacific, conservation efforts focus on the endangered Short-tailed albatross. At one time, about 50 of these birds remained in the world and there are still fewer than 500 breeding age birds today. As the population slowly recovers, the birds can be found in an ever expanding geographical area, and they too dive on the longline gear as it's deployed. In 1996, the U.S. Fish and Wildlife Service (FWS) issued a biological opinion that groundfish longline fishing off Alaska threatened survival of the Short-tailed albatross, and set a limit of four birds killed over two years. Reaching the limit could result in closure of the fishery. Subsequently, the FWS set a limit of two birds in two years for the halibut fishery. The longline industry responded by proactively initiating the use of sea-bird avoidance devices on commercial longline vessels. Regulations now require the use of avoidance devices on vessels larger than 25 feet. However, NMFS observers are not required on halibut vessels except in special cases, so information about what actually happens at-sea is hard to come by.

Sea-birds in Seguam Pass, Aleutian Islands.

At the request of NMFS and the FWS, IPHC port samplers expanded their interview this year to inquire about sea-birds caught and observed.

That's where the IPHC port sampler steps in — someone with whom most fishers are familiar. These employees live in the major ports and collect a wealth of valuable information to help IPHC scientists manage the fishery and the stock. This year, at the request of NMFS and the FWS, port samplers expanded their interview to inquire about numbers of sea-birds caught and Short-tailed albatross observed, as well as method of bird avoidance used.

Port samplers collected information from 266 vessels in British Columbia, and 925 vessels in Alaska, representing 80% and 66% of the pounds landed, respectively. No Short-tailed albatross were reported as caught, although several other species were. The interviews revealed a catch rate of 4-12 birds per million hooks fished, which is only about 10-15 percent of the rates reported by the FWS for groundfish fisheries prior to the

avoidance device regulation. Several conclusions can be drawn from these results including 1) the regulations worked; 2) the fishers underreported seabird bycatch; 3) seabird bycatch rates are different for the two fisheries; or 4) a combination of all three.

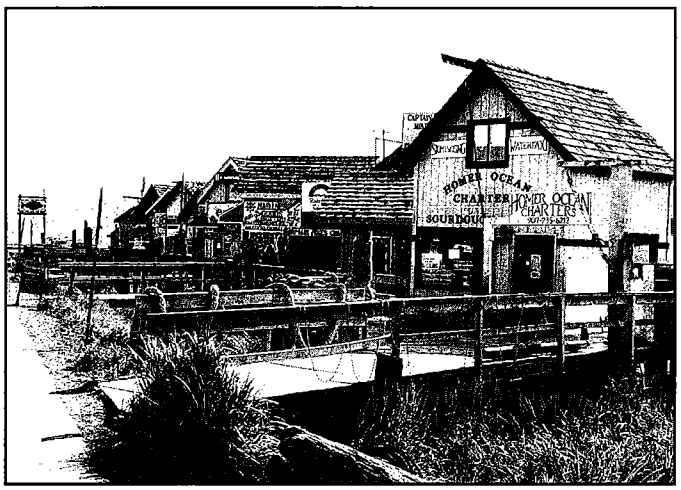
Several techniques were used for avoidance including dragging buoys, weighted groundline, Tori lines (streamers attached to a line and dragged from the stern), setting in the dark, and a combination of techniques used together. While Tori lines and towed buoys had low reported bycatch rates, Alaska fishers using no device also reported low bycatch. Multiple devices and fishing during hours of darkness, which should effectively reduce seabird bycatch had higher rates. These results suggest that interview data may not portray actual seabird bycatch, and should be used cautiously.

Commercial fishers utilized several seabird avoidance techniques this year including dragging buoys, weighted groundline, Tori lines, and setting in the dark.

SPORT FISHING: A FAVORITE PAST-TIME

In 1998, there were about 2,500 sport charter operations in Alaska, Canada, and the U.S. West Coast.

Pacific Fishing Magazine conducted a survey of its subscribers in May, 1984 delving into their personal lives. The results were printed in the March issue and reported of the primarily commercial fishing audience "[you are] so committed to fishing of some kind that when you are not fishing for a living, you're fishing for recreation." The sport fishery has steadily grown since that time and now caters not only to off-duty commercial fishers, residents, and the occasional visitor, but to an ever increasing tourist trade. This year, there were 2,500 sport charter operations in Alaska, Canada, and the U.S. West Coast.



Sport charter companies line the spit in Homer, Alaska.

Although the IPHC must approve regulations relating to bag limits or total harvest (Area 2A only) in the sport fishery, catch statistics and reporting are maintained by the respective state agencies and F&O in Canada. The U.S. West Coast is the only area in which there is an overall sport fishing catch limit. Although the allocation issue has been heating up for the past several years between commercial and sport interests, both British Columbia and Alaska fishers are currently regulated only by bag and possession limits.

ADF&G implemented a logbook program for sport charter operators in Alaska this year.

The only regulatory change in Alaska and British Columbia concerned the issuance of IPHC sport charter licenses. The information collected was not a reflection of active operations, so commissioners voted to discontinue this requirement. ADF&G implemented a logbook program for sport charter operators in Alaska this year to supplement catch estimates and in reviewing potential local depletion issues.

WASHINGTON, OREGON, AND CALIFORNIA

In Area 2A, the halibut pie has to stretch a long way. At the 1998 Annual Meeting, the Commission approved an overall catch limit of 820,000

Sub-area	Average weight
WA north coast	15.9
WA south coast	13.8
Columbia River	20.2
OR central coast	21.0
OR south coast	25.5
California	N/A

pounds which the PFMC then allocated to sport, treaty Indian, and non-treaty commercial users. Sport interests received 364,039 pounds, and managed to catch 382,991 pounds, 5% over the allotment. Average size of halibut ranged widely by subarea as shown in the table. All areas reflected a decline in average size from 1997. For more detailed information about the Area 2A sport fishery, refer to Appendix III.

BRITISH COLUMBIA

The lack of a current estimate of sport harvest from British Columbia continues to be of concern to IPHC. The agency charged with collecting the information, F&O, has faced drastic budget cuts in the past several years, and has been unable to establish a scientifically-based estimation procedure. In some cases, existing monitoring has also been discontinued. The Commission has asked F&O to make these estimates a priority. In the meantime, IPHC scientists continue to use average catch numbers from the F&O Tidal Diary program collected between 1987 and 1992. These numbers are then expanded to total catches using the average weight from the ADF&G creel census for northern Area 2B, and WDF&W average weights from the Neah Bay sampling program for southern Area 2B. The only specific catch data available is the amount of fish caught in Canadian waters by U.S. fishers and landed in Washington's Neah Bay; 10,371 fish weighing in at 184,195 pounds. The resulting sport fish estimate used in the stock assessment for 1998 was 660,000 pounds, but is likely inaccurate.

BUMPER CROP IN ALASKA

Overall Alaskan sport catch was an estimated 7.5 million pounds in 1997.

Record catches were enjoyed in 1997, and preliminary estimates for 1998 suggest another prosperous year. Estimates of sport catch from Alaska come from a postal survey and lags the current fishery by one year. Overall sport catch for 1997 is estimated at nearly 7.5 million pounds.

In southeast Alaska (Area 2C), the sport harvest increased 12% both in poundage and numbers caught compared to 1996. Average weight varied by port and ranged from as low as 14.8 pounds in Craig to as high as 32.8 pounds in Petersburg-Wrangell. The 1998 catch is expected to be even higher based on the fact that the average weight appears to have increased over 1997.

The central Gulf of Alaska (Area 3A) also showed an increase in 1997 of 9% in numbers and 17% in weight from 1996. Some of the increase is attributed to a change in estimation procedure, but not all. The average

weight varied from 15.4 pounds in Deep Creek to 30.6 pounds in Valdez. The 1998 catch is expected to drop slightly.

The catch in the western Gulf (Area 3B) increased by about 27% from 1996, but is relatively small overall. Most of the activity is concentrated in two areas - Sand Point and Popof Strait. The 1998 catch is expected to drop slightly.

Halibut weighing 300 pounds or more are not uncommon in the Bering Sea and Aleutian Islands, making sport fishing in these areas one of Alaska's best kept secrets.

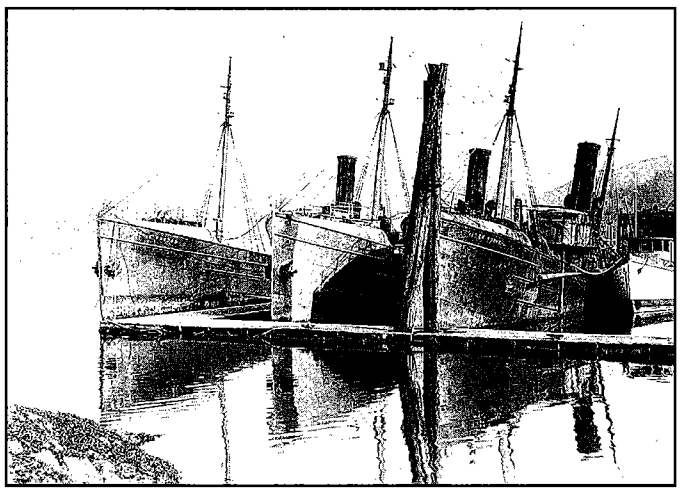
Sport fishing in the Bering Sea and Aleutian Islands (Area 4) is one of Alaska's best kept secrets. Fish weighing 300 pounds, live weight, are not uncommon in these areas, particularly in Dutch Harbor/Unalaska. Overall catch is small relative to the Gulf areas and remained about the same in 1997 compared to 1996. Estimates for the area may be artificially low for two reasons. First, fishers in remote locations may not be licensed. Second, catch is calculated using actual numbers caught, and then applying an average weight from Kodiak Island samples. Conversations with charter operators and other anecdotal information suggests that the average weight could actually be much higher.

SHOW ME THE WAY HOME: NON-RETAINED HALIBUT CATCH IN THE COMMERCIAL FISHERY

PILOT HOUSE LOG BOOK

LOG OF STEAMER	DATE	FROM	TO
Andrew Kelly	*Aug. 25th, 1920*	*Prince Rupert*	*Fishing*

TIME BY CLOCK	NAME OF HEADLAND OR PLACE	PILOT HOUSE COMPASS	WEATHER
2.00 a.m.	*Set out 10 skates SSW*		
2.20 a.m.	*Gear overboard*		
6.00 a.m.	*Started to haul gear. Parted the gear. Left 9 skates out. Blowing a gale from ENE*		
6.00 p.m.	*Jogging ExS. Still blowing. Big sea running.*		
8.00 p.m.	*Wind moderating, heavy cross sea. Rain and misty weather. Jogging East.*		
12.05 a.m.	*August 26th. Steamed one half hour WNW, sounded got no bottom.*		
2.00 a.m.	*30 minutes NW, no bottom.*		
3.00 a.m.	*30 minutes NW, no bottom, drifted. Trying to locate our lost gear.*		
6.00 a.m.	*Gave it up for lost. Weather getting worse, wind increasing.*		
6.30 a.m.	*Started to steam for Cape Spencer with heavy sea.*		



From left: Steamers *C.E. Foster, Andrew Kelly,* and *James Carruthers* in Rupert Harbor, circa 1920.

Non-retained halibut catch or "waste" happens when halibut are caught during the commercial fishery but discarded for some reason - either intentionally or by accident. A large fraction will survive when returned to the sea, and we consider both the survival and the mortality in our calculations. There are several different reasons

Individual quota share fisheries in Canada and the U.S. have drastically reduced waste compared with the derby fisheries.

why a fish might not be brought to port. One reason is that the fish might be caught on lost or abandoned gear and never recovered. Also, during normal fishing operations a fraction of the fish caught are under-sized (<82 cm or 32 in) and have to be discarded. Regulations are in place to ensure that they are released gently so the maximum number will survive the ordeal, but in spite of gentle handling a portion of them still die. A third removal is when too much gear is set and all the fish from the string is released or fish in poor market condition are released outright. This last removal is not yet included in the stock assessment, but is being examined by Commission scientists. Although this waste is as old as the fishery itself, it wasn't routinely figured into the stock assessment until 1986. The good news is that the individual quota fisheries in Canada and the U.S. have drastically reduced wastage compared with the derby fisheries.

LOST OR ABANDONED GEAR

The IPHC port samplers collect logbook information throughout the year at designated ports. The amount of gear lost or abandoned is extracted from this information or is received from mailed-in fishing logs. Fishery wide estimates are then achieved by extrapolating from the qualified logbook data to the total catch values. Only legal sized fish are included in the stock assessment and sub-legal fish are considered when setting exploitation rates.

This removal was first calculated in 1985 and is the ratio of effective skates lost to effective skates hauled, then multiplied by total catch. In 1998, both snap and fixed hook gear is included for all areas where in previous years both gears were not used. Although the ratios in Areas 2B and 3A increased this year from 1997 values, they were still lower than prior to the IQ fishery. Ratios in Area 2C remained the same and in other areas decreased slightly. An estimated 359,000 pounds of legal-sized halibut was killed by lost or abandoned gear in 1998 representing an overall increase of 26% from 1997.

