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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report 1992

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

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1993

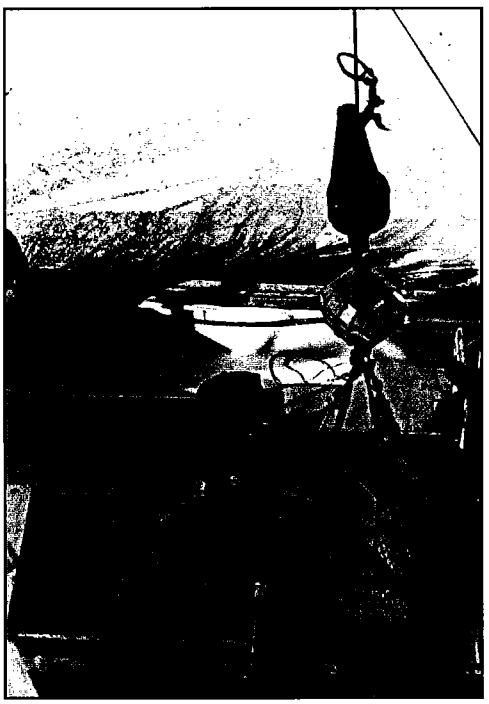
PREFACE

Cover drawing by Joan Forsberg, IPHC

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 the Conference Board, which represents vessel owners and fishermen. 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.



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Unless otherwise indicated, all weights in this report are dressed weight (eviscerated, head-off). Round (live) weight may be calculated by multiplying the dressed weight by a factor of 1.33.

INTERNATIONAL PACIFIC HALIBUT COMMISSION
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ACTIVITIES OF THE COMMISSION

American poet Archibald MacLeish once said "No one can come to the Pacific coast of this continent and feel he has come to the end of anything." If there are mysteries off our shores, surely they are to be found most concentrated along the great continental shelf, where the oceanic currents sweep across in a grand gesture from shore to shore, and powerful upwelling draws plankton and minerals up from the ocean basin and spills rich nutrients along the lip of North America. Here the life cycle, from briny fertilization to final surrender, expresses itself in huge numbers and, particularly in the case of Pacific halibut, even larger-than-life specimens.

The life story of *Hippoglossus stenolepis* is perhaps not as operatic as the far-ranging salmon, nor as often mythologized as the trout. But the Pacific halibut has its charms: Imagine a fish the size of a barn door cruising several thousand miles from Bristol Bay to the coast of Oregon. Though it doesn't fight like a steelhead, there is some challenge to hauling in a halibut on hook and line — rather like reeling a small car through a second-story window.

This one species, so crucial to the livelihoods of thousands of commercial fishermen and untold hundreds of personal use and sport fishermen, deserves every effort to increase our understanding of its habits and habitat. To groundfish harvesters, halibut represent a huge bycatch nuisance that in some years has shut down directed groundfish fisheries altogether — to the seafood industry's great loss.

To those of us who taste the benefits of sport or commercial fishing, halibut represent a flavor of the deep unlike any other, sweet and delicate, rich in protein, free of bones, a flavor one cook called "the sweetest combination of heaven and saltwater yet to be found." No matter what our taste in these deepwater wonders, whether as food or fishing opportunity or simply as material for study on our way to responsible fishery management, the Pacific halibut resource offers abundant meat on which to feast.

1992: THE STORY IN BRIEF

The task of the International Pacific Halibut Commission has never been easy: to oversee fishing activities of all kinds on Pacific halibut ranging from the Bering Sea to Morrow Bay, California, across two national borders taking into

account sport fishing habits, commercial fishing pressures, and native traditions that tie coastal communities to the sea for nourishment less palpable than food.

The Commission's jurisdiction extends throughout Convention waters — that is, the Pacific coasts of Canada and the U.S., as first stipulated in the Halibut Convention of 1923. The Commission sets harvest limits and halibut fishing regulations, estimates the size, trends and movements of halibut stocks, and conducts research relevant to the Pacific halibut. The IPHC staff members pass on information, recommendations and guidelines to the Pacific and North Pacific Fishery Management Councils and to Canada's Department of Fisheries and Oceans, who manage and allocate the yield from the complex of groundfish fisheries off our Pacific shores from California to British Columbia and north to Alaska.

A varied family of fisheries it is, too. In Washington, Oregon and California, commercial, sport and treaty Indian fishermen divide the harvest from a small resource. On the Washington/B.C. border, sport fishing guides are ruffling feathers by fishing over the Canadian line in an area called Swiftsure Bank, where juvenile halibut and salmon congregate. This area, not a critical fishing spot for Canadians, is increasingly targeted by U.S. sport fishermen, and their harvest is subtracted from the total catch available to Canadian fishermen.

The Individual Vessel Quota (IVQ) system in British Columbia gave fishermen a predictable harvest for the second year in 1992, while Alaska fishermen still ran the "derby". Alaska's rapid-fire openings give everyone a fighting chance to catch halibut, but many risk life, limb and vessel in the doing.

Issues facing the halibut fishing community in 1992:

- *Lack of data about Pacific halibut harvests in Russian waters*
- *No significant decrease in halibut bycatch by groundfish harvesters*
- *Obtaining accurate personal use catch statistics*
- *Fishing quotas improved life for British Columbia's 435 halibut fishermen*
- *An IFQ system for halibut fisheries off Alaska will take effect in 1995 — windfall for some of the 5,000 halibut fishermen there, setback for others*

Alaska is due for its own Individual Fishing Quota (IFQ) system, scheduled to be in place by 1995.

In addition to the commercial and sport catch, there are other kinds of catches the Commission calls "personal use." Every year hundreds of thousands of pounds are taken, legally or illegally, by crew aboard commercial vessels, fishermen out prospecting before the season opens, and the sanctioned Indian food fisheries in Canada.

It's the Commission's job to keep track of as much halibut-related activity as possible, both above and below the surface of the water. As market trends change, gear improves, economic pressures shift and evolve, and fishermen grow older or change their way of thinking, the halibut themselves are also on the move. Stocks diminish, average fish size increases, and migratory patterns trace and obscure themselves against the mottled background of our perceptions of the undersea world.

CHANGES IN REGULATIONS

Under the leadership of chairman Steven Pennoyer and vice-chairman Dr. Richard Beamish, the Commission made seven major changes to halibut fishing regulations at its January 1992 meeting in Seattle.

During its 1992 annual meeting, the Commission:

1. **Approved a catch overage plan for the Canadian IVQ fishery.** Fishermen who underharvest their vessel's quota may add up to 5% of their quota to the following year's catch. Fishermen who overharvest must subtract their overage from the following year. (Any overage exceeding 5% of the quota must be forfeited.)

2. **Urged both governments to gather more data on the halibut fishery off the Russian coast.** The IPHC has no jurisdiction over fish caught outside Halibut Convention waters, but the Commission urged both governments to pass regulations affecting Russian halibut that is landed in U.S. or Canadian ports.

3. **Set catch limits and fishing period dates for all areas**. One major change: All cleanup fishing periods for Areas 2C, 3A and 3B could be lengthened from 24 to 48 hours.

4. **Adopted a catch sharing plan for Area 2A, as requested by the Pacific Fishery Management Council**. The plan splits up the Area 2A harvest limit between commercial, sport and treaty Indian uses.

5. **Ended licensing requirements for commercial halibut vessels in Area 2B.** Since these vessels now work under the IVQ system, licenses are unnecessary.

6. **Added Nazan Bay, in Area 4B, as the clearance location for fishermen.** To monitor participation in the halibut fishery in the western Aleutians, the IPHC watches resident and non-resident deliveries in Area 4B, and requires non-resident vessels to clear through a port at the edge of the area.

7. **Refined sport fishing bag limits and size limits.** Starting in 1992, no one may angle for more than one daily bag limit in any one calendar day in any Convention waters. It is legal in Alaska to possess two daily bag limits, as long as it took you at least two calendar days to land them.

BOOKS, BUDGETS AND A BODY OF KNOWLEDGE

The IPHC research budget has diminished yearly for some time including 1992. It included funds for an observer program aboard the Canadian trawl fleet, but was not enough to continue funding the halibut rearing project.

Yet the IPHC's research team covered a lot of ground: bycatch studies, biological clues to the health of the stocks, sport and personal fishing activities, and the interrelationship between halibut, other species, and the marine environment. All IPHC research reports are available to the public upon request free of charge.

The IPHC's overall budget for 1992 was set at $1,698,500, however budget reductions during the fiscal year reduced the 1992 appropriations to $1,667,000. Within this, a research budget of $212,000 was approved ($120,000 from appropriated funds and $92,000 from the sale of fish and/or surplus funds). Commissioners expressed concern at the Annual Meeting that the upcoming Individual Fishing Quota system for the waters off Alaska would increase the costs of port sampling, and that budgets might have to be tightened elsewhere to compensate for the increased costs under IFQs.

NEXT ON THE AGENDA...

Regulations and budgets are the footprints by which we measure the journey from uncertainty to knowledge. But they are not the journey itself. Above all, the IPHC Annual Meeting is a time for fishermen, processors, managers and biologists to gather and ask questions, vent complaints, and seek answers.

Topping concerns at the 1992 Annual Meeting was halibut bycatch by other fisheries. The IPHC sets catch limits for halibut, but U.S. fishery management councils have the ability to set bycatch caps in the fisheries under their control. (The Canadian government has not set bycatch caps for its fisheries.) How much pressure can — or should — the IPHC bring to bear on those management agencies to reduce halibut bycatch? We examine halibut bycatch in a special section of this report. As each country struggles with its own bycatch dilemmas, the IPHC Annual Meeting faced a list of other concerns:

The IPHC hopes to increase cooperation with Russian fishery biologists to gain a more complete picture of halibut harvests and stock information in the waters off the Russian coast.

Russian halibut harvests

Pacific halibut are being harvested by U.S. trawl and longline vessels in Russian waters through joint venture operations, and several million pounds of this product was sold in U.S. markets in 1992. But even spotty import figures give little indication of how much halibut is actually being harvested, how effective their enforcement efforts are, or of the general health of the western Bering Sea halibut stocks. The IPHC hopes to increase cooperation with Russian fishery biologists in the future, and to gain a more complete picture of halibut harvests and stock information in the Western Bering Sea.

Sport catches

State and provincial agencies assist the Commission by conducting creel censuses and telephone surveys. However, sometimes even the combination of surveys, licensing data and catch reports don't add up to a complete understanding of the sport catch of halibut. The IPHC is looking at ways to improve the accuracy in reporting sport catches.

Personal use catches

The Commission considers personal use halibut to be all halibut eaten by people, but neither recorded on a fish ticket nor included in the sport fish statistics. The largest poundage of fish in this category comes from fish taken home for personal use from commercial trips.

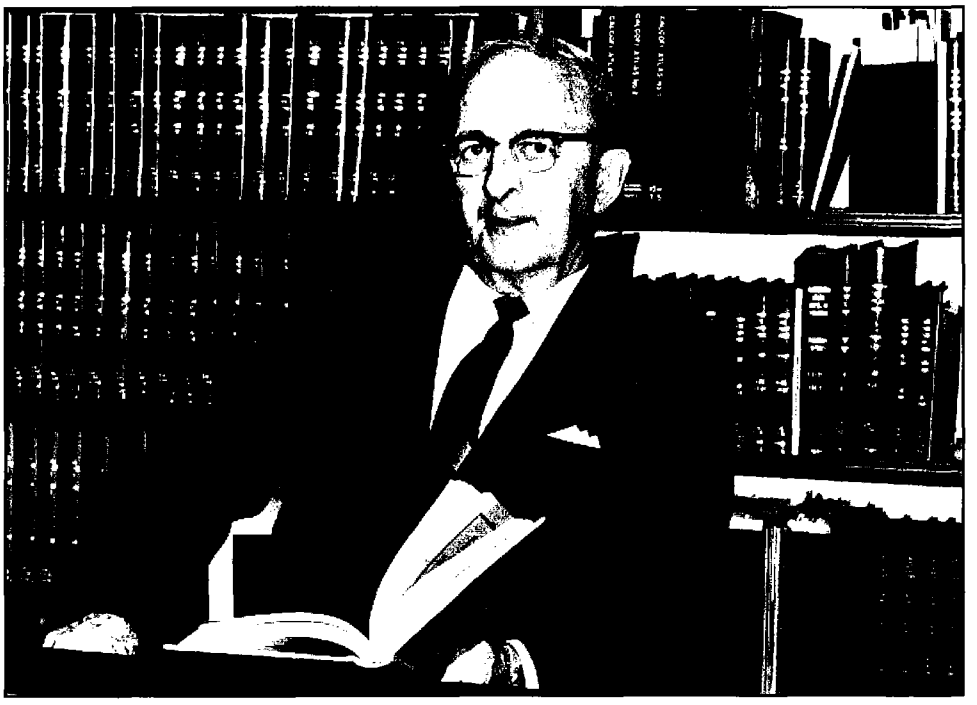
Commercial catches

It was a Catch-22 for British Columbia fishermen in 1991. If they overharvested their IVQs their overages were confiscated and they risked fines. Yet if they underfished their IVQ, there was no way they could make up for the loss the following year. Developed cooperatively by the IPHC and the B.C. fishermen, a new plan was approved in 1992. Some over-harvest or under-harvest, up to 5% of the vessel's remaining quota from the last trip is carried over to the following year. Overharvests of more than 5% will be forfeited.

The Pacific Fishery Management Council is considering an individual quota system for commercial catches on the U.S. west coast.

Change is everywhere in the air. Fishermen on the U.S. west coast and Alaska look with anticipation at the changing fisheries management regimes and wonder how their fisheries will fare as managers devise comprehensive management programs for all Pacific groundfish species in the next few years. Alaska is scheduled to switch to Individual Fishing Quota programs for halibut and sablefish in 1995. The Pacific Fishery Management Council is considering an individual quota system for commercial catches on the U.S. west coast. Unlike British Columbia, where 435 halibut licenses translated to 435 vessel quotas, thousands of people participate in Alaska's halibut fishery. The IFQ program will change every one of their operations — some beneficially, some to their detriment. The picture of the future is foggier on the West Coast. But for Pacific halibut fishermen everywhere, there's a fresh wind blowing and there's change in that salt air.

To Honor the Memory of F. Heward Bell



F. Heward Bell, past director of the Commission and a leader in fisheries management and research, passed away March 5, 1992. Mr. Bell was born July 4, 1902 in Swansea, Wales. He was raised in Canada and graduated an honor student in biology from the University of British Columbia in 1924.

In 1925, Mr. Bell became an associate scientific assistant for what is now known as the International Pacific Halibut Commission. During his first few years with the Commission, he spent a large amount of time in the field, and was aboard the *F/V Scandia* when she sank off Kodiak in February of 1927. He became the assistant director for the Commission in 1943 and remained in that position until he was appointed director in 1963. He served in that capacity until his retirement in 1970.

Among the numerous honors bestowed upon him in connection with his work was the 1953 Coronation Medal of Elizabeth Regina II for services rendered to Canada. He wrote a book entitled "The Pacific Halibut - The Resource and the Fishery" which has become a model of historical literature documenting the fishery.

The Commission has gained a great deal as a direct result of being affiliated with Mr. Bell, and feels very fortunate for all he has accomplished in our name. He was an exceptional humanitarian and will truly be missed.

SHIPWRECK IN ALASKA!
15 SEATTLE MEN SAVED

4 CITY EDITION COMPLETE — TODAY'S NEWS TODAY—IN SEATTLE'S ONLY HOME-OWNED PAPER — THE WEATHER

The Seattle Daily Times

SEATTLE, WASHINGTON, THURSDAY, FEBRUARY 24, 1927.

HALIBUT FISHING CRAFT SCANDIA, OF THIS PORT, SINKS AT KODIAK JUST AS SCIENTISTS AND CREW ARE TAKEN OFF

RADIO STATION SENDS SMALL FLEET IN TIME

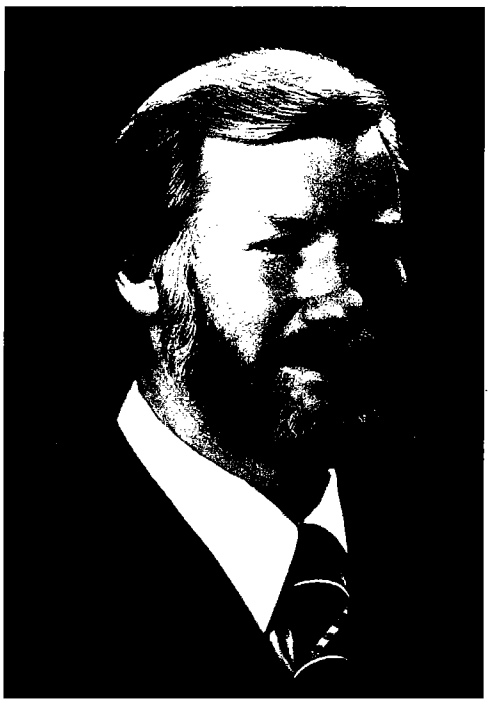
The halibut schooner Scandia covered in ice while docked in Juneau, Alaska on February 16, 1927. The vessel had just completed a tagging trip on Portlock Bank and off Yakutat Bay. One week later on February 23, she became the only vessel to sink while on a Halibut Commission charter. F.H. Bell and 14 crewmen were rescued as she ran aground off Kodiak Island during a violent snow storm.

