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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2013

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

This report produced by IPHC staff
and Eric Chastain
2014

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

IPHC sampler, Levy Boitor, took this shot of crewman, Dylan Hardy, demonstrating a careful release on an undersized halibut aboard the Canadian *F/V Pender Isle*. Levy has been working for the IPHC for 15 years as a port and sea sampler out of Petersburg, Alaska. Photography is a hobby that lets him capture and document some of the events of those years working on fishing vessels throughout Alaska and coastal British Columbia.

Table of Contents

INTRODUCTION

In Shakespeare's play The Tempest, an airy sprite named Ariel sings a song to Ferdinand, the prince of Naples. In it she reveals the seeming fate of his father Alonso, the king of Naples:

> "Full fathom five thy father lies; of his bones are coral made;
> Those are pearls that were his eyes; nothing of him that doth fade
> But doth suffer a sea-change into something rich and strange.
> Sea-nymphs hourly ring his knell: Hark! Now I hear them—
> Ding-dong bell."

Culinary preparation: The Chart Room (Dutch Harbor, AK): Bering Sea Halibut Filet With king crab, grilled prawns and alfredo sauce

William Shakespeare, ever the etymological inventor, had a knack of spinning new words out of thin air. In The Tempest, he used "sea change" for the first time in print, and it signified something momentous. The IPHC went through a sea change in the past couple of years, though it was marked not by tragedy but with possibility.

The roots of a persistent retrospective bias were, in 2012, identified and eliminated, and 2013 was the year that the population assessment took into account a much longer historical time-series (back to the early 1900s), further improving its accuracy. Finally, instead of melding science and policy (as it has done in the past) by both counting fish and making specific catch recommendations, the IPHC staff provided a decision-making framework which clearly illuminated the science-policy divide. It began to provide its Commissioners with harvest choices and the requisite consequences, and left harvest decision-making to them.

Pacific halibut is tasty served dressed up as shown here, or barbequed in the backyard. Photo by Ed Henry.

Culinary preparation: Moonstone Grill (Trinidad, CA): Pan-Seared Halibut With roasted garlic risotto, asparagus, red bell peppers and beurre blanc

The IPHC maintains a halibut recipe page on its website, but most often its marine biologists tend to focus on the health of the living resource. Fishers who drop longlines in inclement weather are mostly intent on getting their product onto ice and off to market in as fresh a state as possible. Consumers obsess primarily on the end product—how fresh that filet in the fishmonger's window looks, or how good that precious morsel of Pacific halibut tastes after it was hurried from a restaurant sauté pan to their table. With that in mind, in the margins of this report are included menu descriptions from fine restaurants all across the geographic range of the Pacific halibut, beginning with two from the farthest reaches of that range—Aleutian Alaska and northern California.

Director's Report

After being in existence for 90 years, the Commission has entered a period of significant changes. Perhaps the most important of these changes is the new approach to the provision of advice on catch limits from the staff to the Commission and the industry. Many industry participants are accustomed to the staff providing specific catch limit recommendations rather than the table of risks and potential benefits that we are now presenting. Some felt the Commission and staff should return to the previous format because the recommendations were scientifically based and adhered to the harvest policy. While we understand the desire to have the staff utilize its expertise in its recommendations, it is important to realize that the staff does not make decisions on catch limits – that is the rightful duty of the Commissioners. To do so, the Commissioners must consider a range of options for catch limits and the potential consequences for the industry and the halibut resource, while considering biological, economic, and social factors. The risk-benefit decision table for catch limit choices that is now presented by the staff actually employs the staff scientific expertise much more fully than the previous format because it provides the best estimate of consequences to the stock and future catch limits based on the various decisions that the Commission may make. It is the staff's role to help inform those decisions and, in this sense, the entire risk-benefit table is the staff advice.

Closely allied with the new decision-making format for the Commission is the development of a Management Strategy Evaluation (MSE) with the help of

Bruce is pictured here with Rob Tournier, captain of the *F/V Star Wars II*, during a visit to Port Hardy, B.C. Photo by Kirsten MacTavish.

the Management Strategy Advisory Board (MSAB). The MSAB is composed of 23 people from the harvesting, processing, recreational, subsistence, and management realms. Defining operational objectives for this fishery is a critical component of the MSE process as it ultimately exposes the key tradeoffs between maintaining long-term productive capacity of the stock and economic sustainability for all halibut user groups. Input from MSAB members will shape this investigation and aid in defining the performance metrics to examine when considering alternative management procedures that could include: alternative apportionment schemes, alternative assessment models, frequency and timeliness of assessments and/or assessment data, changes in minimum size limits, or changes to regulatory area target harvest rates, to name but a few. We'll also solicit ideas on alternative practicable management procedures to test.

During 2013, the MSAB developed a working set of management objectives and performance metrics. The objectives fall under the broad umbrella of biological sustainability, fishery sustainability and stability, assurance of access, minimizing bycatch mortality, and serving consumer needs. The staff is developing a suite of tools with which to evaluate these objectives with the first oriented to a coastwide model and subsequent development models that incorporate some understanding of halibut movement and specific area characteristics. We anticipate that this process will span the next several years and also become a background test bed for new ideas that arise in the future.

Our new Scientific Review Board also kicked off its activities in 2013. This body of external scientific experts reviewed and endorsed our stock assessment and apportionment procedures, while supplying valuable advice on improvements and alternative approaches.

The Commission also completed the process of making our meetings more open and available to the public via interactive webcasting of Commission sessions at our Annual and Interim meetings, as well as the MSAB meetings. Recordings of these meetings are archived on the Commission website.

And we're not finished with change! The Commission has directed the staff to develop a new approach to how we deal with all components of mortality in the determination of catch limits from the stock. We have incorporated all sources of mortality in our stock assessments for decades but some sources of mortality (e.g., directed fishery removals) enter into the catch limit calculation, while others (e.g., bycatch of fish under the legal size limit) are embedded in the harvest policy, rather than directly in catch limit determination. This approach promises to be both technically challenging and thought-provoking, so stay tuned!

Bruce M. Leaman
Executive Director

Activities of the Commission

The International Pacific Halibut Commission (IPHC) meets several times a year, in both formal and informal capacities to consider matters relevant to the halibut stock, the fisheries, and governance.

The 2013 Annual Meeting occurred 90 years after the formation of the IPHC in 1923.

Annual Meeting 2013

The IPHC held its 89th Annual Meeting in Victoria, British Columbia, from January 21 through 25. Mr. Michael Pearson of Canada presided as Chair and Dr. James Balsiger of the U.S. presided as Vice-chair. Besides taking action on a wide range of regulatory issues, 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 2013.

Catch limits and dates for 2013

The IPHC adopted biologically based catch limits for all individual regulatory areas (and for Area 4CDE combined). It recommended to the governments of Canada and the United States that the total coastwide catch limit for 2013 should be 31,028,000 pounds, a 7.5% decrease from the 2012 catch limit of 33,540,000 pounds. The limit was divided into regulatory areas as follows:

- Area 2A 990,000 pounds
- Area 2B 7,038,000 pounds
- Area 2C 2,970,000 pounds
- Area 3A 11,030,000 pounds
- Area 3B 4,290,000 pounds

The F/V *Polaris* was built in 1913 and is still fishing halibut today. Photo by Tracee Geernaert.

- Area 4A 1,330,000 pounds
- Area 4B 1,450,000 pounds
- Area 4C 859,000 pounds
- Area 4D 859,000 pounds
- Area 4E 212,000 pounds

The Pacific Fishery Management Council (PFMC) further allocated the catch limit to user groups in Washington, Oregon, and California. For Canada, the Department of Fisheries and Oceans (DFO) allocated the catch to sport and commercial users in Area 2B. Lastly, the North Pacific Fishery Management Council (NPFMC) allocated the combined 4CDE limit to individual catch limits for each area (Area 4C, 4D, and 4E). Catch limits, commercial halibut catch and related information for each regulatory area are explained further in the *Commercial fishery* section of this report and in Appendix 1. Information regarding the sport catch can be found in the *Sport fishery* section and in Appendix II.

The 2013 Alaska and British Columbia commercial season was designated to open coastwide at noon local time on Saturday, March 23, 2013 and to close at noon local time on Thursday, November 7, 2013. In order to provide more time for its staff to conduct the stock assessment prior to its Interim Meeting, the Commission chose the same closing date as in 2012. The Area 2A Treaty tribal and non-tribal commercial fishery seasons all fell within these season dates, and are listed under the *Commercial fishery* section.

Culinary preparation: The Book Bindery (Seattle, WA): Pan roasted Alaskan Halibut with artichokes, spring garlic, charred tomato broth and a rouille crouton.

2013 regulatory issues

Control of charter harvest in Area 2C

The Commission received a request from the NPFMC to continue from 2012 the Commission's existing one-fish bag limit with a reverse-slot limit length restriction (≤45 in or ≥ 68 in, head on). This proposal was intended to keep the removals by the charter fishery within the NPFMC's Guideline Harvest Level (GHL) for Area 2C. In addition, the entire carcass had to be retained on board the vessel until all fish were offloaded. To accommodate the NPFMC request, the Commission took no action, leaving the existing reverse slot limit regulation for charter halibut fishing in Area 2C for 2013.

Sport fishery management

The Commission forwarded proposals for developing an Alaska sport harvest ticket and an Oregon charter tag to the respective state agencies for their consideration, since these proposals should be appropriately considered by those agencies.

Performance Review

The Commission reviewed the recommendations of the 2012 Performance Review, as well as responses and advice of various stakeholders. It had already taken action on several recommendations concerning increased openness and transparency in Commission meetings and operations. Action on other recommendations will be incorporated into ongoing work to improve the Commission's procedures and processes, including the development of scientific advice, planning and review of research, and operation of the advisory bodies. The Performance Review final report can be found on the IPHC website.

Other non-regulatory decisions

1) The proposal to designate circle hooks as the only legal gear for directed fisheries was not approved, due to several potential difficulties with such a regulation. However, since the Commission is anxious to reduce mortality of fish, IPHC Staff were instructed to conduct outreach on the merits of circle versus other hooks.

2) The proposal to allow preserved fish on board sport fishing vessels in Alaska was not approved, due to enforcement issues. IPHC Staff were instructed to continue working on a solution.

3) The proposal for careful release in all fisheries was not approved, but it was recognized as having some merit. It was noted that the commercial fishery already has careful release requirements, but IPHC Staff will work with enforcement over the next year to consider wording of a regulation that could be put into place for the sport fishery.

The Commission approved the formation of the MSAB and SRB - two advisory bodies that will help bring together expertise from industry, science, and fisheries management to help strengthen the Pacific halibut management process.

4) The proposal to establish abundance-based management for all removals (U32, those fish under the 32 inch commercial size limit and O32, those fish over the commercial size limit) was referred to the Management Strategy Advisory Board (MSAB) for consideration as part of the Management Strategy Evaluation (MSE).

5) Regarding the proposal for a hook mortality study, it was noted that IPHC Staff has been working with Alaska Department of Fish and Game (ADF&G) staff on this issue and have accomplished a considerable amount. They will continue to work with ADF&G and will communicate progress to those who proposed this study.

6) Regarding the request to include Puget Sound and the Strait of Juan de Fuca in the setline survey, and also include those results in the stock assessment, it was noted that IPHC Staff has worked with the proponents on this in the past. The Commission instructed IPHC staff to continue to work with stakeholders, and to gain an understanding of how often this survey should take place.

7) The proposal suggesting that Prince William Sound be closed to longline fishing, or have separate harvest quotas from the larger Area 3A, was referred to the NPFMC. The Commission agreed to communicate with the NPFMC stating that they had considered the issue.

Management Strategy Advisory Board and Scientific Review Board

The Commission approved the formation of the MSAB and the Scientific Review Board (SRB), and will continue to develop terms of reference for the two. The MSAB advises the Commission on the development and evaluation of candidate objectives and strategies for managing the halibut resource. This is a cross-disciplinary group, with representatives from industry, science, fisheries management, and IPHC staff. The Commission accepted nominations for the MSAB and finalized membership by March 2013. The first meeting was held in late spring.

The SRB fulfills the need for ongoing scientific peer review of the stock assessment, harvest advice, and research. The SRB is a small technical body of members invited by the Commission, and began work in 2013.

The two new advisory bodies are dedicated to particular organizational needs and are complementary to the existing advisory structure. They do not replace the functions of the Conference Board (CB), Processor Advisory Group

Commissioners gathered at the IPHC headquarters in Seattle for the Interim Meeting. The meeting was webcast to enhance public participation. Photo by Tracee Geernaert.

(PAG), or Research Advisory Board (RAB) but will work with them in advising the Commission.

Halibut bycatch

The Commission expressed continued concern about the losses in both yield and spawning biomass due to halibut mortality in non-directed fisheries. Significant progress in reducing this bycatch was achieved in Areas 2A and 2B, using individual bycatch quotas for vessels in some fisheries. Reductions in bycatch also occurred in Alaska, and new measures aimed at improving bycatch estimation began in 2013.

The Bycatch Project Team report outlined progress on its four project objectives: 1) quantifying bycatch, 2) documenting impacts to the fishery and resource, 3) exploring options to mitigate impacts, and 4) identifying options to reduce bycatch. Next steps include: 1) refinement of immediate options, 2) discussion of longer-term options, 3) completion of a report by summer 2013, and 4) production of an implementation plan for agreed-upon strategies.

Jamie Nightingale from British Columbia was awarded the 2013 IPHC Merit Scholarship.

IPHC Merit Scholarship

The IPHC honored Jamie Nightingale of Delta, British Columbia as the eleventh recipient of the IPHC Merit Scholarship. Jamie was presented with a $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.

Interim Meeting December 2013

The IPHC held its 2013 Interim Meeting on December 4th and 5th in Seattle, Washington. It was an occasion to prepare for the Annual Meeting one month later. The Commissioners and the public were able to hear IPHC Staff presentations on topics including a review of the 2013 fisheries, the stock assessment, biomass apportionment and harvest policy application, the Management Strategy Evaluation (MSE) framework, the proposed research plan, an outline of the proposed setline survey expansion, regulatory proposals, and research results.

The meeting also provided a preliminary look at the 2014 harvest decision table and what it might mean. The Halibut Bycatch Work Group II report was presented. This was the first meeting that implemented recommendations from the 2012 Performance Review, and for the first time, the entire meeting (with the exception of the Finance and Administration session) was webcast to allow a more open process for the public. The Interim Meeting also enabled the IPHC to revisit any remaining action items from the 2013 Annual Meeting and the Commissioners Work Meeting (held in September).

The IPHC now has a presence on social media with both Facebook and Twitter pages.

IPHC Budget

The IPHC is funded jointly by the U.S. and Canadian governments. For fiscal year 2013, the U.S. appropriated $4.172 million to the IPHC which included funding earmarked for pension deficits and the IPHC headquarters lease. Canada appropriated $848,720 and provided an additional payment of $98,400 to cover pension deficits, similar to that provided in the U.S. appropriations.

In 2013, the IPHC launched a Facebook page in an effort to keep the public informed of staff research and activities.

IPHC REGULATORY AREAS FOR 2013

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. For a quick overview, refer to the map on the inside front cover of this report.

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. It is more precisely described as "all waters in the Bering Sea north of 55°00'00" N. latitude in Isanotski Strait that are enclosed by a line from Cape Sarichef Light (54°36'00" N. latitude, 164°55'42" W. longitude) to a point at 56°20'00" N. latitude, 168°30'00" W. longitude; thence to a point at 58°21'25" N. latitude, 163°00'00" W. longitude; thence to Strogonof Point (56°53'18" N. latitude, 158°50'37" W. longitude); and then along the northern coasts of the Alaska Peninsula and Unimak Island to the point of origin at Cape Sarichef Light." Furthermore, all waters in Isanotski Strait between 55°00'00" N. latitude and 54°49'00" N. latitude are closed to halibut fishing."

The bottom area that makes up Pacific halibut habitat is 396,608 square nautical miles, which translates to 525,225 square miles. That is slightly more than the area of the Northwest Territories, and just under the combined areas of Washington, Oregon, Idaho, Nevada and California. It is also 0.37% 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).

COMMERCIAL FISHERY

The Oscar and Hattie landed halibut for sale 125 years ago and the commercial fishery remains strong today.

On the side of the James Farley Post Office building in New York City one can find this famous inscription: "Neither snow nor rain nor heat nor gloom of night stays these couriers from the swift completion of their appointed rounds." It could also be used to describe the life of a commercial halibut fisher during fishing season. It takes a lot of hours in all kinds of weather, and many thousands of baited hooks to bring in the millions of pounds of halibut eaten by consumers each year.

The commercial halibut fleet (including those vessels used for the IPHC research catch) pulled in 29,043,000 pounds in 2013, down 9.2% from the 31,989,000 pounds caught in 2012. See Appendix I for more information.

Seasons

As mentioned in the *Activities of the Commission* chapter, during the 2013 Annual Meeting, regulations were adopted that governed the 2013 fishing season. These included the opening and closing dates of the season, catch limits, licensing and other regulations. The regulations were approved by the Canadian and United States governments, with one exception. Since 1999, the Canadian government has allowed the landing of live halibut caught in British Columbia waters by choosing not to approve the regulation that required commercially-caught halibut to have their gills and entrails removed before being offloaded from a vessel.

IPHC port sampler, Darlene Haugen, samples a commercial catch landed in Prince Rupert, B.C. Photo by Kirsten MacTavish.

The 2013 Area 2B Individual Quota Fishery (IVQ) fishery, and the Areas 2C, 3A, 3B, 4A, 4B, 4C, 4D, and 4E Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) fisheries commercial fishing season opened at noon local time on March 23, 2013 (a Saturday) and closed at noon local time on November 7, 2013 (a Thursday). Seven 10-hour fishing periods for the non-treaty directed commercial fishery were adopted in Area 2A: June 26, July 10, July 24, August 7, August 21, September 4, and September 18, 2013. All one-day fishing periods were to begin at 8:00 AM and end at 6:00 PM local time, were further restricted by fishing period limits, and the fishery was to close when the commercial allocation was estimated to have been reached. The Area 2A incidental commercial and tribal fishery dates are explained below in the landing section.

Licensing, catch limits, and landings

The coastwide commercial catch of 28,440,000 pounds in 2013 was less than the limit of 29,497,700 pounds by 1,057,700 pounds. Catch limit, as referred to in this report, is the IPHC catch limit set by the Commission at the Annual Meeting. The adjusted catch limit represents the IPHC catch limit with adjustments from the underage and overage programs from the previous year's quota share program. In Area 2B, it also included the relinquishment of quota and quota leasing programs among sectors. In Areas 4C, 4D, and 4E, the NPFMC Catch Sharing Plan (CSP) and IPHC regulations allowed the Area 4D CDQ to be harvested in Area 4D or 4E, and the Area 4C IFQ and CDQ to be harvested in Area 4C or 4D.

NWIFC (Northwest Indian Fisheries Commission) is a support service organization for 20 treaty tribes in western Washington that provides direct services to tribes in areas such as biometrics, fish health, and salmon management. It also provides a forum for tribes to address shared natural resources, management issues, and enables the tribes to speak with a unified voice in Washington, D.C.

Landings

Pacific halibut are not considered "landed" until they have been offloaded from the vessel to a port for processing. The data sources for the landings were the IPHC, National Marine Fisheries Service (NMFS), DFO, Washington treaty Indian tribal fisheries management departments (including the NWIFC, and the Makah, Lummi, Jamestown, Swinomish, Port Gamble, Quileute and Quinault Indian tribes) and state agencies including the Washington Department of Fish and Wildlife (WDFW), the Oregon Department of Fish and Wildlife (ODFW) and the California Department of Fish and Wildlife (CDFW). The last agency was known formerly as the California Department of Fish and Game.