DISCARDING UNDERSIZED HALIBUT

The amount of undersized halibut caught and released during the commercial fishery is figured using the ratio of sub-legal to legal pounds caught during the IPHC setline surveys. Of those, IPHC scientists figure that about 16% of them die. A estimated total of 1.598 million pounds was killed this year. Area 3A was the only area with a decrease. It is important to note that this figure does not reflect good or bad fishing practices, but rather is the product of a higher biomass and catch limit in 1998.

BRINGING HOME THE BACON: PERSONAL USE

Most removals from the halibut population are estimated using logbooks, fish tickets, or other quantitative measures. However, a component without good data to pin down an estimate is personal use, encompassing removals from the stock that are either legal removals or unrecorded personal use. Personal use has been estimated since 1991, and each year IPHC scientists gain a piece of knowledge to fit into the puzzle. This year, we estimated that 726,000 pounds were taken in these fisheries.

This year, the IPHC estimated personal use fish removals to be 726,000 pounds.

WASHINGTON, OREGON, CALIFORNIA

The Area 2A overall catch limit set by the IPHC and allocated to user groups by the PFMC accounts for all known removals to the stock. A personal use fishery in this area is the treaty Indian ceremonial and subsistence harvest which totaled 15,000 pounds in 1998, and is accounted for elsewhere in the stock assessment. Any fish taken home by commercial fishers is accounted for on the state fish ticket.

BRITISH COLUMBIA

All personal use take-home fish caught during the Area 2B IVQ commercial fishery is monitored at offloading and included in the fish ticket. However, personal use fish caught by First Nations in BC is not a component of the commercial fishery monitoring programs. The Government of Canada has embarked on a treaty negotiation process with First Nations in Area 2B. One component of this process will be the development of formal allocation agreements on fisheries resources. It is the intent of this process to develop monitoring programs to implement these agreements. Until these agreements are in place the F&O has estimated First Nations' personal use removals at a fixed level of 300,000 pounds.

ALASKA

As in Canada, all take-home fish from IFQ fishing vessels is recorded on the fish ticket at the time of offload and is accounted for elsewhere in the stock assessment. There are however, several other removals in the personal use category.

At the 1998 Annual Meeting, the Commission gave permission for Area 4E Community Development Quota (CDQ) fishers to retain under-sized halibut for personal use while conducting the CDQ fishery. The groups involved agreed to supply statistics with the help of ADF&G, and an estimated 3,400 pounds was taken this year.

Area 4E CDQ fishers were granted permission by the IPHC at the 1998 Annual Meeting to keep for personal use, any undersized halibut caught.

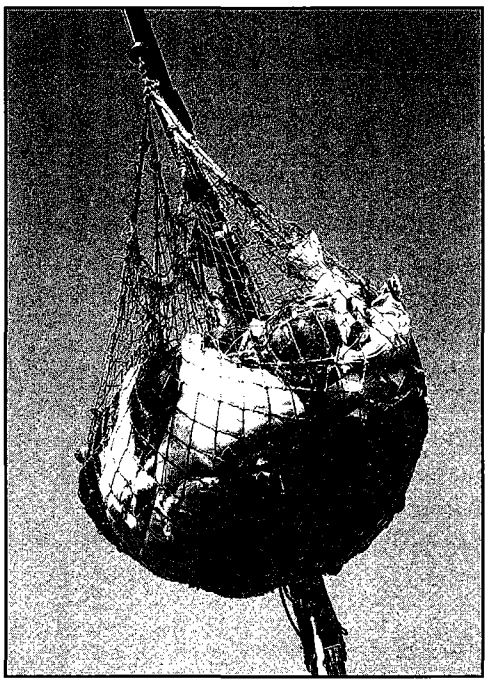
In an ongoing difference between Alaska and the U.S. government concerning Alaska subsistence harvest, biologists and managers from the U.S. government, state of Alaska, and the NPFMC met to assemble data and conclusions on subsistence. NPFMC analysts determined that they could not distinguish among sport, personal use, and subsistence harvest, as these categories had not been defined. Interviews of rural households provided halibut usage obtained from commercial take-home, other non-commercial gear, and rod and reel. While other non-commercial gear landings are clearly subsistence practices, the rod and reel gear category is not so clear-cut. Fish in this category can belong either to the personal use or sport categories. For IPHC purposes, the other non-commercial gear and a portion of the rod and reel estimated to be not represented in direct sport harvest estimates, add up to the personal use harvest. Total personal use removals estimated by the NPFMC for Alaska, not counting the Area 4E CDQ fishery, was 427,000 pounds for 1998.

STOCK ASSESSMENT: LOOKING BACK TO THE FUTURE

Nov. 22 - Thanksgiving Day but no turkey for us. We are bucking slowly into a howling Easterly wind. 04:00 - 76 miles from C. Spencer. 08:00 - 59 miles from C. Spencer. 12:30 - Still jogging slowly - don't know if we are making any headway. We had hoped to be at C. Spencer by 10:00 today. At this rate we will be lucky to reach there by that time tomorrow. 24:00 - Wind 80 mph!

Excerpt from Commission research charter logbook - F/V *Pacific*, 1956

Commission biologists go into the field every year to gather information for the stock assessment scientists to mull over. The halibut stock assessment is at the core of this successful fishery that has lasted over 100 years. Without it, there would be no way to tell how much fish could be caught without damaging the resource.



Unloading the F/V *Ocean Viking* while on a research charter with the IPHC in 1991.

Stock assessment has become more sophisticated over the years but has yet to achieve perfection. Nature is always willing to throw a curve ball just when we think we have it all figured out. Each year, the IPHC scientists assess the abundance of the halibut population using all available information from the commercial fishery and scientific surveys. The best picture of abundance for a particular year-class actually occurs after it has moved completely through the fishery — hindsight is 20/20 — but IPHC scientists must work on a real-time basis and do not have the luxury of waiting. In the meantime, several tools are employed to help develop an accurate snapshot of what's happening in the north Pacific.

THE NUTS AND BOLTS: ASSESSMENT METHODS

From 1982 through 1994, stock size was estimated by fitting a population model to commercial catch-at-age data (the amount of fish caught belonging to each age group in each year) and CPUE. In the early 1990s, it became apparent that age-specific selectivity — the assumption that age is the deciding factor on whether a fish will take the hook — in the commercial fishery had shifted as a result of a decline in halibut growth rates. In 1995, an age and length-specific model was developed to help account for the change in growth over time. Survey data were also incorporated which supplied information about younger fish, many of which are smaller than the commercial size limit.

A young biologist named W.F. Thompson first had the idea to collect logbook information in 1914 while on assignment with the Canadian government to collect as much information as possible about the halibut fishery. Logbooks are a very important piece of the assessment puzzle even today. Incidentally, Mr. Thompson went on to become the first Executive Director of the Commission.

The constant age stock assessment model generally produces lower biomass estimates than the constant length model.

At first, the model assumed that *survey* catchability and length-specific selectivity were constant, while *commercial* catchability and selectivity were allowed to change. However, the survey length-specific selectivity was different when comparing Area 2B with Area 3A, and this suggested that age still played a part. To reflect these revelations, the model has been fitted in two ways: by requiring constant length-specific survey selectivity and by requiring constant age-specific selectivity. As expected, the two variations of the model produce different results, and constant age generally produces lower biomass estimates than constant length. To err on the conservative side, we calculate the constant exploitation yield (CEY — the amount of halibut that can be removed from the population while still leaving enough spawners to replenish the stock) using the age-specific model.

Western Alaskan waters (Areas 3B and 4) present a whole different challenge. Until 1997, the same analytic model was used to estimate Areas 3B and 4 abundance, as was used in other areas. Because there was no historical survey data time series for western Alaska, only commercial fishing data was used. In 1997, the Commission conducted setline surveys in the entire halibut range and found that there were more fish in western Alaska than previously thought. The reason for the discrepancy is almost certainly that the analytic model, when fitted with the commercial data alone, only estimated the size of the exploited population — that portion of the stock that is fished. Considering many parts of western Alaskan waters are fished lightly or not at all, this renders a substantial part of the population invisible to the model, but not to the surveys.

In light of the survey results, we began estimating the stock size a different way in Areas 3B and 4. The procedure now is to calculate analytic

estimates for Area 3A as described above, then scale that estimate by survey estimates of relative abundance (based on CPUE and bottom area) in Area 3B and 4 to obtain absolute estimates for the western areas. In 1997 the sum of the Areas 2A through 3A were used as the reference point, but only Area 3A was used in 1998 since the catch rates there are more comparable to catch rates in the west.

OLD AGE AND NATURAL CAUSES

Information on the amount of halibut killed from human causes such as commercial fishing is gathered and included when figuring stock abundance. But what about the fish that die from natural causes? In order to accurately calculate the stock abundance each year, those removals must also be accounted for.

Since the 1960s, IPHC scientists have used a natural mortality rate of 0.20 — that is, we assumed that 20% of the entire population of halibut dies each year due to natural causes. The figure of 20% is the midpoint of a wide range of estimates calculated by a variety of methods. Unfortunately, on an exploited stock such as halibut, it is nearly impossible to get an accurate accounting of natural mortality because it gets confused with fishing mortality. So scientists analyzed age composition data from the western Aleutians (Area 4B) since it is likely the least exploited stock in the halibut range. The results showed a total mortality (including fishing and natural) of about 0.24 which indicated that the natural mortality was lower than the current figure of 0.20.

IPHC biologist, Calvin Blood getting ready to sample a large halibut aboard the chartered F/V *Judi B.*

It is nearly impossible to assess natural mortality on an exploited stock like halibut, so IPHC scientists looked at the least exploited component of the stock - those fish in the western Aleutians.

Although hard to pinpoint, the natural mortality rate has a number of important effects on both stock size estimates and harvest rate evaluations. This year, IPHC scientists conducted an analysis of the various effects of error in the estimate of natural mortality and concluded that an overestimate could in some circumstances lead to gross overestimates of stock size, while an underestimate is less hazardous. That finding, along with the indications that natural mortality is less than 0.20 in Area 4B, led the staff to adopt a working value of 0.15 (15% mortality) for the stock assessment model.

The optimum harvest rate is also affected by the value of natural mortality used in the harvest rate evaluations, but it is much less sensitive than the stock size estimates. The Commission presently uses a 20% harvest rate, meaning that 20% of the total exploitable biomass is allowed to be harvested while leaving enough fish to replenish the stock. This rate is the bottom end of the range of 20-30% recommended on the basis of the last evaluation, done with a natural mortality rate of 0.20. Repeating the analysis with a 0.15 natural mortality rate would probably lower the whole range by a percentage or two, but 20% exploitation would still be near the low end and it is therefore still suitable for use in calculating estimates of setline CEY.

The IPHC staff adopted a working natural mortality rate of .15, down from the .20 used previously.

STRIKE A POSE: SNAPSHOT OF STOCK CONDITIONS

Each year's catch data is added to the wealth of information already collected, bringing the big picture into slightly better focus. This year, stock conditions were obtained by using the age-specific model in Areas 2 and 3A. All areas showed the dramatic increase in recruitment (at age 8) in the mid-1980s that resulted from the climate change of 1976/77, and the resulting build-up of stock biomass to the present high levels. The large 1987 year-class started showing up in the fishery several years ago and seems to be making a significant contribution in Area 2, but appears much weaker in Area 3A. All areas have shown a recent decline in recruitment, but the last few years of recruitment estimates are uncertain in all areas, and the size of the decrease in Area 3A is particularly questionable. Recruitment may have peaked and declined, but it is too early to say.

In spite of a decline in growth, the overall exploitable biomass is at near-record levels.

In spite of a decline in growth (explained below), the overall exploitable biomass is at near-record levels. At the end of 1998, the exploitable biomass was estimated to be about 568 million pounds. IPHC scientists then apply the 20% exploitation rate, subtract all removals from the fishery including sport, legal-sized bycatch, personal use, and waste, then recommend a setline CEY based on the result. Although recent setline CEYs have been at near record levels, it is unlikely that they will remain this

Otolith of a 46-year-old female halibut caught near Agattu Island in the western Aleutian Islands.

high. Scientists predict an average of about 65 million pounds per year over the long term.

I'M THIS BIG!

Estimating the size and age of halibut is at the heart of the stock assessment. Both in the field and at home in Seattle, IPHC biologists work year-round to provide this information to the stock assessment scientists. Simply put, halibut are getting smaller. Eight year-old halibut have decreased in average length by about 15% and in average weight by about 35% since the 1970s. The decline in 8-year old growth is consistent among areas. Older fish — in this case 16-year-olds — showed the same relative decline in growth as the 8 year olds in Areas 2A and 2B, but a much larger decline in Area 3A. These results suggest that all areas are affected by some factor or factors influencing juvenile growth, while the more northerly areas have been particularly affected by some other factor or factors acting on fish older than 8 years.