F.H. Bell and W.F. Thompson

F.H. Bell (left) and crewmates Pegler, Herrington, Hamilton, and Erikson aboard the F/V Dorothy in the 1920's.

DIRECTOR'S REPORT

In the past several years the Commissions Stock Assessment program has been questioned on a number of occasions. This usually happens when the stocks are in a natural decline and the annual fishing limits are reduced accordingly. Since fishing limits are a constant percentage of the exploitable biomass, the fishing limits rise and fall with the condition of the stocks. When the stocks were increasing as they were in the late 70's and 80's, and fishing limits were increasing each year, our stock assessment procedures were never questioned. We have allowed three separate reviews of our program in the past four years, While all stock assessment programs have shortcomings we have had only minor suggestions for improvement. There is no better assessment of any species on the Pacific coast. The fundamental reason for this is the data sets for Pacific halibut. They date back to the 1920's and are accurate and complete. Few species world wide are so extensively documented.



Even with such good data on the age structure of the catch, and catch and effort statistics, there is still considerable variability associated with the biomass estimates. There may also be some bias but the bias is probably consistent from year to year and our exploitation rate accounts for it. It may be that if we knew the true exploitable biomass the appropriate exploitable rate might be 40% or 20% but with our estimated biomass 30% gives the appropriate catch limits. In any case our estimates are in agreement with trends in fishing success and have allowed successful management of the stocks over many years.

Our stock assessment methods are the same used by many agencies around the world, for those species where age structure data are available. These methods are modified for the specific life history of Pacific halibut. A large complicating factor in estimating biomass is the bycatch of halibut in other fisheries. We do not have satisfactory age data from the bycatch therefore it cannot be added to the catch in our age structure assessment but must be accounted for separately. We are attempting to use the sports catch in our assessment since the age structure is similar to the commercial catch. The other removals, wastage and the personal use catch are considered to have similar age structure as the commercial catch but are not included in the analysis because of the uncertainty of the quantity and are therefore treated separately similar to bycatch. If all the removals were precisely known and their age structures well

documented we would add them to the commercial removals, combine the age data, and proceed to estimate the exploitable biomass. The optimal exploitation rate has been determined to be 30%. The total allowable removals are calculated by taking 30% of the exploitable biomass. The bycatch is compensated for by computing the amount of fish required to replace the bycatch and subtracting this from the total allowable catch. Wastage, personal use and sports removals are also subtracted and the remainder is allocated to the commercial harvest.

At the present time exploitable biomass is computed by management area. Area 2A and 2B are combined 2C, 3A, 3B and 4 have separate biomass estimates. Area 4 is split up into 5 separate subareas based on habitat. Area 2A is split from 2B by the proportion of habitat in each area modified by the relative CPUE in each area. This is a fundamentally sound estimation procedure but it is subject to the variability of the CPUE estimates. In the interest of stability we are investigating an alternative approach of setting the Area 2A catch limit as a constant proportion of Area 2B. On the average this will produce a reasonable catch limit but will not acknowledge annual variability in halibut stocks.

Improvements to our stock assessment will be made largely from more accurate data. The I.V.Q. program in Canada has improved our catch-per-effort data and an improvement in the U.S. will likely occur when a similar program is implemented.

Bycatch remains a problem, if we had a good estimate of the age structure and a more precise estimate of the true magnitude we could improve our overall stock assessment.

While improvements are a major focus of our stock assessment group we are confident that our present assessment allows a level of precision in our management not surpassed by any other agency anywhere in the world.

Donald A. McCaughran
Director

60 Million Pounds of Possibility

THE 1992 COMMERCIAL FISHERY

"No hardier seamen, nor better navigators than the North Pacific halibut fishermen are to be found on any sea," wrote Edward W. Allen in 1936. "If a storm comes up on the banks, the captain sticks the nose of his craft into the wind, battens down the hatches, and rides her out. Anyone who, without getting seasick, can ride out a storm on a halibutter with every porthole closed — every part of the boat tight against the water without, and equally tight against the escape of the slightest part of the combined smell of fish, galley stove and diesel oil within, as the boat rolls and pitches in the wind and waves, is entitled to call himself a deep-sea sailor."

British Columbia's Individual Vessel Quotas (IVQs) are assigned to vessels, not to fishermen. The Individual Fishing Quota (IFQ) system on line for halibut off Alaska will assign quota shares to individual vessel owners and bareboat leaseholders.

In 1992, under slightly better conditions than Allen described, 6,708 commercial fishermen were licensed for the Pacific halibut harvest coastwide, though not quite that many actually fished. Those that did collectively landed nearly 60 million pounds of halibut, 0.2 million pounds under the catch limit. Even so, the harvest was 2.9 million pounds higher than in 1991 (Appendix I - Table 1). In Canada, where the IVQ fishery completed its second full year, quotas went to 435 vessels. In the U.S., 6,273 skippers applied for commercial licenses: 5,619 in Alaska, 265 in Washington, 327 in Oregon and 62 in California. Except for California, these numbers were down from 1991's applications, which totalled 5,982 for Alaska, 284 for Washington, 389 for Oregon and 56 for California. The halibut fishery ex-vessel value for 1992 was $71.2 million.

Though halibut numbers are declining, the halibut biomass for recent years estimated in 1992 was significantly larger than previous years' estimates. This discovery allowed slightly higher catch limits in 1992.

In the middle of a downward swing in stock abundance, why was the commercial harvest raised for 1992? IPHC biologists have recently gained a clearer picture of the halibut population than they have ever had before. More accurate biological information revealed that though halibut populations are declining, the halibut biomass was significantly larger than previous years' estimates. This discovery allowed catch limits to be set a little higher for all areas except 3A and 3B. In fact, the IPHC staff recommended higher catch limits than the limits proposed by the industry.

Boundaries of the Bounding Main

Regulatory areas mean nothing to the halibut and everything to the fishermen. The ten regulatory areas for the 1992 commercial Pacific halibut fishery are shown in Figure 1 — they're the same as in recent years. The southeastern flats in the Bering Sea, excluding Bristol Bay, remained closed to halibut fishing in 1992.

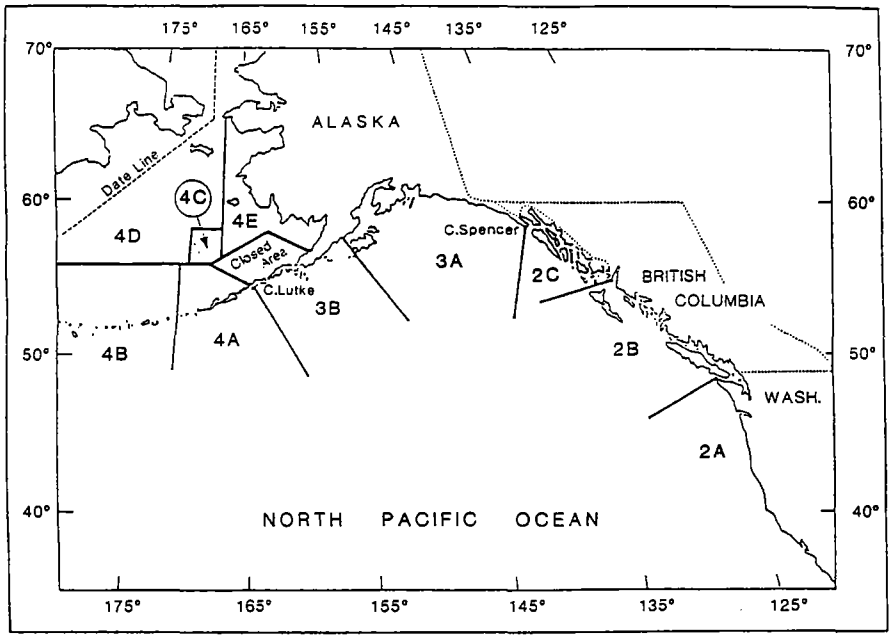


Figure 1. Regulatory areas for the 1992 commercial fishery

The ten areas are:

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 - includes 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.

Following the rules

The IPHC outlines commercial fishing regulations every year at its Annual Meeting, and forwards those regulations to the Canadian and United States governments for approval. Some changes to the regulations came in 1992:

- Canadian halibut vessels no longer required Commission licenses;
- In Area 2B, fishing stayed open until either all the IVQs were taken, or until October 31, whichever came first;
- Vessel clearance requirements were tightened in Area 4. Where some local vessels had been allowed to fish Area 4A without vessel clearances, all vessels were required to obtain clearance for that area in 1992. In Area 4B, all non-local vessels were required to obtain a clearance at Nazan Bay on Atka Island. And where fishermen previously were allowed to fish in multiple regulatory areas, this year each operator had to choose one fishing period and regulatory area. These regulations are designed to produce better catch statistics and improve enforcement in this remote area.

Halibut don't sit still long, and fishermen don't either. Fishing regulations have to be flexible to keep up with both populations. Each year we look at catch rates for each area and, toward the end of the season, set fishing period limits to keep the fleet from overshooting the catch limit. Fishing period limits restrict the amount of fish (in net weight of halibut, dressed, head-off) that each vessel can deliver during a single opening. When period limits are in effect, a skipper can make several deliveries as long as the cumulative poundage does not exceed the fishing period limit. Any excess must be forfeited, and if a skipper really overshoots the limit, he or she might suffer a fine as well.

In some cases, fishing was stopped for the year before the catch limit was harvested. We do this when it becomes clear that even a severely restricted opening would exceed the catch limit.

The view from the grounds

In some cases, fishing was stopped for the year before the catch limit was harvested. We do this when it becomes clear that even a severely restricted opening would exceed the catch limit.

Fisheries management is far more than a simple waltz between catching too much or too little. Each area supports its own community of boats; each population of fish expands or diminishes according to its own subtle call; the needs of the nation are weighed against the forward thrust of the fishing lifestyle and the itch each longline fisherman feels to stand on the forward deck in a bracing wind on opening day.

To see how the 1992 season played out in each area, review Appendix I. The differing seasons and catch limits only hint at the variety of forces at work in each area of the Pacific that halibut call home.

Area 2A
Catch limit: 396,250 pounds
Actual catch: 437,000 pounds

From the Strait of Juan de Fuca to Monterey Bay, hundreds of commercial fishermen and several Indian tribes, shared 396,250 pounds of Pacific halibut for a multitude of purposes in 1992. The total commercial catch by Indian and non-Indian fishermen measured 437,000 pounds. In this area that strides the coast through three states, the IPHC managers set a catch limit 125,000 pounds higher than the 1991 limit.

The great Pacific has been both larder and lifeblood for coastal communities since long ago. Most Indian tribes along the Pacific coast depended more on salmon than they did on halibut, which required more seaworthy boats. But the Makah Indians of northwest Washington have always fished off Cape Flattery and even further out to sea for the deepwater flatfish. Their tradition continues today; each year a portion of the Area 2A commercial fishery is allocated to the twelve tribes included in the Washington State treaty Indian fishery for commercial and traditional uses.

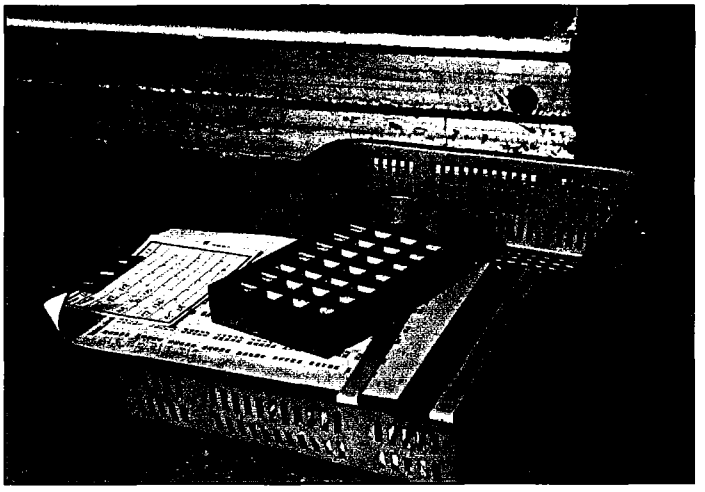
This year the treaty Indian fishery was allocated 162,500 pounds, of which 152,500 pounds were designated for their commercial activities, and 10,000 pounds were reserved for ceremonial and subsistence fishing. The Indian commercial fishery unfolded in three stages. It started with two "all-gear" fishing periods in early March, netting 129,200 pounds of halibut. The second stage consisted of five "limited-gear" fishing periods in May, in which fishermen could work only a limited amount of gear and their catches were restricted. The limited-gear fishery produced 18,700 pounds of halibut.

The final stage allowed salmon trollers to land incidentally caught halibut between March 1 and May 31; this period produced an additional catch of 7,500 pounds. The total commercial catch for all three stages of the Indian fishery totaled 155,400 pounds, just slightly over the catch limit.

The non-treaty commercial catch was limited to 243,750 pounds of halibut, and fishermen were given two 10-hour fishing opportunities, the first on July 29 and the second on August 12. Fishing period limits were imposed during both openings (Appendix II); even so, fishermen exceeded the catch limit by 38,000 pounds.

Area 2B
Catch limit: 8,000,000 pounds
Actual catch: 7,626,000 pounds

This was British Columbia's second year under the Individual Vessel Quota system for commercially-caught halibut. Fishing began at noon on March 8 on a favorable tide, and was open until noon October 31. For the second year in a row, B.C. halibut fishermen earned more money per pound for their fish, on the average, than did their U.S. counterparts. Theirs is also the longest halibut opening by far — each quota share holder is allotted a predetermined amount of halibut based on the overall catch limit — and fishermen off British Columbia did not appear to envy other halibut fishermen their derby days of 24-hour openings. B.C. quota holders voted overwhelmingly to continue the IVQ system, which was instituted in 1991 for a two-year trial period.



In their second year under an Individual Vessel Quota system, Canadian fishermen voted overwhelmingly to continue the program.

One of the most important changes to the IVQ system gives fishermen who miss their quota target by 5% or less (or 400 pounds, whichever is greater) a chance to add the difference to the following year's quota, or subtract it, as the case may be. This change was approved in 1992, and allowed fishermen to sell their overharvests of 5% of their quota or less without forfeiture or penalties, as long as they subtract that overharvest from next year's quota. (Overharvests topping 5% must be forfeited.)

Some IVQ fishermen have moved out of the hottest halibut grounds into areas where halibut catches come a little slower — and with eight months to catch their quota, fishermen in B.C. can afford to fish wherever they want.

This year, fishermen came pretty close to the target. They harvested all but 374,000 pounds of the area catch limit, and approximately 200,000 pounds of the fish they missed will be added to fishermen's quotas in 1993.

Initially, there was some concern about raising the Area 2B catch limit to 8 million pounds for 1992, up 600,000 pounds from the 1991 limit. Several factors convinced the Commission to raise it: decreased waste in the IVQ fishery; a conservative catch limit for Area 2B; a 1991 underharvest of 200,000 pounds.

The B.C. halibut fleet took a quantum leap when they signed up for the IVQ system in 1991. Not only did the method of management change, but the dynamics of the fleet have changed as well. Some fishermen have moved out of the hottest halibut grounds into areas where halibut catches come a little slower — and with eight months to catch their quota, fishermen in B.C. can afford to

fish wherever they want to. This shift in itself could reduce CPUE, but it could also be due to changes in vessel size and fishing location.

Another interesting note: B.C. fishermen on the average are fishing in slightly shallower waters these days than they have in the past few years. These shifts in fishing locations and in gear preferences may affect the kind of data we collect from catch samples in future years.

Area 2C
Catch limit: 10,000,000 pounds
Actual catch: 9,819,000 pounds

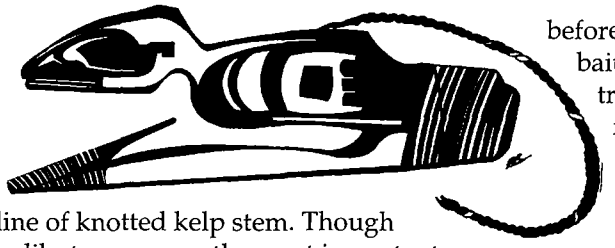
The longliners of Southeast Alaska overfished their limit by 1.3 million pounds in 1991. This year they came up 181,000 pounds short, but the catch limit was 2.6 million pounds higher than the year before. The IPHC staff, in refiguring previous stock estimates with new information, recommended putting a full meal on the plates of Southeast Alaska longliners. But the fishermen balked; even if the biomass was higher than previously estimated, they said, their own catch rates told them to tread tenderly on the halibut grounds this year. Catch limits eventually were set at 10 million pounds — still significantly higher than the 7.4 million pound limit of 1991.

Southeast Alaska longliners overfished their limit by 1.3 million pounds in 1991. This year they came up 181,000 pounds short, and they still were over one million pounds richer than the year before.

Fishermen bellied up to the table for one unrestricted 24-hour fishing period in June, followed by two 48-hour fishing periods in September and October, both of them accompanied by trip limits (Appendix II - Table 1).