Area 2A (California, Oregon, and Washington)

The directed fishery in Area 2A which takes place South of Point Chehalis, Washington caught 165,000 pounds of halibut in 2013, 5% under the catch limit of 173,390 pounds. This was accomplished in two 10-hour fishing periods, with 101,000 pounds taken during the first period (June 26) and 64,000 pounds on the second (July 10). Each H-class vessel (56 feet or longer) was allowed a limit of 9,000 pounds for June 26 and 3,000 pounds for July 10, small vessel classes receiving less poundage accordingly. As the limit was estimated to have been reached after only two days, the remaining fishing days—July 24, August 7, August 21, September 4, and September 18—were cancelled.

The IPHC issued 609 total vessel licenses for Area 2A, of which the directed commercial halibut fishery and the sablefish fishery received 149 licenses (28 less than in 2012). In addition, 333 (22 more than in 2012) licenses went to the

salmon troll fishery for retaining incidental halibut caught, and 127 licenses (four less than in 2012) went to sport charter vessels.

The fixed gear, limited-entry sablefish fishery, north of Point Chehalis, Washington, retained 15,000 pounds of incidentally caught halibut (30% under the catch limit of 21,410 pounds) from May 1 through October 31 (the end of sablefish season). The allowable landing ratio was 75 pounds of halibut per 1,000 net pounds of sablefish and up to two additional halibut in excess of the ratio limit.

In Area 2A the commercial fishery is regulated according to vessel hours as well as limits per vessel size. Not knowing in real time the number of boats participating can readily lead to overfishing, so this method works as an alternative.

The salmon troll fishery retained 30,000 pounds of incidentally caught halibut (2% under the catch limit of 30,600 pounds) from May 1 through August 10. The allowable landing ratio was one halibut per three Chinook salmon, plus an extra halibut per landing, with the total number of halibut per vessel not allowed to exceed fifteen. With the goal of extending the fishing opportunity through the summer, on August 1 the trip maximum was changed to no more than five halibut per trip.

The total treaty Indian commercial catch for Area 2A-1 was 315,000 pounds of halibut (slightly over the catch limit of 314,300 pounds). The treaty Indian tribes managed the commercial catch by allocating 75% to an open access fishery, and the remaining 25% to a restricted fishery with daily and vessel catch limits. The single open access fishery occurred between March 23 and 25, with 223,000 pounds of halibut landed. The five restricted fisheries consisted of two 36-hour openings (April 3-4 and April 15-16) and three 12-hour openings (May 8, June 6 and July 13). The former had 500-pound limits per vessel per day, and pulled in 75,000 pounds of halibut. The latter had limits of 150 pounds for May 8, and 200 pounds each for the June 6 and July 13 openings, and pulled in 10,000 pounds of halibut. One special fishery was held from July 20 through August 3, for the "Paddle to Quinault" celebration. Each vessel was limited to 1,000 pounds of halibut, and a total of 8,000 pounds was landed.

Area 2B (British Columbia)

The IVQ fisheries of British Columbia caught 5,951,000 pounds of halibut (less than 1% under the catch limit of 5,957,550 pounds) between March 23 and November 7. Since 2006, the halibut IVQ fishery is part of the Groundfish Integrated Fisheries Management Plan (IFMP). It was implemented to meet conservation needs, including addressing rockfish conservation concerns and improving catch monitoring. It includes quota shares on all hook-and-line groundfish fisheries, limited transferability between license holders, and 100% monitoring.

Culinary preparation:
Vista 18
(Victoria, BC):
Pacific Northwest
Halibut Cheek
With tomato dust, confit fingerling potato, arugula salad & onion soubise

Halibut was landed by 236 active licenses, of which 154 were halibut licenses and 82 were licenses from other groundfish fisheries. Each halibut vessel was allocated by the DFO a fixed poundage of halibut for the season, which comprised their "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, and eligibility had to be designated to a specific commercially registered fishing vessel.

Alaska—Quota share fisheries

The total halibut catch from the IFQ/CDQ fishery for Alaskan waters was 21,963,000 pounds in 2013, 5% under the catch limit of 23,000,000 pounds and nearly 12% less than the 24,829,000 pounds caught in 2012. This catch amount

Port sampler, Bryna Mills, enjoys clear skies in Sand Point, AK. Photo by Lara Erikson.

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 2,528 people receiving IFQs from the NMFS Restricted Access Management (RAM) program in 2013.

By regulatory area, the Alaskan quota share commercial fisheries were under their catch limits in 2013. Areas 2C and 3A were under the limit by 2%. Areas 3B, 4A, and 4B were under the limit by 7%, 9%, and 16%, respectively. Under the NPFMC CSP, Area 4CDE's commercial catch of 1,759,000 pounds was 9% under the combined area catch limit of 1,930,000 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. Bureau of Indian Affairs to conduct a commercial halibut fishery within the Reserve. The community ran ten two-day openings between April 19 and September 8 for a total catch of 54,990 pounds (11% more than the 48,987 pounds caught in 2012), an amount that was included in the Area 2C commercial catch.

Landing patterns

Alaska accounted for approximately 77% of the total commercial catch. Area 3A landed more halibut in 2013 than any other regulatory area, with about

Commercial catch sampling occurred in 14 ports, plus several treaty Indian locations in Washington state. For the Area 2A non-treaty commercial fisheries, there were no sampling ports in California, one in Oregon (Newport), and one in Washington state (Bellingham). British Columbia had three ports with samplers: Vancouver, Port Hardy, and Prince Rupert. Alaska had the remaining nine ports: Petersburg, Sitka, Juneau, Seward, Homer, Kodiak, Dutch Harbor, Sand Point, and St. Paul.

49% of the Alaskan commercial catch landed in three ports. Homer received 4,429,000 pounds (20%), Kodiak accounted for 3,395,000 pounds (15%), and Seward took in 2,756,000 pounds (13%). For ports in Area 2C, Sitka landed the most fish, at 1,200,000 pounds, followed by Juneau at 1,146,000 pounds and Petersburg (including Kake) at 1,045,000 pounds, with each port taking around 5% of the Alaskan total.

Area 2B halibut were landed in ten different ports on the British Columbia coast, though 88% of the fish came from just two ports. Port Hardy (including Coal Harbour and Port McNeill) led the Area 2B standings with 3,045,000 pounds (51% of the BC total). Prince Rupert/Port Edward took in 2,192,000 pounds (37%). In the past, Vancouver typically held third place for halibut landings, but its volume decreased by 38% in 2013, and Ucluelet took third place with 326,500 pounds (5%).

Culinary preparation: Georgie's Beachside Grill (Newport, OR): Parmesan & Parsley Encrusted Halibut Six-ounce halibut fillet baked to a golden brown and topped with a creamy bay shrimp sauce

The Quota Share (QS) landings were spread between March and November of 2013. The most productive month for Alaskan landings was May, followed by June (both 17%), and August (15%). In British Columbia, August and July were the most productive months (17% each). After this, the volumes in the remaining months dropped off rapidly. 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 4,437 pounds, a 13% increase from the amount caught in 2012 (3,938 pounds) and more than three times the historical low of 1,026 pounds from 2011. For context, the high in live landings was 103,000 pounds in 1999.

Commercial catch sampling

One of the most important ways that the IPHC collected data on Pacific halibut in 2013 was sampling of the commercial catch. This involved IPHC samplers stationed in halibut ports coastwide collecting otoliths and tags, and recording halibut lengths, logbook information, and final landing weights. In Area 2A, the ports staffed by IPHC samplers included Newport (Oregon), Bellingham (Washington), and several smaller treaty Indian ports in Washington state. In Area 2B, Port Hardy, Prince Rupert, and Vancouver were staffed. In Alaska, nine ports were staffed, including Petersburg, Sitka and Juneau in Area 2C; Seward, Homer, and Kodiak in Area 3A; Sand Point in Area 3B; Dutch Harbor in Area 4A; and St. Paul in Area 4C. Vessels travel to multiple regulatory areas and are not limited to where they may land their catch such that all areas landed are sampled by staff stationed in the listed ports.

Great care was taken to ensure that the sampling protocols were representative of the entire catch, including the ports chosen for sampling, the days on which sampling occurred, and the percentage of fish sampled. These protocols differed at times from port to port, in order to achieve greater sampling representation.

Otoliths

The target number for total otoliths to be collected in 2013 was 11,500, with 11,378 otoliths collected, by sampling 35% of the catch in 768 sampled landings. The target number for otoliths in Areas 2B, 2C, 3A, 3B, 4A, and the combined number for Area 4CD was 1,500 ± 500. Although there was some fluctuation around the target number, collections from all areas were within the acceptable

range. In British Columbia, samplers took in 1,122 otoliths. Samplers in ports receiving Alaskan catch collected 9,194 otoliths: 1,907 (Area 2C), 1,564 (Area 3A), 1,496 (Area 3B), 1,523 (Area 4A), 1,304 (Area 4B), and 1,400 (Area 4CD).

In Area 2A, the otolith target number was 1,000 ± 500, with 650 expected from the treaty Indian fishery (Area 2A-1) and the remaining 350 from the directed commercial catch and the incidental retention of halibut in the sablefish fishery (Area 2A). Overall, this goal was met, with 1,058 otoliths taken. However, Area 2A-1 took only 643 of the hoped-for 650 (though it fell within the acceptable range), while Area 2A took 415 otoliths.

Separate from these, otoliths were also collected for the Clean Otolith Archive Collection (COAC). The COAC is supplied primarily by the Standardized Stock Assessment (SSA) survey. However, in 2013, the SSA sampling rate in Areas 2A, 4B, and 4CD was 100%, so samples from the commercial fleet were collected. To that end, 100 otoliths per area were targeted for collection. The actual collection amounted to 163 COAC otoliths in Area 2A, 133 in Area 4B, and 100 in Area 4CD.

IPHC port sampler, Dave Jackson, gathers log information in Kodiak, AK. Photo by Lara Erikson.

Fork length — length from the tip of the snout to the end of the middle caudal fin rays (the fork in the tail fin).

Net weight — the weight of caught halibut that is without gills and entrails, head-off, washed, and without ice and slime.

Logbooks

Logbooks were another focus of IPHC samplers. A total of 3,571 logbooks were collected from key ports (ports with an IPHC sampler presence), for a total of 4,603 logbooks from all ports in 2013. Of the latter number, 3,980 (86%) were collected from U.S. ports and 623 (14%) were collected from Canadian ports.

Tags

Samplers collected 20 halibut tags in 2013, from various research studies. Twelve tags came from a 2013 archival tags project; five came from a 2010 Aleutian Islands wire tags project; one came from a 2008 archival tags project; and two sport tags were recovered (one from 1998 and the other from 2009).

Electronic data collection

Current port sampling techniques are recorded primarily in the way they have been done for decades—with paper and pencil. With the advent of ruggedized computing, the IPHC has been experimenting with computerized

data collection. The eventual goal is to have an electronic tablet in each Alaskan port and in Bellingham, Washington. Fishing data from paper logbooks would be entered into a remote data entry (RDE) application. This type of data collection and management will result in transmission of data to research scientists more quickly, allowing greater precision, better verification, and more time for data analysis.

During most of 2013, the RDE tablets were tested in the IPHC headquarters. Toward the end of the fishing season, tablets were sent to Petersburg, Sitka, Juneau, Homer, and Seward for testing and modification, where samplers entered data from both official logs and test logs. In 2014, the project will be expanded to all Alaskan ports and Bellingham, Washington.

Culinary preparation: Olive and Anchor (Vancouver, BC): Pan Roasted Halibut Filet With lemon-caper butter sauce, roasted red pepper, Yukon gold mashed potato, seasonal vegetables and crispy lotus root

Age distribution of halibut in the commercial fishery

In 2013 port samplers collected a total of 11,378 market sample otoliths for stock assessment. Only 11,039 of them were usable, with 31 otolith pairs not aged due to subsampling, and 304 not usable due to being broken, crystallized, or right-sided. Furthermore, 396 otolith pairs (additional to the total) were collected for the COAC, and were not counted in these numbers.

Plant workers sort and clean the commercially landed halibut catch. Photo by Lara Erikson.

Of the 11,039 commercially caught halibut that were sampled in ports during 2013, eleven-year-olds from the 2002 class were the most abundant (1,629 fish at 14.8% of the total). The most abundant grouping was eleven-to-fourteen year-olds, which comprised 55.5% of the total (6,124 fish).

Grouping by age, the youngest and oldest halibut in the commercial samples were six years and 48 years, respectively. Ten six-year-old fish were caught: three from Area 2B measuring between 84 and 96 cm in length, two from Area 2C measuring between 86 and 87 cm, and one each from Areas 3A, 3B, 4A, 4C, and 4D, measuring between 83 and 114 centimeters. The 48-year-old fish was captured in Area 4A and had a fork length of 124 centimeters. The largest halibut caught in the commercial samples was a 216 cm fish from Area 2C, which was 34 years old.

Length-weight pilot project

The length-weight pilot project was launched in 2013, with the purpose of collecting data for estimating the relationship between fork length and net weight. This included the mathematic adjustments required to convert head-on weight to net weight. The current method was initiated in 1926 and re-estimated in 1989. The relationship between fork length and net weight possibly varies both regionally and seasonally, therefore this is being investigated to ensure there is no systematic bias among regulatory areas.

This project collected data coastwide, throughout the season, in order to better estimate the geographic and seasonal variations that existed in the length to weight relationship. This 2013 pilot phase of the project, in which 813 halibut were measured and weighed, occurred in Bellingham (WA), Port Hardy (BC), Prince Rupert (BC), and the Alaskan ports of Petersburg, Sitka, Juneau, Seward, and Homer. In 2014, the intent is for the collection to occur throughout the season in all ports staffed with IPHC samplers.

HARM reduction pilot project

The Halibut Angler Release Mortality (HARM) reduction project, though not an IPHC project, was assisted by the IPHC port sampling program in 2013. As charter fishing anglers encounter more restrictive halibut regulations, they will be forced to release more fish than they have in the past. The HARM project aims to reduce handling injuries and release times by enabling anglers to measure a fish while still in the water, using a smartphone application.

The HARM project was assisted by IPHC port samplers in 2013. This program aims to reduce halibut handling injuries incurred by fish that are not kept during sport charter fishing.

Sport fishery

The IPHC estimated the sport harvest of Pacific halibut in 2013 to be 6.716 million pounds, a 2.2% decrease from the 6.87 million pounds caught in 2012, and nearly 38% less than the all-time high of 10.86 million pounds caught in 2005. The regulations for catching halibut varied substantially among the regulatory areas, to better serve the welfare of the halibut fishery in each area. The IPHC relied on state and federal agencies to assemble the sport estimates.

Are there halibut in Iowa? There are now. Gene Jones of Bellevue, Iowa won the $21,281 grand prize in the Homer Jackpot Halibut Derby by hauling in a 236.2-pound Pacific halibut on July 25, 2013. He caught the beast on the Central Charters boat "Grand Aleutian" skippered by David Bayes. Although this fish was the best of the season, it still falls short of the sport fishing record: a 459-pound halibut caught near Unalaska, Alaska in 1996.

Area 2A (California, Oregon, and Washington)

Area 2A sport fishers pulled in 507,044 pounds of Pacific halibut, which was 88,944 pounds (21%) over the 418,100-pound allocation. The allocation was 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 (191,980 pounds), and Southern Oregon/California (6,063 pounds). Sport fishing trends in 2013 essentially mirrored past years, with the halibut catch dependent on the availability of salmon or albacore tuna. Also, the number of days that each subarea was open varied widely (between one and 184 days), depending on conditions. Three of the subareas were estimated to be within 2% of the allocated amount, and the Columbia River subarea was 45% under the allocation. The two areas without inseason management were the areas with the largest overages: Oregon (south of Humbug Mountain, at 42°40' 43") and California caught a remarkable 56,209 pounds, 50,146 pounds (828%) over the allocation, and WA inside waters harvest was close to 100,000 pounds, 42,549 pounds or 74% over the allocation. Area 2A estimates were provided by WDFW, ODFW, and CDFW.

In other sport fishery management news, the PFMC (in its November 2013 meeting) decided to make a change in how the subareas of Area 2A were defined.

These sport fishers proudly display their catch in Homer, AK. Photo by Tracee Geernaert.

Starting in the 2014 season, the "South of Humbug" subarea (which included all of California and the portion of Oregon up to Humbug Mountain) is to be divided at the California/Oregon border. Where there used to be one subarea, now there will be a California subarea and an Oregon South Coast subarea. Each area will receive its own allocation for its fisheries.

Area 2B (British Columbia)

DFO estimated that the 2013 Area 2B sport harvest totaled 822,000 pounds. This harvest was 258,000 pounds (23%) under the 2013 allocation of 1,080,000 pounds, and 334,000 pounds (28.9%) under the 2012 catch of 1,156,000 pounds. The catch plan announced by the DFO in February 2012, and continued in 2013, allocated 85% of the catch limit to the commercial fishery and 15% to the sport fishery.

DFO also implemented four restrictions in 2013 to slow the rate at which fish were caught, with the intent of lengthening the season. First, a length restriction (effective on April 1, 2013) mandated that the one fish allowed in the daily limit must not be larger than 126 cm (50 inches) in total length. Second, the possession limit was two halibut, of which one had to be smaller than 83 cm (32.7 inches). Third, the DFO enacted an annual limit of six halibut per angler. Fourth was the prohibition of halibut retention in DFO Area 121 (waters off the southwestern coast of Vancouver Island) seaward from 12 nautical miles. The DFO estimated its numbers from a combination of aircraft overflights, on-water vessel counts, creel sampling, and lodge logbooks (which have largely not been validated).

Guideline Harvest Level is a benchmark harvest level for participants in the charter halibut fishery in Regulatory Areas 2C and 3A. GHLs are dependent on the Constant Exploitation Yield (CEY) levels in each area.

Areas 2C, 3, and 4 (Alaska)

The sport fishery in Areas 2C and 3A are divided into the charter (guided) and private (unguided) categories. The total sport harvest in Area 2C was estimated to be (a preliminary) 1,627,000 pounds, an increase of 44,000 pounds (2.7%) from the 1,583,000 pounds caught in 2012. Of the total catch, private boats accounted for 904,000 pounds (55.6%) and charter boats pulled in 723,000 pounds (44.4%), which was lower than the GHL of 788,000 pounds. The GHL was developed by the NPFMC to manage the guided harvest, to make it increase or decrease in tandem with halibut abundance. Following a recommendation by the NPFMC, the IPHC enacted a reverse slot limit for charter fishing in Area 2C. It allowed for the retention of halibut $\leq$ 45 inches or $\geq$ 68 inches in total length, meaning that fish between those lengths were released. The NMFS imposed several restrictions on charter boat anglers, some of which were new and others continuing. Anglers could only use one fishing line, and no more than six lines were allowed on any charter vessel fishing for halibut. None of the charter crew was allowed to catch or retain halibut during charter fishing trips. The names and fishing license numbers of anglers had to be recorded in charter logbooks. Finally, anglers retaining halibut had to sign the logbook at the end of each fishing trip.

In Area 3A, the total estimated sport catch was 3,715,000 pounds, an increase of 89,000 pounds (2.4%) from the 3,626,000 pounds caught in 2012. Charter boats caught 2,271,000 pounds (61.1%) of the total, which was 463,000

Culinary preparation: Marx Brothers Cafe (Anchorage, AK): Neapolitan Seafood Mousse Layers of Maine lobster, smoked salmon and smoked halibut served with toast points, red onion gremolata and American caviar

pounds (16.9%) under the GHL of 2,734,000 pounds. Private boats caught 1,444,000 pounds (38.9%). The catch regulations in Area 3A did not change in 2013—its bag limit of two fish with no size restrictions continued, along with no prohibition on halibut harvest by the boat crew.

