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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2010

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

This report produced by IPHC staff
and Eric Chastain
2011

International Pacific Halibut Commission
2320 West Commodore Way, Suite 300
Seattle, WA 98199-1287
www.iphc.int

PREFACE

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

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

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

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

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

Writer

Eric Chastain is a Seattle-based writer who has written articles for Edible Seattle, Food Product Design and other food magazines. Prior to this, he worked both in advertising and for Starbucks Coffee. He dreams of one day catching his very own 032 halibut.

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

- The Bering Sea NMFS/RACE division group in Seattle for saving us a spot on their survey and collecting halibut otoliths when we couldn't be on board.
- Scott Meyer at ADF&G for valuable consultation on sport fish and fish health issues.
- Those involved with the construction of the new IPHC offices including CB Richard Ellis, Turner Construction, JPC Architects, and numerous construction trades and suppliers.
- The many processing plants who assist the IPHC port sampling and survey programs by storing and staging equipment and supplies.
- Makah, Quinault, and Lummi samplers for port sampling Area 2A tribal commercial fisheries.
- The owners and captains of the vessels who agreed to host IPHC staff during IQ fishing for the purpose of conducting at-sea commercial sampling: Robert Stanley, Robert Irvin, Jay Hebert, Jeffery Kauffman, Lando Echeverio, Jorg Schmeisser, and Julie Miller.
- Lando Echeverio and Jorg Schmeisser for providing consulting regarding mooring assemblies and agreeing to deploy geomagnetic-sensing instruments during commercial fishing.

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Acronyms and other terms commonly used in this report

ADF&G —Alaska Department of Fish and Game
Archival tag — a tag that can measure and store environmental data while attached to a fish
Biomass —weight in net pounds
Bird Avoidance Devices — used on longline vessels to scare seabirds away from the gear
BAWM — bycatch and wastage mortality
CEY — Constant Exploitation Yield
CLR — Catch Limit Recommendation
CPUE/NPUE/WPUE — catch, number, and weight per unit effort
CSP — Catch Sharing Plan
Catchability — The likelihood that a fish will be caught on the gear
Daily Bag Limit — the max number of halibut a person may take per day while sport fishing
DFO —Fisheries and Oceans, Canada
DMR — Discard Mortality Rate
GHL — Guideline Harvest Level
NMFS —United States National Marine Fisheries Service
NOAA —National Oceanic and Atmospheric Administration
NPFMC —North Pacific Fishery Management Council
ODFW — Oregon Department of Fish and Wildlife
PAG —Processor Advisory Group
PFMC —Pacific Fishery Management Council
PHI —prior hooking injuries
PIT tag —Passive Integrated Transponder tag
POST —Pacific Ocean Shelf Tracking Program
RAB —Research Advisory Board
Profiler —oceanographic equipment used to collect environmental data
SSA survey — Standardized stock assessment survey conducted by IPHC
SWHS — Statewide Harvest Survey used to monitor the sport fishery in Alaska
Trawl survey — A survey conducted by NMFS with trawl gear
WDFW —Washington Department of Fish and Wildlife

Introduction: From bait to plate

The Pacific halibut is a humble animal, spending its life scuttling along the ocean floor, swimming sideways. It lacks the glorious plumage of the the scorpionfish. It can't rocket through pelagic waters like the bluefin tuna. It lacks the celebrity of the clownfish. For years it has been the butt of jokes and puns, silly songs, and Monty Python skits. The great writer of humorous fiction—P.G. Wodehouse—was fond of throwing quips about halibut into his novels and stories. In short, it gets little respect.

Carl Linnaeus, the Swedish father of modern taxonomy, is credited with naming a cousin of the Pacific halibut—the Atlantic halibut—though his horse deserves much of the credit. Linnaeus was a horseman (like many scholars of the 1700s), and somehow received scientific inspiration from his steed. Maybe this unique kite-shaped flatfish didn't inspire him. Maybe he found inspiration in his horse's tongue as he was dealing with the bridle. In any case, he dubbed the anonymous Atlantic halibut "horse tongue," which is what *hippoglossus* means in Latin. Further taxing his creative juices, he gave it a second name, and *Hippoglossus hippoglossus* was christened.

Moving forward in time 150 years, once again inspiration had a near miss. Russian scientist P.J. Schmidt had his hands full when he tried to give a Latin name to the Pacific halibut in 1904. The die already being cast for horse tongue, he hit upon *Hippoglossus stenolepis*, which means narrow-scaled horse tongue.

On the cover

The Pacific halibut pictured beautifully on this Annual Report cover was prepared by Chef Jason Franey of Seattle's Canlis Restaurant. To make this delicious, albeit complex dish yourself, follow the recipe on the next pages. Alternatively, reservations are available. Cover photograph by Brian Canlis.

Halibut Trivia:
The first categorization of Atlantic halibut occurred in Peter Artedi's Ichthyologia, published in 1738. He and Carolus Linnaeus were friends and scientific colleagues who agreed to finish each other's research if something were to happen to one of them. While both of them were visiting Amsterdam in 1735, Artedi fell into a canal and drowned. It was left to Linnaeus to finish the publishing of Artedi's book. Although Linnaeus gets credit for first naming the halibut, it's possible that Peter Artedi deserves some share of the credit.

Halibut with Artichokes, Arugula, Black Olives, and Tomato Confit

Recipe courtesy of Chef Jason Franey and Canlis Restaurant

Artichoke Puree

Ingredients:

4 Tbsp. Extra Virgin Olive Oil, 2 Tbsp. Shallots minced, 1 Tbsp. Garlic minced, 1 lb Globe Artichokes peeled trimmed and small diced, 1/2 Cup Yukon Gold potato peeled and small diced, 1 Cup White Wine, 2 Cups Water

Method:

As you peel globe artichokes, keep them from browning by immersing them in adiculated water. One gallon of water can be acidulated with the juice of two lemons or a few tablespoons of ascorbic acid powder.

Heat extra virgin olive oil in a large, wide pot over medium heat. Saute shallots and garlic until translucent. Add artichokes and Yukon Gold potatoes and increase heat to high. Sweat vegetables well, tossing, until they start to cook, but not color. Add wine and reduce until dry. Add water, bring to a simmer, and turn down heat to maintain a simmer. Cover and cook until totally cooked through. Puree immediately and strain. Cool rapidly. Reheat for service.

Artichokes Barigoule

Ingredients:

12 ea Baby Artichokes cleaned trimmed and halved, 3 Cups White Wine, 3 Cups Extra Virgin Olive Oil, 1 ea Garlic clove smashed, 4 ea Thyme sprigs, Salt to taste.

Method:

Hold peeled artichokes in acidulated water until ready to cook.

Heat white wine and reduce until the alcohol is cooked off and the wine has reduced slightly. Season with salt. Add extra virgin olive oil, garlic and thyme, and bring up to a high simmer. Add the artichokes and cook, maintaining a high simmer until the artichokes are easily pierced with the tip of a knife. Cool rapidly in the refrigerator. Reheat in their liquid when ready for service.

Tomato Confit

Ingredients:

12 ea Cherry tomatoes, 4 Tbsp. Extra Virgin Olive Oil, 1 ea Garlic clove smashed, 4 ea Thyme sprigs

Method:

Heat a broiler to high. Toss all of the ingredients together and spread in a single layer in a heatproof dish. Cook under the broiler until the skin just blisters, perhaps one or two minutes. Cool in the refrigerator and when cool, peel back the skin, exposing the flesh.

Arugula Pesto

Ingredients:

2 Cups Arugula leaves washed and dried, ¼ Cup Extra Virgin Olive Oil, 2 Tbsp. Pine Nuts, Salt to taste

Method:

In a large pot of rapidly boiling salted water, quickly cook the arugula leaves until just cooked, perhaps one minute. Chill rapidly by shocking the leaves in ice water. Drain and press out excess liquid. Toast the pine nuts briefly until aromatic.

In a blender, puree the arugula leaves and remaining ingredients with the pine nuts until smooth. Add a few tablespoons of cold water if necessary to thin. The pesto should have a sauce-like consistency. Makes 1/2 pint. Reserve cold for service.

Black Olive Oil

Ingredients:

4 Cups Taggiasca Olives, 1 Cup Extra Virgin Olive Oil

Method:

Pit the olives if necessary by pinching between the thumb and forefinger. This recipe requires one cup of pitted olive flesh. Once pitted, chop the olives to ensure there are not pits, then transfer to a blender. Puree with the olive oil until smooth. The oil should be salty enough from the olives. Makes 1/2 pint. Reserve cold.

Sauce Barigoule

Ingredients:

1/4 Cup Extra Virgin Olive Oil, 2 Tbsp. minced Shallots, 1 Tbsp. minced Garlic, 1 Globe Artichoke (peeled, trimmed and small diced), 1/4 Cup Sundried Tomato (rehydrated), 1/2 Cup Roasted Peppers (peeled), 2 Cups Chicken Stock, 1 bunch Basil, 1 bunch Arugula

Method:

Heat extra virgin olive oil in a wide saucepot. Saute shallots and garlic until aromatic, and add artichokes, tomatoes, and peppers and sweat until cooked but not colored. Add white wine and reduce. Add the chicken stock and bring up to a simmer. Cook at a brisk simmer until the vegetables are well cooked. Puree in a blender until fine and strain. Cool rapidly in the refrigerator and hold until service. When ready to serve, heat up to a simmer and steep a small handful of each arugula and basil leaves and strain out.

Final Preparation

Ingredients:

4 Pacific Halibut portions (center cut, skinned), Salt to taste, 4 Tbsp. Olive Oil, Artichoke Puree, Artichokes Barigoule, Tomatoes Confit, Arugula Pesto, Black Olive Oil, Sauce Barigoule, 1 bunch Arugula Leaves, Extra Virgin Olive Oil to taste, White Balsamic Vinegar to taste

Method:

Preheat a convection oven to 350°F. Warm the Artichoke Puree, Artichokes Barigoule, Tomatoes Confit, and Sauce Barigoule. Keep the Arugula Pesto and Black Olive Oil at room temperature.

Place the fish on a baking rack. Season the fish generously with salt. In this way, the excess salt will fall away from the fish. Heat an ovenproof sauté pan large enough to accommodate the fish, heat the olive oil until just smoking. Carefully place the filets in the pan flesh side down and cook briefly, until the fish is well browned. Move the pan to the oven and cook there about six minutes, checking periodically until the fish is cooked and warm in the center. Remove from the oven and take out of the pan and onto a cloth napkin-lined tray. Keep the fish warm.

In the center of a warmed dinner plate, spoon the Artichoke Puree and spread out in a circle with the bottom of a spoon. On the side of the puree, place the Artichokes Barigoule and Tomatoes Confit. Spoon the Arugula Pesto, Black Olive Oil and Sauce Barigoule around the Artichoke Puree. Place the fish in the center of the Artichoke Puree. Toss the arugula leaves with the extra virgin olive oil and vinegar and garnish the fish with these leaves.

Activities of the Commission

The 2010 Annual Meeting

Halibut Trivia: First known reference to "Halybutte" in the English language: Fifteenth Century Cookery Book. Harleian Manuscript 279, about 1420 A.D.

The 86th Annual Meeting of the International Pacific Halibut Commission took place in Seattle from January 25 to 29, and Commissioner James Balsiger of Juneau chaired the proceedings. The commissioners heard reports from IPHC staff about the state of the Pacific halibut population, considered the suggestions of expert advisory groups, and took in public commentary before making its decisions on catch limits and regulations for the 2010 season.

The main event: 2010 catch limits and dates

The Commission recommended to the governments of Canada and the United States that the catch limit for 2010 should total 50,670,000 pounds, a 6.3% decrease from the 54,080,000 pounds allowed in 2009. Harvest rates were changed this year to accommodate a different methodology for dealing with various size components of the catch. The stock assessment portion of this report goes into more detail on the subject. The result was a target harvest rate of 21.5% in Areas 2 and 3A and a target of 16.125% in Areas 3 and 4. The decreased catch limit resulted from a decline in halibut biomass seen in recent years, as the large year classes of 1987 and 1988 passed out of the fishery.

The Commission set the individual quota (Individual Fishing Quota (IFQ) in Alaska and Individual Vessel Quota (IVQ) in B.C.) and Washington Treaty tribal commercial fishing season to open on March 6 — a Saturday, to facilitate better marketing — and to close on November 15, 2010. The non-treaty directed commercial fishery in Area 2A was set to 10-hour fishing seasons with fishing period limits until the catch limit was attained.

The legal-size limit for the commercial halibut fishery is 32 inches or greater. The removals of halibut 32 inches or over are known as O32 (over 32), and removals of halibut under 32 inches are U32. A further breakdown of U32/O26 has been used for halibut bycatch mortality and wastage.

2010 regulatory issues

The IPHC changed the Area 2A vessel license requirements so that persons fishing in Subarea 2A-1, as members of U.S. treaty Indian tribes, were not required to get an Area 2A license. In addition, IPHC revised the regulations to reflect that the license numbers to be recorded on State fish tickets were state, federal, or tribal numbers, not the IPHC license number. It also approved that Washington tribal tickets could be used when permitted by the Washington Department of Fish and Wildlife (WDFW) and that the same IPHC regulations that applied to State fish tickets would apply to tribal tickets.

The IPHC updated the coordinates of the Cape Spencer Light in its regulations (on the Alaskan Panhandle, Area 2C) from the 2003 U.S. Coast Guard light list to the 2009 light list.

Once again there was extensive discussion about the sport fishery—especially charter boats—with respect to regulations and their enforcement. There was support for a harvest tag—for all recreational halibut fisheries in Alaska—that would provide accurate and timely accounting. The IPHC decided to send letters to the North Pacific Fisheries Management Council (NPFMC) and the Alaska Department of Fish and Game (ADF&G) stating its support for the initiative. The IPHC agreed to monitor the implementation of the National Marine Fisheries Service (NMFS) proposed catch sharing plan between

The IPHC Staff pose for one last photo on the stairs outside of the University of Washington office. Headquarters moved off-campus in late 2010. Photo by Tom Kong.

commercial and sport fisheries and directed its staff to develop alternative sport charter control measures for consideration at the Commission's 2011 meeting, should the catch sharing plan not be implemented in a timely manner.

Other issues and actions

The IPHC decided to reconvene the Halibut Bycatch Work Group, which first met in 1991. The HBWG II (as it is now called) was tasked with examining how bycatch can best be incorporated into stock assessment and management as well as to review progress on bycatch reduction and the target levels for reduction identified in 1991.

The IPHC honored Mr. Parker McLelland (Port Townsend, Washington) and Mr. Ryder Whitmire (Anchorage, Alaska) as the seventh and eighth recipients of the IPHC Merit Scholarship award. Each received college scholarships of $2,000 USD which are annually renewable for up to four years.

Headquarters move

After spending most of its history (1925-2010) on the University of Washington campus, the IPHC moved in the fall of 2010 to its current address on West Commodore Way, just down the street from Fisherman's Terminal in the Interbay neighborhood of Seattle. The new office provides better facilities for the Commission functions and easier access for the public.

New IPHC headquarters. Photo courtesy of Salmon Bay LLC.

Director's Report

We began 2010 with some changes in how we assessed and apportioned coastwide biomass into Regulatory Area Catch Limits. The first concerned what bottom area we assume to contain halibut. Of late, we have used the 0-300 fm range as halibut habitat but the increasing occurrence of fishing in deeper water, during the time of the IPHC summer surveys (which covers 20-275 fm), meant that we needed to accommodate a broader distribution. We examined catch records and determined that the 0-400 fm range was a better descriptor of habitat but we also note that any extrapolation beyond the survey data range carries a potential for bias. We are looking at ways to acquire data from this expanded depth range (both shallower and deeper than the current survey range) but it is unlikely that we will be able to occupy all the additional stations that might be required, on a continuous basis. Instead, we may need to sample these other depths only periodically and scale intervening estimates on the basis of those data.

Bruce Leaman talks with Mickey Knight, skipper of the *F/V Starship*, during a SE Alaska port tour. Photo by Lara Erikson.

The second change was more of a housekeeping measure and involved how we treat data for fish less than the legal size of 32 inches (U32) but above 26 inches (O26). Historically, we have treated these fish differently, depending upon the fishery where they originated. For commercial fisheries, removals of this size group had been accounted for in calculating the target harvest rate for the stock. For sport and personal use fisheries, these smaller fish are legal and are included in the estimated removals. While the effect of these different treatments on the stock was neutral, it appeared inconsistent and the staff changed the accounting procedures for these removals so that they are treated as direct deductions, regardless of the fishery of origin. This is a more consistent and transparent approach.

The other significant change to the assessment/catch limit process is the proposed shift from the Slow Up – Fast Down (SUFD) harvest control rule to a Slow Up – Full Down (SUFullD) rule. The original rule was developed as a precautionary measure designed as a long-term equilibrium scenario. However, the halibut stock has been declining for the past decade and the reductions in catch limits in response to declining assessment estimates have not kept pace. Instead, using just the 50% cuts in the SUFD harvest control rule meant we have not been catching up to the stock decline. The SUFullD control rule is designed to ensure that necessary reductions in catch limits occur as they are needed.

Two other issues continue to frustrate halibut management: adherence to recreational fishery harvest targets in some areas and adequate monitoring and control of bycatch mortality in non-target fisheries. The continued overages of charter halibut fishery harvest in Area 2C, in many years well in excess of Guideline Harvest Levels, destabilizes halibut management in this area for all users. The Commission is concerned about the effective and timely implementation of the Catch Sharing Plan (CSP) for charter and commercial halibut fisheries in Area 2C and has instructed the staff to bring forward alternative measures for control of the charter fishery, should a timely implementation of the CSP not occur.

Monitoring of halibut bycatch mortality in non-target fisheries in the Gulf of Alaska is not adequate for providing reliable estimates. While we are encouraged that the re-structuring of the NMFS Observer Program will provide improvements we remain concerned that poor accounting of bycatch mortality contributes to the problems of accurately estimating both removals and exploitable biomass of the halibut stock.