Fishing period limits are stricter during 48-hour fishing periods than they are in 24-hour periods. But generally, fishermen prefer the flexibility they get in a longer period, strict limits and all. Poor weather is a long-time companion of the halibut fleet, and when it came to visit during both the September and October fishing periods, fishermen were just as glad to have time to sit out the worst of it in safe harbor. At season end, they'd landed 9.8 million pounds of halibut — just 2% off their mark.

When the first schoonermen explored north of Dixon Entrance for good halibut grounds more than a century ago, they discovered Indian tribes with specialized halibut gear already in the water. Like their distant neighbors to the south, the Tlingit, Haida and Tsimshian Indians fished for halibut centuries



The Natives of the Pacific Northwest traditionally fished halibut with large wooden fishing tackle and barbed bone hooks attached to fishing line of knotted kelp stem.

before Euro-Americans ever baited a J-hook. They traditionally fished the giant flounder with large wooden hooks and barbed bone hooks attached to fishing line of knotted kelp stem. Though halibut was never the most important subsistence food for the Indians of the Pacific Northwest, after 100 years of commercial fishing and a hundred generations of fishing for food, halibut do play a role in the nurture and nourishment of the Native culture in this region.

A special Metlakatla Indian fishery, authorized by the U.S. Secretary of the Interior, is carried on within 3,000 feet of the Annette Islands Reserve. This year, participants caught 22,651 pounds in eight two-day harvests between April and September. Their 1992 treaty catch, which is counted against the total Area 2C catch limit, was 37% of the previous year's catch.

Areas 3A and 3B
Catch limit: 35,400,000 pounds
Actual catches: 35,400,000 million pounds

The two regulatory areas that span the Gulf of Alaska are the richest halibut grounds in the eastern Pacific. Puget Sound fishermen ventured north and west of Cape Spencer for the first time in 1913, and as they found richer and richer stocks — and overused them along the way — they moved ever westward. Today the fleet ranges from open skiffs to large longliners of 100 feet or more, and harvests more than 59% of the coastwide halibut catch in Areas 3A and 3B.

The Gulf of Alaska halibut fleet ranges from open skiffs to large longliners, and harvests more than 59% of the coastwide halibut catch.

The two areas of the Gulf of Alaska are given separate catch quotas. If the combined catch from both areas hits the combined limit, fishing is closed in both areas. The 1992 catch limit was 26.6 million pounds for Area 3A and 8.8 million pounds for Area 3B. Excellent fishing conditions prevailed throughout the Gulf of Alaska during the 24-hour June 8 fishing period, which netted 14.6 million pounds from Area 3A and 7.2 million pounds from Area 3B. Fishing period limits were imposed on both areas during a 24-hour September fishing period (Appendix II - Table 1), with a more generous serving given to Area 3A to encourage fishermen to

fish where the limit was highest. Stormy weather harassed fishermen during the September 7 period, which brought in only 11.5 million pounds from both areas. A third period was called for 48 hours beginning at noon on October 5, and trip limits helped keep fishermen from overharvesting the catch.

Areas 4A and 4B
Catch limit: 4,600,000 pounds
Actual catch: 5,000,000 pounds

The two regulatory areas in waters surrounding the Aleutian Islands are also managed under a combined catch limit. This year, equal limits of 2.3 million pounds were set for each area. The limit was exceeded by 400,000 pounds in Area 4A, and by 17,000 pounds in Area 4B. Higher trip limits and more fishing time were allowed in Area 4B to attract fishermen into the more remote waters.

The 24-hour June 8 fishing period in Area 4A produced 260,000 pounds. Based on 1991 experience, managers expected an intense fishery throughout Area 4. Therefore, fishing period limits were imposed for the August 6 period and fishing was restricted to 12 hours between 8:00 am and 8:00 pm. The turnout was only half the expected fleet size, and rough weather hampered the boats that did show. Only 650,000 pounds were caught in that second period, leaving 60% of the catch limit remaining. Two more fishing periods were scheduled, one on a stormy day in August and the last in September, and it was this last 1.3 million-pound period that brought the fleet 400,000 pounds over the catch limit.

To increase fishing opportunities, the Area 4B halibut fishery was managed so that only 10% of the catch limit would be taken in June and July, with the balance of the catch to be reserved for the general Area 4 fishery scheduled for August 6. The catch limits for Area 4 are shown in Figure 2. The first 24-hour period started June 8, followed by seventeen 12-hour openings between June 10 and July 12, and by the last day 219,000 pounds had been landed. Fishing period limits, a 48-hour clock and some bad Bering Sea weather kept the August 6 opener down to 516,000 pounds.

As in Area 4A, an additional fishing period began on August 21. Trip limits were increased and the length of the fishing period increased to 72 hours. The resulting catch of 1,239,000 pounds left only 326,000 pounds of the catch. A final 48-hour fishing period that started September 22, with smaller fishing period limits, brought in a catch of 343,000 pounds, for a season total just 17,000 pounds over the catch limit for the area.

Area 4C
Catch limit: 800,000 pounds
Actual catch: 793,000 pounds

Pribilof Island Aleuts have gone after halibut since they were transported to the Pribilof Islands by Russian fur traders. To give the island communities room to develop a commercial fishery of their own, the NPFMC asked the IPHC to regulate Area 4C in a manner that would split the catch with

an eye toward discouraging non-locals from overwhelming the Pribilof fleet. In 1992, the Area 4C catch limit of 800,000 pounds was harvested during a series of 24-hour fishing periods that began on June 7 and were interspersed with 24-hour closures. All vessels were restricted to a maximum catch of 10,000 pounds per fishing period. In 16 fishing periods from June 7 through July 7, fishermen landed 584,000 pounds of halibut; an additional 209,000 pounds were taken during a 24-hour period July 18-19, and the year's harvest stopped at 793,000 pounds.

Area 4D
Catch limit: 800,000 pounds
Actual catch: 727,000 pounds

These offshore fishing grounds north and west of the Pribilof Islands were drastically overfished in 1991, when more than twice the limit was taken. In 1992, managers set restrictive fishing period limits (Appendix II - Table 1), and opened fishing for only 48 hours August 6 - 8. The Area 4D catch limit was 800,000 pounds, and a conservative 727,000 pounds were taken.

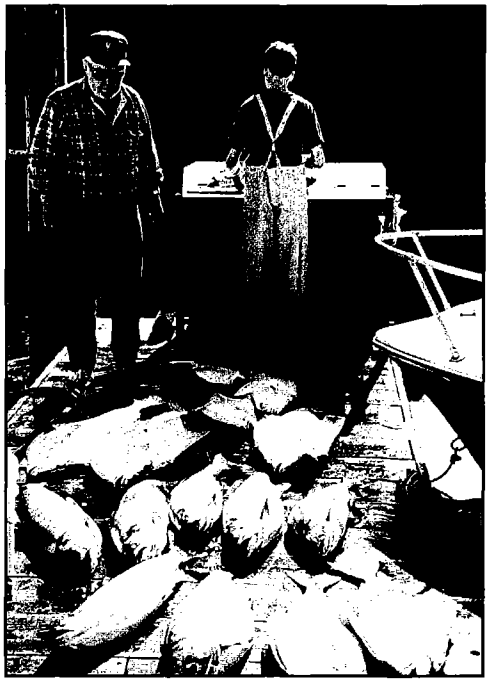
Area 4E
Catch limit: 130,000 pounds
Actual catch: 72,000 pounds

The eastern Bering Sea waters of Area 4E were managed so that 30% (39,000 pounds) of the available halibut would be taken southeast of Cape Newenham (4E-SE), and 70% (91,000 pounds) from waters northwest of Cape Newenham (4E-NW). After August 1, 50% of any poundage left in the 4E-NW catch limit was available to be taken in 4E-SE.

Fishing started in Area 4E on May 31 with a series of 48-hour fishing periods, interspersed by 24-hour closed periods, ending September 18. From September 19, halibut fishing was open continuously through October 31. All vessels were restricted to a maximum catch of 6,000 pounds per fishing period. Approximately 15,000 pounds were caught in Area 4E-SE, with no landings reported after June 20. In Area 4E-NW, 57,000 pounds were reported from June 18 through August 22. In 4E-NW, resident fishermen caught 35,000 pounds, and non-resident fishermen caught 22,000 pounds.

DROPPING A LINE INTO ANOTHER WORLD: THE 1992 SPORT FISHERY

"The charm of fishing is that it is the pursuit of what is elusive, but attainable; a perpetual series of occasions for hope." — John Buchanan



The Pacific halibut sport fisheries are managed to give as many people as possible every opportunity to wet a line for halibut.

Salmon may mystify, sole may intrigue, but no steak on the plate is at once as beguiling and tasty as a hearty halibut steak. Pacific halibut feeds the taste buds as well as the belly. Most of all, to the thousands of anglers who jig rocky bottoms, drag currents and snag their gear in pursuit of the mighty Hippoglossus stenolepis, halibut feeds that oblique part of a fisherman's soul that drives him or her to probe the murky depths for treasures yet untasted.

Homer, Alaska is the halibut capital of the Pacific coast for sport fishing, and as usual Homer and the Kenai Peninsula dominated sport catches in 1991. The Gulf of Alaska produces 60% of the coastwide sport catch.

Higher catch allowances in 1992 off the coasts of Washington, Oregon and California prompted the fishery managers to adjust the seasons to provide anglers with plenty of opportunity to plan their fishing trips. On the north Washington coast, bag limits were increased: a fisherman could possess one halibut of any size plus an additional halibut of 40 inches or greater. Area changes in Oregon gave more latitude to small-boat anglers fishing inside the 30-fathom curve from Cape Falcon to the California border. And, as in recent years, the Commission adopted a series of regulations developed by the Pacific Fishery Management Council for Area 2A.

Hope jigs eternal: 1992 sport catches

Sport catch statistics are harder to collect than commercial catch figures, so we run about a year behind in tallying the total. A summary of sport catches in each halibut area from 1987 through 1991 (Appendix III - Table 1) shows 1991 catches about 17% higher than 1990 — the highest by far since the late 1980s.

Homer, Alaska is the halibut capital of the Pacific coast for sport fishing, and as usual, Homer and the Kenai Peninsula dominated sport catches of halibut in 1991. In the Gulf of Alaska and Prince William Sound, catches increased more than 15% from 1990, for an overall Gulf of Alaska (Area 3) catch of 4.2 million pounds. Catches in Southeast Alaska rebounded from a downward swing in the late 1980s, and increased about 24% between 1990 and 1991. Southeast may see smaller catches, but they enjoy slightly bigger fish. The average halibut caught in Area 2C weighed 23.0 pounds; the average weight in Area 3 was 22.4 pounds.

Out in the Bering Sea/Aleutian Island areas, sport catches nearly

The average sport-caught halibut caught in Puget Sound and the Strait of Juan de Fuca weighed in at 22.5 pounds, 30% bigger than the 17.3 pound average of 1991.

doubled from 40,000 pounds in 1990 to 74,000 pounds in 1991. Catches in British Columbia (Area 2B) increased slightly in 1991.

For the waters off Washington, Oregon and California we have preliminary 1992 catch figures (Appendix III - Table 2). Here, managers had hoped for a sport catch of 243,750 pounds areawide. But never underestimate the tenacity of a halibut fisherman; West Coast anglers landed 249,677 pounds before all was said and done. Fishermen in the Strait of Juan de Fuca and Puget Sound caught 51,068 pounds of halibut, slightly over the 1992 allocation. The average halibut they caught weighed in at 22.5 pounds — 30% bigger than the 17.3-pound average of 1991.

North coast Washington anglers caught slightly less than their allocated 92,664 pounds in 1992, just as they did in 1991. Increasing the bag limit to one fish of any size plus one fish 40 inches or bigger allowed fishermen to take a lot of fish very quickly. To spread the allocation out over a longer period of time, managers reduced the bag limit to one fish of any size on May 20. After the first season closure on May 25, fishing was opened again on Fridays only, starting July 3. The average halibut caught during the two-fish opening weighed 16.2 pounds; during the one-fish fishery the average was 15.6 pounds. Both showed a hefty weight gain over the 1991 season average of 13.3 pounds.

For the past three or four years, Neah Bay sport fishermen have ventured north into the Canadian side of Swiftsure Bank to fish after the north Washington coast season was closed or cut back to one day a week. These U.S. fishermen took as much as 15 - 20% of the entire Canadian sport catch in some years, to the chagrin of many Canadian commercial fishermen who felt these removals were unfair and may adversely affect their commercial quotas. Management of most of Swiftsure Bank falls to the Canadian government, which in 1992 closed most of the Swiftsure area to all fishing, and increased efforts to ensure U.S. charter operators complied with the proper business and work permits. (Individual sport anglers could still fish in Canadian waters with their

proper sport licenses.) In 1992, U.S. sport fishermen caught less than 40,000 pounds of halibut in Canadian waters — one-third the 1991 figure.

The total sport catch in waters off British Columbia — Area 2B — are not available for 1992. But a look at recent trends shows increasing sport catches for the past five years, increasing from 329,000 pounds in 1987 to 598,000 in 1989 and an estimated 836,000 pounds in 1991.

Fishermen in southern Washington down to Cape Falcon, Oregon took us by surprise in 1992: Though the fishing season was designed to give fishermen enough time to harvest 7,700 pounds without interruption, they actually caught nearly three times the catch limit. Their intensifying interest in halibut might mean severely reduced seasons in years to come. In the meantime, these fishermen scored big; halibut caught in this fishery averaged 20.6 pounds.

Fishermen south of Cape Falcon and into California were given plenty of opportunity to land 92,590 pounds of halibut but barely landed 81,000 pounds, and after Labor Day they turned their thoughts away from halibut altogether. Halibut averaged 20.2 pounds in 1992, up from the 1991 average of 18.8 pounds, but similar to the 1990 average of 20.4 pounds.

OFF THE BOOKS: HALIBUT TAKEN FOR PERSONAL USE

A lot more fish are taken each year than we can keep track of, and these we attempt to estimate for the "personal use" category. Personal use fish are all those not recorded on a fish ticket nor accounted for in the sport fish statistics, such as those taken home for dinner by commercial crew members, illegally retained bycatch from other commercial fisheries, or by people fishing when they shouldn't be. It's difficult to estimate how much halibut might be taken each year for these multifarious purposes. In 1992 the Commission used an estimate of 1.1 million pounds to cover personal use, 1 million pounds in Alaska and 100,000 pounds in Canada. (Very little halibut is taken for personal use in Washington, Oregon or California.) We're trying to come up with a more accurate assessment, but so far our numbers are still only speculative.

We estimate that 1.1 million pounds of undocumented fish were taken home in 1992 in what we call the personal use fishery, a take we are just now learning how to estimate.

In June 1992, we interviewed commercial fishermen in Sitka, Seward and Kodiak and, while this effort can't be called a scientific study, it did give us some indicators to learn from. Our survey told us that fishermen in those three

ports took home an average of 0.35% of their catch for personal use — 0.37% in Sitka, 0.35% in Seward and 0.33% in Kodiak. But the June opening was without trip limits; we suppose that during openings with trip limits (and the overages that come with them) and during the fall openings when everyone is more eager to stock the larder before winter, the percentage of take-home fish would be higher.

In Canada, the IVQ port monitors document all take home fish and charge them against the vessel's quota. Canadian fishermen take home an average of 0.8% of their catch. If we apply this 0.8% rate to the 50 million-pound Alaska quota we come up with an estimated 400,000 pounds of take-home fish. However, given the size of the fishing fleet in Alaska and the number of people with easy access to the resource, we figure that an additional 600,000 pounds of unreported catch was taken for personal use in 1992. Whether Alaska's actual take for personal use is a million pounds or is closer to the 1.95 million pounds we estimated for 1991 is a disturbing uncertainty.

The primary source of unreported catch in Canada is the unmonitored Indian food fishery. With no hard data to go by, the Commission used 50,000 pounds as an estimate for the unreported catch in 1991. We knew the Indian food fishery increased in 1992, so we estimated 75,000 pounds of personal use fish taken during that fishery and 25,000 pounds taken by other users, for a combined Canadian estimate of 100,000 pounds.

WHEN NO ONE IS FISHING AT ALL: WASTING THE PACIFIC HALIBUT

We estimated that 1.3 million pounds of halibut were killed by lost and abandoned longline gear in the 1992 commercial halibut fishery.

Even after the boat's back in harbor, the Hellys are hung up and the kids are hugged, there are usually some fish still out there still dying. Each year fish caught on lost gear die, and undersized halibut may die from damage they sustained from being caught and thrown back. Waste in the commercial halibut fishery is diminishing but still is great enough to give biologists, fishermen and consumers alike a bit of heartache.