Sport fishing in Area 3B and Area 4 was far less common than in other parts of Alaska, due to the relative remoteness of the ports. For Area 3B, there was an estimated catch of 20,000 pounds, a decline of 2,000 pounds from the 22,000 pounds caught in 2012. For Area 4, the estimated catch was 25,000 pounds, a decline of 3,000 pounds from the 28,000 pounds caught in 2012. Estimates from these areas may be problematic in that the results relied on the numerical fish count from ADF&G's Statewide Harvest Survey, from which the IPHC estimates weight by applying the average weight of fish landed in Kodiak. On the positive side, the small amount of halibut caught was unlikely to skew the overall results very much.

The IPHC was concerned that the new reverse slot limit and size limit programs implemented recently would lead to greater numbers of halibut discard mortality. It requested in March 2012 that all agencies involved with the management of recreational halibut fishing develop data collection programs to better count the level of discard mortality. Agency budgetary restraints have deterred this collection of information to a large degree. The ADF&G supplied preliminary mortality data for 2013, and the IPHC are looking into expanding this information to the other regulatory areas.

Incidental mortality of halibut in the commercial fishery (wastage)

Pacific halibut may be "removed" from their biomass in several ways: commercial landings, sport catch, personal use (ceremonial and subsistence), bycatch mortality from other fisheries, and mortality in commercial halibut fisheries. Wastage in the commercial fishery includes the mortality of all halibut that do not become part of the landed catch.

In 2013 a total of 1,429,000 pounds of Pacific halibut died from incidental mortality (a.k.a. "wastage") in the coastwide commercial fishery, less than the 1,666,000 pounds in 2012. Prior to 2013, U32 halibut that died from lost fishing gear and those discarded for regulatory reasons had not been estimated. In order to standardize the treatment of all removals, that was updated in 2013. With this inclusion, there are now three main categories of such mortality: 1) fish that are estimated to die on lost or abandoned fishing gear; 2) fish that are captured and discarded because they are U32; and 3) fish that are discarded for regulatory reasons (such as a vessel limit being exceeded). Each of these categories contains different mortality information and so requires different methods to account for it.

"Wastage" in the halibut fishery includes the mortality of all halibut that are not landed.

Wastage from discarded U32 halibut

The amount (weight) of U32 halibut mortality was determined indirectly as direct observations by fisheries observers or electronic monitoring are not available coastwide for the commercial halibut fisheries. One regulatory area that now has a relatively accurate count is the B.C. fishery, which (from 2006

Undersized halibut like the one shown here, are discarded when caught on commercial longline gear. Many survive, but a portion of them die from damage sustained during the process. Photo by Alex Ravelo.

Discard Mortality Rate (DMR) is the percentage or 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.

to the present) has recorded in logbooks the number of halibut discarded—a number verified by video monitoring. This number was then converted into estimated pounds, based on the average observed weight of U32 halibut in the setline survey. In all other regulatory areas, the IPHC's setline survey was used as a proxy for the commercial fleet, and its discard numbers were extrapolated to apply to the entire area. But first, to make them more comparable, the setline survey stations are filtered to stations with a higher catch rate (by weight) of O32 halibut, similar to those observed in the commerical fishery. Since the beginning of individual quota fisheries (1991 in Canada and 1995 in Alaska), a universal mortality rate of 16% has been applied to all halibut discards. For derby fisheries in previous years in B.C. and Alaska, and for the Area 2A directed fishery, a mortaltiy rate of 25% is applied. So to estimate the pounds of U32 halibut killed in the commercial fishery, the ratio of U32 to O32 halibut in each area was multiplied by the estimated annual commercial catch for that area, which was then multiplied by the mortality rate.

Wastage from lost or abandoned gear

Another type of mortality—from lost or abandoned gear—was calculated by multiplying the total landed catch by the ratio of effective skates lost to effective skates hauled aboard each vessel. Effective skates were those where no data (such as skate length, hook spacing, or number of hooks per skate) were missing, and where the gear type met the standardization criteria. The ratio included both snap gear and fixed-hook gear in all areas.

Wastage from discard mortality for regulatory reasons

This third type of mortality exists primarily in Area 2A, where a derby system is still used for the commercial fishery. The result has been halibut catches that at times exceeded the limits allowed per vessel, per trip. When that happened, the excess O32 halibut were discarded. On some vessels, the amount was logged and compared to landed halibut. The ratio of such discards to landings was then used to estimate O32 halibut discards for all landings reported on fish tickets. U32 halibut were accounted for in a similar manner. What was not included was the amount of halibut retained by the Area 2A salmon and sablefish fisheries, as they were accounted for under bycatch mortality estimates. Finally, quota share fisheries in British Columbia and Alaska were not included here, since their discards occurred only on the last fishing trip of the season (if they had any), and are generally only small amounts.

PERSONAL USE (SUBSISTENCE) HARVEST

The personal use catch is defined as halibut caught neither for sport nor commercial use (since its resale is not allowed), but to permit those who have traditionally relied on halibut as a critical food source or for customary use to continue to harvest it. The IPHC defines it further as halibut taken in: 1) the federal subsistence fishery in Alaska; 2) the sanctioned First Nations Food, Social, and Ceremonial (FSC) fishery in British Columbia; 3) treaty Indian Ceremonial and Subsistence fisheries in Washington state; and 4) U32 halibut retained by commercial fishers in Areas 4DE under IPHC regulations. The IPHC permits U32 halibut in the last case to be retained because of the historic customary use to rely on this undersized halibut, and because of the remote location there is no worry that these halibut will enter the market place (and be unaccounted for).

First Nations FSC fishery refers to the "food, social and ceremonial purposes" catch. 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.

Estimated harvests by area

For 2012, the personal use harvest came to 1,136,700 pounds coastwide. This was down from the 1,144,800 pounds caught in 2011, and the lowest since 2003 (the first year of the Alaska program). The estimates for the subsistence halibut harvest typically lag by a year, so the 2013 estimates are not complete.

The results of a day's fishing. Photo by Tracee Geernaert.

Area 2A (California, Oregon, and Washington)

The 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 (C&S) fishery.The 2013 Area 2A allocation for the C&S fishery was 32,200 pounds,and 28,500 pounds was harvested. The final estimate of C&S harvest in 2012 was 24,500 pounds.

State regulations required that any halibut caught

for personal use from commercial hook-and-line fisheries be counted in the commercial catch, and so were not counted again here as personal use.

Area 2B (British Columbia)

In British Columbia, the DFO-sanctioned personal use harvest was the FSC fishery. In the past, the IPHC received some logbook and halibut landing information from the DFO, but that data wasn't adequate for an IPHC estimate on personal use harvest. Instead, the IPHC has come to rely on the DFO's own estimate, which has remained unchanged at 405,000 pounds since 1997. Personal use halibut within the IVQ commercial fisheries has already been counted as part of the commercial catch, and thus was not counted again here.

Culinary preparation: Duke's Chowder House (Seattle): "It's So Dreamy Parmesan Halibut" Encrusted with parmesan/asiago and served with a lemon caper beurre blanc

Areas 2C, 3 and 4 (Alaska)

The personal use fishery in Alaska accounted for 687,000 pounds of Pacific halibut (60.4% of the coastwide total) in 2012, which was down from the 697,600 pounds caught in 2011. Complete figures for 2013 won't be available until the 2014 report. This fishery was defined by the NPFMC for customary use by rural residents and members of federally-recognized Alaska Native tribes. NMFS has regulations in place which define the fishery, including a registration program. According to the ADF&G's voluntary annual survey, Area 2C pulled in the most halibut, at 396,000 pounds (57.6 % of the Alaskan total), followed closely by Area 3A, at 253,500 pounds (36.9%). The remaining regulatory areas were but a small fraction of these two, with Area 3B claiming 16,000 pounds (2.3%), while the combined Area 4 pulled in 21,500 pounds (3.1%). Not counted with the ADF&G survey—though still counted as part of the coastwide total—were the 20,200 pounds of fish caught by the Alaskan CDQ fishery in Areas 4D and 4E.

As in other areas, fish used for personal use and not sold during the commercial fisheries are counted within the person's quota so are not accounted for here.

Retention of U32 halibut in the CDQ fishery

Supplementing the Alaskan personal use catch was the CDQ harvest in Area 4DE (Bering Sea). As mentioned earlier, this harvest totaled 20,200 pounds of halibut in 2012, a larger amount than the 16,867 pounds caught in 2011. A preliminary figure of 10,005 pounds was projected for 2013, though this won't be confirmed until the 2014 annual report. This was half of what was caught in 2012, due largely to the effort put out by small local fleets and the availability of fish in nearshore fisheries.

The IPHC compiled the amount of U32 halibut caught in this commercial fishery as an additional personal use removal. Although the ADF&G annual subsistence 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 3,493 pounds of halibut in 2013, a 31.4% decrease from the 5,095 pounds processed in 2012. The 371 U32 halibut that comprised this catch had an average weight of 9.4 pounds, and 90% of the halibut were 26 inches or greater in length. 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 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. The CVRF processed 5,250 pounds of Pacific halibut in 2013, at six different local plants (Chefornak, Hooper Bay, Kipnuk, Mekoryuk, Toksook Bay and Tununak). This was a 50.4% decrease from the 10,424 pounds processed in 2012. A total of 546 halibut were processed, for an average weight of 9.6 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 plant) 1,290 pounds of halibut in 2013, a 72.4% decrease from the 4,668 pounds processed in 2012. The number of fish making up this catch was 147 U32 halibut, with an average weight of 8.6 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.

"The point about Alaska being a land of greater contrasts than any other single portion of the earth's surface began to have meaning for me, too. Moving along smoothly between the Inside Passage islands Alaska could seem a lovely, smiling princess. But then she could become savagely barbaric in the mountains of southeastern Alaska, with their majestic glaciers and wild, roaring torrents rushing to join the sea."

—Lyman Ellsworth. Halibut Schooner. New York: David McKay Company, 1953, p.21.

INCIDENTAL MORTALITY

Incidental mortality (also called "bycatch") is defined as the unintentional 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. This 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. In a positive trend, bycatch levels have been gradually falling over the last few decades. According to NMFS estimates, 7,886,000 pounds of Pacific halibut were killed as bycatch in other fisheries in 2013, which was a 21.5% reduction from the 10,044,000 pounds lost in 2012. The 2013 estimates were derived from a re-structured NMFS observer program, having a different deployment pattern from previous years. It was also the lowest bycatch since before 1962 (barring the 7,700,000 pounds lost in 1985).

An estimated 7.886 million pounds of halibut mortality resulted from being caught as bycatch. This is a 21.5% reduction from a year earlier.

Sources of bycatch information

The IPHC, not having the resources to monitor bycatch on its own, must rely on observer programs run by various government agencies in the U.S. and Canada for those data. 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, from 100% of vessels based in the Bering Sea/Aleutian Islands (BSAI), to 0% for some Gulf of Alaska (GOA) vessels. Where direct observation was not possible, the IPHC projected bycatch estimates based on the bycatch rates observed on IPHC survey vessels or from data for similar fisheries.

Halibut are caught incidentally in many different fisheries and by a variety of gears. Shown here are the results of a trawl gear tow during a NMFS survey. Photo by Paul Logan.

Discard mortality rates

Discard mortality rates (DMRs) are fixed estimates that allow the IPHC an idea of how many halibut are killed as bycatch in an area, often when physical observation of that bycatch is not available. They can vary by both fishery and area. Where observers are used, DMRs are calculated from data gathered on the release viability or injury of halibut. The NMFS collected observer data in Alaska, as did observers deployed on bottom trawl vessels in Areas 2A and 2B. In Alaska, the DMRs are in place for a three year period but data are collected continuously from observers. New data are used to update the assumed estimates every three years. In Area 2A, the sablefish hook-and-line fishery was assigned a DMR rate of 16%, the pot fishery a DMR of 18%, and the catcher/processor midwater fishery for Pacific hake a DMR of 100%.

Monitoring Alaska groundfish fisheries

In 2013 the NMFS implemented a new method to choose fishing vessels for the monitoring of incidental catch. This new plan—instead of relying on the previous method of allowing vessel operators to choose when observers accompanied the vessel—used a scientifically driven selection process to assign observers and thus reduce bias. The plan did not apply to vessels in fishery programs that already implemented 100% observer coverage, such as the Gulf of Alaska Rockfish Program, the American Fisheries Act pollock cooperative, the BSAI CDQ fisheries, and the BSAI Amendment 80 fishery cooperative. The 2013 plan was funded largely by a 1.25% fee assessed by the NMFS (split between the vessel and the processor) on the value of halibut landings. This revenue source provided funding for roughly 31,800 days of on-the-water monitoring, which was intended to cover 15% of available vessel trips. The effectiveness of this new deployment pattern will be evaluated after 2013.

Bycatch of Pacific halibut in the groundfish fisheries off Alaska is managed by the NPFMC's Prohibited Species Catch limits. The limits are subdivided by gear type, target fishery and time period. Halibut limits are set as mortality rather than total catch, and the amounts are given in both metric tons and in pounds (round weight, not net pounds). For the Gulf of Alaska, the NPFMC set a halibut bycatch mortality limit of 2,273 metric tons (5,011,056 pounds). This included a trawl fishery limit of 1,973 metric tons (4,349,676 pounds) and a hook-and-line limit of 300 metric tons (661,380 pounds), while groundfish pots and jigs were exempted. For the BSAI, the NPFMC set a total halibut bycatch limit of 4,575 metric tons (10,086,045 pounds), of which 3,675 metric tons (8,101,905 pounds) was assigned to trawl fisheries, and 900 metric tons (1,984,140 pounds) to fixed gear fisheries.

The PFMC, 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 supported by NMFS and enforced by the National Oceanic and Atmospheric Administration (NOAA), the U.S. Coast Guard and local law enforcement agencies.

Bycatch mortality by regulatory area

Area 2A (California, Oregon and Washington)

Preliminary numbers for 2013 are not yet available, so the results from 2012 are projected forward for now. The final estimate for Area 2A bycatch in 2012 was 130,000 pounds, which was 63% lower than the 350,000 pounds caught in 2010, the last year of open access fishing. The PFMC set the 2013 Individual

Emptying the codend. Photo by Paul Logan.

The Area 2A hook-and-line fishery took an estimated 59,000 pounds of bycatch in 2012.

Quota (IQ) mortality limit for halibut in the coastwide groundfish trawl fishery at 194,033 net pounds, with 177,495 net pounds (91.5%) 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%) were reserved for fisheries operating south of that latitude. In the hook-and-line fishery, bycatch in 2012 came to an estimated 59,000 pounds. In the shrimp fishery, shrimp excluders that were implemented in 2003 have resulted in essentially zero halibut bycatch.

Area 2B (British Columbia)

According to the DFO, the estimated bycatch for Pacific halibut in Area 2B in 2013 was 225,000 pounds, up from the 189,000 pounds caught in 2012. The groundfish trawl fishery took all of it, largely during the summer months.

Area 2C (Southeast Alaska)

In Area 2C, observer coverage of fisheries has been very poor over the years, with the result that bycatch has not been well understood. Most vessels have either operated in state waters that required little if any coverage, or have been shorter than the 40-foot minimum threshold for coverage in federal waters. Historically, Alaskan bycatch has been attributed to four fisheries: 1) beam trawling for shrimp and flounder in inside waters; 2) hook-and-line fisheries for sablefish in Chatham Strait and Clarence Strait; 3) sablefish fisheries in Prince William Sound; and 4) 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 changed this, beginning the process of reviewing these four fisheries and their datasets, with the eventual goal of revising the bycatch estimates. Until this process is finished, bycatch estimates from these

fisheries will be artificially zeroed out and "unavailable". For example, the most significant change is the crab pot/shrimp trawl fishery, which has historically taken an assumed 303,000 pounds per year, and has been reduced to zero until further notice. Bycatch is likely much less than the historical estimate for this fishery due to a change of fishing gear to crab pots that have shown lower bycatch rates in other fisheries.

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

Bycatch mortality for Area 3 in 2013 was estimated preliminarily to be 2,318,000 pounds of halibut, of which 1,823,000 pounds (78.6%) came from the groundfish trawl fishery (targeting species such as arrowtooth flounder, rock sole, and yellowfin sole). This was a 33.3% reduction from the 2012 levels, where the bycatch was estimated to be 3,480,000 pounds. The next highest bycatch numbers (20.3%) 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.

Halibut bycatch mortality was down 16.5% in Area 4, totaling 5.206 million pounds.

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. This program and its limits continued unchanged through the 2013 season. By the end of November, 2013 only 100,000 pounds (38% of the 320,000 pound bycatch allocation) had been taken, while 86% (26,524,510 pounds) of the CGOARP groundfish allocation had been taken.

Area 4 (Bering Sea/Aleutian Islands)

Halibut bycatch mortality in Area 4 for 2013 was estimated to be 5,206,000 pounds, a 16.5% decrease from 6,236,000 pounds the previous year. Bycatch from the trawl fishery—including rock sole, yellowfin sole, Pacific cod, and pollock—accounted for 4,501,000 pounds (86.5%) of the total. Hook-and-line fisheries (focusing their efforts on Pacific cod) took an estimated 699,000 pounds (13.4%) of halibut. Finally, pots used to catch sablefish and Pacific cod accounted for 6,000 pounds of halibut bycatch.

Bycatch from the Prohibited Species Donation program

The Alaska groundfish fishery maintains a Prohibited Species Donation (PSD) program that enables Pacific halibut caught by trawl vessels in the Bering Sea/Aleutian Islands and the Gulf of Alaska to be processed and donated to food banks throughout the United States. SeaShare (an organization based on Bainbridge Island, Washington) acquires the bycatch halibut. After Seattle-based SeaFreeze turns the fish into halibut steaks, SeaShare sends it out to hunger

The Prohibited Species Donation program resulted in more than 250,000 halibut meals in 2012 and 2013 combined.

relief programs. The halibut comes from companies such as Alyeska, Unisea, Icicle, Alaska Pacific Seafoods, Ocean Beauty, and Trident. The PSD program was adopted by the NMFS and the NPFMC in 1998 and initially included only shoreside vessels landing catch in Dutch Harbor, but was updated in 2011 to also include Gulf of Alaska landings. This program has contributed an estimated 395,075 net pounds.

In 2013, preliminary figures indicated that SeaShare collected 33,890 pounds of halibut, with 9,021 pounds (26.6%) originating in the Bering Sea, and 24,869 pounds (73.4%) coming from the Gulf of Alaska. Final numbers for 2012 showed a harvest of 36,151 pounds, with 5,502 pounds (15.2%) originating in the Bering Sea and 30,649 pounds (84.8%) coming from the Gulf of Alaska. The amount of halibut donated in 2012 and 2013 represented 251,445 meals for receiving food banks.

POPULATION ASSESSMENT

The population (or stock) assessment of Pacific halibut has been at the heart of the IPHC's mission since 1923. It consists of three main topics, while (for the second year) the actual apportionment process is covered in its own chapter immediately following this one. The first topic concerns data sources and how they form the background of the assessment. The second covers the actual process of the assessment and its results. The third part explains the MSE concept and how it applies to the population assessment.

Culinary preparation: Crow's Nest (Anchorage, AK): Alaskan Halibut With Israeli cous cous, roasted vegetable hash, ras el hanout, baba ghanoush, sherry and raisin jam and toasted cauliflower

Data sources

One significant change in the way halibut were counted occurred in 2013, with the inclusion of historical data. By studying the halibut population over time, scientists were better able to identify cyclical trends that affected the current population. Data collection has continued to improve over the years. The good news is that the data the IPHC collects today has never been better; the bad news is that parts of the historical data are incomplete or imperfect in some way. There are three types of data that the IPHC relies upon: fishery-independent data, fishery-dependent data, and auxiliary data.

Veteran IPHC sea sampler, Bruce Biffard, measures a halibut during the setline survey, a major source of fishery-independent data. Photo by Heather Jackson.