Lastly, the exploitable biomass of the halibut stock continues to decline due both to lower recruitment from the 1989-1997 year classes and continuing declines in size at age for halibut. The latter in particular, means that current year classes contribute far less weight than previous year classes of similar numbers. A concerted conservation effort by all users of the halibut resource is required to stabilize this decline and rebuild the stock to more productive levels.

Bruce M. Leaman
Executive Director

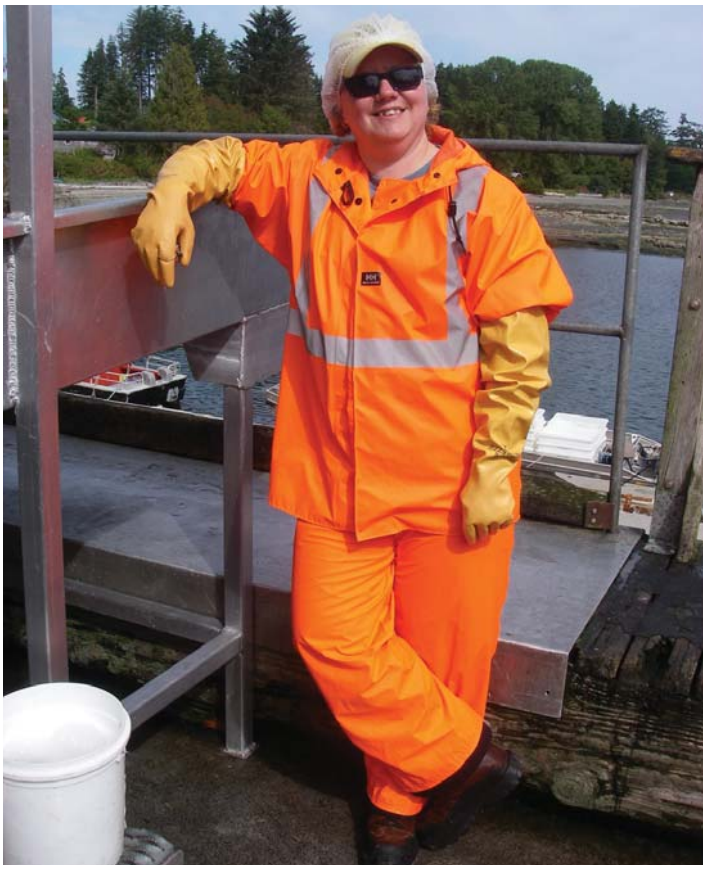
COMMERCIAL FISHERY 2010

The Pacific halibut's scientific name (Hippoglossus stenolepis) was first proposed in 1904 by P.J. Schmidt, a Russian scientist who noted anatomical differences such as scale shape, pectoral fin length, and body shape which Schmidt thought distinguished it from the Atlantic halibut (Hippoglossus hippoglossus).

The lion's share of the Pacific halibut catch for 2010 went to commercial fishing. Unlike the shoals of Alaskan pollock taken by trawl nets, commercial fishers have to tempt halibut one-at-a-time to take a baited hook at the end of a gangion. However, it doesn't take an enormous amount of tempting to get these perennially hungry fish to go for a delicious bait, even with a circle hook hiding somewhere inside. And with the retail price of halibut going for more than $20 USD per pound in Seattle fish markets—over twice the price of other white fish such as pollock, cod, or lingcod—the hard work over a long season can be worth it in the end. This section provides an overview of the 2010 commercial catch which is further broken down in the Appendix I tables of this report.

IPHC Regulatory Areas for 2010

The IPHC has established ten regulatory areas, from California northward through the Bering Sea. They were first put into place with the formation of the IPHC in 1923 and initially included only four regulatory areas (numbered one through four). They have changed in their numbering and their geographic boundaries over the years, but the current boundary lines have remained the same since 1990.



IPHC port sampler, Rhonda Miller, takes a break from collecting earbones in Port Hardy, B.C. to pose for the camera. Photo by Kirsten MacTavish.

The numbered areas begin in California and work their way northward. Area 2A includes all of California, Oregon, and Washington; Area 2B is comprised of the coast of British Columbia; Area 2C is southeast Alaska (the Alaska Panhandle, essentially), and Areas 3A through 4E make up the remaining coastline of Alaska. Here is how the regulatory areas are divided in more detail.

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 — waters off Southeast Alaska, south and east of Cape Spencer. It is defined in more detail as "all waters off Alaska that are east of a line running 340° true from Cape Spencer Light (58°11'56" N. latitude, 136°38'26" W. longitude) and south and east of a line running 205° true from said light."

Area 3A — waters off Southern Alaska, between Cape Spencer and the southernmost tip of Kodiak Island (Cape Trinity). More specifically, it is described as "all waters between Area 2C and a line extending from the most northerly point on Cape Aklek (57°41'15" N. latitude, 155°35'00" W. longitude) to Cape Ikolik (57°17'17" N. latitude, 154°47'18" W. longitude), then along the Kodiak Island coastline to Cape Trinity (56°44'50" N. latitude, 154°08'44" W. longitude), then 140° true."

Area 3B — waters off the Alaskan Peninsula, west of Cape Trinity (Kodiak Island). The specific boundaries are "all waters between Area 3A and a line extending 150° true from Cape Lutke (54°29'00" N. latitude, 164°20'00" W. longitude) and south of 54°49'00" N. latitude in Isanotski Strait."

Area 4A — Eastern Aleutian Islands. The actual boundaries are "all waters in the Gulf of Alaska west of Area 3B and in the Bering Sea west of the Closed Area [defined below] that are east of 172°00'00" W. longitude and south of 56°20'00" N. latitude."

Area 4B — Western Aleutian Islands. This includes "all waters in the Bering Sea and Gulf of Alaska west of Area 4A and south of 56°20'00" N."

Area 4C — A small square of water surrounding the Pribilof Islands in the Bering Sea. It is measured as "all waters in the Bering Sea north of Area 4A and north of the closed area defined in section 10 which are east of 171°00'00" W. longitude, south of 58°00'00" N. latitude, and west of 168°00'00" W. longitude."

Area 4D — Western Bering Sea. More specifically, it includes "all waters in the Bering Sea north of Areas 4A and 4B (56°20'00" N.), north and west of Area 4C, and west of 168°00'00" W. longitude."

Area 4E — Eastern Bering Sea, including "all waters in the Bering Sea north and east of the Closed Area, east of 168°00'00" W. longitude, and south of 65°34'00" N. latitude."

Closed Area — This trapezoid-shaped body of water in Bristol Bay is closed to commercial halibut fishing. It is a relatively shallow body of water that serves as a nursery for juvenile Pacific halibut. This area encompasses "all waters in the Bering Sea north of 55°00'00" N. latitude in Isanotski Strait that are enclosed by a line from Cape Sarichef Light (54°36'00" N. latitude, 164°55'42" W. longitude) to a point at 56°20'00" N. latitude, 168°30'00" W. longitude; thence to a point at 58°21'25" N. latitude, 163°00'00" W. longitude; thence to Strogonof Point (56°53'18" N. latitude, 158°50'37" W. longitude); and then along the northern coasts of the Alaska Peninsula and Unimak Island to the point of origin at Cape Sarichef Light."

If what you need is a quick overview, these descriptions are more cumbersome than merely referring to a map, which can be found on the inside front cover of this report.

Halibut Trivia: Gangions are the lines (similar to a leader) that run between the hooks and the groundline. In Europe, gangions are called "snoods." Oddly enough, snoods are also distinctive hairbands worn by young, unmarried Scottish women of the past.

Net Weight or Net Pounds is essentially the weight of a caught Pacific halibut that is ready for market, which means that it is without gills and entrails, its head is off, it has been washed and is without ice and slime.

The best halibut baits are white halibut skin, and the heads or guts of salmon or mackerel, octopus, herring, crab, cod and squid.
—www.halibut.net

Season dates

For all commercial fisheries in Alaska and British Columbia, the season opened at 12 noon local time on March 6, 2010 and closed at 12 noon local time on November 15, 2010. This included the Canadian IVQ fishery in Area 2B, the United States IFQ fishery in Areas 2C through 4D, and the Community Development Quota (CDQ) fisheries for Alaska. The Area 2A-1 tribal fisheries fall within these dates.

In addition, Area 2A (California, Oregon, and Washington) had seven 10-hour fishing periods scheduled (all on Wednesdays) for the non-treaty directed commercial fishery: June 30, July 14, July 28, August 11, August 25, September 8, and September 22. Each fishing period was to begin at 8:00 a.m. and end at 6:00 p.m. local time, with fishing period limits. These dates were chosen after surveying directed commercial halibut fishery license holders on their preference of start date. The Area 2A incidental commercial halibut fishery concurrent with the salmon troll season is set by domestic regulations, in this case, NMFS.

Removals

For 2010, Pacific halibut exploitable biomass was estimated at 334,000,000 pounds. The total removals of Pacific halibut in 2010—incorporating all six types of removals—was estimated to be 73,911,000 pounds overall. Of this, the total commercial catch was 48,886,000 pounds, the sport fishery caught 7,803,000 pounds, bycatch mortality was 10,543,000 pounds, personal use removals came to 1,308,000 pounds, wastage mortality was 3,143,000 pounds (105,000 pounds of O32 halibut and 3,038,000 pounds of U32 halibut), and IPHC research caught 832,000 pounds.

The IPHC adopted biologically-based catch limits for all the individual regulatory areas. As well the Pacific Fishery Management Council (PFMC) Catch Sharing Plan for Area 2A, the NPFMC Catch Sharing Plan for Areas 4CDE, and the DFO combined catch limit for Area 2B, were adopted.

Landing patterns

Once a Pacific halibut is caught, it has to be delivered (or landed) somewhere to get to market. Since most of the catch occurred in Alaskan waters, most of it was landed in a handful of Alaskan ports. The commercial Alaskan catch was 41,872,000 pounds (over 85% of the total commercial catch) with May as the busiest month. Homer (on the Kenai Peninsula) landed just over 10,634,000 pounds of halibut (25% of the commercial Alaskan catch and nearly 22% of the total commercial catch). The ports of Kodiak (15%) and Seward (11%) were second and third, respectively. In southeast Alaska, Sitka landed 1,982,000 pounds (4.7% of the Alaskan commercial catch), Juneau received 1,752,000 pounds (4.2%) and Petersburg/Kake accounted for 1,530,000 pounds (3.7%).

For Area 2B (British Columbia), most of the commercial catch (6,607,000 pounds) was landed in three ports with March being the busiest month. Port Hardy received over 3,229,000 pounds (49% of the British Columbia catch). Prince Rupert/Port Edward landed 36% and Vancouver landed 6%. Landings of

live halibut are legally allowed by DFO in Area 2B. Live halibut landings totaled 5,500 pounds in 2010, reaching a new low and compared to a high of almost 104,000 pounds in 1999.

The Area 2A commercial catch was 407,600 pounds, all of which was landed in Washington, Oregon, and California. In addition, 787,000 pounds, caught in Alaskan waters, were also landed in Washington and Oregon.

Area 2A (California, Oregon, and Washington)

A plant worker helps guide a large halibut to the table during an offload. Photo by Lara Erikson.

The PFMC is a regional fishery management council that has jurisdiction over the 317,690 square miles of ocean—from the shoreline to the 200-mile Exclusive Economic Zone (EEZ) —off the coasts of California, Oregon, and Washington for over 119 species of fish. It works with the IPHC to manage Pacific halibut in regulatory Area 2A. The Pacific halibut total catch in Area 2A was divided between commercial and recreational fisheries, tribal and non-tribal fisheries, and among various fisheries in California, Oregon, and Washington by means of a Catch Sharing Plan. The Plan stipulated that 35% of the catch went to U.S. treaty Indian tribes in the state of Washington, in a subarea that is north of Point Chehalis, Washington (46°53.30' North latitude) and east of 125°44.00' West longitude. The remainder—65%—went to non-tribal fisheries in Area 2A.

The Exclusive Economic Zone (EEZ)—stretching from a country's seashore to 200 nautical miles out to sea—was recognized worldwide by the United Nations Convention on the Law of the Sea in 1982.

The total catch limit for Area 2A in 2010 was 810,000 pounds of halibut. The 35% that treaty Indian tribes were permitted to take commercially came to 253,072 pounds, and 30,428 pounds for ceremonial and subsistence (C&S) purposes. The commercial portion of the catch limit is managed by the treaty Indian tribes by an allocation of 75% for an open access fishery and the remaining 25% to a restricted fishery with daily and vessel limits. The commercial fishery occurred between March 6 and April 8. The total treaty

Indian commercial catch was 252,157 pounds and the total C&S catch was 25,300 pounds.

The non-treaty commercial catch limit was set at 166,900 pounds of halibut, of which the directed fishery was allowed 141,865 pounds (85%), and the incidental fishery (for halibut caught in the commercial salmon troll fishery) was allowed 25,035 pounds (15%). The actual 2010 catch for the directed fishery pulled in 126,898 pounds which was taken in one 10-hour fishing period. In the last 10 years, there has been an average of four fishing periods per year thus one fishing period is unusual. The incidental fishery during the salmon troll season caught 28,541 pounds. The salmon troll fishery was allowed to catch a maximum of one halibut for every three Chinook salmon (*Oncorhynchus tshawytscha*), plus one extra per landing, though the season ran only from May 1 through June 16, due to the high catch rate of both halibut and salmon. Coupled with this 1:3 ratio, each boat was allowed up to 35 halibut per offload. The Catch Sharing Plan states that a primary limited-entry longline sablefish (*Anoplopoma fimbria*) fishery north of Point Chehalis, Washington (46°53'18"N) will be allocated part of the Washington sport allocation only if the total Area 2A catch limit is over 900,000 pounds. Because the total Area 2A catch limit of 810,000 pounds did not exceed this threshold, there was no incidental retention of halibut during the limited-entry sablefish fishery.

Note the difference between a troll fishery and a trawl fishery. A troll fishery tows a line with hooks behind a vessel to catch pelagic fish, such as salmon or tuna. A trawl fishery tows a net, which can be midwater or bottom, to catch fish in its path.

The IPHC issued 565 vessel licenses for Area 2A in 2010. The directed commercial fishery received 192 licenses; the incidental commercial fishery (salmon troll) received 233 licenses, and 140 licenses went to the sport charter fishery.

Area 2B (British Columbia)

Regulatory Area 2B was governed by IVQ controls that were overseen by Fisheries and Oceans Canada (DFO). To meet conservation needs, in 2006 DFO

Halibut from an offload are headed and sorted into totes at a processing plant in Kodiak, AK. Photo by Suzanne Romaine.

implemented a groundfish Integrated Fisheries Management Plan (IFMP), that was continued into 2010. The major result of the IFMP was that quota shares were set for all hook-and-line groundfish fisheries. Also implemented was 100% monitoring of catches at sea and at dockside, vessel accountability for all catch (both landed and discarded), and transferability of fish between license holders.

The total catch limit for Area 2B set by the IPHC was 7,500,000 pounds which included both commercial and sport, which was then allocated between the two entities by DFO: the commercial fishery allocation was 6,598,600 pounds, and the sport fishery allocation was 901,440 pounds. In addition, adjustments totaling 2,500 pounds were made to the commercial fishery catch limit including carryover from the previous year's underage/overage program, quota leased to the recreational sector, and quota held by DFO for First Nations through relinquishment processes. In 2010, almost 90,000 pounds from the commercial sector were leased to the recreational sector. The total catch (not including research) was 7,740,000 pounds, with a commercial catch of 6,607,000 pounds, and sport catch of 1,133,000 pounds.

Alaska - Area 2C Metlakatla fishery

Regulatory Area 2C (southeast Alaska) is comprised of the Alaska Panhandle. Part of that area, inside the Annette Islands Reserve (just south of the city of Ketchikan), is the Metlakatla Indian Community, which has been authorized by the U.S. Bureau of Land Management to conduct a commercial halibut fishery within the Reserve. Eleven 48-hour fishing periods—conducted between April 23 and September 12—caught 44,914 net pounds of halibut. This amount was included in the Area 2C commercial catch.

Alaska – Quota share fisheries

The IFQ fishery has been in effect for the waters off Alaska since 1995. The IPHC approved the catch limit which was then divided and administered by NMFS for both Pacific halibut and sablefish. There were 2,780 people who held quota shares in 2010, for a total catch of 41,872,000 pounds, which was within 1% of the total catch limit.

For Area 2C, 3A, and 3B combined, the catch was within 1% of the catch limit – i.e. slightly under in Area 2C and slightly over in Areas 3A and 3B. However, when the catch limits were adjusted to allow for the overage/underage program, all catches were within the catch limits. In Area 4, even though catch limits were exceeded in some areas, once adjustments were made as per the regulations allowing Area 4D CDQ to be harvested in Area 4E and Area 4C IFQ and CDQ to be harvested in Areas 4C or 4D, the combined catch was below the Area 4CDE catch limit.

"Authorized pounds for annual IFQ permits are determined by the number of QS units held, the total number of QS units in the "pool" for a species and area, and the total amount of halibut or sablefish allocated for IFQ fisheries in a particular year."
—NOAA Fisheries, National Marine Fisheries Service, Alaska Regional Office website

Age distribution of halibut in the commercial fishery

There were two reports generated by IPHC staff on age distribution of halibut caught in 2010. The commercial catch age composition is discussed here and the age composition of the IPHC survey catch is discussed in the Surveys chapter.

Of the 16,209 fish sampled in the 2010 commercial catch, the ages ranged from 5 to 50 years of age. The five-year-olds came from five different regulatory areas. The 50-year-old came from Area 4B, and had a fork length of 121 cm

Jessica Marx, IPHC port sampler, braves the snow to sample the commercial catch being landed in Homer, AK early in the season. Photo by Lara Erikson.

(48 inches). Also from Area 4B was the largest halibut sampled—a 25-year-old female measuring 226 cm (89 inches). Eleven-year-olds (from the class of 1999) made up the largest age group overall, accounting for 17% of all halibut sampled. The classes of 1998 (14%) and 2000 (12%) were the next most abundant, respectively.

Of the 16,209 otoliths collected, 15,711 were aged. The average age for 2010 was 14 years—equal to the average age of sampled commercially-caught halibut for the previous four years. The average length for 2010 was 100.8 cm. The average weight was 23.8 pounds— similar to the 23.6 pound average in 2009.