1998 otoliths	# Aged
IPHC grid survey	8,531
NMFS trawl survey	1,191
Commercial fishery	14,395
Sport fishery	3,000
Tag recoveries	99

Where are the 11-year-old fish	
Area	% of the commercial catch
2A	32%
2B	22%
2C	23%
3A	14%
3B	19%
4A	39%
4B	24%
4C	51%
4D	31%

IPHC scientists believe that there may be several factors influencing both juvenile and adult growth.

To determine the age of a halibut, the otolith (or ear bone) is looked at under a dissecting microscope and the rings are counted — one ring corresponds to each year of age. In 1998, a total of 27,216 otoliths were aged from all sources combined. IPHC scientists aged all of the otoliths except for the sport fish which were aged by ADF&G biologists.

The average halibut in the commercial fishery this year was 12.6 years old and measured 105.2 cm (41.4 in.). The large 1987 year-class has been the most abundant in the commercial catch since 1996, when they were 9-year-olds. As 11-year-olds in 1998, they accounted for 26.7% of the catch with the 1986 and 1988 year classes in hot pursuit comprising 11.2% and 14.9% of the catch, respectively.

The oldest and youngest halibut in this year's market sample — those fish sampled from the commercial fishery — were 42 years old and 5 years old, respectively. The 42-year-old came from Area 4B which has the highest percentage of fish over 26 years. Five 5-year-olds were sampled, and four of those came from Area 2B.

A LOOK AT THE GRID SURVEYS

An integral part of the stock assessment is the information collected on the grid surveys. A large amount of information was collected in both 1997 and 1998 to give scientists a glimpse into the age structure of the stock.

A whopping 14,775 otoliths were aged from the 1997 surveys. The youngest fish was a 3-year-old female caught in Southeast Alaska and the oldest was a 52-year-old male caught in the western Aleutians. Of all the areas surveyed, the U.S. west coast (Area 2A) had the youngest average age of only 9 years and one of the smallest average sizes at 91 cm (36 in) long. The western Aleutians (Area 4B) caught the oldest fish on average at 13 years, but southeast Alaska (Area 2C) caught the largest fish on average measuring in at 100 cm (39 in).

A 46 year-old female halibut caught off Agattu Island in Area 4B during the setline survey this year set an age record as the oldest female halibut to date.

Areas 2A, 4C, and 4D were not surveyed in 1998. Although some fish are caught on these surveys, not enough are caught to pay for the operation. In light of budget constraints, the Commission was unable to conduct the surveys. However, the other areas were surveyed and IPHC scientists believe they paint a fairly accurate picture of the overall age structure. A total of 8,531 otoliths were aged this year. The youngest fish caught were four-year-olds, found in several areas. The oldest fish caught this year was also a record. A 46-year-old female halibut was caught in June off Agattu Island in Area 4B. The previous age record for a female halibut was 42 years. Both the average length and average age are smaller than those found in the commercial fishery which is to be expected since the survey encompasses all fish caught, and commercial catch is only those larger than 81 cm (32 in). For more information about how the otoliths and length information was collected, see the Survey section in this volume.

Grid surveys						
	Average length		Average age		# of otoliths aged	
Area	1997	1998	1997	1998	1997	1998
2A	91	-	9	-	1,090	-
2B	93	91	11	11	2,472	1,224
2C	100	99	11	12	1,654	883
3A	94	95	12	12	1,888	1,830
3B	91	94	12	13	2,061	1,998
4A	92	94	12	13	1,921	2,076
4B	99	102	13	15	2,218	520
4C	93	-	11	-	495	-
4D	92	-	12	-	976	-
All areas	94	95	12	12	14,775	8,531

UNWELCOME BOUNTY: INCIDENTAL CATCH

"In dealing with the North Pacific fisheries problems we shall be mindful of our responsibility for the preservation of vital fishing resources... We shall hope for the same understanding from other nations."

John F. Kennedy, 1963

Bycatch, or incidental catch, of halibut first hit the spotlight in the 1960s. Japanese trawl vessels caught and killed millions of pounds of halibut while targeting groundfish. Canadian and U.S. fishers saw this as a threat to their livelihood and began a movement to control it. Since that time, bycatch management has become more and more complex. Regional councils in the U.S. and F&O in Canada govern incidentally caught halibut. Although the IPHC has no jurisdiction over other fisheries that catch halibut , the Commission formed a work group in 1990 to help the Councils and F&O find solutions for decreasing bycatch, and to set goals for reduction.

Both countries have brought bycatch under control with various management tools such as seasonal allocations in the U.S. and individual bycatch quotas in Canada. In fact, Canada has substantially exceeded the reduction goal set in 1990. Although the U.S. has not met the Work Group reduction goal, bycatch has declined slowly. The Commission believes that more progress in bycatch reduction is required in U.S. fisheries. Several additional management tools are currently being discussed at the Council level and to facilitate continuing cooperation between the two bodies, the Commission and the NPFMC have met annually for the past two years to discuss this and other common issues.

HOW MANY ACTUALLY DIE?

Estimates of incidentally caught halibut come from NMFS and F&O observer data.

For stock assessment purposes, the mortality of those caught (the amount of fish removed from the population) is the important figure. Halibut is a hearty fish and many will live after being caught and subsequently discarded. The estimates are based on information collected by NMFS and F&O observers during the various fisheries, which are then analyzed by agency and IPHC staff. In the few cases where fishery observations are unavailable (the shrimp trawl and crab pot fisheries off Alaska, for example), survey research information is used. Mortality in a few of the Canadian fisheries such as sablefish pot and rockfish longline, is largely unknown, but F&O is working on providing those estimates in the future. Observer information for the Area 2A domestic fisheries is lacking. IPHC staff, state and federal agencies have recently established methodology for estimating bycatch using commercial fishery logbook information and results from gear

experiments. Estimates are now being calculated every three years, coinciding with NMFS trawl surveys of the area.

An estimated 13.1 million pounds of bycatch died in 1998, a 3% reduction from 1997 and a 35% reduction from 1992. The bulk of the decrease is due to IFQs in the Alaskan sablefish fishery and individual vessel bycatch quotas (IVBQs) in the Canadian trawl fishery.

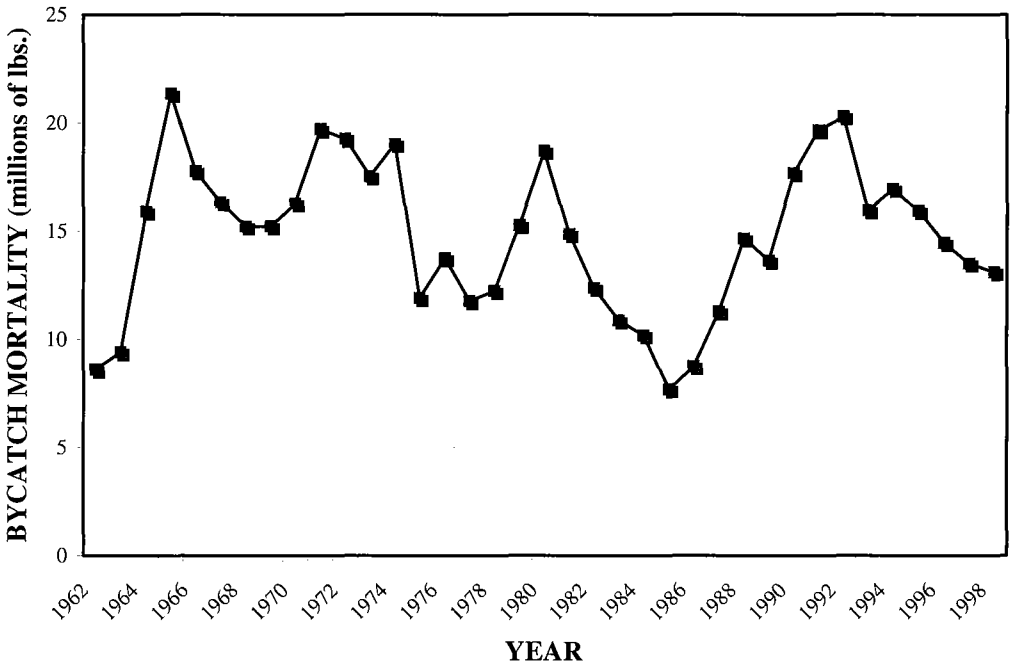


Figure 2. Pacific halibut bycatch mortality (millions of pounds, net weight) for the years 1962 to 1998.

In 1998, an estimated 12.9 million pounds of fish were removed as bycatch from the population in U.S. waters.

United States

Most fisheries in the U.S. have a halibut bycatch mortality cap — that is, when a fishing fleet reaches a certain mortality level, the entire fishery is shut down. In order to spread effort over a longer period of time, many of the groundfish fisheries are split into seasons complete with seasonal caps. In 1998, an estimated 12.9 million pounds of fish were removed from the population in U.S. waters. The Bering Sea (Area 4) had by far the highest amount, weighing in at 7.6 million pounds; a still-substantial amount of 4.3 million pounds was caught in Area 3. Much of the bycatch mortality in Southeast Alaska (Area 2C) has been eliminated with the introduction of the IFQs. Only a minor amount of trawling occurs in that area, and mostly in the inside waters in state-managed fisheries for flatfish.

Although 7.6 million pounds caught and killed in Area 4 is substantial, it represents a reduction of 4% from 1997. There were fewer killed in the trawl fishery this year because neither the cod nor pollock fisheries reached their bycatch cap. In the past, both fisheries routinely reached the cap and were shut down prior to being able to harvest all their groundfish.

Although 7.6 million pounds of halibut caught and killed in Area 4 is substantial, it represents a reduction of 4% from 1997.

Canada

In 1998, British Columbia was in its third year of an Individual Vessel Bycatch Quota (IVBQ) program — that means that each trawl vessel can catch and discard only a pre-set amount of halibut bycatch. The onus is on the fisher to find ways to keep halibut bycatch at bay while being able to harvest the full allotment of groundfish. The system has proven very effective and although Canada's fisheries are run much differently than U.S. fisheries, managers from both countries have met periodically to compare ideas.

In 1995, the Area 2B bycatch mortality was more than 1.5 million pounds. Since the start of the IVBQ program, mortality has consistently been below 300,000 pounds, and in 1998, the figure was 243,000 pounds.

U.S. fishery managers have met with Canadian managers to compare ideas about how to reduce bycatch.

WHAT'S NEXT?

Bycatch management reaches across several forums from the Commission to the Councils to F&O. Many groundfish stocks are thriving right now and halibut harvests are at near record levels which makes halibut bycatch seem like less of a problem. However, resource managers know that populations naturally fluctuate and this time of abundance will not last forever. To that end, the Commission maintained its directive to pursue avenues of reducing bycatch in 1998.

Canada continued to manage its trawl fisheries off British Columbia with the IVBQ program, and is expected to continue in the foreseeable future. However, the shrimp trawl fishery has not been monitored in the past. In 1998, F&O initiated an examination of their shrimp fishery and results are expected to be announced in 1999.

The U.S. Councils and NMFS continue to pursue four major programs in the Alaskan fisheries, and two others for fisheries off the west coast. In Alaska, the most promising is the work underway by the NPFMC on a vessel bycatch account (VBA) program. The NPFMC's VBA committee, composed of fishing industry members, met in early 1998 to finalize their recommendations. Following review by the NPFMC, the committee was given the go-ahead to draw up a straw-man proposal.

In 1998, the NPFMC adopted a regulation which prohibits bottom trawls in the Bering Sea pollock fishery. Midwater, or pelagic trawls, will still be allowed and experienced fishers know how to set them close to the bottom. However, the larger mesh sizes required in the pelagic nets should help to reduce bycatch. Halibut savings is expected to be about 166,000

pounds (100 metric tons, round weight) and the NPFMC has reduced the 1999 trawl halibut mortality cap by that amount.

The American Fisheries Act, or Senate Bill 1221 (SB1221) as it became known, was passed in 1998. Although it does not specifically address bycatch, it allows for fishery cooperatives in the pollock fishery. Not only will each cooperative receive a pollock allocation, but a halibut bycatch allocation as well; putting fishers back in the driver's seat so they can figure out their own ways to reduce bycatch without worrying that someone else will catch their target. In addition, SB1221 set up a vessel buyback fund of $95 million to remove nine vessels from the fleet.

Off the west coast, the PFMC is proceeding with the industry voluntary observer program and the Oregon Department of Fish and Wildlife enhanced logbook program. The observer program has been underway for three years, but the expectation is that coverage has been too low to provide much in the way of meaningful information useful to managers.