Fishery-independent data

Fishery-independent data are generated from the IPHC setline survey. This catch-rate information, along with that from the commercial catch, makes up the primary source of trend information

for the stock assessment. Fishery-independent data includes four measures: 1) survey weight per unit effort (WPUE), 2) survey age distributions, and 3) survey weight-at-age. The survey gear and protocols are standardized to enable comparisons over space and time. However, there are still differences. In Area 2A, the survey was expanded in 2013 to cover a portion of northern California. Thus the historical catch rates had to be expanded as well. Also, the geographic extent of the 0-400 fathom bottom area was added to the Area 2A calculations. The processing of survey WPUE in the Bering Sea (Areas 4C, 4D, and 4E) is extensive—requiring several "expansions" to accurately estimate halibut density—since there are large regions that are not covered by the annual setline survey.

The second measure of fishery-independent data—survey age distributions—is gained from otoliths collected randomly during the setline survey. Sampling rates are adjusted annually by regulatory area to achieve a similar number of samples from each area in each year. The age frequencies for 2013 did not show any signs of strong incoming cohorts, nor much deviation from the recent observed age structure.

Survey weight-at-age (the third measure of fishery-independent data) is obtained as the setline survey collects individual length observations on all halibut captured. These are then converted to estimated weights via the accepted length-weight equation. Because the sampling of ages is random within the survey catches for each regulatory area each year, the average weight-at-age by area, sex, and year is calculated. Where there are not a sufficient number of samples, the results can be interpolated. The inevitably differing trends among the various areas requires appropriate weighting—using estimates generated from the survey number-per-unit-effort (NPUE)—to create a coastwide time-series that accurately represents the entire stock. What was revealed in 2013 was a population-level decline in weight-at-age for both male and female halibut over the recent time-series available from the survey.

IPHC uses both fishery dependent (commercial, sport, and personal use), and fishery-independent (surveys) data sources for the stock assessment.

Fishery-dependent data

Fishery-dependent data comes directly from halibut removals within these three fisheries: 1) commercial, 2) sport, and 3) personal use. Unintended removals such as commercial wastage and bycatch mortality also comprise the data. The data are the catches from each source, directed fishery WPUE, fishery age distributions and fishery weight-at-age. Halibut landings from the commercial fishery comprise the single largest input to fishery-dependent data, and (since 1981) have taken the form of commercial fish tickets that are reported to the IPHC. Prior to 1981, landings are available only in aggregated form for all of Regulatory Area 4. Landings from 1935 to 1980 are not currently included in the IPHC's database; however previous analysts have left data behind that appear to correspond well with tables published in technical reports, and other IPHC documents. Because the raw data are not able to be reprocessed directly, the landings estimates prior to 1981 are more uncertain than those after 1981. Historical landings prior to 1935 were reconstructed within current regulatory areas from summaries by historical statistical areas. Reported landings of halibut begin in 1888; however, it appears the commercial fishery may have started before then with over one million pounds already being landed per year at that time. Sport or recreational removals are reported to the IPHC by the respective government agencies responsible for managing the fishery. These

IPHC quantitative scientist, Ian Stewart, and port sampler, Jaelee Vanidestine, shoot the breeze on the dock at Seward Fisheries. Photo by Lara Erikson.

include (from south to north) the CDFW, ODFW, WDFW, DFO, and ADF&G. None of the agencies provides mortality rates of released fish. It is generally assumed that there was little sport fishing for halibut before the mid-1970s, though sport removals have grown dramatically since then, peaking in the mid-2000s with annual harvests of over 10 million pounds.

Subsistence (or personal use) harvest estimates have been provided since 1991 to the IPHC by the DFO (for the Canadian catch) and by the NMFS for the catch in the United States. These estimates don't occur annually, and estimates must regularly be extrapolated for intervening years.

In 2013, the coastwide WPUE was 187 net pounds/skate. WPUE is one of several calculations performed on the data, and is used as a proxy for density.

Wastage of halibut in the commercial fishery was estimated to be at its highest in the early 1980s, decreasing for a time, then increasing again from 1995 to 2010 as the size-at-age of halibut declined and more fish at older ages remained below the minimum size limit. Prior to 1981, wastage in Area 4 couldn't be estimated, though it is believed that little wastage actually occurred then.

Estimated bycatch of halibut from non-halibut fisheries is reported to the IPHC by the NMFS and DFO annually. The estimates vary greatly in quality, due to the fluctuation of many factors. The peak occurred in 1992, with over 20,000,000 pounds caught, and has declined (almost) steadily since then, with an estimated 7,890,000 pounds caught in 2013.

Fishery-dependent data is processed similarly to fishery-independent data: 1) fishery WPUE, 2) fishery age distributions, and 3) fishery weight-at-age. The IPHC considers the commercial WPUE to be another "survey" of the stock, and so its estimates serve as a proxy for density. In 2013 the coastwide WPUE was 187 net pounds/skate.

Culinary preparation: Elliott's Oyster House (Seattle, WA): Fresh Alaskan Halibut With mustard spaetzle, sugar snap peas and bacon-beer sauce

Recent fishery ages are gathered from otoliths collected by port samplers in proportion to the landings in the ports that are annually staffed by the IPHC. Because of this method, the raw ages can be directly aggregated within each area and year to estimate the age composition of the catch. Because port samplers also collect individual lengths, the average weight within each area can also be directly estimated via the length-weight relationship. Dividing the

total commercial catch for each regulatory area and year by the average fish weight gives an estimate of the number of fish captured. The age distribution obtained from this method showed a similar trend to the age distribution found in the setline survey—a plentiful 1987 class that had moved through the stock. It also revealed that halibut in the commercial landings from the 1930s to 1973 (when the current 32-inch minimum size was implemented) were predominantly between the ages of 6-14.

Fishery weight-at-age (the third measure) refers to the average weight of halibut at a given age. It's significant because it allows for the comparison of fish size over time. By weighting the historical weight-at-age for each regulatory area by the number of fish in the landings for that area, a coastwide weight-at-age was constructed for the entire time-series. It showed a clear pattern of increasing fish size from the 1930s through the 1970s, followed by a decline that continues through the present year.

Culinary preparation: The Fish House at Stanley Park (Vancouver, BC): Butter-poached Haida Gwaii Halibut With crispy wild mushroom polenta cake, Manila clams, bacon and creamed leeks

Auxiliary inputs

Several additional sources of information are included in the population assessment and treated as data, even though they represent the products of analyses themselves. These include: 1) weight-length relationship, 2) maturity schedule, 3) aging bias and imprecision, and 4) Pacific Decadal Oscillation (PDO).

There exists a weight-length relationship for Pacific halibut where if one knows the fork length of a fish (in centimeters), its gutted weight (in net pounds) can be readily determined by a simple equation. Taking the example of a 32-inch (81.28 cm) halibut: raise 81.28 to the power of 3.24 to get 1,542,933.37. Multiply that by 0.00000692 to get 10.68 net pounds.

Maturity schedule (the second measure) is a chart that shows the age at which halibut become sexually mature. It has been investigated several times historically, and maturity-at-age was found to be very stable despite long-term changes in length-at-age and weight-at-age. For 2013, the estimates of age at which 50% of female halibut were sexually mature averaged 11.6 years among all regulatory areas, with very few fish younger than five years, and nearly all fish mature by age seventeen.

Age data are generated by estimating the ring count on halibut ear bones (otoliths).

The third auxiliary input—age bias and imprecision—comes from the treatment of halibut ages. They are often referred to as "data", though in actuality they are merely estimates based on the counting of rings on an otolith. And estimates by their very nature are subject to bias and imprecision, however slight. Halibut are relatively easy to age (compared to other groundfish), and historical analysis of the currently standard "break-and-bake" aging methods have shown it to be remarkably precise. Prior to 2002, the "surface aging" method was the primary way halibut were aged. However, it was biased toward older fish, and also not very precise when applied to other marine species. In order to determine the level of bias in those early aging samples, the IPHC conducted a surface aging test in 2013. It selected 4,362 otoliths from the setline survey of 1998 and tested them for age using both methods. The "break-and-bake" method showed a level of imprecision that was expected – it is a very precise aging method. The surface reading method showed a strong bias for ages above 15 years, although this bias was less than previous estimates which did not include a random sample of otoliths.

The F/V *Clyde* offloads its catch on a sunny day in Alaska. Photo by Tracee Geernaert.

Previous research by the IPHC showed a strong correlation between the environmental conditions in the northeast Pacific Ocean (specifically the PDO) and the recruitment of halibut to the commercial fishery during the 20th century. As the PDO entered its "positive" phase ("up" through 1947, and during 1977-2006), more recruitment of juvenile halibut into the commercial fishery occurred. Since 2006, the deviations have been negative—the longest stretch of negative annual values since the late 1970s. The PDO conditions change about every 30 years, with positive conditions before 1947, poor conditions from 1947 to 1977, positive conditions from 1978 to 2006, and poor conditions from 2007 to the present.

The PDO is a phenomenon describing the cyclical change in surface temperatures of the Pacific Ocean north of 20° North. In the "positive" (or warm) phase, the eastern Pacific warms while the western Pacific cools. The process continuously oscillates, reversing over a span of 20 to 30 years.

Notable data processing changes for 2013

Here are changes that ocurred in 2013 in order to continue updating the process and ensure "best practices." 1) Revision of sex-specific age composition information. In the past it was estimated from the setline survey. Now, treatment of fishery age data is conducted directly using age-frequency data for both sexes combined. 2) Using total WPUE. In the past, the sublegal catch was not included when constructing the setline survey WPUE. There is no compelling reason to artificially partition the survey catch data, so that practice has been abandoned. 3) Three improvements in how commercial fishery wastage is counted have been adopted: the use of logbook-reported discards in Area 2A; use of logbook-reported sublegal catches in Area 2B; and correcting historical bias by re-estimating survey catch rates for Areas 2A, 2B and 2C, to compare with commercial catch rates. 4) Three changes to how weight-at-age is handled, including: generating a coastwide aggregate of weight-at-age by weighting the area-specific weights-at-age for both survey and fishery observations by the numbers caught in each category; using mathematical smoothing over years (instead of ages) of weight-at-age observations for the survey data; and using trends observed in the fishery data to project weight-at-age through the historical time series. 5) Updating the 0–400 fathom bottom area geographically, based on more accurate bathymetric measurements. 6) Including Areas 2A and 4C in the coastwide fishery WPUE index.

Culinary preparation: Seatown (Seattle, WA): Alaskan Halibut Fingerling potatoes, snap peas and parsley-clam broth

The SRB formed and began meeting in 2013 to review the IPHC's science products and programs. In the longer term, the SRB expects to broaden its focus toward other scientific programs, and providing advice to the IPHC and its Commissioners. However, its short-term focus produced some important recommendations and new approaches of population assessment modeling that were incorporated into the 2013 assessment.

Population assessment at the end of 2013

The population assessment of 2013 was the first in recent years to make use of historical time-series. As such, all halibut removals (including all sources of mortality) over the last 100 years added up to 6.9 billion pounds, with an annual removal rate of 34 to 100 million pounds. For 2013, total removals were 46,000,000 pounds, down from 52,000,000 pounds in 2012. Female spawning biomass was estimated to be 196,800,000 pounds, and it has hovered around the 200 million mark since 2009. At the end of 2013 the coastwide exploitable biomass was estimated to be 170,290,000 pounds. The survey WPUE for catching halibut in 2013 was 44.0 pounds coastwide. Although survey and fishery age distributions continue to indicate a relatively stable stock of halibut, WPUE has declined since 1997, when it averaged 137.5 pounds.

Assessment

Over the last 30 years, the population assessment for Pacific halibut has undergone many different modeling approaches in order to better implement improvements in model assumptions, in how fisheries are analyzed, and in dealing with recurring retrospective biases. The year 2012 brought an end to the most recent retrospective bias problem. Prior to 2012, each subsequent analysis had estimated a lower stock size than the previous year's assessment.

In solving the bias problem, the IPHC produced stock estimates that were much lower than in previous analyses. The 2013 assessment presents a method called the "ensemble approach"—reviewed by the IPHC's SRB in 2013—that should make the process both stronger and more flexible to future model changes. Originating from the field of weather and hurricane forecasting, it recognized that there is no "perfect" assessment model, and that healthy risk assessment can only be achieved with the inclusion of multiple models in the estimation of management quantities (and the uncertainty about these quantities).

The 2013 ensemble used three alternative models to produce the stock estimates and decision table results including: the new short and long time series models, and the 2012 model. The first new approach used Stock Synthesis—a widely used modeling platform developed at the NMFS—to completely recreate (from zero) the existing population assessment model. This corroborated the results of the 2012 assessment, though it suggested a larger halibut biomass in the late 1990s and early 2000s. The second approach included developing an assessment model that could accommodate all of the historical information from the commercial fishery and setline survey (accounting for all the changes over the years such as introduction of size limits, spatial expansions, the transition from J hooks to circle hooks, and many others). This allowed for a re-evaluation of the link between environmental conditions in the north Pacific and halibut recruitment success. The model's comprehensive time-series of stock size estimates provided a second independent comparison, using over 100 years of additional data, with the assessment results from 2012. The comparison was remarkably close, with the long time-series model also providing needed historical perspective into both the current abundance levels and the recent declines in stock.

Biomass, recruitment, and reference point results

Using both the ensemble and the long time-series model, the 2013 assessment indicated that the Pacific halibut stock has been declining

continuously during most of the 2000s as a result of recruitment strengths that were much smaller than those observed during the 1980s and 1990s, and a decrease in size-at-age. The long time-series model provided, for the first time in recent years, historical estimates that were integrated with the current population assessment results. It was able to recreate the population age structure and match the patterns in survey and commercial catch rates observed during the 100-plus years of the historical period. It also showed that halibut recruitment was 37% higher during periods of favorable PDO conditions. The highest level of recruitment observed historically occurred from 1977 to 2006, which led to much larger stock sizes and therefore greater fishery yields.

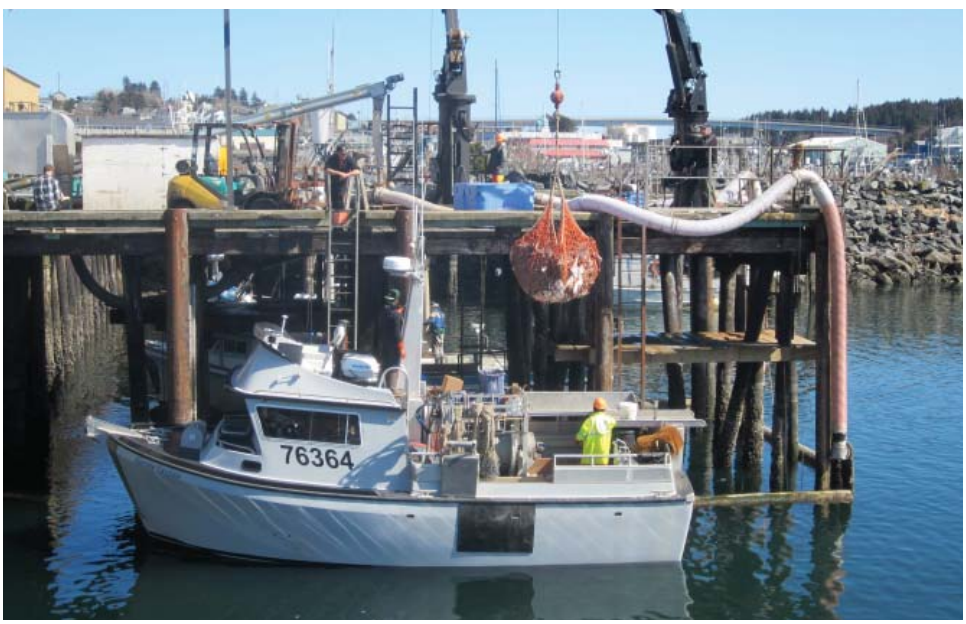
The long time-series model suggested that major stock fluctuations of the past three decades would have ocurred even without human removals.

The long time-series model suggested that the stock increases of the 1980s and 1990s, and the present stock declines, would have occurred even without removals of halibut by human hands. The model also indicated that surplus production—the amount of biomass produced each year in excess of that needed to maintain the standing stock—was exceeded by removals during the early 1900s. During most of the 20th century, removals were nearly equal to annual surplus production (which increased as size-at-age increased). In the last few years, surplus production has declined to perhaps just below the long-term average.

Major sources of uncertainty

As in any statistical model, uncertainty pervades the halibut population assessment. This includes uncertainty from the estimation of model parameters, how the data is treated, how selectivity is structured (length-based vs. age-based), natural mortality (fixed vs. estimated), and other differences found in the three models included in the ensemble. One example of uncertainty was the distribution for exploitable biomass—an amount that is used to generate harvest rates and apportionment. Another example of uncertainty was the role of natural mortality, which was identified as the most influential fixed parameter in the 2012 assessment. Three values (0.1, 0.15, and 0.2) were included in the decision table

The Walrus and the Carpenter (Seattle, WA): Halibut Carpaccio With mustard oil and salad burnet



The F/V *Naknek Leader* offloads in Kodiak, AK. Photo by Dave Jackson.

because that year's assessment model wasn't able to identify an accurate single value. This was no longer necessary for the 2013 assessment, because alternate female natural mortality values—0.2 from the long time-series and 0.15 from the short time-series—were already included in the models that comprised the ensemble approach.

An important source of uncertainty that has remained unaddressed was the spatial structure of the assessment model. Recruitment variability continues to be a source of uncertainty as well, due to the lag between birth year and direct observation in the fishery. Low size-at-age is a recurring source of uncertainty, though it changes relatively slowly. Future expansion of the ensemble process is expected to improve uncertainty and create more flexible and accurate assessment results.

Recruitment variability continues to be a source of uncertainty due to the lag between birth year and direct observation in the fishery.

Sensitivity analyses were conducted in 2013, with the most useful results reported in the long time-series model. The most influential source of uncertainty was the sex ratio of the commercial catch (which relied on indirect estimates from the setline survey). Three other sources of uncertainty surrounding types of halibut removals were conducted: bycatch, sport discards, and commercial wastage. The bycatch analysis explored the influence on coastwide population assessment if the bycatch were to be doubled or halved. The analysis of discards from the sport fishery showed that there was no appreciable change in the spawning biomass time-series even with a 5% increase in sport discards. As for commercial wastage, the analysis investigated its magnitude, and though its true level is unknown, any reasonable level was found to make little difference on coastwide estimates.

A retrospective analysis using the long time-series model did not reveal a pattern in the recent spawning biomass estimates, as data were removed from the model sequentially. Moreover, even the estimates that deviated the most from the model were still within the confidence intervals. This was a dramatic contrast to the assessment results for 2006 through 2011, in which retrospective bias was very strong.

Forecasts and the decision table

As in 2012, halibut stock projections were conducted this year using the coastwide population assessment (all three models of the ensemble), summaries of the 2013 fishery, other sources of mortality, results of apportionment calculations, and the application of the harvest policy. This was done in three steps: 1) apportioning the coastwide estimate of exploitable biomass according to the survey catch rates in each regulatory area (adjusted for hook competition and survey timing); 2) applying the area-specific harvest rates to estimate both the total constant exploitation yield (TCEY) and all other removals associated with a given level of harvest; and 3) calculating the total mortality and projecting the stock trends both one and three years into the future. Results and staff advice were presented to Commissioners in the form of a decision table (Fig. 1).

Current harvest policy uses a ramp that mandates zero fishing when the relative spawning biomass is at 20%, and increases gradually up to the target harvest rate when the relative spawning biomass reaches 30% or more. The current target harvest rates are 21.5% in Areas 2A, 2B, 2C, and 3A; and 16.125% in Areas 3B, 4A, 4B, and 4CDE. Harvest rates coastwide are estimated to have been above target levels for the 2000s, though mortality reductions from 2010 through 2013 have brought the realized harvest rate closer to the target harvest

rate. For the near future, the halibut population is projected to increase slightly in the absence of any mortality during 2014, and all levels of harvest above 30 million pounds of total mortality would result in declines in the current stock size by 2015. Due to the small decrease in the estimate of exploitable biomass relative to 2012, repeating the removal levels from last year would result in a slightly higher harvest rate than realized in 2013.