Lost gear finds halibut

We gather information about lost or abandoned gear from logbooks and interviews, or by mail, and measure it in "effective skates," a term we use to equalize data about gear that varies considerably as to skate length and numbers of hooks. We estimated that about 1.3 million pounds of

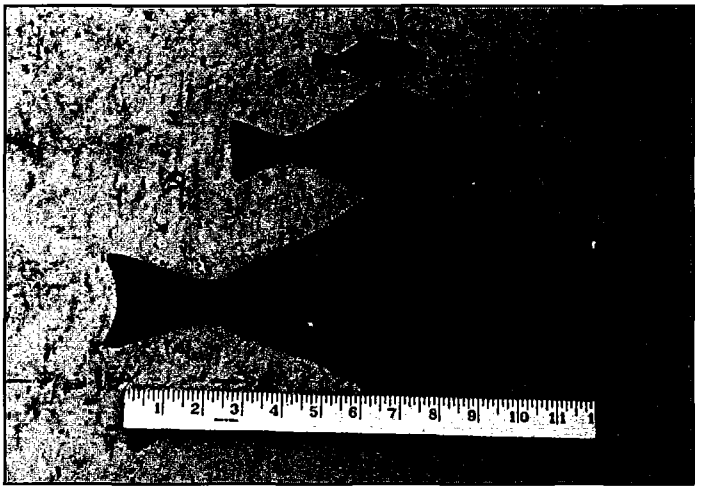
halibut were killed by lost and abandoned longline gear in 1992. This estimate is about 900,000 pounds less than 1991's estimate; perhaps a result of poor weather during the 1991 openings.

The young and the restless

No matter how careful fishermen are, young, undersized halibut die every year when they're accidentally caught in the commercial fishery. And in the frenzied fisheries in most halibut areas, fishermen don't have time to be careful. We estimate that over a million pounds of sublegal halibut were killed in 1992. Previous surveys help us predict the percentage of the catch that is under the 32-inch limit for each area: 8% for Area 2A and Area 4; 11.7% for Area 2B; 6% for Area 2C; 7% for Area 3A and 12.7% for Area 3B. There was no specific data available for Area 2A and Area 4, so we used a weighted average from the other areas. However, a survey was made in Area 4 in 1992, and that data will be used to estimate 1993 ratios of sublegal catches there.

The derby-style free-for-all of the halibut and sablefish longline fisheries don't give fishermen much time to avoid undersized fish or to be tender to the youngsters they do catch. Observations of the longline fishery in the U.S. indicate that 25% of the halibut caught as bycatch in this fishery in 1991 did not survive; we used that same 25% mortality rate to estimate undersized halibut mortality rates in the halibut fishery. In Canada, the IVQ system does give fishermen time to properly release undersized or non-targeted fish; here the mortality rate is estimated at 16%.

To calculate discard mortality, we multiply each area's total catch by the estimated ratio of legal to sublegal fish, and then multiply by the mortality rate.



About 25% of the halibut discarded as bycatch in the derby-style longline fisheries will not survive. Fewer, only about 16%, die in the Canadian IVQ fisheries.

POPULATION ASSESSMENT

THE THEORY AND PRACTICE OF OCEAN LIFE

Just as light is refracted through murky water, knowledge of the oceanic world shifts and refracts, and comes to us at an angle. We can't see the details of a halibut's life from which we could learn so much, and so we learn about them other ways: by taking annual stock assessment surveys, measuring catch relative to effort, marking the ages of the fish we harvest, comparing size with sexual maturity, and collecting as much information as we can about the communities of halibut along the continental shelf. From this family portrait we estimate the total exploitable biomass of Pacific halibut, and form a picture of how the stocks are changing.

In 1992, IPHC staff members traveled to 12 major halibut ports to interview skippers, measure fish and take otoliths from halibut as they were delivered to processors. In all, we sampled 13% of the catch and collected 14,321 otoliths. We also gathered log information from more than 3,500 halibut deliveries coastwide, which helped us compile CPUE. All this information helps build the foundation for estimating the size and condition of the halibut stocks each year, and for factoring in the various influences that affect growth or declines in the stocks.

HALIBUT STOCKS CONTINUE TO DECLINE

The total exploitable biomass of Pacific halibut in the waters off the western coast was estimated to be 265.8 million pounds in 1992 (Figure 2). Stocks

The total exploitable biomass of Pacific halibut in the waters off the western coast was estimated to be 265.8 million pounds. Stocks declined 11% this year.

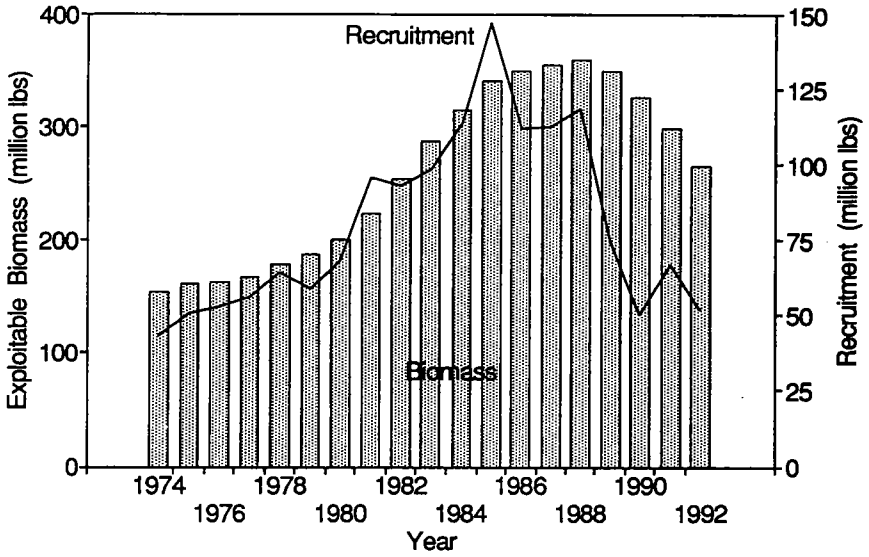
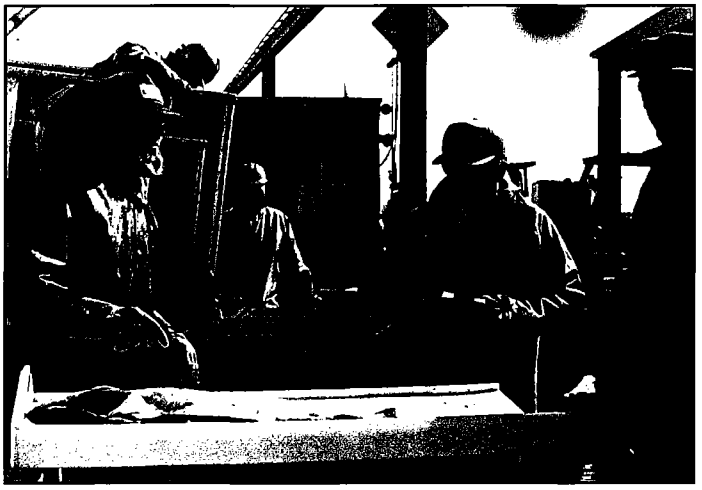


Figure 2. Pacific halibut bycatch mortality form 1960 through 1993.

declined 11% since 1991, slightly more than the 5-10% declines seen in previous years. The estimated exploitable biomass decreased by 6% in Area 2A, increased by 3% in Area 2B, and decreased by 6%, 13%, 34%, and 12% respectively in

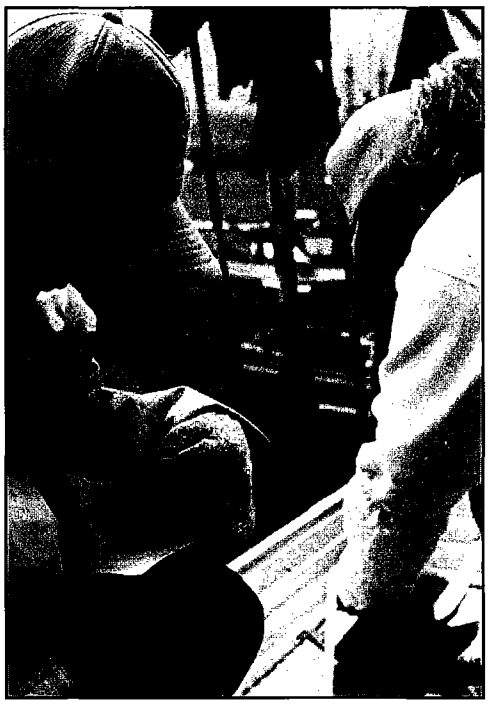


Areas 2C, 3A, 3B, and 4.

Halibut are about eight years old when they get big enough to be commercially harvested. Recruitment of 8-year-olds into the fishery appears to have dropped in Areas 3A, 3B, and 4, and to have levelled off in Area 2C, though recruitment is increasing in Areas 2A and 2B. The population is declining from the other end, too: This year's fifteen-year-old year class, which recruited strongly as 8-year-olds in 1985 is contributing less and less now to the catch.

A decreasing recruitment means that the stock will continue its 5-10% annual decline for the next several years. Low recruitment appears to be a symptom of the cyclical nature of halibut stocks; if previous cycles are an indicator, we can expect recruitment to remain low for a few years.

CPUE data reflect the amount of halibut landed for a standard measure of effort. By measuring catch per unit of effort, we learn some clues about halibut abundance. The waters off British Columbia and Southeast Alaska are the only areas where CPUE showed an upturn. CPUE declined in all other areas.



Catch per unit of effort is one clue to halibut abundance. CPUE declined in all areas except British Columbia and Southeast Alaska.

POLISHING THE MIRROR

Each year we not only estimate halibut stock levels, we refine our estimates for previous years using updated information. As we gather more accurate data on actual bycatch levels, waste and sport harvests for recent years, and increase our understanding of the inherent variability in stock dynamics, we sometimes adjust our previous estimates of halibut abundance. This is why the Commission might set catch limits higher than the industry expects in some areas, even though the stocks

In recent years, the Commission has recommended harvesting no more than 35% of the exploitable biomass. This level, though conservative, might be decreased in future years.

are going through a general decline. Catch limits are always based on the most current available information, and traditionally have been set according to a conservative exploitation rate.

For the past few years, the Commission has used an exploitation rate of 0.35, which means catch limits are set so that the total take will not exceed 35% of the exploitable biomass. A slightly lower exploitation rate of 0.30 has been recommended for the years ahead.

For the past few years, the total catch has been affected not only by diminishing abundance but also by an effort to compensate for the halibut taken as bycatch in other fisheries. Most of the halibut taken as bycatch are younger and smaller than those taken in the directed fishery, so growth and relative survival of these fish must be accounted for when computing actual compensation. In the end, the allowable catch for each area is reduced by one pound for every pound of halibut taken as bycatch.

GROWING OLDER: IT HAPPENS TO ALL OF US

Pacific halibut are getting older — but not as fast as the rest of us. The overall average age of the Pacific halibut biomass has advanced one year since 1988, and is now 12.1 years. The oldest fish are in Area 4 and Area 2C, where they average 12.7 years. The youngest fish are in Area 2A, where they average 10.7 years. The 1983 through 1978 year classes, which are now 9 through 14-year olds, dominated halibut landings in 1992. Age composition data is among the demographic information hardest to estimate about the halibut population, and we often come back to adjust our numbers slightly as final age and catch data come in.

THE RIGHT SIDE OF THE TRACKS: MAPPING HALIBUT NEIGHBORHOODS

Stock assessment formulas are designed around the assumption that the halibut population is evenly distributed throughout each area. But this is no more true for halibut than it is for people — they live in communities just as we do, clustered where the food is concentrated, or in areas that provide the best protection from enemies, or gathered for reasons yet obscure to their observers. Fishermen don't spread out evenly across an area, either, and so catch data are affected by fishing habits as well as the habits of the fish themselves. For this reason, stock assessment surveys are deliberately conducted in a grid pattern to measure not only abundance but distribution of halibut within an area.

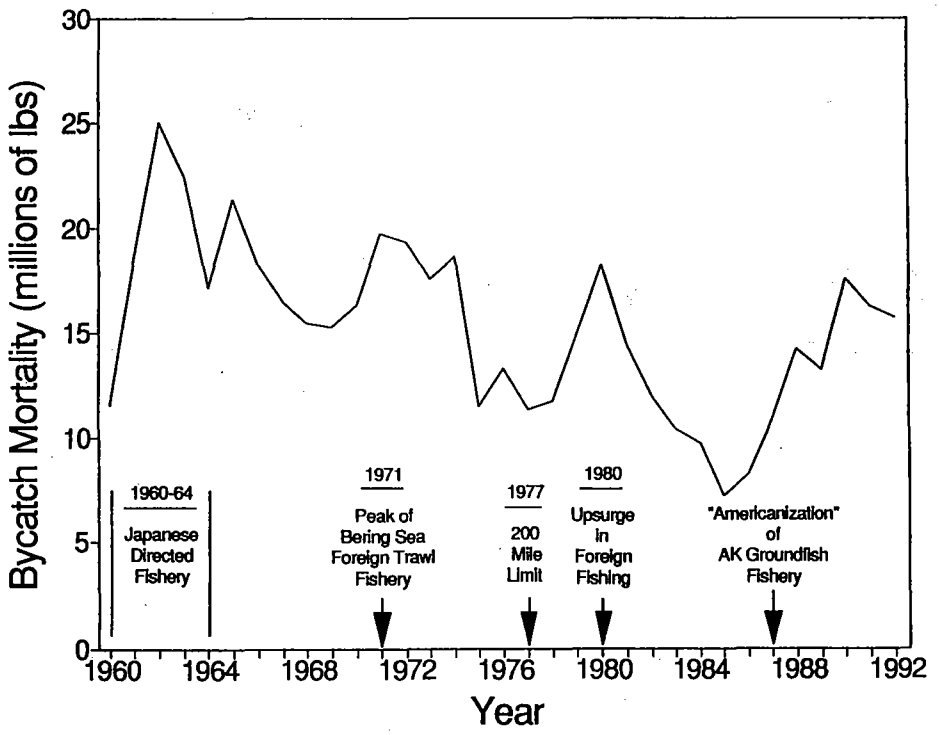
Traditionally, we estimate CPUE in the commercial fishery by dividing the total catch by the total fishing effort. We don't know how profoundly the spatial distribution of halibut, and the distribution of effort among the fleet, might prejudice the final abundance assessment. To find out, the IPHC staff is attempting to use survey data, collected along more methodological lines than commercial catch data, to draw maps of halibut distribution. These maps can later be combined with commercial data to give us a clearer picture — not only of how many halibut live off our shores, but where in that vast frontier they congregate. This geostatistical study was begun on an important commercial fishing ground for halibut off Kodiak.

WORLDS INTERTWINED
THE TANGLED WEB OF HALIBUT BYCATCH

Drop a net into any ocean and it will encounter a teeming mass of marine life. From the microscopic to the mega-sized, every creature off our coasts plays a part in the great food web. The ocean is a protein party-line, and at this time at least, it is hard to ring up a groundfish along the north Pacific coast without a halibut listening in. The interrelated nature of the ocean is part of its power, and one of its greatest puzzles.

In the North Pacific, one tangle in the web is the incidental catch of Pacific halibut by groundfish fishermen. Halibut bycatch has raised concern since the 1960s, when foreign groundfish vessels swarmed into the Bering Sea and the Gulf of Alaska in search of pollock and cod. Halibut bycatch skyrocketed as a result, hitting 25 million pounds in 1962. Bycatches have never been that high since, though some years have seen sudden leaps in bycatch rates: 1971, for example, when the foreign trawl fishery in the Bering Sea was at its peak, and again in 1980 when foreign fishing saw sudden increased pressure.

But halibut bycatch wasn't just a problem for foreign fishermen. After full Americanization of the North Pacific groundfish fisheries in 1987, bycatch rates shot up again. By 1990, bycatch mortality topped 17.5 million pounds. That year a mandatory domestic observer program set monitors aboard most groundfish vessels. Observers recorded about 90% of the Bering Sea groundfish catch and about 40% of the Gulf of Alaska operations that year (not all vessels were required to carry observers aboard on all fishing trips), and from the observers' data we began learning more about how the bycatch of halibut might be reduced.



Pacific halibut bycatch mortality from 1960 through 1992.

The domestic groundfish observer program allowed the North Pacific Fishery Management Council (NPFMC) to mandate bycatch reduction by setting bycatch caps for the groundfish trawl and longline fisheries in the Gulf of Alaska and the Bering Sea. In 1990 for the first time, domestic groundfish fisheries in the North Pacific were called to a halt when the halibut bycatch caps were reached. The closure was a painful lesson for fishermen and processors throughout the North Pacific, but that year changes began to be made. Since then, halibut bycatches have decreased only slightly — 4% in 1991 and 3% in 1992 - but groundfish catch has increased. The Commission's ongoing research, increasing awareness among the fleet, and a number of projects in the industry seeking out ways to reduce halibut bycatch, give us some hope that halibut losses to bycatch mortality will decrease significantly in the future.

The bycatch of Pacific halibut in the groundfish longline and trawl fisheries poses some philosophical — and some very real — problems for fishermen, fishery managers and the IPHC. Who should be allowed to harvest the halibut of the North Pacific? If some halibut bycatch is inevitable, what's the optimum bycatch cap? Is halibut bycatch a biological, or an allocative, issue? And what is the best use of the halibut that is taken as bycatch? The IPHC is focusing its attention on helping fishermen reduce bycatch, advocating for decreased bycatch limits, and documenting survival and mortality rates by gear type. Actual allocation decisions are made by the U.S. fishery management councils and by Canada's Department of Fisheries and Oceans, but the IPHC has lent its weight to these decisions as well, on behalf of Pacific halibut fishermen — and, some would say, on behalf of the fish themselves.