SPORT FISHERY 2010

The sport harvest of Pacific halibut was estimated to be 7.8 million pounds in 2010. This was a 10% decrease over the 8.7 million pounds caught in 2009. Who were the men and women who took home this harvest? Among those millions of pounds, 337 pounds were found in one fish landed by a young man from Colorado, and he came in second! The largest we are aware of was a 380-pounder taken home by a grandmother from California. The common factor they shared were their freezers—packed with a bounty of halibut that may have cost them over $20 a pound at their local fish markets.

Some sport fishers are pros in everything but name—they own their own boat and all their tackle, and are experts in their own right. Others are newcomers to the fishery, relying on charter boat captains to lead them to where the barn doors are biting. However you might describe them, here is how they did in 2010.

Halibut Trivia:
In the commercial fishery, Weight Per Unit Effort (WPUE) and Number Per Unit Effort (NPUE) are the reigning measures of fishing success.
In the Sport fishery, the measures become more exotic. One might still encounter Catch Per Unit Effort (CPUE), Pounds Per Rod, Pounds Per Hour on the Water, Pounds Per Angler Hour, or the less scientific Whatever Floats Your Boat.

General results

As in the past, the IPHC depended on both national and state (or provincial) agencies for estimates of the sport fishery harvest in 2010. For Area 2A (California, Oregon, and Washington), that information was provided through dockside sampling by state agencies. For Area 2B (British Columbia), the estimates were based on a combination of self-reporting by fishing lodges, logbooks, overflights that counted fishing boats, and a fishing creel monitoring program. For the areas off Alaska, ADF&G sent out a post-season mail-in survey to all anglers as well as conducting creel sampling. The resulting catch of 7.8 million pounds was substantial, but below the all-time sport harvest of 11.5 million pounds caught in 2007. For detailed sport statistics, see Appendix II in this report.

The day's sport catch is on display in Ninilchik, AK. Photo by Lara Erikson.

Halibut Trivia: According to the Alaska Daily News, June 15, 2010, an angler from Conifer, Colorado, landed a 337 pound halibut that was 88 inches tall (just under 7 1/2 feet)—while competing in the Seward Halibut Derby in June 2010. The angler was on the charter vessel, Crackerjack Voyager, captained by Andy Mezirow, at Montague Island, near Seward, Alaska.

Area 2A (California, Oregon, and Washington)

The U.S. west coast sport fishery was allocated 359,600 pounds of Pacific halibut in 2010 through the Catch Sharing Plan administered by the PFMC. The actual estimated catch was 372,754 pounds—13,154 pounds (3.7%) over the allowable limit.

Area 2A was divided into six smaller sub-areas: Southern Oregon/ California, Oregon Central Coast, Columbia River, Washington South Coast, Washington North Coast and Washington Inside Waters. Of these, the Oregon Central Coast had both the largest allocation (153,548 pounds) and the largest estimated catch (155,567 pounds).

Area 2B (British Columbia)

British Columbia's preliminary harvest estimate, provided by DFO, is 1,156,000 pounds. The accuracy of this estimate is problematic in that logbooks provided by fishing lodges were self-reported and largely unverified, and neither comprehensive sampling of licenses nor coastwide creel sampling exist. However, the DFO's concern about harvest levels led it to constrain the sport harvest for 2010. They reduced the daily bag limit from two to one fish (with a possession limit of two fish), and prohibited keeping any halibut in DFO Area 121 (southeast of Ucluelet, Vancouver Island) seaward from 12 nautical miles. The season opened on February 1 and ended on October 18, when DFO projected that the sport quota had been met.

Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E (Alaska)

ADF&G provided the catch estimates for the Alaska sport fishery. A preliminary estimate of the 2010 statewide sport catch came to 6,296,000 pounds of halibut. The sport fishery season began on February 1 and ended on December 31. Southeast Alaska (Area 2C) pulled in 1,971,000 pounds, compared to the 2,383,000 pounds caught in 2009. There were two sectors in the Area 2C sport fishery—guided and unguided. For the guided fishery, the number of fish caught dropped by 15% from 2009, though the average weight increased from 23.2 pounds to 27.2 pounds—resulting in a total catch of 1,279,000 pounds. The Guideline Harvest Level (GHL)—the amount of halibut designated to the guided (or charter boat) fishery by the NPFMC—for Area 2C in 2010 was 788,000 pounds. For the unguided fishery, although the average weight of each fish remained nearly the same as in 2009, the number of fish caught increased by 12%, leading to a net increase in poundage.

Central Alaska (Area 3A) caught the most halibut, at 4,285,000 pounds—down from the 4,758,000 pounds caught in 2009. The guided fishery pulled in 2,698,000 pounds, which was lower than the GHL of 3,650,000 pounds. The unguided fishery caught 1,587,000 pounds, down from the 2,023,000 pounds landed in 2009. For both sectors, the daily bag limit remained at two halibut.

It is a bit problematic for ADF&G to accurately estimate the sport halibut catch in Areas 3B and 4, since it does not normally do any creel sampling due to the relative remoteness of ports in those areas. Instead, estimates of the number of fish caught came from the Statewide Harvest Survey (SWHS), and applied mathematically to the average weight of halibut caught in the Kodiak area. The results showed that the Alaskan Peninsula (Area 3B) caught the least amount of

halibut of all the areas, at only 24,000 pounds. The harvest for the rest of Alaska (Area 4) was estimated at 16,000 pounds.

Besides the bag limit of one fish for Area 2C, NMFS adopted four new regulations for 2010. In summary they are: 1) a charter vessel angler may use only one fishing line, and no more than six lines are allowed on a charter vessel fishing for halibut; 2) charter operators, guides, and crew may not catch and retain halibut during a charter fishing trip; 3) the names and fishing license numbers of anglers are to be recorded in the trip log book; and 4) anglers retaining halibut must sign the log at the end of the charter vessel fishing trip.

According to KTLA News: June 24, 2010- An even larger halibut was caught by a 5 foot 3 inch grandmother from Moorpark, California.
The grandmother hauled aboard a 380 pound, 88-inch Pacific halibut in late June 2010 near Sitka, Alaska. She didn't get any records because the scales were closed that day at the Kingfisher Lodge, but she and her husband brought home 150 pounds of halibut for their freezer.

WASTAGE

How is wastage defined? In the commercial halibut fishery, the definition has two parts: wastage of O32 halibut that are killed by lost or abandoned longline fishing gear, and of U32 halibut that must be released by regulation and subsequently die. Note that these definitions do not include halibut of any size that are caught by other fisheries and discarded. Instead, those fish are defined as "bycatch," which is presented in a later chapter. Wastage can also occur if more gear is set than is needed to obtain a fishing period limit in Area 2A or quota share elsewhere, and the fish is subsequently discarded and dies. Occassionally, halibut are discarded at sea due to poor fish quality resulting from predation.

This halibut caught the attention of a predator or two. Photo by Suzanne Romaine.

Calculating wastage due to lost or abandoned gear

The amount of gear lost or abandoned in the halibut fishery is the basis on which the IPHC calculates the wastage figure for halibut. Wastage in 2010 was calculated from the ratio of effective skates lost to effective skates hauled aboard, multiplied by total catch. It was estimated that 105,000 pounds of Pacific halibut were wasted in 2010 due to lost or abandoned fishing gear. In 2009 the figure was 131,000 pounds, and this was far below the recorded high of 3,200,000 pounds in 1986.

Calculating wastage due to discarded U32 halibut

Another form of wastage came from Pacific halibut that were caught by the commercial halibut fleet, but were U32s and thus too small to keep legally. IPHC regulations specify that these must be released in the least harmful way. The amount of wastage due to discarded U32 halibut was 3,038,000 pounds in 2010. Unfortunately, this was the highest amount since the earliest year (1974) this statistic was calculated. It was also about 16% higher than the amount for 2009 (2,624,000 pounds).

How was the wastage of U32 halibut caught by the commercial halibut fishery calculated? By taking the area-specific ratio of U32 fish to O32 fish and multiplying it by the estimated commercial catch in each regulatory area. This ratio is obtained from sampling on the IPHC surveys. The resulting poundage was then multiplied by the discard mortality rate of 16% (the amount of fish killed during catch and release, used to determine the fraction of the estimated bycatch that dies) to obtain the estimated poundage of U32 halibut killed in the commercial halibut fishery.

It made more sense for the stock assessment to treat like-sized fish from different fisheries the same.

Accounting for U32/O26 and U26 halibut

The IPHC determined that U32/O26 halibut needed to be accounted for separately in the halibut stock assessment, in order to standardize their treatment with that of the sport and personal use fisheries, which allow U32 halibut to be caught and kept. The wastage mortality of U32/O26 Pacific halibut for 2010 was 2,852,000 pounds across all regulatory areas, an amount that was an all-time high. The wastage mortality of U26 Pacific halibut was 186,000 pounds, also a historical high.

PERSONAL USE (SUBSISTENCE) HARVEST

William Cowper's poem (page 27 of this report) may not have been the first or the only tribute to a wonderful plate of halibut, but his is the first one that made it to print. The subsistence or personal use fishery for Pacific halibut is all about what ends up on the plate. It is a small fishery in comparison to the commercial fishery, yet it accounts for an important class of harvest for the individuals involved.

Photo by Rob Ames.

Personal use is defined as halibut caught neither for sport nor for commercial use (as resale is forbidden), but to allow those who traditionally have depended on it as a critical food source to continue to harvest it. Personal use harvests are further defined by IPHC as halibut taken in: 1) the federal subsistence fishery in Alaska; 2) the sanctioned First Nations Food, Social and Ceremonial (FSC) fishery in British Columbia; 3) Treaty Indian Ceremonial and Subsistence fisheries in California, Oregon, and Washington (Regulatory Area 2A); and 4) U32 halibut retained in Areas 4D and 4E (northern Bering Sea) under IPHC regulations.

The amount of personal use halibut caught in 2010 has not yet been determined as the results often lag by one year. The amount of halibut caught in 2009, which would be indicative of 2010 levels, was 1,305,600 pounds coastwide.

Estimated harvests by area

Subsistence fishing for halibut is a tradition dating back well before the commercial fishery.

Washington, Oregon and California (Area 2A)

The PFMC allocated the overall catch limit in Washington, Oregon, and California to commercial, sport and treaty Indian fisheries. These treaty Indian tribes further allocated their catch between commercial, and ceremonial and subsistence fisheries. The treaty tribes reported a personal use (ceremonial and subsistence) harvest of 29,000 pounds of halibut in 2009.

British Columbia (Area 2B)

The main personal use harvest in British Columbia is the catch by the First Nations FSC fishery. It is administered by a Communal License issued by DFO, and has priority over all other fisheries in Canada. Overall, an estimated 405,000 pounds of halibut were caught in 2009, an estimate that has remained constant since 2007.

Alaska (Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D and 4E)

The largest personal use halibut harvest for 2009 occurred in Southeast Alaska (Area 2C), at 457,000 pounds. Central Alaska (Area 3A) accounted for 328,500 pounds. The Alaskan Peninsula (Area 3B) caught 25,500 pounds. The

eastern Aleutian Islands (Area 4A) and western Aleutian Islands (Area 4B) caught 33,500 pounds and 1,200 pounds, respectively. The Pribilof Islands (Area 4C) pulled in 6,300 pounds of halibut. Finally, the northern Bering Sea (Area 4D) and the Eastern Bering Sea (Area 4E) areas caught 600 pounds and 8,700 pounds, respectively.

U32 retention during CDQ fishing

In addition to the subsistence fishery described in the previous section, there was a separate subsistence harvest that took place during the Area 4D/4E CDQ fishery that enabled fishers to retain U32 halibut. The IPHC, at its 1998 Annual Meeting, approved an exemption (only for Area 4E) to the requirement that all U32 halibut caught had to be discarded. In 2002 this exemption was expanded to Area 4D.

The overall landings of U32 Pacific halibut in 2010 by CDQ harvesters in Areas 4D and 4E was 9,517 pounds. This was down from the 11,259 pounds landed in 2009. Three organizations, made up of local communities, participated in this retention.

On one hand, opportunities for work are limited here. On the other, the south Bering Sea holds a larger percentage of juvenile (U32) halibut than any other regulatory area. Also, local communities have a traditional reliance and use of the natural resources in their areas. In order to balance the good of the people with the good of the halibut population, the NPFMC, which is responsible for groundfish management in the Gulf of Alaska, Bering Sea, and Aleutian Islands petitioned the IPHC to allow these fishers to retain, as personal use, the U32 halibut caught with their normal CDQ commercial fishing. The Commission agreed to this, with reporting requirements.

Who is retaining U32 halibut during CDQ fishing?

Coastal Villages Regional Fund

The Coastal Villages Regional Fund (CVRF) landed 3,924 pounds of the total, down from the 4,277 pounds they landed in 2009. A total of 464 halibut were caught, for an average weight of 8.5 pounds per fish. The CVRF is an organization that provides—as they say in their motto—”WORK FISH HOPE.” The communities of the CVRF are remote coastal villages bounded by Norton Sound to the north and Bristol Bay to the south. The towns that make up the CVRF are: Chefornak, Chevak, Eek, Goodnews Bay, Hooper Bay, Kipnuk, Kongiganak, Kwigillingok, Mekoryuk, Napakiak, Napaskiak, Newtok, Nightmute, Oscarville, Platinum, Quinhagak, Scammon Bay, Toksook Bay, Tuntutuliak and Tununak.

Norton Sound Economic Development Corporation

The Norton Sound Economic Development Corporation (NSEDC) brought in 3,438 pounds, down from the 6,060 pounds caught in 2009. A total of 407 halibut were caught, resulting in an average weight of 8.4 pounds per fish. The NSEDC is an organization that provides fishing opportunities for its fifteen member communities. These communities are primarily on the coast of the Seward Peninsula, bounded by Kotzebue Sound on the north and Norton Sound

on the south. From approximately south to north, they are: Saint Michael, Stebbins, Unalakleet, Shaktoolik, Koyuk, Elim, Golovin, White Mountain, Nome, Teller, Brevig Mission, Wales and the island communities of Little Diomede, Gambell and Savoonga.

Bristol Bay Economic Development Corporation

The Bristol Bay Economic Development Corporation (BBEDC) caught 2,155 pounds, up from the 922 pounds landed in 2009. A total of 245 halibut were caught by ten fishers, for an average weight of 8.8 pounds per fish. Unlike the other two CDQ organizations, the BBEDC only measured length of caught halibut, and used the IPHC length/weight relationship to estimate weight.

The southernmost of the three CDQ organizations, the BBEDC is made up of seventeen member villages, all on the shores of Bristol Bay: Aleknagik, Clark's Point, Dillingham, Egegik, Levelock, Ekuk, King Salmon/Savonoski, Manokotak, Naknek, Pilot Point, Port Heiden, South Naknek, Togiak, Twin Hills, Ugashik, Ekwok and Portage Creek. The halibut it caught were landed primarily at Togiak, with some delivered to Naknek.

The BBEDC is an organization whose goal is "building sustainable communities from sustainable harvests." To paraphrase its mission statement, its programs provide jobs, training and educational opportunities to its residents, and economic development tools and resources for its member communities.

To The Immortal Memory Of The Halibut On Which I Dined This Day

[Written by poet William Cowper in a letter to his friend the Reverend William Unwin on April 25, 1784.]

WHERE hast thou floated, in what seas pursued
Thy pastime? when wast thou an egg new-spawn'd,
Lost in th' immensity of ocean's waste?
Roar as they might, the overbearing winds
That rock'd the deep, thy cradle, thou wast safe—
And in thy minikin and embryo state,
Attach'd to the firm leaf of some salt weed,
Didst outlive tempests, such as wrung and rack'd
The joints of many a stout and gallant bark,
And whelm'd them in the unexplor'd abyss.
Indebted to no magnet and no chart,
Nor under guidance of the polar fire,
Thou wast a voyager on many coasts,
Grazing at large in meadows submarine,
Where flat Batavia just emerging peeps
Above the brine,—where Caledonia's rocks
Beat back the surge,—and where Hibernia shoots
Her wondrous causeway far into the main.
—Wherever thou hast fed, thou little thought'st,
And I not more, that I should feed on thee.
Peace therefore, and good health, and much good fish,
To him who sent thee! and success, as oft
As it descends into the billowy gulph,
To the same drag that caught thee!—Fare thee well!
Thy lot thy brethern of the slimy fin
Would envy, could they know that thou wast doom'd
To feed a bard, and to be prais'd in verse.

The Complete Poetical Works of William Cowper.
H. S. Milford, ed. London: Henry Frowde, 1905. 359-360.

INCIDENTAL CATCH

Bycatch is a serious challenge facing the Pacific halibut resource—mostly because it's a problem that takes a coordinated effort to solve. Halibut bycatch is defined as the unintentional or incidental catching of Pacific halibut by another fishery, and regulations require those halibut be returned to the sea with no further injury. However, many of these fish face significant injury or death

Looking to the stern of a trawl vessel. Halibut is taken as bycatch by trawl gear as well as longline and pot gear. Photo by Paul Logan.

from the act of being caught or handled after capture. For example, when trawlers haul up a net full of pollock and halibut are part of the catch, it may take hours before the halibut are sorted out and tossed overboard.

Bycatch amounts

The IPHC estimates that 10,543,000 million pounds of Pacific halibut were caught and killed as bycatch in 2010. This is a 7.3% decrease from the 11,378,000 pounds killed in 2009, and a 44% decrease from the all-time high of 20,293,000 pounds killed in 1992.

Regulatory Area 2A (California, Oregon, and Washington) accounted for 509,000 pounds of the total. Area 2B (British Columbia) had 213,000 pounds of bycatch. Area 2C (Southeast Alaska) caught 341,000 pounds. Area 3 (Southern Alaska) caught 3,889,000 pounds, while Area 4 (Bering Sea/Aleutian Islands) accounted for 5,591,000 pounds.