Figure 1. Commissioners receive staff advice via a decision table - pictured here without specific metrics. This allows them to consider the risks of various harvest levels before making final decisions regarding catch limits.

Future research

Based on data and model exploration completed during 2013, and recommendations from the SRB, future research will focus on these seven topics: 1) development of methods for sampling the sex ratio of the commercial catch; 2) continued expansion of the ensemble of models used in the stock assessment; 3) Bayesian methods for fully integrating the uncertainty of parameters in order to provide improved uncertainty estimates with ensemble models; 4) further investigation of the factors contributing to recruitment strength and observed size-at-age in order to better project trends in these quantities; 5) exploration of methods for estimating wastage and bycatch in the assessment model as a function of effort, in order to better capture these sources of uncertainty; 6) analysis of projection methods for weight-at-age to determine if alternatives to recent trends might provide better estimates of likely future values and the uncertainty associated with these values; and 7) integration of the assessment results in the decision table with ongoing developments in the harvest policy arising through the MSE process.

Culinary preparation: Tojo's (Vancouver, BC): Halibut Cheek Sautéed in a crème garlic teriyaki sauce

Management Strategy Evaluation

Fisheries management can be described as making choices among alternative harvest levels. These choices should be guided by a policy that is likely to achieve the goals and objectives of the fishery. To get to that policy,

it had to be modeled and tested so that the way the system works was fully understood. That brings us to the MSE process. In fisheries management, there are two types of variables: those that can be managed directly (such as size limits or annual catch), and those that cannot be managed directly (migration or natural mortality). The former can be simulated via management procedures, while the latter can be simulated through the alternative scenarios. Both are used in simulation trials to try to evaluate outcomes. This MSE approach consists of four primary components: 1) a set of management objectives; 2) a set of performance measures related to the management objectives; 3) a suite of management procedures or alternative harvest policies to be considered; and 4) an operating model in which to simulate alternative population scenarios which is used to test the alternative procedures. In the first component above, the management objectives have to have three criteria: a stated variable (such as catch), a duration in which to achieve the objective, and a probability for how important the objective is (compared to other objectives). For the second component, the performance measures have to be both related to the management objectives and be quantifiable within the operating model. For example, fisheries harvest policies are commonly tied to population status of a fish stock, and one of the existing management objectives for Pacific halibut is to maintain the spawning biomass above 30% of the unfished state for 80% of the years for the full catch limits to permitted.

Key terms in MSE:

Management Procedures: a combination of data, catch statistics, assessment models or data filters, and a harvest control rule (all of which can be directly managed) in which to calculate annual total allowable catch.

Scenario: a set of hypotheses concerning the dynamics of the resource in question and things that cannot be directly managed.

Simulation Trial: one of many single realizations that is used to characterize the distribution of responses to alternative management procedures for each scenario.

Preliminary objectives

The IPHC formed the MSAB in the spring of 2013. One of its first tasks was to learn how the MSE process had been used in other fisheries (such as the British Columbia sablefish fishery). It also worked to develop the IPHC's harvest policy, its research, and both short-term and long-term management objectives. The MSAB met in June and October 2013. Eventually the MSAB identified five overarching objectives: 1) biological sustainability (identifying stock conservation objectives); 2) fishery sustainability (identify the harvest minimum); 3) assured fishery access (minimize probability of closures); 4) minimize bycatch mortality; and 5) serving consumer needs. The MSAB continues to work on refining objectives, identifying the most relevant performance metrics, and investigating alternative population scenarios.

Operational challenges

Several technical challenges to make the MSE process fully operational for the Pacific halibut fishery exist. The first challenge is ensuring that stakeholder input is taken into full consideration. The formation of the MSAB was an important step in this process. The next challenge was the development of the operating model, as well as the underlying data structures for that model. The first operating model will be the coastwide model and will be followed by the development of more spatially-explicit models. Finally, making this process operational will require dedicated attention from the staff analysts, MSAB members, other stakeholders, and the IPHC Commissioners—requiring time and feedback from each to make the process work. Managing the requirement for thorough evaluation of the process against the need for urgency is one of the greatest operational challenges for MSE.

AREA APPORTIONMENT

Apportionment of the Pacific halibut population is a little like cutting the cake at a children's birthday party—one has to judge how big the cake is, how many people get a piece, and the size of each piece. After assessing the halibut population comes the step of apportioning it out to harvesters. In the past the IPHC staff made area-specific catch recommendations to the Commission that were then implemented regionally by national and state agencies. In 2013, the IPHC staff left the cake cutting to the Commissioners, giving them the assorted options (and related consequences) of various apportionment choices.

Apportionment is the process of dividing up the available catch among regulatory areas.

Since 2007 the IPHC has used the setline survey mean WPUE index of halibut density, weighted by bottom area to apportion estimated coastwide biomass among the regulatory areas. Looking back on the first year of the SRB's review of the apportionment of coastwide biomass, the IPHC believes (cautiously) that it is scientifically objective. The process carefully delineates the role of science (to generate plausible hypotheses and assessments of halibut stock dynamics) from that of policy (to generate objectives and feasible regulatory options for achieving goals). The great advantage of this separation of science and policy is that each role is made explicit and that all procedures used in decision-making are transparent. The process is also consistent with apportionment methods used in some other fisheries such as sablefish in the Gulf of Alaska.

Vessels tied up to the dock in Coal Harbour, B. C. Photo by Kirsten MacTavish.

Culinary preparation: Joe Forte's Seafood & Chop House (Vancouver, BC): Halibut Cheeks Tomatoes, leeks, herbs, butter and Yukon gold potatoes

Constant Exploitation Yield (CEY) — a biologically determined level (in units of thousands of net pounds) for total removals of halibut from a regulatory area. Calculated by applying a fixed harvest rate (%) to the estimate of exploitable biomass (net pounds) in that area. The corresponding level subject to allocation in directed fisheries is called the "fishery CEY."

Bottom area revision

Bottom area is defined as the area of the continental shelf within the halibut range that lies between the zero and 400-fathom (2,400 feet) contour lines. This area is used to weight the WPUE density index values for each regulatory area for apportionment calculations. In 2013 the bottom area used for Area 2A increased, due to the expansion of Area 2A to include waters between 40° N. and 42° N. With this change, the new measurements for the bottom area of the regulatory areas are (in square nautical miles): 16,679 (Area 2A); 29,916 (Area 2B); 14,329 (Area 2C); 49,297 (Area 3A); 30,361 (Area 3B); 20,224 (Area 4A); 19,730 (Area 4B); and 218,694 (Area 4CDE).

Survey timing

The timing of the setline survey can alter the survey numbers. If the survey occurs after much of the commercial fishing has occurred, the amount of halibut that the survey catches will be smaller. This has been particularly true in Area 2A, where typically over 80% of the catch has already been landed before the setline survey's mean date. The converse is also true. To get around this, the IPHC staff standardizes the WPUE of a regulatory area to its expected value if 50% of all O32 removals have been taken before the mean date of the setline survey in that area. This does not change the survey timing methodology for 2013; what it does is update all the data inputs for calculating the adjustment. It included both revisions to 2012 and to earlier data made during 2013. As harvest rates have been reduced over recent years, the impact of the survey timing adjustment on WPUE has decreased.

Hook competition

Hook competition is essentially the presence of other, non-halibut species that "compete" against halibut for the baited hooks, with the result that their capture results in fewer halibut landings and greater bycatch. The fraction of baits that remain on the survey gear upon retrieval—not taken by either halibut or other species—within each regulatory area is used to compute an adjustment factor for hook competition. For example, if a smaller than average proportion of baits are returned in an area (more fish on the hooks), that 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. Conversely, an area with a greater proportion of baits returned (fewer fish on the hooks) would have its WPUE index adjusted downwards. This adjustment method is intended to avoid the situation where differences in abundance of non-halibut species among regulatory areas would create bias in the observed WPUE index of density.

Three-year weighting

In addition to the previous two adjustments, the WPUE for apportionment was also smoothed using a 75:20:5 reverse-weighted average of the current and

previous two year's adjusted WPUE values for each area. This weighting was intended to improve precision of the WPUE estimates, and by using only 20% and 5% of past observations, significant past bias was limited.

Apportionment results

For the 2013 fishery, the exploitable biomass for Pacific halibut was apportioned as follows: Area 2A (2.4%), Area 2B (15.6%), Area 2C (14.9%), Area 3A (32.9%), Area 3B (13.6%), Area 4A (5.7%), Area 4B (4.2%), and Area 4CDE (10.6%). Due to rounding, the above percentages fell just short of 100%. The only significant structural change occurred in Area 2A, due to the expansion in range. However, this changed what would have been 2.1% to 2.4% of the biomass, and had only minor effects on the other areas (due to the relatively small fraction of the halibut population that lives in Area 2A), and that the 0.3% change was absorbed by all the other regulatory areas.

Looking at the 2013 stock assessment estimates of coastwide exploitable biomass, and after recalculating apportionment levels for recent years, some trends have come to light. Exploitable biomass appears to have declined sharply in Area 3 and Area 4 early in the time series, and then slowed in recent years. Historically, Area 2 had the highest rates of exploitation, and this is where the greatest response to reduced harvest rates can be found.

Total Constant Exploitation Yield (TCEY)—the target level of harvest of halibut exceeding 26 inches (66 cm) in fork length (O26). This value is found by applying regulatory area-specific harvest rates to the coastwide estimate of Exploitable Biomass after it has been apportioned among areas.

Yield calculations

Calculating the actual physical yield—stated in pounds—for each regulatory area starts with the estimated coastwide exploitable biomass from the stock assessment. The current harvest policy uses different target exploitation rates—stated in percentages—for each regulatory area. For Areas 2A, 2B, 2C and 3A, the rate for 2013 was 21.5%. For Areas 3B, 4A, 4B and 4CDE, the rate was 16.125%. Taken from these, the effective coastwide harvest rate came to 19.7%. With a coastwide exploitable biomass estimate of 170,290,000 pounds, the TCEY coastwide was 33,490,000 pounds. The fishery constant exploitation yield (FCEY) is that portion of the total yield that can be taken by the commercial fishery, as well as the sport catch in Area 2B, and the sport plus ceremonial and subsistence catches in Area 2A. To obtain this, the other removals are subtracted from the TCEY. For 2013, the total FCEY was 24,240,000 pounds.

SURVEY ACTIVITIES

Every year the IPHC conducts a standardized setline survey and participates in NMFS-run trawl surveys. Each of the surveys samples a unique component of the stock.

Setline survey

The Standardized Stock Assessment Survey (also called the "setline survey" or the SSA) is conducted both to supplement the data culled from the commercial halibut catch, and to enable the IPHC to rely on multiple data sets. Because halibut fishers tend to go where the halibut are, the commercial catch is not as good an indicator of changes in population as the survey catch. Survey vessels have to fish consistent patterns at specified geographic locations, whether or not the fish are biting (Fig. 2). 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 chartered 11 fishing vessels to carryout the IPHC setline survey in 2013. These were: F/V Bold Pursuit, F/V Clyde, F/V Free to Wander, F/V Kema Sue, F/V Norcoaster, F/V La Porsche, F/V Pacific Surveyor, F/V Pender Isle, F/V Star Wars II, F/V Van Isle, and F/V Waterfall.

Design and procedures

The 2013 setline survey design encompassed both nearshore and offshore waters coastwide from northern California northward into the Bering Sea. This area was divided into 29 charter regions, each requiring between 10 and 41 days to complete. Eleven commercial longline vessels (seven Canadian and four from

The F/V *Kema Sue* surveyed three regions in 2013: 4A Edge, 4D Edge, and Unalaska. Photo by Sam Parker.

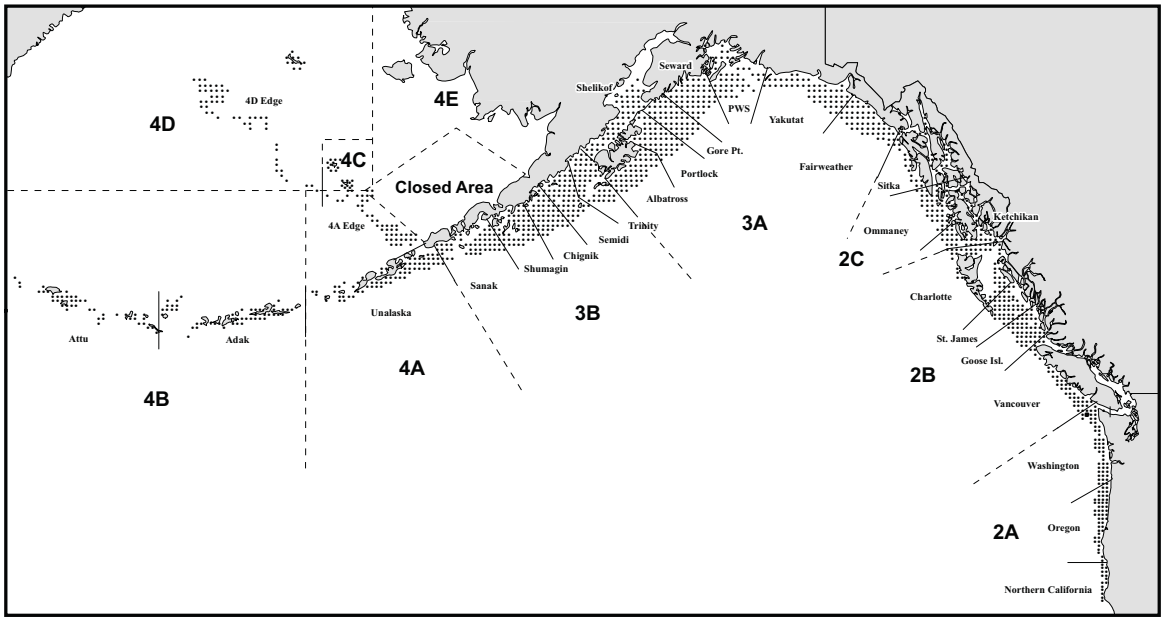


Figure 2. Stations fished during the 2013 setline survey.

the United States) completed a combined 68 trips and 659 charter days to fish a planned 1,297 stations (of which 1,284 were effective for stock assessment). The current station layout has been in place since 1998, with stations (the location at which the survey longlines were set) located at the intersections of a 10x10 nautical mile grid within the depth range occupied by Pacific halibut during summer months (20 to 275 fathoms in most areas). Fifteen stations were added in 2013 in northern California. Additionally, thirteen stations in southeast Alaska and eight rockfish index stations in Washington were fished on a different layout and were not included in the setline survey data set.

The setline survey 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 six skates were set at each station in all charter regions. Each hook was baited with 0.25 to 0.33 pounds of chum salmon. 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. For the sake of continuity and avoidance of nocturnal predators, 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.

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.

Culinary preparation:
The Fish House
at Stanley Park
(Vancouver, BC):
Seafood Risotto
Carbonara
Pan-seared halibut,
Alaska weathervane
scallop, prawns,
king crab, mussels,
prosciutto, sweet peas
and a quail egg

At-sea biologists assess halibut for length, sex, maturity, otoliths, and prior hooking injuries.

Sampling protocols

IPHC sea samplers (shipboard biologists) collected data according to set protocols. As gear was set, 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, samplers generally recorded the hook status (empty, returned bait, species captured, and bait type) of the first 20 consecutive hooks of each skate. In the northern waters of Area 2A, samplers recorded the status of all hooks in the order in which they were hauled, in place of 20-hook counts. Finally, samplers recorded the length of all halibut caught along with the corresponding skate number. The survey vessel crew then dressed each O32 halibut and passed it to the IPHC sampler, who collected data from it, including sex, maturity, prior-hooking injury severity and evidence of depredation, and removed 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, for studies investigating the spatial and temporal variation in their abundance.

Special projects

The IPHC took on twelve special projects that provided specialized data on: rockfish in Area 2A, yelloweye rockfish in Area 2C, oceanographic monitoring, environmental contaminants, *Ichthyophonus* parasites, spiny dogfish, skates, octopus, external archival tagging, Pacific sleeper shark, Pacific cod, depredation by marine mammals, and longline gear sink rates. These are discussed briefly here, and larger projects are included in greater depth in the Research chapter.

The survey team - including sea samplers as well as assorted Seattle staff and port samplers - pose for the group photo which marks the end of survey training and the beginning of the survey field season. Photo by Tom Kong.

Oceanographic monitoring

The IPHC deployed water column profilers from every chartered vessel on every station in 2013 (unless poor weather or tide conditions made deployment too risky) to measure chlorophyll, pH, temperature, depth, salinity, and dissolved oxygen (DO) concentration on the halibut grounds. This effort is explained more fully in the *Research* chapter.

Rockfish sampling in Regulatory Area 2A

In 2013 the F/V *Pacific Surveyor* fished all the setline survey stations in Area 2A, along with eight rockfish-specific stations (which were last fished in 2009). IPHC samplers retained all rockfish caught (12,951 pounds) in Area 2A, marked them with a tag and recorded the station and skate of their capture. After the fish were offloaded, state biologists from WDFW, ODFW, and CDFW collected additional data (such as sex, weight, length, and maturity) and biological material such as otoliths from each fish. The tags enabled biologists to identify catch data for each fish, such as the location and depth of capture.

The Area 2A rockfish stations were located off the coast of northern Washington, surrounding IPHC station 1082 at 2.5 nautical mile intervals. The fishing effort consisted of only three skates, to limit impacts on the rockfish population. Halibut that were caught on these rockfish skates were measured and released alive, with none of the data used in the stock assessment.

Culinary preparation: Simon and Seaforts (Anchorage, AK): Crab and Macadamia Nut Stuffed Halibut Oven roasted with king crab, tarragon, Swiss cheese, parmesan and buerre blanc

Yelloweye rockfish enumeration in Alaska

IPHC samplers on survey vessels recorded the capture of all yelloweye rockfish encountered in Area 2C and in the Fairweather charter region of Area 3A. A total of 1,168 yelloweye rockfish were recorded in 2013, and all associated data were sent to ADF&G for analysis.

Environmental contaminant sampling

IPHC samplers collected flesh samples from Pacific halibut caught by survey vessels, as part of an ongoing project with the Alaska Department of Environmental Conservation 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, polychlorinated biphenyl congeners, methyl mercury, and heavy metals such as arsenic, selenium, lead, cadmium, nickel and chromium.

The goal was to collect samples from 15 small fish (80-89 cm), 15 medium fish (90-112 cm), 30 large fish (113-148 cm), and 10 extra large fish (148 cm or greater). In 2013, there were 194 samples collected in all—59 from the Sanak region in the Aleutians (15 S, 16 M, 27 L, and 1 XL), 65 from the Albatross region (15 S, 15 M, 30 L, and 5 XL), and 70 from the Ommaney region in southeast Alaska (15 S, 15 M, 30 L, and 10 XL). Sometimes less than ten extra-large samples were collected, due to the scarcity of extra-large halibut.

Icthyophonus sampling

In 2013 the IPHC continued its investigation of the prevalence of a microscopic protozoan parasite called *Ichthyophonus* in the Pacific halibut population. This study is considered in more detail in the Research chapter.

In addition to standard halibut sampling, the survey also included 12 additional projects in 2013.

Spiny dogfish sampling

IPHC samplers were required by the NMFS Auke Bay Laboratories to record the length and sex of the first five spiny dogfish brought aboard survey vessels in Areas 2A, 2B, 3A, and 3B. They were required to record length and sex of all spiny dogfish caught by survey vessels in Area 4A, 4B, 4C, 4D, and 4E. A total of 2,931 dogfish samples were collected in 2013. The results were compared to those from the NMFS sablefish longline surveys. The goal of the study was to examine species distribution and to test the hypothesis that there may be two biological stocks of dogfish—a population that lives in inside waters in southeast Alaska, and a population that lives in coastal waters elsewhere. These data will be used to develop a length-based population dynamics model for the annual dogfish stock assessment.