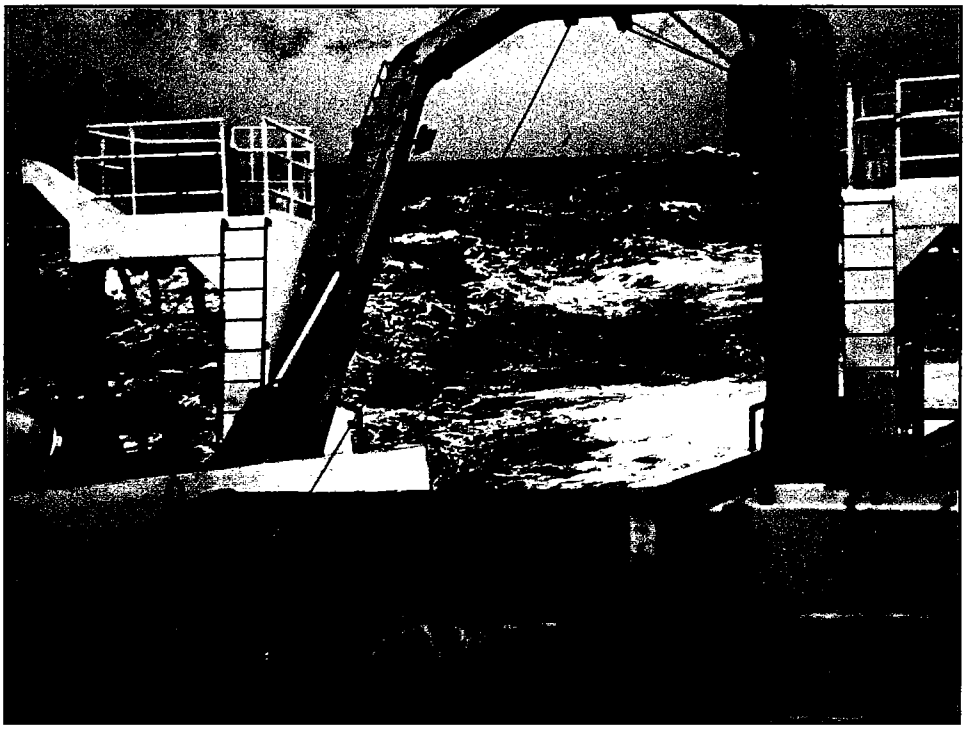
THE PICTURE IN 1992

Estimated 1992 bycatch mortality by IPHC area

Area 2	*2.6 million pounds*
Area 3	*5.0 million pounds*
Area 4	*8.1 million pounds*

We estimate that 15.7 million pounds of halibut were killed as bycatch in the groundfish fisheries in 1992. Most of them were taken from the waters off Alaska, where total groundfish harvests topped 2.1 million mt. The Gulf of Alaska halibut bycatch mortality limit was 2,000 mt for trawlers and 750 mt for longliners. In the Bering Sea/Aleutian Islands region, overall bycatch caps, not mortality caps, were imposed on specific trawl fisheries, with an overall limit of 5,033 metric tons. In 1992, the NPFMC changed the procedure for 1993, to a mortality cap of 3,775 mt. A bycatch mortality limit of 900 mt was set for Bering Sea longline fisheries, but was not actually enacted until November, after fishing was over for the year. Because of the implementation delay, halibut mortality from bycatch exceeded the cap by 81% in the Bering Sea longline fisheries in 1992.

In the end, bycatch caps shut down the Gulf of Alaska trawl and longline fisheries before the entire target quotas had been reached.



SOME CHANGES IN THE WAY THINGS ARE RUN

The NPFMC began a vessel incentive program in 1991 to encourage groundfish fishermen to decrease their halibut bycatch. The vessel incentive program established bycatch rate standards for some trawl fisheries in the Gulf and Bering Sea. Actual bycatch rates are documented by on-board observers, and for every month that a vessel exceeds a predetermined bycatch rate standard, the owner risks paying a fine. Because there is no on-the-grounds enforcement, the fines are levied after the season is over.

Pelagic trawls are exempt from bycatch caps, because they're usually fished in midwater where they don't encounter many halibut. But this year, a number of fishermen worked pelagic trawls hard on the bottom, where they took significantly more halibut than was expected. In 1992, the NPFMC changed the definition of pelagic trawl gear to prevent on-bottom fishing. This will go into effect in 1993. The new ruling on pelagic trawls, combined with the Bering Sea/Aleutian Island mortality limit finally imposed upon longliners, is expected to help significantly reduce halibut bycatch in years to come.

The IPHC, and much of the industry, still hopes for an effective in-season incentive program that rewards the most conscientious fishermen. However, problems with statistical reliability and lack of enforcement resources have hampered development of in-season incentives. As the next best alternative, we fall back on traditional management methods — setting halibut bycatch limits by period, area, and gear. We also emphasize teaching longline and trawl fishermen how to handle halibut gently and return them to the sea quickly and in good shape. Most fishermen cooperate with this approach, if they see that it directly benefits their fishing operations by extending their fishing seasons and providing them the opportunity to catch additional groundfish.

BYCATCH IN BRITISH COLUMBIA

Canada also is doing its part to help reduce halibut bycatch in the groundfish fisheries off British Columbia. Canada's Department of Fisheries and Oceans (DFO) began a Hecate Strait pilot program of fishery observers on groundfish vessels in late 1991, which continued through the summer of 1992. The pilot program, partially funded by the IPHC, provided background data for a mandatory observer program for the future.

One benefit of the pilot observer program: We learned that both the halibut bycatch and the resulting mortality rates by groundfish trawls in the area sampled off British Columbia were lower than previously thought.

HOW WE ESTIMATE BYCATCH MORTALITY

To catch a fish is one thing, and to return it alive and viable to the sea is another. In recent years we have observed and experimented with halibut caught incidentally on different types of gear, and have developed a way of measuring the "condition factor" of each fish by which observers can gauge the chances each incidentally caught halibut has of surviving once it's returned to the water.

Estimated discard mortality rates for the 1991 groundfish fisheries
Of the halibut incidentally caught in these fisheries, how many died?

Bering Sea/Aleutian Islands trawl fisheries
- *Midwater pollock: 80%*
- *Atka mackerel, rock sole, and other flatfish: 70%*
- *Pacific cod, bottom trawl pollock, and rockfish: 60%*
- *Arrowtooth flounder, Greenland turbot, and "other species": 40%*

Bering Sea/Aleutian Islands hook and line fisheries
- *All targets: 20%*

Gulf of Alaska trawl fisheries
- *Midwater pollock: 75%*
- *Rockfish, shallow water flatfish, and "other species": 60%*
- *Pacific cod, bottom trawl pollock, and deep water flatfish: 55%*

Gulf of Alaska hook and line fisheries
- *Sablefish: 25%*
- *Pacific cod and rockfish: 16%*

Pot fisheries in all areas
- *All targets: 5%*

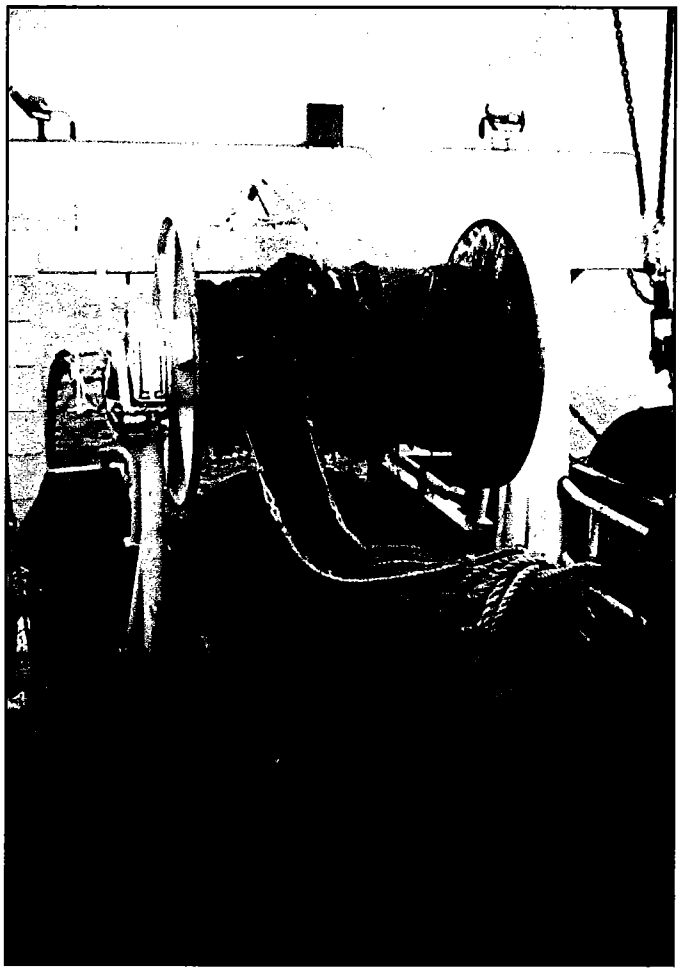
Each year, data from observers helps us refine the estimated mortality rates for each gear type.

When observers assess the condition factor of an incidentally caught halibut, they divide fish into categories: excellent, poor, and dead (or nearly dead). We estimate a 20% death rate for trawl-caught halibut in excellent condition, 55% for poor condition, and 90% for fish that are dead or nearly so.

For the longline fisheries, we estimate 2-5% of the excellent condition halibut will die; 51-53% of the poor condition fish will die; and 100% of the dead or nearly-dead fish will be lost.

WHERE'S THE PROBLEM?

In the Bering Sea and Aleutians, trawl vessels that harvested very large volumes of groundfish, or that incidentally caught the smallest halibut, reported the highest proportion of poor and dead condition halibut in their tows. Trawl nets seem hardest on small halibut, especially trawl nets that are jam-packed. In those fisheries that brought up larger halibut in their bycatch, or that harvested smaller amounts of groundfish, condition factors registered a lot better.



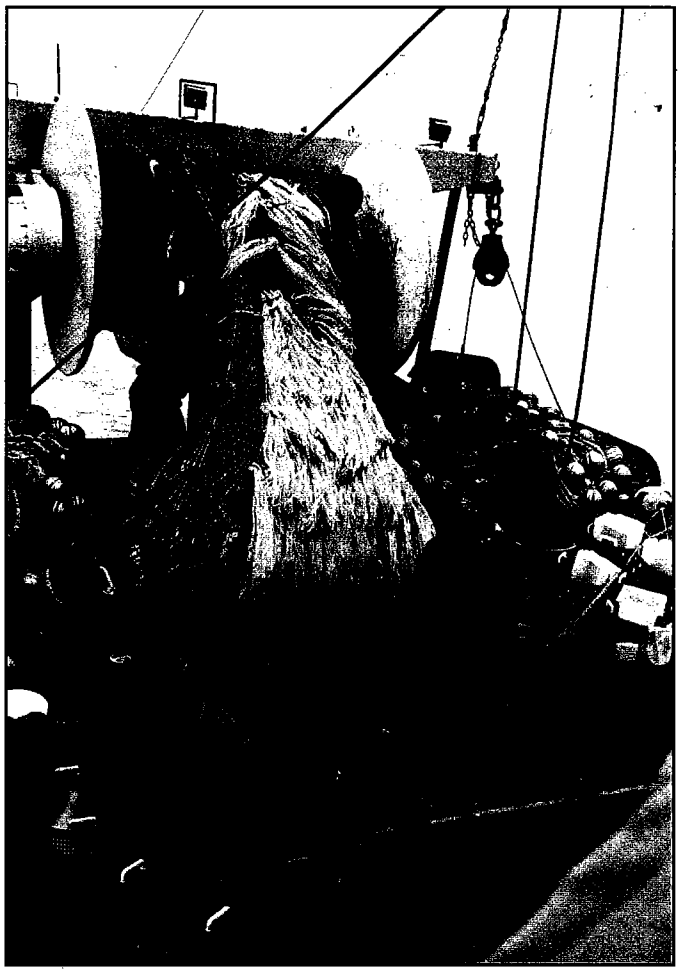
In the Gulf of Alaska trawl fisheries, there were other factors at work. Larger groundfish catches definitely contributed to poorer condition of the halibut, but here even the large trawl-caught halibut had a rough time. Species mix may have something to do with it; a great many halibut were harmed by rockfish spines.

Survivability of incidentally caught halibut varies widely by fishery, area, gear type — even from year to year. In the hook and line fisheries, the crewman at the roller plays the biggest role in halibut survivability; in the trawl fisheries there is less an individual crewman can do to increase a halibut's chances of surviving the trawl net. We hope that by keeping the most accurate information possible about mortality rates, and by designing workable incentive programs, we can help diminish halibut losses to bycatch in the future.

DOES BYCATCH AFFECT THE HALIBUT BIOMASS?

Bycatch affects the halibut population in two ways. One way is that bycatch removes fish from the population, just as directed fishing does. Halibut taken as bycatch frequently are smaller than those taken in the directed halibut fishery, and the population loses potential growth as well as biomass removed immediately as bycatch. The second way is lost reproduction potential. When calculating yield losses from bycatch, we consider not only the immediate loss of the fish, but also the lost reproductive capacity of the fish that will not grow, mature and reproduce.

Catch limits for the halibut fishery are reduced one pound for each pound of bycatch to compensate for the reproductive losses resulting from bycatch. The combination of reduced catch limits, lost biomass, and lost growth adds up to a total yield loss to the halibut fishermen of 1.6 pounds for every pound of bycatch mortality. In other words, we figure that the commercial halibut fishery loses 1.6 pounds of halibut for every pound of bycatch mortality in other fisheries.



The actual yield losses suffered from halibut bycatch vary by gear. Trawl gear tends to catch smaller halibut than longline or pot gear does, so yield losses from trawl gear are about twice those for longline or pot bycatches, because those small fish represent more potential growth than larger fish do. Remember also that actual mortality from bycatch varies by area and time of year. Using observer data and the formulas refined over the past few years, we are able to estimate the amount of yield loss the halibut fishery suffers from bycatch in each groundfish fishery, by gear type and area every year.

LOOKING THE PROBLEM IN THE EYE: ABOARD GROUNDFISH BOATS IN 1992

To get a better look at halibut bycatch on groundfish vessels fishing off Alaska, we hopped aboard a freezer longliner and a factory trawler in 1992. We took these trips to gain a better understanding of the problems faced by groundfish fishermen when halibut bycatch occurs and to suggest ways of increasing survival of those fish returned to the sea.

Our trip on the freezer longliner, which fished Pacific cod in the Bering Sea, gave us the opportunity to see how halibut are handled by longline fishermen. We tried several methods of carefully releasing halibut to find out which was easiest for the crew and the fish.

Some have suggested that survival of halibut caught on factory trawlers could be improved by returning the fish to the sea from the deck, rather than via the overboard chute in the factory as is usually the case. We tried this during our trip on the factory trawler and found that it is easier said than done. Picking all the halibut out of the tons of groundfish wasn't easy because the trawl net gets emptied pretty fast. Close coordination with the deck crew will be necessary to slow the emptying of the net in order to ensure the halibut are found. Nonetheless, it appeared possible to sort halibut out on deck before they get into the factory.

LOOKING AHEAD

The Commission has established a bycatch management goal to reduce bycatch mortality, with the historically low values as a target. However, bycatch mortality limits for Alaskan waters are expected to stay near status quo levels for the next few years. While bycatch mortality should not increase, neither are large declines likely.

At the IPHC, we continue our research to help reduce halibut mortality from bycatch and other discards. In the coming years, we plan to continue gathering information from gear experiments, underwater video projects that investigate halibut behavior around trawl nets, and trips aboard trawlers and longliners, and will use this information to help reduce bycatch and discard mortality of Pacific halibut throughout the great Pacific region.

EVALUATING THE SIZE LIMIT

Commercial fishermen can only keep halibut 32 inches or longer. The Commission established this size limit in 1973 after estimating the average yield per fish at various size limits. In other words, the minimum size limit is set to ensure that the public gains the most benefits from the fish that are landed without harming the overall health of the resource.

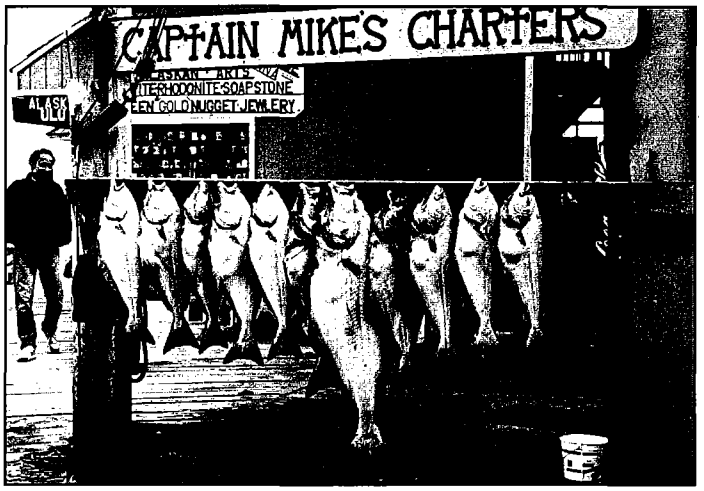
Female halibut grow faster than males do, and thus reach harvestable size at a younger age. Fish off Alaska also grow faster than their southern cousins do.

