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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2012

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

This report produced by IPHC staff
and Eric Chastain
2013

International Pacific Halibut Commission
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PREFACE

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

Three IPHC Commissioners are appointed by the Governor General of Canada and three by the President of the United States. 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 O32 halibut.

On the Cover

Steve Kaimmer has worked as a biologist for the Halibut Commission for 28 years. Just before joining the IPHC, while herding a bunch of US catchers for a Polish joint venture in 1984, and while fondly remembering his days as a halibut crew, he sketched the 'anchor fish' displayed on this year's cover.

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INTRODUCTION

The halibut occupies a unique niche in literature. It doesn't possess centuries of glorious folktales, like salmon. Unlike rainbow trout, a river doesn't run anywhere near it. The Atlantic cod has its own best-selling biography. And the halibut? Mostly scientific reports and cookbooks. When it is featured in a book, anything written about it tends to be humorous, with halibut the butt of the joke. Indeed, if tuna is the "chicken of the sea," then halibut could be called the "Woody Allen of the ocean." How is a comedic actor from New York like a halibut? Besides being naturally funny, most of the stories feature Atlantic halibut. The Pacific halibut, separated from its Atlantic brethren by 50 states and 10 provinces, enjoys comparative literary anonymity.

The International Pacific Halibut Commission (IPHC) isn't above a little humor itself. It has a life-like fiberglass halibut cast from a real one, that the staff named "Eric" (inspired by Monty Python's "Fish License" sketch). However, "Eric" serves a serious purpose in educating students and other groups about the Pacific halibut. Similarly, the IPHC has a serious side, and takes the fish and its wellbeing to heart. Since 1923, when it was founded, the IPHC's mandate has been to manage the stocks of Pacific halibut and conduct biological research on those same stocks. As a result, the Pacific halibut stock is one of the healthiest in the world. A little anonymity can go a long way.

*""I read an interesting thing the other day. It said the sardine's worst enemy was the halibut, and I give you my word that until I read it I didn't know the sardine *had* an enemy. And I don't mind telling you my opinion of the halibut has gone down considerably. Very considerably. Fancy anything wanting to bully a sardine." – P.G. Wodehouse. From the play* ***Good Morning Bill****, 1939.*

A hearty thank you

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 and Gulf NMFS/RACE division groups for saving us a spot on their surveys.
• Makah, Quinault, Lummi, Jamestown S'Klallam, Port Gamble S'Klallam, and Swinomish biologists for port sampling Area 2A tribal commercial fisheries.
• Scott Meyer at ADF&G for sharing his expertise regarding sport fish.
• Jane DiCosimo (NPFMC staff) for her assistance with Alaska sport fish, IFQs, and bycatch issues.
• The staffs of the PFMC and NPFMC for their courtesy in accommodating IPHC presentations, submissions, and consultations.
• State and federal agency staffs for their assistance in the provision of data for sport and personal use fisheries, as well as the provision of halibut bycatch estimates.
• The many processing plants who assist the IPHC port sampling and survey programs by storing and staging equipment and supplies.
• The NOAA National Marine Mammal Laboratory for providing us space at their St. Paul residence facility when our field biologists are in town.
• Trident Seafoods for renting us space (room and board) at their Sand Point facility when our field biologist is in town.

"Halibut Jackson was shy. Halibut Jackson didn't like to be noticed. Halibut Jackson liked to blend into the background."– David Lucas. ***Halibut Jackson****. 2003.*

Director's Report

Events concerning the recommendations from the Commission's external Performance Review and the retrospective feature of the halibut stock assessment dominated much of our activities in 2012.

The Performance Review generated 12 important recommendations concerning the operation of the Commission and its interaction with stakeholders. Since the Commission is a relatively mature organization (89 years young!), the recommendations for updated communications, improved transparency, and formalized procedures were unsurprising, but clearly recognized and necessary. The Commission invited public comments on the recommendations and received numerous positive responses and suggestions. Most of the review's recommendations were accepted and action plans were created for their implementation. This resulted directly in one new advisory body (the Scientific Review Board, SRB), to provide an ongoing independent, external review of the Commission's science. It also triggered an increased openness to the Commission's activities, with web-based, interactive broadcasting of meetings being adopted as the normal format for future meetings of the Commission. Formal Rules of Procedure were drafted for review by all Advisory Bodies to the Commission and we anticipate adoption of the finalized versions in 2013.

Two recommendations from the Performance Review were not adopted by the Commission: a recommendation to expand the number of Commissioners and a recommendation to elevate the importance of Tribes and First Nations in the Commission process. The Commission was satisfied with the current complement of six Commissioners and felt that the initiatives to improve communication and transparency would address the perceived need for more Commissioners. Both the U.S. and Canada have well-developed processes for addressing their unique relationships and responsibilities to Tribes or First Nations, and the Commission respects that those processes occur independently within the two countries.

Bruce chats with Peter Tofton, plant manager of Cove Fisheries, during a port tour in Port Hardy, B.C. Photo by Kirsten MacTavish.

The 2012 Annual Meeting in January was disconcerting for many because of the uncertainty concerning stock status and yield which was generated through consideration of alternative means to deal with the retrospective bias in the assessment. Should we decrease the yield estimates to deal with a likely continuation of the bias, without solving the problem, or should we devote intensive efforts to solving the problem and eliminating the bias? The Commission chose the latter route, directing that the solution to the bias problem was the staff's highest priority in 2012. Bolstered by new assessment scientists, the staff was able to develop such a solution to the retrospective bias. The solution involved accommodating the fact that the age and size components of the stock vary over time and by individual regulatory area due to migration, recruitment, and growth, in a very dynamic way. This means that the selectivity of the various fisheries for components of the stock is not the same across the entire coast. Building more flexibility into the assumed selectivity of these fisheries appears to have solved the retrospective problem. However, the solution to this problem also resulted in much lower estimates of current biomass and recent recruitment than previous estimates. These lower year-class strengths mean that we should not expect a major increase in the coastwide stock biomass over the next several years.

The Commission also embarked on Management Strategy Evaluation (MSE) to provide a vehicle within which to evaluate proposed modifications to the harvest policy and the associated harvest control rules or management procedures in a rigorous simulation environment, prior to proposing implementation of any new procedures. The MSE process will be guided by the second new advisory body formed by the Commission, the Management Strategy Advisory Board (MSAB). The MSAB will be composed of a broad group of stakeholder representatives who will help the Commission develop management objectives, harvest policy, candidate management procedures, and metrics of performance to be investigated under the MSE.

The final significant development in the stock assessment, also linked to a recommendation in the Performance Review, was to provide advice in a risk-based decision table, so that policy choices of yield could be interpreted and evaluated based on the risks to the stock biomass and the fishery. This is an extremely positive and necessary procedural change. Through this process, the twin elements of science (evaluating risk) and policy (deciding on harvest levels) can both be considered when making decisions. It clearly delineates the roles of the staff (estimating the probabilities of particular outcomes associated with harvest levels) and the Commission (deciding on the levels of harvest that will be taken). This process will evolve over the next several years, as the Commission and the halibut users become more familiar with using such an approach to deciding on harvest, as well as exploring different metrics of stock and fishery performance.

Bruce M. Leaman
Executive Director

Activities of the Commission

Annual Meeting 2012

The International Pacific Halibut Commission (IPHC) held its 88th Annual Meeting in Anchorage, Alaska, from January 24th to 27th, 2012. Dr. James Balsiger of Juneau presided as Chair of the meeting. The Commissioners heard reports from IPHC staff about the condition of the Pacific halibut population, considered the suggestions of expert advisory groups, and asked for public comments before setting catch limits for 2012. The Commission also took action on a wide range of regulatory issues, including bycatch management, scientific assessment review, and the IPHC's performance review.

The Convention between Canada and the United States for the preservation of the halibut fishery of the northern Pacific Ocean, including the Bering Sea, was signed in 1923.

IPHC Commissioners hear public comment during a session of the 2012 Annual Meeting. From left to right: Ralph Hoard (U.S.), Philip Lestenkof (U.S.), James Balsiger (U.S.), Laura Richards (Can.), Michael Pearson (Can.), and Gary Robinson (Can.). Photo by Michelle Drummond.

Catch limits and dates for 2012

The Commission recommended to the governments of Canada and the United States that the total catch limit for 2012 should be 33,540,000 pounds, an 18.3% decrease from the 2011 catch limit of 41,070,000 pounds.

The IPHC adopted biologically based catch limits for all individual regulatory areas and for Area 4CDE combined. In subsequent actions, the Pacific Fishery Management Council (PFMC) and the North Pacific Fishery Management Council (NPFMC) in the U.S., and Fisheries and Oceans Canada (DFO), allocated the halibut limits using Catch Sharing Plans (CSPs) among commercial, sport and tribal fisheries in Area 2A, into three separate areas for Area 4CDE, and to sport and commercial users in Area 2B, respectively. The CSPs were recommended by the domestic parties and adopted by the IPHC.

The allocations among sectors vary across areas. For Area 2A, the CSP developed by the PFMC allocates 44.4% to the sport fishery, 35% to the treaty tribes for commercial and ceremonial and subsistence catch, and 20.6% to the non-treaty commercial fishery. DFO implemented a new allocation framework in 2012 for the commercial and recreational sectors, with an allocation of 85% to the commercial fishery and 15% to the recreational fishery. Catch limits and other information for each area can be found in Appendix 1.

The 2012 commercial season was designated to open coastwide at 12 noon local time on Saturday, March 17, 2012 and to close at 12 noon local time on Wednesday, November 7, 2012. The Alaska Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) for Areas 2C through 4, the Canadian Individual Vessel Quota (IVQ) for Area 2B, and the Area 2A commercial, including the Treaty tribal commercial, fisheries, all fell within these season dates. It was recommended that up to seven 10-hour fishing periods (June 27, July 11, July 25, August 8, August 22, September 5, and September 19) for the non-treaty directed commercial fishery in Area 2A be allowed, with fishing period limits and the provision that once the catch limit was reached, there would be no further openings.

2012 regulatory issues

Logbooks

The Commission approved IPHC staff recommendations to modify its regulations so as to provide conformity with DFO logbook regulations in Area 2B (requiring latitude/longitude position information and recording of catch by set), and to allow the use of the Oregon Department of Fish and Wildlife (ODFW) gear logbook as an approved logbook for commercial fishing in Area 2A.

Area 2A licensing

The overall Area 2A catch limit was sufficient to permit non-treaty incidental harvest of halibut during the limited entry sablefish longline fishery, under provisions of the PFMC CSP. Therefore, the Area 2A licensing regulations remained the same as in 2011, with one exception. Vessels fishing in the incidental halibut fishery concurrent with the sablefish fishery north of Point Chehalis (near Ocean Shores, Washington) were also required to obtain a commercial license from the Commission. Commercial fishers had to choose between a license for (1) retaining halibut caught incidentally during the salmon troll fishery, or (2) fishing in the directed commercial halibut fishery (south of Point Chehalis) and/or retaining halibut caught incidentally in the primary sablefish fishery (north of Point Chehalis).

In the Old Norse language, halibut was "heilag-fiski" which literally means, "Holy fish."

Control of charter harvest in Area 2C

The Commission approved a request from the NPFMC to change the Commission's existing one-fish daily bag limit with 37-inch maximum length for charter fishing in Area 2C, to a one-fish daily bag limit with a U45/O68 "reverse slot limit" restriction (i.e., $\leq$ 45 inches or $\geq$ 68 inches, head on). This change is intended to keep the removals by the charter fishery within the NPFMC's 0.931 million pound Guideline Harvest Level (GHL) for Area 2C. In addition, the entire carcass must be retained on board the vessel until all fillets are offloaded.

Recreational fishery release mortality

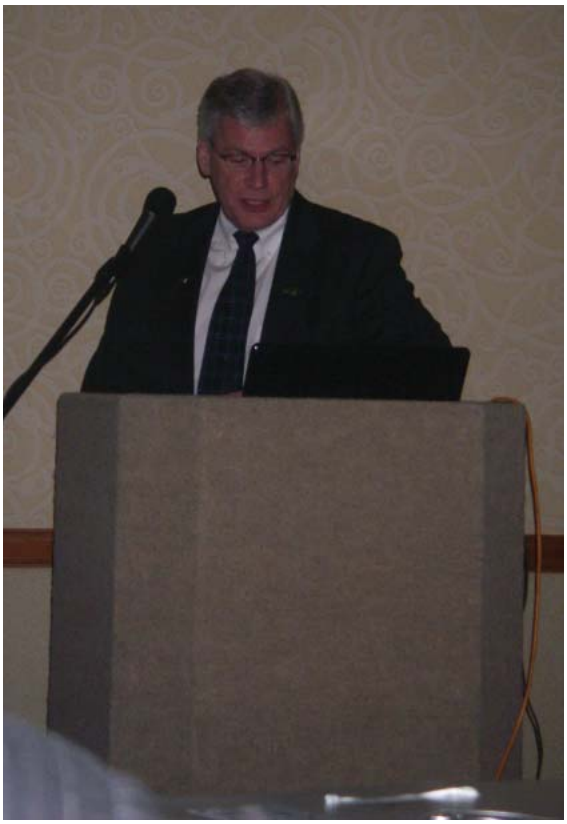
As there are currently no estimates of halibut release mortality during recreational fishing (though such releases are known to be common), the Commission directed IPHC staff to write letters to all agencies involved in management of halibut recreational fisheries, requesting implementation of data collection programs and estimation of such mortality for all recreational fisheries.

IPHC Merit Scholarship

The IPHC honored Mr. John Scott of Girdwood, Alaska as the tenth recipient of the IPHC Merit Scholarship. Mr. Scott, though unable to attend the meeting due to class requirements, was presented with his $2,000 USD scholarship, which is renewable for up to four years of study. The Commissioners expressed their continued support for the scholarship program and commended the Scholarship Committee for their efforts in assessing the candidates.

Upcoming Annual Meetings

The 89th Annual Meeting for the IPHC was scheduled for January 21st through 25th, 2013, in Victoria, B.C. The 90th Annual Meeting for the IPHC was scheduled for January 13th through 17th, 2014, in Seattle, Washington.



IPHC Director, Bruce Leaman, presents a summary of regulatory proposals for 2012. Photo by Michelle Drummond.

Other activities throughout the year

Halibut Bycatch Work Group

At the Annual Meeting, the Halibut Bycatch Work Group reported on a number of items including actions taken by both countries, thus far, to reduce bycatch.

The Commission expressed continued concern about the losses to yield and to spawning biomass due to halibut mortality in non-directed fisheries. Significant progress in reducing this bycatch has been achieved in Areas 2B and 2A, using individual bycatch quotas (IBQs) for vessels in some fisheries. Reductions in bycatch have also occurred in Alaska, and new measures aimed at improving bycatch estimation will begin in 2013, which will help refine those estimates. At the Annual Meeting, the Halibut Bycatch Work Group was tasked with a review of a staff report on migration, actions taken by both countries to reduce bycatch mortality, identification of further actions that will be effective in reducing bycatch mortality, and identification of options to mitigate the effects of such mortality.

To that end, the NPFMC and the IPHC held a workshop on halibut bycatch, biology, and management in Seattle on April 24th and 25th, 2012. It was attended by 92 people, and 111 others participated via webcast. The first day was spent viewing 19 presentations that reviewed the state of knowledge on halibut ecology and bycatch issues, followed by questions from invited panelists. The second day included public testimony, with a summary presented in the afternoon. Suggestions for future research included: inter-species interaction, halibut size

at age, halibut migration studies, climate impacts, fishing as a cause of changing halibut traits, otolith re-ageing, diet studies, statistical/sampling changes, management approaches, and additional analyses.

Assessment work team

The Commission approved and funded a multi-year plan to review current and planned research activities as well as to plan and prioritize activities in the following areas: peer review of the current assessment model, analysis of the causes for the currently observed retrospective bias in estimates of exploitable biomass, analysis of the ongoing decline in halibut size at age, and development of a Management Strategy Evaluation framework for the halibut stock. A planning meeting for this initiative, involving the Commission with its staff and scientific advisors was held in May 2012.

Commission performance review

A performance review was conducted by a contracted company, CONCUR. They identified 12 recommendations for improving Commission function and interaction with stakeholders.

At the behest of the Canadian and U.S. governments, the Commission agreed to undergo an independent performance review to ensure that its work continued to be relevant and effective. The review was carried out by a U.S.-based company called CONCUR. The reasons for the review were that, despite its many successes over the years, the IPHC has recently begun to face falling constant exploitation yields (CEYs), challenging analytic uncertainties, tough environmental conditions, and a growing unease among its stakeholders. In essence, what has worked so well in the past is not working as well in the present.

In May, after conducting 43 interviews and observing the IPHC in action for one meeting cycle, CONCUR presented to the Commissioners a summary of the issues within the IPHC that they recommended be addressed. The CONCUR reviewers found that many of the core activities of the IPHC such as the stock assessment model, stakeholder input, research activities, staff advice, and presentations lacked transparency and were not always well understood. Furthermore, Commission decisions lacked clarity and documented rationales.

Recommendations

To help remedy the problems, CONCUR developed twelve recommendations, which were intended to foster greater transparency; promote informed decision-making; articulate predictable processes; cultivate more balanced and effective stakeholder input; foster fresh, independent critiques; further strategic thinking and actions; and strengthen the implementation of treaty obligations. A summary of the recommendations follows:

No. 1: Adopt clear and comprehensive protocols/rules of procedure. Update and expand the existing Rules of Procedure for the Commission and all its bodies so that everyone has an accurate and consistent understanding of its structure and practices.

No. 2: Improve Commission transparency. The bulk of the Commission's Annual Meeting should occur in public. Discussion summaries of any private meetings that occur should be made public in a timely manner.

No. 3: Revisit stakeholder engagement structure. Take steps in the next two years to transition the current stakeholder advisory structure into a unified, integrated body.

No. 4: Develop strategic approach to research. Develop a five-year research plan that links research projects to Commission objectives, accompanied by a consistent budget. Formalize the Research Advisory Board (RAB).

No. 5: Strengthen stock assessment model. Promote regular peer review of the IPHC's stock assessment model and outputs, along with the associated apportionment process. Also articulate in writing a predictable process for considering changes to the model and any other recommended actions, so that interested parties have adequate time to provide input.

No. 6: Expand Commission composition. The U.S. and Canada should each add up to three alternate Commissioners to better include interests not presently represented. Each nation should also put in place a rotation among permanent and alternate Commissioners to add legitimacy and integration across interests. The IPHC should develop recruitment criteria that emphasize the ability to negotiate effectively and integrate across interests.

No. 7: Develop long-term strategic plan. Develop a long-term strategic plan, coupled with associated annual plans and yearly budgeting, to better coordinate, focus and streamline efforts. The plan should include specific milestones and performance measures to track progress, which should be reported at each Annual Meeting.

Stakeholder comment was solicited in addressing the CONCUR recommendations.

No. 8: Strengthen delineation between scientific analysis and policy options. The Commission needs to be more explicit in demarcating the line between science and policy. Clarify the respective roles and responsibilities of Commissioners and staff for each step of the analysis and policy development cycle. Staff should provide to the Commission a range of options relating to annual catch limits, and to forecast the associated risks and benefits of each option.

No. 9: Greater leadership needed at Commissioner level. Commissioners should take an active role in articulating a vision for the IPHC (including providing guidance to staff) and engaging in actions to carry out that vision.

No. 10: Elevate importance of Tribes and First Nations. Any change to the IPHC structure should accommodate Tribal and First Nations participation. Tribal and First Nations scientists should also be actively included in structured peer reviews.

No. 11: Strengthen Interim and Annual Meeting process. Address the shortcoming in the current meeting process by adding a third meeting to the annual cycle, promoting stronger internal meeting preparation, providing materials earlier, and increasing opportunities for more public comment.

No. 12: Improve communications. To address communication gaps and assuage public concerns about staff biases, improve the timeliness and use of meeting summaries, draft policies to guide staff on policies under consideration, and improve outreach to non-traditional groups.

Implementation of recommendations

The Commission then asked for stakeholder input on the recommendations and which were most pressing. As a first step, the Commission decided to convene a peer review workshop for the 2012 halibut stock assessment and to

Annual Meeting participants chat prior to the joint session between the advisory bodies and the Commission. Photo taken by Michelle Drummond.