DONATING HALIBUT TO THE HUNGRY

Slightly less than 20,000 pounds of halibut was processed for food banks through a bycatch utilization program administered by Northwest Food Strategies Inc.

Several years ago, a philanthropic organization known as Northwest Food Strategies Inc. (NFS) requested that the Commission allow them to obtain incidentally caught halibut for food banks. After serious consideration, the Commission granted the request with the stipulation that only fish from Bering Sea shore-based trawlers who can not sort at sea could be used. NFS still had to conform to several NMFS regulations before the program could get underway. This year, the program saw its first halibut in mid-summer. Slightly less than 20,000 pounds was processed for food banks through this program, although a maximum of 50,000 pounds is allowed annually.

TESTING THE LIMITS: ASSESSING THE DISCARD MORTALITY

Halibut mortality rates, or the amount of halibut that die, in the groundfish fisheries is figured using observer data. The observers assign a code of either dead, poor, or excellent to each fish in a sample based on pre-determined criteria. IPHC scientists then assign rates to each category of fitness to arrive at an overall mortality for the fishery. In 1995, a tagging experiment took place to investigate the accuracy of the current condition codes and the mortality rate assigned to each one for the bottom trawl fishery. It takes several years to get enough data from a tagging experiment before we can begin looking at results.

Whereas tagging experiments study long-term survival, the University of Washington Fisheries Research Institute (UW/FRI) conducted another experiment simultaneously to study short term survival. Fish for that experiment were held in pens for up to five days after capture and from that, the UW/FRI was able to develop a short-term survival model for discarded halibut bycatch. However, IPHC scientists believe that up to 20% of bycatch

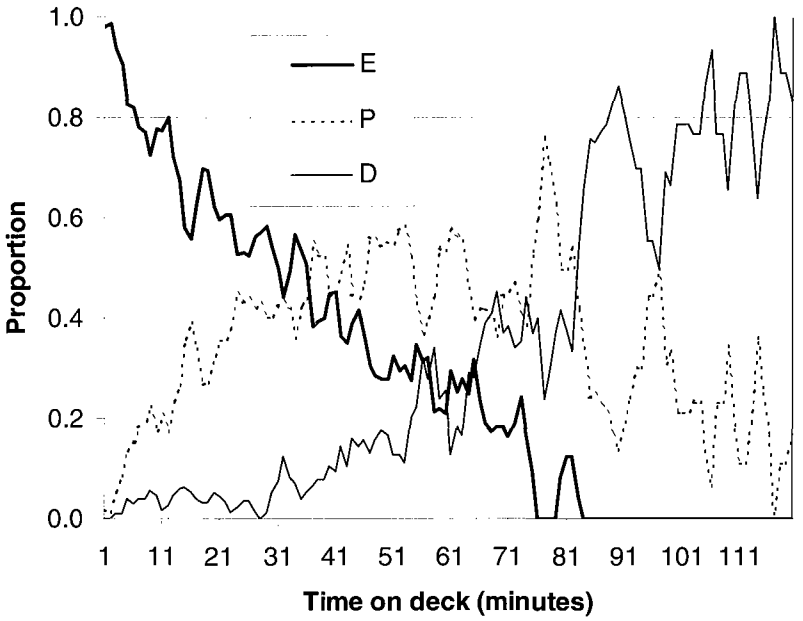


Figure 3. Condition of halibut after a 60 minute tow vs. time on deck.

mortality happens in the long term and this was the question that we hoped to have answered by the tagging experiment.

The 1995 experiment took place aboard a bottom trawl vessel. A total of 4,852 halibut were tagged during 15 days of fishing. The average halibut was about 63 cm in length, but ranged from 20 to 162 cm. Approximately equal numbers of halibut were tagged in each of the three condition categories; excellent, poor, and dead.

The results so far have been disappointing. A total of 105 tags have been returned, and that includes 32 tags which were recaptured by our chartered vessel during the tag release operation.

It is unclear why tag returns from the trawl fleet were so low. Special efforts were made to inform the trawl fleet of the IPHC experiment and its intent. In addition, IPHC port samplers and NMFS observers were asked to keep an eye out for them. The intent of the experiment, to compare long-term mortality estimated from tagging to short-term mortality estimated from the pens, cannot be accomplished with the current data set. The topic of whether to go ahead and adopt the short-term survival criteria will be debated in the future.

Only 105 tags have been recovered so far from more than 4,800 released during a trawl experiment in 1995. Scientists are disappointed and unable to explain the low return rate.

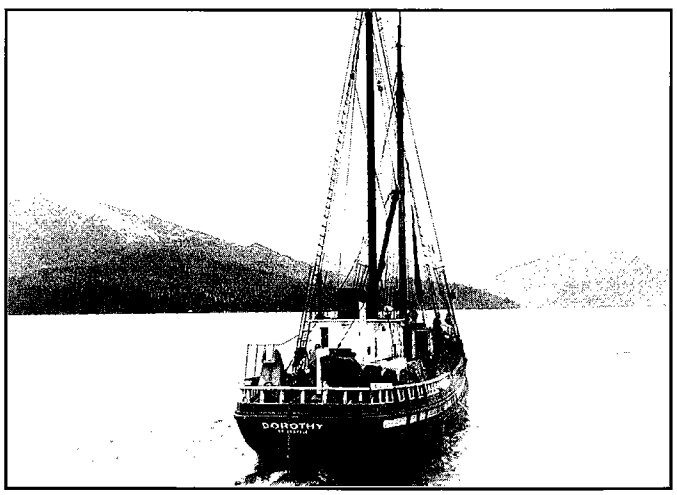
SURVEY SAYS... 1998 ENDEAVORS

"Struck ledge ESE Sisters about 1/4 mile. The mate had just come to pilot house and was exchanging watches with Captain. The vessel raised about 3 ft for 'd and heavy jolt experienced. Took small list to port and rested with no grinding. Put out two dories. There was no leak anywhere and we came off as the tide rose at 6 am. Decided to examine her at Port Althorp. Too much swell here to beach.

Put vessel's nose on beach but at low tide did not see any damage. The water was not out far enough however. I and Captain were satisfied as to the condition but one of the crew was very uneasy so I ordered the vessel to be properly beached as I believed that the idea of going out would have to be unanimous. We beached at 10 pm and examined her at about 4 am. Just a small portion of the shoe was splintered. The rest of the keel and planks were unhurt. The blow had struck on the steel covered prow. Note: I did not communicate with Seattle as press would hear of it and exploit a minor accident maybe unfavorable to Commission and no doubt the same to Captain."

F.H.B. [F. Heward Bell]
Excerpt from Commission research logbook, *F/V Dorothy* - November 4-5, 1927

Experiences like this one were not uncommon in 1927 aboard IPHC research chartered vessels. These days radar, better charts, and sophisticated systems able to pinpoint a vessel's global position within 10 feet not only make sea life more comfortable, but also allow us to conduct precise surveys of the halibut grounds.



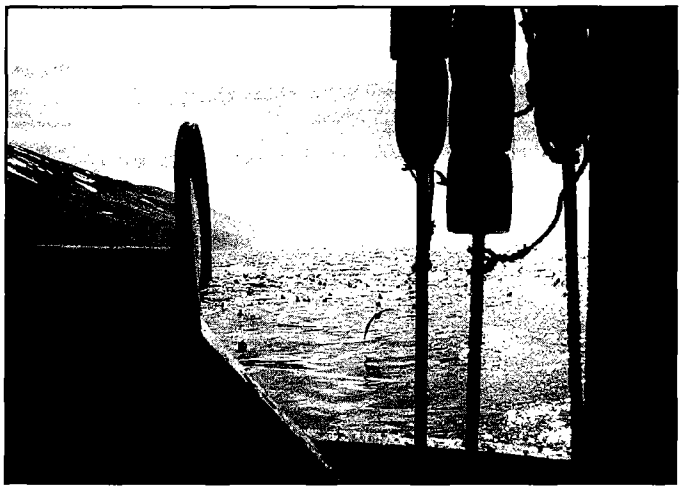
F/V *Dorothy* - circa 1927.

This year the Commission

conducted a standardized setline survey and also participated in the NMFS Bering Sea and West Coast trawl surveys. Data from these surveys is used in the stock assessment as a fishery independent source of age structure information for the halibut population.

GRIDLOCK: THE STANDARDIZED SETLINE SURVEY

The stock assessment survey is a means of providing IPHC scientists with catch information and biological data independent from the commercial fishery. This data is a valuable piece of the stock assessment in Areas 2 and 3A and invaluable in Areas 3B and 4 (for more information about how the data is used, see the Stock Assessment section in this report). Vessels are chartered then staffed with two IPHC biologists. The vessels fish a grid of stations in an assigned area while standardizing as many aspects of the fishing operation as possible; things such as bait type, bait size, and gear. By standardizing the fishing operation, scientists can compare results survey to survey, area to area, and year to year.



A view off Gareloi Island in the Aleutians from the stern of the F/V *Trident* while on charter with the IPHC.

The IPHC staff continued the 5-year cycle of comprehensive stock assessment surveys in 1998.

Biologists on board then sample the fish for otoliths, length, gender, maturity, and whether or not the fish has a healing injury from being hooked prior to the survey.

How it's Done

This year was the second in a five-year series of comprehensive surveys. The 1997 operation was considered a success, but taught the survey organizers some lessons which they were able to use for improvement in 1998. The majority of the funding for the surveys as well as other scientific investigations comes from the selling of legal-sized halibut from the IPHC fishing operations. Surveys had traditionally been conducted in areas with high catches, but when the Commission decided to expand the area in 1997 out to the entire range of halibut, the current way of doing business proved too costly.

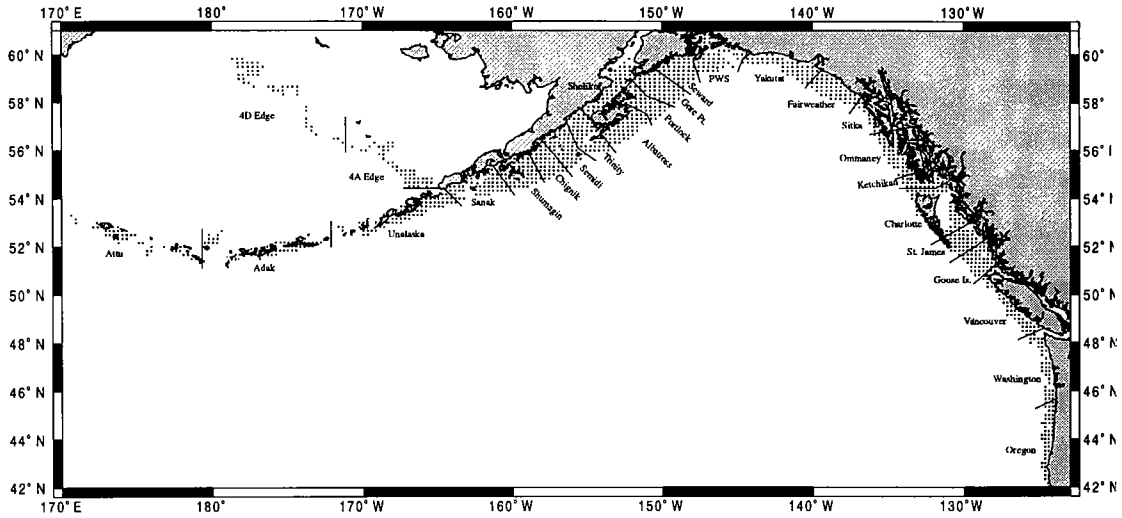


Figure 4. A map showing fishing stations in the stock assessment survey. (Some stations were not fished in 1998 due to cost contraints.)

The survey design was changed from a triangular pattern to a square grid to help streamline the fishing process and reduce costs.

Several options were discussed to help offset the loss of doing surveys in all areas, and in light of a severe financial crisis in 1998, the Commission did three things. First, the survey design was changed from a triangular design where vessels were forced to fish four stations a day, to a square grid where any number of stations could be fished in a day. The second change was to add gear set at each station. Instead of six standard skates set at each station, there were seven. Not only did this yield additional fish for sale, but increased the amount of information collected in the data set. Still not breaking even, and only as a last resort, the Commission dropped the highest cost areas from the 1998 survey altogether; those being in the Bering Sea (Area 4D edge), the U.S. West Coast (Area 2A), and the west side of Vancouver Island (part of southern Area 2B).

Additional measures were taken to decrease costs, which included buying all the bait needed ahead of time (about 300,000 pounds) and shipping it to ports where the vessels were most likely to sell their catch and pick up supplies for the next trip. Another change was in the selling of the fish, giving more responsibility to the biologists in the field and the vessel captains. Unfortunately for fishers and the Commission alike in 1998, the bottom fell out of the halibut market and the research vessels received an average of only $1.12 per pound, well below the price expected. In spite of working at a loss most of the season, the IPHC completed all of Area 2B (except the west coast of Vancouver Island), 2C, 3A, 3B, 4A, and most of 4B.