In recent years, the IPHC staff has re-evaluated the size limit, taking into account that male and female halibut grow at different rates, that halibut in different areas grow at different rates, and that growth patterns of halibut are slower than they were ten or twenty years ago. Should this new information prompt us to change the legal size limit?

The information we applied to this study is pretty interesting in itself:

- As in other species, females grow faster than males do, so female halibut reach 32 inches at a younger age than males do;
- Halibut off Alaska grow faster than their southern cousins, so they also reach legal size sooner;
- Halibut off Alaska also reach sexual maturity at a larger size than they did in the 1960s and 1970s. Halibut off British Columbia matured at a smaller size than in previous decades, and halibut in Area 2A showed no trend;
- Halibut off British Columbia and the Pacific coast recruit into the fishery at a younger age than halibut off Alaska; and
- The growth rate of Alaskan halibut has slowed in recent years, but it has not slowed for halibut off British Columbia or the U.S. west coast.

We combined information from longline research cruises with trawl survey data. Trawl gear selects halibut of different sizes and ages than longline gear does. Longline gear harvests larger fish than trawl gear. Small fish are more vulnerable to trawls, but that vulnerability decreases as the halibut get bigger. The two sets of data, from the commercial sampling and the trawl survey, complement each other, like testimony from two different witnesses to the same event.



Small fish are more vulnerable to trawls, but that vulnerability decreases as the halibut get bigger.

The average yield per recruit was calculated for several size limits to determine what size limit would provide the highest yield from the fishery. Other factors were included in the calculations: Females do not mature until they reach 43 to 48 inches so even with a 32-inch

legal limit, many females are caught long before they reach sexual maturity and begin to spawn. This is a good reason not to lower the size limit. On the other hand, since females grow larger than males do, raising the size limit would substantially reduce the harvest of males, which are less heavily exploited than females already. This is a reason not to raise the size limit. With this data, the Commission decided to leave the size limit alone.

SHOULD WE SET A SIZE LIMIT FOR THE SPORT FISHERY?

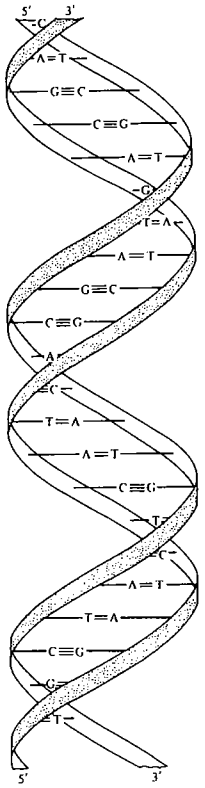
Sport fishermen can keep halibut of any size, except off Oregon and California, where the limit is 32 inches. About half the sport-caught halibut coastwide are under 32 inches, but when figured by weight, only about one quarter of the sport catch is fish that are smaller than 32 inches. In some areas, however, these fish make up a majority of the sport-caught landings.

In both cases, the great majority of fish smaller than 32 inches are only a little smaller. What this means is that the sport fishery isn't targeting the very small fish, and there would be little gain in yield from applying the size limit to the sport fishery. Yield, of course, is only one factor to consider in adopting a sport size limit. There would be social and economic consequences, probably some redistribution of catch from the commercial to the sport fishery, and possibly fewer interceptions of juveniles migrating south from Alaska. But these effects would be very difficult to estimate. The overall result of the size limit study was, at least at this time, to keep things just the way they are.

SCIENTIFIC INVESTIGATIONS

FAMILY TIES: TRACKING HALIBUT BY THEIR DNA

Who would have guessed, back in 1888 when the first commercial schooner set sail from Port Townsend to Cape Flattery in search of Pacific halibut, that one day we would be fingerprinting different halibut stocks by their DNA? In the 1960s, we began searching for biological and chemical markers that would help determine the relationship among different halibut communities in the North Pacific. Can halibut from the eastern Pacific be distinguished from Pacific halibut off the Russian coast? What genetic differences separate Pacific from Atlantic halibut, and when did they diverge from a single species? Can halibut within Commission waters be separated into individual stocks?



DNA studies of halibut show some variation in fish taken from different areas. We hope to gather enough DNA information in the future to identify separate halibut stocks within the North Pacific region.

For answers, we look to the halibut themselves. We found differences all right, but no pattern that would help differentiate among the stocks. A second study compared Pacific and Atlantic halibut using protein electrophoretic analysis. We found plenty of difference between Pacific and Atlantic halibut, but no significant difference between populations of North Pacific halibut.

In 1990, we started looking at DNA. Sampling began in 1991 and continued in 1992, along with some preliminary analysis. Tissue samples were taken of heart, cheek muscle, collar muscle and livers from a small number of fish taken from two different areas, and were analyzed with an automated sequencing system. A total of 1,117 nucleotides were sequenced from each of the fish. We found two different DNA markers, but both were found in fish from each location. With such a limited number of samples, the chances of finding variation were small. But the fact that we found any variation at all gives us a clue that, with more samples from a wider set of sampling stations, some pattern may emerge.

In 1993, we plan to collect samples from four different regions: British Columbia, the Bering Sea, the Russian coast, and the Atlantic coast. Samples will be collected during the winter months from spawning populations and sent to a lab for processing. This project may, however, be put on hold pending additional funding.

YOU ARE WHAT YOU EXPLOIT: HALIBUT AND THEIR PARASITES

Most people look at parasites as problems to eradicate. The IPHC looks at parasites as tellers of a tale, contributors to the grand database from which we learn about the world beneath the sea. The IPHC, Canada's Department of Fisheries and Oceans, and the Department of Zoology at the University of

Alberta are cooperatively studying halibut parasites for five reasons:

1) to determine the kinds of parasites present in halibut and their patterns of occurrence;
2) to clarify the taxonomy of those parasites;
3) to identify possible pathogens of halibut and parasites of public health concern;
4) to identify parasites that affect flesh quality and marketability of halibut; and
5) to see if parasites can tell us anything about halibut stocks or migratory pathways.

In 1992, we collected 43 halibut from southern B.C. and the U.S. west coast, approximately 400 adult and juvenile fish from the waters off Southeast Alaska to the Aleutians, and 200 newly settled larvae from the Gulf of Alaska. Laboratory examinations were restricted to samples collected from various localities in 1991.

By looking at parasite patterns, we hope to learn more about halibut stocks and migratory patterns, about their health, and about any potential problems that may affect marketability of the fish.

In a sample of 100 juvenile fish collected from five localities in 1991, we found 19 species of gastrointestinal helminth parasites. There were from one to eight parasite species per fish, and from seven to 1,242 worms per fish. We found no significant relationships between fish size, sex, depth of capture, number of species, or number of worms, but we did find that the Bering Sea samples had both more parasite species and more worms than fish from other areas.

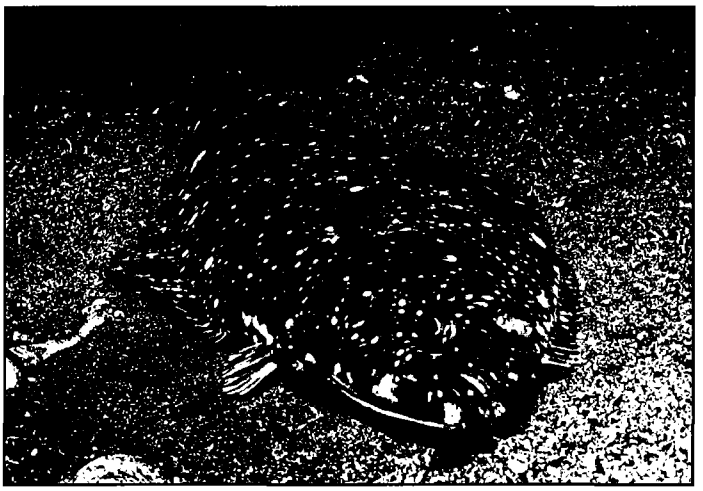
There are a few parasite species that are abundant coastwide. Several other species appear quite consistently in every area, but not in high numbers. Many of the more ubiquitous species are found in a wide variety of marine fishes, but some of them appear to be more common in halibut. Some parasite species are concentrated by area.

There is still little evidence that parasites cause significant harm to halibut. We already know that *Anisakis simplex* and *Pseudoterranova decipiens* in improperly frozen or undercooked halibut can cause infection in humans, and that *Kudoa thrysites* can cause milky textured flesh in heavily infected fish that are not frozen quickly after landing. We hope to learn more about the pathology of halibut parasites when the 1992 samples are processed.

Overall, halibut parasites seem to be similar to those found in other fishes, though there are some species that are more common in halibut than in other fishes. We continue to believe that local conditions determine, to a great extent, the pattern of parasites in halibut, and this gives us hope that we may be able to identify different populations by the parasites they carry.

EYEWITNESS TO THE UNDERWORLD: VIDEOS SHOW HALIBUT BEHAVIOR

Two hundred million pounds of halibut are hard to hide. For trawlers targeting groundfish in the North Pacific, halibut can be just as difficult to hide *from*. The groundfish fleet off Alaska is leading a concerted effort to avoid incidental catches of halibut, crab, salmon, and other species by studying gear modifications, time and area closures, and adhering to bycatch limits imposed by the North Pacific Fishery Management Council, a management device that closes down fisheries when the halibut bycatch limit has been reached.



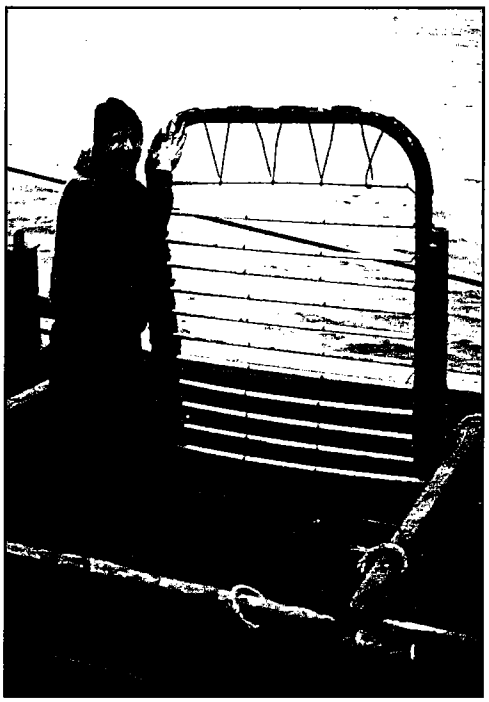
The underwater video project is helping document how halibut behave in the presence of trawl gear, and how their behavior differs from pollock and cod. This information will help the industry reduce halibut bycatch.

Gear modifications have successfully reduced bycatch in a number of fisheries worldwide, particularly the Nordmore grid used to separate shrimp from fish, and the Turtle Excluder Device, which allows turtles to escape from shrimp trawls. The IPHC believes gear modifications show promise in helping North Pacific trawlers reduce their halibut bycatch.

For the past three years, we have been involved in a cooperative project with the National Marine Fisheries Service using an underwater video camera system to watch the behavior of halibut and other species in and around bottom trawl gear. We hope to document some behavioral difference between the target species — pollock and Pacific cod — and the halibut who share their habitat, so trawlers can find a way to change trawl gear or adjust fishing methods to better avoid the halibut.

We took the underwater video camera gear out on the *Royal Baron*, a Kodiak-based trawler, from August 13 to September 4, 1992. We knew that time of year would give us both strong daylight and relative freedom from plankton blooms, which reduce visibility for the video cameras. We worked the east side of Kodiak Island in water shallower than 50 fathoms, as we had done in 1990 and 1991, picking trawl locations most likely to yield both halibut and Pacific cod.

As in previous years, we mounted a low-light camera on a pan/tilt apparatus attached to the trawl. The camera was connected to the surface by an electro-mechanical cable, so we could record on 8 mm video tape and observe through the camera at the same time. The camera system was attached to the trawl at several locations, including several points on the top midline of the



Staff from the IPHC and NMFS collected 60 hours of underwater video taken of 50 trawl hauls.

trawl, between the headrope to the codend, and on the upper trawl wing. From these different positions, we could watch the fish as they encountered the lower bridles, as they swam ahead of the footrope, as they passed through the trawl, as they accumulated near the codend, and as they encountered several modifications of the trawl.

We included several gear modifications in this year's video study, and watched how halibut and cod behavior changed when the gear modifications were added.

After 50 trawl hauls that gave us 60 hours of video and sonar observations, we had a lot of material to analyze. During that time we also used sonar to observe pollock behavior in front of a bottom trawl, and a team from the University of Washington collected a small number of halibut for a study of the mortality of trawl-caught fish.

The underwater video cruise went far better in 1992 than the previous year. The gear proved more durable, we took along a spare camera, and we had a new pan/tilt and a more rugged connecting cable, and so didn't suffer the same gear problems that plagued the 1991 cruise.

By the end of the year, we had just begun analyzing the data recovered from the underwater video observations we made. These data will be added to the studies other organizations are conducting on trawl gear modifications and how they might decrease halibut bycatch in the groundfish fisheries.

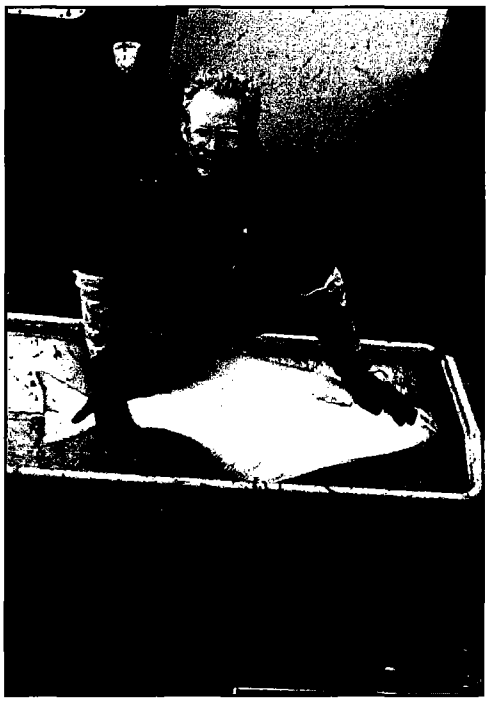
ASKING QUESTIONS OF THE SEA: LONGLINE SURVEYS OFF ALASKA

Anyone who starts out life as a larva drifting in the currents and ends up flattened on the bottom of the sunless sea no doubt has a story to tell. We take our questions down to the sea in surveys, hook our questions to well-placed longline gear and learn as much as we can from the evidence we bring up. From our longline surveys we learn not only the relative abundance and distribution of the stocks but also average size, age, sex composition, growth rates, mortality rates and a lot about the personal lives of Pacific halibut.

One of the most important clues we have to the growth patterns of halibut has been the otolith — the tiny, pearl-white earbone that registers the life course of a halibut the way a tree forms rings as the years go by. These annuli, or otolith rings, reveal certain details about food abundance, water temperatures

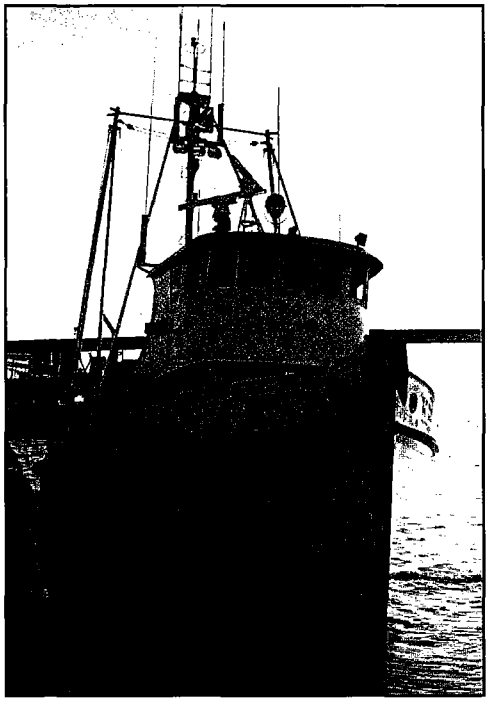
and other environmental factors the halibut encounter through their lives.

Since the early 1960s, we have been able to estimate the length of a particular halibut by measuring its otolith. The method of prediction has evolved over the years; since 1978 we have estimated fish length by the weight of the otolith. We first noticed a downward trend in this relationship in 1986, and in 1988 we began questioning our established procedures for estimating fish size this way. We conducted a cruise that year in Area 3A aboard the chartered vessel *Polaris* to test our standard procedure. We learned that the average weight at age was declining as a result of a change in the sex ratio of the catch — remember that males grow more slowly than females — and that our estimates of body weight from otolith weight had developed a bias that did not take the changing sex ratio into account.