The recommendation to improve transparency was addressed at the 2012 Interim Meeting where all except the Finance and Administration session were opened to the public.

develop a long-term research plan. Additionally, steps were taken immediately to improve transparency at IPHC meetings. The entire 2012 Interim Meeting (with the exception of the Finance and Administration session) was available to the public for the first time, via web broadcast. The Commission continued to consider the performance review recommendations during the rest of the year, incorporating them into ongoing initiatives and including public discussion on the agendas for the 2012-2013 meeting cycle.

Interim Meeting November 2012

The IPHC held its 2012 Interim Meeting on November 28th and 29th in Seattle, Washington. As is the case every year, it was an occasion to prepare for the Annual Meeting the following January. The staff presented the stock assessment and research results from 2012, as well as a new decision-table format for harvest advice. This was the first Interim Meeting open to the public.

IPHC Regulatory Areas for 2012

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. The numbered areas begin in California and work their way northward. Here is how the regulatory areas are divided in more detail. Specific descriptions (and those in quotations below) can be found in Section 10 of the *Pacific Halibut Fishery Regulations 2012*. For a quick overview, a map can be found on the inside front cover of this report.

The bottom area that makes up Pacific halibut habitat is 396,608 square nautical miles. This is 0.38% of the Earth's water surface area (105,289,244 square nautical miles) and 0.27% of the surface area of the Earth (148,713,199 square nautical miles).

Area 2A—waters off the coasts of California, Oregon, and Washington

Area 2B—waters off the coast of British Columbia

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

Area 3A—Central Gulf of Alaska. Waters off South Central Alaska, between Cape Spencer and the southernmost tip of Kodiak Island (Cape Trinity).

Area 3B—Western Gulf of Alaska. Waters south of the Alaska Peninsula, from west of Cape Trinity (Kodiak Island) to a line extending southeast from Cape Lutke (Unimak Island).

Area 4A—waters surrounding the 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—waters surrounding the 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. latitude."

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

Area 4E—Northeastern 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's a relatively shallow body of water that serves as a nursery for juvenile Pacific halibut.

Commercial Fishery

Commercial fishing vessels caught the vast majority of Pacific halibut in 2012, pulling in 31.3 million pounds of fish, two percent under the catch limit set by the IPHC. Supplementing this was 0.731 million pounds landed from IPHC stock assessment surveys. Landing this quantity of fish is always a challenge, due to the fact that each commercial halibut is caught by baiting individual hooks and dropping them on longlines to the sea floor. This section gives an overview of the 2012 commercial catch, with more detail provided in the tables of Appendix I.

The commercial fishery caught 31.3 million pounds of halibut in 2012.

Halibut catch

In this context, a Pacific halibut has not yet been "landed" until it has been delivered to a port for processing. The data come from several sources, including IPHC, National Marine Fisheries Service (NMFS), DFO, Washington treaty tribes (including the Northwest Indian Fisheries Commission and the Makah, Lummi, Jamestown, Port Gamble, Swinomish, Quileute, and Quinault tribes), and state agencies, including the Alaska Department of Fish and Game (ADF&G), the Washington Department of Fish and Wildlife (WDFW), ODFW, and the California Department of Fish and Wildlife (CDFW).

Season dates

IPHC port sampler, Michele Drummond, takes the otolith from a halibut at Taku Fisheries in Juneau, AK. Photo taken by Lara Erikson.

The 2012 commercial fishing season for Area 2B IVQ, and Area 2C-4 IFQ and CDQ, opened at 12-noon local time on March 17, 2012 (a Saturday) and closed at 12-noon local time on November 7, 2012 (a Wednesday). The Area 2A Treaty Indian commercial fisheries fell within those dates. The Area 2A non-treaty fishery included seven 10-hour fishing periods with trip limits.

Area 2A (California, Oregon and Washington)

In 2012, the IPHC issued a total of 619 vessel licenses in Area 2A. Area 2A's directed fishery caught 164,400 pounds of halibut in 2012, 5% under the catch limit of 173,216 pounds. The directed commercial halibut fishery and the sablefish fishery received 177 licenses (30 more than in 2011, due in part to permitting the sablefish fishery to keep incidentally caught halibut for the first time since 2009). In addition, 311 (5 less than in 2011) went to the salmon troll fishery for retaining incidental halibut caught, and 131 licenses (10 less than in 2011) went to sport charter vessels.

During the sablefish fishery 4,900 pounds of incidentally-caught halibut (77% under the catch limit of 21,173 pounds) were retained from May 1 through October 31. The allowable landing ratio was 50 pounds of halibut per 1,000 net pounds of sablefish and up to two additional halibut in excess of the ratio limit.

During the salmon troll fishery 29,700 pounds of incidentally-caught halibut (3% under the catch limit of 30,568 pounds) were retained from May 1 through July 3. The allowable landing ratio was one halibut per four chinook salmon, plus an extra halibut per landing, with the total number of halibut per vessel not allowed to exceed 20. The current 1:4 ratio has decreased from 1:2 in 2008 and 2009, and 1:3 in 2010.

The total treaty Indian commercial catch for Area 2A-1 was 357,000 pounds of halibut (11% over the catch limit of 321,650 pounds). The treaty Indian tribes were allowed both unrestricted fishing with no landing limits and restricted fishing with limits, as well as a late-season fishery that could be set up either with or without landing limits. The unrestricted fishery opened at noon on March 24 and closed at noon on March 26. The restricted fishery opened at noon on March 17 and closed on March 19, with a daily limit of 500 pounds per vessel. The mop-up fishery (which had no landing restrictions) lasted for 13 hours on May 1.

Area 2B (British Columbia)

The IVQ fisheries of British Columbia caught 5,874,000 pounds of halibut in 2012, 1% under the catch limit of 5,953,350 pounds, and 11% less than the 6,612,000 pounds caught in 2011. It was landed by 176 active vessels, with a total of 239 licenses, of which 155 were halibut licenses and 84 were licenses from other groundfish fisheries.

Each halibut vessel was allocated, by the DFO, a fixed poundage of halibut for the season, or IVQ, and was licensed with either an "L" or "FL" license. L commercial licenses were limited and vessel-based. FL communal licenses were reserved for First Nations groups, and the eligibility had to be designated to a specific commercially registered fishing vessel. The halibut catch was subject to the Groundfish Integrated Fisheries Management Plan (IFMP), which has been in effect in British Columbia since 2006. It maintains 100% monitoring of groundfish to improve catch sustainability.

IVQ (Canadian Individual Vessel Quota) *allocates the amount of halibut a single vessel can pull in during a fishing season in Area 2B.*

IFQ (U.S. Individual Fishing Quota) *allocates the amount of halibut an individual can land in a fishing season in Alaskan waters.*

CDQ (U.S. Community Development Quota) *is a program in western Alaska that allocates a percentage of all Bering Sea and Aleutian Islands quotas for groundfish, prohibited species, halibut, and crab to eligible communities for economic development and poverty alleviation.*

IPHC biologist, Lara Erikson, prepares to take logbook information from the *F/V Gulf Maiden* in Kodiak, AK. Photo by Dave Jackson.

Alaska—Quota share fisheries

The total halibut catch from the IFQ and CDQ fisheries for Alaskan waters was 24,829,000 pounds this year, 2.7% under the catch limit of 25,512,000 pounds, and 22% less than the 31,711,000 pounds caught in 2011. This catch amount was regulated by a quota share system that has been in operation in Alaska since 1995 (when 4,831 people received the initial IFQs). The number has fallen since then, with 2,569 people receiving IFQs from the NMFS Restricted Access Management program in 2012.

In total, the Alaskan commercial fisheries were under their catch limits in 2012, with Areas 2C, 3A, and 4A under the limit by 2%, Area 3B under by 3%, and Area 4B under by 8%. Only Areas 4D and 4E landed more than the limit. The NPFMC CSP allowed Area 4D (Northwestern Bering Sea) CDQ to be harvested in either Area 4D or Area 4E (Northeastern Bering Sea), and allowed Area 4C (Pribilof Islands) IFQ and CDQ to be harvested in either 4C or 4D. Taken collectively, Area 4CDE's commercial catch of 2,328,000 pounds was 6% under the combined catch limit of 2,464,000 pounds.

Alaska—Area 2C Metlakatla fishery

The Annette Islands Reserve (just south of the city of Ketchikan) is part of Area 2C. The Metlakatla Indian Community, which makes its home there, has been authorized by the U.S. government to conduct a commercial halibut fishery within the Reserve. The community ran eleven two-day openings between April 20 and September 23 for a total catch of 48,987 pounds (20.9% less than the 61,900 pounds caught in 2011), an amount which was included in the Area 2C commercial catch.

PFMC (Pacific Fishery Management Council) is a regional council established to oversee management of U.S. fisheries in the Exclusive Economic Zone off California, Oregon, and Washington.

NPFMC (North Pacific Fishery Management Council) is a regional council established to oversee management of U.S. fisheries in the Exclusive Economic Zone off Alaska, with primary responsibility for groundfish management in the Gulf of Alaska, Bering Sea, and Aleutian Islands.

DFO (Department of Fisheries and Oceans) is a governmental agency that manages Canada's waterways and aquatic resources.

Landing patterns

Once again, Area 3A landed more halibut in 2012 than any other regulatory area, with nearly half of the Alaskan commercial catch landed in three ports. Kodiak accounted for 4,866,000 pounds (20%), Homer landed 4,419,000 pounds (18%) and Seward took in 2,595,000 pounds (10%). In Area 2C, Sitka once again landed the most fish, at 1,209,000 pounds (5%), followed by Petersburg at 1,013,000 pounds (4%) and Juneau at 939,000 pounds (4%).

Area 2B halibut were landed in eleven different ports on the British Columbia coast, though 94% of the fish were landed in only three of them. Port Hardy led the Area 2B standings with 2,898,000 pounds (49%). Prince Rupert/ Port Edward took in 2,309,000 pounds (39%), followed by Vancouver with 298,000 pounds (5%).

Kodiak was the top landing port in Alaska, taking in 20% of the catch. Port Hardy took the top prize in B.C. with 49% of the catch.

The quota share landings were spread between March and November of 2012. August was the most productive month for Alaskan landings (19%), followed by June (16%) and May (14%). This is a switch from 2011, when May was the most productive month at 18%. In British Columbia, August was also the most productive month (18%), followed by April (14%) and October (13%). Live halibut landings in Area 2B (allowed by the DFO since 1999 as a means to get halibut to certain markets in a fresher state) came in at 3,938 pounds.

Commercial catch sampling

The IPHC collected data on Pacific halibut in several ways in 2012, each of which was important in its own right. One of these ways was sampling of the commercial catch. This was done by stationing IPHC samplers in selected halibut ports coastwide and having them copy logbooks from commercial vessels (gleaning information on weight per unit effort, fishing location, and data for research projects), measure halibut lengths, collect otoliths (earbones used for determining the age of the fish), and check for tags from assorted research projects over the years. Great care was taken to ensure that the sampling was representative of the entire catch, including the ports chosen for sampling, the days on which it occurred, and the percentage of fish sampled.

Commercial catch sampling occurred in 21 locations. For the 2A non-treaty commercial fisheries, there was one sampling port in Oregon (Newport), and one in Washington (Bellingham). For the quota share fisheries British Columbia had three ports with samplers: Vancouver, Port Hardy, and Prince Rupert. Alaska had nine ports: Petersburg, Sitka, Juneau, Seward, Homer, Kodiak, Dutch Harbor, Sand Point, St. Paul, and Bellingham, Washington for deliveries of Alaskan catch. Treaty Indian fisheries' sampling locations included Westport, Taholah, Neah Bay, Port Angeles, Sequim, La Conner, and Bellingham (all in Washington state).

The target number of otoliths for 2012 was 1,000 ± 500 for Area 2A, with 650 expected from the treaty Indian fishery and the remaining 350 from the commercial catch. This goal was met handily, with 1,297 otoliths collected in the Treaty Indian Area 2A-1 (by members of the Makah, Quinault, Lummi, Swinomish, Jamestown S'Klallam, and Port Gamble S'Klallam tribes). The non-treaty segment collected 346 otoliths in Newport from commercial vessels fishing the directed halibut fishery and 12 otoliths in Bellingham from halibut

Sitka port sampler, Tachi Sopow, samples the *F/V Archangel* catch, while IQ holder, Todd Nevers, looks on. Photo by Lara Erikson.

caught incidentally to the sablefish fishery. For the remaining Regulatory Areas, a goal of 1,500 ± 500 otoliths was set for each area (with Areas 4C and 4D combined). The samplers in Area 2B collected 1,242 otoliths. The Alaskan ports met their otolith targets: 1,420 (Area 2C), 1,697 (Area 3A), 1,834 (Area 3B), 2,468 (Area 4A), 1,549 (Area 4B) and 1,364 (Area 4CD). In all, 13,229 otoliths were collected for age determination. Of these, 12,981 were aged, with the remaining 248 not readable due to crystallization, being badly broken, or right-sided. Additional otoliths were collected in some ports for the Clean Otolith Archive Collection (COAC) which is discussed further in the Research section of this report. A total of 4,767 logbooks were obtained, with 56 collected in Oregon, 342 in Washington, 751 in British Columbia, and 3,618 in Alaska.

Samplers collected nine halibut tags of assorted styles in 2012 from various research studies. Four double-tags from a 2003 study were found in British Columbia. Two tags from a 2010 study were collected in the Aleutian Islands. One PAT tag was found in Homer, and two tags from a 2009 study were collected in Kodiak and Homer.

As mentioned previously, many of the halibut ports boast resident IPHC port samplers (listed on the inside back cover). Additionally, Seattle Staff can be found periodically visiting various ports to interact with stakeholders and to see first hand where the commercial data originate. The Staff who made port visits in 2012 were: Lara Erikson, Kirsten MacTavish, Bruce Leaman, Heather Gilroy, Joan Forsberg, Tom Kong, Aregash Tesfatsion, and Steve Keith. Ports visited included: Oregon - Newport; Washington - Port Gamble, Swinomish Indian Tribal Community, Sequim, Lummi Nation, Neah Bay, and Bellingham; British Columbia - Port Hardy, and Prince Rupert; Alaska - Petersburg, Sitka, Juneau, Seward, Homer, Kodiak, Sand Point, and Dutch Harbor.

IPHC staff depend on the generous cooperation of the many processing plants where data are collected. Particular thanks goes to: Bering Fisheries and Westward Seafoods in Dutch Harbor, AK; Trident Seafoods in St. Paul, AK;

*"His face darkened. He looked like a halibut that's taken offense at a rude remark from another halibut." – P.G. Wodehouse. **Stiff Upper Lip, Jeeves.** 1963.*

Trident Seafoods in Sand Point, AK; Alaska Fresh Seafoods, Alaska Pacific Seafoods, International Seafoods, Island Seafoods, Ocean Beauty Seafoods and Trident Seafoods in Kodiak, AK; Copper River Seafoods, Icicle Seafoods, Kachemak Bay Seafoods, Snug Harbor Seafoods, The Auction Block Co., and The Fish Factory in Homer, AK; Resurrection Bay Seafoods, Seward Fisheries (Icicle), and Snug Harbor Seafoods in Seward, AK; Alaska Glacier Seafoods and Taku Fisheries Smokeries in Juneau, AK; Seafood Producers Cooperative and Sitka Sound Seafoods in Sitka, AK; Petersburg Fisheries (Icicle) and Trident Seafoods in Petersburg, AK; Aero Trading, Canadian Fishing Company, and Tenerife Packing in Prince Rupert, B.C.; Cove Fisheries and Marine Services Ltd., and Keltic Seafoods and Custom Processing in Port Hardy, B.C.; SM Products and Steveston Seafood Auction Inc. in Vancouver, B.C.; Bellingham Cold Storage in Bellingham, WA. A thank you also goes to CBSFA in St. Paul, AK for storing our gear in the off season.

The largest halibut caught in the commercial fishery this year was a little over 2 meters in length and 22 years old.

Age distribution of halibut in the commercial fishery

Of the 12,981 commercially-caught halibut sampled in 2012 that were aged, twelve-year-olds from the 2000 year class were the most abundant (2,058 fish at 15.8% of the total). The most abundant grouping was 10-13 year-olds, which comprised 55% of the total (7,199 fish). The youngest and oldest halibut in the commercial samples were five years and 43 years, respectively. Two five-year-old fish were caught in Area 2A and 3A, each 83 cm in length. The 43 year-old fish measured 131 cm in length, and was captured in Area 4B. The largest halibut caught in the commercial samples was a 206 cm fish from Area 2B, which was 22 years old. The smallest was an eleven year-old fish from Area 2A that measured 73 cm.

Recreational Fishery

The sport harvest of Pacific halibut in 2012 was estimated to be 6.931 million pounds, a 2.2% decrease from the 7.089 million pounds caught in 2011. The recreational fishery regulations varied substantially among the regulatory areas. As in most years, the regulations either tightened or loosened size restrictions, or restricted days of fishing based on what was deemed necessary to conserve the resource and maintain a healthy sport fishery. Historical catch and season information can be found in Appendix II.

James Peeples of Chico, California won the grand prize in the Homer Jackpot Halibut Derby on August 31, 2012 by hauling in a 323-pound Pacific halibut. He and some friends fished aboard "The Tackle Box", captained by his father, Phil Peeples.

Area 2A (California, Oregon, and Washington)

In Area 2A, sport fishers pulled in 415,383 pounds of Pacific halibut (2,510 pounds below the 417,893 pound allocation), of which 214,110 pounds were caught by Washington state anglers, and the remaining 203,783 pounds by Oregon and California anglers. The allocation was further subdivided into six subareas: Washington Inside Waters (57,393 pounds), Washington North Coast (108,030 pounds), Washington South Coast (42,739 pounds), Columbia River (11,895 pounds), Oregon Central Coast (191,780 pounds), and Southern Oregon/California (6,056 pounds). The only subarea estimated to have taken more halibut than allocated was the Oregon Central Coast, at 4,251 pounds over the limit. The IPHC relied on state and federal agencies to assemble these estimates for the 2012 catch. In Area 2A, state agencies such as the CDFW, the ODFW, and the WDFW, supplied information to the IPHC, both in-season and post season.

Staff biologist, Steve Kaimmer, shows off his catch during a sport fishing trip in the Strait of Juan de Fuca. Photo credit: Steve Kaimmer.

Although final catch estimates were not known until the middle of 2013, in-season reports indicated that the success of Oregon anglers in 2011 was not repeated in 2012. For all of

Area 2A, the effort for halibut was heavily dependent upon the opportunities to fish for other species, such as salmon and albacore tuna.

Area 2B (British Columbia)

In British Columbia, DFO estimated that the Area 2B sport harvest came to 1,144,380 pounds, over the 1,085,000 million pound quota by 59,380 pounds (5.5%). The harvest plan was revised by the DFO in February 2012 so that 85% of the Area 2B fishery catch limit was allocated as commercial, and 15% was allocated as sport (an increase of 3% for the sport fishery). The DFO formed its estimate of sport catch from a combination of aircraft overflights, on-water vessel counts, creel sampling, and self-reported lodge logbooks.

The current sport fishing record halibut is a 459-pounder caught near Unalaska, Alaska in 1996.

The DFO also implemented several restrictions in 2012 to slow the pace of the fishery and thereby lengthen the season. First, on April 1 it ruled that the daily bag limit for sport-caught halibut was one fish and the possession limit was two fish, of which only one could be greater than 83 cm (32.7 inches) in length. Second, it prohibited retention of halibut in DFO Area 121 (waters off the southwestern coast of Vancouver Island) seaward from 12 nautical miles. Third, the season opening was delayed until March 1. The DFO closed the sport halibut season on September 9, when the quota was deemed to have been reached. Finally, an experimental program was implemented whereby commercial quota could be temporarily leased by sport harvesters, allowing fishing to continue after September 9. This enabled the 59 licensees to catch a further 814 pounds.

Areas 2C, 3, and 4 (Alaska)

The sport fishery in Areas 2C and 3A is divided into the guided (charter) and unguided categories. The total sport harvest in Area 2C was estimated to be 1.405 million pounds, an increase of about 376,000 pounds (36.5%) from the 1.029 million pounds caught in 2011. This increase was due primarily to changing the maximum size regulation from 37 inches in 2011 to the reverse slot limit which permits retained halibut to be less than or equal to 45 inches or greater than or equal to 68 inches in length (U45/O68) in 2012, which increased both the number of fish caught as well as the average weight. Of the total catch, private boats accounted for 761,000 pounds (54%) and charter boats pulled in 645,000 pounds (46%), which was noticeably lower than the GHL for the guided fishery of 931,000 pounds. The GHL was developed by the NPFMC to manage the guided harvest, to make it increase or decrease in rough coordination with halibut abundance.