Sources of bycatch information

The IPHC doesn't have the resources to personally monitor Pacific halibut caught by other fisheries. Instead, it relies on information sent from observer programs operating in those fisheries. In the U.S., NMFS operates observer programs in groundfish fisheries off the coast of Alaska and the U.S. west coast, and provides those bycatch numbers to the IPHC. Similarly, observer programs in Canada provide bycatch information for Area 2B. Where fishery observations are not available, the IPHC uses research survey information to generate estimates of bycatch. The bycatch numbers in Table 1 of Appendix I represent the IPHC's best estimate based on both sources.

Discard mortality rates and assumptions

Discard mortality rates (DMRs) represent the percentage of fish discarded after capture that do not survive. DMRs are a tool used to determine the fraction of the estimated bycatch that dies, and can vary by fishery and area. Where observers are present, the rate can be measured; where they are not, the mortality rate must be estimated from other sources.

No gear type or fishery is free of bycatch, but of the three main commercial gears – i.e. pot, longline, and trawl - trawl is the major culprit for the bycatch mortality of halibut. For instance, the Alaskan groundfish fisheries (Gulf of Alaska and the Bering Sea/Aleutian Islands) had DMRs of between 60% and 90% for the halibut they caught. In other words, up to 90% of all (mostly juvenile) halibut caught by these fisheries was thrown back dead or nearly so.

Bycatch mortality by regulatory area

Bycatch in Area 2A

Area 2A (California, Oregon, and Washington) accounted for 509,000 pounds of the 2010 bycatch mortality total. The estimate came from the NMFS, which estimated mortality from multi-species groundfish trawl fisheries and fixed gear sablefish fisheries.

This year marked a significant improvement in the NMFS bycatch estimation model. Before 2003, the IPHC estimated bycatch based on limited sampling. Since then, the NMFS started an observer program, which led to more data throughout the year and across broader areas, resulting in more accurate estimates. Improvements to the estimation occurred in 2010 which provided even better information to IPHC.

Bycatch in Area 2B

Area 2B (British Columbia) had an estimated 213,000 pounds of bycatch in 2010, an amount that was unchanged from 2009. It occurred mostly during the summer months, by the bottom trawl fishery. DFO supplied the estimates, based both on observer data and extrapolation.

Halibut Trivia:
The USS Halibut was launched into the U.S. Navy in Vallejo, California on January 9, 1959. She patrolled the Pacific Ocean until her decommissioning on June 30, 1976. The USS Halibut's badge showed the top view of a Pacific halibut launching a guided missile out of its mouth. The USS Halibut was named after another submarine that served with distinction during World War II. Ironically, that Halibut (SS-232) also had a fish on its badge, but it was an orange carp with green and yellow fins.

Bycatch in Area 2C

Area 2C (Southeast Alaska) had 341,000 pounds of halibut bycatch mortality in 2010, which was low relative to the levels caught in the rest of Alaska. Much of the bycatch came from brown king crab (*Lithodes aequispina*) pot fishing, hook-and-line fishing targeting Pacific cod (*Gadus macrocephalus*) and sablefish, and beam trawling for shrimp and flounder in the inside waters of the Alaska panhandle.

Bycatch in Area 3

Area 3 (western and central Alaska) had 3,889,000 pounds of halibut bycatch mortality in 2010, a 3% decrease from 2009 and below the ten-year average of 4,400,000 pounds. Trawl fisheries accounted for 75% of it (for approximately 3,000,000 pounds), with 2,200,000 pounds being caught in Area 3A and 800,000 pounds in Area 3B. Half of this 75% was caught in the trawl fisheries targeting rock sole (*Lepidopsetta spp.*), yellowfin sole (*Limanda aspera*) and arrowtooth flounder (*Atheresthes stomias*). Another trawl fishery that caught halibut was the Rockfish Pilot Program (RPP)—a program that permitted harvesters to form voluntary cooperatives and thus gain exclusive harvest privileges for certain rockfish species, with pooled halibut bycatch mortality allowances. Finally, halibut were also caught in the hook-and-line Pacific cod fishery.

Bycatch in Area 4

Area 4 (Bering Sea/Aleutian Islands) accounted for 5,591,000 pounds of bycatch mortality in 2010. This was an 11% decrease from the 6,297,000 pounds caught in 2009—a drop that came from lower bycatch rates in the Area 4 trawl fisheries. Trawl fisheries took 4,330,000 million pounds (77%) of bycatch halibut in Area 4. Of this amount, 63% were from the fisheries targeting rock sole and yellowfin Sole. Hook-and-line fisheries and pot fisheries for species such as Pacific cod and sablefish were also responsible for halibut bycatch.

The original HBWG convened in 1991 in response to a growing domestic trawl fishery and the resulting halibut bycatch.

Halibut Bycatch Work Group II

In January 2010 the IPHC reconvened its work group after a long hiatus. The HBWG was first formed in 1991 in response to concerns brought by Canada that fisheries off Alaska were catching excessive amounts of halibut bycatch, which directly affected the halibut population in Canadian waters. Those commissioners wanted the problem to be addressed quickly and forcefully. The HBWG met and discussed the status of bycatch monitoring and control, and forwarded its recommendations to the IPHC.

The HBWG II (as the new group was renamed) was tasked by the Commission to review progress on bycatch reduction, and whether the initial HBWG goals were still appropriate given the expansive changes in groundfish and bycatch management and monitoring since 1991. HBWG II was also tasked to review how bycatch is incorporated in the annual assessment of the halibut stock.

HBWG II was composed of three Canadians and five Americans, all from governmental organizations dealing with fisheries issues. They had a series of meetings in 2010, and their discoveries and recommendations were

Trawl vessel, *Ocean Explorer*, tied to the dock. Photo by Paul Logan.

presented to the Commission at the 2011 Annual Meeting in Victoria, B.C. Bycatch management since 1991 had experienced mixed success, with Canada showing the most improvement in both limiting and reducing bycatch through an individual bycatch quota (IBQ) program. The U.S. west coast recently introduced a program that would, for the first time, provide IBQs to limit trawl fishery bycatch and also reduce its levels. Alaska was problematic, showing less reduction than other areas since 1991. The prospects for further meaningful reductions depend on the success of recent initiatives to lower bycatch limits, to improve observer coverage, and to improve the survival of fish released by large catcher/processors through enhanced deck sorting.

Stock Assessment

"How many halibut are out there? And how many can we catch?" These are the two most important questions asked of the IPHC every year. At the heart of the IPHC's operations, the annual stock assessment attempts to answer them. All the data from surveys and various sampling programs work their way into the stock assessment model, and from this the IPHC staff makes its recommendations about the next year's catch, and the Commission sets overall catch limits. IPHC staff recommended a catch limit of 50,670,000 pounds for 2010.

2010 catch limits were based on a coastwide exploitable biomass of 334 million pounds.

Coastwide biomass apportionment

The stock assessment from the end of the previous year is used to recommend catch limits for the coming year. The stock assessment completed at the end of 2009 provided a coastwide biomass estimate which was then apportioned into regulatory area estimates for the 2010 season. Area 2A had the lowest exploitable biomass (E_{Bio})level, at 4,094,000 pounds (1.2% of the total). Area 2B had 30,382,000 pounds (9.1%). Area 2C had 25,101,000 pounds (7.5%). Area 3A had the highest E_{Bio}, with 130,962,000 pounds (39.2%). Area 3B had 65,723,000 pounds (19.7%). Area 4A had 21,673,000 pounds (6.5%). Area 4B had 19,858,000 pounds (5.9%), and the combined Areas 4CDE had 36,207,000 pounds (10.8%). These totaled 334,000,000 pounds coastwide. The IPHC

The IPHC charters commercial longline vessels each summer to conduct stock assessment surveys. The *F/V Proud Venture* pictured here has been working with the IPHC for several years. Photo by Tucker Soltau.

staff believe that apportionment of the halibut biomass among the regulatory areas using survey weight per unit effort (WPUE) and bottom area is the most consistent and objective method possible. It also provides the best distribution of yield to achieve the IPHC's goal of a proportional harvest among all the regulatory areas.

How stock assessment works

The remainder of this section describes the stock assessment process for 2010 which will be used to provide staff recommended catch limits for the 2011 season.

In relatively fine detail, the box below contains a list of how the assessment and allocation process come together over the course of the year, in mostly chronological order.

1. Assemble estimates of halibut density from NMFS and ADF&G trawl surveys (for Area 4CDE).
2. Determine WPUE from IPHC setline survey (all IPHC areas except 4CDE).
3. Assemble sex, age and weight data for survey-caught halibut.
4. Determine WPUE for commercial catch (from logbooks collected in ports).
5. Assemble sex, age, and weight data for commercial catch.
6. Assemble "other removals" data (bycatch, sport, subsistence, wastage).
7. Put values into the stock assessment model.
8. Fit the assessment model to survey and commercial catch rates.
9. Evaluate the Stock Assessment results.
10. Determine Exploitable Biomass.
11. Determine the estimate of Uncertainty.
12. Determine Retrospective Performance
13. Adjust survey WPUE for hook competition & timing of setline survey.
14. Average the survey WPUE using Kalman filtering.
15. Apportion Biomass among Regulatory Areas.
16. Compute Constant Exploitation Yield (CEY).
17. Compute Fishery Exploitation Yield.
18. Input Slow Up Fast Down or Slow Up Full Down adjustment.
19. IPHC staff makes Catch Limit Recommendations.
20. Staff recommendations posted on IPHC website for public comment.
21. Commission Advisory Bodies (PAG, Conference Board) provide evaluation of staff recommendations and their own recommendations.
22. IPHC Commissioners announce Catch Limits.
23. U.S & Canadian governments ratify Catch Limits.

Observations

Types of halibut removals

Besides natural mortality (e.g., disease, predation by marine mammals, and dying of old age), there were seven other "unnatural" ways for Pacific halibut to be removed from the halibut population, all of them accounted for: 1)

commercial catch (including halibut caught on IPHC surveys); 2) O32 wastage from the commercial halibut fishery; 3) U32 wastage from the commercial halibut fishery; 4) O32 bycatch from non-target fisheries; 5) U32 bycatch from non-target fisheries; 6) sport or recreational catch; and 7) personal use or subsistence catch.

A change in the definition of halibut habitat

Halibut Habitat was redefined in 2010 as all bottom area between 0 and 400 fathoms (equivalent to 2,400 feet or approximately 732 meters).

Halibut habitat was redefined in 2010 as all bottom area between zero and 400 fathoms (equivalent to 2,400 feet or approximately 732 meters). Previous to this, it was measured up to 300 fathoms, but with recent evidence of successful commercial halibut fishing in depths greater than 300 fathoms (mainly in Area 4), it was decided to expand the definition.

The total halibut habitat—the total bottom area coastwide between zero and 400 fathoms—is 396,608 square nautical miles. Defining halibut habitat is critical to the process of apportioning the coastwide biomass (dividing up the entire mass of fish among the ten regulatory areas).

Area 4CDE (large size + low density = special treatment)

The survey data results for Area 4CDE (the combination of Areas 4C, 4D, and 4E) were estimated using a different method than the other areas. It was treated differently because of the large geographic size and comparatively low density of halibut in this portion of the Bering Sea, which precluded having a grid of setline survey stations across its entire range. Instead, a statistical dataset was constructed that projected a comprehensive and representative count for this combined area.

To construct the dataset, five subareas were identified and analyzed: the Area 4D Edge (the northwest-to-southeast drop-off to the Aleutian Basin), the Pribilof Islands (known operationally as Area 4IC), St. Matthew Island (known operationally as Area 4ID), and the northern Bering Sea Flats and southern Bering Sea Flats (known operationally as Area 4N and 4S, respectively). The first three subareas got their density estimates from the IPHC setline survey; the latter two from NMFS trawl surveys.

Coastwide IPHC setline survey

There were two major components of the annual IPHC data collection effort: IPHC fishery-independent surveys (including setline surveys and trawl surveys), and sampling the commercial catch. The annual setline survey, also called the Standardized Stock Assessment (SSA) survey, was conducted in the summer of 2010, from southern Oregon to Attu Island in the Aleutian Islands. The survey dropped groundlines every ten nautical miles at depths that ranged from 20 fathoms to 275 fathoms, for a total of 1,262 stations.

A key result from the SSA was the weight of O32 Pacific halibut caught per standardized skate. This was defined as the “survey WPUE” and was an indicator of halibut density and stock status. The SSA survey results showed that the survey WPUE declined coastwide by nearly 50% over the last ten years—indicating a coastwide decline in exploitable biomass. It was also notable that there was a tendency for fish in the western areas to be older than those in the eastern areas. In particular there was a striking lack of fish older than 20 years in Area 2.

Bering Sea trawl surveys

In 2010, as in every year, the IPHC placed a sampler aboard a NMFS chartered vessel for its eastern Bering Sea trawl survey of crab and groundfish. The trawl survey was used because implementing the IPHC survey (which occurred in other regulatory areas to count halibut stock) in the eastern Bering Sea would be too expensive and would catch too few fish to be useful. Instead, the measure of halibut density has to be derived statistically every year, and the NMFS groundfish trawl data are critical in achieving this estimate.

According to the trawl survey, the index of total halibut biomass in the eastern Bering Sea has been increasing steadily since 2002, and is at its highest level in the history of the trawl survey. Another important outcome of the NMFS survey is that, for stock assessment purposes, all Pacific halibut are now accounted for in Area 4CDE up to 65.5° N latitude.

Commercial fishery

The second major part of the IPHC's data collection was sampling the commercial catch. Similar to the WPUE results in the SSA survey, the commercial WPUE also declined in 2010. There are three possible reasons for this. The first is smaller size-at-age—in effect, slower growth. The second possibility is "fishery induced evolution"—a genetic change in the population where larger, faster-growing fish are removed from the breeding population, leaving the smaller, slower-growing ones to breed. Neither of these are as likely as the third possibility—the "density dependent effect"—which says that the more fish there are in an area, the smaller the average size tends to be, due to competition for food and habitat. Not only were there more halibut in the ocean in 2010 than had been measured before, there were more flatfish—particularly arrowtooth flounder, whose biomass is estimated to be at least five times that of the Pacific halibut and which has very few predators.

Commercial fishery data are gathered throughout the season for use in the stock assessment. Here, halibut are sorted into totes after being offloaded in Homer, AK. Photo by Lara Erikson.

Commercially-caught Pacific halibut are typically bled and gutted as soon as possible, then laid on ice for the return to port where the IPHC samplers measure

What is an Area of Particular Concern? There's not a hard and fast rule to determine that an area is of particular concern, but rather a range of considerations. For example, if an area is showing a sharp decline in WPUE, the IPHC staff conducts extra studies in that area to determine a cause and if there is reason to believe that the decline is biologically based and cause for concern, the Staff recommends to the Commission to take precautions with that area by way of a reduced harvest rate and reduced catch limit.

their length and remove their otoliths for further study. Unfortunately, their sex organs go overboard with their entrails when they are dressed at sea in order to preserve a high quality product. To address this, the IPHC uses a statistical methodology called "sex-ratio-at-age-and-length" which relies on the observation that female Pacific halibut grow faster than males, and therefore tend to be larger at every age class, after about the age of six. So for any given combination of length and age, a fish is assigned a specific probability that it is female. This statistical tool isn't perfect, since the commercial catch and scientific surveys may take place at different times of year when the activities of the fish may differ, but it is an indicator. Separately, approximately 1,500 otoliths per regulatory area were collected from commercial vessels in 2010, with a smaller number collected in Areas 2A and 4B.

The assessment model

The 2010 halibut assessment model—identical to that used in 2009 and 2008—has been widely accepted as an assessment tool and produces an estimate of exploitable coastwide biomass. The focus of the fishing industry and the IPHC staff has therefore turned to the apportionment of this exploitable halibut biomass among the regulatory areas. It is important to note that the assessment model is a coastwide model, which is more accurate and flexible than the old closed-area models, which were used up through 2006.

Effect of the 2010 data on abundance estimates

From 2009 to 2010 the coastwide WPUE declined by 15% in the survey and by 6% commercially. This decline in halibut density led to a downward revision of the coastwide model estimate of abundance by about 18% in the 2010 assessment model, from the estimate of abundance made at the beginning of 2010 from the 2009 model.

Countering this was an increase in halibut abundance of 16% in 2010. The net result of these two alterations is an estimated decrease in E_{Bio} over the course of the year.

Quality of fits

The assessment model predicted the survey NPUE at sex and age, and the commercial catch at age very well. It also successfully predicted the increasing number of halibut aged 25 years or older—especially males—appearing in both the survey and commercial catches. Regarding the latter prediction, the very slow growth rate for males meant that many were not "recruiting" into the commercial halibut fishery until they were older than 25, despite "recruitment" of males historically occurring at about age eight.

Estimates of exploitable biomass, spawning biomass, and recruitment

At the end of 2010, the E_{Bio} was estimated to be 318 million pounds, and the female spawning biomass (S_{Bio}) was estimated to be 350 million pounds. Both had been in decline since 1998, with S_{Bio} bottoming out in 2007 and E_{Bio} bottoming out in 2009. The main target of the commercial fishery for the past several years has come from the classes between 1989 and 1997, which were smaller than average. The smaller year classes, combined with reduced growth

rates, resulted in the sharply declining E_{Bio} and S_{Bio} of the last decade. Incoming year classes (1998 and later) are much larger in numbers than average. The assessment model predicted that both E_{Bio} and S_{Bio} are now on the rise again, due to the larger incoming classes (1998 through 2003), illustrating the cyclical nature of the halibut population. Recruitment (measured as age-eight fish in the year of assessment) varied between seven and 33 million halibut since the 1988 class, with a mean of 17.9 million fish.

Uncertainty

When predicting the future, or when analyzing the previous year with incomplete or imperfect information, uncertainty comes with the territory. For the halibut assessment, since there are a lot of high-quality data, most of the uncertainty comes from the design of the model itself. In other words, does the model describe the fishing and biological processes correctly? So assuming that the estimate of E_{Bio} at the end of 2010 was 317 million pounds, how certain could one be that it was accurate? We can estimate that uncertainty by examining how well the model fits the underlying data and express it in terms of the "95% confidence interval" around the estimates produced by the assessment model.

The model used to estimate abundance is a statistical catch-at-age model. It takes all the data and produces a best, or "maximum likelihood", estimate. To express uncertainty, the estimate is given a 95% confidence interval which, in simple terms, describes an estimate that stock assessment scientists can say they are 95% confident in.