Boats and Skates, Catches and Rates

Fifteen vessels ranging in size from 55 to 122 feet in length were selected through a bid process early in the year to carryout the surveys. Between May 28th and September 9th, these vessels attempted 1045 stations and completed 1022 stations.

A total of 1022 stations were completed this year.

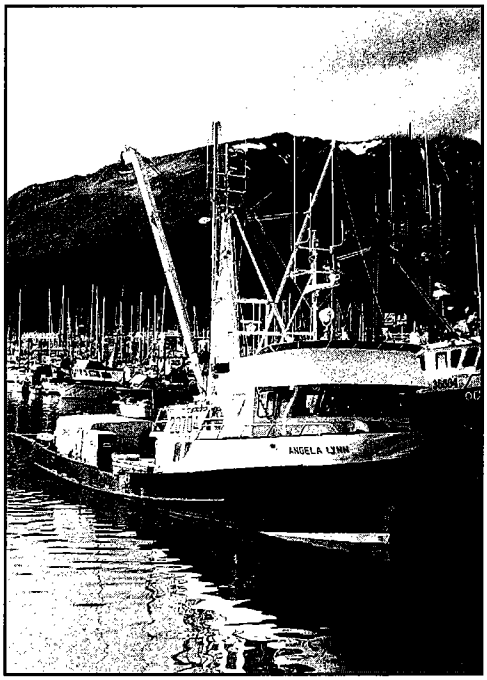
Vessel	Home port	Stations completed
Angela Lynn	Vancouver, B.C.	85
Bold Pursuit	Comox, B.C.	142
Defiant	Kodiak, Alaska	94
Elizabeth F.	Kodiak, Alaska	45
Kristiana	Seattle, Washington	91
Lualda	Seattle, Washington	48
Ocean Viking	Pender Harbor, B.C.	39
Pacific Sun	Newport, Oregon	61
Sand Island	Port Orchard, Washington	31
Taasinge	Kodiak, Alaska	44
Tradition	Kodiak, Alaska	85
Tyanaa	Campbell River, B.C.	42
Venturous	Delta, B.C.	82
Western Sunrise	Comox, B.C.	46
Zenith	Seattle, Washington	87

Seven standard skates (each 1800 feet long) were set at each station location and were fitted with 100 gangions and size 16/0 circle hooks each set 18 feet apart. Number two semi-brite or comparable quality salmon was used for bait. Except for the increase in number of skates fished at each station, the gear is the same as that used in previous surveys. Catch per unit of effort — that is the amount of fish in pounds caught per standard unit of gear (skate) — dropped from 1997 in Areas 2B, 2C, and 3A, but increased in Areas 3B and 4. This same trend in catch per effort is reflected in the commercial fishery.

The goal in 1998 was to collect a minimum of 2,000 otoliths per regulatory area. This is the number that the stock assessment scientists believe give us the best look at the distribution of ages in a given area. The decrease in catch per effort in the Gulf was a surprise,

Area	Survey catch per effort (lbs/skate)	Halibut sold (lbs)
2B	94	75,407
2C	224	181,033
3A	282	650,560
3B	438	650,057
4A	293	196,320
4B	216	96,821
Total		**1,850,198**

and the sampling rate was too low to acquire the full 2,000 per area in Areas 2 and 3A. However, IPHC scientists believe that the number collected will be enough to paint a fairly accurate picture of the population (To see specifically how many otoliths were collected in each area, see the section titled, "A Look at the Grid Surveys" earlier in this volume). By the end of the summer, 9,472 otoliths had been collected from the surveys altogether of which 8,531 were aged.



Among other tasks, biologists assess maturity of individual fish.

F/V *Angela Lynn* in Seward, Alaska while on charter with the IPHC.

Every fish brought aboard a charter survey vessel is measured for length. The length is converted to weight and those figures are used for the catch per effort calculations. All of the legal-sized and all of the undersized halibut kept for otolith sampling were also examined for gender type and maturity stage. Maturity was broken down into four categories for female halibut (immature, ripening, ripe/spawning, spent/resting) and two categories for males (immature, and mature). An "immature" rating for both genders means that the fish will probably not participate in the upcoming winter spawning whereas the other stages represent various stages of maturity and those fish could possibly participate. From this information, scientists can make educated assumptions regarding maturity in relation to age and how it changes over time.

HITCHING A RIDE ON THE WEST COAST TRAWL SURVEY

An IPHC biologist joined NMFS scientists aboard the West Coast trawl survey.

While the IPHC conducts its hook and line surveys, the NMFS is busy conducting standardized surveys with trawl gear. Each year, the NMFS charters commercial trawl vessels to survey one of three different areas of the north Pacific, including the West Coast, the Gulf of Alaska, and the Aleutian Islands. That way, each area is surveyed every three years. This year, it was the West coast's turn, so two chartered vessels — F/V *Dominator* and F/V *Vesteraalen* — surveyed the coast from Point Conception, California to southwest Vancouver Island, B.C. The IPHC put a biologist aboard the *Dominator* in Eureka, California (beginning of the second trip) on June 26 to gather information about halibut in the area. The survey lasted until August 7.

The halibut caught with trawl gear tend to be smaller than those caught with hook and line, giving IPHC scientists a glimpse of what's to

F/V *Vesteraalen* while on charter with NMFS. Photo taken by IPHC sea-sampler, Scott Casey.

come in the commercial fishery. The West Coast is unique in that it is the southern most part of the range for halibut , and there are no known nursery grounds. Although the overall numbers are lower, the halibut caught are more likely to be mature and tend to be a little bigger than those caught in other area trawl surveys.

The survey covered depths ranging from 30 to 273 fathoms (55 to 500 m), and was organized in east/west track lines with stations spaced 10 nautical miles apart. Sensory equipment was placed on the trawl to record how the net was fishing and at what depth and temperature. The IPHC biologist sampled all the halibut caught on one vessel for length, otoliths, gender, maturity stage, and evidence of hooking injuries — the same information gathered on the setline surveys.

A total of 328 halibut were caught and sampled from 201 tows. About an equal number of males and females were caught — 168 and 160, respectively. The average size of the males was 81 cm and 89 cm for the females. Only about 8% of the females and 16% of the males were immature — the rest appeared to be preparing for the upcoming winter spawning season.

Sampling halibut on the NMFS trawl survey.

As expected, the majority of both male and female halibut were considered mature and were possibly preparing for the upcoming spawning season.

SURVEYING THE BABIES OF THE BERING SEA

Although the other areas are surveyed by trawl gear only

once every three years, the Bering Sea is surveyed by the NMFS annually. This year the IPHC put a biologist aboard one of two NMFS chartered vessels to collect halibut information — the F/V *Arcturus* for the first two trips and the F/V *Aldebaran* for the last trip. Whereas fish caught in the west coast trawl survey are usually larger than average, the fish caught in the Bering Sea survey tend to be smaller than average because of the presence of nursery grounds in the area.

Whereas fish caught in the west coast trawl survey are usually larger than average, the fish caught in the Bering Sea survey tend to be smaller than average because of the presence of nursery grounds in the area.

The survey spanned a geographical region from the eastern Bering Sea continental shelf from inner Bristol Bay to the shelf break, and between Unimak Pass to north of St. Matthew Island. The stations were selected using a 20-nautical mile square grid in depths ranging from 30 to 200 fathoms (55 to 366 m). Gear was standardized and then monitored while fishing with instruments attached to the net. The survey lasted from June 9 to July 29. The vessels fished side by side so that each vessel would get a representative sample of the entire area. The IPHC biologist sampled all the halibut caught on one vessel for length, otoliths, gender, maturity stage, and evidence of hooking injuries — the same information gathered on the setline surveys.

A total of 903 halibut were caught and sampled in 192 tows — 477 females and 426 males. The average female was 61 cm in length and the average male was 56 cm. Most of the females (96%) and most of the males (91%) were immature and the rest were in various phases of maturity. The otoliths collected will probably be examined sometime in 1999.

FOOL ME TWICE — SHAME ON ME: PRIOR HOOKING INJURIES

On both the setline and trawl surveys, IPHC biologists examined each halibut for hooking injuries sustained prior to the current capture. The investigation was started in 1997 after an increasing number of sport fishers noted healing hooking injuries on the fish they were catching. Evidence shows that halibut, if released with care, can survive capture and release. Therefore, commercial groundfish hook and line and IFQ fishers are not allowed to use hook strippers (a hook clearing device which can severely damage the head and mouth of a fish) when releasing halibut and are required to use one of three methods called Careful Release — these include careful twisting and shaking, hook straightening, and gangion cutting. The presence of severe wounds from a previous capture could indicate compliance problems with the Careful Release regulation or that one or more of the approved methods is not producing the benefit expected. A fish sustaining a severe injury can survive for an extended time, but IPHC scientists believe that both feeding and reproduction are affected.

A fish sustaining a severe injury can survive for an extended time, but IPHC scientists believe that both feeding and reproduction are affected.

Last year biologists were instructed to indicate simply the presence or absence of a previous hooking injury, but in 1998 the categories were expanded to indicate the severity of the wound. Fifteen different setline survey operations and two trawl survey operations took part, examining over 108,000 halibut. Overall, about 6% of the halibut on the setline surveys and west coast trawl survey, and about 7% on the Bering Sea trawl survey

showed evidence of prior hooking injury. The statistic in itself is unremarkable, but when examined by area, some interesting patterns begin to develop.

Southeast Alaska (Area 2C) showed an increase of 40% in prior hooking injuries over the 1997 values. The western Aleutians (Area 4B) showed a decrease of 30%, but a whopping 80% of those had moderate to severe injuries, compared to all the other areas which indicated the majority of injuries to be minor to moderate. The Bering Sea as a whole had the highest prior injury incidence at about 11% overall. As noted above, the Bering Sea trawl survey indicated a much lower rate of 7% — an expected result since many of the fish caught in the trawl survey are not yet large enough to be captured by hook and line. The lowest incidence of prior injury was 4% in British Columbia (Area 2B). This is the only area coastwide where hook strippers are not allowed aboard commercial groundfish vessels. Although the information is interesting, it will take several more years before conclusions can be drawn.

Halibut caught on the IPHC grid survey has a healed injury from a previous capture.

The Bering Sea showed the highest incidence of prior hooking injuries at 11% overall.

SCIENCE IS FIRST COMMON SENSE: BIOLOGICAL RESEARCH

"Science is first common sense, and in a way, the discoveries of the fisherman are science in an elemental state - as far as the fishermen are able to carry it. So that the first effort of the scientist is to acquaint himself with those elemental facts."

W.F. Thompson notes - March 8, 1915

Although just a young biologist at the time, W.F. Thompson's notes capture a philosophy of the Commission still valued today. The IPHC looks to industry regularly for input, and this year there was something for everyone as the staff investigated industry-related as well as pure scientific issues.

Climate change and its effects on fishery stocks is of concern to everyone, so the IPHC staff worked closely with other agencies and scientists to create a comprehensive set of information. Of direct interest to halibut fishers were experiments involving bait effectiveness as well as the effectiveness of bird avoidance devices now required in all groundfish fisheries. Of interest to industry were investigations exploring the incidence of "chalky" halibut — a condition which leaves the flesh dry and coarse. From a more pure scientific perspective, the DNA and early life history investigations progressed as well.

IPHC scientists conducted several special experiments at sea this year in search of ways to reduce survey costs without sacrificing information.

FINDING THE ELEMENTAL FACTS

IPHC setline surveys are designed in such a way as to standardize as many aspects as possible so that results can be compared across areas and years. Budgets are tight everywhere and the Commission is no exception so some important questions were asked about the surveys — can a less expensive grade of bait be used or possibly smaller pieces on each hook? — are there ways to piggy-back on other agency setline surveys where gear used is not consistent with halibut gear? — how important is hook size and spacing? In order to take full advantage of the field experiments, the IPHC also conducted a pilot project concerning bird avoidance devices in conjunction with other work.

Bait Experiments

Bait size was examined on nine separate vessel trips. Four-ounce chum salmon (the size used on the setline surveys) was chosen as the

standard against other sizes of bait which included 2, 3, 6, 7 and 8 oz sizes. Although not always the case, the general trend was that when two sizes of bait were compared, the catch per effort (amount of halibut caught per skate of gear) was higher for the larger baits.

Bait quality was tested using four different grades of bait. In most cases there was a definite trend for one bait to out-fish the other, but the better bait was not always the most expensive. In five trials, dark chum salmon out-fished semi-brite chum by 20 percent or more, they fished about the same in two trials, and in two cases, the semi-brite out-fished the dark. In most cases, bait batches were from widely different sources, but in one of the trials, care was taken to get both darks and semi-brites from the same source. That was one case where the semi-brites out-fished the darks.

A large fluctuation in the fishing power of same grade bait could mean that there are other criteria that IPHC should use to standardize the bait used on IPHC surveys.