In Area 3A, the total estimated sport catch was 3,938,000 pounds, an 11% decrease from the 4,408,000 pounds caught in 2011. Unlike Area 2C, Area 3A did not change its daily bag limit of two fish with no size restrictions. Of the total poundage, 1,563,000 pounds (46%) went to private boats. The remaining 2,375,000 pounds (54%) caught by charter boats was 728,000 pounds below the Area 3A GHL of 3,103,000 pounds.

Sport fishing in Areas 3B and 4 was far less common than in other parts of Alaska, due to the relative remoteness of the ports. For Areas 3B and 4, there was an estimated sport catch of 13,000 pounds and 16,000 pounds, respectively. Each area showed a decline of approximately 1,000 pounds from 2011. Estimates

A hopeful youngster drops his line in the water at the dock in Kodiak, AK in hopes of catching a halibut. Photo by Danielle Vracin.

from these areas are calculated differently than other Alaskan areas. The results rely on the numerical fish count from ADF&G's Statewide Harvest Survey, from which the weight is estimated by applying the average weight of fish landed in Kodiak. However, the small amount of halibut caught is unlikely to skew the overall results very much.

In addition to IPHC regulations, NMFS adopted several more for the guided sport fishery in an effort to not exceed the GHL.

Finally, the NMFS adopted new regulations in 2012 for the guided fishery (in addition to IPHC regulations). Besides the reverse slot limit of U45/O68 already mentioned: 1) A charter vessel angler may use only one fishing line. No more than six lines are allowed on a charter vessel fishing for halibut in Area 2C; 2) Charter operators, guides and crew may not catch and retain halibut during a charter fishing trip in Area 2C; 3) Anglers' names and fishing license numbers 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.

Incidental Mortality from the Commercial Fishery (Wastage)

"This time he went westward, because he had fallen on the trail of a great shoal of halibut, and he needed at least one hundred pounds of fish a day to keep him in good condition." – About Kotick the White Seal. In Rudyard Kipling's ***The Jungle Book****. 1900.*

There are a handful of ways that Pacific halibut may be "removed" from the halibut biomass. These include the commercial catch, the sport catch, personal use (both for subsistence and ceremonial purposes), bycatch (by non-halibut fisheries), and incidental mortality (wastage) in the commercial and sport halibut fisheries. Incidental mortality from the sport fishery is not determined at this time but could be included in the future. Incidental mortality in the commercial halibut fishery is estimated and defined as the mortality of legal-sized (32 inches and over, or "O32") halibut from lost or abandoned longline fishing gear as well as a proportion of sublegal (or U32) halibut that must be released by regulation but subsequently die. Incidental mortality in the commercial fishery can also occur when halibut caught in excess of limits or quotas have to be discarded. These discards are not currently included and are being reviewed to determine if they should be included in the future.

Baited gear waits to be set. Photo by Levy Boitor.

Lost or abandoned gear

An estimated 68,000 pounds of O32 halibut were killed by lost or abandoned longline gear in the commercial halibut fishery in 2012. Although still preliminary, this number is lower than the 104,000 pounds estimated in 2011; indeed, it is the lowest since this statistic was first calculated in 1985.

Incidental mortality from lost or abandoned gear was calculated by multiplying the total catch by the ratio of effective skates lost to effective skates hauled aboard each vessel. Effective skates are those where no data (such as skate

length, hook spacing, number of hooks per skate) are missing, and where the gear type met the standardization criteria. The ratio included both snap gear and fixed-hook gear in all areas. For 2012, the ratios of effective skates lost to effective skates hauled were: 0.008 (Area 2A), 0.002 (Area 2B), 0.004 (Area 2C), 0.001 (Area 3A), 0.002 (Area 3B), and a range between 0 to 0.002 in Area 4. Although these ratios have fluctuated from year to year, they have remained lower than when derby fisheries for halibut existed in Alaska and B.C.

Discarded U32 halibut

The IPHC determined that the commercial halibut fishery killed an estimated 1,536,000 pounds of undersized halibut in 2012. These U32 fish could not be legally kept, yet did not survive their return to the ocean. Although any wastage is troubling, this amount is less than the 2,213,000 pounds estimated in 2011, and the lowest amount in a decade. Area 2A had the lowest U32 wastage, at 9,000 pounds. Area 3A had the highest, at 579,000 pounds.

One challenge in determining the amount of U32 halibut mortality is the lack of observers on board commercial vessels. With no accurate direct measure, the weight of U32 halibut mortality has to be estimated indirectly. For each regulatory area, the top one-third (by weight of fish caught) of IPHC survey stations are identified and deemed to be representative of typical commercial fishery catches for the whole. The average ratio of U32 fish to O32 fish caught at these stations over the previous three years was calculated, and then multiplied by the commercial catch in that area. This number was multiplied by the discard mortality rate (DMR) of 16% to get the final U32 incidental mortality number.

Halibut in the commercial fishery are accounted for differently than in the sport and personal use fisheries. In order to standardize their treatment statistically, the incidental mortality of halibut between 26 inches and 32 inches in length (U32/O26) was listed in addition to O32 and U32 halibut. In 2012, 1,469,000 pounds of U32/O26 halibut were killed coastwide. This was an improvement over the 2,052,000 pounds in 2011, and the lowest amount in over a decade.

Discard Mortality Rate (DMR) is the percentage of fish discarded after capture that do not survive. A mortality rate of 16% has been applied to all discards since the beginning of individual quota fisheries (1991 in Canada and 1995 in Alaska). For the earlier years of derby fishing and for all years in Area 2A, a mortality rate of 25% was used.

Personal Use (Subsistence) Harvest 2012

The personal use harvest is small in the grand scheme of the halibut biomass, but critically important to individuals who have the legal right—due to treaties—or the need to catch and retain halibut for their families' sustenance.

Personal use is defined as halibut caught neither for sport nor commercial use (as resale is not allowed); an allowed harvest for those who have traditionally relied on halibut as a critical food source. The IPHC identifies personal use harvest 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 (C&S) fisheries in Washington state; and, 4) U32 halibut retained by commercial fishers in Areas 4DE under IPHC regulations.

First Nations FSC fishery refers to the "food, social, and ceremonial purposes" catch in Canada. It is part of the Canadian First Nations fishery program. A Canadian Supreme Court ruling determined that FSC fisheries have priority over all other fisheries in Canada.

A fisher waits for the next halibut to come up on the gear. Photo by Levy Boitor.

Estimated harvests by area

The estimates for the subsistence halibut harvest typically lag by a year, so the 2012 numbers are not yet available. For 2011, the personal use harvest came to 1,144,800 pounds coastwide. This was down from the 1,242,600 pounds caught in 2010, and the lowest since 2003. Prior to this, the dramatic changes in the personal harvest estimates were due more to changes in estimation methods than to actual harvest level changes.

Area 2A (California, Oregon and Washington)

The Pacific Fishery Management Council (PFMC) allocated the catch limit in Area 2A to commercial fisheries (both directed and incidental), sport fisheries,

and treaty Indian fisheries operating off the northwest coast of Washington state. The Treaty Tribes then subdivided a portion of their allocation for their own ceremonial and subsistence fishery.

For 2011, Area 2A harvested an estimated 25,300 pounds of halibut in the personal use fishery. The 2012 allocation to the Tribes was 24,500 pounds, though the actual estimated catch won't be known until the 2013 report.

Area 2B (British Columbia)

In British Columbia, the First Nations peoples participate in the FSC fishery. The IPHC relies on DFO for estimates of the FSC harvest. The latest harvest estimate of 405,000 pounds has remained unchanged since 2007.

The Alaskan subsistence fishery was down almost 13% in 2011 compared to the 2010 catch.

Areas 2C, 3, and 4 (Alaska)

The Alaskan subsistence fishery caught 714,500 pounds (49% of the coastwide total) in 2011, which was down from the 807,200 pounds caught in 2010. Figures for 2012 won't be known until the 2013 report. According to the ADF&G's voluntary annual survey, Area 2C pulled in the most halibut, at 387,000 pounds (54% of the Alaskan total), followed closely by Area 3A, at 266,100 pounds (37%). The remaining regulatory areas were but a small fraction of these two, with Area 3B claiming 22,000 pounds (3%), while the combined areas within Area 4 caught 44,500 pounds (6%).

Who retains U32 halibut in the CDQ fishery?

Supplementing the Alaskan personal use catch was the CDQ harvest in Area 4DE (Bering Sea). This harvest totaled 20,187 pounds of halibut in 2012, a larger amount than the 16,867 pounds caught in 2011.

The IPHC compiled the amount of U32 halibut caught in this commercial fishery as an additional personal use removal. Although the ADF&G annual survey included all registered fishers and households in all areas in the state, commercial fishers in the CDQ fisheries in Areas 4D and 4E were instructed to exclude any commercially-caught (and retained) U32 halibut from their survey responses. The amount of halibut they caught needed to be fully counted, and so were included in this section.

Bristol Bay Economic Development Corporation

The Bristol Bay Economic Development Corporation (BBEDC), the southernmost of the three CDQ organizations, processed 5,095 pounds of halibut in 2012, an 85.1% increase of the 2,752 pounds processed in 2011. The 651 U32 halibut that comprised this catch had an average weight of 7.8 pounds. The BBEDC is made up of seventeen member villages, all on the shores of Bristol Bay. Roughly south to north, they are: Port Heiden, Ugashik, Pilot Point, Aleknagik, Egegik, King Salmon, South Naknek, Naknek, Levelock, Ekwok, Portage Creek, Ekuk, Clark's Point, Dillingham, Manokotak, Twin Hills, and Togiak. The halibut it caught were landed primarily at Togiak, with some delivered to Dillingham. 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.

Coastal Villages Regional Fund

The Coastal Villages Regional Fund (CVRF) lies between the Norton Sound Economic Development Corporation (NSEDC) to the north, and the BBEDC to the south. Its motto states: "WORK FISH HOPE." All that work enabled them to process 10,424 pounds of Pacific halibut in 2012, a 5.2% increase over the 9,909 pounds processed in 2011. A total of 1,146 halibut were processed, for an average weight of 9.1 pounds. The twenty communities that comprise the CVRF, roughly south to north— Platinum, Goodnews Bay, Quinhagak, Eek, Napaskiak, Oscarville, Napakiak, Tuntutuliak, Kongiganak, Kwigillingok, Kipnuk, Chefornak, Nightmute, Toksook Bay, Mekoryuk, Tununak, Newtok, Chevak, Hooper Bay, and Scammon Bay—are remote coastal villages bounded by Norton Sound to the north and Bristol Bay to the south.

Norton Sound Economic Development Corporation

The northernmost of the three organizations, the NSEDC processed (in its Nome, AK plant) 4,668 pounds of halibut in 2012, an 11% increase over the 4,206 pounds processed in 2011. The number of fish making up this catch was 517 U32 halibut, with an average weight of 9.0 pounds. 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.

Seasonal timing of personal use harvests

The majority of personal use harvest is taken in the late spring and summer months in B.C. and Alaska, and earlier in spring in Area 2A.

Temporal distribution of all halibut removals—that is, when halibut are caught, as opposed to where—is one factor used to adjust catch rates among different regulatory areas in the IPHC stock assessment. For the personal use harvest, these data are generally not available, so the IPHC assumption has been that the fish were caught evenly throughout the calendar year. To gain better accuracy and insight into the actual situation, in 2012 the IPHC queried staff from agencies that provided the personal use harvest estimates to determine what they knew about timing of this harvest. Here is what they found: 1) in Area 2A about 90% of the harvest is taken in March and April, with the remainder spread out equally among the other months; 2) in Area 2B approximately 80% of the FSC catch was taken between April and the end of September; and 3) about 90% of the Alaskan subsistence catch occurred between May and September.

Incidental Catch of Halibut

Incidental catch (also called "bycatch") is defined as the unintentional or incidental catching of Pacific halibut by other fisheries. Although regulations require those halibut to be returned to the sea without further injury, a significant number do not recover from the trauma of being pulled aboard a fishing vessel, for some fisheries. The mortality can be due to injuries sustained in handling, or to the amount of time a fish lingers out of water before being identified as bycatch and tossed back overboard.

One of the earliest fictional references to halibut was David Carey's humorous 1822 play: "Life in Paris: a drama in three acts. (Adventures of the Halibut Family)."

Halibut bycatch can occur with all gear types. Here, a trawl net is being emptied on deck. Photo by Paul Logan.

The amount of bycatch in 2012

According to IPHC estimates, 9,869,000 pounds of Pacific halibut were killed as bycatch in other fisheries in 2012, just slightly down from the 9,995,000 pounds lost in 2011. It is heartening to note that bycatch levels have gradually been falling over the last two decades. The 2012 amount was the smallest since 1986; indeed, since 1962 there have only been four years with lower bycatch numbers. However, better regulatory tools (e.g., individual bycatch limits) have been shown to effectively lower bycatch mortality and would be a welcome addition in those areas where they are not currently in place.

Sources of bycatch information

The IPHC (not being omnipresent) lacks the capability to fully monitor the incidental catch of Pacific halibut. Instead, it has to rely on assorted government agencies in the U.S. and Canada, some of which operate observer programs. Trawl fisheries off the coast of Alaska and the U.S. west coast were monitored by NMFS, while DFO monitored fisheries off British Columbia. Observer coverage varied widely. There was 100% coverage for such fisheries as the Area 2B groundfish fisheries, U.S. west coast trawl fisheries, and trawl-catcher vessels based in the Bering Sea/Aleutian Islands (BSAI), compared to 0% for some Gulf of Alaska (GOA) vessels where coverage is based on vessel size. Where direct observation was not possible, the IPHC projected bycatch estimates from the bycatch observed on IPHC survey vessels or similar observed fisheries.

The Pacific Fishery Management Council, one of eight councils operating in U.S. waters, manages 119 species of fish in the waters off Washington, Oregon, and California. Its decisions are implemented by the National Marine Fisheries Service and enforced by NOAA, the U.S. Coast Guard, and local law enforcement agencies.

Discard mortality rates (DMRs)

DMRs are the estimated fixed percentages of how many halibut caught as bycatch are killed or are expected to die following release. They vary both by fishery and area. Where observers are used, DMRs are calculated from data that are collected on release viability or injury of halibut. Observer data to calculate DMRs were collected by the NMFS in Alaska, and by observers deployed on bottom trawl vessels in Areas 2A and 2B. In Area 2A, the sablefish hook-and-line fishery was assigned a DMR rate of 16%, the pot fishery had a DMR of 18%, and the whiting catcher/processor mid-water fishery's DMR maxed out at 100%.

Bycatch mortality by regulatory area

Bycatch in Area 2A (California, Oregon, and Washington)

The estimated bycatch for Area 2A in 2012 was 106,000 pounds. In 2011, an IBQ program was implemented for the domestic groundfish trawl fisheries operating in Area 2A, similar to the program that has been in existence in British Columbia since 1997. The PFMC set the total coastwide halibut mortality limit for IBQs at 191,180 pounds, with 174,642 pounds (91.3%) of that reserved for trawl fisheries that operated north of 40°10' N. (Cape Mendocino, just south of Eureka, California). The remaining 16,538 pounds (8.7%) was reserved for fisheries operating south of that latitude. Now in its second year, the program has reduced bycatch from an estimated 346,000 pounds in 2010, to 106,000 pounds in both 2011 and 2012. Fish excluders were implemented in the shrimp trawl fishery in Area 2A in 2003, which resulted once again in an estimated zero Pacific halibut caught as bycatch in 2012.

Bycatch in Area 2B (British Columbia)

According to data obtained from DFO the estimated bycatch for Pacific halibut in Area 2B in 2012 was 189,000 pounds, down from the 232,000 pounds caught in 2011. The groundfish trawl fishery took all of it, largely during the summer months.

Bycatch in Area 2C (Southeast Alaska)

In 2012 the IPHC made a significant change in how it counted bycatch in Alaskan waters, with the result that only 7,000 pounds of bycatch was recognized in Area 2C in 2012, far less than the 342,000 pounds estimated in 2011. Why the change? Historically, Alaskan bycatch has been attributed to three fisheries: 1) beam trawling for shrimp and flounders in inside waters; 2) hook-and-line fisheries for sablefish in Chatham Strait and Clarence Strait; and 3) king/tanner crab and shrimp fisheries. As there has been a lack of comprehensive observer coverage for these fisheries, for years the IPHC has been making its estimates based on research data from the early 1980s. In 2012, the IPHC began a review of these fisheries with the goal of revising the bycatch estimates, and until the process is finished, estimates are going to be "not available." The most significant change can be attributed to the crab pot/shrimp trawl fishery, which has historically taken the most halibut—an assumed 303,000 pounds per year—that has been reduced to zero until data are available. This change also reflects the significant change in fishing gear used in the crab fishery since the 1980s.

Several bycatch estimates for fisheries with low or no observer coverage rely on research data from the early 1980s. This year IPHC began a review of these fisheries in an effort to update the estimation process.

Bycatch in Area 3 (Eastern, Central, and Western Gulf of Alaska)

Bycatch mortality for Area 3 in 2012 was estimated to be 3,519,000 pounds of halibut, 2,961,000 pounds (84.1%) of which came from the groundfish trawl fishery (targeting species such as arrowtooth flounder, rock sole, and yellowfin sole). In the groundfish trawl fishery, 1,625,000 pounds were taken in Area 3A and 1,336,000 pounds in Area 3B. The next highest bycatch numbers (14%) came from hook-and-line fisheries targeting Pacific cod. It should be noted that Area 3 has the most poorly estimated bycatch estimates of all the regulatory areas, due to limited observer coverage.

The Central Gulf of Alaska Rockfish Program (CGOARP) began in 2012, replacing the Rockfish Pilot Program. It allows harvesters to form voluntary cooperatives and receive exclusive harvest privileges for certain rockfish species. Participants received assigned rockfish quota shares based on their catch history, which was then aggregated to the cooperative and fished collectively by its members. Two cooperatives were formed, one for catcher/processors and one for catcher vessels, with the requirements for 100% observers and limits to halibut bycatch mortality. These limits were a portion of the overall trawl bycatch mortality limit for the Gulf of Alaska. The total limit for halibut bycatch was set at 320,000 pounds (net weight) for all cooperative fishing in 2012, though the operational limit—when fishing must cease—was set at 270,000 pounds. In the end, the cooperatives caught 92% of their allocation for groundfish (rockfish and other species of groundfish) through December 2012. In doing so, they pulled in only 150,000 total pounds of halibut (54% of the operational limit).

Bycatch in Area 4 (Bering Sea/Aleutian Islands)

Halibut bycatch mortality in Area 4 was estimated to be 6,048,000 pounds, an 11% increase over the 5,382,000 pounds from 2011. Bycatch from the trawl fishery—including the rock sole, yellowfin sole, Pacific cod, and pollock fisheries—accounted for 5,059,000 pounds (83.7%) of the total. Hook-and-line fisheries (focusing their efforts on Pacific cod) took an estimated 980,000 pounds (16.2%) of halibut. Finally, pots used to catch sablefish and Pacific cod accounted for 9,000 pounds of halibut bycatch.

Recommendations for DMRs in Alaska groundfish fisheries

Since it is impossible to observe the total amount of mortality of Pacific halibut caught by the Alaskan groundfish fishery, DMRs were estimated from viability (condition and injury) data collected by fishery observers. The data from fishery observers included the number of caught halibut and their condition; either excellent, poor, or dead if caught in trawls or pots, or minor, moderate, severe or dead if caught on longlines. The data were then analyzed by the IPHC, for use in stock assessment. Most recently, the IPHC analyzed viability data collected during the 2009-2011 CDQ and non-CDQ groundfish fisheries off Alaska. These results were combined with results from previous years to generate recommended DMRs for both in-season estimation and management of halibut bycatch in the 2013-2015 CDQ and non-CDQ groundfish fisheries. These recommended DMRs, broken down by species and area, may be obtained from the IPHC.

Bycatch mortality in 2011 consisted of about 34% U26 halibut and 66% O26 halibut.

More than a third of the halibut that die as bycatch are small, i.e. less than 26 inches in length. Photo by Paul Logan.