For the halibut population, there was a 95% confidence interval that the E_{Bio} was between 283 and 355 million pounds, and that the S_{Bio} was between 309 and 394 million pounds.

"There are some things that you know to be true, and others that you know to be false; yet, despite this extensive knowledge that you have, there remain many things whose truth or falsity is not known to you. We say that you are uncertain about them."
—Dennis Lindley, Understanding Uncertainty, 2006, Wiley-Interscience, p.1.

Harvest policy

Since the 1980s, the IPHC's harvest policy has been to harvest 20% of the coastwide E_{Bio} when the S_{Bio} is estimated to be above 30% of the unfished biomass. As S_{Bio} moves from 30% toward 20%, the policy calls for a linear reduction in the harvest rate. The aim of this policy is to preserve a healthy female population to replenish what is caught.

The estimated S_{Bio} at the end of 2010 appears to be healthy. Its value of 350,000,000 pounds came to 43% of the unfished biomass—estimated to be 811,000,000 pounds. This is encouraging and indicates that adequate reproductive potential remains in the ocean for the foreseeable future.

The constant harvest rate policy has been adjusted since the early 2000s with a tool called "Slow Up Fast Down (SUFD)." With SUFD, the harvest rate is increased slowly and carefully, and reduced quickly. It is essentially a conservation aid for the long-term benefit of the resource. As the yearly estimates of E_{Bio} have continued to decline along with those of the size-at-age, SUFD has been called into question as being too gradual. So in 2010, the staff developed an alternative "Slow Up Full Down" (SUFullD) scenario which will be considered at the 2011 Annual Meeting. The average WPUE for Pacific halibut coastwide in 2010 was 47 pounds based on the setline survey. The WPUE is the indicator used by staff to figure out the density of halibut on the grounds. It is density times the amount of habitat, which gives a relative amount of halibut in each area.

Comparing the IPHC assessment and NMFS trawl survey biomass estimates

It is useful to validate the coastwide stock assessment against other independent models, when possible. The NMFS and DFO conduct bottom trawl surveys across most of the continental shelf of the U.S west coast, British Columbia, and Alaska, although not all are annual. The IPHC was able to obtain from these two organizations swept-area estimates of abundance at length. From these estimates the IPHC was able to derive independent estimates of biomass. The agreement between trawl surveys and the IPHC's stock assessment was surprisingly good for most of the regulatory areas.

Another fact that the trawl data confirmed was the widespread presence of smaller halibut. The significance of this was that while the current exploitable biomass was not very high, the total biomass is and as these small halibut grow in size, the exploitable biomass should grow as predicted in the coastwide stock assessment.

The WPUE is the indicator used by staff to figure out how dense the halibut are on the grounds. It is density times the amount of habitat, which gives a relative amount of halibut in each area.

Adjustment factors

The catchability of halibut is affected by other predators competing to see who can get to the baited hook first, a process called "hook competition." We use data from the catches and the number of baits returned to estimate that competition and adjust the survey data to account for it. The survey was designed to measure E_{Bio} at approximately mid-year in each regulatory area. The data from surveys earlier or later in the year are adjusted mathematically to account for the difference in timing.

***F/V Van Isle* tied up to the dock between IPHC charter trips in the Gulf of Alaska. Photo by Suzanne Romaine.**

Time averaging methods to adjust survey WPUE

The WPUE was historically adjusted by the IPHC using time averaging to avoid having any recent year influence, since the survey is only a snapshot in time. In the past, this entailed taking the WPUE values for the last three years and averaging, or weighting them equally (1:1:1). In 2010 the IPHC conducted a detailed statistical analysis to determine if the equal weighting method was

optimal. The results of the analysis showed that equal weighting was inferior to what is called reverse Kalman weighting. In this latter method, depicted as (75:20:5), the most recent year's WPUE is given a "weight" of 75%, the year before that 20%, and the year before that 5%. This new weighting will take affect for the 2011 season.

Accounting for U32/O26 BAWM

Bycatch and wastage mortality (BAWM) is defined as a figure that represents the number or weight of U32 halibut that are killed by other fisheries, by lost or abandoned longline gear in the commercial halibut fishery, and the proportion of U32 halibut released by regulation in the halibut fishery that die from injuries. These lost fish have to be accounted for in the stock assessment in some way. The default method to account for BAWM has been: no inclusion of U32 mortality in the other removals category but accounting for it through a decrease in the harvest rate. A second method proposed is for U32/O26 BAWM to be included in the other removals category but U26 mortality to still be accounted for in the harvest rate. A third proposed method is for all U32 BAWM to be included in the other removals.

Apportioning biomass and computing fishery constant exploitation yield

There are two steps that have to be accomplished before IPHC staff can make catch limit recommendations—apportioning biomass (E_{bio}) and computing fishery constant exploitation yield (CEY). Apportioning halibut biomass among the regulatory areas can be accomplished in a number of ways. In 2009 IPHC staff presented 32 possible methods for apportionment. In 2010 this was reduced to 12 methods, of which the staff chose one as the most appropriate.

The chosen method counted U32/O26 BAWM in other removals, used both WPUE adjustments (hook competition and survey timing), and reverse time-weighting (75:20:5).

The next step in the apportionment process, after determining the fishery CEY, is for IPHC staff to make catch limit recommendations. Before doing that, the SUFD or Slow Up Full Down (SUFullD) adjustment is made.

Definition:
Constant Exploitation Yield (CEY) is a biologically determined level for total removals of halibut from a regulatory area. Calculated by applying a fixed harvest rate to the estimate of Exploitable Biomass in that area. The corresponding level subject to allocation in directed fisheries is called the "fishery CEY."

Area summaries

According to the coastwide stock assessment, the E_{Bio} has declined by about 50% during the last decade. The reasons for the decline vary depending on the regulatory area. The following summaries briefly explain the situation in each regulatory area.

Area 2A, 2B, and 2C (coasts of California, Oregon, Washington, British Columbia and the Alaska Panhandle)

What appeared to be happening in Area 2 this past year was a continuation of years past—a steady decline in E_{Bio}. The reasons for the decline were twofold. One was the passing through of two very large year classes (1987 and 1988). The second was that realized harvest rates—those that actually occurred—were over the 20% target harvest rate of E_{Bio}, and at times, over 50%. Removals of halibut were generally larger than the surplus production of halibut, which further stalled the rebuilding of Area 2 stocks.

Not all of the news was negative. On an encouraging note, the Commission has set lower removals in Area 2 over the last few years. This was prompted by the change from the closed-area stock assessment to the coastwide stock assessment. Lower removals have lowered the historical harvest rates and with the possibility that several large year classes are about to enter the E_{Bio}, Area 2 is beginning to show some recovery.

Area 3A and 3B (central and western Gulf of Alaska)

Area 3 occupies the current central core of distribution of the Pacific halibut stock. As such, it was the only regulatory area where halibut immigration was roughly equivalent to emigration.

Removals in Area 3A have been relatively stable over the last 15 years. However, the WPUE has shown steady decline over the last five years as fish size has decreased and the catch limits set by the Commission have followed suit. In 2010, the average survey WPUE of 117 pounds per skate was by far the lowest

IPHC port sampler, Levy Boitor, talks with Ron Reed, skipper of the *F/V FishNPohl*, in Petersburg, AK. Photo by Lara Erikson.

on record and about 40% off the values seen in the 1990s. The commercial WPUE was also at its lowest point since the change from "J" hooks to "C" hooks in 1984, and was about 66% below the levels of the 1990s.

Although Area 3A had the largest E_{Bio} of all the regulatory areas, recent sharp declines in WPUE indicated that exploitation rates may be too high. The IPHC is not yet considering Area 3A to be of particular concern, but if the decline continues, it will be looked at more closely for possible reductions in harvest rate.

Area 3B has been an area of concern for several years. The IPHC estimated that halibut removals greatly exceeded surplus production between 1998 and

2007. The 2010 survey WPUE was only 21% of what it had been in the 1990s, and commercial WPUE was only 31% of that level. What happened was that relatively light fishing before the mid-1990s led to an E_{Bio} that was considered to be "surplus." Quotas gradually increased from 4 million pounds to 17 million pounds. The surplus was eventually caught and the quotas were reduced to 10 million pounds, but even that quota level was not sustainable. Escalating matters was that Area 3B is a net exporter of halibut.

It is very important that the ongoing decline in Area 3B be halted, without which the true level of productivity there cannot be accurately estimated. To aid in the recovery, in 2010 the IPHC reduced the harvest rate for Area 3B to 15%.

A recent decline in Area 3B is being addressed through a lower harvest rate.

Area 4A, 4B, and 4CDE (western Gulf of Alaska and Bering Sea)

Area 4 has been an area of concern for at least two years, with a resultant harvest rate of 15%. When the quota was cut, the WPUE started to bounce back almost immediately, but all of Area 4 declined once again in 2010. Survey WPUE in 2010 was only about 30% of what it had been in the 1990s.

The biggest concern for the IPHC is the level of bycatch mortality, which directly affects productivity and sustainability. Both O32 and U32 bycatch were about three to four million pounds each in 2010. The U32 bycatch is of greater concern because the smaller fish mean a larger number of fish are killed.

On two hopeful notes, Area 4 has the broadest age distribution of halibut of any regulatory area. This indicates that it is a reservoir of older females (a valuable commodity for any fish population). Secondly, both setline and trawl surveys have shown the presence of an extremely large population of juvenile halibut in the 50 to 80 cm range, which bodes well for the E_{Bio} in the next few years.

SURVEY ACTIVITIES

The IPHC collected data during two surveys in 2010 that dealt directly with the Pacific halibut population. The main survey was the standardized stock assessment (SSA) survey, in which the IPHC chartered fishing vessels during the summer months to fish with halibut gear. Unlike commercial fishing boats, these vessels used standardized fishing methods, bait, and gear to catch halibut in a manner consistent over years. They set gear on a predetermined grid and fished whether or not the fish were biting. A secondary survey that supplemented the information collected during the SSA survey, was the NMFS trawl survey of the Bering Sea shelf. As it has since 1998, the IPHC placed a biologist aboard one of the vessels to sample the catch.

Finally, there were seven special projects in 2010 conducted aboard the surveys that contributed either to the further understanding of Pacific halibut and/or were valuable to agencies and researchers outside of the IPHC. These were: 1) oceanographic data collection, 2) tagging, 3) rockfish sampling in Area 2A, 4) rockfish sampling in Area 2B, 5) Yelloweye rockfish enumeration in southeast Alaska, 6) environmental contaminant sampling, and 7) whale depredation tracking.

IPHC charter vessels in 2010 were: F/V Blackhawk, F/V Bold Pursuit, F/V Clyde, F/V Free to Wander, F/V Kema Sue, F/V Pacific Sun, F/V Pender Isle, F/V Predator, F/V Proud Venture, F/V VanIsle, and F/V Waterfall.

SSA survey design and results

The 2010 SSA survey consisted of 11 commercial longline vessels—six Canadian and five U.S.—that completed 74 trips and 684 charter days throughout the summer, with June being the month of heaviest activity. The vessels operated

Halibut is hauled over the roller by crew members of the *F/V Proud Venture* during the IPHC stock assessment charter. Photo by Andy Vatter.

in 27 charter regions, from southern Oregon to Attu Island in the Aleutians and northward into the Bering Sea. Each charter region took between 21 and 39 charter days to complete. Consistency makes for good comparisons, and the study methods haven't changed since 1998.

The survey gear and sampling procedures were standardized for all stations coastwide. Gear consisted of fixed-hook, 1,800-foot skates with 100 circle hooks of size 16/0 spaced 18 feet apart. The length of the gangions ranged from 24 to 48 inches. All hooks were baited with 1/4 to 1/3 pound pieces of ASMI grade No. 2, semi-bright or better Chum salmon (*Oncorhynchus keta*). Each vessel set between one and three stations per day, starting at 5 AM and leaving the gear in the water to "soak" for at least five hours before retrieving it. Fishing at night was avoided when at all possible. As the fishing gear was set, samplers recorded details of the gear set and evaluated the performance of bird avoidance devices. Upon retrieval of the gear samplers recorded the hook status as it came aboard. Length, sex, maturity, prior hooking injuries and evidence of depredation were all recorded, and the left side otolith was removed from a random sample of the halibut. Water column profilers were deployed at each station to record oceanographic data, and the presence and abundance of seabirds was also recorded on every station. All O32 halibut were dressed and iced for sale to help offset the cost of the research. A percentage of U32 halibut were sampled for otoliths, sex, and length and then discarded. The U32 halibut not in the random sample were quickly measured and released in the best possible condition.

Definitions:
A Charter Region is a formally named (by IPHC staff) segment of the halibut grounds used for survey purposes. The IPHC recognizes 27 charter regions within the ten Regulatory Areas.
A Survey Station is a designated geographic point within a Charter Region, where grid lines intersect at ten nautical mile intervals. Survey vessels, carrying a professional fishing crew and biologists, fish each station for at least five hours before pulling in the line and sampling the catch.

SSA survey results

Weight per unit effort

A total of 1,262 survey stations were completed, of which 1,256 (99.5%) were deemed effective for stock assessment analysis. The survey pulled in 894,591 pounds of O32 Pacific halibut. Average WPUE varied widely between regulatory areas, from a low of 17 pounds/skate in Area 2A to a high of 117 pounds/skate in Area 3A. The average WPUE for the entire survey was 89 pounds/skate.

Otolith collection

The goal for otolith collection was to take 2,000 otoliths per IPHC Regulatory Area, with a minimum of 1,500 per area. In only two areas (2B and 3A) was the 2000-otolith goal reached. Four areas (2C, 3B, 4A, and 4B) achieved the minimum goal, and three areas (2A, 4C, and 4D) did not reach the minimum. In Area 4E, otoliths were collected only on the NMFS survey because the IPHC does not survey this area during the SSA. A new and separate archival otolith collection began in 2010, in which the otoliths are dried and stored for future research.

Median length

The median length of Pacific halibut caught on the survey stations was 80 cm (31.5 inches), which is below the commercial-legal size limit of 81.3 cm. The largest median lengths were in Area 4D (91 cm) and Area 4B (90 cm), while the smallest came from Area 3B (76 cm).

Sex ratio

The sex of every O32 halibut (unless its gonads were lost on deck or to predation), and a subsample of U32 halibut was recorded. There was wide variation in sexual balance among the areas. Area 4C had the highest percentage of females, at 78%, while Area 4B had the lowest at 39%. In general, the western areas (3B, 4A, and 4B) had a lower percentage of females than the others.

Using the results

The biological data collected on the SSA survey (such as the size, age, and sex of halibut) is used to monitor changes in the biomass, as well as growth and mortality. Other fish species that are caught as bycatch during the survey inform the IPHC about bait competition and the rate of bait attacks. This survey bycatch serves a useful purpose in helping the IPHC track the characteristics of bycatch in the commercial fishery.

Any O32 halibut caught on the SSA survey stations were sampled for biological data and sold to offset the cost of the survey program. These halibut were delivered to 22 different ports and sold with the dual aim of getting fair market value and maintaining a variety of buyers. Vessels usually received 10% of the halibut proceeds along with their lump sum charter fee. Rockfishes and Pacific cod were also retained—their distended swim bladders rendered them dead or dying when they were brought aboard—and sold, with the vessel and the local state/provincial management agency splitting the proceeds evenly. Approximately 128 species of fish and invertebrates—though no birds or marine mammals—were caught as bycatch during the survey.

Age distribution of Pacific halibut on the SSA survey

One of the products of the SSA survey is the age distribution. Of the 14,080 otoliths aged from the setline survey in 2010, analysis showed that ages ranged from 4 to 50 years old. The largest age group was made up of 11-year-olds (from the class of 1999), with 2,377 caught. The maximum fork length recorded was a female from Area 3A that was 219 cm and 35 years old. The oldest fish was a 50-year-old male from Area 4A with a fork length of 121 cm. The smallest halibut were two females measuring 41 cm. One was a four-year-old from Area 4A and the other a six-year-old from Area 4C.

In all the regulatory areas, the males were, on average, older than the females. Area 4D had the oldest average halibut, with a mean age of 17.4 years for males and 14.4 years for females. Area 4C had the youngest fish for both sexes, with a mean age of 10.6 years for males, and 10.2 years for females.

As part of the setline survey, halibut otoliths were collected for both present and—for the first time in 2010—future analysis. The IPHC intends to continue this dual collection from now on. Present analysis looks primarily at age, while future study may favor isotopic and elemental analysis. Those meant for study right away were cleared in a solution of half glycerin and half water, to make the annual growth rings on the otolith more readable. Those being saved for the future, of which 625 were collected, could not be exposed to any chemicals (such as glycerin) or even metal tools. Instead, they were dried carefully and archived.

Seabird occurrence

The IPHC has been in the bird watching business since 2002. The program was developed along with Washington Sea Grant, NMFS, and ADF&G. Part

of the SSA survey every year since then has been a count of seabirds collected after the gear is hauled aboard. The purpose of this count is to assemble a seabird database for Alaska that can be analyzed both for population purposes and for eventual regulatory changes for seabird avoidance measures for commercial fishing vessels.

Over 525,000 seabirds have been recorded, in 11,184 observations, since the observations began. In 2010, 64,382 birds of 21 unique species were observed during 1,260 counts. The most common species observed was the Northern Fulmar (*Fulmarus glacialis*)— a member of the Procellariidae family, which includes petrels and shearwaters—and made up 73% of the sightings. Four species of gull made up 14% of the overall sightings. Three types of albatrosses were observed, including the rare Short-tailed albatross (*Phoebastria albatrus*), of which there were only 27 sightings. Assorted storm petrels, kittiwakes, shearwaters, and puffins made up most of the remaining sightings. The significance of seabird mortality is that if endangered birds like the Short-tailed albatross are killed by fisheries, those fisheries can be shut down.

Halibut Trivia:
The Short-tailed Albatross (Phoebastria albutrus) breeds off Japan, where it was hunted almost to extinction for its feathers. Compounding the peril, its home island—Torishima, which is now a bird sanctuary—is subject to the eruptions of an active volcano.

Albatrosses sighted near a survey vessel in the Gulf of Alaska. Photo by Paul Logan.