Skate age and maturity sampling

Before the 2013 fishing season, the NMFS requested that the IPHC conduct a project in the Gulf of Alaska that entailed collecting age and maturity data on both longnose skates and big skates. Because of the project's complexity, only a pilot study was attempted, in order to determine if skate sampling during the IPHC setline survey would inhibit the data collection on halibut. One vessel collected samples from 93 longnose skates and 18 big skates. Each fish was sexed and measured, and had a vertebral section removed for aging.

Octopus sampling

The NMFS also requested that the IPHC conduct a comprehensive survey of octopus seen during the 2013 stock assessment survey. The purpose of the study was to investigate the spatial and depth distribution of the octopus species seen on halibut longline gear. A total of 169 octopi were recorded, with 154 (91%) of them identified as Pacific giant octopus. Eighty-one of the samples were sexed, and 48 (59%) of them were determined to be female. The average estimated weight was 13 kilograms.

External archival tagging

In 2013, two survey vessels—the F/V *Clyde* and the F/V *Waterfall*—tagged 901 O32 halibut with dummy archival tags to determine best practices in attaching archival tags. Four different methods were used. Although it is still too early to determine the best method, it is hoped that this will be revealed in the future. Details of this study can be found in the Research chapter.

Pacific sleeper shark genetic collection

Staff at the NMFS Auke Bay Laboratories requested assistance from the IPHC in collecting samples from Pacific sleeper sharks. The purpose was to examine their population genetics in the north Pacific. A previous study indicated that Pacific sleeper sharks in the Bering Sea form overlapping, multiple populations, and this new study was meant to supplement that data. Five survey boats, spread geographically, collected genetic samples from 67 sharks, of which 19 were measured.

Pacific cod length frequencies

The NMFS Alaska Fisheries Science Center requested data from the IPHC on Pacific cod captured during IPHC surveys in Areas 4A and 4D. The data, when combined with current NMFS data, were used in a continuing study to assess the stock of Bering Sea and Aleutian Islands Pacific cod. In 2013, IPHC samplers aboard the F/V *Kema Sue* collected 4,656 Pacific cod lengths (measuring the first 15 fish from each skate of gear).

Depredation tracking

Marine mammals such as killer whales, sperm whales, seals and sea lions target Pacific halibut. Halibut that are caught by the commercial fishery are especially vulnerable to depredation, since they are unable to escape predators when hooked. In 2013, IPHC samplers were tasked with recording all damaged and missing hooks during gear retrieval, in order to establish a baseline rate of gear damage against which stations with suspected depredation problems could be compared. In 2013, marine mammals approached charter vessels during gear retrieval on 46 sets. Twenty six (56.5%) of these encounters involved either

Culinary preparation: Duke's Chowder House (Seattle, WA): "Dungeness Crab Stuffed Just for the Halibut" Stuffed with Dungeness crab, wild Mexican prawns and imported cheeses

Sea samplers record interactions with marine mammals during fishing to track depradation rates. Photo by Sam Parker.

sperm whales or killer whales. Although damaged halibut were observed on ten of those stations at which whales were present, no sets where deemed ineffective for halibut stock assessment as a result of depredation. Analysis of marine mammal depredation is expected to continue into the future.

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 Alaskan Seafood Marketing Institute

grades A through E. The IPHC purchased approximately 255,000 pounds of this bait from five U.S. suppliers in August 2012 for the 2013 season. An additional 5,200 pounds of chum salmon were purchased during the 2013 season from two Alaskan salmon processors for use in the Alaska portion of the survey. The bait quality was monitored throughout the season, and found to have met the standard. The only exception to this was six sets that unintentionally used sockeye salmon; these sets were not included in the stock assessment.

Fish sales

O32 Pacific halibut caught by survey vessels—and sacrificed for their otoliths and other biological information—were retained and sold in 24 different ports in 2013 to offset costs of the survey program. There were a total of 602,191 pounds of such halibut in 2013. Although the price per pound varied by location, the coastwide average was $5.35 USD per pound, for a sales total of $3,221,294.05.

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. For boats in U.S. waters, bycatch sales were split between the survey vessel and the requisite state agency. For boats in Canadian waters, the DFO kept all the bycatch proceeds, but paid a bycatch handling fee to those boats.

The coastwide average price for survey-caught fish was $5.35 USD. The IPHC is able to sell the O32 halibut to help fund the survey.

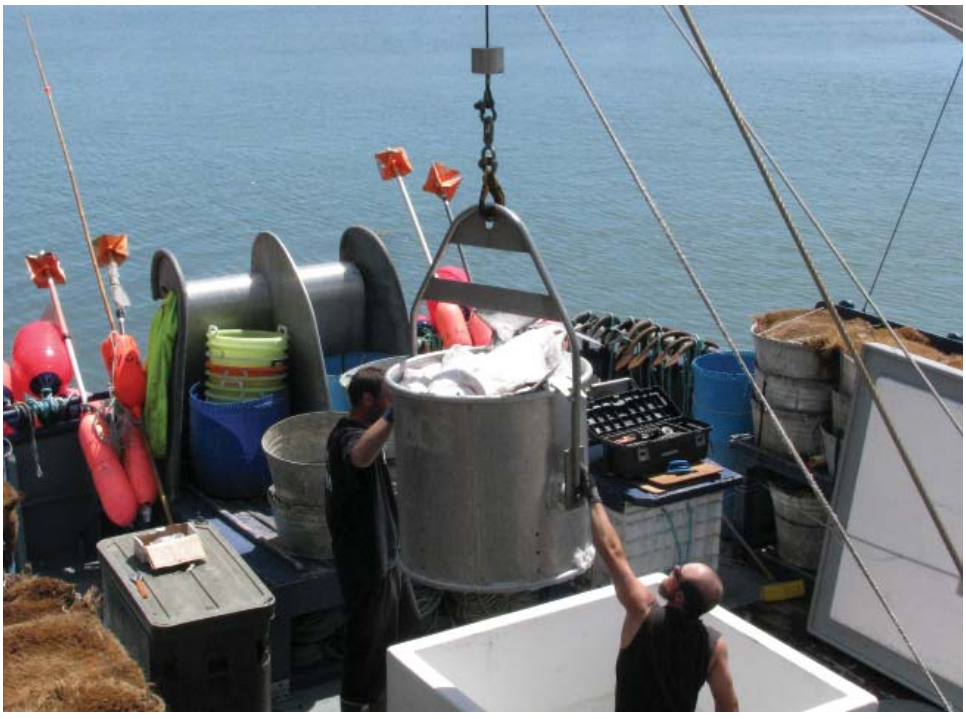
Field personnel

The IPHC used a mixture of seasonal hires and IPHC staff to work on survey vessels during the summer. It employed 22 seasonal samplers in 2013, all of whom worked a combined 1,400 person days (including travel days, sea days, and debriefing days). Additionally one port sampler worked 44 days and three IPHC staff participated on three different survey vessel legs for a total of 30 days. The IPHC typically assigns two samplers aboard each survey vessel, one shipboard biologist to work on deck (handling fish and collecting data and samples) and another sampler to work in a portable shelter, recording data and storing samples. The exception to this occurred in Area 2A. With catch rates there comparatively low, only one sampler was deployed per vessel (with the exception of the first trip in northern Washington waters, when two were assigned).

Setline survey results

The results of the standardized stock assessment survey encompassed subjects such as WPUE, survey timing, 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 following section.

As it has done every year, in 2013 the IPHC targeted the months of June through August for survey fishing. Only 25 stations (which comes to less than 2% of the total) were fished outside this window, with 20 stations fished during the last full week of May, and five stations fished during the first full week of September. Coastwide, survey activity grew in intensity at the beginning of the survey season and tapered off by the end of August as boats finished their charter regions. Typically, most boats that were chartered had to fish multiple regions that were not adjacent to one another. As long as all assigned stations were fished,



Crewmen from the F/V *Pacific Surveyor* offload their catch following a survey trip. Photo by Tracee Geernaert.

the boats did not have to adhere to a regulated order, but set their own fishing pattern.

Because the survey is fished on a grid instead of spaced opportunistically, the coastwide WPUE is generally lower for the survey compared to the commercial fishery.

Weight and number 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. Coastwide, the average WPUE was 87 pounds per skate, a decrease from the 98-pound average of 2012. The average WPUE figures for the regulatory areas were:

- Area 2A (24 pounds/skate)
- Area 2B (94 pounds/skate)
- Area 2C (183 pounds/skate)
- Area 3A (117 pounds/skate)
- Area 3B (64 pounds/skate)
- Area 4A (42 pounds/skate)
- Area 4B (57 pounds/skate)
- Area 4C (35 pounds/skate)
- Area 4D (25 pounds/skate).

Area 4E was not fished for survey purposes. Only two regulatory areas—2C and 4B—increased in WPUE in 2013; the rest declined.

Although weight is the primary unit of measure when studying population and removals, the number of halibut is also a critical measure. There was a 16% decrease in the catch rates of O32 halibut, and a 21% decrease in the numbers of U32 halibut caught in 2013, when compared to 2012. The NPUE for U32 halibut rose 12% in 2013. Areas 2C, 4B, and 4C all had slight increases in the rate of

capture. Area 3A showed its first NPUE decrease in both O32 and U32 halibut since 2010. Area 3B also showed a decline in both large and small halibut, and continues to have the largest gap in catch rates, with 45% more U32 halibut caught. It appears that numbers of large fish are continuing to decline, while numbers of small fish continue to increase.

Washington Sea Grant is part of a national network of 30 Sea Grant colleges administered by NOAA. Washington Sea Grant-sponsored research identifies and addresses important marine issues, provides better tools for management of the marine environment and use of its resources, and initiates and supports strategic partnerships within the marine community.

Otolith collection

An important part of survey operations was the removal and analysis of halibut otoliths. The otolith collection goal for 2013 was 2,000 per regulatory area (with a minimum target of 1,500 per area). A total of 13,031 otoliths were removed from the 67,864 halibut caught by survey vessels coastwide, a 19% removal rate. Due to low catch rates and few survey stations, four of the regulatory areas did not reach the minimum 1,500-otolith goal, despite 100% sampling rates: 2A (1,062), 4A (1,118), 4C (461) and 4D (623). Additional otoliths were collected in most regulatory areas for the clean otolith archive.

Bycatch

Approximately 107 species of fish and invertebrates were caught as bycatch during the survey. No marine mammals or birds were caught by IPHC charters in 2013. Coastwide, the most frequently caught bycatch species was Pacific cod, followed by sharks. Dogfish were the most commonly caught shark species in Areas 2A (99%), 2B (100%), 2C (96%), 3A (94%), and 4A (82%). In Areas 3B and 4A, Pacific cod was the most common bycatch. 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.

Halibut 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 91 and 120 fathoms (546 to 720 feet).

Just over 53% of the halibut caught (36,097 fish) on the 2013 survey were shorter than 32 inches, with a median length of 80 cm (31.5 inches) coastwide. Area 3A had the greatest proportion of these U32 halibut, at 40% (14,295 fish). Area 3A also had the greatest proportion of O32 halibut, at 42% (13,368 fish). The largest median lengths, both at 86 cm, occurred in Areas 2A and 2C. In 2013, median lengths increased in Areas 2C, 4A, and 4D, and decreased in Areas 2A, 3B, 4B, and 4C. They didn't change at all in Areas 2B and 3A. The areas that had average halibut lengths below the O32 threshold were Areas 3A, 3B, 4A, 4B, and 4C.

The sex composition for O32 halibut caught for the survey varied considerably by regulatory area, ranging from 41% to 81% female. The lowest percentage of females were caught in Areas 3B, 4A, and 4B, while the highest percentage were found in Area 4C. Most females caught in the summer survey months were in the ripening stage, and expected to spawn in the upcoming season.

Age distribution

Halibut age is determined by examination of the rings in otoliths. Of the otoliths collected during the survey 12,717 were successfully aged. The most

commonly occurring year class was 2002, with 1,653 (13.0%) eleven-year-olds caught. Next most common were the years 2004 and 2003, with 1,561 (12.3%) and 1,478 (11.6%) fish caught, respectively. The age distribution differed slightly for males and females. Of the 5,208 male halibut caught in the survey and aged, eleven-year-olds (from 2002) made up the most abundant class, at 654 (12.5%) fish aged. For females, 7,407 halibut were caught and aged, and the most abundant were nine-year-olds from 2004, with 1,019 (13.8%) fish aged.

The numbers below reflect only survey-caught fish. The oldest halibut caught in the survey was one 43-year-old male from Area 4B with a fork length of 118 cm. The youngest halibut, at four years of age, were two females. One came from Area 2B with a fork length of 68 cm, and the other was from Area 4D with a fork length of 50 cm. The largest halibut was one 30-year-old female from Area 4B measuring 210 cm. The smallest halibut sampled was a five-year-old male from Area 4C that measured 48 cm in length. Finally, 458 paired otoliths were collected for the COAC, which began in 2010.

Seabird occurrence

The IPHC (in collaboration with Washington Sea Grant) began collecting seabird occurrence data in 2002, along with the NMFS sablefish survey. Initially a collaborative project between the IPHC, 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 regulating seabird avoidance requirements for commercial fishing vessels. Seabirds are important to these organizations and commercial fisheries because fisheries can be shut down if the mortality of endangered seabirds (such as the 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.

The northern fulmar was the most commonly observed seabird during the setline survey.

Since the project began, 693,405 seabirds (including 36 unique species) have been observed in 15,130 separate counts. In 2013, a total of 51,363 seabirds (in 27 unique species) were observed in 1,293 separate counts during survey fishing operations. At 37,171 sightings for 72.4% of the total, the northern fulmar

Various species of seabirds are often observed during the survey. Photo by Sam Parker.

was the most commonly observed bird. In second place was the glaucous-winged gull, at 4,907 counts (9.6%), followed by the black-footed albatross with 4,392 counts (8.6%). The endangered short-tailed albatross—which is more commonly a Western Pacific bird—was counted 21 times in 2013.

New and unusual for 2013 were the sightings of 30 thick-billed murres off St. Matthew Island in the Bering Sea, a flock of eight ruddy turnstones in the Shelikof Strait, and 507 western gulls observed in the waters off California and Oregon.

NMFS Bering Sea trawl survey

In 2013 the IPHC participated for the 16th straight year in the NMFS annual trawl survey on the eastern Bering Sea shelf. Between June 7 and August 1, the survey stretched from Unimak Island in a northwesterly direction past St. Matthews Island. 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 caught in the trawl net, with the primary objective of continuing the annual series of crab and groundfish assessment surveys for the eastern Bering Sea standardized since 1982. An IPHC biologist was stationed aboard the F/V *Alaska Knight* for the duration of the cruise to accomplish two main objectives: 1) sample 100% of the halibut caught on all standard groundfish tows for fork length, sex, maturity, otoliths, and prior-hooking injuries (PHI); and 2) collect otoliths for the COAC.

In 2013, the IPHC put a biologist aboard both the NMFS Bering Sea and Gulf of Alaska groundfish trawl surveys.

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. The F/V *Alaska Knight* conducted 198 tows in three trips, and caught a total of 1,008 halibut. Of the total, 576 (49%) halibut were female and 604 (51%) were male. Ninety-nine percent of the female fish and 51% of the males were immature. The survey harvested 99 halibut otoliths for the COAC.

Size and age composition

Abundance is derived from area-swept estimates based on the survey catch and refers to the total number of fish in an area, as opposed to biomass, which is the total number of pounds that all those fish weigh. A survey time series such as this is particularly useful in tracking the year classes of Pacific halibut as they move through the population and approach commercial size. It is also the only measure of abundance for much of the Bering Sea, as the IPHC does not have the financial capability to sample it in its entirety. Total abundance of all sizes of halibut for 2013 was estimated to be 65.1 million fish. The corresponding biomass estimate was 405.6 million pounds. Although abundance is declining sharply, biomass has been relatively level during the past four years. Age composition for 2012 showed that seven-year-olds (class of 2005) represented the most numerous class, making up 24% (235 fish) of the 969 halibut caught in that survey.

NMFS Gulf of Alaska trawl survey

In 2013 the IPHC participated in the GOA trawl survey operated by the NMFS. This survey, targeting groundfish and invertebrates, was a continuation

Sorting the halibut out from the rest of the catch during the NMFS Bering Sea trawl survey. Photo credit: Sam Parker.

of a time series started in 1984. The survey was performed every three years up to 1999, and every two years since then. The main objective is to gather data to extend the statistical time series of monitoring trends in distribution, abundance, and biological condition of various groundfish stocks in the northeast Pacific Ocean. The IPHC has participated in each survey since 1996 and the objective remains the same: collect Pacific halibut size and maturity information, along with age structures to aid in stock assessment and year-end forecasting.

Culinary preparation: Dahlia Lounge (Seattle, WA):
Alaskan Halibut
With curried green chickpeas, yogurt, tomato chutney, papadum and cilantro

Two vessels—the F/V *Alaska Provider* and the F/V *Sea Storm*—were chartered to carry out the survey. Each vessel held a scientific crew of six scientists besides its professional crew and captain. The IPHC sampler was aboard the F/V *Alaska Provider*. The survey began on May 29 and stretched from the waters south of the Islands of Four Mountains, eastward along the Alaskan coast to Dixon Entrance where it concluded on August 4. The survey area was divided into 59 strata in depths from 15-700 m, with the number of samples taken per stratum based primarily on distribution and abundance estimates from prior surveys and the relative commercial value of the major groundfish species. At least two samples were required from each stratum, and they were taken by towing a trawl net at a rate of three knots for 15 minutes (bottom duration).

The proportion of males to females in the Bering Sea sample was close to equal (i.e. 51% and 49%, respectively). In the GOA, the percentages favored males comprising 59% of the sample, compared to females at 41% of the sample.

Halibut lengths were recorded on 100% of the halibut from both vessels. On the F/V *Alaska Provider*, a two-thirds subsample was retained for measurement of gender, maturity determination, and otolith removal. The halibut that were lengthed only, were returned to the sea unharmed after measurement.

The two vessels completed 548 successful stations during the survey. The F/V *Alaska Provider* attempted 301 groundfish tows (averaging four to six tows per day), and completed 268 successful tows for abundance estimation. A total of 1,823 halibut were caught and measured, with 1,118 retained for sampling. Of the latter number, 1,051 stayed in the general sample and 67 were retained for the COAC. Fifty-nine percent of the halibut sampled were male, and 41% were female. Of the females sampled, 12.5% were coded as mature, the highest level in recent years. For males, 96.9% were coded as mature.

Abundance and age composition

The 2013 abundance estimate of 105 million halibut continued a steadily declining trend over the last decade (with the exception of 2009). Beginning in 2007, the year classes of 2004 and 2005 showed great promise—comprising 13% and 9% of the catch, respectively—and continued to dominate the catch through 2011. The recent coastwide decline in abundance shows up clearly in the western areas of the GOA, but is more muddled in the east. There are also size differences among the regions. In the east, catch composition was primarily 40-79 cm (approximately 15 to 31-inch) halibut and very few under 40 cm, in contrast to the west where there are more halibut in numbers, but the fish are generally smaller.

Prior hook injuries

Detected PHIs in the setline survey ranged widely from a 5.3% incidence in Area 4B to 19.7% in Area 4D.

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 moderate and severe PHIs is still widespread. This phenomenon concerns the IPHC because these PHIs are visible evidence of past rough handling, and IPHC studies have shown that moderate to severe injuries increase halibut mortality.