Science is sometimes fickle but experiments are just as important for the questions that are asked as for those that are answered. Very interesting results came from comparing batches of the same grade bait but from different sources. In two trials, one batch consistently produced higher catches than the other batch of comparable quality. A large fluctuation in the fishing power of same grade bait could mean that there are other criteria that IPHC should use to standardize the bait used on IPHC surveys. Biologists plan to investigate this further in 1999.

Gear Experiments

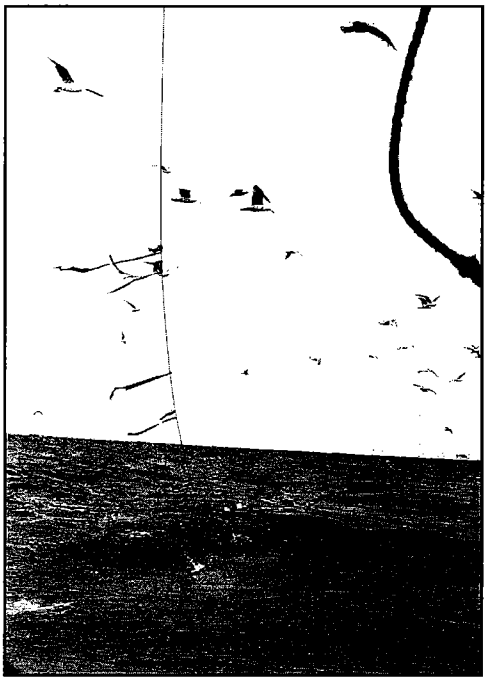
Different hook sizes were compared in four separate trials. The hooks were placed 18 feet apart (standard halibut gear) and consisted of the standard 16/0 hook compared to smaller hooks — 13/0 and 14/0. In three of the four trials, the larger hooks resulted in a larger overall catch per effort. Looking more closely, it is clear that the smaller hooks tended to catch more smaller fish (sublegal to about the 20 pound range) and the larger hooks tended to catch more larger fish (over 40 pound range).

Gear comparisons were also made between sablefish gear (smaller hooks and hook spacing) and halibut gear. The results have not yet been analyzed.

Do Sea-bird Avoidance Techniques Really Work?

In 1973 the Short-tailed albatross was placed on the endangered species list. Albatross and other sea-birds dive on longline baits as the gear is deployed and sometimes get caught and subsequently drown. If the groundfish fishery kills four short-tailed albatross in two years, the fishery may be shut down. The limit for the halibut fishery is two birds in two years. Needless to say, efforts are underway by several groups to develop methods of keeping birds off the gear. With special permission from the U.S. Fish and Wildlife Service and ADF&G, the IPHC staff conducted a pilot project to assess the efficiency of bird avoidance methods in conjunction with the gear experiments.

Attacks were about double on gear where no bird bag was towed compared to when a bag was used.



Trying out a bird avoidance device called a Tori Line on the F/V *Trident* during an IPHC research charter.

A bird bag (a buoy towed from the stern of the vessel and positioned over or near the longline to scare sea-birds during gear deployment) was used as a bird avoidance method for this project. Sets were made alternating between using a bird bag and using no avoidance method. A large part of the experiment was to also determine the area in which the birds are vulnerable to being hooked on the gear before it sinks.

Several types of birds were observed around the vessel including northern fulmars, laysan and black-footed albatross, shearwaters, and various types of gulls. Fortunately, no birds were actually captured. Attacks occurred from shortly after the bait entered the water to about 70 m (230 ft) aft of the vessel. Attacks were about double on the gear with no bird bag compared to when the bag was used.

This year's project was a pilot to a much larger proposal. Commission scientists are seeking outside funding for the continuation of the project.

JUST ANOTHER FISH IN THE SEA: FISHERIES OCEANOGRAPHY

The ENSO and the PDO are two climatic forces of particular interest to fishery scientists of the north Pacific.

This marked the second year of an ongoing project to examine the influence of climate variability on Pacific halibut biology. Growth and recruitment are of particular interest to IPHC scientists since both strongly affect the stock assessment. In 1998, several research projects were conducted to study the link between atmospheric and oceanic changes and marine populations.

Two climatic forces are of particular interest. El Niño Southern Oscillation (ENSO) events occur every two to five years with episodes lasting 12 to 18 months. The impact is strongest in the tropics and diminishes with latitude. This year, North American coastal sea surface temperatures were analyzed yielding an index that differed from traditional ENSO indices in that it indexed events based on the strength of their northern (as opposed to equatorial) impacts. The new index is termed "Niño North." The Pacific Decadal Oscillation (PDO) is the other climatic event of interest and is

identified with temporal differences spanning several decades. In the 20th century, the PDO has alternated between warm and cool phases every twenty to thirty years also called regime shifts. It takes several years to determine when a regime shift has occurred, and the last confirmed one on record occurred in 1977.

The IPHC does not have the funds to carry on an independent full-scale oceanography research program. One scientist was hired to conduct oceanographic work and to join a network of other scientists and organizations doing similar research. In 1998, four meetings were hosted by the IPHC, bringing together 25 northwest scientists working on similar projects. At these meetings, specific evidence of climatic and biological change in both 1997 and 1998 were brought forth with the goal of establishing whether a regime shift occurred in the early 1990s.

The hope is that by identifying factors that influence what makes a big or small year-class, scientists can better project what future stock sizes will be.

At the heart of the staff's involvement in oceanography research is assessing the influence that the current population size has on future population sizes, versus outside influences not related to population size such as currents, sea temperature, and salinity. The hope is that by identifying factors that influence what makes a big or small year-class, scientists can better project what future stock sizes will be.

Commission scientists and scientists from other agencies have found that north Pacific and Bering Sea fishery stocks such as most salmonids and some flatfish have displayed a relationship between recruitment and the PDO over the past 70 years. Other groundfish stocks such as Atka mackerel, Pacific cod, Pacific hake, and walleye pollock display a stronger relationship with Niño North. Both these findings suggest that climatic forces play an important role in governing year-class strength of northeast Pacific marine fish stocks.

Most environmental oceanographic investigations deal with surface characteristics and do not take near ocean bottom conditions into account. Since Pacific halibut is a bottom dweller, part of the challenge is gathering together all the available information on its demersal environment. By the end of 1998 nearly 145,000 observations of eight hydrographic variables (dissolved oxygen, nitrate, nitrite, phosphates, pH, salinity, silicates, and temperature) taken within 15 m of the ocean floor were gathered into one database. The additions this year included 35 years of Russian bottom trawl temperature data and an update of National Oceanic Data Center hydrocasts.

Most environmental oceanographic investigations deal with surface characteristics, but IPHC scientists are working to gather ocean bottom information as it pertains more closely to halibut.

The projects are slated to continue. In the meantime, updated information can be found on a set of websites:

www.iphc.washington.edu:80/PAGES/IPHC/Staff/hare/html/decadal/decadal.html
www.iphc.washington.edu:80/PAGES/IPHC/Staff/hare/html/papers/OBT/obt.html
www.iphc.washington.edu:80/PAGES/IPHC/Staff/hare/html/decadal/post1977/post1977.html
www.iphc.washington.edu:80/PAGES/IPHC/Staff/hare/html/1997ENSO/1997ENSO.html

OTOLITHS, NOT JUST FOR AGING: TRACKING ENVIRONMENTAL CHANGES

Bottom temperature is one of the gauges used to track decadal shifts in the environment (as explained in the previous section). This year the IPHC, F&O, and NMFS collaborated on a project to examine the chemical composition of halibut otoliths. The calcium carbonate that makes up the otolith contains two forms of oxygen isotopes, and the ratio of one form to the other depends on the temperature at the time of otolith growth zone formation. The lower the value, the warmer the water, and the higher the value, the colder the water. Halibut otoliths have two distinct growth zones for each year (corresponding to winter and summer) and so a single otolith has the potential to provide information over the years of its growth. As it turns out, the IPHC may be in possession of unique materials needed to track bottom temperature in the Gulf of Alaska and Bering Sea over the past 70 years, since all otoliths ever aged by commission scientists are stored safely at the IPHC office.

As it turns out, the IPHC may be in possession of unique materials needed to track bottom temperature in the Gulf of Alaska and Bering Sea over the past 70 years.

In 1998, three different phases of the project were conducted. For all the studies, otoliths from 13-year-old halibut were used. We first examined all the growth zones on a number of otoliths from halibut captured in 1980 and 1993 to see if it was possible to detect the assumed movement of juvenile halibut from warmer inshore waters to cooler offshore habitats as they got older. The otoliths did indeed catalogue the journey, and in fact showed differences between the two years of study.

The second part of the project was to look at whether it was possible to detect area differences; in this case detect differences between fish caught in the Bering Sea/Aleutian Islands and the Gulf of Alaska. The water in the Bering Sea/Aleutian Islands tends to be colder than in the Gulf. Several otoliths from Area 4A and Area 3A fish which had been tagged and released from 1985 to 1997 were examined. Only the last few adult growth zones on each otolith were looked at so there would be no confusion between the differences among juvenile vs adult halibut noted, with any area differences. The otoliths from Area 4A displayed higher isotope ratios than those from Area 3A, supporting the concept that area temperature differences are detectable by this method.

Previous studies from salmon and halibut production conclude that regime shifts of ocean environments occur at decadal scales. The third phase of the project was to look at whether isotope ratio differences corresponded with regime shifts. Scientists know that a regime shift occurred in 1977 and suspect that another occurred around 1990. The isotope study indicates support for both of these shifts. More work is scheduled for 1999.

YOU WIN SOME, YOU LOSE SOME: EARLY LIFE HISTORY

Science is always a gamble. Sometimes the results are a surprise and once in a while something unforeseen along the way can stall the efforts. The IPHC early life history project was an investigation targeted at raising

halibut from the larval to the juvenile stages under various experimental conditions. The hope was that the information could eventually lead scientists to a better understanding of what determines strong and weak year-classes.

At the January, 1997 Annual Meeting, the commissioners took a hard look at the project and its progress. Having already spent a good deal of research funds supporting the project, and realizing that the budget would be strained over the next several years, the Commission stipulated that to receive further funding, the project must raise halibut larvae through metamorphosis in 1997. A water quality failure killed all the halibut larvae in the lab about two weeks before the anticipated beginning of metamorphosis. In light of the near-miss, the Commission granted one more year of funding with the same stipulation. When the project failed to achieve metamorphosis of halibut larvae again in 1998, the Commission discontinued the project.

COULD THERE BE AN ERASER FOR THE CHALKY CONDITION IN HALIBUT?

Chalky condition is when the flesh of a halibut becomes opaque and course in texture. Although there is no danger in consuming the affected meat, the product looks undesirable and can be difficult to sell to the consumer. The condition is difficult to detect during the offload since much of the halibut sold at the dock is left whole until it reaches a secondary market. In some cases, chalkiness is not detected until several days or even weeks later if frozen. Each year, chalky halibut results in a monetary loss to fish buyers, especially in the southern most areas. In response to industry requests, this year the Commission staff continued the project started in 1996 to investigate the incidence of the chalky condition.

Nine incidents of chalky halibut were reported during the year from five respondents amounting to about 12,000 pounds of fish.

The efforts in 1998 focused on a series of surveys conducted by mail and the IPHC port samplers to document each occurrence of chalky halibut. Following the close of the season in November, questionnaires were sent to media, fisher's groups, and all individuals who bought halibut the previous year. Due to poor response from Area 2A (Washington, Oregon, and California) a phone survey was conducted to a number of Area 2A buyers in early December.

Only nine incident reports were received during the year from five different respondents. Just over 12,000 pounds was reported on these forms with .25 to 20 percent of the individual catch affected. The latter report was also the largest single chalky load reported, with 8,000 pounds in one delivery. In all cases, the fish had been dressed at sea and well chilled when delivered.

The end of year survey yielded 27 responses representing 58 million pounds, substantially more than received last year. A total of 324,000 pounds — or .56 percent — was reported chalky.

Only two written surveys were received from Area 2A, so the IPHC staff conducted a phone survey late in the year. Nine companies were contacted which handled more than 130,000 pounds. About 2 percent or 3,100 pounds was reported chalky.

The general trend suggested by the 1996 and 1997 surveys appears to continue. The overall incidence of chalkiness is about 0.5 to 1.0 percent with a higher incidence in the southern most regions, although all regions show some chalkiness. Anecdotal evidence indicates that chalkiness occurs most often in what appears to be exhausted fish — lactic acid builds up in the tissue. While proper handling of setline halibut may reduce the development of chalkiness, in no case is there any indication that fish handling can stop or reverse the development of chalkiness once the fish dies in an exhausted state.

The overall incidence of chalkiness is about 0.5 to 1.0 percent with a higher incidence in the southern most regions, although all regions show some chalkiness.