Marine mammal depredation

A significant and growing problem for commercial fishers and the IPHC is the continued depredation of caught Pacific halibut by marine mammals, particularly by toothed whales. In 2009 the IPHC began to collect more refined data on these interactions in its SSA survey, an effort which continued in 2010. Categorizing marine mammal depredation is important for understanding the impact on survey results and the commercial catch. The way that categorization occurred was for samplers aboard IPHC survey vessels to fill out a marine mammal sighting form for the U.S. National Marine Mammal Laboratory (NMML) every time they encountered one, or if marine mammals approached within 100 meters of the vessel, or depredation on halibut occurred.

Results

Preliminary analysis showed that Orca whales (*Orcinus orca*), which tended to depredate in groups, were responsible for both decreases in catch rates as well as substantial damage to fishing gear. Sperm whales (*Physeter macrocephalus*), which tended to operate singly or in pairs, also preyed on hooked halibut, and damaged fishing gear, but their interactions were more difficult to measure.

The IPHC suspects that the increasing depredation was due both to the cessation of large-scale whaling and the introduction of quota-based fishing. When large-scale whaling stopped, the whale population began to grow. Not only were there more whales competing for food, but they lost their fear of humans and began to venture alongside fishing vessels, something they had avoided in the past. The second reason for increased depredation—a quota-based fishing system—meant that fishing vessels were at sea most of the year, instead of mere days as would occur in derby fisheries. The result was captured fish that were available for a much longer time than before.

Only about 4% of survey sets experienced marine mammal interactions, but when Orcas were observed in the vicinity, 82% of the sets had damaged catch.

The SSA survey vessels experienced relatively little damage from marine mammals, although when whales were present there was usually significant damage to the halibut on the gear. Marine mammal interactions occurred on only 51 IPHC setline stations in 2010. However, when Orcas were observed in the vicinity, 82% of the sets had damaged catch, and 29% of the sets had damaged catch when Sperm whales were present The average approach of Orcas to survey vessels was 58 m in 27 interactions, with the closest approach at 3 m. For Sperm whales, their average approach was 37 m in 35 interactions, with the closest at 1 m from the vessel. Non-halibut catch was also impacted.

When IPHC survey vessels encountered whale depredation, they either stopped fishing or moved to an area not yet fished, so as not to affect the results of the study. Commercial fishing vessels often do not have the same luxury, and must remain where the halibut are. The result is that unchecked marine mammal depredation may result in commercial halibut vessels leaving their fishing grounds permanently due to loss of productivity.

Bering Sea trawl survey cruise report

The IPHC has participated in the annual NMFS Bering Sea shelf trawl survey since 1998—thirteen straight years—and did so again in 2010. For the traditional survey, the NMFS chartered two vessels for the duration (the *F/V Aldebaran* and the *F/V Alaska Knight*). There were 376 total survey stations, each of which was positioned on a 20x20 nautical mile grid, in depths ranging from 30 to 200 m. The last part of the survey was spent conducting a northern expansion exploratory survey to look at fish stocks in Norton Sound, and included an additional vessel (*F/V Vesteraalen*).

The survey began on June 3rd and concluded on August 4th. Each vessel carried a scientific crew of six. On the *F/V Aldebaran* one of that crew was an IPHC biologist who evaluated Pacific halibut for length, sex, maturity, and prior hooking injuries, and collected 1,855 otoliths for aging. The IPHC biologist was replaced on the third trip by a northern Alaska tribal biologist who agreed to conduct halibut sampling during the northern extension portion of the survey. Those samples along with samples collected aboard the *F/V Vesteraalen* by NMFS personnel yielded a total of 231 sampled halibut in the north.

Halibut are caught routinely on the trawl surveys and sampled by IPHC and NMFS biologists. Photo by Paul Logan.

Survey results

Of the 1,855 halibut sampled in the standard survey, 861 (44%) were male fish, and 994 (56%) were female. Less than 1% of the female halibut were mature and about 88% of the males sampled were mature. The northern extension halibut included 51 males and 180 females. The grand total sampled was 2,086 halibut. The average fork length was 49 cm in the standard survey and 62 cm in the northern extension.

What do the results tell us?

The swept-area abundance estimate (that is estimated total number of halibut) based on the NMFS survey in the eastern Bering Sea for 2010 was 107 million fish. For the northern extension, the abundance estimate was 7.4 million fish. These levels were estimated by statistically expanding the survey catches per area swept to the total survey area. Although the levels were down from the recent high in 2006, it showed an upward trend from 2009. It is important to keep in mind when looking at both the IPHC and NMFS estimates that the trawl estimate is based on totals regardless of size whereas the IPHC estimate looks at primarily exploitable biomass (total weight available for harvest).

Prior hook injuries

Prior hook injuries (PHI) are injuries to Pacific halibut due to previous capture by hook and line gear, and the data provide an indication of how the fish were handled in the past. However, interpreting those data isn't always easy or straightforward.

The surveys have been providing a means of examining coastwide trends in hook removal injuries for halibut since the late 1990s. Every halibut caught during the SSA and trawl survey is examined for PHI and their condition coded as one of the following: no injury, a minor injury, moderate injury, severe injury, or unknown.

Results

Approximately 101,000 halibut were examined in 2010 on the SSA survey. Of those, 8,789 halibut (8.7%) showed evidence of prior injury. Area 2C had the lowest percentage of PHI, at 5.7%. Area 4D had the highest, at 26.3%. In the trawl survey, PHIs were found on 3% of the fish in the standard survey area. It's not unusual for the trawl survey to have a lower rate of PHI than the SSA since the trawl survey catches many more small fish that have not yet entered the hook and line fisheries compared to the SSA survey. Northern extension halibut in the trawl survey were not examined for PHIs since there was no IPHC sampler present during that portion. The IPHC has concluded that the high rate of PHI in both the Bering Sea and the Aleutian Islands is due primarily to the interception of Pacific halibut by the Pacific cod groundfish fisheries.

The significance of PHIs is murky. Are the regulations not being observed by all fishers, or is the PHI rate high because those fish have been caught and released according to regulation and more are surviving to show off their scars? Are the regulations being observed, but the recommended hook release techniques inflict worse damage than expected? The IPHC’s own studies have shown that Pacific halibut with moderate to severe PHIs often die, and those that survive often stop growing or grow at a reduced rate. All three outcomes have serious consequences for the commercial halibut fishery. Substantial improvement in handling of Pacific halibut is unlikely unless there are direct individual incentives for such behavior.

Besides the assessment and management of the Pacific halibut fishery, one of the important functions of the IPHC is research. Some of it affects the IPHC's halibut function directly; other research is supportive in nature, though still important.

Oceanographic monitoring

"I have a face that is a cross between two pounds of halibut and an explosion in an old-clothes closet.
-Actor David Niven.

In 2010 the IPHC continued oceanographic monitoring on the SSA survey; a project made possible by a grant from the National Oceanic and Atmospheric Administration (NOAA) in 2008. The collection of oceanographic data consists of water column profilers dropped to the ocean bottom in the same grid pattern as the survey. The profilers capture depth, temperature, dissolved oxygen, acidity, salinity, and chlorophyll *a* concentrations throughout the water column.

Each survey vessel is outfitted with a Seabird$_{TM}$ 19*plus* V2 profiling unit, a laptop computer dedicated to the profiler and assorted accessory gear. Briefly, the profiler is allowed to freefall to the ocean floor using a combination of lines, anchors, and floats, taking measurements four times per second as it drops. It is deployed at each survey grid station just before the fishing gear at the station is hauled aboard. Approximately once a day, the profilers are hooked up to their dedicated laptops, their information is uploaded, and are reset for the next day's operations.

Maintenance is performed on the profilers by the on-board biologists after every cast, keeping them in top working order. Photo credit: Andy Vatter.

Out of a possible 1,262 setline grid stations, 1,229 (97%) were successfully profiled in 2010. Poor weather and heavy tides were the reasons that the remaining 33 stations were not profiled. The data collection went relatively smoothly and while there were no insurmountable problems with the profilers, damage to a laptop computer in the field resulted in the loss of 77 stations worth of data. New storage and backup protocols are being established for future data collection to try and eliminate this problem in the future.

One of the goals of the project is to make the survey profiler data available to scientists worldwide, which has been accomplished for both 2009 and 2010. The IPHC works with the Pacific Marine Environmental Laboratory at NOAA and the Joint Institute for the Study of Atmosphere and Ocean at the University of Washington, to process the data and make it accessible. The data are available at www.ecofoci.noaa.gov/projects/IPHC/efoci_IPHCData.shtml. The IPHC plans to continue the deployment of the profilers on the SSA survey into the foreseeable future.

Tagging studies

The IPHC has been tagging Pacific halibut since 1925. Since then over 450,000 halibut have been tagged and released, of which over 50,000 of them have been recovered later. Tagging is an effective way to study a variety of things such as migration, spawning, growth, and mortality of halibut. As such, it is an enduring part of the IPHC's monitoring of the halibut population.

Definition:
The Operculum is the hard bony flap at the back of a halibut's head and it protects the gills. In Opercular Tagging, external archival tags are attached to the operculum.

In recent years, the IPHC has used four types of tags to track Pacific halibut: wire tags, passive integrated transponder (PIT) tags, pop-up archival transmitting (PAT) tags, and archival tags. A large scale PIT tag program was completed in 2009 and there are no further results this year.

Wire tag releases and recoveries

In 2010 the IPHC tagged 773 halibut by wrapping plastic-coated wire tags around their dark-side preopercular bone (behind the mouth and above the gills). The fish were then released in the Aleutian Islands as part of a study to define active spawning periods and to examine various aspects of their migration. As that study has just begun, it is not discussed in this Annual Report, but future results will be used to determine the optimum tagging locations for a new generation of archival tags.

There were 79 tags recovered in 2010, of different types and a variety of studies. Of these, 48 were from past or present IPHC tagging experiments, and 31 were from sport fishery tagging programs. There are undoubtedly halibut that are still carrying around PIT tags which were tags used during a large scale study in the mid 2000s, but these tags are invisible from the outside and require a specialized detector. The detection program was concluded in 2009, so there were no PIT tag recoveries made in 2010.

One tag from the 2010 Aleutian Islands wire tagging study described above was recovered. Similarly, one tag from the 1992 Glacier Bay local movement study was recovered. Ten tags from the 2003 Hecate Strait double-tagging study (using both external wire and PIT tags) were recovered in 2010, which brings the total recovered to 723 out of the original 2,661 tags released—a 27% recovery rate.

All the tag recoveries mentioned up to this point were in the commercial halibut fishery. There were also some tag recoveries in the sport fishery. One halibut that had been tagged and released (in Larson Bay, Area 3A) in 1998 as part of that year's voluntary Charter Boat Tagging Program was caught in 2010, in the same area. Sixteen tags (out of 100 total) released as part of the 2010 Homer Halibut Derby were returned to the IPHC. In addition, 14 tags from previous Homer Halibut Derby releases were recovered in 2010: six tags from the 2009 derby, five from the 2008 derby, two from the 2007 derby, and one from the 2002 derby.

Archival tagging

In 2002 the IPHC started an electronic tagging program to study the seasonal movements of halibut, their behavior, and population structure. The program had five main goals: 1) quantify migration distances between summer and winter grounds; 2) identify winter spawning areas in poorly-studied regions such as the Bering Sea; 3) examine basin-specific differences in the loyalty of halibut to various sites from year to year; 4) define seasonal migration periods and seasonal depth-specific habitat use, representing the stock's transition between shallow-water summer distribution and deep-water winter distribution; 5) define active spawning periods on a regional basis as evidenced by short-period vertical migratory behavior. PAT tags were used initially, but it was decided that, to meet the program goals, the tagging needed to include smaller fish, the tags needed to be less expensive, and to be able to track fish for long periods of time. This disqualified PAT Tags on all counts. Smaller fishery-recovered archival tags appear to be the answer for this type of study for the foreseeable future.

This halibut has been tagged with two different types of tags. Near the dorsal is a cylindrical tag with green wire, and sticking out of the gut cavity is a light stalk which is attached to an internal tag that was surgically placed. If found and returned to IPHC, these tags are worth $500 each. Photo by Tim Loher.

To determine the usefulness of fishery-recovered archival tags, an experiment was designed in which thirty-five live Pacific halibut were caught and placed in the Oregon Coast Aquarium in Newport. There, surgical techniques for tag attachment were perfected, as some of the fish were fitted with externally-fixed tags, others implanted with internal tags, and a control group that wasn't tagged at all.

Finding the archival tag that is "right for the job" has been a challenge, but the potential results are worth the work.

IPHC researcher, Tim Loher, works with halibut at the Newport, OR, facility in order to find an archival tag that will work best for halibut in the wild. Photo by Renee Rensmeyer.

Two of the 35 halibut died. Six tags were lost or shed within weeks of attachment and will not be replaced because the IPHC does not expect to use these tagging methods. All of the remaining subjects have appeared to be in good health. Observation at the Oregon Coast Aquarium will continue at ten-to-twelve week intervals through 2011.

Pop-up Archival Transmitting (PAT) tags

The IPHC has been using PAT tags since 2002 to study the environmental conditions experienced by halibut, and halibut behavior, in the eastern Pacific Ocean. These expensive and somewhat unwieldy units have the distinct advantage of popping to the surface after a pre-set amount of time and allowing their position to be determined via satellite. During the 2008 SSA survey, 115 halibut were tagged and released in the Bering Sea and Aleutian Islands in order to examine both their seasonal migration patterns and how the fish dispersed over the course of a year.

To give the 2008 PAT tagging study some perspective, it was launched in response to the unusual results of the PIT tag study from 2003. That study included 43,999 PIT tagged Pacific halibut that were released coastwide in proportion to the abundance that was measured in the setline survey. What was unusual was the extremely low recovery rates for fish released in the Bering Sea and Aleutian Islands compared to other areas. The 2008 PAT tag study was undertaken to investigate why so few “western-region” PIT tags had been recovered.

The 2008 PAT study addressed three research topics in the Bering Sea/ Aleutian Islands region: 1) the migratory fate of fish in Area 4B (western Aleutian Islands), with emphasis on the potential differences in dispersal between

the Andreanof Island section and the Near Island/Rat Island section; 2) the fate of fish along the Area 4D Edge and the major island systems of the southeast Bering Sea shelf (such as St. Matthew and the Pribilof Islands); and 3) the fates of fish north of the Aleutian Islands (in Area 4) compared to those south of the island chain.

A total of 115 adult halibut were tagged by IPHC sea samplers during the 2008 SSA survey; an additional 17 tags were deployed near St. Matthew Island and St. Paul Island in 2009. There were seven geographic regions where tagged halibut were released: 1) Far west Gulf of Alaska (Area 4A, south of the Aleutians); 2) southeastern Bering Sea (Area 4A, north of the Aleutians); 3) Pribilof Islands (Area 4C); 4) northeastern Bering Sea shelf edge (Area 4D); 5) St. Matthew Island (Area 4D); 6) Andreanof Islands (Area 4B); 7) Near Island/ Rat Island (Area 4B).

Results

Of the 118 tags eventually recovered, 86 provided useful environmental data and location fixes within the desired time range of the study. The halibut tagged in the western Aleutian Islands (Area 4B) were essentially non-migratory; in other words, none left that area. Furthermore, none of the fish moved between the island systems in Area 4B (the Andreanofs and Near Island/Rat Islands). The tagged halibut near the Area 4D Edge were a study in contrast, showing a moderate level of migration, some of which could be permanent. One fish moved southward into northern 4A and two northward into Russian waters. With respect to the fish north and south of the Aleutian Island chain, the results suggest that some mixing of adult halibut may occur across the Aleutian Ridge within Area 4A, and somewhat more movement out of southern 4A to the east. However, the sample size for all regions was small and caution must be used in extrapolating any definitive migration trends.

Deepwater acoustic tag listening array

Since it started tagging Pacific halibut in 1925, the IPHC has continuously sought new and better ways to track halibut in their habitat. One more potential way to do this is the Pacific Ocean Shelf Tracking (POST) project—a telemetry network designed to monitor the migration of fish and other marine species by means of an acoustic tag listening array. In theory, halibut would be fitted with acoustic tags that transmitted a unique code either continuously or in bursts. As the tagged halibut went about their daily lives, an array of receivers installed on the ocean floor would pick up their signals and store them for later analysis. The IPHC worked in conjunction with NMFS, ADF&G, and POST on a project to examine whether this technology will work for halibut.

The equipment—Vemco VR2W receivers and Vemco V16-5H transmitters—hasn't been tested sufficiently for use in halibut habitat, a shortcoming that this study was designed to rectify. There were three concerns that needed to be evaluated before these acoustic tags could be considered for regular use by the IPHC. First, the receivers had never been tested in the deep waters (900 m) frequented by halibut during some periods of the year. Second, the receivers were supposed to detect transmitted signals up to 1,000 meters away, but whether or not this was accurate had not been demonstrated

in a deepwater environment. Third, there was a concern that boat noise and other undersea noises may interfere with the ability of the receivers to detect transmitters effectively.

With these questions in mind, the IPHC deployed acoustic tag listening stations in spots around Baranof and Chichagof Islands (in Area 2C, west of Juneau) in both 2009 and 2010. Four stations were installed in 2009. After some problems (described below), two more stations of a slightly different configuration were installed in 2010. Receivers were deployed in midwater, over bottom depths ranging from 150-560 m. The transmitters weren't installed on fish. Instead, as part of a controlled experiment, they were installed near the bottom and at five meters above the ocean floor—to mimic the benthic and epibenthic positions of halibut—at distances of 400, 600, 800, 1000, and 1200 m from the base of each of the receiver nodes.

The POST study was a successful pilot project in that it was determined that the technology was not appropriate for halibut.

The study could be described both as a failure and a success. One of the 2009 receiver stations (north of Baranof Island) detached from its mooring and was returned by a commercial fisher to the ADF&G. It was later determined that the release unit became flooded and released prematurely. The IPHC attempted to recover the remaining 2009 receiver stations. The stations were found, the acoustic releases were successfully activated, but no receivers were recovered. It was believed that the manufacturer's recommended configuration for the acoustic releases resulted in entanglement with the mooring chains. After twelve hours of dragging with a grappling hook, one receiver was retrieved, but the others were not. It is hoped that they will eventually release and be returned to the IPHC.