In the 2013 SSA survey, 67,864 halibut (using 7,608 standard survey skates on 1,276 sets) were examined for PHIs. This was far less than the 81,977 examined in 2012. As in 2012, six skates were fished at each station. Coastwide, 4,958 (7.5%) halibut were found to have had PHIs, the same percentage as in 2012. The regulatory area with the smallest percentage of PHIs was Area 4B (5.3%), and the highest was Area 4D (19.7%). The percentage of PHIs for all halibut fluctuated, either increasing or decreasing slightly from the previous year. The only significant changes were the increases in Areas 2B and 2C, and the decrease in Area 3B. PHI rates remained comparatively high in Area 4, especially 4D (19.7%). The PHI changes for U32 halibut were more telling. Coastwide, they fell from 5.8% in 2012 to 4.9% in 2013. PHI rates decreased dramatically in Areas 2A, 3B, 4A-Aleutians, 4B, 4C, and 4D. Rates increased in Areas 2B, 2C and 4A-Bering Sea, and remained mostly unchanged in Area 3A. The highest rate of PHIs for U32 halibut was still in Area 4D, at 13.4%, though this was a noticeable drop from the 17.9% in 2012.

The samplers aboard the NMFS trawl survey in the Bering Sea also gathered PHI data. In the 2013 survey, 1,180 halibut were inspected and the PHI rate was determined to be 5.1%, up from the 2.8% measured in 2012. The biannual NMFS Gulf of Alaska trawl survey in 2013 inspected 1,147 halibut and experienced a 3.3% PHI rate, the same rate as was found in 2011, the year the last survey was done.

The IPHC has determined that high PHI rates in both the Bering Sea and the Aleutian Islands likely reflect the interception of Pacific halibut by Pacific cod groundfish fisheries in those areas. The impact of this fishery is probably more severe than the evidence shows, because the IPHC's PHI observations only reflect the number of injured halibut that survived the ordeal. Moderate to severe hooking injuries commonly kill halibut, and those that do survive often stop growing, or grow at a very stunted rate. There is no way to count the halibut that

did not survive. The IPHC is currently investigating the PHI data time series to determine whether there are relationships (with respect to space or time) of injury rates with fishing effort. In particular it plans to develop models relating injury rates to commercial and sport efforts that will allow it to examine how such relationships vary through space and time.

Photo by Sam Parker.

Culinary preparation: Anthony's Pier 66 (Seattle, WA): Fresh Alaska Halibut Alder planked with smoked garlic and fresh basil beurre blanc. Seared and lightly seasoned. Served over spring asparagus and risotto

RESEARCH

In addition to assessing the halibut stock, biological research projects are an important supplementary activity that adds to the knowledge base about Pacific halibut. This enables both the IPHC and scientists worldwide to better understand halibut and their environment. Unlike the standardized population assessment, research projects may change from year to year. In 2013, these projects included oceanographic monitoring, parasites (including the troublesome *Ichthyophonus*), the archived collection of clean otoliths, a sampling pilot study, and tagging studies.

Research projects are generally geared towards supplementing the knowledge base of Pacific halibut habitat, health, and migration, among other things.

Oceanographic monitoring on the setline survey

The year 2013 was the fifth for a continuing coastwide project that began in 2009, in which the IPHC used water column profilers to collect oceanographic data on the halibut grounds from southern Oregon northward along the coast all the way to the Aleutian Islands and into the Bering Sea. The coastwide project was initiated with help from NOAA and ODFW. The objective is to better understand the factors behind the fluctuations in distribution, growth, and recruitment of fish populations, especially those relating to climatic and oceanic conditions. Oceanic conditions directly affecting fish include variations in water temperature, salinity, and dissolved oxygen (among other environmental factors).

In 2013 biologists and crew on the eleven vessels chartered by the IPHC successfully profiled 1,043 out of a possible 1,297 stations, an 80% success rate. New for this year was the addition of fifteen stations in northern California. Occasionally the research staff experienced unsuccessful data capture. This was

Coast (Vancouver, BC): Grilled Haida Gwaii Halibut With warm Nicoise-style potato salad, prosciutto and romesco sauce

The profilers are deployed just prior to hauling the gear at each survey station. Photo by Sam Parker.

due primarily to poor weather or strong tides. The majority of mechanical issues were corrected promptly, with the exception of pH sensors on two profilers. This resulted in 960 usable stations for acidification data. One final mishap was the failure of one laptop that got inadvertently swamped with seawater.

Deployment protocols have been standardized across areas and years to ensure uniformity in data collection. 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, DO, pH, and chlorophyll *a* concentration. Once it hit bottom, the profiler was hauled aboard, cleaned and prepped for the next station. Approximately once a day, the data it captured was uploaded onto a computer and 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 all over the world, at http://www.ecofoci.noaa.gov/projects/IPHC/efoci_IPHCData.shtml.

2013 was the fifth consecutive year of environmental data collection on the setline survey coastwide. Approximately 5700 successful casts have been completed thus far.

The highest chlorophyll concentration was found east of Amchitka Pass in the Aleutian Islands, although blooms were found coastwide. Not unexpected, the coolest bottom temperatures were found in the northern Bering Sea along the Area 4D Edge, and the warmest were found further south in Hecate Strait, British Columbia. The most acidic and largest area of low DO water was found off Oregon and Washington.

After five years of profiling, some environmental generalizations can be made. Relative to other sampled areas, near-bottom conditions along the U.S. west coast and British Columbia are characterized by low DO, low pH, warmer temperatures and moderate amounts of primary production. The continental shelf waters in the GOA differ between the east and the west, with the western portion featuring warmer temperatures, higher DO and less acidification compared to the eastern and central GOA. The Bering Sea and the Aleutian Islands are characterized by relatively cooler temperatures, higher DO (except at very deep stations), moderate primary production, and a variety of pH conditions.

Ichthyophonus prevalence in Pacific halibut

Culinary preparation: Orso (Anchorage, AK): Walnut Crusted Fresh Alaskan Halibut Basil, chive and walnut crust, creamy rosemary polenta and mustard sauce

Ichthyophonus hoferi is a microscopic marine parasite that is harmless to humans, yet can be devastating to fish populations. It resides in the internal organs (especially the heart) and musculature of fish, forming numerous tiny cysts that eventually lead to death. It has infected more than 80 species worldwide, including Pacific 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.

In order to better understand *Ichthyophonus*, the IPHC and the United States Geologic Survey (USGS) in 2011 collected halibut heart tissue samples from three geographically diverse sites and tested them. It has continued the study every year since then. In 2013 contamination was measured at 29.7% in the northern Bering Sea, 23.7% off the Oregon Coast, and as high as 58.3% in Prince William Sound. It remains unclear why Prince William Sound has been affected more significantly than other places, though a localized infection source

or environmental conditions might be the culprit. Coastwide, the IPHC estimates that *Ichthyophonus* has infected an average of 37.2% of all Pacific halibut. Age, sex, and size have not been significant differentiators in the infection rates of Pacific halibut. It is important to note that there are no historical data for *Ichthyophonus* infection in Pacific halibut, nor is it known what effects it may be having on mortality or growth dynamics. Although it impacts other species in profound ways, its effects on Pacific halibut are as yet unknown. The IPHC is only in the beginning stages of what is expected to be an intensive long-term study.

A total of 31 IPHC tags were recovered in 2013. Another 55 were wearing sport fishery tags.

Tagging studies

Since the IPHC began tagging Pacific halibut in 1925, over 450,000 halibut have been tagged and released—for the study of migration, utilization, age, growth, and mortality. Of that total, over 50,000 tags have been recovered. The tags have taken different forms over the years, due both to experimental requirements and to technological advancement.

Tag Releases in 2013

The IPHC tagged and released 901 halibut with inactive ("dummy") archival tags into Area 3A to evaluate tag mounting locations. A single archival dummy tag was attached to the cheek in 25% of the fish. The remaining 75% were double-tagged with both a wire cheek tag and an archival dummy tag attached to the fish's dorsal area using a dart and tether assembly. By the end of 2013, only twelve halibut from this study had been recovered; eleven of these had been double-tagged and nine were still carrying both tags. This study is described more fully below.

Culinary preparation: The Brooklyn (Seattle, WA):
Wild Alaskan Halibut Potato crusted and pan roasted, served with golden chanterelle mushrooms, crusted and pan roasted, served with golden chanterelle mushrooms and finished with a brandied lobster butter

Tag Recoveries

In 2013, eighty-six tagged Pacific halibut were recaptured; 31 from various IPHC tagging experiments, and 55 wearing sport fishery 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 2013, seventeen of these tags were recovered—eight from fish captured in 2013 and the remainder in previous from NMFS observers. To date, 38 (5%) of these tags have been recovered.

Pop-up satellite transmitting archival (PAT) tags

PAT tags are electronic tags that are attached to halibut using a dart-and-tether (leader) system. The tags are programmed to release from the fish on a specific date and broadcast their information to passing satellites. These tags can be recovered by fishers before the programmed pop-up date, or found on beaches after releasing, and fish that once bore tags can be captured many years later still carrying the leader. In 2013, one PAT tag leader was recovered from a halibut that was part of a 2008-2009 tag release studying halibut dispersal in the Bering Sea. Of the original 127 tags, 116 of them (91%) released and broadcast as expected, and to date eight (6%) of the tags have been recovered, as well as five (4%) of the fish carrying just the leaders.

Archival & dummy archival tags

In 2013, one tag (and its mounting cradle) from a 2008 archival tagging release conducted in Area 2B washed ashore on a beach and was returned to the IPHC. Of the original 166 tags released in that study, 22 (13%) had been recovered by the end of 2013.

Sport tags

IPHC research scientist, Tim Loher, experiments with archival tags. Photo by Tracee Geernaert.

The IPHC supplies tags to the Homer Jackpot Halibut Derby and the Seward Halibut Tournament on an annual basis. It also supplied tags to a new halibut fishing derby—the Coffman Cove Derby of Coffman Cove, Alaska. The Homer Derby released 116 tags in 2013, and 31 were recovered. Additionally, 23 tags from previous Homer derbies were recovered—one from 2007, two from 2009, one from 2010, and 19 from the 2012 derby. All but one, which was recovered from a commercial fish delivery in Area 2B, were recovered by sport fishers during the derby. The Seward Tournament—now in its second year—released eleven tags in 2013, one of which was recovered during the derby. Finally, the inaugural Coffman Cove Derby released five tags in June 2013, and none have been recovered to date.

Halibut derbies whereby fish are tagged and released, then are worth a prize if re-captured, have become a popular enticement for sport fishing enthusiasts.

External archival tagging project

As mentioned earlier, the IPHC released 901 O32 halibut with archival dummy tags in 2013 as part of a tagging field test. Described more fully in the "Field Testing" section below, this was the latest in a series of tagging experiments that the IPHC began in 2002 in order to study the seasonal movements of halibut. The program has 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.

The IPHC began this research program using PAT tags, but those tags have some limitations. Among them are limited battery life due to the power that is required during their satellite transmissions, and a large size that can only be placed on larger fish, leaving out the study of smaller fish. More recently, the IPHC has begun using smaller electronic tags that can operate for more than five years, but halibut carrying these tags must be recaptured and ensuring that the tags will remain attached for long periods is a challenge. With that in mind, the IPHC began a series of experiments designed to study tag retention, using captive fish. These started by implanting "dummy" archival tags into halibut in 2006, with implantations first occurring in wild fish in 2009. In November of the same year (2009), a study (results summarized below) was initiated to expand the range of possible tagging methods: this study employed intracoelomic implantation, external attachment to the dorsal musculature using three different attachment techniques, and perpendicular attachment to the operculum. In 2011, additional tagging methods were used, including parallel attachment to the operculum, two new methods of external attachment to the dorsal musculature, and two different methods for embedding tags into the dorsal musculature. All of the captive fish used in these experiments have been housed at the Oregon Coast Aquarium in Newport, Oregon. The experiment that began in 2009 is expected to continue through 2014.

The right attachment of an archival tag is paramount to a successful tagging study.

Results of the ongoing captive tagging experiment

All the tagged halibut, and a group of untagged "controls", were examined and observed at regular intervals after the initial series of taggings. These occurred at week 0 (initial tagging in November 2009), 2, 5, 13, 22, 32, 44, 54, 69, 77, 86, 106, 115, 126, 146, 167, 179, and 203 weeks.

Since the captive holding study began, six fish have died—one in week 6 from suture failure after intracoelomic implantation; one control (untagged) fish from mysterious causes in week 48; a third (with a tag that was dorsally mounted using a tether and titanium dart) in week 100; the fourth (with a through-body flat pack tag); the fifth (with a stainless steel dart) mortalities, which occurred in 2013, were due to ovarian infections common to fish that are unable to release their eggs in captivity; and the sixth (with an intracoelomic implantation) died in 2013 from unknown causes after an eight-month decline in its general health.

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 was 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 (one with a flat stainless steel dart and one with a cylindrical PVC dart), the tags extruded within ten weeks of implantation, though they haven't been completely shed through 126 weeks of observation. Up to now, no behavioral differences have been noted between the various tagging groups, though it will be analyzed statistically at the end of the experiment. No single method has yet been identified as the best future option.

Field Testing

In the most recent field test, 901 halibut were fitted with external archival dummy tags. The tagging protocol stipulated that the halibut chosen for tagging had to be geographically in proportion to the surveyed abundance of O32 halibut within the chosen study area, which was the region just to the north and east of Kodiak Island. With that in mind, the 47 survey stations that had the highest catch rates in the target survey regions during the 2010-2012 surveys were chosen. At each station between twelve and 32 fish were to be tagged, at rates roughly in proportion to average O32 halibut catch rates observed from 2010-2012. After some necessary adjustments for actual halibut abundance and condition, the final result became 53 tagging stations, each with between one and 45 tagged fish. Of the 901 total archival tags, 226 were mounted with a flat titanium dart and tether, 224 with a flat stainless steel dart and tether, 225 with a cylindrical PVC plastic dart and tether, and 225 were attached to the fish's operculum (perpendicular to its anterior-posterior axis). An unfortunate transcription error, left one fish tagged with an unidentifiable method. Of the total, twelve tagged fish were recovered in 2013: eight that were attached using a flat titanium dart and tether, two with a stainless steel dart and tether, one with a plastic (PVC) dart and tether, and one with the dummy tag mounted to the operculum. These four tagging treatments used exacting methods and specific materials, which are described completely in the 2013 RARA. All tags, whether dummy or wire, were printed with tag numbers and return information. Each tag returned to the IPHC is worth a $100 reward.

Rewards are given for many tag recoveries. *See page 93 of this report for more information.*

Passing by the Aleutian Islands. Photo by Sam Parker.

Staff Happenings

The research and programs highlighted in this report account for the majority of IPHC staffers' time. However, there is also a considerable amount of effort put into public outreach, attending conferences that enhance knowledge, participating on committees outside of the IPHC, and seeking further education and training. This section highlights some of those activities.

The IPHC welcomed veteran otolith reader, Chris Johnston, and newly trained otolith reader, Dana Rudy, to the age lab staff in 2013. Photo by Tom Kong.

Conferences, meetings, and workshops

- 2nd International Conference on Fish Telemetry in Grahamstown, South Africa - Tim Loher
- Committee of Age Reading Experts (CARE) workshop in Seattle, WA - Joan Forsberg, Robert Tobin
- 7th International Fisheries Observer and Monitoring Conference in Chile - Heather Gilroy, Gregg Williams
- Managing Our Nations Fisheries meeting in Washington D. C. - Bruce Leaman
- Halibut Advisory Board (HAB) meeting in Vancouver, B. C. - Kirsten MacTavish, Ian Stewart
- American Fisheries Society meeting in Lake Chelan, WA - Robert Tobin
- CAPAM Selectivity Workshop in LaJolla, CA - Ian Stewart
- Pacific Halibut Management Association Meeting in Nanaimo, B. C. - Bruce Leaman
- eLandings Interagency Meeting in Anchorage, AK - Huyen Tran
- Catchability Workshop in Seattle, WA - Ian Stewart
- Young Fishermen's Summit in Anchorage, AK - Bruce Leaman
- International Fisheries Commission Pension Society Annual Meeting in Victoria, B. C. - Bruce Leaman, Michael Larsen

Awards, training, and certifications

- Ergonomic Injury Prevention for Commercial Fishermen class - Ed Henry, Tracee Geernaert
- Shipping Hazardous Materials Training - Ed Henry

The IPHC and NOAA are co-hosting the 9th International Flatfish Symposium in Fall of 2014. Pictured above is the local organizing committee (comprised of staff from both agencies), which began planning for the conference in 2012. Photo by Tom Kong.

- Laboratory Safety Standard Compliance class - Ed Henry, Robert Tobin
- NPFVOA cold water survival training - all sea samplers and a number of Seattle Staff

Outreach and education

- Pacific Marine Expo ('Fish Expo') in Seattle, WA - Steve Kaimmer, Claude Dykstra, Ed Henry, Steve Keith, Tom Kong, Kirsten MacTavish, Dana Rudy, Huyen Tran, Tracee Geernaert
- Fishermen's Fall Festival in Seattle, WA - Tracee Geernaert, Ed Henry
- Pacific Northwest Sportsmen's Show in Portland, OR - Steve Kaimmer, Heather Gilroy, Ed Henry, Bruce Leaman
- Saltwater Sportsmen's Show in Eugene, OR - Steve Kaimmer
- Expanding Your Horizons science workshops in Edmonds and Bellevue, WA - Lauri Sadorus
- Beach naturalist with the Seattle Aquarium in Seattle, WA - Claude Dykstra
- Western Washington University Environmental Studies class guest speaker - Lauri Sadorus
- Graduate committee member, University of Alaska Fairbanks - Tim Loher

Committees and organization appointments

- 9th International Flatfish Symposium local organizing committee - Tim Loher (co-chair), Lauri Sadorus, Lara Erikson, Tracee Geernaert, Tamara Briggie
- Western Groundfish Conference organizing committee - Claude Dykstra, Kirsten MacTavish
- Gulf of Alaska Groundfish Plan Team - Ian Stewart
- Technical Subcommittee for the Canada-U.S. Groundfish Committee (TSC) in Seattle, WA - Kirsten MacTavish, Claude Dykstra
- IPHC liaison to the NPFMC and PFMC - Gregg Williams, Heather Gilroy, Bruce Leaman, Ian Stewart
- Observer Science Committee - Ray Webster
- NOAA/NMFS Pretrale and Darkblotched STAR panel reviewer - Ian Stewart

APPENDICES

The tables in Appendix I provide catch information for the 2013 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 2013 estimates of total removals (thousands of pounds, net weight), 2013 catch limits and catch of Pacific halibut by regulatory area, and 2013 sport guideline harvest level and sport guided harvest for Areas 2C and 3A.

Table 2. The Area 2A 2013 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (net weight).

Table 3. The 2013 Area 2B catch limits as allocated by the Canadian Department of Fisheries and Oceans and estimated catches (thousands of pounds, net weight).

Table 4. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2013 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 2013 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 2013 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 2013.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2013 by statistical area and regulatory area.

Table 9. The fishing period limit (pounds, net weight) by vessel class used in the 2013 directed commercial fishery in Area 2A.

Table 10. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2013.

Appendix II.

Appendix I.

Table 1. The 2013 estimates of total removals (thousands of pounds, net weight), 2013 catch limits and catch of Pacific halibut by regulatory area, and 2013 sport guideline harvest level and sport guided harvest for Areas 2C and 3A.

Area	2A	2B	2C	3A	3B	4	Total
Commercial	526	5,951	2,912	10,852	4,009	4,190	28,440
Sport[1]	507	822	1,627	3,715	20	25	6,716
Bycatch Mortality[2]**:**							
O26	119	185	8	927	621	3,186	5,046
U26 fish	10	40	0	510	260	2,020	2,840
Personal Use[3]	29	405	396	254	16	32[4]	1,132
Wastage Mortality:	27	207	107	518	407	163	1,429
IPHC Research	16	92	121	225	82	67	603[5]
Total Removals	1,234	7,702	5,171	17,001	5,415	9,683	46,206
2013 Catch Limits[6]	990[7]	7,038[8]	2,970	11,030	4,290	4,710	31,028
2013 Catch	1,062[7]	6,773[8]	2,912	10,852	4,009	4,190	29,798
2013 Sport GHL			788	2,734			NA
2013 guided harvest			723	2,271			NA

[1]Alaska and Area 2A sport estimates are preliminary.
[2]Area 2A bycatch is the 2012 estimate as the 2013 estimate will not be available until 2014.
[3] Includes 2012 Alaskan subsistence harvest estimates.
[4] Includes 10,000 pounds of U32 halibut retained in the 2013 Area 4DE Community Development Quota.
[5] Includes pounds discarded at the dock and differences due to rounding.
[6] Does not include pounds from the underage/overage programs in Area 2B or Alaska.
[7] Includes commercial, sport, and treaty subsistence allocations and catch.
[8] Includes commercial and sport allocations and catch.