Coastwide estimates of lost CEY and FSBio from bycatch

The estimated 2011 bycatch mortality for Pacific halibut was approximately 9,995,000 pounds (which would equate to a female spawning biomass loss of 22,606,000 over 30 years). The U26 component of this was 3,425,000 pounds (34.3%), while the O26 component was 6,570,000 pounds (65.7%).

Bycatch of Pacific halibut by other fisheries has both immediate and delayed impacts on the halibut population. The immediate impact comes from O26 halibut, which could be harvested legally by the halibut fishery, but instead are lost in other fisheries. This is a direct reduction to the yield available to the directed halibut fishery. Male or female, every pound of O26 halibut bycatch equates to one pound of halibut lost to the halibut fishery. There is no extra impact on the female spawning biomass (FSBio) from the O26 component of the

bycatch mortality because its impact is the same as fish removed in the directed fishery. The delayed impact of bycatch mortality comes from U26 halibut, which are too small to be harvested by the halibut fishery, but whose future spawning potential—their contribution to future FSBio—is curtailed. Every pound of U26 halibut lost today equates to a cumulative 6.6 pounds lost over 30 years.

Bycatch from the Prohibited Species Donation program

The NMFS maintains a Prohibited Species Donation (PSD) program that enables Pacific halibut caught by trawl vessels in the BSAI and the GOA, which is not sorted at sea, to be processed and donated to food banks throughout the United States. SeaShare, an organization based on Bainbridge Island, Washington, acquires the bycatch halibut, processes it into steaks and sends it out to hunger relief programs. The halibut comes from companies such as Alyeska, Unisea, Icicle, Alaska Pacific Seafoods, Ocean Beauty, and Trident. The fish is then processed and frozen by Seattle-based SeaFreeze. The PSD program was adopted by the NMFS and the NPFMC in 1998, and has contributed an estimated 354,733 net pounds since then.

In 2011, SeaShare collected 23,830 pounds of halibut, with 9,147 pounds (38%) originating in the Bering Sea, and 14,683 pounds (62%) coming from the GOA. Preliminary figures for 2012 indicated that 29,699 pounds were processed, a 25% increase over 2011. The amount of halibut donated in 2011 and 2012 represented 236,900 meals for receiving food banks.

The PSD program was approved by the Commission and subsequently adopted by NMFS and the NPFMC in 1998, yielding nearly 355 thousand pounds of fish since then.

STOCK ASSESSMENT

A thorough review of the stock assessment and the process of delivering information to decision-makers resulted in three key developments.

The year 2012 could be considered a watershed year for the IPHC's stock assessment program. There were three important developments: the retrospective bias was resolved (to all indications), the way in which uncertainty was propagated through the model was improved, and the structure of how the stock assessment is presented for review to Commissioners and stakeholders was in the form of a decision table which outlines estimated risks and rewards to different harvest levels. In addition, a considerable amount of investigation of both data and model structure was performed, leading to a peer review that identified additional work needed to create a more stable and easily reviewed stock assessment in future years.

Estimated stock size at the end of 2011

Catch limit decisions for the year are based on the stock assessment at the end of the previous year. In this case, the assessment at the end of 2011 was used to make decisions for the 2012 fishery. At the end of 2011 the coastwide exploitable biomass was estimated to be 260 million pounds, down 18% from the 317 million pounds estimated at the end of 2010. Female spawning biomass was estimated to be 319 million pounds, a decline of 9% from the 350 million pounds from 2010. The constant exploitation yield (CEY) at the end of 2011 was estimated to be 50,543,000 pounds, while the fishery CEY was estimated to be 33,884,000 pounds.

IPHC chartered survey vessel, *Star Wars II*. IPHC archive.

Assessment peer review

Realizing that it needed to address the issue of retrospective bias (along with related issues), and that the stock assessment had not been formally peer-reviewed since 2007, the IPHC took steps to start a review. This began with a meeting in May 2012 that developed the Terms of Reference. The actual peer review took place in October 2012. The five main objectives of the peer review were: 1) a better understanding of the model structure and its underlying assumptions; 2) exploration of key model sensitivities and identification of major sources of uncertainty; 3) insight into causes of retrospective bias in the model; 4) recommendations for modifications to improve the current halibut stock assessment; and 5) exploration of methods to present catch advice in a format more consistent with current best practices in the U.S. and Canada. A brief overview is presented here; much greater detail can be found in the 2012 RARA document.

The halibut stock assessment was peer reviewed in 2012, in an effort to address several model structure questions and to update how harvest advice is presented to stakeholders and Commissioners.

Retrospective bias

Retrospective bias in the model— i.e., as each new year of data were added, estimates from previous years were corrected downward—had been an ongoing problem for several years. Prior to the review, a large number of sensitivity analyses were carried out, and three of them began to reveal the source of the retrospective problem: that recent recruitment was being overestimated. The first approach—placing a high penalty on recruitment deviations to reduce the magnitude of recent recruitment estimates—resolved the retrospective bias and identified large estimates of recent recruitment as a direct cause of the bias. The second approach—placing greater weight on the survey indices in the objective function—also reduced the retrospective bias considerably. However, neither of these approaches addressed the underlying causes of the problem, and had their own undesirable effects on fitting the model to the data sets. The third approach—allowing the fishery and survey to have time-varying availability (also referred to as "selectivity" in the model)—was the most effective way to reduce retrospective bias while not compromising other elements of model fit, and was deemed to be the best option to the review team. It had the added benefit of solving the bias without requiring any extra weighting or other model changes, and it fit the time series well.

Catch advice

Another high priority item identified by the Terms of Reference meeting was the development of appropriate ways to present catch advice in a risk-based format. Instead of merely forwarding catch recommendations to the Commissioners, the IPHC staff needed to present choices to them, with accompanying risks for each choice. In the new format, the Commissioners have to make a catch decision based on the total mortality from all sources and the coastwide Fishery CEY (FCEY), because risks to the spawning population can only be measured at a coastwide level. In this framework, risk is presented in a table format, with alternative levels of removals given in rows, with probabilities of predicted changes in fishery and stock status under each catch level given in columns. The risk is then presented in terms of the estimated probability of undesirable changes in each of four metrics: fishing intensity (probability that

coastwide harvest rate will be above the effective coastwide target harvest rate next year); stock status (probabilities that the spawning biomass will fall below 20% and 30% of unfished levels in the next year); stock trend (probability that the spawning biomass will decrease by more than 5% in the next year or decrease over the next three years); and catch trend (probability that the Coastwide FCEY based on current harvest policy will decrease after next year's assessment). Once the Commissioners have chosen the coastwide level of removals, the predicted harvest rate can then be compared with the effective coastwide target harvest rate.

Stock assessment 2012

Total removals

Total removals for Pacific halibut were estimated at 51.36 million net pounds in 2012, below both the 60.04 million pounds taken in 2011 and the 100-year average of 64 million pounds. The lion's share of this was 31.87 million pounds caught by the commercial fishery. Bycatch came next, with 9.87 million pounds, followed by the sport catch at 6.85 million pounds. Commercial wastage and personal use rounded up the removals at 1.54 million pounds and 1.24 million pounds, respectively.

Total Removals—the seven ways a halibut can be removed from the population, besides natural mortality (disease, predation, and dying of old age): commercial catch (including halibut caught in IPHC surveys), O32 wastage from the commercial halibut fishery, U32 wastage from the commercial halibut fishery, O32 bycatch from non-target fisheries, U32 bycatch from non-target fisheries, sport (recreational) catch, and personal use (subsistence) catch.

Data sources

Before getting into how the 2012 assessment model functions, it's worth considering the sources of data used. The stock assessment used three different data sources: fishery-independent data, fishery-dependent data, and auxiliary sources. All raw observations underwent various processing steps to account for sampling methods. First they were summarized by regulatory area, then weighted to reflect their contribution to the total available data, then finally aggregated to be meaningful at the coastwide level.

Fishery-independent data

Fishery-independent data came from sources outside the commercial halibut fishery, such as the IPHC setline survey and NOAA trawl surveys. The former provided key quantitative data for the assessment, while the latter provided a general qualitative comparison and calibration for the setline numbers in unsampled regions of the Bering Sea and other areas. Some of the information gathered included both Weight Per Unit Effort (WPUE) and Numbers Per Unit Effort (NPUE) for O32 halibut. In 2012 the coastwide setline survey WPUE was 49.9 pounds/skate, an increase from the 44.7 pounds/skate caught in 2011. The setline survey NPUE also increased, going from 5.1 halibut/skate in 2011 to 5.5 halibut/skate.

Fishery-dependent data

Fishery-dependent data came from within the commercial halibut fishery, including WPUE and NPUE, fishing effort, and gear characteristics obtained from logbooks that are kept by the fishers. The commercial fishery WPUE stayed the same for both years, at 209 pounds/skate, and the commercial fishery NPUE actually decreased slightly, from 9.6 to 9.5 halibut/skate.

***F/V Pender Isle* skipper, Garth Roberts, pulls a halibut aboard during the IPHC longline survey. The survey is the primary fishery-independent source of data for the halibut stock assessment. Photo by Levy Boitor.**

Auxiliary information

Auxiliary information was obtained and analyzed outside the bounds of the stock assessment, then used either as a fixed parameter value or as a structural assumption to adjust the assessment. An example of auxiliary information is the maturity schedule, indicating that female halibut reach approximately 50% maturity by age eleven to twelve.

The "decision table" format for presenting results of the stock assessment enables the Staff to focus on the scientific components while Commissioners can focus on the economic and political issues surrounding different harvest levels.

The model

Major sources of uncertainty

When one has to rely on a model to estimate population, uncertainty is an important part of the results. In the case of the halibut stock assessment and those for every other species, there are many sources of uncertainty in the stock and the model. The Scientific Review Meeting held in October 2012 identified a number of data- and model-related aspects of uncertainty that could be included in future stock assessments. One of the most important was the level of natural mortality. This uncertainty was included in the 2012 decision table. However, due to time constraints prior to the assessment review, several other important sources were not included in the 2012 assessment. One of these was total removals. Some of these were observed directly through landings, but most—including discard mortality and bycatch—came from incomplete data. Finally, the mechanisms that caused decreasing size at age and below-average recruitment (which contributed to the overall stock decline) remained unknown.

2012 sensitivity analyses

The stock assessment model underwent a preliminary evaluation during 2012, during which a wide range of sensitivity analyses were conducted to better understand the general modeling approach, to identify important aspects of data and data weighting used during the model fitting portion, and to determine which components of the entire analysis had the most direct effect on the absolute estimates of stock size. For 2012, natural mortality was identified as the most influential fixed parameter or assumption in the Pacific halibut stock assessment. The method of including and reporting natural mortality was included in the decision-making table for forecasting.

Retrospective analyses

The 2012 stock assessment model was analyzed for retrospective bias, via the removal of annual spawning biomass data in a sequential manner, and little pattern was found. This was important to the decision-making process in that previous estimates included bias, which meant that reduced halibut catches might have to be implemented. The lack of retrospective bias in the 2012 model meant that the results of the assessment were likely to be more reliable than those reported in recent years.

Summary of the 2012 model

The stock assessment began with the gathering of data (age, weight, sex) from the three types of data sources. Measurements of abundance (WPUE and NPUE) were determined, and removal numbers from sources other than the commercial fishery were assembled. All this was plugged into the complex mathematical formulae that comprise the stock assessment model.

Three primary changes were made: 1) time-varying availability was used to correct the retrospective bias; 2) uncertainty in natural mortality was explicitly included in model results; and 3) results were framed in a decision table allowing a direct comparison of the risks for various catch levels. The decision table prepared for the Commissioners, instead of presenting one recommended path for consideration, presented ten harvest scenarios and the consequences to the stock and the fishery for each. This not only put the IPHC process more in line with fishery management approaches used by other agencies, it also focused the IPHC staff's attention on the scientific side of assessment (its strength), while entrusting the more economic and political action of weighing risk to the Commissioners (their strength). Finally, the IPHC identified additional work needed to create a more stable and easily reviewed stock assessment in the future (which will be covered in more detail under the "Future research" heading).

Model results show that the halibut biomass has been declining since 1997, but has leveled out in recent years.

Halibut biomass and recruitment estimated results

The results of the 2012 stock assessment showed that the Pacific halibut stock has been declining continuously since 1997. The decline is two-fold: decreasing size at age (mature fish are generally smaller than in the past) and poor recruitment strengths (lower numbers of fish "recruitng" to legal size). Despite this, the exploitable biomass and spawning biomass seem to have plateaued over the last few years. Spawning biomass (the weight of reproductively mature female Pacific halibut) is estimated to have increased from 190.1 million pounds in 2011 to 196.9 million pounds in 2012, with a projected further increase to 200.7 million pounds in 2013.

	Fishing intensity	Stock status		Stock trend			Catch trend
	Effective coastwide HR	Spawning biomass					Fishery CEY
Coastwide Fishery CEY (total removals) millions lb	2013	2014				2016	2014
	is greater than target	is less than 30%	is less than 20%	is less than 2013	is 5% less than 2013	is less than 2013	is less than 2013
Benefits	RISK						
	a	b	c	d	e	f	g

Figure 1. The decision table shown here is structured to give decision-makers a better idea of the risks associated with harvesting at various levels from zero to much higher. The actual table presented to Commissioners and stakeholders includes several lines of data generated from the model.

The current harvest policy stipulates that there shall be no fishing for halibut if the spawning biomass is 20% (or lower) of the average level of biomass that would be in the sea if there were no fishing. If the spawning biomass is above 30%, the target harvest rates can be applied. Between 30% and 20%, there exists a steep linear ramp, reducing the rate at which halibut can be caught as the stock biomass diminishes. At the end of 2012, the spawning biomass was estimated to be at 35% of estimated unfished biomass. This indicated the default target harvest rates of 21.5% in Areas 2A-C and 3A, and 16.125% in Areas 3B and 4A-E would be consistent with current harvest policy.

The IPHC intends to continue the assessment model review process into the future.

Future research

Historically, the IPHC has undertaken significant investigations into the performance of both area-specific and coastwide models for conducting the halibut stock assessment. Following the conclusions from the Scientific Review Meeting in October 2012, the IPHC intends to focus its future stock assessment investigations in four areas: 1) improved accounting of uncertainty; 2) development of improved spatial models to better incorporate the spatial variability observed in halibut; 3) further investigation of the factors contributing to recruitment strength and observed size at age in order to better forecast trends in these quantities; and 4) simulation testing of the stock assessment model based on data generated from a research model.

AREA APPORTIONMENT

The 2012 stock assessment process was a dramatic departure from the way things had been done for many years. In past years, the assessment and apportionment were linked together to develop staff catch recommendations for the Commissioners to consider. In the last chapter, the decision table was described as a new way of disseminating harvest information to Commissioners and stakeholders that allows the staff to present the risk to the stock of certain harvest levels, but removes them from having to choose among those risks in the form of "advice". The decision table refers to the coastwide stock, so even after a harvest level is selected, the job of dividing the catch among regulatory areas (apportionment) still exists.

The model and decision table refers to the coastwide stock, but after a harvest level is selected there is still the job of apportioning to individual regulatory areas.

Since 2007 the IPHC has used the setline survey mean WPUE index of density (weighted by bottom area), to apportion the estimated exploitable biomass among regulatory areas. Two adjustments are made in order to account for factors that influence the survey catch rates of halibut. These are survey timing and hook competition. The adjustments are a way to standardize the WPUE index by accounting for differences among the regulatory areas in the timing of the survey compared to that of the fishery, and in the degree of competition for baits between other species and halibut across areas.

Survey timing

Since the halibut season typically begins in March, and the survey typically takes place between May and September, there needs to be a way to account for halibut that are caught by commercial vessels—lowering the survey WPUE—before the survey vessels have a chance to count them. Area 2A is especially vulnerable to this, where typically over 80% of the commercial catch is taken prior to the mean survey date. The method to account for this is to mathematically standardize the WPUE to its expected value if 50% of removals had been taken prior to the mean date of the setline survey in each area.

Hook competition

The fraction of baits that remain on the survey gear upon retrieval within each regulatory area is used to compute an adjustment factor for hook competition. If a smaller than average proportion of baits are returned, an area's WPUE index is adjusted upwards because higher competition for baits in that area would have had a negative effect on the halibut catch and therefore on that area's WPUE. The converse is adjusted accordingly. This basic method has been improved for 2012, such that the adjustment for each area is standardized so that the coastwide adjustment factor is "1" (no adjustment). This means that there is equal weight in computing the hook competition for each area.

Three-year weighting

In addition to the two previous adjustments, WPUE for apportionment is smoothed using a Kalman filter—a 75:20:5 reverse weighted averaging of the current and the previous two years' adjusted WPUE values for each area. This is intended to dampen year-to-year errors in the WPUE estimates, without introducing significant bias from including past observations.

A three-year weighting is used to smooth WPUE estimates for apportionment.

Yield calculations

Total yield and fishery yield calculations were performed using methods consistent with recent analyses. The process began with the estimated coastwide exploitable biomass from the end of 2012. Based on the survey apportionment calculations just described, the estimated proportions from 2012 are used to infer the distribution of the exploitable biomass among the regulatory areas at the beginning of 2013. The current harvest policy used different target exploitation rates by regulatory area. These rates are 21.5% for Areas 2A, 2B, 2C, and 3A; and 16.125% for Areas 3B, 4A, 4B, and 4CDE. Based on the observed distribution of biomass in 2012, the application of these target rates resulted in an effective coastwide harvest rate of 19.6%. The Coastwide Total Constant Exploitation Yield (Coastwide TCEY) based on current harvest policy was therefore 36,630,000 pounds, given the coastwide exploitable biomass estimate of 186,490,000 pounds. Commissioners and stakeholders will be considering these numbers in conjunction with the overall harvest levels presented in the decision table at the 2013 Annual Meeting held in January.

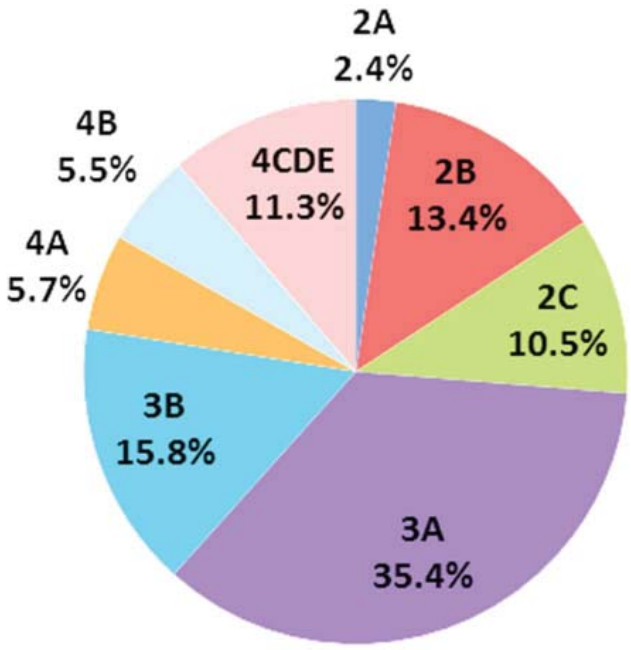


Figure 2. Apportionment for 2012.

Survey Activities

IPHC participated in three different surveys in 2012. The IPHC-run setline survey, the NMFS Bering Sea trawl survey, and the NMFS Aleutian Islands trawl survey.

Every year the IPHC carries out its own surveys to collect catch information and biological data on Pacific halibut and other species. It does this so that it doesn't have to rely exclusively on the commercial fishery for data, and so that the data it generates is scientifically valid. For instance, halibut fishers tend to go where the halibut are; survey vessels have to fish in a consistent geographic pattern. The data collected are used to monitor changes in biomass, growth, and mortality in adult and older juvenile halibut. In addition, the other species caught in the halibut surveys provide insights into bait competition and the rate of bait attacks, and serve as an index of abundance over time, making them valuable to the assessment, management, and avoidance of bycatch species.

The IPHC also participates in trawl surveys conducted by NMFS. In 2012, NMFS surveys included the Bering Sea and Aleutian Islands.