The IPHC is planning to discontinue the mail survey since three years of data have revealed similar results. IPHC scientists have suggested that industry work with a food technology lab or university to develop a tool to identify fish on the dock which have the potential to become chalky — perhaps a specialized pH meter inserted in the tissue would be all that's needed.

FAMILY OR NEIGHBORS: GENETIC VARIATION IN PACIFIC HALIBUT

Scientists have been debating for years whether halibut of the north Pacific and Bering Sea are one big soup or a number of distinct populations. This year brought us closer to the answer through examination of halibut DNA. Every living thing has a distinct genetic code, but within a species, certain parts of the code are constant — take for instance the part of the halibut DNA that instructs the eyes to migrate so that they are both on the same side of the head. Just as there are distinct markers within species, there are also codes that are distinct within groups of a given species. Those are the codes that tell us if there are isolated populations — and those are the codes that scientists have tried to isolate in halibut.

Scientists are working to isolate genetic markers which can differentiate between populations of halibut from different areas.

Wallace W. Hinderer from the F/V *Rachel Louise* holds a "pinto" fish in Chignik, Alaska.

The first job was to find the part of the DNA that distinguished between populations — if there are indeed distinct populations. A technique was used to identify genetic markers — otherwise called simple sequence repeats — that could be used to compare fish from

different areas. After some intensive work, scientist identified three markers for the study.

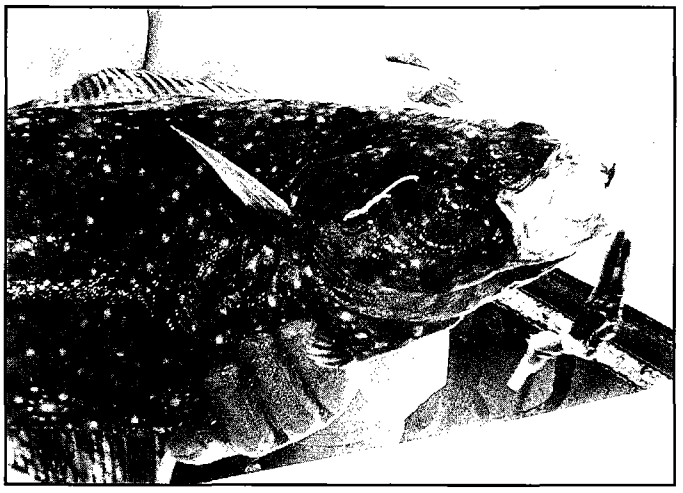
Over the past two years, 605 fin samples were taken from five geographic regions — Russia, Bering Sea, Gulf of Alaska, Washington, and the Atlantic Ocean. Two different preservatives were used, and unfortunately, one of the preservatives thought to be safe ended up destroying a large number of the samples. On the bright side, samples from all regions except the Bering Sea were salvaged for the project and in the end, 358 samples were used for the study.

The two most geographically distinct samples of Pacific halibut were from Washington state and Russia which differed by two out of three markers. Differences were also found at one marker between the Gulf of Alaska and Russia, but there was no difference between Washington state and the Gulf of Alaska populations. The results suggest that halibut populations are structured by distance on oceanic scales, such that populations that are closer to each other are more likely to mingle.

In the last two months of 1998, IPHC scientists conducted winter research charters to obtain samples from halibut on the spawning grounds.

The research so far is a beginning, but has some downfalls. First, additional markers need to be identified in order to do a more in-depth analysis. Second, new Bering Sea samples will need to be taken. Third, all the samples were collected during the summer months. Through tagging studies, halibut are known to migrate long distances between summer feeding grounds and winter spawning areas. The best time to sample halibut would be during the reproductive season. So in November and December of this year, the IPHC conducted the first winter research charter since 1983 to carry out data and sample collections for several different projects including this one. Some interesting results are sure to come.

TAGGING, YOU'RE IT!



IPHC halibut tag.

Tags are a tool often used by scientists to glean information about an animal's migratory habits or to assess handling impacts among other things. For a highly migratory fish like halibut, tags are an effective way to assess survival from fishing impacts as well as track migration patterns. The IPHC has used

tags since the 1920s for various endeavors. The way it works is this — the fish is captured and tagged, information about the fish is recorded, and the fish is released. All fishers in the industry know to watch for tagged fish when encountering halibut, and are urged to keep the tag, record the catch location, depth, and time of capture, and return the information to the IPHC.

The only fish tagged this year were during two sport programs where the tags are from the IPHC, but the programs are actually administered by another group. The Homer Derby Association holds a halibut sport fishing contest each year where fish are caught, tagged, and released. The sport fisher bringing in a tagged fish wins a prize. This year, the derby tagged 67 fish in Cook Inlet, Alaska. The second program involves sport charter operators who voluntarily catch and release fish instead of keeping them. Details of the program can be found in the sport fishery section of this volume.

There are currently four experiments conducted from 1988 through 1995 which still regularly yield tag returns.

Since halibut are a long-lived animal, tagged fish can remain at large for several years before being captured again. There are currently four experiments from 1988 through 1995 which still regularly yield tag returns. The Sitka Spot experiment in 1988 was testing local depletion; the central Oregon experiment in 1989 studied migratory patterns; the longline mortality study conducted in 1993-94 was an effort to assess Careful Release methods and the long term mortality of each; and the trawl mortality experiment in 1995 was an effort to assess observer condition codes and the resulting mortality of each condition category. (Further explanation of the mortality studies can be found in the bycatch section of this report.) Tag returns from most of the experiments have been acceptable except for the trawl study. IPHC researchers believe that returns for the 1995 experiment are artificially low but have yet to determine why.

Experiment	Release year	Number Released	Number Recovered	Recovery rate
Sitka spot	88	2652	1245	47%
Central Oregon	89	2118	621	29%
Longline mortality	93	3800	260	7%
Longline mortality	94	9296	747	8%
Trawl mortality	95	4852	105	2%

Tag returns in 1998 dropped from 1997. A total of 201 tags were redeemed this year compared to 325 last year. Kodiak, Alaska had the most recoveries with 95 tags and Homer, Alaska had nearly double the tag returns from the previous year (most likely due to increased activity in this port). By far, the largest number of tag returns came from Area 3A (Central Gulf) where the largest number of releases took place, and the majority of those

were found very close to their release site. Consistent with the southerly migration theory, a number of tagged fish moved from their Alaskan area of release south into British Columbia. Northerly migration was also represented when one fish tagged in central Oregon nine years ago, was captured near Middleton Island in Alaska this year.

SCIENCE AND SPORTS: CHARTERBOAT TAGGING PROGRAM

Tag recovery information indicates that recreational and commercial fisheries likely operate on somewhat different but related components of the stock, which may be good news to those concerned about conflicts on the grounds.

The IPHC sport tagging program adds a new twist to catch-and-release. Started six years ago at the request of sport charter operators with conservation concerns, the program allows sport enthusiasts to capture, tag, and release halibut that would otherwise end up on someone's dinner plate. The tag is printed with a number so release information can be paired up with capture information (if and when the fish is captured again). IPHC scientists use this data to examine migratory patterns.

Sport fishers released 427 tags in 1998, the most since 1994. Area 2C has long been the top release area, but was exceeded in 1998 by both Areas 2A and 3. A total of 46 tags were recovered this year, most by commercial longline and sport fishers. What is the IPHC doing with this information? This program is unique because the releases are done by sport fishers. Sport and commercial users have long been at odds concerning portions of the harvest, but recovery information suggests that the sport industry recovers 1.3 times more tags than commercial interests. Recreational and commercial fisheries likely operate on somewhat different but related components of the stock, which may be good news to those concerned about conflicts on the grounds.

APPENDICES

The tables in Appendix I provide catch information for the 1998 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 1998 seasons, and Appendix III shows the current sport fishing statistics.

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

APPENDIX I.

Table 1. Commercial catch of Pacific halibut by regulatory area (thousands of pounds) for 1994-1998.

Table 2. The total pounds (thousands) of 1998 commercial landings, including research, of Pacific halibut for Alaska and British Columbia by regulatory area and month.

Table 3. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 1998 commercial fishery a) for Area 2B, Alaska, and the Alaskan regulatory areas, and b) Area 2A commercial fisheries not including the treaty Indian commercial fishery.

Table 4. Fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 1998 Pacific halibut commercial fishery.

Table 5. Commercial landings (including research trips) of Pacific halibut by port and country for 1998 (thousands of pounds).

Table 6. Commercial halibut fishery catch (thousands of pounds) in 1998 by country, statistical area, and regulatory area.

APPENDIX II.

Table 1. The fishing period limits (pounds, net weight) used in the 1998 directed commercial halibut fishery in Area 2A.

Table 2. Metlakatla community fishing periods, number of vessels, and halibut catch (pounds, net weight), 1998.

APPENDIX III.

Table 1. Fishing dates, opportunity, size limits, and bag limits for the 1998 Pacific halibut sport fishery.

Table 2. 1998 harvest allocations and estimates (pounds, net-weight) by sub-area within regulatory Area 2A.

Table 3. Harvest by sport fishers (millions of pounds, net-weight) by Regulatory Area, 1977-1998.

APPENDIX I.

Table 1. Commercial catch of Pacific halibut by regulatory area (thousands of pounds) for 1994-1998

REGULATORY AREA	1994	1995	1996	1997	1998
2A	370	297	295	413	460
2B	9,911	9,625	9,557	12,420	13,150
2C	10,379	7,761	8,860	9,920	10,192
3A	24,844	18,342	19,696	24,628	25,703
3B	3,860	3,122	3,662	9,072	11,160
4A	1,803	1,617	1,694	2,907	3,418
4B	2,017	1,680	2,075	3,318	2,901
4C	715	668	680	1,117	1,256
4D	711[1]	643	703	1,152	1,308
4E	120	127	120	251	188
Total	**54,730**	**43,882**	**47,342**	**65,198**	**69,736**

[1] Includes 18,000 pounds in 1994 from Subarea 4D-N.

Table 2. The total pounds (thousands) of 1998 commercial landings, including research, of Pacific halibut for Alaska and British Columbia by regulatory area and month.

Area	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
2A	296	0	4	5	83	59	13	0	0	0	460
2B	1,235	1,837	1,530	1,518	1,926	1,636	1,689	1,181	581	17	13,150
2C	1,084	1,339	1,653	1,648	873	1,192	1,354	584	465	0	10,192
3A	1,294	2,690	4,167	3,514	2,936	3,625	3,212	2,507	1,708	50	25,703
3B	59	453	1,485	1,554	2,170	2,305	1,748	911	475	0	11,160
4A	0	0	254	591	996	718	465	315	79	0	3,418
4B	0	0	122	619	756	701	519	114	70	0	2,901
4C	0	0	0	192	703	203	157	1	0	0	1,256
4D	0	0	8	41	464	426	218	131	20	0	1,308
4E	0	0	9	83	73	6	2	15	0	0	188
Alaska Total	2,437	4,482	7,698	8,242	8,971	9,176	7,675	4,578	2,817	50	56,126
Monthly Total	3,968	6,319	9,232	9,765	10,980	10,871	9,377	5,759	3,398	67	69,736

APPENDIX I.

Table 3a. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 1998 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	3	88	51	129
< 26 ft.	0	0	262	613
26 to 30 ft.	3	52	152	1,082
31 to 35 ft.	21	523	254	4,217
36 to 40 ft.	76	2,164	276	3,818
41 to 45 ft.	85	3,317	225	4,667
46 to 50 ft.	37	2,273	171	5,281
51 to 55 ft.	29	2,324	88	3,571
56 + ft.	35	2,409	329	32,748
Total	289	13,150	1,808	56,126

Overall Vessel Length	Area 2C		Area 3A	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	38	60	10	42
< 26 ft.	90	194	48	92
26 to 30 ft.	68	299	42	172
31 to 35 ft.	104	923	115	1,621
36 to 40 ft.	157	1,727	128	1,658
41 to 45 ft.	122	1,531	137	2,510
46 to 50 ft.	92	1,471	112	2,855
51 to 55 ft.	56	1,340	49	1,440
56 + ft.	129	2,647	261	15,313
Total	856	10,192	902	25,703

Overall Vessel Length	Area 3B		Area 4	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	1	25	3	NA
< 26 ft.	3	12	122	316
26 to 30 ft.	0	0	43	611
31 to 35 ft.	34	557	56	1,116
36 to 40 ft.	31	342	3	90
41 to 45 ft.	36	525	2	NA
46 to 50 ft.	34	686	7	269
51 to 55 ft.	18	491	6	299
56 + ft.	168	8,522	90	6,266
Total	325	11,160	332	9,071

APPENDIX I.

Table 3b. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class for the 1998 Area 2A commercial fisheries. Information shown does not include the treaty Indian commercial fishery.