We have long used otolith size to estimate the size of the fish. We now are learning that the relationship between otoliths and fish size is changing.

The IPHC staff has been following up on this research in the years since. In 1989 we chartered the Canadian vessel *Ocean Viking* to survey Area 2B and the U.S. vessel *Chelsea* to survey Areas 3A and 3B. These collection cruises provided a sample of some 5,100 fish of known sex, age, and individual weight. We concluded that the otolith/fish size ratio differed from area to area, but equally important was the confirmation that the relationship had changed over time.

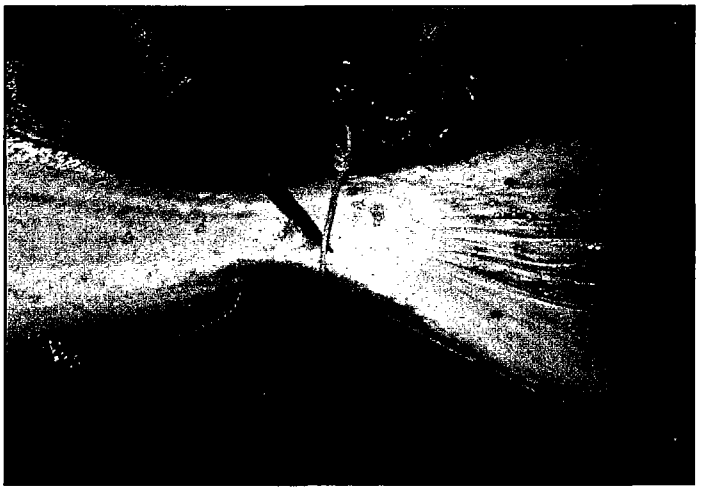


In 1992 we chartered the U. S. vessel *Kaare* to conduct collection research cruises in Area 3 and Area 4. The *Kaare* collected about 7,000 fish from both areas for otolith weight/body weight comparisons of known sex, age, and individual weight. We also recorded length at age

and maturity data by sex.
From this survey, we were able to:

- validate the length-weight relationship in Area 4;
- collect biomass information and CPUE estimates from the lightly exploited grounds of western Area 4B;
- obtain length at age and maturity data;
- estimate the proportion of sublegal fish in setline catches;
- compare the results of otolith weight-body weight relationshipsobtained in Areas 3A and 3B in 1992 with those obtained in 1989.

We also used this survey as an opportunity to explore the western part of Area 4B, west of the Petrel Bank. The commercial halibut fleet has neglected this area recently, partly because of short fishing openings, the remoteness of the region, and lack of fueling facilities west of Dutch Harbor. With the fishing periods in Area 4 ranging from 24 to 72 hours, it has become financially impractical for most of the fleet to fish the western part of Area 4B. As a result, we lack current data on the relative abundance of halibut in this area. We were particularly interested in obtaining a good sample of age, size composition data, and stock biomass from those lightly exploited grounds.



For the survey, the *Kaare* fished conventional gear, 1500 foot skates, #3 circle hooks, with 13-foot spacing between the hooks, for an average number of 113 hooks per skate. We fished in as many different depth strata as possible.

News from west of Petrel Bank:
Some field observations from western 4B

- *Not exactly a retirement spot, but there appears to be a moderate accumulation of large and older fish in the area.*
- *The CPUE appeared to be generally higher here than in the area east of 180° (Unimak Pass to Petrel Bank), thougt considering the fact that there's little fishing pressure here, the CPUE seemed particularly low. It also seems to vary with the terrain.*
- *Sand flea predation increased as darkness fell.*
- *Any abundance of larger and older fish that this area might enjoy now probably would be eliminated if directed fishing is increased in this area.*

Generally, soak time for the first string was about four hours.

All legal-sized halibut were retained, measured, and documented, and we kept three fish from each 1-cm size interval below the legal limit for the otolith weight-body weight study. The length, sex, and sexual maturity of every fish was determined, the left-side otolith was removed and numbered, and a correspondingly numbered plastic disk was attached to the tail of the fish with braided nylon twine so that its weight could be recorded when the fish were unloaded.

Some curious observations

Age reading of the otoliths from the 1992 longline cruises will be available in 1993. In the meantime, a few on-the-grounds observations raised some curiosity among biologists. Though they might not be scientifically quantifiable, these observations may significantly increase our understanding of the life history of halibut.

First, some halibut in Area 4A exhibited various degrees of grey coloration on the blind side (white side). In general, the halibut whose blind side was more than 50% gray turned out to be males. Female halibut usually had only slight grey coloration. In females, the light gray pattern was usually concentrated on the head, and typically was arranged in a narrow band along the dorsal fin and/or in a band extending between the lower jaw and the pelvic fins.

Some male halibut in Area 4A turn a dusky gray color on at least a portion of their blind side. Females had less gray coloring.

Another curiosity arose over the size or thickness of some of the otoliths collected during the survey. The otolith in some large halibut was found to be extremely thick, and the progression of the annuli appears to the naked eye to curl sharply downward at the edge, possibly giving a false surface reading. We also noticed other variations that might lead biologists to misread otoliths. The white side otoliths in some halibut were smaller than usual, compared to otoliths from similar-sized fish. In most cases, these otoliths displayed no external sign of crystallization and the dark-side otolith was twice the size, or more, than the small white-side otolith.

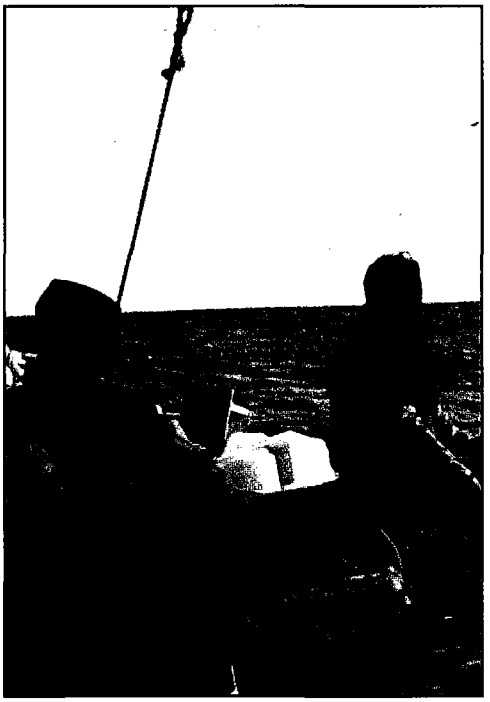
TRAWLING FOR THE TRUTH: AREA 2A SURVEY

Every three years NMFS conducts a bottom trawl survey of the fisheries off the West Coast at depths ranging 55 meters to 366 meters. In 1992, we participated in their survey to collect otoliths and length and gender data of the Pacific halibut caught along the way. Information from trawl surveys helps us compare the differences between fish that are caught in trawl gear and the fish targeted by the commercial longline fishery. The 1992 trawl survey captured 222 halibut in 103 of the 568 survey tows. All of these fish were sampled in the field except for 43, which were frozen and sent to biologists in Nanaimo, B.C. for an ongoing parasite study.

The *F/V Green Hope* and the *R/V Alaska* fished the NMFS survey trawls. The *Green Hope* began sampling off Point Conception on July 13, working northward, and was joined by the *Alaska* off Eureka, CA on August 20. The two vessels worked together for the remainder of the survey, sampling alternate tracklines up to Estevan Point on Vancouver Island. The survey period was divided into roughly 20-day legs, four legs for the *Green Hope* and two for the *Alaska*.

Trawl surveys complement the information gained from the commercial longline fishery, since trawls bring up a different species complex than longline gear does.

A NMFS survey is slightly more complicated than a normal commercial trawling voyage. The sampling grid was stratified by both latitude and depth, based on known distributions of Pacific hake (*Merluccius productus*) and juvenile sablefish (*Anoplopoma fimbria*). Tracklines, or tow patterns, were set perpendicular to the coast at 10 nmi intervals. Additional tracklines were used in areas designated for high-density sampling. Crew members measured length of tow, vertical and horizontal dimensions of the trawl, depth of tow, distance fished, and surface and bottom temperatures.



The surveys showed a small decrease in halibut biomass in 1992, and a somewhat larger decrease in numbers since 1989. For the whole area surveyed, the estimated biomass decreased from 7,308 tons in 1989 to 6,882 tons in 1992. We saw higher abundance of halibut only in the Columbia River area and the U.S. portion of the Vancouver area, and decreases in every other area surveyed.

One significant change in the fish surveyed: The older fish are a higher proportion of the catch. Presumably, the large year-classes from the middle and late 1980s are now being followed by smaller year-classes, which would explain the preponderance of large fish.

TRAWLING FURTHER NORTH: HALIBUT APLENTY

A large portion of the Bering Sea is considered a nursery ground for juvenile halibut. Fish aged two to six years normally migrate south and eastward. The NMFS trawl surveys of the Bering Sea, conducted first in 1975 and annually since 1979, provide invaluable information not only about halibut but about the whole Bering Sea ecosystem north to about 61°N. These surveys cover the primary summer feeding grounds for juveniles. Every third year the survey extends out to the northern shelf and the continental slope.

Biologists estimate abundance by counting the catch from the trawl and figuring out how much biomass is out there, assuming the trawl catches everything between the wings and nothing outside that path. This estimate may be biased high or low, but we believe that over a long period it provides a good index of the relative abundance of halibut.

The 1992 NMFS trawl survey of the Bering Sea brought in an estimate of about 100,000 metric tons of halibut or approximately 42 - 47 million fish.

The total halibut biomass in the Bering Sea has increased since 1979, but has changed little since 1983. In the past two years' surveys, we have been seeing about twice the average number of juvenile halibut, those under 65 centimeters, but we believe there has been no real change in the overall stocks since the late 1980s. Meanwhile the total number of fish took a downturn in 1992 after increasing for several years.

Sometimes a year-class of halibut stands out, as the 1977 year-class did as 20-centimeter two-year-olds in 1979. That year-class sustained the overall level of juvenile abundance for the next two or three years. Bering Sea halibut enjoyed a baby boom again in 1987. That year-class showed up strongly in 1989, and appeared in 1990 as an enormous spike, head and shoulders above the spike the 1977 year-class had showed in 1980. Again in 1991 and 1992, the 1987 year-class appeared stronger than the 1977 year-class at the same ages (age 4 in 1981 and age 5 in 1982). It does not appear, however, that the 1987 year-class is surrounded by other good year-classes as the 1977 year-class was.

The total halibut biomass in the Bering Sea has increased since 1979, but has remained fairly steady since 1983. The 1987 year-class was the strongest in the last decade.

Since the 1987 baby-boomers throw a significant curve on overall statistics, their health and behavior are worth watching. At five years old, their natural mortality and steady migration out of the Bering Sea probably are

responsible for the decline in the number of juveniles in the 1992 survey. Fish of the 1987 year-class will begin to appear in the commercial longline fishery coastwide at age eight in 1995.

KEEPING TABS ON HALIBUT

The IPHC has released more than 264,000 tags over the last twenty years. When the tags show up, they tell quite a story about the fish that carried them.

In 1992, we recovered 372 tags from the commercial and sport fisheries, 114 from Area 2B and 104 from Area 3A, our two primary tagging areas. We were sent 46 tags from fish harvested in Area 2A, 44 from Area 2C, and 39 from the Bering Sea. There were 25 tags from unknown recovery areas, usually turned in by plant workers, fish tenders, or others who have no way of knowing where the fish was actually harvested.

In 1992 we recovered 372 tags from the commercial and sport fisheries. Tagging studies reveal volumes of information about halibut migratory patterns.

Our most recent tagging experiments have produced high returns. We have recovered 44% of the tags from the 1988 Sitka Spot experiment in northern British Columbia, which released 2,652 tags. In 1989 we tagged 2,118 halibut off the coast of central Oregon, and by the end of 1992 we had recovered more than 20%. Tagging studies tell us of migratory patterns, growth and other halibut activities we otherwise probably would not be able to detect.

Some smooth movers

Most tagged fish don't go too far, but a few fish take remarkable trips through the North Pacific. Figure 3 shows the fish that traveled farthest from

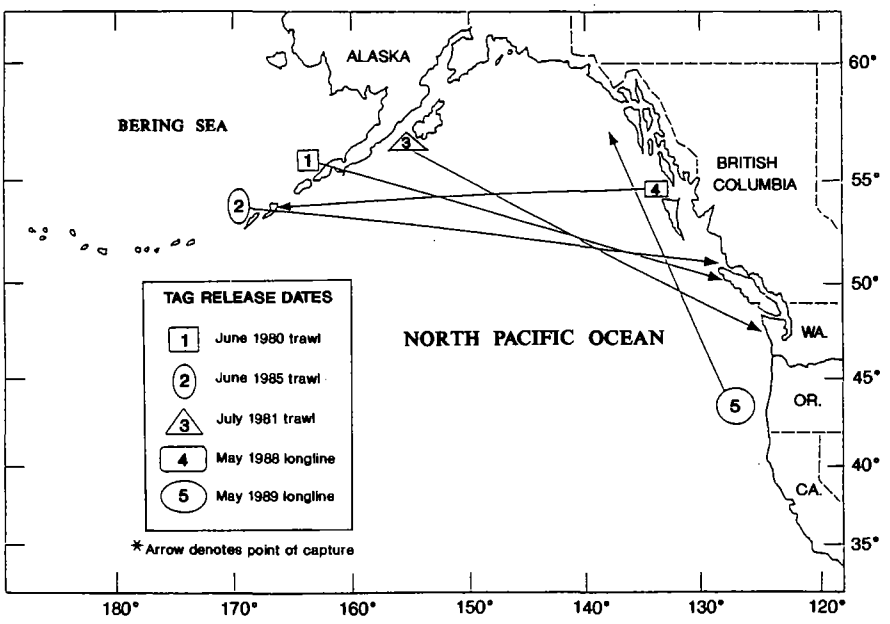
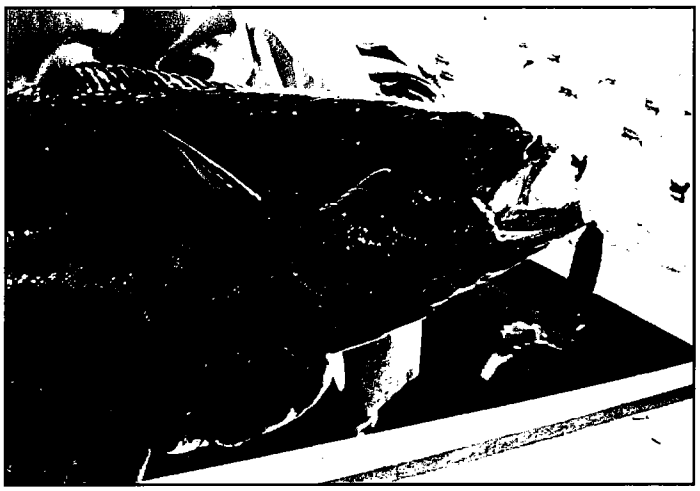


Figure 3. Five tags recovered in 1992 that moved the greatest distance from the area of release.



their release area. Two that were tagged in the Bering Sea were finally harvested off northern Vancouver Island. These fish were part of trawl experiments in 1980 and 1985 and were sublegal in size (less than 82 centimeters) when they were released. Another tagged fish was recovered off the Washington coast, eleven years after it was released near the Trinity Islands in western Alaska. And, bucking the trend, two of our star swimmers migrated north, probably to spawn. Both fish were released as part of longline experiments. One fish moved to Southeast Alaska from the 1989 Oregon tagging project, and the other to Unalaska Island from the 1988 Sitka Spot study off Rose Spit in B.C.

Most halibut tags are recovered by longline fishermen in the commercial fishery — 280 in 1992. Most of these came from waters off Alaska and B.C. A few are recovered by Oregon and Alaska sport anglers. Fewer still are recovered by trawlers, mostly off the Washington and Oregon coasts.

In 1992 38 tagged fish were released in Cook Inlet as part of the Homer halibut derby, and Glacier Bay National Park started a research project on local halibut. This research is using sonic tags combined with IPHC wire tags to track halibut movement within and outside of park boundaries. In 1992 researchers in the park tagged over 500 halibut with wire tags, and the Commission collected about 15 of these in conjunction with port sampling work. Tagging in the park will continue, with possibly 1,000 tag releases in 1993.

Tagging also tells us about the fishing grounds

Sometimes a tagging study can tell us more than just fish tales. The Sitka Spot experiment of 1988 has told us a little bit about the fishing grounds as well. The Sitka Spot is a particularly bountiful fishing area in inside Dixon Entrance at the northern end of Area 2B. About one mile by 2.5 miles, the area ranges between 87 and 105 fathoms deep and has always been intensively targeted by fishermen. To what end? we asked ourselves. Does intense fishing pressure over a long period of time have a detrimental effect on the local halibut population? Is there a resident halibut population in this area, or do a large number of fish just move through regularly?

The Sitka Spot tagging study of 1988 has revealed some significant information about why these grounds are so productive.

For 21 days in 1988, we carefully harvested, weighed, measured, sexed and tagged 2,652 halibut (2,395 adults and 257 sublegal size). The average

participant in this study was 97 centimeters, or 37.8 inches long, with females averaging about 10 centimeters longer than the males. The ratio of males to females was about equal.