Setline survey

Design and procedures

The 2012 Standardized Stock Assessment (SSA) survey design encompassed both nearshore and offshore waters coastwide from Oregon into the Bering Sea. This area was divided into 27 regions, each requiring between 17 and 48 charter days to complete. The 10 vessels completed a combined 70 trips and 686 charter days to fish 1,274 stations (of which 1,270 were effective for stock assessment). Stations (the location targeted for the middle of a where the longline gear is set) were located at the intersections of a 10x10 nautical mile grid within the depth range occupied by Pacific halibut during summer months (20 to 275

A big halibut is caught on the *F/V Pender Isle* during the setline survey. From left to right: Dylan Hardie, Jason Roberts, Levy Boitor, and Byron Hardie. Photo credit: Levy Boitor.

fathoms in most areas). Two stations in Area 2B (2094 and 2116) were purposely relocated in 2012 to avoid protected sponge reefs in Hecate Strait.

In recent years, the standardized bait used has increased in price and has been more difficult to acquire, leading the staff to explore less expensive and more readily available alternatives that may be used in the future. To that end, a bait comparison experiment was incorporated to the standard survey on a coastwide basis, which is described in more detail later in this chapter.

The survey gear was standardized for all 1,274 stations coastwide, and hasn't changed since 1998, for consistency. 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. A total of eight skates were set at each station in all charter regions, six of which used baited gear, and two that used standard-length skates with no hooks (which were used to separate bait treatments). Four consecutive skates were baited with 0.25- to 0.33-pound pieces of chum salmon. Of the other two baited skates, one was baited with pink salmon and the other was baited with walleye pollock. Each vessel set one to four stations daily beginning at 5:00 a.m. (or later), and soaked the gear at least five hours before hauling it in. Vessels avoided soaking the gear at night when possible. Data from gear soaked longer than 24 hours were not used for assessment purposes. Sets were considered not usable for stock assessment if the predetermined limits for lost gear, snarls, predation, or displacement from predetermined station coordinates were exceeded.

*A **Charter Day** is any day (including fishing days, port days and weather days) when a sampler is on board a fishing vessel that has been chartered to conduct surveys.*

The fork lengths of all halibut captured were recorded to the nearest centimeter and were converted to an estimated weight using a standard formula (that can be found in the 1992 IPHC Scientific Report No. 75), which was then used to generate the WPUE data. Average WPUE, expressed as pounds per skate, was calculated by dividing the estimated catch in net pounds of O32 halibut by the number of standardized skates hauled for each station, and averaging these values for each area.

*A **Standardized Skate**, for the purposes of the Standardized Stock Assessment, is an 1,800-foot section of groundline with 100 16/0-sized circle hooks on 24- to 28-inch gangions spaced 18 feet apart. All hooks are baited with 0.25- to 0.33-pound pieces of Alaska Seafood Marketing Institute (ASMI) grade No. 2 semi-bright or better chum salmon (Oncorhynchus keta).*

Sampling protocols

IPHC sea samplers (aka ship biologists) collected data according to the protocols established in both the survey manual and the bycatch sampling manual. As gear was set to soak, they evaluated the performance of the bird avoidance devices and recorded the exact number of hooks set and baits lost per skate. As gear was retrieved, they recorded the hook status (empty, returned bait, species captured, and bait type) of only the first 20 consecutive hooks of each skate (with occasional exceptions to record all hooks). In the northern waters of Area 2A and in all of Area 2B, samplers recorded the status of all hooks in the order in which they were hauled, in place of 20-hook counts.

The survey vessel crew then dressed each O32 halibut and passed it back to the IPHC sampler, who collected various data from it, including sex, maturity, prior-hooking injury severity and evidence of depredation, and finished with removal of otoliths for further study.

Samplers assessed whether male halibut were mature or immature, and whether females were immature, mature, spawning, or spent/resting. The sex and maturity level of U32 halibut was recorded only if that fish was randomly selected for otolith removal. Those not selected were measured and released alive. Prior-hooking injuries were recorded for all measured halibut.

At the end of each haul, samplers recorded the presence and abundance of seabirds within a 50-meter radius of the vessel's stern, in order to determine the spatial and temporal variation in their abundance.

Vessel operations

For the coastwide survey, ten commercial longline vessels (six Canadian and four American) were chartered by the IPHC. They fished a combined 70 trips and 686 charter days to complete the survey. Of all the survey stations fished, 99.7% were considered statistically effective.

A total of 10 vessels participated in this year's survey, and 686 charter days later, the survey was completed.

Chartered F/V	Charter days	Regulatory area(s) fished
Bold Pursuit	56	2C
Clyde	24	3A
Free to Wander	78	3B
Kema Sue	107	3B, 4A, 4C, 4D
Norcoaster	62	4B
Pacific Surveyor	60	2A
Pender Isle	79	2B, 3A
Star Wars II	39	2B
Van Isle	90	3A, 4A
Waterfall	91	3A

Special projects

Although the IPHC's primary survey focus was catching and counting Pacific halibut at survey grid stations, it also completed special projects that analyzed oceanographic factors, rockfish, environmental contaminants, *Ichthyophonus* parasites, spiny dogfish, Pacific cod, Pacific lampreys, depredation by marine mammals, and longline gear sink rates. These are discussed briefly in this chapter, and a number are discussed in more detail in the *Research* chapter of this report.

Oceanography

The IPHC deployed water column profilers from every chartered vessel on every station in 2012 (unless poor weather or tide conditions made deployment too risky) to measure chlorophyll, pH, temperature, depth, salinity, and dissolved oxygen concentration. More information and results from this project are available in the *Research* chapter of this report.

Rockfish sampling Regulatory Area 2A

IPHC samplers retained all rockfish caught in Area 2A, marked them with a tag and recorded the station and skate of capture. After the fish were offloaded, state biologists from WDFW collected additional data (such as sex, weight, length, and maturity) and biological material such as otoliths from each fish.

Rockfish sampling in Regulatory Area 2B

IPHC samplers, in cooperation with DFO, worked aboard two boats to record round weight, round length, sex, and maturity, and to take otoliths from all rockfish species in waters off British Columbia. In this continuing project, they sampled 2,112 rockfish in 2012 (representing 16 different species), and took otoliths from 2,006 of them. The data and otoliths were shared with the DFO.

Yelloweye rockfish enumeration in Alaska

IPHC samplers recorded the capture of all yelloweye rockfish encountered by survey vessels in Area 2C and in the Fairweather charter region of Area 3A. A total of 1,331 yelloweye rockfish were recorded, with all associated data being sent to ADF&G for analysis.

For the past several years, the IPHC has collected tissue samples from a small number of halibut on the survey in order to monitor contaminants in the fish.

Environmental contaminant sampling

IPHC samplers collected flesh samples from a small subsample of halibut caught by survey vessels, as part of an ongoing project with the Alaska Department of Environmental Conservation (ADEC) to study environmental contaminants in Alaskan fish. The samples were part of a larger study involving thirteen fish species and numerous environmental contaminants, including organochlorine pesticides, dioxins, furans, polybrominated diphenyl esters (PBDEs), polychlorinated biphenyl congeners (PCBs), methyl mercury, and heavy metals such as arsenic, selenium, lead, cadmium, nickel, and chromium. There were 228 samples collected in all.

Icthyophonus sampling

Icthyophonus sampling gear. Photo by Andy Vatter.

In 2012 the IPHC expanded on its 2011 pilot study investigating the prevalence of a parasite called *Ichthyophonus* in the Pacific halibut population. Although *Ichthyophonus* is not a blight that visibly affects halibut quality to the naked eye, there is concern because of massive fish kills that it has precipitated in other species. Results can be found in the *Research* chapter of this report.

Spiny dogfish sampling

The year 2012 marked the second year of a two-year project requested by NMFS to record the length and sex of the first five spiny dogfish captured on

every set. IPHC samplers collected 2,939 sets of data that will be compared to the data obtained in 2011 to examine species distribution and to test the theory that there are two stocks of spiny dogfish in Alaska: one in Southeast Alaska and the other in coastal waters elsewhere. This data will be used to develop a length-based population dynamics model for the annual dogfish stock assessment.

Pacific cod lengths were collected to facilitate the stock assessment for that species by NMFS.

Pacific cod length frequencies

The Alaska Fisheries Science Center (part of the research branch of the NMFS) requested data from the IPHC regarding Pacific cod captured on IPHC surveys in Areas 4A and 4D. The data, when combined with current NMFS data, was used in a continuing study to assess the stock of BSAI Pacific cod. In 2012, IPHC samplers aboard the *F/V Kema Sue* collected 4,644 Pacific cod lengths (measuring the first 15 fish from each skate) from Bering Sea stations.

Pacific lamprey wound sampling

The IPHC received a request from the University of Alaska Fairbanks for images and information about any wounds on Pacific halibut or Pacific cod caused by Pacific lamprey or Arctic lamprey. In response, IPHC samplers (in waters off Oregon, Washington, and the charter regions of the 4A Edge and 4D Edge) collected 278 photographs of lamprey wounds on Pacific cod and 29 photographs on Pacific halibut.

Depredation tracking

Marine mammal depredation (from sperm and killer whales) on the halibut catch has been a continuing issue, and one that is difficult to identify and quantify. To help measure this phenomenon, IPHC samplers were tasked

Keeping tabs on marine mammals that may be enjoying an easy snack from the longline gear, is one of the special projects being conducted by samplers on the survey. Photo by Ian Stewart.

with recording all damaged and missing hooks during gear retrieval to establish a baseline rate of gear damage. Stations with suspected marine mammal depredation could then be compared against the baseline to better assess the damage. Samplers were also tasked to observe toothed whales within 100 meters of a survey vessel, and to record the species, numbers present, position relative to the vessel, the gear used, the offal discharged, the hook number at the first and last sighting, and the duration of the encounter. Samplers also noted any damaged halibut or bycatch retrieved during these encounters.

Longline gear sink rates

The IPHC sampler on the single Oregon charter vessel, in cooperation with Washington Sea Grant, used temperature depth recorders to collect the sink rates of longline halibut gear. The reason for the study was to design ways to reduce the hooking rates of seabirds (as seabirds can only access baited hooks to a certain depth and distance from a vessel). Knowing the sink rates of baited hooks, vessel speed and the maximum attack depth of seabirds allows estimation of their vulnerable zone—where the streamer lines should be flying to prevent the hooking of seabirds—to be determined.

Longline gear sink rates were recorded as part of a cooperative study looking at reducing seabird hooking rates.

Bait purchases

The IPHC maintains a minimum quality requirement for the bait used in its survey operations, both for fishing success and for consistency from season to season. That requirement stipulates individually quick-frozen (headed and gutted) chum salmon that is No.2 semi-bright ASMI grades A through E.

The IPHC purchased approximately 175,000 pounds of this bait from three U.S. suppliers in August 2011 for the 2012 season. An additional 1,600 pounds of chum salmon were purchased during the 2012 season from an Alaskan salmon processor for use in the Alaska portion of the survey.

For the bait comparison portion of the study—the IPHC purchased from U.S. suppliers approximately 45,000 pounds of headed and gutted, individually quick-frozen pink salmon, and 48,000 pounds of J-cut, longline-caught, sea-frozen walleye pollock. An additional 1,800 pounds of pink salmon and 1,500 pounds of pollock were purchased during the 2012 season from two Alaskan processors.

Fish sales

Commercial-sized (O32) Pacific halibut caught by survey vessels—and sacrificed for their otoliths and other biological information—were retained and sold in 22 different ports in 2012 to offset costs of the survey program. Ten percent of the halibut proceeds were shared with the charter vessels, to supplement their charter fees. Survey vessels also kept rockfish and Pacific cod that were caught as bycatch, because their swim bladders were typically irreversibly damaged as they were pulled to the surface. The IPHC did not keep any of the proceeds from selling the latter two species. These bycatch sales were split between the survey vessel and the requisite state agency (for U.S. bycatch) and the DFO (for Canadian bycatch).

The IPHC has announced a correction to its 2011 report on fish sales: the Area 4A Edge and Unalaska survey regions actually received 14,228 pounds and 23,853 pounds, respectively.

Brett Haynes, crewman on the *F/V Clyde*, prepares the bait for the next set. Photo by Danielle Vracin.

It takes a village to execute the setline survey including IPHC staff (both Seattle-based and field samplers), commercial fishing vessels and crews signing on for the charters, and processing plants willing to help with storing and staging gear.

The IPHC would like to thank the many processing plants who assisted the survey by storing and staging gear among other things. The following were especially instrumental in keeping the survey running smoothly: Ocean Beauty Seafoods, Alitak Taku Fisheries, The Ice House, Harbor Cold Storage, Yakutat Seafoods, Sitka Sound Seafoods, Trident Seafoods – Sand Point; Trident Seafoods – St. Paul; Delta Pacific Seafoods, Canfisco – Port Hardy; Canfisco Oceanside Plant, Astoria Pacific Seafoods, Pacific Shrimp, Seward Fisheries, Petersburg Fisheries, E.C. Phillips and Son Inc., Allied Shipbuilders Ltd., and Bellingham Cold Storage.

Field personnel

The IPHC employed 21 seasonal samplers in 2012, who worked a total of 1,540 person days (including travel days, sea days, and debriefing days). The IPHC typically assigned two samplers aboard each survey vessel, one to work on deck (handling fish and collecting data and samples) and the other to work in a portable shelter (recording data and storing samples). It also assigned one port sampler to work 47 days on IPHC surveys during the summer. The IPHC also deployed two samplers aboard NMFS trawl survey vessels in the Bering Sea (the *F/V Alaska Knight* for 67 days) and the Aleutian Islands (the *F/V Ocean Explorer* for 71 days).

Setline survey results

The results of the standardized stock assessment survey (SSA) encompassed subjects such as NPUE, depth distribution, length distribution, sex ratio of the catch, collection of otoliths, bycatch, and tracking marine mammal depredation. These are discussed briefly in the section that follows.

Timing of the SSA survey

As in every year, in 2012 the IPHC targeted the months of June through August for survey fishing. Only 54 stations (amounting to less than 5% of the total) were fished outside this window, with 45 stations being fished during the last week of May and nine stations being fished during the first week of September. The greatest number of stations were fished between June 19 and July 10. Coastwide, survey activity grew in intensity at the beginning of the survey season, and tapered off by the end of August.

Weight per unit effort

The SSA covered both commercial and non-commercial fishing grounds, so the average WPUE for all regulatory areas was below that of the commercial fleet. All WPUE figures provided in this report were generated solely from the four skates fishing chum salmon as bait; walleye pollock and pink salmon skate data were not used for stock assessment purposes.

Coastwide, the average WPUE was 98 pounds per skate, an increase over the 87 pounds per skate averaged in 2011. The average WPUE figures for the regulatory areas were:

- Area 2A (30 pounds/skate)
- Area 2B (103 pounds/skate)
- Area 2C (160 pounds/skate)
- Area 3A (137 pounds/skate)
- Area 3B (87 pounds/skate)
- Area 4A (64 pounds/skate)
- Area 4B (48 pounds/skate)
- Area 4C (37 pounds/skate)
- Area 4D (31 pounds/skate)

Only two of the regulatory areas—4B and 4C—saw a decrease in WPUE; the remaining areas increased or remained the same.

The highest WPUE on the survey was in Area 2C and the lowest was in Area 2A, with Area 4D coming in a close second.

Number per unit effort

Although weight is the primary unit of measure when studying population and removals, the number of halibut is also useful. Although the NPUE for O32 halibut has trended slightly downward in the past ten years, it rose by 9% in 2012. The NPUE for U32 halibut rose 6% in 2012. Despite the recent rise in NPUE, it appears that numbers of large fish are declining, while those of small fish are increasing.

Depth distribution

The greatest number of U32 halibut was caught between 31 and 60 fathoms (186 to 360 feet), while the greatest number of O32 halibut was caught at depths between 121 and 150 fathoms (726 to 900 feet).

Length distribution

Just over 53% of the halibut caught on the 2012 survey were shorter than 32 inches, with a median length of 80 cm (31.5 inches) coastwide. Area 3B had the greatest proportion of these U32 halibut. The largest median lengths occurred in Areas 2A (87 cm) and 4B (86 cm). In 2012, median lengths increased in Areas

3A and 4C, and decreased in Areas 2A, 2B, 4A, 4B and 4D. They didn't change at all in Areas 2C and 3B.

Sex ratio of the catch

The sex composition for O32 halibut caught for the survey varied noticeably by regulatory area. The greatest percentage of females (81%) was caught in Area 4C. In fact, more females than males were caught in every regulatory area except 4B, where females made up only 38% of the catch. Most females caught in the summer survey months were ripening, and expected to spawn in the upcoming season.

Females were a larger proportion of the O32 catch composition than males in all areas except Area 4B.

Otolith collection

An important part of survey operations was the removal and analysis of halibut otoliths. The otolith collection goal from standard grid skates (using chum salmon bait) for 2012 was 2,000 per regulatory area (with a minimum target of 1,500 per area). As previously mentioned, in 2012, a bait study was performed on all stations concurrent with the standard survey. Additional skates of gear using different bait types were fished in the same string as the standard survey skates. Otoliths were collected from halibut caught on these experimental bait skates at the same rate as on the standard survey skates. The otoliths from the experimental bait skates were also aged. A total of 17,896 otoliths were collected for age determination from the 2012 setline survey; 11,924 from the standard grid skates using chum salmon bait and 5,972 from the experimental bait skates. Of these, 17,459 were aged, with the remaining 437 not readable due to crystallization, or being badly broken or right-sided. The otoliths collected for age determination were stored in a glycerin/thymol solution to better reveal the readability of the concentric rings. An additional 676 pairs of otoliths were collected in 2012 from the setline survey as part of the archival study, in which otoliths are merely dried and stored for future analysis. The latter is discussed in more detail in the *Research* chapter of this report.

Bycatch

Approximately 107 species of fish and invertebrates were caught as bycatch during the survey. Although special precautions were taken to prevent the capture of birds or marine mammals, one black-footed albatross was captured in Area 3A. It was given to the U.S. Fish & Wildlife Service in Anchorage. Coastwide, the most frequently caught bycatch species was Pacific cod, followed by sharks. Dogfish were the most commonly caught shark species in Areas 2A (98%), 2B (99.7%), 2C (96%), and 3A (98%). Sleeper sharks were the most common in Areas 3B (75%) and 4D (100%). Bocaccio, canary rockfish, and yelloweye rockfish populations have become a subject of concern in Areas 2A, 2B, and 2C, and their numbers often drive catch regulations.

Depredation tracking

Marine mammals such as orca whales, sperm whales, seals, and sea lions target Pacific halibut. Halibut that are caught by the commercial fishery are especially vulnerable to predation, since they are unable to escape as they are being pulled slowly to the surface. In 2012, marine mammals approached charter

vessels during gear retrieval on 41 sets. Twenty-two (53.6%) of these encounters involved either sperm whales or killer whales. IPHC field staff noted a reduction in catch rate for halibut at two stations where a suspected depredator arrived, but it was unclear whether it was caused by depredation or not.

Future work

The IPHC plans to continue fishing most of the current SSA survey stations, but survey operations have been dependent on the ability of the project to remain self-funding. The surveys are designed exclusively to fulfill scientific needs, and do not take commercial sales into account, but if average halibut sale prices or WPUE fall substantially in the future, the IPHC may have to find alternate sources of funding to collect these important data.

In 2013, it is expected that the SSA work will be conducted in all 27 traditional regions, including the more remote stations around St. Paul, St. George, and St. Matthew Islands. Additionally, there is a proposal before the Commissioners to conduct a pilot survey expansion into northern California.

Seabird occurrence

The IPHC began collecting seabird occurrence data in 2002, with a NMFS sablefish survey. Initially a collaborative project between the IPHC, Washington Sea Grant, the ADF&G and the NMFS, the purpose of the project was to assemble a seabird database that could be analyzed for population purposes, and to take part in the process of regulating seabird avoidance requirements for commercial fishing vessels. The importance of seabirds to these organizations and commercial fisheries lies in the fact that fisheries can be shut down if the mortality the endangered short-tailed albatross becomes too high. Although the collaboration ended in 2004, the IPHC made tracking bird encounters a permanent part of its survey program.

"Far up above the noisy throng an osprey sailed on the blue expanse of the sky, and quick as thought swooped down upon a halibut which had ventured to take a peep at the rising sun." –Hjalmar Hjorth Boysen. Tales From Two Hemispheres. 1871.

Juvenile Herring gulls perch on a piece of driftwood near the *F/V Pender Isle*. Photo by Levy Boitor.