The study was a success in demonstrating that the current technology of acoustic tags and receivers do not appear appropriate for the purposes of the IPHC. The transmitter frequency may be too high for use in water of that depth and the signals attenuate rapidly beyond about 800 m from the receiver. A lower, more powerful frequency should function better. Another limitation was that the current maximum depth of the receivers capable of recording the tag data (500 meters) is problematic to track fish that go as deep as 900 meters. In addition, the fortnightly tidal cycle appears to have a significant effect on the detection capability of the transmitter-receiver combination. High tidal current velocities appear to seriously degrade detection capability.

Pilot project sampling Pacific halibut aboard commercial vessels

Halibut in the commercial fishery are landed with their entrails removed and the body cavities packed with ice to preserve freshness. This means that the sex of landed halibut cannot be determined even though the stock assessment needs data on the sex composition of the commercial catch. The Commission currently estimates the sex composition for the commercial catch through a statistical method, based on the sex composition of halibut at each length obtained on the IPHC surveys. The IPHC recently discovered, while doing population genetic research, that specific alleles (genes) showed a female sex-correlation. This was significant in that there might exist the potential to identify the sex of commercially caught Pacific halibut genetically, without having to resort to statistical estimations, or at least to test the accuracy of statistical estimation and potentially correct any errors associated with it.

In order for the IPHC to compare the genetic analysis with the sex-at-length methodology, it required a stock of biological samples from commercially-harvested fish where the sex of each fish was already known. To pursue this, the IPHC's 2010 summer intern was tasked with sampling halibut at the port of St. Paul, Alaska in the Pribilof Islands (Area 4C), as well as aboard two fishing vessels in Areas 2B (British Columbia) and 3A (Southcentral Alaska). Sampling in all cases would not have been possible without the fishers who volunteered platforms and data for this research, and we thank them.

A total of 33 halibut from five fishing vessels in Area 4C (Pribilof Islands), 245 from the *F/V Ashley Erin* in Area 2B (British Columbia), and 216 from the *F/V Kruzof* in Area 3A (Southcentral Alaska) were successfully sampled. Additional samples from Area 4C need to be collected in order to get a statistically significant sample. All samples still need to be analyzed genetically, after which the sex ratio estimation methods will be compared.

A small boat harbor. Photo by Jen Lucke.

APPENDICES

The tables in Appendix I provide catch information for the 2010 fisheries. The areas specified are the IPHC Regulatory Areas, depicted in the figure located on the inside front cover of this report. Appendix II reports on the most current sport fishing statistics.

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

Appendix I.

Table 1. The 2010 catch and catch limits for Pacific halibut by IPHC regulatory area, and 2010 sport guided fishery guideline harvest level (GHL) and associated harvest for Areas 2C and 3A (thousands of pounds, net weight).

Table 2. The 2010 Area 2B Pacific halibut catch limits allocated by the Canadian Department of Fisheries and Oceans and estimates of catch (thousands of pounds, net weight).

Table 3. The Area 2C and 3A sport halibut harvest and sport charter fishery Guideline Harvest Level (GHL) (millions of pounds, net weight), 2000-2010.

Table 4. The 2010 Area 2A Pacific halibut catch limits allocated by the Pacific Fishery Management Council catch sharing plan and catch estimates (pounds, net weight).

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2010 commercial fishery, including IPHC research catch, by regulatory area and month.

Table 6. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2010 commercial fishery for a) Area 2B, Alaska, and the Alaskan regulatory areas, and b) Area 2A commercial fisheries, not including the treaty Indian commercial fishery.

Table 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2010 Pacific halibut commercial fishery.

Table 8. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2010.

Table 9. Commercial halibut catch (thousands of pounds, net weight) in 2010 by statistical area[1] and regulatory area.

Appendix II.

Appendix I.

Table 1. The 2010 catch and catch limits for Pacific halibut by IPHC regulatory area, and 2010 sport guided fishery guideline harvest level (GHL) and associated harvest for Areas 2C and 3A (thousands of pounds, net weight).

Area	2A	2B	2C	3A	3B	4	Total
Commercial	407	6,607	4,390	20,186	9,958	7,338	48,886
Sport	373	1,156	1,971	4,285	24	16	7,803
Bycatch Mortality[1]							
O32 fish	198	109	214	951	445	2,283	4,200
U32 fish	311	103	127	1,712	781	3,309	6,343
Breakdown of U32							
U32/O26	*270*	*87*	*88*	*777*	*416*	*1,137*	*2,775*
U26 fish	*41*	*16*	*39*	*935*	*365*	*2,172*	*3,568*
Personal Use[2]	25[3]	405	457	329	26	61[4]	1,303
Wastage Mortality							
O32 fish	1	27	9	21	20	27	105
U32 fish	7	233	242	1,417	887	252	3,038
Breakdown of U32							
U32/O26	*7*	*229*	*233*	*1,369*	*807*	*224*	*2,869*
U26 fish	*0*	*4*	*9*	*48*	*80*	*28*	*169*
IPHC Research	11	122	96	316	156	131	832
Total Removals	1,333	8,762	7,506	29,217	12,297	13,425	72,540
2010 Catch Limits[5]	810[6]	7,500[7]	4,400	19,990	9,900	8,070	50,670
2010 Catch	805[6]	7,740[7]	4,390	20,186	9,958	7,338	50,417
2010 Sport GHL			788	3,650			NA
2010 Guided Harvest			1,086	2,698			NA

[1] Area 2A bycatch is the 2009 estimate as the 2010 estimate was not yet available.
[2] Includes 2009 Alaskan subsistence harvest estimates.
[3] Treaty Indian ceremonial and subsistence fish authorized in the 2010 catch sharing plan.
[4] Includes 10,300 pounds of U32 (sublegal-sized) halibut retained in the 2009 Area 4DE Community Development Quota fisheries.
[5] Does not include poundage from the underage/overage programs in Area 2B or Alaska.
[6] Includes commercial, sport, and treaty subsistence catch.
[7] Includes commercial and sport catch.

Appendix I.

Table 2. The 2010 Area 2B Pacific halibut catch limits allocated by the Canadian Department of Fisheries and Oceans and estimates of catch (thousands of pounds, net weight).

Fishery	Allocation	Catch
Commercial fishery	6,598.6	6,607.0
Sport fishery	901.4	1,155.7
Total allocation/catch	7,500.0	7,762.7
IPHC research catch		122.0
Total	7,500.0[1]	7,884.7

[1]Adjustments totaling 2,500 pounds were made to the commercial fishery catch limit incuding carryover from the previous year's underage/overage plan, quota leased to the recreational sector, and quota held by DFO for First Nations through relinquishment processes. Adjustments totaling 118,953 pounds were made to the sport fishery catch limit including 28,979 pounds carried over from 2009 and 89,974 pounds leased from the commercial sector in 2010.

Table 3. The Area 2C and 3A sport halibut harvest and sport charter fishery Guideline Harvest Level (GHL) (millions of pounds, net weight), 2000-2010.

	Area 2C				Area 3A			
Year	Private	Guided	Total	GHL	Private	Guided	Total	GHL
2000	1.121	1.130	2.251	-	2.165	3.14	5.305	-
2001	0.721	1.202	1.923	-	1.543	3.133	4.676	-
2002	0.814	1.275	2.089	-	1.478	2.733	4.211	-
2003	0.846	1.412	2.258	1.432	2.046	3.382	5.428	3.650
2004	1.187	1.750	2.937	1.432	1.937	3.668	5.605	3.650
2005	0.845	1.952	2.797	1.432	1.984	3.689	5.673	3.650
2006	0.723	1.804	2.527	1.432	1.674	3.664	5.338	3.650
2007	1.131	1.918	3.049	1.432	2.281	4.002	6.283	3.650
2008	1.265	1.999	3.264	0.931	1.942	3.378	5.32	3.650
2009	1.123	1.249	2.372	0.788	2.023	2.734	4.758	3.650
2010	0.885	1.086	1.971	0.788	1.587	2.698	4.285	3.650

Table 4. The 2010 Area 2A Pacific halibut catch limits allocated by the Pacific Fishery Management Council catch sharing plan and catch estimates (pounds, net weight).

Area	Catch Limit	Catch
Non-treaty directed commercial	141,865	126,898
Non-treaty incidental commercial with salmon troll fishery	25,035	28,541
Treaty Indian commercial	253,072	252,157
Treaty Indian ceremonial and subsistence	30,428	25,300
Sport - Washington	192,699	209,612
Sport - Oregon/California	166,901	163,142
Total allocation	810,000	805,650
IPHC research catch		11,123
Total	810,000	816,773

Appendix I.

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2010 commercial fishery, including IPHC research catch, by regulatory area and month.

	March	April	May	June	July	August	September	October	November	Grand Total
2A	249	3	17	27	122[1]	-	-	-	-	418
2B	1,392	1,052	837	620	792	659	544	562	271	6,729
2C	590	847	771	610	312	529	393	335	99	4,486
3A	2,439	3,313	3,995	2,507	1,714	2,530	2,048	1,706	250	20,502
3B	170	362	1,622	1,939	2,057	1,523	1,176	1,061	204	10,114
4A	-	102	263	230	356	678	447	171	78	2,325
4B	-	33	68	309	303	596	268	127	125	1,829
4C	-	-	-	96	445	199	45	4	-	789
4D	-	-	134	482	316	242	607	335[2]	-	2,116
4E	-	-	1	61	240	69	31	8	-	410
Alaska Total	3,199	4,657	6,854	6,234	5,743	6,366	5,015	3,747	756	42,571
Grand Total	4,840	5,712	7,708	6,881	6,657	7,025	5,559	4,309	1,027	49,718

For confidentiality:
[1]Area 2A catch in August was combined with July
[2]Area 4D catch in November was combined with October

Appendix I.

Table 6a. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2010 commercial fishery for Area 2B, Alaska, and the Alaskan regulatory areas.

Overall Length	Area 2B		Alaska	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk.Length	32	889	60	80
0 to 25 ft.	0	0	219	419
26 to 30 ft.[1]			104	722
31 to 35 ft.[1]	6	136	203	3,907
36 to 40 ft.	26	579	134	1,555
41 to 45 ft.	38	927	141	3,574
46 to 50 ft.	20	941	137	4,020
51 to 55 ft.	24	1,225	66	2,885
56+ft.	37	2,032	254	25,409
Total	183	6,729	1,318	42,571
Overall Length	**Area 2C**		**Area 3A**	
	No. of Vessels	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk.Length	53	68	6	12
0 to 25 ft.	53	96	25	89
26 to 30 ft.[1]	32	145	22	92
31 to 35 ft.[1]	94	612	82	2,040
36 to 40 ft.	83	420	54	884
41 to 45 ft.	76	544	66	2,104
46 to 50 ft.	77	800	70	1,807
51 to 55 ft.	39	520	38	1,532
56+ft.	102	1,281	192	11,942
Total	609	4,486	555	20,502
Overall Length	**Area 3B**		**Area 4**	
	No. of Vessels	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk.Length			0	0
0 to 25 ft.			141	234
26 to 30 ft.[1]			50	485
31 to 35 ft.[1]	35	571	32	684
36 to 40 ft.	15	180	4	71
41 to 45 ft.	34	718	5	208
46 to 50 ft.	34	1,035	9	378
51 to 55 ft.	17	598	7	235
56+ft.	138	7,012	69	5,174
Total	273	10,114	317	7,469

For confidentiality reasons:

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

[2] Unknown length vessels and vessels 0 to 30 ft. in Area 3B were combined with 31 to 35 ft. vessels.

Appendix I.

Table 6b. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2010 commercial fishery for Area 2A commercial fisheries, not including the treaty Indian commercial fishery.

Overall Length	Area 2A Directed Commercial		Area 2A Incidental Commercial (Salmon)	
	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's bs.)
Unk. Length	0	0.0	3	0.9
0 to 25 ft.[1]	-	-	3	0.1
26 to 30 ft.[1]	-	-	4	0.6
31 to 35 ft.[1]	6	0.8	5	0.3
36 to 40 ft.	14	9.5	15	1.7
41 to 45 ft.	17	23.1	28	11.5
46 to 50 ft.	14	31.9	24	10.8
51 to 55 ft.	8	15.4	7	2.6
56 + ft.	11	46.3	0	0.0
Total	70	127.0	89	28.5

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

Appendix I.

Table 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2010 Pacific halibut commercial fishery.

Area 2A	Fishing Period	Catch Limit	No. of Days	Commercial Catch	Research Catch	Total Catch
Treaty Indian	Separately managed: 3/6 – 3/20		15			
	Restricted: 3/ 6 – 4/8		34			
Total		253.1		252		252
Commercial Incidental in Salmon Fishery	5/1 – 6/16	25.0	47	28		28
Directed	6/30[1]		10-hours	127		
Directed Total		141.9				127
2A Total		420.0		407	11	418

Area	Fishing Period	Catch Limit	Adjusted Catch Limit[2]	Commercial Catch	Research Catch	Total Catch
2B	3/6 – 11/15	6,598.6	6,596.0	6,607[3]	122	6,729
2C	3/6 – 11/15	4,400.0	4,544.0	4,390[4]	96	4,486
3A	3/6 – 11/15	19,990.0	20,356.0	20,186	316	20,502
3B	3/6 – 11/15	9,900.0	10,116.0	9,958	156	10,114
4A	3/6 – 11/15	2,330.0	2,395.0	2,265	60	2,325
4B	3/6 – 11/15	2,160.0	2,218.0	1,785	44	1,829
4C	3/6 – 11/15	1,625.0	1,650.0	782[5]	7	789
4D	3/6 – 11/15	1,625.0	1,665.0	2,096[5, 6]	20	2,116
4E	3/6 – 11/15	330.0	330.0	410[6]	0	410
Alaska Total		42,360.0	43,274.0	41,872	699	42,571
Grand Total		**49,378.6**	**50,290.0**	**48,886**	**832**	**49,718**

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

Appendix I.

Table 8. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2010.

IPHC Group	Canada	United States	IPHC Research	Grand Total
CA & OR	-	135	8	143
Seattle/Bellingham	-	857	4	861
WA	-	201	-	201
Vancouver	386	-	-	386
Port Hardy	3,229	-	56	3,285
Southern BC	382	-	7	389
Prince Rupert & Port Ed.	2,389	-	94	2,483
Northern BC	221	-	-	221
Ketchikan, Craig, Metlakatla	-	379	24	403
Petersburg, Kake	-	1,530	-	1,530
Juneau	-	1,752	10	1,762
Sitka	-	1,982	39	2,021
Hoonah, Excursion, Pelican	-	532	-	532
Southeast AK	-	649	-	649
Cordova	-	1,001	-	1,001
Seward	-	4,760	78	4,838
Homer	-	10,634	58	10,692
Kenai	-	43	-	43
Kodiak	-	6,271	117	6,388
Central AK	-	4,822	200	5,022
Akutan & Dutch Harbor	-	3,833	109	3,942
Bering Sea	-	2,898	28	2,926
Grand Total	**6,607**	**42,279**	**832**	**49,718**

Appendix I.

Table 9. Commercial halibut catch (thousands of pounds, net weight) in 2010 by statistical area[1] and regulatory area.

	Catch				
Stat Area	Commercial	Research	Total	Regulatory Area	Catch for Reg Area
007-030	119	6	125		
040	33	1	34	2A	418
050	255	4	259		
060	224	7	231		
061	35	0	35		
070	99	8	107		
080	109	3	112		
081	11	0	11		
090	195	5	200		
091	357	10	367		
092	43	0	43		
100	750	2	752		
102	1,094	27	1,121		
103	38	0	38		
110	66	2	68	2B	6,729
112	1,188	28	1,216		
114	57	0	57		
120	31	0	31		
121	304	8	312		
122	22	0	22		
130	361	8	369		
131	679	4	683		
132	216	5	221		
133	234	4	238		
134	31	1	32		
135	463	0	463		
140	103	11	114		
141	22	7	29		
142	87	7	94		
143	105	4	109		
144	31	0	31		
150	268	16	284		
151	226	8	234		
152	314	2	316		
153	92	2	94		
160	717	11	728		
161	246	4	250	2C	4,486
162	612	5	617		
163	80	2	82		
170	209	5	214		
171	173	2	175		
173	111	2	113		
174	37	0	37		
181	432	5	437		
182	314	1	315		
183	110	2	112		
184	101	0	101		

Appendix I.

Table 9. continued.

185	991	16	1,007		
190	1,010	15	1,025		
200	1,151	23	1,174		
210	833	11	844		
220	1,135	6	1,141		
230	487	13	500		
232	63	1	64		
240	2,922	19	2,941	3A	20,502
242	211	5	216		
250	3,850	42	3,892		
260	2,433	69	2,502		
261	730	13	743		
270	2,175	40	2,215		
271	357	8	365		
280	1,639	29	1,668		
281	199	6	205		
290	4,134	41	4,175		
300	1,694	35	1,729		
310	836	30	866	3B	10,114
320	2,117	24	2,141		
330	788	15	803		
340	389	11	400		
350	201	6	207		
360	267	2	269		
370	83	4	87		
380	89	11	100		
390	45	1	46		
395	4	0	4		
400	274	0	274	4	7,469
410	23	5	28		
420	35	5	40		
430	13	1	14		
440	222	5	227		
450-510	180	11	191		
Bering Sea	5,902	80	5,982		
Grand Total	**48,886**	**832**	**49,718**		**49,718**

[1]Statistical areas as defined in IPHC Technical Report No. 49; available on the IPHC website.

Appendix I.

Table 10. The fishing period limits (net weight) by vessel class used in the 2010 directed commercial halibut fishery in Area 2A.

Vessel Class		Fishing Period & Limits
Letter	Feet	June 30
A	0-25	755
B	26-30	945
C	31-35	1,510
D	36-40	4,165
E	42-45	4,480
F	46-50	5,365
G	51-55	5,985
H	56+	9,000

Table 11. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2010.