During the tagging study, we also monitored catch rates to measure how much the local stock was being depleted day by day. Usually, catch rates on a fishing ground will decline as fish are removed, but a 1987 study in lower Hecate Strait showed that the local stock fluctuated during a period of continuous fishing but didn't actually decline. This told us there must have been a high rate of migration of halibut into the area. Was the same true for Sitka Spot?

To find out, we chartered two vessels, the Canadian *F/V Snowfall* and the U.S. *F/V Cape Flattery*. On separate trips the two vessels intensively fished the Sitka Spot area, making six sets daily of four skates per set. Within this relatively small fishing area, it was interesting to see how catch rates differed from set to set. Even the average weight of the fish increased, from 21.4 pounds on the first fishing trip to 24.4 pounds on the second.

The significant discovery was that the number of halibut in the area didn't appear to diminish even after a period of intense fishing. The average catch rate fluctuated a little between trips one and two, but overall catch figures from both trips indicate that no depletion of the halibut population was taking place.

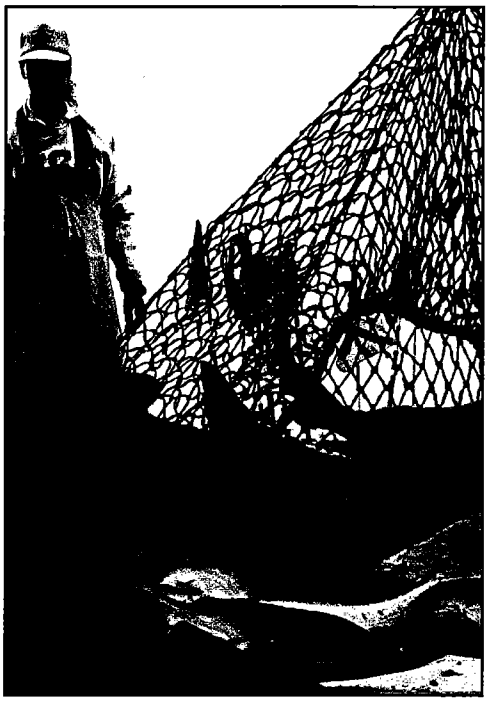
In contrast, the catch rate of dogfish dropped significantly over the fishing period on both trips. Dogfish and halibut were the dominant species in the total catch of both trips, and while dogfish numbers decreased to just a few fish by the end of each trip, halibut numbers sometimes increased with time. These results tell us that the Sitka Spot enjoys such a bountiful halibut harvest because fish regularly migrate into the area to take the place of the individuals newly departed via longline gear.

The number of halibut in the Sitka Spot area didn't seem to decrease, even after periods of intense fishing. Dogfish, the second most abundant species in the area, did decrease.

To date, we have recovered 1,178 tags, 44% of the original tagged releases. While overall tag recoveries decreased after the quota system began in British Columbia, recoveries from the Sitka Spot area actually increased from 130 in 1990 to 163 in 1991, indicating what a hot fishing spot this area is. From 1988 to 1992, tagged fish were recovered from the Goose Island Bank in Queen Charlotte Sound to Unalaska Island on the Aleutian Chain. Most of the tag recoveries, 72%, came from the immediate area; in fact, 96% came from the area of release or areas very close by. This tells us that not many fish migrated out of the study area in the past five years.

However many fish migrated in. Some 54 tags showed up from other tagging studies, and most of these migrated into the Sitka Spot area from the north. Three tags were recovered from more southerly climates. We are now analyzing the results of this tagging study for a forthcoming report.

WE GO DOWN TO THE SEA IN SHIPS



From tag studies to trawl surveys, from underwater videos to otoliths collected at the dock, all our data collection leads to one inescapable fact: That we who live beside the sea, who make our living in the lab or in a labyrinth of oceanic forces, are witness to a life cycle almost beyond our comprehension. And as stewards of the resource, as consumers of its protein and harvesters of its deepest and most sustaining mysteries, the entire fisheries community — biologist, manager, fisherman, policy-maker, marketer, chef or skiff-boat angler — is fortunate indeed.

We hope the research the IPHC conducts, together with studies done by other agencies and organizations, will help increase understanding of the Pacific halibut that live off our coasts, and of the great froth of life beyond our shores that feeds us and nourishes our world.

APPENDICES

The tables in Appendix I provide season and catch information for the 1992 fishery. 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 1992 commercial fishing season, and Appendix III shows current sport fishing statistics.

All of the weights used are dressed (eviscerated), head off. Round weight can be calculated by multiplying dressed weight by a factor of 1.33.

APPENDIX I:

Table 1. Fishing periods, number of fishing days, catch limit ancatch (000s of pounds) by regulatory area for the 1992 commercial Pacific halibut fishery.

Table 2. Number of vessels and catch (000s of pounds) of Pacific halibut by vessel length class in the 1992 commercial fishery. Information shown for Area 2A does not include the treaty Indian commercial fishery.

Table 3. Commercial landings in 1992 of Pacific halibut by port and country (000s of pounds).

APPENDIX II:

Table 1. Fishing period limits used in 1992 for each regulatory area and fishing period.

APPENDIX III:

Table 1. Catch by sport fishermen (000s of pounds) by area, 1987-1991.

Table 2. 1992 catch allocations and estimates by subarea (pounds, net weight) within regulatory Area 2A.

APPENDIX I.

Table 1. **Fishing periods, number of fishing days, catch limit and catch (000s of pounds) by regulatory area for the 1992 commercial Pacific halibut fishery.**

Area	Fishing period	No. of days	Catch Limit	Catch
2A	3/01-5/31[1]	91	152.5	155
	7/29	10 hrs	243.75	173[2]
	8/12	10 hrs		109[2]
				282
2B	3/08-10/31	237	8,000	7,626
2C	6/08-6/09	1	10,000	5,719
	9/07-9/09	2		2,039[2]
	10/05-10/07	2		2,061[2]
				9,819[3]
3A	6/08-6/09	1	26,600	14,580
	9/07-9/08	1		10,422[2]
	10/05-10/07	2		1,780[2]
				26,782
3B	6/08-6/09	1	8,800	7,220
	9/07-9/08	1		1,089[2]
	10/05-10/07	2		311[2]
				8,620
4A	6/08-6/09	1	2,300	260
	8/06	.5		652[2]
	8/21	.5		488[2]
	9/22-9/23	1		1,299[2]
				2,699
4B	6/08-6/09	1	2,300	3
	6/10-7/12	8.5[4]		216
	8/06-8/08	2		516[2]
	8/21-8/24	3		1,239[2]
	9/22-9/24	2		343[2]
				2,317
4C[5]	6/07-7/07	16[6]	800	584
	7/18-7/19	1		209
				793
4D[2]	8/06-8/08	2	800	727
4E[5]	5/31-9/18	74[7]	130	72
	9/19-10/31	42		0
				72
Total			60,126.25	**59,892**

1 Treaty Indian fishery.
2 Fishing period limits by vessel class.
3 Includes 23,000 pounds taken by Metlakatla Indians during additional fishing within reservation waters.
4 Alternating 12 hours open and 36 hours closed.
5 Single fishing period limit for all vessels.
6 Alternating one day open and one day closed.
7 Alternating two days open and one day closed.

APPENDIX I.

Table 2. **Number of vessels and catch (000s of pounds) of Pacific halibut by vessel length class in the 1992 commercial fishery. Information shown for Area 2A does not include the treaty Indian commercial fishery.**

Overall Vessel Length	Area 2A		Area 2B	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	2	2		
< 26 ft	43	16		
26 to 30 ft.	12	4		
31 to 35 ft.	16	8	*Data not yet available	
36 to 40 ft.	46	58		
41 to 45 ft.	28	49		
46 to 50 ft.	26	48		
51 to 55 ft.	14	33		
56 + ft.	18	64		
Total	205	282	433	7,626

Overall Vessel Length	Area 2C		Area 3A	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	15	35	20	125
< 26 ft.	386	428	233	229
26 to 30 ft.	141	250	143	196
31 to 35 ft.	231	774	261	1174
36 to 40 ft.	364	1,752	324	2292
41 to 45 ft.	230	1,934	232	2727
46 to 50 ft.	177	2,035	179	2444
51 to 55 ft.	72	827	102	2155
56 + ft.	159	1,784	428	15,440
Total	1,775	9,819	1,922	26,782

Overall Vessel Length	Area 3B		Area 4	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	2	28	6	23
< 26 ft.	8	12	56	189
26 to 30 ft.	2	<1	16	171
31 to 35 ft.	68	556	48	330
36 to 40 ft.	80	595	11	123
41 to 45 ft.	60	687	6	158
46 to 50 ft.	63	921	18	392
51 to 55 ft.	32	569	13	404
56 + ft.	163	5,252	127	4,818
Total	478	8,620	301	6,608

APPENDIX I.

Table 3. Commercial landings in 1992 of Pacific halibut by port and country (000s of pounds).

Ports	Canada	United States	Total
California & Oregon		548	
Seattle		1,288	
Bellingham	70	752	
Misc. Washington	79	939	
Vancouver	2,947	43	2,990
Port Hardy	1,430		1,430
Misc. Southern B.C.	964		964
Prince Rupert	1,872	689	2,561
Misc. Northern B.C.	264		264
Ketchikan, Craig, & Metlakatla		1,704	1,704
Wrangell		614	614
Petersburg		3,388	3,388
Juneau		530	530
Sitka		3,149	3,149
Hoonah, Excursion, & Pelican		2,469	2,469
Misc. Southeast Alaska		165	165
Cordova		1,531	1,531
Seward		3,997	3,997
Homer		6,124	6,124
Kenai		1,124	1,124
Kodiak		12,604	12,604
Chignik, King Cove, & Sand Point		3,774	3,774
Misc. Central Alaska		2,758	2,758
Akutan & Dutch Harbor		3,466	3,466
Misc. Bering Sea		610	610
Total	7,626	52,266	59,892

APPENDIX II.

Table 1. Fishing period limits used in 1992 for each regulatory area and fishing period.

		Pounds Net Weight										
Reg. Area Opening		2A 7/29	2A 8/12	2C 9/7-9 2C&3A/B 10/5-7	3A 9/7-8	3B 9/7-8	4A 8/6 8/21	4A 9/22-24	4B 8/6-8	4B 8/21-24	4B 9/22-23	4D 8/6-8
Vessel Class												
Ltr	Len(ft)											
A	0-25	500	250	700	1,400	1,000	1,300	1,800	2,100	3,150	2,400	1,900
B	26-30	600	300	1,200	1,700	1,200	1,400	2,000	2,200	3,300	2,500	1,900
C	31-35	900	450	1,900	6,100	4,400	6,600	9,200	10,600	15,900	11,900	9,300
D	36-40	2,400	1,200	3,000	6,300	4,500	7,700	10,800	12,300	18,450	13,800	10,800
E	41-45	2,500	1,250	4,800	9,500	6,800	9,400	13,200	15,100	22,650	17,000	13,200
F	46-50	3,000	1,500	6,800	12,600	9,000	11,400	16,000	18,200	27,300	20,500	16,000
G	51-55	3,400	1,700	6,800	19,200	13,700	16,900	23,700	27,100	40,650	30,500	23,700
H	56+	5,000	2,500	10,000	35,000	25,000	25,000	35,000	40,000	60,000	45,000	35,00

APPENDIX III.

Table 1. Catch by sport fishermen (000s of pounds) by area, 1987-1991.

Area	1987	1988	1989	1990	1991[a]
2A	446	249	327	197	158
2B	329	508	598	760	836
2C	780	1,076	1,559	1,330	1,654
3	1,989	3,264	3,005	3,638	4,236
4	30	36	24	40	74
Total	3,574	5,133	5,513	5,965	6,958

a Preliminary Estimates

Table 2. 1992 catch allocations and estimates by subarea (pounds, net weight) within regulatory Area 2A.

Subarea	Catch Allocation	Catch Estimate
Washington		
Puget Sound[a]	48,323	51,068
North Coast[b]	92,664	91,373
South Coast[c]	7,700	23,143
Oregon		
Central Oregon[d]	2,911	1,738
Southern Oregon[e]	60,131	57,164
Cent. and So. Oregon[f]	8,333	706
Cent. and So. Oregon	21,215	22,012
California	2,473	2,473
Total	243,750	249,677

a East of Bonilla-Tatoosh Line
b Bonilla-Tatoosh Line to Queets River
c Queets River to Cape Falcon
d Cape Falcon to Nestucca Bay
e South of Nestucca Bay
f Restricted to waters inside the 30 fathom curve

PUBLICATIONS

The Commission publishes three serial publications - Annual Reports, Scientific Reports, and Technical Reports - and also prepares and distributes regulation pamphlets and information bulletins. Items produced during 1992 by the Commission and staff are shown below. A list of all Commission publications is shown on the following pages. Commission materials are available upon request free of charge.

CALENDAR YEAR 1992

Clark, W. G. 1992. Estimation of Halibut Body Size from Otolith Size. Int. Pac. Halibut Comm. Sci. Report No. 75: 31 p.

International Pacific Halibut Commission. 1992. Annual Report, 1991: 57 p.

_____. 1992. Pacific halibut fishery regulations 1992: 13 p.

McCaughran, D. A. and S. H. Hoag. 1992. The 1979 Protocol to the Convention and Related Legislation. Int. Pac. Halibut Comm. Tech. Report No. 26: 32 p.

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St-Pierre, G. 1992. Visual determination of sex in live Pacific halibut. ICES J. Mar. Sci., 49: 373-376.

Sullivan, P. J. 1992. A Kalman Filter Approach to Catch-at-Length Analysis. Biometrics 48: 237-257.

Trumble, R. J. 1992. Looking beyond time-area management of bycatch - an example from Pacific halibut. In (R. W. Schoning, R. W. Jacobson, D. L. Alverson, T. H. Gentle, and J. Awyong, eds.) Proceedings of the National Industry Bycatch Workshop, Natural Resources Consultant, Seattle: 142-158.

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REPORTS

1. Report of the International Fisheries Commission appointed under the Northern Pacific Halibut Treaty. John Pease Babcock, William A. Found, Miller Freeman, and Henry 0 'Malley. 31 p. (1931). [Out of print]
2. Life history of the Pacific halibut (13 Marking experiments. William F. Thompson and William C. Herrington. 137 p. (1930).
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. (19303~ lout of print]
6. Biological statistics of the Pacific halibut fishery (13 Changes in the yield of a standardized unit of gear. William F. Thompson, Harry A. Dunlop, and F. Heward Bell. 108 p, (193 13. [Out of print]
7. Investigations of the International Fisheries Commission to December 1930, and their bearing on the regulation of the Pacific halibut fishery. john Pease Babcock, William A. Found, Miller Freeman, and Henry O'Malley. 29 p. [1930). [Out of print]
8. Biological statistics of the Pacific halibut fishery (23 Effects of changes in intensity upon total yield and yield per unit of gear. William F. Thompson and F. Heward Bell. 49 p. (1934). [Out of print]
9. Life history of the Pacific halibut (23 Distribution and early life history. William F. Thompson and Richard Van Cleve. 184 p. (1936). [Out of print]
10. Hydrographic sections and calculated currents in the Gulf of Alaska. 1929. Thomas G. Thompson, George F. McEwen, and Richard Van Cleve. 32 p. (1936).
11. Variations in the meristic characters of flounders from the northeastern Pacific. LawrenceD. Townsend. 24 p. (1936).
12. Theory of the effect of fishing on the stock of halibut. William F. Thompson. 22 p. (1937).
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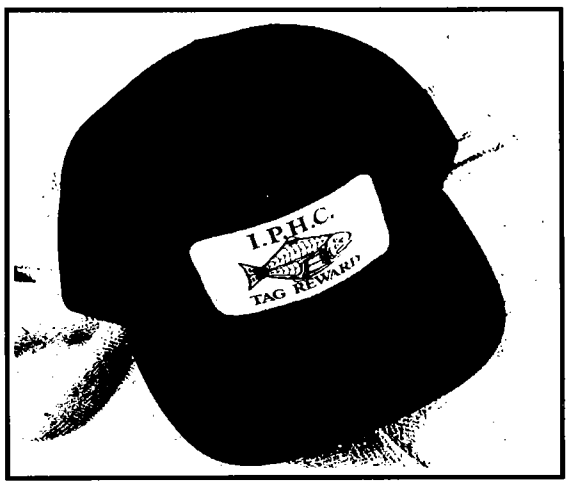
TAGGED HALIBUT

The INTERNATIONAL PACIFIC HALIBUT COMMISSION attaches plastic tags to the cheek on the dark side of the halibut. Fishermen should return all tags, even those from halibut below legal size or those caught in trawls.



REWARD

$5.00 will be paid for the return of each tag.
OR
A "Hat" will be paid for the return of each tag.

WHEN YOU CATCH A TAGGED HALIBUT:

1. Record tag numbers, date, location and depth in your log book.
2. Leave the tag on the fish.
3. Mark the fish with a gangion around 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, length of fish, and, if possible, earstones.

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

International Pacific Halibut Commission
P.O. Box 95009
Seattle, Washington 98145-2009