Since the project began, 640,528 seabirds (of 33 unique species) have been observed in 13,741 separate counts. In 2012, 57,337 seabirds were observed in 1,273 separate counts during survey fishing operations. Twenty-two unique species were observed, with the most commonly observed bird—the northern fulmar—counted 40,900 times (71.3% of the total). After the fulmar, the glaucous-winged gull was next most common, at 7,318 counts (12.8%), followed by the black-footed albatross with 5,207 counts (9.1%). The endangered short-tailed albatross—which is more commonly a western Pacific bird—was counted 17 times in 2012. Unusually, three of these rare birds were seen in Queen Charlotte Sound in British Columbia. This garners considerable attention from management agencies because regulations surrounding its protection and recovery affect all of the north Pacific longline fisheries.

"[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)."
- IPHC website

Setline survey age distribution

Halibut age is determined by examination of otoliths. In 2012, IPHC staff aged 11,661 otoliths collected on standard survey skates. The most commonly occurring year class was 2002, with 1,669 (14.3%) ten-year-olds caught. Next most common were the years 2000 and 2001, with 1,626 (13.9%) and 1,541 (13.2%) fish caught, respectively. The oldest halibut caught in the 2012 survey were two 44-year-old males from Areas 2C and 4B with fork lengths of 116 cm and 107 cm, respectively. The youngest halibut, at four years of age, was a female from Area 2B with a fork length of 60 cm. The largest halibut caught on the 2012 survey were three females measuring 200 cm. One was a 28-year-old from Area 2B, and the other two were from Area 2C, aged 17 and 23 years. The smallest halibut sampled was a seven-year-old male from Area 4A that measured 41 cm in length.

Of the 5,972 otoliths collected from the experimental bait skates on the 2012 survey, 5,798 were aged. The most numerous fish were twelve-year-olds from the 2000 year-class, with 918 caught (15.8%).

Coastwide comparison of alternative setline survey baits

The rising cost and decreasing availability of chum salmon—the bait that the IPHC has traditionally used for its annual setline survey—has led the IPHC to consider alternative baits. While this wouldn't be a problem for a commercial halibut fishing operation, it does pose complications for a scientific organization. The results of the setline survey are regularly analyzed against the results of previous surveys. Changing the bait could affect where, when, and how many fish are caught, making future analysis more difficult. To explore alternative baits, the IPHC began a small-scale pilot study in 2011 in just two setline survey regions. The results led the IPHC to select a randomized block design that deployed three different baits on a single set. In 2012 the study was expanded to a coastwide effort in conjunction with the annual setline survey.

The three baits were the (currently-used) chum salmon, pink salmon and walleye pollock. All baits were individually frozen, and thawed just before use. A distribution error led to the use of both headed and gutted pollock (the intended alternative) and whole, round pollock. The latter was used, after it was chopped up and the heads and offal discarded, in all of Area 4B, 55 stations in the Unalaska area, and 18 stations in the Portlock area. It remains unclear to the IPHC what, if any, catch differences arose from two different pollock baits,

Pollock was one of the three baits used in the alternative bait study. Photo by Andy Vatter.

although the data from Unalaska and Portlock show similar differences in halibut catch rates between each pollock type and the chum and pink salmon baits

The results of the 2012 study showed differences in WPUE of O32 halibut, and that these varied among the regulatory areas. For instance, the pollock WPUE was higher than the other baits in the Gulf of Alaska but lower in parts of the Bering Sea and Aleutian Islands. There were also differences in performance with respect to returned baits, missing baits, bycatch, and the length and age distribution of caught halibut. Any bait change would also require the stock assessment model to estimate different values for catchability, selectivity for length, and selectivity for age. Any change to an alternative bait will require careful accounting for all these differences, and several years of using the present bait and the future bait together before finally switching.

NMFS Bering Sea trawl survey

IPHC biologists were aboard the NMFS Bering Sea trawl survey for the 15th consecutive year in 2012. The trawl survey catches a high proportion of small fish that aren't seen in the setline survey, giving IPHC scientists a glimpse into the future health of the commercial stock.

In 2012 the IPHC participated in the NMFS annual trawl survey—from June 4 to July 30—in the Bering Sea for the 15th year in a row. The annual survey began in 1975, and has operated continuously since 1979. The survey consisted of 376 stations positioned on a 20x20 nautical mile (nmi) grid on the continental shelf in the eastern Bering Sea, in depths ranging from 30 to 200 meters. For the survey, two chartered fishing vessels (the *F/V Alaska Knight* and the *F/V Aldebaran*) were each staffed with a scientific crew of six, who took data from numerous species. An IPHC biologist was stationed aboard the *F/V Alaska Knight* for the duration of the cruise to accomplish three main objectives: 1) sample 100% of the halibut caught on all standard groundfish tows for fork length, sex, maturity, otoliths, and prior-hooking injuries; 2) collect otoliths for the archival otolith study; and 3) collect heart and liver tissue samples for the *Ichthyophonus* project. The *F/V Alaska Knight* conducted 176 tows in three trips and the sampler collected data on a total of 1,008 halibut (514 female and 494 male). There were 183 halibut otoliths gathered for the archive, and 162 heart and liver samples were gathered for the *Ichthyophonus* project.

Size and age composition

A survey time series such as this is particularly useful in tracking the length and year classes of Pacific halibut as they move through the population and approach commercial size. It is also the only measure of halibut abundance (numbers) for much of the Bering Sea, as the IPHC doesn't have the financial

IPHC sea sampler, Paul Logan, and NMFS scientist, Kim Sawyer, prepare to collect data on the halibut caught aboard the *F/V Ocean Explorer* during the Aleutian trawl survey.

The IPHC does not have the financial resources to be able to sample the Bering Sea in its entirety and so relies on the trawl survey data to help with estimating the halibut stock in that region.

capability to sample it in its entirety. Total abundance for 2012 for the Bering Sea was estimated to be 79.6 million fish, a continuous drop since the high of 134 million in 2006. The biomass (weight) estimate for the same area was 416.7 million pounds, not far off the high of 437.3 million pounds estimated in 2010. It is important to note that these estimates include both U32 and O32 halibut. Age composition was only available for the 2011 survey, and six-year-olds (class of 2005) represented the most numerous class, with 426 (27.6%) of the 1,631 halibut caught that year.

NMFS Aleutian Islands Trawl Survey

Although the NMFS Aleutian Islands trawl survey takes place every two years, the IPHC's participation in the 2012 survey was its first since 2000. The survey operated from Unimak Pass westward to Stalemate Bank (just west of Attu Island), between June 9 and August 11 and was accomplished using two vessels; the *F/V Sea Storm* and the *F/V Ocean Explorer*. The survey was designed such that 420 stations between 0-500 meters depth were chosen randomly from a combination of sites successfully fished in the past as well as those not previously trawled. An IPHC biologist was aboard the *F/V Ocean Explorer* for the duration. That vessel performed 232 tows and caught a total of 668 halibut. IPHC objectives for the survey were: 1) sample all halibut caught on that vessel for length, sex, maturity, left-side (from the dark side) otoliths and prior-hooking injuries; 2) collect heart and liver tissue samples for the *Ichthyophonus* project; 3) collect a sample of halibut in the round measuring less than 25 cm for an otolith archiving project; and 4) identify and photographing halibut that had lamprey wounds.

Of the 668 halibut pulled aboard, 266 (40%) were female and 402 (60%) were male. The great majority of females (92%) were rated as immature. Conversely, only 5% of the males were immature. Prior-hooking injuries were found on only 23 (3.4%) of the halibut. Thirty-eight fish had crystallized otoliths, which had to be discarded. A total of 157 tissue samples for the *Ichthyophonus* project were collected. There were no halibut under 25 cm in length caught for the archival otolith project. Finally, sixteen halibut with lamprey wounds were photographed.

Following each trawl survey, NMFS scientists use a swept-area technique to estimate total biomass and abundance for the sampled area. For the Aleutian area, the estimated biomass of halibut in 2012 was 69.6 million pounds and 8.94 million fish.

Prior hook injuries

Prior hook injuries (PHIs) are defined as injuries that appear to have happened to fish that were caught previously by hook-and-line gear and released. Although groundfish and halibut longline fishers are required to use careful release techniques when returning halibut to the sea, the incidence of PHIs is still widespread. This phenomenon concerns the IPHC because PHIs are visible evidence of past rough handling, and past studies have shown that moderate to severe injuries commonly kill halibut. Of even greater concern are the number of halibut that died from such injuries, of which there remains no evidence.

In the 2012 SSA survey, all 81,997 halibut captured (using 7,621 standard survey skates) were examined for PHIs. This was more than the 76,950 examined in 2011. As in 2011, six skates were fished at each station, but this time two of them used experimental bait. Coastwide, 6,139 (7.5%) halibut were found to have had prior hook injuries, which was lower than the 8.3% measured in 2011. The regulatory area with the smallest number of PHIs was Area 2B (5.4%), and the highest was Area 4D (19.8%). The incidence of PHIs increased in Area 2A, decreased in Area 2B, and remained largely the same in the remaining regulatory areas.

Every halibut caught on the surveys is examined for prior hooking injuries which gives clues about past handling.

This halibut caught during the setline survey, has both new and old hooking injuries. Photo by Levy Boitor.

The NMFS trawl surveys in the Bering Sea and Aleutian Islands also gathered PHI data. In the Bering Sea, 1,054 halibut were inspected and the PHI rate was determined to be 2.8%, slightly down from the 3.3%

measured in 2011. In the Aleutian Islands, a PHI rate of 3.4% was observed. Rates on the trawl surveys tend to be lower than in the setline survey because the average forklength is much lower and the fish have had less opportunity to be captured by longline gear.

The IPHC has determined that high PHI rates in both the Bering Sea and the Aleutian Islands setline survey likely reflect the interception of Pacific halibut by Pacific cod fisheries in those areas. There exists a relationship between mortality and the PHI rate, but what that relationship is remains a mystery.

The lowest incidence of PHIs on the setline survey were found in Area 2B.

A view from the water of Mt. Vsevidof on Umnak Island, AK. Photo by Paul Logan.

Quantifying the numbers and biomass of Pacific halibut is the *raison d'être* of the International Pacific Halibut Commission. Biological research is an important supplementary activity that adds to the knowledge base about halibut, enabling the IPHC to better understand its subject and improving the stock assessment. In 2012, research projects included oceanographic monitoring, parasites (including the worrisome *Ichthyophonus*), a hook modification study to reduce rockfish bycatch, tagging studies, halibut genetics, and the continuing study of otoliths.

Oceanographic monitoring on the setline survey

In a continuing project that began in 2009, the IPHC deployed water column profilers from its survey vessels to collect oceanographic data from southern Oregon northward along the coast all the way through the Aleutian Islands and into the Bering Sea.

Readying the profiler for deployment aboard the *F/V Clyde*. Photo by Danielle Vracin.

The impetus behind this project was the desire to better understand the factors contributing to the fluctuations in growth and recruitment of the halibut population, especially those relating to climatic and oceanic conditions, as well as local effects on survey catch rates. As climate change progresses, scientists believe that on average, oceans will become progressively warmer, more deprived of oxygen, and more acidic, all of which could affect the animals living there in different ways. Monitoring these changes is imperative to the full understanding of halibut population dynamics over time.

Monitoring oceanic conditions on the halibut grounds may provide insight to factors contributing to fluctuations in growth and recruitment as well as distribution patterns and survey catchability.

Ten vessels successfully collected data at 1,083 out of a possible 1,274 stations, an 85% success rate. Prior to hauling up fishing gear at each station, the profiler

was allowed to fall freely to the bottom, taking measurements all the way, four times per second. Each profiler took a snapshot of a specific column of seawater, measuring depth, temperature, salinity, dissolved oxygen, pH, and chlorophyll *a* concentrations. Once it hit bottom, it was hauled back aboard and cleaned and prepped for the next station. Approximately once a day, the data it captured were uploaded onto a computer, and then sent back to the Seattle office either remotely or through data storage cards. The IPHC worked with the Joint Institute for the Study of the Atmospheric and Ocean (JISAO) at the University of Washington, and with NOAA's Pacific Marine Environmental Laboratory to process the data and make it available to scientists worldwide. Data are available at http://www.ecofoci.noaa.gov/projects/IPHC/efoci_IPHCData.shtml.

Influence of environmental factors on halibut distribution

Low dissolved oxygen has been a persistent problem off the west coast for several years. Data collected in the area suggest that halibut can tolerate mild hypoxia, but likely leave areas where more severe hypoxia develops.

The profiles were collected just prior to hauling the gear at each survey station, providing an environmental snapshot that is directly applicable to the fishes caught on the gear. Since the coastwide rollout of the profiler program in 2009, a total of 4,659 profiles have been successfully collected.

The area surveyed by the IPHC is known halibut habitat, where one can expect to find halibut. In order to determine how climate changes affect halibut, it is informative to study these effects in "fringe" areas—such as the coasts of Oregon and Washington, and into the Bering Sea and Aleutian Islands—where the numbers of halibut may already be reduced.

The waters off Oregon and Washington typically experience low dissolved oxygen in summer. The animals living there may be somewhat adjusted to hypoxic conditions (oxygen concentrations 1.4 ml/L or lower) but will still exhibit minimum thresholds, i.e. where slow moving and stationary animals may succumb and where mobile fishes may be pushed out of their normal habitat to areas with higher oxygen. For halibut, the minimum tolerance threshold appears to be around 0.9 ml/L.

Temperature also affects halibut distribution. Halibut typically thrive in waters between 2 and 8°C. The northern Bering Sea has bottom temperatures that fall below zero Celsius. Sample sizes are small, but when these very low temperatures are compared with NPUE measures, it appears that halibut may have a minimum temperature threshold of about 0.5°C.

Ichthyophonus prevalence in Pacific halibut

Ichthyophonus hoferi is a marine parasite that affects more than 80 species worldwide. Although it doesn't directly affect the health of humans (as far as we know), it has been associated with large fish kills in species other than halibut. *Ichthyophonus* was first identified in the northeast Pacific in 1986, and is now found in nearly all Pacific herring south of the Bering Sea, and in Chinook salmon from the Yukon River. It is believed to be responsible for six massive die-offs of Atlantic herring in the past 100 years. The parasite resides in the heart (and other internal organs) and musculature of fish, forming numerous tiny cysts that can eventually lead to death.

In 2011 the United States Geologic Survey (USGS) and the IPHC collected halibut heart tissue samples from three geographically separate sites and tested

them for *Ichthyophonus*. Incidence in the northern Bering Sea was measured at 26.6%, at 33.8% off the Oregon Coast, and as high as 76.7% in Prince William Sound. In response to these relatively high levels, the 2012 study was undertaken at a coastwide level to better understand the infection in the halibut population.

Twelve sites (ten from the annual setline survey and two from the NMFS trawl survey) were chosen for the collection of halibut hearts. The sites were geographically divergent, repeated the three initial sites, and overlapped an area of concern for Pacific herring (Prince William Sound). Sixty halibut were sampled on each IPHC vessel and up to 180 samples were pulled from fish on the two NMFS trawl vessels. The samples were sent to the USGS Marrowstone Marine Field Station near Port Townsend, Washington.

Icthyophonus infection was found to be widespread and tended to be found at higher rates in older and larger fish.

The IPHC setline survey regions showed an average *Ichthyophonus* infection rate of 46.4%, with the low in the Attu region (15.0%) and the high in Prince William Sound (73.3%). It is unclear why Prince William Sound has been so profoundly affected. The NMFS trawl survey showed infection rates of 1.7% for the Bering Sea flats and 21.7% for the Aleutian Islands. The coastwide average infection rate was 33.7%. Size was a factor, with larger fish (greater than 60 cm) having a greater prevalence of carrying the parasite. Similarly, age was a factor, with older fish (6 years or older) more likely to be infected.

It is important to note that there is no historical data on *Ichthyophonus* infection in Pacific halibut. Although it affects other species in profound ways, its effects on Pacific halibut are as yet unknown. Further studies are planned.

Hook modification study to reduce rockfish bycatch

Rockfish bycatch—especially that of yelloweye and quillback rockfish—continues to be a problem for the commercial halibut fishery. With this in mind, the IPHC hypothesized that the placement of spring wires across the gap in halibut circle hooks might reduce the incidence of rockfish capture while not affecting the capture of Pacific halibut. An experiment was devised and implemented in Alaska in May 2012 to test this hypothesis.

Spring wires were placed on circle hooks to examine whether this might help reduce rockfish bycatch in the hook and line fisheries. While the modification showed some hope for smaller fish, the larger rockfish, more typically seen in the halibut fishery, did not result in a hooking decrease.

The *F/V Towego* was chartered to deploy an illuminated drop camera to film with digital video the interactions of fish and the modified circle hooks. Fifty-two gear deployments were completed in depths ranging from 20 to 65 fathoms. The camera observed 215 hook attacks by eleven species, and 201 attacks by the three target species. Of these 201, twelve attacks were by Pacific halibut, 25 were by quillback rockfish and 164 by yelloweye rockfish. The IPHC caught and released four halibut (a 33.3% total hooking success rate), zero quillback rockfish, and six yelloweye rockfish (for a 3.7% total hooking success rate). Although none of 158 yelloweye rockfish that weighed between 2 and 3 kilograms were caught using the modified hooks, all six yelloweye rockfish over 4.5 kilograms were caught on the modified hooks. Significantly, the majority of yelloweye rockfish caught as bycatch in the halibut fishery weigh over 4 kilograms, so these hooks would not reduce bycatch. Additionally, the fishers handling the fishing gear found the hooks to be very cumbersome, with major improvements needed to make them acceptable to the fishing industry. After these results, the IPHC has decided that pursuing circle hook modification to reduce bycatch is not a fruitful research pursuit for the future.

Tagging studies

The IPHC has been tagging Pacific halibut in some form since 1925. Since then over 450,000 halibut have been tagged and released—for the study of migration, utilization, age, growth, and mortality—and over 50,000 have been recovered. The tags have taken different forms over the years, as technology has improved and to satisfy the needs of different experiments.

In the 87 years that the IPHC has been tagging halibut, there have been over 50,000 recoveries, shedding light on subjects such as migration, utilization, age, growth, and mortality.

Tag recoveries

Although no tagging was done by the IPHC in 2012, 43 recovered tags were reported—18 from previous IPHC tagging experiments, and 25 sport fishing tags.

Wire tags

In 2010 the IPHC tagged 773 halibut with plastic-coated wire tags and released them in the Aleutian Islands to define active spawning periods and to examine migration. In 2012, eight of these tags were returned. One came from a fish which had been captured in 2011 and seven came from fish captured in 2012.

Passive integrated transponder tags

Two large Passive integrated transponder (PIT) tag experiments were conducted in 2003 and 2004, with over 67,000 total tags released. In 2003, 43,999 fish were tagged and released coastwide; in 2004, 23,437 fish were tagged and released in Regulatory Areas 2B and 3A. A double-tag experiment using both external wire and internal PIT tags took place during September 2003 in Hecate Strait, BC to evaluate the *in situ* PIT tag shedding rate. Each fish in this study was tagged with both an external wire tag (in the standard location on the operculum of the dark side) and an internal PIT tag (over the interopercular bone on the white side). Between 2003 and 2009, samplers in major ports scanned halibut from commercial landings to determine the presence of tags. Five recoveries from the 2003 experiment occurred in 2012. In two of the fish, both wire tags and PIT tags were recovered. In the other three fish, only the wire tags were recovered; the PIT tags had been shed in two of the fish and the third fish was not examined for the presence of its PIT tag.

Pop-up satellite transmitting archival tags

In 2012, one pop-up satellite transmitting archival (PAT) tag leader (from a 2011 recovery) was turned in to an IPHC port sampler. Unfortunately, the identification number had worn away, so the release year or experiment could not be determined.

Archival & dummy archival tags

In 2012, four halibut were recovered with archival or dummy archival tags. One was from a 2011 experiment on geomagnetic-sensing in Regulatory Areas 2C and 3A. Three tags came from a 2009 experiment in Area 3A, where 200 halibut were double tagged (with external wire tags and dummy archival tags that were either attached externally or internally implanted).

Biologists attach a satellite tag to a large halibut. IPHC archive.

Sport tags

The IPHC supplies tags to the Homer Jackpot Halibut Derby and the Seward Halibut Tournament on an annual basis. The Homer Derby released 100 tags in 2012, and nine of them were recovered. Additionally, 14 tags from previous derbies were recovered—two from 2009, three from 2010, and nine from 2011. The Seward Tournament released ten tags in 2012, and two were recovered. Although sport tagged halibut are occasionally caught by commercial fisheries, in 2012 all tags were recovered by sport fishers.