Fishing Period Dates	Number of Vessels	Catch (Pounds)
April 23 - 25	8	1,889
May 7 – 9	14	4,912
May 21 – 23	15	4,821
June 4 – 6	17	7,690
June 18 –20	16	6,607
July 2 – 4	9	3,626
July 16 – 18	9	2,659
July 30 – August 1	8	3,991
August 13 – 15	4	1,611
August 27 – 29	6	4,716
Sept. 10 – 12	6	2,392
11 Fishing Periods		44,914

Appendix II.

Table 1. Summary of the 2010 Pacific halibut sport fishery seasons. No size limits were in effect unless otherwise noted.

Regulatory Area & Region	Fishing Dates	Fishing Days per week	No. of Fishing Days	Daily Bag Limit
Area 2A - Washington, Oregon & California				
WA Inside Waters				
East of Low Point	May 1 – 22	3 (Thurs-Sat)	10	1
	May 28 – 30	3 (Fri-Sun)	3	1
Low Point to Sekiu River	May 28 - 30	3 (Thurs-Sat)	3	1
	Jun 3 - 19	3 (Fri-Sun)	9	1
WA North Coast (Sekiu River to Queets River)	May 13 - 22	2 (Thurs, Sat)	4	1
	Jun 3, 5, 19	2 (Thurs, Sat)[a]	3	1
WA South Coast (Queets River to Leadbetter Pt.)				
All Depths	May 2 - 23	2 (Sun, Tues)	7	1
Northern nearshore	May 3 - Sep 30	7 (Mon - Sat)	151	1
Columbia River (Leadbetter Pt. to Cape Falcon)	May 1 – Jun 19	3 (Thurs - Sat)	22	1
	Jun 24 - 25	2 (Thurs - Fri)	2	1
	Aug 6 - Sep 26	3 (Fri - Sun)	24	1
OR Central Coast (Cape Falcon - Humbug Mtn.)				
All Depths	May 13 - Jul 2	3 (Thurs - Sat)[b]	14	1
	Aug 6 - 7	2 (Fri - Sat)	2	1
Less than 40 fathoms	May 1 – Jul 17	7 (Sun - Sat)	78	1
OR/CA (South of Humbug Mtn.)	May 1 - Oct 31	7 (Sun - Sat)	184	1
Area 2B - British Columbia	Feb 1 - Oct 18	7 (Sun - Sat)	260	1
Area 2C - Alaska				
Guided anglers	Feb 1 - Dec 31	7 (Sun - Sat)	334	1
Unguided anglers	Feb 1 - Dec 31	7 (Sun - Sat)	334	2
Areas 3 and 4 - Alaska	Feb 1 - Dec 31	7 (Sun - Sat)	334	2

[a]Fishing was not permitted on June 17.

[b]Fishing was not permitted during May 27-29 and in every other week during June.

Appendix II.

Table 2. 2010 Area 2A sport harvest allocations and catches (pounds, net weight) by subarea.

Subarea	Allocation	Catch Estimate	Over/(Under) Pounds	Over/(Under) Percent
WA Inside Waters[1]	50,542	71,801	21,259	42.1%
WA North Coast	101,179	95,014	(6,165)	(6.1%)
WA South Coast	35,887	34,554	(1,333)	(3.7%)
Columbia River	13,436	10,811	(2,625)	(19.5%)
OR Central Coast	153,548	155,567	2,019	1.0%
South OR/California[1]	5,007	5,007	0	0.0%
Total	359,600	372,754	13,154	3.7%

Table 3. Harvest of halibut by sport fishers (millions of pounds, net weight) by IPHC regulatory area, 1977-2010.

Year	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	Total
1977	0.013	0.008	0.072	0.196	-	-	0.289
1978	0.010	0.004	0.082	0.282	-	-	0.378
1979	0.015	0.009	0.174	0.365	-	-	0.563
1980	0.019	0.006	0.332	0.488	-	-	0.845
1981	0.019	0.012	0.318	0.751	-	0.012	1.112
1982	0.050	0.033	0.489	0.716	-	0.011	1.299
1983	0.063	0.052	0.553	0.945	-	0.003	1.616
1984	0.118	0.062	0.621	1.026	-	0.013	1.840
1985	0.193	0.262	0.682	1.210	-	0.008	2.355
1986	0.333	0.186	0.730	1.908	-	0.020	3.177
1987	0.446	0.264	0.780	1.989	-	0.030	3.509
1988	0.249	0.252	1.076	3.264	-	0.036	4.877
1989	0.327	0.318	1.559	3.005	-	0.024	5.233
1990	0.197	0.381	1.330	3.638	-	0.040	5.586
1991	0.158	0.292	1.654	4.264	0.014	0.127	6.509
1992	0.250	0.290	1.668	3.899	0.029	0.043	6.179
1993	0.246	0.328	1.811	5.265	0.018	0.057	7.725
1994	0.186	0.328	2.001	4.487	0.021	0.042	7.065
1995	0.236	0.887	1.751	4.511	0.022	0.055	7.462
1996	0.229	0.887	2.129	4.740	0.021	0.077	8.084
1997	0.355	0.887	2.172	5.514	0.028	0.069	9.025
1998	0.383	0.887	2.501	4.702	0.017	0.096	8.585
1999	0.338	0.859	1.843	4.228	0.017	0.094	7.379
2000	0.344	1.021	2.251	5.305	0.015	0.073	9.009
2001	0.446	1.015	1.923	4.675	0.016	0.029	8.104
2002	0.399	1.260	2.090	4.202	0.013	0.048	8.011
2003	0.404	1.218	2.258	5.427	0.009	0.031	9.348
2004	0.487	1.613	2.937	5.606	0.007	0.053	10.703
2005	0.484	1.841	2.798	5.672	0.014	0.050	10.860
2006	0.516	1.752	2.526	5.337	0.014	0.046	10.191
2007	0.504	1.556	3.049	6.283	0.025	0.044	11.461
2008	0.481	1.536	3.264	5.320	0.026	0.040	10.667
2009	0.458	1.098	2.383	4.758	0.025	0.039	8.697
2010	0.373	1.156	1.971	4.285	0.024	0.016	7.803

PUBLICATIONS

The IPHC publishes three serial publications - Annual reports, Scientific reports, and Technical Reports - and also prepares and distributes regulation pamphlets and information bulletins. Articles and reports produced during 2010 by the Commission and Staff are shown below and a list of all Commission publications is shown on the following pages. All reports published by IPHC are available through the online library at www.iphc.int/library.html.

2010 Research publications

Cahalan, J. A., B. M. Leaman, G. H. Williams, B. H. Mason, and W. A. Karp. 2010. Bycatch characterization in the Pacific halibut fishery: A field test of electronic monitoring technology. U.S. Dept. Commer., NOAA Tech Memo. NMFS-AFSC-211, 66 p.

International Pacific Halibut Commission. 2010. IPHC Annual Report 2009.

Loher, T., and Rensmeyer, R. 2010. Physiological responses by Pacific halibut, *Hippoglossus stenolepis*, to intracoelomic implantation of archival tags, with a review of tag implantation techniques employed in flatfishes. Reviews in Fish Biology and Fisheries. DOI: 10.1007/s1116-010-9192-4.

IPHC Publications 1930-2010

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 O' Malley. 31 p. (1931).[Out of print]
2. Life history of the Pacific halibut. 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. (1930).
6. Biological statistics of the Pacific halibut fishery. Changes in the yield of a standardized unit of gear. William F. Thompson, Harry A. Dunlop, and F. Heward Bell. 108 p. (1930). [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, 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 - 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 flounder from the northeastern Pacific. Lawrence D. Townsend. 24 p. (1936).
12. Theory of the effect of fishing on the stock of halibut. William F. Thompson. 22 p. (1937).
13. Regulation and investigation of the Pacific halibut fishery in 1947 (Annual Report). IFC. 30 p. (1948).
14. Regulation and investigation of the Pacific halibut fishery in 1948 (Annual Report). IFC. 30 p. (1949).
15. Regulation and investigation of the Pacific halibut fishery in 1949 (Annual Report). IFC. 24 p. (1951).
16. Regulation and investigation of the Pacific halibut fishery in 1950 (Annual Report). IFC. 16 p. (1951).
17. Pacific Coast halibut landings 1888 to 1950 and catch according to areas of origin. F. Heward Bell, Henry A. Dunlop, and Norman L. Freeman. 47 p. (1952).
18. Regulation and investigation of the Pacific halibut fishery in 1951 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, and George W. Nickerson. 29 p. (1952).
19. The production of halibut eggs on the Cape St. James spawning bank off the coast of British Columbia 1935-1946. Richard Van Cleve and Allyn H. Seymour. 44 p. (1953).
20. Regulation and investigation of the Pacific halibut fishery in 1952 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, George W. Nickerson, and Seton H. Thompson. 29 p. (1953).
21. Regulation and investigation of the Pacific halibut fishery in 1953 (Annual report). IPHC. 22 p. (1954).
22. Regulation and investigation of the Pacific halibut fishery in 1954 (Annual Report). IPHC. 32 p. (1955).
23. The incidental capture of halibut by various types of fishing gear. F. Heward Bell. 48 p. (1955).
24. Regulation and investigation of the Pacific halibut fishery in 1955 (Annual Report). IPHC 15 p. (1956).

25. Regulation and investigation of the Pacific halibut fishery in 1956 (Annual Report). IPHC. 27 p. (1957).
26. Regulation and investigation of the Pacific halibut fishery in 1957 (Annual report). IPHC. 16 p. (1958).
27. Regulation and investigation of the Pacific halibut fishery in 1958 (Annual Report). IPHC. 21 p. (1959).
28. Utilization of Pacific halibut stocks: Yield per recruitment. IPHC Staff. 52 p. (1960).
29. Regulation and investigation of the Pacific halibut fishery in 1959 (Annual Report). IPHC. 17 p. (1960).
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Other Publications

Miscellaneous

Pacific Halibut Flat or Fiction? Lauri Sadorus and Birgit Soderlund (*illustrator*). 24 p. (2005). This is a full-color, non-fiction children's book. Hardcopies are available free of charge in limited quantities upon request and it is also available on the IPHC website.

Annual Reports

These reports provide summaries of Commission and Staff research and activities as well as the state of the fishery, and have been produced annually since 1969. Reports are available on the IPHC website. Limited quantities of the most current reports in hard copy may be available upon request.

Information bulletins and news releases

Bulletins and news releases are periodically issued to disseminate important information in a timely manner. They can be accessed on the IPHC website.

You caught a tagged halibut

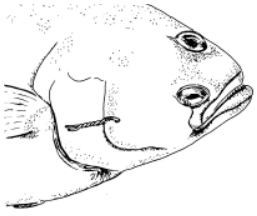
Now What?

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

Instructions:

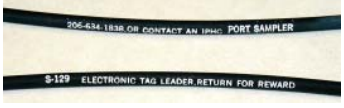
- Leave the tag on the fish until landed.
- Notify the IPHC by telephone. If there is an IPHC port sampler in that port, they will redeem the tag, as well as take measurements and an otolith from the halibut. If there is no sampler in the area, a staff member will instruct you on safe removal of the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

Reward offered for every tag returned!



1. Traditional wire tags

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



2. Pop-up archival transmitting tags

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

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

3. Electronic archival tags

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

*** See the following page for information on a new tag that was recently deployed and its $500 reward!**

International Pacific Halibut Commission
2320 W Commodore Way, Suite 300
Seattle, Washington 98199-1287
(206) 634-1838

$500 REWARD for tags from double-tagged halibut

- **External (backpack) tag**
- **Stalk from gut tag**

The IPHC has double-tagged 30 halibut in Regulatory Areas 3A and 2C with a combination of external electronic “backpack tags” and electronic internal “gut tags”. The IPHC is asking harvesters to look for tagged halibut, bearing in mind that each fish should carry two tags.

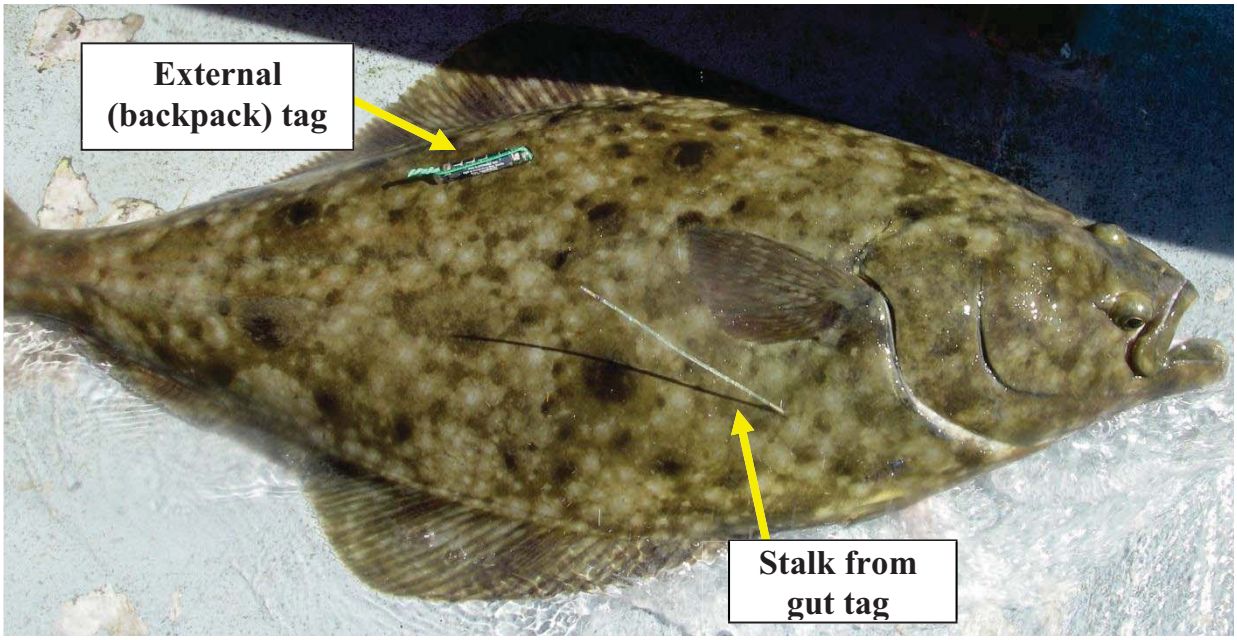
What’s this study about?

The study looks at whether geomagnetism can be used as a means of tracking halibut migrations. The tags are capable of recording the local magnetic field in ways that can be converted into location estimates.

Tag descriptions:

1) The backpack is a black plastic cylinder that measures ~3” (7.6 cm) long by ½” (1.2 cm) in diameter, and is attached to the dark side of the fish, below the dorsal fin, using a green-coated tagging wire, with a white backing plate that rests on the underside of the fish.
2) Gut tags are surgically implanted in the gut cavity, but have a translucent green stalk that protrudes from the belly on the fish’s dark side (see picture below). The stalk contains sensors that record ambient light levels. Note that, over time, gut tags can become “encapsulated” by the intestines, making them difficult to find without the stalk.

- Two different tags that are each worth $500 so keep and return both tags.
- One tag is a black plastic cylinder with tagging wire and backing plate.
- One tag is internal but has a translucent green stalk protruding from the belly.
- Tags are on the dark side of the halibut.
- Tagged halibut can be retained regardless of the fishery (see the poster on the previous page for more instructions).
- Contact the IPHC if you find any tagged halibut.

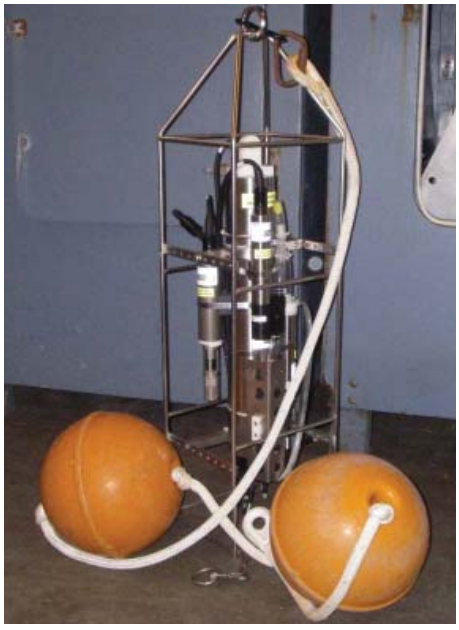


$1500 Reward

For the Recovery and Return of Oceanographic Research Equipment

In 2009, the International Pacific Halibut Commission (IPHC) launched a program to collect oceanographic data alongside survey fishing data to better understand halibut distributions and abundance in relation to climate. Since then, oceanographic profilers have been routinely launched from the decks of the survey boats and safely retrieved. However, in two cases, the profilers were not retrieved safely and remain on the fishing grounds. The instruments, or profilers, weigh about 60 pounds each and are housed inside a steel cage that measures approximately 11" width x 9" depth x 42" height (see figure below). **The IPHC is offering a $1500 reward each for the retrieval and return of the missing instruments.**

Missing Profiler One. A profiler was lost on July 30, 2009 off the east side of Kodiak Island at 56°49.95N latitude and 153°09.12W longitude in about 45 fathoms of water. When lost, the profiling instrument had a 40 pound anchor attached to the bottom and no floats attached on top. The profiler is thought to be sitting hard on bottom and may be snagged by fishing or other gear.



Sea-bird profiling instrument and floats used for IPHC research.

Missing Profiler Two. The second profiler was lost June 11, 2011 on the south side of Adak Island at coordinates 51°29.785N latitude and 176°53.543W longitude in about 247 fathoms of water and moderate currents. When lost, the instrument had a 60 pound weight attached to the bottom via 15 m of buoy line, and orange hardball floats attached to the top. If the anchor/float assembly is intact, the floats will have suspended the profiler approximately 15 m off bottom. The instrument is attached to the anchor line via a weak link that is designed to pull loose if forced, sending the instrument and float configuration to the surface. It may be possible to snag the assembly with fishing or other gear.

A reward of $1500 is offered for each of these instruments if recovered either alone, or with supplemental gear (anchor and/or floats) attached. No reward is offered for floats and anchor only.

If found, please contact Lauri Sadorus (x7677) or Michael Larsen (x7671) at the IPHC (206-634-1838).

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