Overall Vessel Length	Area 2A Directed Commercial		Area 2A Incidental Commercial	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	0	0	2	0.1
< 26 ft.	6	2	6	0.4
26 to 30 ft.	4	<1	6	0.9
31 to 35 ft.	6	2	21	2.8
36 to 40 ft.	25	25	38	4.2
41 to 45 ft.	25	41	21	2.8
46 to 50 ft.	20	33	11	1.2
51 to 55 ft.	8	22	3	0.5
56 + ft.	9	26	1	<0.1
Total	103	152	109	13.0

APPENDIX I.

Table 4. Fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 1998 Pacific halibut commercial fishery.

AREA	FISHING PERIOD	NO. OF DAYS	CATCH LIMIT	COMMERCIAL CATCH	RESEARCH CATCH	TOTAL CATCH
2A treaty Indian	3/15 - 3/20[1]	6	272	295.6	-	295.6
2A Commercial						
Incidental	May – June	61		10.2	-	10.2
	Aug. – Oct.	92	25.3[2]	2.8		2.8
				13.0		13.0
Directed	7/22	10-hours		82.0	-	82.0
	8/12	10-hours		43.0		43.0
	8/26	10-hours		14.5		14.5
	9/23	10-hours		12.0		12.0
			143.6[3]	151.5		151.5
Total			168.9	164.5		164.5
2A Total			440.9	460.1		460.1
2B	3/15 - 11/15	245	13,000[4]	12,895[5]	255	13,150
2C	3/15 - 11/15	245	10,500[7]	9,666[6]	526	10,192
3A	3/15 - 11/15	245	26,000[7]	24,538	1,165	25,703
3B	3/15 - 11/15	245	11,000[7]	10,464	696	11,160
4A	3/15 - 11/15	245	3,500[7]	3,221	197	3,418
4B	3/15 - 11/15	245	3,500[7]	2,788	113	2,901
4C	3/15 - 11/15	245	1,590[7]	1,256		1,256
4D	3/15 - 11/15	245	1,590[7]	1,308		1,308
4E	3/15 - 11/15	245	320[7]	188		188
Alaska Total			58,000	53,429	2,697	56,126
TOTAL			71,440.9	66,784.1	2,952	69,736.1

[1] Different treaty Indian tribes closed on different days, from 3/15 to 3/20.

[2] Pounds were carried over from the incidental to directed commercial catch limit.

[3] Fishing period limits by vessel class.

[4] An additional 33,000 pounds available as carryover from 1997.

[5] Includes the pounds that were landed by Native communal commercial licenses (F licenses).

[6] Includes 11,000 pounds taken by Metlakatla Indians during additional fishing within reservation waters.

[7] Additional net carryover pounds (000's) from the underage/overage program were 2C=216; 3A =393; 3B=84; 4A=43; 4B=51; 4C=13; 4D=4; 4E=0.

APPENDIX I.

Table 5. Commercial landings (including research trips) of Pacific halibut by port and country for 1998 (thousands of pounds).

Port Region	Canada	United States	IPHC Research	Total
California and Oregon		191		191
Seattle		581		581
Bellingham	63	3,472		3,535
Misc. Washington		367		367
Vancouver	3,289		48	3,337
Port Hardy	3,296		198	3,494
Misc. Southern B.C.	1,009			1,009
Prince Rupert	5,038	598	540	6,176
Misc. Northern. B.C.	198			198
Ketchikan, Craig, Metlakatla		1,087	12	1,099
Petersburg, Kake		2,828		2,828
Juneau		1,816	37	1,853
Sitka		3,501	19	3,520
Hoonah, Excursion, Pelican		1,472		1,472
Misc. Southeast Alaska		1,966	23	1,989
Cordova		1,173	190	1,363
Seward		5,436	404	5,840
Homer		10,450	174	10,624
Kenai		256		256
Kodiak		8,531	557	9,088
Misc. Central Alaska		3,810	480	4,290
Akutan & Dutch Harbor		4,617	270	4,887
Bering Sea		1,739		1,739
Totals	**12,893**	**53,891**	**2,952**	**69,736**

APPENDIX I.

Table 6. Commercial halibut fishery catch (thousands of pounds) in 1998 by country, statistical area, and regulatory area.

Stat. Area Group	Catch Commercial	Research	Catch Total	Regulatory Area	Catch for Reg. Area
00-03	152	-	152		
04	13	-	13	2A	460
05	295	-	295		
06	214	-	214		
07	70	-	70		
08	924	-	924		
09	348	4	352		
09 - I	653	8	661		
10 - I	1,499	18	1,517	2B	13,150
10 - O	1,399	-	1,399		
11 - I	1,847	163	2,010		
11 - O	146	2	148		
12 - I	403	5	408		
12 - O	26	-	26		
13 - I	4,714	47	4,761		
13 -O	652	8	660		
14 - I	440	43	483		
14 - O	52	236	288		
15 - I	1,445	24	1,469		
15 - O	498	30	528		
16 - I	2,487	14	2,501	2C	10,192
16 - O	1,531	146	1,677		
17 - I	820	12	832		
17 - O	747	10	757		
18S - I	894	5	899		
18S - O	752	6	758		
18 W	1,739	17	1,756		
19	1,245	40	1,285		
20	1,492	50	1,542		
21	911	19	930		
22	1,097	45	1,142		
23	996	69	1,065	3A	25,703
24	3,364	290	3,654		
25	2,464	135	2,599		
26	3,487	153	3,640		
27	4,112	81	4,193		
28	3,631	266	3,897		
29	4,968	91	5,059		
30	1,496	150	1,646		
31	953	139	1,092		
32	1,848	163	2,011	3B	11,160
33	841	102	943		
34	358	51	409		
35	593	47	640		
36	782	15	797		
37	40	16	56		
38	160	40	200		
40	153	1	154	4	9,071
41	461	12	473		
42+	732	46	778		
Bering Sea	5,840	133	5,973		
Total	66,784	2,952	69,736		69,736

APPENDIX II.

Table 1. The fishing period limits (pounds, net weight) used in the 1998 directed commercial halibut fishery in Area 2A.

VESSEL CLASS		FISHING PERIODS			
LTR	FT	7/22	8/12	8/26	9/23
A	0-25	250	200	200	200
B	26-30	315	230	200	200
C	31-35	505	370	200	235
D	36-40	1,390	1,202	465	650
E	42-45	1,495	1,095	500	695
F	46-50	1,790	1,310	595	835
G	51-55	1,995	1,465	665	930
H	56+	3,000	2,200	1,000	1,400

Table 2. Metlakatla community fishing periods, number of vessels, and halibut catch (pounds, net weight), 1998.

FISHING PERIOD DATES	NUMBER OF VESSELS	CATCH (LBS)
April 17 – 19	1	NA
May 15 – 17	3	885
May 29 – 31	6	2,814
June 19 – 21	3	676
July 3 – 5	2	NA
July 18 – 20	2	NA
August 7 – 9	0	0
August 21 – 23	7	5,290
Sept. 4 - 6	3	517
9 Fishing Periods		11, 587

APPENDIX III.

Table 1. Fishing dates, opportunity, size limits, and bag limits for the 1998 Pacific halibut sport fishery.

Area	Fishing Dates	Days open	Size Limit	Bag Limit
2A				
WA Inside Waters[1]	5/21-8/3	56	No	1
WA North Coast[2]	5/1-7/25	62	No	1
WA South Coast (all depths)[3]	5/3-6/25	40	No	1
WA South Coast (near shore)	6/26-7/9	14	No	1
Columbia River[4]	5/1-9/30	153	Yes	1
OR Central Coast (all depths)[5]	5/14-5/23	6	Yes	2
OR Central Coast (< 30 fathoms)[6]	5/24-8/23	92	Yes	2
OR South Coast (all depths)[7]	5/14-5/23	6	Yes	2
OR South Coast (< 30 fathoms)[8]	5/24-8/23	92	Yes	2
OR Coast[9]	8/7,8, 14	3	Yes	2
California[10]	5/1-9/30	153	Yes	1
2B, 2C, 3 and 4	2/1-12/31	334	No	2

[1] East of Bonilla-Tatoosh Line, closed Tuesday and Wednesday

[2] Bonilla-Tatoosh Line to Queets River, closed Sunday and Monday

[3] Queets River to Leadbetter Point, open 7 days per week

[4] Leadbetter Point to Cape Falcon, open 7 days per week, minimum size limit of 32 inches

[5] Cape Falcon to Siuslaw River, closed Sunday through Wednesday, minimum size limit of 32 inches for the first fish, and 50 inches or greater for the second fish

[6] Cape Falcon to Siuslaw River, inside 30-fathoms, open 7days per week, minimum size limits same as for all depth fishery

[7] Siuslaw River to California/Oregon border, same open days and minimum size limits as in OR Central Coast Fishery (all depths)

[8] Siuslaw River to California/Oregon border, same open days and minimum size limits as in OR Central Coast Fishery (< 30 fathoms)

[9] Cape Falcon to California/Oregon border, same minimum size limits apply

[10] Open 7 days per week, minimum size limit of 32 inches

APPENDIX III.

Table 2. 1998 harvest allocations and estimates (pounds, net-weight) by sub-area within regulatory Area 2A.

Sub Area	Allocation	Catch Estimate
WA Inside Waters	57,191	73,279
WA North Coast	96,052	97,176
WA South Coast (all depths)	36,648	37,030
WA South Coast (near shore)	N/A[1]	N/A
Columbia River	8,565	5,185
OR Central Coast (all depths)	101,566	82,311
OR Central Coast (<30 fathoms)	10,455	1,852
OR South Coast (all depths)	9,462	8,773
OR South Coast (<30 fathoms)	2,365	393
OR Coast	37,341[2]	72,599
California	4,393	4,393
Total	364,038	382,991

[1] The Washington South Coast all depth fishery was restricted to fishing in near shore waters when the harvest was projected to be within 1,000 pounds of the overall quota.

[2]After accounting for underages and overages in previous openings from Cape Falcon to the California border, about 70,000 pounds remained to be harvested.

Table 3. Harvest by sport fishers (millions of pounds, net-weight) by Regulatory Area, 1977-1998.

	AREA						
YEAR	2A	2B	2C	3A	3B	4	TOTAL
1977	0.013	0.017	0.072	0.196			0.298
1978	0.010	0.009	0.082	0.282			0.383
1979	0.015	0.018	0.174	0.365			0.572
1980	0.019	0.011	0.332	0.488			0.850
1981	0.019	0.023	0.318	0.751		0.012	1.123
1982	0.050	0.066	0.489	0.716		0.011	1.332
1983	0.063	0.103	0.553	0.945		0.003	1.667
1984	0.118	0.124	0.621	1.026		0.013	1.902
1985	0.193	0.525	0.682	1.210		0.008	2.618
1986	0.333	0.372	0.730	1.908		0.020	3.363
1987	0.446	0.527	0.780	1.989		0.030	3.772
1988	0.249	0.504	1.076	3.264		0.036	5.129
1989	0.327	0.635	1.559	3.005		0.024	5.550
1990	0.197	0.762	1.330	3.638		0.040	5.967
1991	0.158	0.584	1.654	4.264	0.014	0.127	6.801
1992	0.250	0.580	1.668	3.899	0.029	0.043	6.469
1993	0.246	0.657	1.811	5.265	0.018	0.057	8.054
1994	0.186	0.657	2.001	4.487	0.021	0.042	7.394
1995	0.236	0.657	1.759	4.488	0.022	0.055	7.217
1996	0.229	0.657	1.534	4.822	0.022	0.071	7.335
1997	0.355	0.657	1.714	5.637	0.028	0.072	8.463
1998[1]	0.383	0.657	1.869	5.407	0.023	0.061	8.400

[1] Only Area 2A harvest is current data, all other areas are projected harvests. These projections will be updated when data becomes 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 1998 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 (see Preface).

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3. Determination of the chlorinity of ocean waters. Thomas G. Thompson and Richard Van Cleve. 14 p. (1930).
4. Hydrographic sections and calculated currents in the Gulf of Alaska, 1927 and 1928. George F. McEwen, Thomas G. Thompson, and Richard Van Cleve. 36 p. (1930).
5. History of the Pacific halibut fishery. William F. Thompson and Norman L. Freeman. 61 p. (1930).
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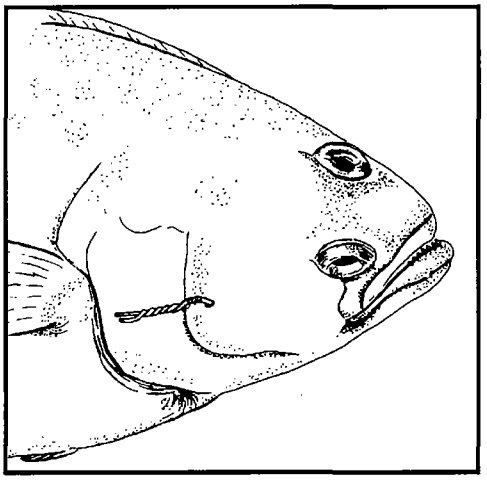
TAGGED HALIBUT

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
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