Rogue tags

Over the last decade, there have been occasions when individuals or groups have unlawfully tagged and released Pacific halibut in Alaska and northern Washington. The IPHC, the ADF&G, and NOAA's Office of Law Enforcement have contacted them to ensure the tagging has ceased, and most have complied. In 2012, two rogue tags were recovered—one from a halibut that was caught and released alive on a commercial groundfish trip in Area 2A, and another from a halibut caught on an IPHC survey trip in Area 2C.

Archival tagging projects

The IPHC began using electronic archival tags in halibut in 2002 in order to study the seasonal movements of halibut. The program had five main goals: to quantify migration distances between summer and winter grounds, identify winter spawning areas in poorly-studied regions such as the Bering Sea, examine the loyalty of halibut to various basins from year to year, define when halibut migrate and at what depths they live in different seasons, and identify when halibut spawn in different regions by studying how they move vertically in the water column.

Archival tags can supply information about a halibut's whereabouts and environment on a small time scale. These are especially useful when examining seasonal migration routes and site loyalty across different seasons.

PAT tags were employed for this study, yet they had significant drawbacks. Among them were a limited battery life that couldn't last more than one year, and a large size that could only be placed on larger fish, precluding the study of smaller fish. Gradually they have been replaced by smaller tags that can operate for more than five years on a single charge. On the plus side, this means experiments can last longer and gather more data. On the negative side, it's a complicated challenge to make sure a tag stays on a fish for that long. With that in mind, the IPHC began implanting "dummy" archival tags in halibut in 2009, and continued with more implantations in 2011. All fish were housed in the Oregon Coast Aquarium in Newport, Oregon. In November 2009, five tagging methods were employed, including intracoelomic implantation, external attachment to the dorsal musculature with three different tags, and perpendicular attachment to the operculum. In 2011, another five tagging methods were used. The first—parallel attachment to the operculum—began on March 24. The remaining four—external attachment to the dorsal musculature with two different tags, and two different tags embedded in the dorsal musculature—began on May 20.

To date, halibut have shown no obvious behaviorial difference between the untagged condition and after implantation with an archival tag.

Results to date

All the tagged halibut were examined and observed at regular intervals after tagging. These occurred at week 0 (initial tagging in November 2009) and at 2, 5, 13, 22, 32, 44, 54, 69, 77, 86, 106, 115, 126, and 146 weeks. Monitoring was expected to continue at 16-week intervals through 2013.

Since the program began, three fish have died—one from the 2009 intracoelomic implantation group died in week 6 from suture failure, one control (untagged) fish died mysteriously in week 48, and one externally titanium-darted fish from the 2009 study died during week 100. Persistent sores and irritation have been observed in four treatments: intracoelomic implantation, external attachment to the dorsal musculature, and the two opercular attachment configurations. Tag shedding has been observed in three methods (two through-body dorsal attachments and one perpendicular opercular attachment). One method has already been abandoned in week 77: the 2009 external attachment to the dorsal musculature using a through-body cradle. In two of the treatments from May 2011—two different tags embedded in the dorsal musculature—rapid extrusion of the tags (within 10 weeks of implantation) was observed, yet they haven't been completely shed through 69 weeks of observation. Up to now, no behavioral differences have been noted between the various tagging groups. Behavioral data will be statistically analyzed at the end of the experiment. No single method has yet been identified as the best future option.

Comparison of survey and genetic estimating of sex composition

Through about 1985, male and female halibut entered the Gulf of Alaska commercial fishery at roughly the same average age—males at 7 years and females at 8 years. This has changed over the years, so that now males enter the Gulf of Alaska commercial fishery at an average of 15 years and females at 10 years. Coastwide, females enter the fishery an average of three years sooner than males. This is one example of the complications faced in trying to determine

the sex of commercially caught halibut. When caught commercially, they are not weighed or sexed and are gutted. The fork length (from tail to the tip of the head) is the sole remaining clue as to what weight or sex the fish was. It is relatively straightforward to estimate the weight, but determining sex is far more complicated. Knowing how many female halibut are caught is critical, because the IPHC's harvest policy is structured to decrease harvest rates when the female spawning biomass reaches 30% of the average unfished female spawning biomass.

Since 2005, calculating the sex composition of commercial halibut landings has been a preparatory step to producing data for the IPHC's stock assessment model. The calculation uses a method based on observed sex at length, age, regulatory area, and year within survey catches. Basically, large halibut are more likely to be female, and small, old halibut are more likely to be male. However, this method contains some built-in inaccuracies: halibut are migratory from season to season; they also tend to feed differently, depending on reproductive expenditures, age, and size.

Thankfully, genetics has stepped into the fray. It was only in 2006 when researchers noticed that three nuclear microsatellite loci showed different alleles in female Pacific halibut than in male Pacific halibut. In short, the cells of female halibut can be differentiated from male halibut with a test.

In the future, routine genetic sampling could be used to determine the sex composition of the commercial catch, a statistic that is currently estimated using survey data.

This study, which used tissue samples collected in 2010 and 2011, was concluded in 2012. Its aim was to compare the accuracy of sex determination using genetic markers, compared to the length-at-age model developed in 2004. A total of 1,772 tissue samples (caudal fin clips) were collected from O32 halibut between December 1998 and October 2011.

For the genetic sample analysis, tissue from caudal fin clips was analyzed using three different, commonly used protocols. The DNA was compared to a baseline DNA from 75 known female samples and 62 known male samples from Haida Gwai and Adak Island.

Results

For the 137 baseline DNA samples, the genetic method identified 99% of the females and 94% of the males. When 16 samples (with DNA that was not clearly male or female) were removed, the method correctly identified 100% of the females and 98% of the males. When the sample set of fish of unknown sex (1,722 total fish) was tested, 1,544 fish (95.2%) were correctly assigned to the correct sex. Only 4.8% were incorrectly assigned. For the traditional length-at-age sex identification method, over 10% of the samples were misidentified.

In general, both methods provide reasonable estimates of sex ratio by area and year. The sex -at-length method was typically off by 5% to 10%, and was somewhat variable, being affected by factors such as demographics, growth rates, fish and fishery behavior, and spatial and temporal stock dynamics. Genetic sex determination using nuclear microsatellites was less variable and not as sensitive to the aforementioned factors. It is, however, more costly than is currently practicable. There is a genetic sex identification method using single nucleotide polymorphisms (SNPs) that is cheaper and more appropriate for large scale testing. In conclusion, the IPHC recommends developing SNP assays that would be rapid, cost-effective, and accurate, should routine genetic catch sampling be initiated.

Clean otolith archive collection

Both the commercial fishery and survey chapters mentioned briefly the existence of an archival otolith collection. This initiative, which started in 2010, is described more fully here. Historically, otoliths have been collected to measure the age of halibut as well as the elements that exist in their environment. After being collected, they were typically stored in a glycerin/thymol solution to improve readability. Recent advances in technology now enable scientists to measure very small concentrations of isotopes and elements—such as beryllium, magnesium, calcium, strontium, barium, and manganese—found in the microstructure of otoliths. The catch is: the otoliths must be extremely clean and uncontaminated by glycerin/thymol or any other preservatives. Hence otoliths intended for this new archive are removed without contact with any metal, carefully dried, and stored in a climate-controlled environment for future study.

Examining microstructures of otoliths may eventually shed light on such things as nursery ground origin, temperatures experienced by the fish, and diet.

IPHC biologist, Joan Forsberg, determines the age of a halibut. Photo by Tom Kong.

The annual sampling goal for the Clean Otolith Archive Collection (COAC) is to collect a random sample of 100 pairs of otoliths from each of the Regulatory Areas 2A through 4B, and from a combined Area 4CD. Ideally, most (if not all) would come from the SSA, since both the sex and exact capture location are available for sampled otoliths. However, in regulatory areas where otolith sampling rate is 100% for the stock assessment collection, COACs are obtained from the commercial catch (Commercial Port or CP). Additional COAC samples are collected from the NMFS trawl survey and any special charters that sacrifice halibut for research. The NMFS trawl survey catch consists of small halibut that are not seen in the SSA or CP collections. Halibut under 25 cm (9.84 inches) in length selected for COAC sampling on NMFS trawl surveys are shipped whole to Seattle—to avoid contamination at sea—where the otoliths could be removed in the IPHC "wet lab."

For 2012, a total of 1,164 clean otolith pairs were collected. Collection goals in Areas 2A through 4A and on the NMFS Bering Sea trawl survey were met, while collections in Area 4B and on the NMFS Aleutian Islands trawl survey fell short. Of the total, 676 were collected during the SSA survey from Areas 2B, 2C, 3A, 3B and 4A. Port samplers in Dutch Harbor, St. Paul, and Newport collected a total of 301 otolith pairs for the COAC from Areas 2A, 4B, 4C, and 4D. In

the Eastern Bering Sea trawl survey, 186 pairs were collected from fish over 25 cm, and one fish under 25 cm was sent back to Seattle. Zero otoliths were taken during the NMFS Aleutian Islands trawl survey.

Pacific-Atlantic halibut aging workshop and otolith exchange

Fish that are important commercially and ecologically are often managed by multiple agencies, with each agency developing its own techniques to age the stock. In an effort to standardize the treatment of aging techniques among northeast Pacific fish species, the Committee of Age Reading Experts (CARE) was formed in 1983 from Federal and state agencies in California, Oregon, Washington, British Columbia, and Alaska. One of the methods they found to be most effective was hands-on workshops.

CARE was formed in the 1980s to provide a venue for age readers to share ideas and ensure consistency in aging techniques.

Pacific halibut and Atlantic halibut are different species with certain similarities, including their respective otoliths. In the U.S., Atlantic halibut are managed by several organizations, including the Maine Department of Marine Resources (Maine DMR) and the NMFS Northeast Fisheries Science Center (NEFSC). With an eye toward standardizing the treatment of halibut otoliths for aging, staff from the IPHC and these two organizations attended an otolith exchange workshop in Boothbay Harbor, Maine in September 2011. The main objective of the workshop was to work on methodologies for otolith sample preparation prior to an exchange of Pacific halibut otoliths and Atlantic halibut otoliths. The exchange was intended to calibrate age estimates between the two fish species.

The East Coast agencies use an otolith preparation method called the "transverse thin-section technique." The IPHC uses the "break-and-bake technique" for production age reading, but has used the thin section technique for research purposes. To keep on the same page, the thin-sectioning technique was chosen for the age estimate calibration exchange. Twenty-five otoliths were to be chosen randomly by each agency, with preference placed on left side (white side) otoliths due to their better readability. After collection, the otoliths were stored dry until processing. They were then cut transversely into thin sections (0.5 mm in thickness) and mounted on glass slides for microscope study. High resolution digital photographs were then taken, and the images were manipulated in Photoshop so that each otolith was presented in a single panorama view. The images were then sent electronically to all participating agencies. Due to funding cuts in 2011, Maine DMR dropped out of the study. A total of 50 otoliths were exchanged between the IPHC and the NEFSC. The ages ranged from zero years to 28 years. After each agency aged the otoliths, it was discovered that complete agreement of age estimates between the agencies was 34%. Agreement with one year of discrepancy was 72%, and for two years was 92%. The difference between the agencies was attributable to three factors: 1) age range of each agency's samples was highly skewed, with a much wider range for the Pacific halibut samples; 2) difficulty in identifying the first and last annual rings due to poor preparation of the samples; and 3) the difficulty in interpreting "checky" or vague increment patterns.

Keeping Up With the IPHC Staff

A large amount of time is spent by the IPHC staff on the programs and research highlighted in this report, but that's really only part of the story. If a staff member isn't at their desk, they may be participating on a committee, conducting public outreach, attending a fisheries conference, or seeking additional education. This section highlights staff, both new and veteran, and some of the activities in which they participate outside their normal routine.

2012 brought some new faces to the IPHC staff. From left: Ian Stewart - Quantitative Scientist, Steve Martell - Quantitative Scientist, Ed Henry - Survey Operations, Jim Traub - Database Administrator. Photo credit: Chris Johnston.

Conferences and workshops

- Western Groundfish Conference 2012 in Seattle, WA – Claude Dykstra, Robert Tobin, Joan Forsberg, Lara Erikson, Bruce Leaman, Gregg Williams, Heather Gilroy, Steve Keith
- Ocean Acidification Third Symposium in Monterey, CA – Lauri Sadorus
- Pacific Seabird Group Conference in Turtle Bay, HI – Tracee Geernaert
- Ecological Society of America (ESA) Conference in Portland, OR – Bruce Leaman
- National Academy of Sciences Sackler Colloquium on the Science of Science Communication – Bruce Leaman
- Interagency eLandings/CDQ workshop in Anchorage, AK – Lara Erikson, Aregash Tesfatsion, Huyen Tran

Awards, training, and certifications

- NPFVOA cold water survival training - All sea samplers and a number of Seattle Staff
- Master's degree in fisheries from University of Washington - Lauri Sadorus

Steve Kaimmer tells a "big fish" story at the Saltwater Sportsmen's Show. Photo credit: Steve Kaimmer.

Outreach and education

- Pacific Marine Expo ('Fish Expo') in Seattle, WA – Steve Kaimmer and Staff
- Pacific Northwest Sportsmen's Show in Portland, OR – Steve Kaimmer, Gregg Williams, Steve Keith
- Saltwater Sportsmen's Show in Salem, OR – Steve Kaimmer
- Fishermen's Fall Festival in Seattle, WA – Steve Kaimmer, Tracee Geernaert, Eva Luna
- Beach naturalist for the Seattle Aquarium in Seattle, WA – Claude Dykstra
- California Department of Fish and Wildlife's public meeting on halibut management in Eureka, CA - Gregg Williams
- Expanding Your Horizons science workshops for high school students in Bellevue, WA and Edmonds, WA – Lauri Sadorus
- Graduate committee member, University of Alaska Fairbanks - Tim Loher

Committees and organization appointments

- South of Humbug Pacific Halibut Workgroup, South of Humbug Pacific Halibut Policy Committee, IPHC liaison to the PFMC and NPFMC, and Joint IPHC/NPFMC Bycatch Workshop organizer - Gregg Williams
- Western Groundfish Conference organizing committee - Claude Dykstra (2012), Kirsten MacTavish (2014)
- International Flatfish Symposium 2014 co-chair - Tim Loher
- International Flatfish Symposium 2014 local organizing committee - Tamara Briggie, Tracee Geernaert, Lauri Sadorus, Lara Erikson, Steve Keith
- North Pacific Albatross Working Group committee - Tracee Geernaert
- NPFMC Gulf of Alaska Groundfish Plan Team - Ian Stewart
- NPFMC Scientific and Statistical Committee - Ray Webster and Steve Martell
- Interagency eLandings strategic planning meetings – Heather Gilroy
- Canada-U.S. Groundfish Committee's Technical Subcommittee - Heather Gilroy and Claude Dykstra

APPENDICES

The tables in Appendix I provide catch information for the 2012 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 2012 total removals (thousands of pounds, net weight), 2012 catch limits and catch of Pacific halibut by IPHC regulatory area.

Table 2. The 2012 Area 2B catch limits as allocated by the Canadian Department of Fisheries and Oceans and estimated catches (thousands of pounds, net weight).

Table 3. The Area 2A 2012 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (pounds, net weight).

Table 4. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2012 commercial fishery, including IPHC research catch, by regulatory area and month.

Table 5. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2012 commercial fishery for Area 2A (excluding treaty Indian commercial), Area 2B, Alaska, and the Alaskan regulatory areas. All Areas, with the exception of Area 2A, include IPHC research catch.

Table 6. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2012 Pacific halibut commercial fishery.

Table 7. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2012.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2012 by statistical area[1] and regulatory area.

Table 9. The fishing period limit (pounds, net weight) by vessel class used in the 2012 directed commercial fishery in Area 2A.

Table 10. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2012.

Appendix II.

Appendix I.

Table 1. The 2012 total removals (thousands of pounds, net weight), 2012 catch limits and catch of Pacific halibut by IPHC regulatory area.

Removal Source	2A	2B	2C	3A	3B	4	Total
Commercial	556	5,874	2,575	11,735	4,932	5,586	31,258
Sport	455	1,156	1,405	3,938	13	16	6,983
Bycatch Mortality[1]							
O26 fish	103	175	6	1,259	1,109	3,685	6,337
U26 fish	2	14	1	681	470	2,362	3,530
Personal Use[2]	32[3]	405	387	266	22	39[4]	1,151
Wastage Mortality							
O26 fish	13	165	73	561	467	185	1,464
U26 fish	0	6	5	30	57	28	126
IPHC Research	17	109	119	297	113	76	731
Total Removals	1,178	7,904	4,571	18,767	7,183	11,977	51,580
2012 Catch Limits[5]	989[6]	7,038[7]	2,624	11,918	5,070	5,901	33,540
2012 Catch	1,043[6]	7,030[7]	2,575	11,735	4,932	5,586	32,901

[1] Area 2A bycatch is the 2011 estimate as the 2012 estimate will not be available until 2013.
[2] Includes 2011 subsistence harvest estimates for the Alaskan areas.
[3] Treaty Indian ceremonial and subsistence catch.
[4] Includes 16,900 pounds of U32 halibut retained in the 2011 Area 4DE Community Development Quota fishery.
[5] Does not include poundage from the underage/overage programs in Area 2B or Alaska.
[6] Includes commercial, sport, and treaty tribes subsistence catch.
[7] Includes commercial and sport catch.

Appendix I.

Table 2. The 2012 Area 2B catch limits as allocated by the Canadian Department of Fisheries and Oceans and estimated catches (thousands of pounds, net weight).

Fishery	Allocation	Catch
Commercial fishery	5,953.35	5,874
Sport fishery	1,084.65	1,156
Totals	7,038.00	7,030
IPHC research catch		109
Totals	7,038.00[1]	7,139

[1] Adjustments totaling 5,000 pounds were made to the commercial fishery catch limit from the underage/overage plan. In addition, there was an opportunity for individual leasing of quota to the sport sector from the commercial quota share holders and 814 pounds were landed under these recreational licenses.

Table 3. The Area 2A 2012 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (pounds, net weight).

Fishery	Catch Limit	Catch
Non-treaty directed commercial	173,216	164,418
Non-treaty incidental commercial with salmon troll fishery	30,568	29,661
Non-treaty incidental commercial with sablefish fishery	21,173	4,867
Treaty Indian commercial	321,650	357,022
Treaty Indian ceremonial and subsistence	24,500	32,200
Sport – Washington	214,110	231,236
Sport – Oregon/California	203,783	224,112
Totals	989,000	1,043,516
IPHC research catch		17,478
Grand Total	989,000	1,060,994

Appendix I.

Table 4. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2012 commercial fishery, including IPHC research catch, by regulatory area and month.

	March	April	May	June	July	August	September	October	November	Grand Total
2A[1]	224		144	159	46			-	-	573
2B	624	838	714	601	706	1,065	513	759	163	5,983
2C	335	379	519	469	220	309	282	159	22	2,694
3A	672	1,746	1,746	1,928	1,157	1,703	1,225	1,728	127	12,032
3B[2]		247	770	788	737	1,324	506	560	113	5,045
4A	-	72	174	309	255	466	214	84	9	1,583
4B[3]			263	242	290	493	285	123	42	1,738
4C[4]	-	-	-		267	221	69	6	-	563
4D[5]	-	-	72	229	308	367	323	132		1,431
4E[6]	-	-	-	120	178	19	30	-	-	347
AlaskaTotal	1,007	2,444	3,544	4,085	3,412	4,902	2,934	2,792	313	25,433
GrandTotal	1,855	3,282	4,402	4,845	4,164	5,967	3,447	3,551	476	31,989

For confidentiality:
[1]Area 2A catch in April was combined with May; August and September were combined with July.
[2]Area 3B catch in March was combined with April.
[3]Area 4B catch in March and April were combined with May.
[4]Area 4C catch in June was combined with July.
[5]Area 4D catch in November was combined with October.
[6]Area 4E catch in May was combined with June, October was combined with September.

Appendix I.

Table 5. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2012 commercial fishery for Area 2A (excluding treaty Indian commercial), Area 2B, Alaska, and the Alaskan regulatory areas. All Areas, with the exception of Area 2A, include IPHC research catch.

	Area 2B		Alaska	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	24	640	60	301
0 to 25 ft.[1]			221	284
26 to 30 ft.	0	0	100	534
31 to 35 ft.[1]	11	162	191	2,525
36 to 40 ft.	28	693	123	1,023
41 to 45 ft.	37	863	136	1,879
46 to 50 ft.	26	1,076	129	2,513
51 to 55 ft.	19	852	64	1,538
56 + ft.	31	1,697	239	14,836
Total	176	5,983	1,263	25,433

	Area 2C		Area 3A	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	45	53	9	116
0 to 25 ft.	51	64	28	45
26 to 30 ft.	32	98	14	50
31 to 35 ft.	83	349	78	1,315
36 to 40 ft.	67	239	51	577
41 to 45 ft.	76	308	64	1,145
46 to 50 ft.	72	436	64	1,066
51 to 55 ft.	41	347	39	837
56 + ft.	96	800	176	6,881
Total	563	2,694	523	12,032

	Area 3B		Area 4	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	6	56	4	76
0 to 25 ft.[2]			142	175
26 to 30 ft.[2]			54	386
31 to 35 ft.[2]	31	340	37	521
36 to 40 ft.	15	130	6	77
41 to 45 ft.	30	322	5	104
46 to 50 ft.	30	486	10	525
51 to 55 ft.	12	256	3	98
56 + ft.	122	3,455	61	3,700
Total	246	5,045	322	5,662

For confidentiality reasons:

[1] Vessels 0 to 25 ft. in Area 2B were combined with 31 to 35 ft. vessels

[2] Vessels 0 to 25 and 26 to 30 ft. in Area 3B were combined with 31 to 35 ft. vessels

Table 5. continued

Overall Vessel Length	Area 2A Directed Commercial No. of Vessels	Area 2A Directed Commercial Catch (000's lbs.)
Unk. Length	0	0.0
0 to 25 ft.	3	0.2
26 to 30 ft.	6	1.7
31 to 35 ft.	10	5.1
36 to 40 ft.	16	10.9
41 to 45 ft.	14	34.0
46 to 50 ft.	24	57.1
51 to 55 ft.	5	5.7
56 + ft.	10	49.7
Total	88	164.4

Overall Vessel Length	Area 2A Incidental Commercial (Salmon) No. of Vessels	Area 2A Incidental Commercial (Salmon) Catch (000's lbs.)	Area 2A Incidental Commercial (Sablefish) No. of Vessels	Area 2A Incidental Commercial (Sablefish) Catch (000's lbs.)
Unk. Length	0	0.0	0	0.0
0 to 25 ft.	4	0.4	0	0.0
26 to 30 ft.	7	1.3	0	0.0
31 to 35 ft.	16	1.9	0	0.0
36 to 40 ft.	23	3.0	0	0.0
41 to 45 ft.	29	11.6	4	2.0
46 to 50 ft.	20	9.6	3	0.7
51 to 55 ft.[1]	4	1.9	0	0.0
56 + ft.[1]			3	2.2
Total	103	29.7	10	4.9

[1] For confidentiality reasons, 55+ft. vessels in the Incidental Commercial (Salmon) fishery were combined with 51 to 55 ft. vessels.

Appendix I.

Table 6. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2012 Pacific halibut commercial fishery.

Area 2A	Fishing Period	Catch Limit	No. of Days	Commercial Catch	Research Catch	Total Catch
Treaty Indian	Unrestricted:					
	3/24 –26		48-hours	157.0		157.0
	5/1		13-hours	133.0		133.0
	Restricted:					
	3/17-19		55-hours	67.0		67.0
Total		321.7		357.0		357.0
Incidental in Salmon Fishery	5/1 – 7/3	30.6	64 days	29.7		29.7
Incidental in Sablefish Fishery	5/1 – 10/31	21.1	184 days	4.9		4.9
Directed[1]	6/27		10-hours	134.3		
	7/11		10-hours	30.1		
Directed Total		173.2		164.4		164.4
2A Total		546.6		556.0	17	573.0

Area	Fishing Period	Catch Limit	Adjusted Catch Limit[2]	Commercial Catch	Research Catch	Total Catch
2B	3/17 – 11/7	5,953	5,958	5,874[3]	109	5,983
2C	3/17 – 11/7	2,624	2,656	2, 575[4]	119	2,694
3A	3/17 – 11/7	11,918	12,033	11,735	297	12,032
3B	3/17 – 11/7	5,070	5,225	4,932	113	5,045
4A	3/17 – 11/7	1,567	1,627	1,543	40	1,583
4B	3/17 – 11/7	1,869	1,922	1,715	23	1,738
4C	3/17 – 11/7	1,107	1,136	559[6]	4	563
4D	3/17 – 11/7	1,107	1,140	1,422 [5,6]	9	1,431
4E	3/17 – 11/7	250	250	347[6]	0	347
Alaska Total		25,512	25,989	24,829	604	25,433
Grand Total		32,012[7]	32,494[7]	31,258	731	31,989

[1] Fishing period limits by vessel class.

[2] Includes adjustments from the underage/overage programs. and in 2B, quota held by DFO for First Nations through relinquishment processes.

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

[4] Includes the pounds taken in the Metlakatla fishery within the Annette Island Reserve.

[5] Area 4C IFQ and CDQ could be fished in Area 4D by NMFS and IPHC regulations.

[6] Area 4D CDQ could be fished in Area 4E by NMFS and IPHC regulations.

[7]Includes Area 2A catch limit.

Appendix I.

Table 7. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2012.

IPHC Group	Canada	United States	IPHC Research	Grand Total
CA & OR	-	140	10	150
Bellingham/Seattle	-	659	3	662
WA	-	316	4	320
Vancouver	298	-	-	298
Port Hardy	2,898	-	39	2,937
Southern BC	279	-	6	285
Prince Rupert & Port Ed.	2,309	-	104	2,413
Northern BC	90	-	-	90
Ketchikan, Craig, Metlakatla	-	233	11	244
Petersburg, Kake	-	1,013	46	1,059
Juneau	-	939	20	959
Sitka	-	1,209	67	1,276
Hoonah, Excursion, Pelican[1]	-		-	-
Southeast AK	-	763	-	763
Cordova	-	543	14	557
Seward	-	2,595	78	2,673
Homer	-	4,419	13	4,432
Kenai	-	54	-	54
Kodiak	-	4,866	107	4,973
Central AK	-	2,403	120	2,523
Akutan & Dutch Harbor	-	2,755	59	2,814
Bering Sea	-	2,477	30	2,507
Grand Total	5,874	25,384	731	31,989

[1]Included in Southeast AK

Appendix I.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2012 by statistical area[1] and regulatory area.

Stat Area	Catch			Regulatory Area	Catch for Reg Area
	Commercial	Research	Total		
08-09	9	1	10	2A	573
10	23	2	25		
20	90	5	95		
30	16	1	17		
40	82	3	85		
50	336	5	341		
60	92	6	98	2B	5,983
61	8	0	8		
70	129	5	134		
80	107	2	109		
81	17	0	17		
90	277	4	281		
91	312	10	322		
92	60	0	60		
100	563	1	564		
102	924	26	950		
103	28	0	28		
110	59	2	61		
112	1,037	27	1,064		
114	33	0	33		
120	91	0	91		
121	203	4	207		
122	28	0	28		
130	417	6	423		
131	594	5	599		
132	219	5	224		
133	190	4	194		
134	64	1	65		
135	422	1	423		
140	49	12	61	2C	2,694
141	10	8	18		
142	80	9	89		
143	83	5	88		
144	9	0	9		
150	118	19	137		
151	147	8	155		
152	214	5	219		
153	42	3	45		
160	337	16	353		
161	120	5	125		
162	485	4	489		
163	37	1	38		
170	194	6	200		
171	90	3	93		
173	46	3	49		
174	19	0	19		
181	236	8	244		
182	153	2	155		
183	41	2	43		
184	65	0	65		

Appendix I.

Table 8. continued.

185	835	17	852	3A	12,032
190	553	20	573		
200	595	17	612		
210	579	13	592		
220	818	6	824		
230	338	11	349		
232	81	3	84		
240	1,109	21	1,130		
242	138	7	145		
250	2,319	31	2,350		
260	1,476	56	1,532		
261	520	16	536		
270	937	32	969		
271	313	12	325		
280	985	26	1,011		
281	139	9	148		
290	1,921	23	1,944	3B	5,045
300	899	25	924		
310	565	26	591		
320	834	19	853		
330	492	13	505		
340	221	7	228		
350	118	6	124	4	5,662
360	169	1	170		
370	67	3	70		
380	124	5	129		
390	19	1	20		
400	99	0	99		
410	31	1	32		
420	105	3	108		
430	73	2	75		
440	194	2	196		
450	11	0	11		
460/470	2	1	3		
480	24	1	25		
490	115	4	119		
500	3	0	3		
Bering Sea	4432	46	4,478		
Grand Total	31,258	731	31,989		

[1] Statistical areas as defined in IPHC Technical Report No. 49.

Appendix I.

Table 9. The fishing period limit (pounds, net weight) by vessel class used in the 2012 directed commercial fishery in Area 2A.

Vessel Class		Fishing Period & Limits	
Letter	**Feet**	**June 27**	**July 11**
A	0-25	755	200
B	26-30	945	200
C	31-35	1,510	250
D	36-40	4,165	695
E	42-45	4,480	745
F	46-50	5,365	895
G	51-55	5,985	1,000
H	56+	9,000	1,500

Table 10. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2012.

Fishing Period Dates	Number of Vessels	Catch (Pounds)
April 20 – 22	10	3,595
May 4 – 6	6	2,178
May 18 – 20	9	1,834
June 1 – 3	7	4,010
June 15 – 17	9	3,660
June 29 –July 1	9	4,874
July 13 – 15	8	4,407
August 10 – 12	11	6,470
August 24 – 26	13	10,293
September 7 – 9	10	5,095
September 21 – 23	5	2,571
11 Fishing Periods		48,987

Appendix II.

Table 1. Harvest of halibut by sport fishers (millions of pounds, net weight) by IPHC regulatory area, 1977-2012.

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	8.083
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	8.586
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	8.012
2003	0.404	1.218	2.258	5.427	0.009	0.031	9.347
2004	0.476	1.613	2.937	5.606	0.007	0.053	10.692
2005	0.477	1.841	2.798	5.672	0.014	0.050	10.852
2006	0.511	1.773	2.526	5.337	0.014	0.046	10.207
2007	0.504	1.556	3.049	6.283	0.025	0.044	11.461
2008	0.487	1.536	3.264	5.320	0.026	0.040	10.673
2009	0.487	1.098	2.383	4.758	0.030	0.024	8.780
2010	0.392	1.156	1.971	4.285	0.024	0.016	7.844
2011	0.399	1.224	1.029	4.408	0.014	0.017	7.091
2012[a]	0.455	1.156	1.405	3.938	0.013	0.016	6.983
2011-2012 change							
Pounds	0.056	-0.068	0.376	-0.470	-0.001	-0.001	-0.108
Percent	14.0	-5.6	36.5	-10.7	-7.1	-5.9	-1.5

[a] Preliminary

Appendix II.

Table 2. Summary of the 2012 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 3 – 19	3 (Thur – Sat)	9	1
	May 24 – 27	4 (Thur – Sun)	4	1
	May 28, 31	2 (Mon, Thur)	2	1
	Jun 1-2	2 (Fri, Sat)	2	1
Low Point to Sekiu River	May 24 – 27	4 (Thur – Sun)	4	1
	May 28, 31	2 (Mon, Thur)	2	1
	Jun 1-2	2 (Fri, Sat)	2	1
	Jun 7 – Jun 23	3 (Thur – Sat)	9	1
WA North Coast (Sekiu Rvr to Queets Rvr)	May 10 – 19	2 (Thur, Sat)	4	1
	May 31, Jun 2	2 (Thur, Sat)	2	1
	Jun 14	1 (Thur)	1	1
WA South Coast (Queets Rvr to Leadbetter Pt.)				
All depths	May 6 – 20	2 (Sun, Tues)	5	1
Northern nearshore	May 7 – Jun 8	7 (Mon – Sun)	33	1
Columbia River (Leadbetter Pt. to Cape Falcon)	May 3 – Jul 14	3 (Thur – Sat)	33	1
	Aug 3 – Sep 29	3 (Fri – Sun)	27	1
OR Central Coast (Cape Falcon - Humbug Mtn.)				
All depths	May 10 – Jun 30	3 (Thur – Sat)[1]	17	1
	Aug 3 – 18	2 (Fri – Sat)[2]	4	1
Less than 40 fathoms	May 1 – Jul 22	7 (Sun – Sat)	83	1
	Sep 24 – Oct 31	7 (Sun – Sat)	38	1
OR/CA (South of Humbug Mtn.)	May 1 – Oct 31	7 (Sun – Sat)	184	1
Area 2B - British Columbia	Mar 1 – Sep 9	7 (Sun – Sat)	192	1
Area 2C - Alaska				
Guided anglers	Feb 1 – Dec 31	7 (Sun – Sat)	334	1[3]
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

[1] Fishing was prohibited during June 7-9 and June 21-23.

[2] Fishing was prohibited during August 10-11.

[3] A reverse slot limit defining retained halibut as ≤45 inches or ≥68 inches in total length was in effect in 2012.

Appendix II.

Table 3. 2012 Area 2A sport harvest allocations and preliminary harvest estimates (pounds, net weight) by subarea.

Subarea	Allocation	Harvest Estimate	Pounds Over/(Under)	Percent Taken
WA Inside Waters	57,393	77,385	19,992	134.8
WA North Coast	108,030	105,478	(2,552)	97.6
WA South Coast	42,739	42,467	(272)	99.4
Columbia River	11,895	7,950	(3,945)	66.8
OR Central Coast	191,780	191,535	(254)	99.9
South OR/California	6,056	30,524	24,248	504.0
Total	**417,893**	**455,339**	**37,446**	**109.0**

Table 4. Estimated harvest by the private (unguided) and charter (guided) sport halibut fishery in millions of pounds (net weight) in Areas 2C and 3A, 2000–2012. Also shown is the Guideline Harvest Level (GHL) applicable to the charter fishery.

	Area 2C				Area 3A			
Year	Private	Charter	Total	GHL	Private	Charter	Total	GHL
2000	1.121	1.130	2.251	-	2.165	3.140	5.305	-
2001	0.721	1.202	1.923	-	1.543	3.132	4.675	-
2002	0.814	1.275	2.090	-	1.478	2.724	4.202	-
2003	0.846	1.412	2.258	1.432	2.046	3.382	5.427	3.650
2004	1.187	1.750	2.937	1.432	1.937	3.668	5.606	3.650
2005	0.845	1.952	2.798	1.432	1.984	3.689	5.672	3.650
2006	0.723	1.804	2.526	1.432	1.674	3.664	5.337	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	5.320	3.650
2009	1.133	1.249	2.383	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
2011	0.685	0.344	1.029	0.788	1.615	2.793	4.408	3.650
2012[a]	0.761	0.645	1.405	0.931	1.563	2.375	3.938	3.103

[a]Preliminary

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 2012 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.

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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).
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Other Publications

Children's book

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 a pdf is 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?

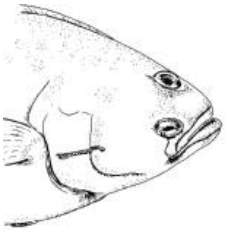
Fishers should retain all tagged halibut regardless of gear type used, time of year caught, size of halibut, or type of tag!

Instructions

1. Leave the tag on the fish until landed.
2. Notify the IPHC office or local port sampler for further instructions.

Traditional wire tags

- Threaded through the operculum (cheek area) on the dark side of the body.
- The usual reward is $5 cash or an IPHC tag hat for each tag returned.
- Some wire tags are worth $100 or $200 and these have the reward printed on the tag.



Spaghetti tags

- Plastic spaghetti tags were used in the voluntary sport charter-boat tagging program from the 1990s. Tags were attached to either a plastic or stainless steel dart and inserted either in the back of the fish (plastic darts) or the cheek on the dark side (stainless steel dart). Recoveries of this tag type are not very common since releases occurred quite some time ago.

Pop-up archival transmitting tags

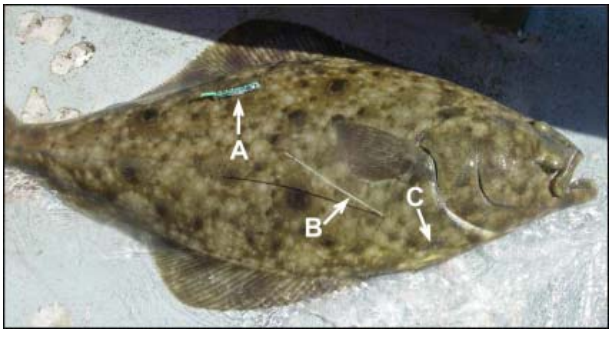
- Attached near the dorsal by a metal dart and leader.
- Rewards: $500 for tag body*, $50 for the leader and metal dart tag only, $5 or tag hat for leader only.
  *Note that these tags may be found attached to a halibut, free floating, or washed ashore

Electronic archival tags

- Attached near the dorsal via a plastic "cradle" and wires.
- $500 reward for the return of the tag body.

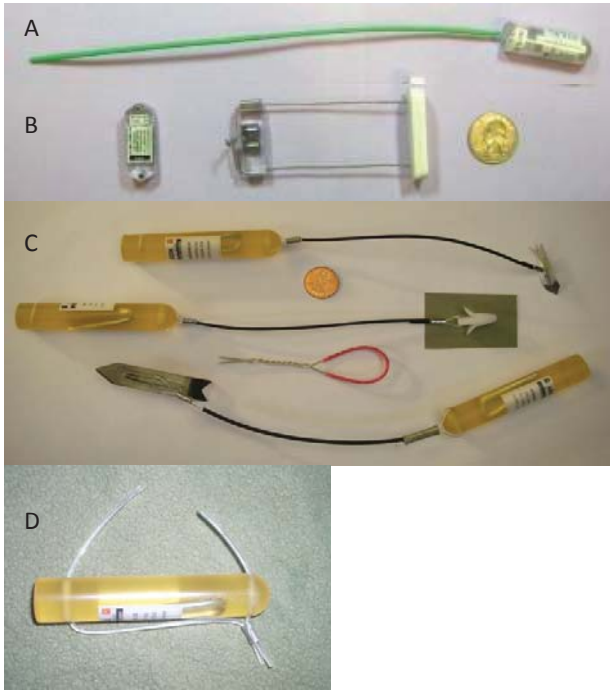
Double-tagged electronic archival tags

- Fish has both an external electronic “backpack tag” and an internal “gut tag”
- Externally mounted tag is a black plastic cylinder with tagging wire and backing plate, attached on the dark side below the dorsal fin (A in photo).
- Internal tag has the tag body inside the abdominal cavity with the translucent green stalk protruding outside the fish from the belly (B in photo).
- $500 reward for the return of each tag type so keep and return both tags.



"Dummy" archival tags

- Fish with internal dummy archival tag or external dummy tag attached near the dorsal also has pink wire tag in the cheek.
- Internal "gut" tag has the tag body inside the abdominal cavity with the stalk protruding outside the fish (A).
- There are two general types of externally mounted tags that are attached near the dorsal fin, either with wires (B) or using one of three different dart-and-leader configurations (C)
- Third type of external dummy tag is attached to the operculum with monofilament (D). Fish tagged with opercular dummy tag does not have a pink wire tag.
- $100 reward for the return of the dummy archival tag body.
- $100 reward for the return of the pink wire tag (reward printed on tag).

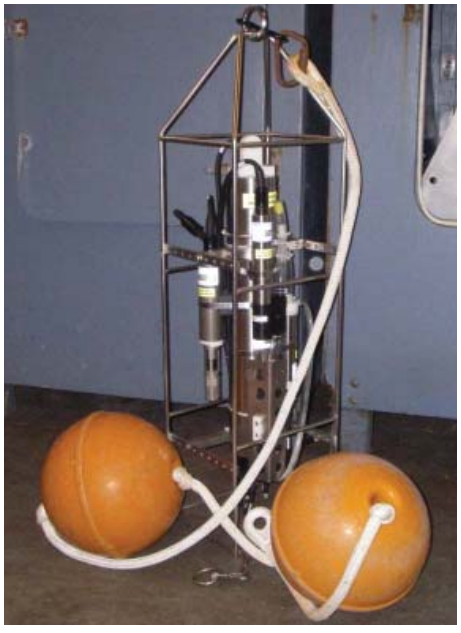


$1500 Reward

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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