Appendix I.

Table 2. The Area 2A 2013 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (net weight).

Area	Catch Limit	Catch
Non-treaty directed commercial	173,390	165,000
Non-treaty incidental commercial with salmon troll fishery	30,600	30,000
Non-treaty incidental commercial with sablefish fishery	21,410	15,000
Treaty Indian commercial	314,300	316,000
Treaty Indian ceremonial and subsistence	32,200	28,500
Sport – Washington	214,110	255,000
Sport – Oregon/California	203,990	252,000
Total allocation/catch	990,000	1,061,500
IPHC research catch		16,000
Grand Total	990,000	1,077,500

Table 3. The 2013 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	5,958	5,951
Sport fishery[1]	1,080	822
Total allocation/catch	7,038	6,773
IPHC research catch		92
Grand Total	7,038[2]	6,865

[1] The Experimental Recreational Halibut Fishery pilot program (XRQ) allowed sport operators to lease quota (8,931 pounds) from commercial operators; sport catch included 7,751 pounds from the XRQ program and 813,784 pounds from the recreational fishery.

[2]Adjustments totaling +26,248 pounds were made to the total catch limit in 2013, including pounds from the commercial underage/overage program (+55,056 pounds), carryover from the XRQ 2012 sport fishery (+1,227 pounds), and treaty mitigation adjustments (-30,035 pounds).

Appendix I.

Table 4. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2013 commercial fishery, including IPHC research catch, by regulatory area and month.

	March	April	May	June	July	August	Sept.	Oct.	Nov.	Grand Total
2A	223	76	22	115	97	4	2	3	-	542
2B	431	657	704	572	1,083	1,065	615	813	103	6,043
2C	271	508	555	502	235	365	305	263	29	3,033
3A	342	1,964	2,432	1,784	1,063	1,296	1,172	824	200	11,077
3B[1]		317	558	717	459	881	656	379	124	4,091
4A	-	9	204	198	183	263	209	159	8	1,233
4B[2]		98	145	119	178	374	157	145	37	1,253
4C[3]	-	-	-	15	330	97	70		-	512
4D[4]	-	-		348	276	80	275			979
4E[5]	-	-		102	155	23			-	280
Alaska Total	613	2,896	3,894	3,785	2,879	3,379	2,844	1,770	398	22,458
Grand Total	1,267	3,629	4,620	4,472	4,059	4,448	3,461	2,586	501	29,043

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

Appendix I.

Table 5. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2013 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	591	52	208
0 to 25 ft.	0	0	238	365
26 to 30 ft.[1]			106	486
31 to 35 ft.[1]	12	160	166	2,471
36 to 40 ft.	28	764	109	896
41 to 45 ft.	33	781	120	1,842
46 to 50 ft.	26	1,001	118	2,251
51 to 55 ft.	23	1,223	61	1,498
56 + ft.	28	1,523	224	12,441
Total	174	6,043	1,194	22,458

	Area 2C		Area 3A	
Overall Vessel Length	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length	44	79	6	95
0 to 25 ft.	57	69	22	59
26 to 30 ft.	31	102	16	61
31 to 35 ft.	73	446	69	1,287
36 to 40 ft.	65	256	46	529
41 to 45 ft.	65	339	61	1,119
46 to 50 ft.	69	452	57	960
51 to 55 ft.	43	431	35	758
56 + ft.	88	859	169	6,209
Total	535	3,033	481	11,077

	Area 3B		Area 4	
Overall Vessel Length	No. of Vessels	Catch (000's lbs.)	No. of Vessels	Catch (000's lbs.)
Unk. Length[2]	4	34		
0 to 25 ft.[2,3]			160	237
26 to 30 ft.[3]			59	323
31 to 35 ft.[3]	32	281	30	457
36 to 40 ft.	9	77	5	34
41 to 45 ft.	28	327	3	57
46 to 50 ft.	30	378	7	461
51 to 55 ft.	10	196	3	113
56 + ft.	108	2,798	55	2,575
Total	221	4,091	322	4,257

For confidentiality reasons:

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

[2] Vessels of unknown length in Area 4 were combined with 0 to 25 ft. vessels.

[3] Vessels 0 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.	0	0.0
26 to 30 ft.[1]		
31 to 35 ft.[1]	6	1.8
36 to 40 ft.	6	12.1
41 to 45 ft.	12	31.5
46 to 50 ft.	22	47.9
51 to 55 ft.	7	11.7
56 + ft.	7	60.4
Total	60	165.4

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

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.	6	0.7	0	0.0
26 to 30 ft.	10	2.6	0	0.0
31 to 35 ft.	13	2.8	0	0.0
36 to 40 ft.[1]	19	4.4		
41 to 45 ft.[1]	29	9.3	3	2.3
46 to 50 ft.	17	7.7	3	2.1
51+	6	3.0	7	10.3
Total	100	30.5	13	14.7

For confidentiality reasons:

[1] Vessels 36 to 45 ft. in the Area 2A Incidental Commercial (Sablefish) fishery were combined with 46 to 50 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 2013 Pacific halibut commercial fishery.

Area 2A	Fishing Period	Catch Limit	No. of Days	Commercial Catch	Research Catch	Total Catch
Treaty Indian	Unrestricted:					
	3/23 –25		48-hours	223		223
	Restricted/Mop-up:					
	4/3-4, 4/15-16,		36-hours	75		75
	5/8, 6/6, 7/13		12-hours	10		10
	Special Fishery:					
	7/20-8/3			8		8
Total		314.3				316
Incidental in Salmon Fishery	5/1 – 8/10[1]	30.6		30		30
Incidental in Sablefish Fishery	5/1 – 10/31	21.4	184 days	15		15
Directed[2]	6/26		10-hours	101		
	7/10		10-hours	64		
Directed Total		173.4		165		165
2A Total		539.7		526	16	542

Area	Fishing Period	Catch Limit	Adjusted Catch Limit[3]	Commercial Catch	Research Catch	Total Catch
2B	3/23 – 11/7	5,958	5,974	5,951[4]	92	6,043
2C	3/23 – 11/7	2,970	3,004	2,912[5]	121	3,033
3A	3/23 – 11/7	11,030	11,221	10,852	225	11,077
3B	3/23 – 11/7	4,290	4,392	4,009	82	4,091
4A	3/23 – 11/7	1,330	1,354	1,207	26	1,233
4B	3/23 – 11/7	1,450	1,505	1,224	29	1,253
4C	3/23 – 11/7	859	886	508[6]	4	512
4D	3/23 – 11/7	859	883	971[6,7]	8	979
4E	3/23 – 11/7	212	212	280[7]	0	280
Alaska Total		23,000	23,457	21,963	495	22,458
Grand Total		29,497.7	29,971[8]	28,440	603[9]	29,043

[1] Closed on August 8 in the area north of Cape Falcon, Oregon.
[2] Fishing period limits by vessel class.
[3] Includes adjustments from the underage/overage programs, and in 2B, quota held by DFO for First Nations through relinquishment processes and the quota leased through the Experimental Recreational Halibut Fishery (XRQ) pilot program.
[4] Includes the pounds that were landed by Native communal commercial licenses (FL licenses).
[5] Includes the pounds taken in the Metlakatla fishery within the Annette Island Reserve.
[6] Area 4C IFQ and CDQ could be fished in Area 4D by NMFS and IPHC regulations.
[7] Area 4D CDQ could be fished in Area 4E by NMFS and IPHC regulations.
[8] Includes Area 2A catch limit.
[9] Includes pounds discarded at the dock and differences due to rounding.

Appendix I.

Table 7. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2013.

IPHC Group	Canada	United States	IPHC Research	Grand Total
CA & OR	-	147	13	160
Bellingham/Seattle	-	531	3	534
WA	-	283	-	283
Vancouver	184	-	-	184
Port Hardy	3,045	-	23	3,068
Southern BC	348	-	7	355
Prince Rupert & Port Ed.	2,192	-	100	2,292
Northern BC	182	-	-	182
Ketchikan, Craig, Metlakatla	-	239	9	248
Petersburg, Kake	-	1,045	40	1,085
Juneau	-	1,146	12	1,158
Sitka	-	1,200	39	1,239
Hoonah, Excursion, Pelican	-	223	-	223
Southeast AK	-	604	-	604
Cordova	-	592	7	599
Seward	-	2,756	57	2,813
Homer	-	4,429	22	4,451
Kenai	-	51	-	51
Kodiak	-	3,395	99	3,494
Central AK	-	2,098	105	2,203
Akutan & Dutch Harbor	-	2,096	22	2,118
Bering Sea	-	1,654	45	1,699
Grand Total	**5,951**	**22,489**	**603**[1]	**29,043**

[1] Includes pounds discarded at the dock and differences due to rounding.

Appendix I.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2013 by statistical area[1] and regulatory area.

Stat Area	Catch			Regulatory Area	Catch for Reg Area
	Commercial	Research	Total		
008/009	6	4	10	2A	542
010	30	4	34		
020	106	2	108		
030	8	1	9		
040	59	1	60		
050	317	4	321		
060	176	4	180	2B	6,043
061	12	0	12		
070	101	2	103		
080	142	1	143		
081	6	0	6		
090	192	2	194		
91	290	8	298		
92	37	0	37		
100	467	1	468		
102	900	24	924		
103	14	0	14		
110	112	2	114		
112	1199	20	1,219		
114	46	0	46		
120	90	0	90		
121	241	5	246		
122	27	0	27		
130	412	7	419		
131	549	5	554		
132	267	5	272		
133	229	4	233		
134	50	0	50		
135	392	2	394		
140	78	12	90	2C	3,033
141	12	9	21		
142	47	10	57		
143	102	3	105		
144	6	1	7		
150	104	22	126		
151	194	9	203		
152	263	4	267		
153	35	4	39		
160	365	13	378		
161	124	4	128		
162	520	6	526		
163	72	1	73		
170	221	7	228		
171	101	3	104		
173	80	3	83		
174	23	0	23		
181	276	6	282		
182	178	2	180		
183	35	2	37		
184	76	0	76		

Appendix I.

Table 8. continued.

185	675	16	691		
190	675	15	690		
200	731	16	747		
210	605	9	614		
220	771	10	781		
230	206	10	216		
232	73	2	75		
240	1111	13	1,124	3A	11,077
242	218	4	222		
250	2225	30	2,255		
260	1347	30	1,377		
261	421	9	430		
270	818	27	845		
271	258	8	266		
280	633	23	656		
281	85	3	88		
290	1821	21	1,842		
300	628	20	648		
310	351	17	368	3B	4,091
320	540	11	551		
330	435	8	443		
340	234	5	239		
350	90	4	94		
360	196	1	197		
370	36	2	38		
380	84	3	87		
390/395	7	0	7		
400	97	1	98		
410	48	2	50	4	4,257
420	75	2	77		
430	58	2	60		
440	96	2	98		
450-480	19	4	23		
490	110	3	113		
500	11	1	12		
Bering Sea	3263	40	3,303		
Grand Total	**28,440**	**603**[2]	**29,043**		

[1] Statistical areas as defined in IPHC Technical Report No. 49.
[2] Includes pounds discarded at the dock and differences due to rounding.

Appendix I.

Table 9. The fishing period limit (pounds, net weight) by vessel class used in the 2013 directed commercial fishery in Area 2A.

Vessel Class		Fishing Period & Limits	
Letter	**Feet**	**June 26**	**July 10**
A	0-25	755	250
B	26-30	945	315
C	31-35	1,510	505
D	36-40	4,165	1,390
E	42-45	4,480	1,495
F	46-50	5,365	1,790
G	51-55	5,985	1,995
H	56+	9,000	3,000

Table 10. Metlakatla community fishing periods, number of vessels, and halibut catch (net weight), 2013.

Fishing Period Dates	Number of Vessels	Catch (Pounds)
April 19 – 21	12	5,513
May 3 – 5	13	3,156
May 17 – 19	16	5,984
May 31 – June 2	21	8,401
June 14 – 16	15	5,772
June 28 – 30	13	6,369
July 26 – 28	7	3,969
August 9 – 11	7	6,146
August 23 – 25	8	5,282
September 6 – 8	6	4,398
10 Fishing Periods		54,990

Appendix II.

Table 1. Harvest of halibut by sport fishers (millions of pounds, net weight) by IPHC regulatory area, 1977-2013.

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	0.487	1.613	2.937	5.606	0.007	0.053	10.703
2005	0.484	1.841	2.798	5.672	0.014	0.050	10.859
2006	0.516	1.752	2.526	5.337	0.014	0.046	10.191
2007	0.504	1.556	3.049	6.283	0.025	0.044	11.461
2008	0.487	1.536	3.264	5.320	0.026	0.040	10.673
2009	0.487	1.098	2.382	4.758	0.030	0.024	8.778
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	0.455	1.156	1.583	3.626	0.022	0.028	6.870
2013[1]	0.507	0.822	1.627	3.715	0.020	0.025	6.716
2012-2013 change							
Pounds	+0.052	-0.334	0.044	0.089	-0.002	-0.003	-0.154
Percent	+11.4%	-28.9%	2.8%	2.5%	-9.1%	-10.7%	-2.2%

[1] Alaska and Area 2A sport catch estimates are preliminary.

Appendix II.

Table 2. Summary of the 2013 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 2 – 18	3 (Thur – Sat)	6	1
	May 23 - 26	4 (Thur - Sun)	4	1
	May 30-31	2 (Thur - Fri)	2	1
Low Point to Sekiu River	May 23 – 26	4 (Thur – Sun)	4	1
	May 28 – Jun 1	3 (Thur - Sat)	3	1
	Jun 8	1 (Sat)	1	1
WA North Coast (Sekiu Rvr to Queets Rvr)	May 9, 11	2 (Thur, Sat)	2	1
	May 16, 18	2 (Thur, Sat)	2	1
WA South Coast (Queets Rvr to Leadbetter Pt.)				
All depths	May 5 – 19	2 (Sun, Tues)	5	1
Northern nearshore	May 7 – 20	7 (Mon – Sun)	14	1
Columbia River (Leadbetter Pt. to Cape Falcon)	May 3 – Jul 28	3 (Fri – Sun)	39	1
	Aug 2 – Sep 29	3 (Fri – Sun)	27	1
OR Central Coast (Cape Falcon - Humbug Mtn.)				
All depths	May 9 – Jun 22	3 (Thur – Sat)[1]	15	1
	Aug 2 – 3	2 (Fri – Sat)	2	1
Less than 40 fathoms	May 2 – Jul 26	7 (Sun – Sat)[2]	26	1
OR/CA (South of Humbug Mtn.)	May 1 – Oct 31	7 (Sun – Sat)	184	1
Area 2B - British Columbia	Mar 15 – Dec 31	7 (Sun – Sat)	292	1[3]
Area 2C - Alaska				
Guided anglers	Feb 1 – Dec 31	7 (Sun – Sat)	334	1[4]
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 May 23-25 and June 13-15.

[2] Fishing was prohibited during weeks of May 6-19, May 27-June 9, and June 17-23.

[3] During Mar 15-31, the daily bag limit was one fish and a possession limit of two fish, but only one could be greater than 83 cm. From Apr 1 – Dec 31, the daily bag limit was one fish with a maximum size of 126 cm in total length. The possession limit was two fish; one fish had to be less than 83 cm. An annual limit of six fish was also in effect.

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

Appendix II.

Table 3. 2013 Area 2A sport harvest allocations and harvest estimates (pounds, net weight) by subarea.

Area	Allocation	Harvest Estimate	Pct Taken	Pounds Over/(Under)
WA Inside Waters	57,393	99,942[1]	174.1%	42,549
WA North Coast	108,030	107,856	99.8%	(174)
WA South Coast	42,739	42,085	98.5%	(654)
WA/OR Columbia River	11,895	6,468	54.4%	(5,427)
OR Central Coast	191,980	194,484	101.3%	2,504
OR/CA South of Humbug	6,063	56,209	927.8%	50,146
Total	**418,100**	**507,044**	**121.3%**	**88,944**

[1] Preliminary

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, 2000–2013. Also shown is the GHL applicable to the guided 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	0.977	0.605	1.583	0.931	1.341	2.284	3.626	3.103
2013[1]	0.904	0.723	1.627	0.788	1.444	2.271	3.715	2.734

[1] 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 2013 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.

2013 research publications

Dougherty, D. T., R. Hilborn, A. E. Punt, and I. J. Stewart. 2013. Modeling co-occurring species: a simulation study on the effects of spatial scale for setting management targets. Canadian Journal of Fisheries and Aquatic Sciences 70:49-56.

International Pacific Halibut Commission. 2013. Annual Report 2012. 96 p.

Ralston, S. and I. J. Stewart. 2013. Anomalous distributions of pelagic juvenile rockfish on the U.S. west coast in 2005 and 2006. CalCOFI Reports 54:1-12.

Stewart, I. J., A. C. Hicks, I. G. Taylor, J. T. Thorson, C. Wetzel, and S. Kupschus. 2013. A comparison of stock assessment uncertainty estimates using maximum likelihood and Bayesian methods implemented with the same model framework. Fisheries Research 142:37-46.

Thorson, J. T., I. J. Stewart, I. G. Taylor, and A. E. Punt. 2013. Using a recruitment-linked multispecies stock assessment model to estimate common trends in recruitment for US West Coast groundfishes. Marine Ecology Progress Series 483:245-256.

Webster, R. A., Clark, W. G., Leaman, B. M. and Forsberg, J. E. 2013. Pacific halibut on the move: a renewed understanding of adult migration from a coastwide tagging study. Canadian Journal of Fisheries and Aquatic Sciences, 70: 642-653.

IPHC Publications 1930-2013

Reports

1. Report of the International Fisheries Commission appointed under the Northern Pacific Halibut Treaty. John Pease Babcock, William A. Found, Miller Freeman, and Henry O' Malley. 31 p. (1931).[Out of print]
2. Life history of the Pacific halibut. Marking experiments. William F. Thompson and William C. Herrington. 137 p. (1930).
3. Determination of the chlorinity of ocean waters. Thomas G. Thompson and Richard Van Cleve. 14 p. (1930).
4. Hydrographic sections and calculated currents in the Gulf of Alaska, 1927 and 1928. George F. McEwen, Thomas G. Thompson, and Richard Van Cleve. 36 p. (1930).
5. History of the Pacific halibut fishery. William F. Thompson and Norman L. Freeman. 61 p. (1930).
6. Biological statistics of the Pacific halibut fishery. Changes in the yield of a standardized unit of gear. William F. Thompson, Harry A. Dunlop, and F. Heward Bell. 108 p. (1930). [Out of print]
7. Investigations of the International Fisheries Commission to December 1930, and their bearing on the regulation of the Pacific halibut fishery. John Pease Babcock, William A. Found, Miller Freeman, and Henry O'Malley. 29 p. (1930). [Out of print]
8. Biological statistics of the Pacific halibut fishery, Effects of changes in intensity upon total yield and yield per unit of gear. William F. Thompson and F. Heward Bell. 49 p. (1934). [Out of print]
9. Life history of the Pacific halibut - Distribution and early life history. William F. Thompson and Richard Van Cleve. 184 p. (1936). [Out of print]
10. Hydrographic sections and calculated currents in the Gulf of Alaska. 1929. Thomas G. Thompson, George F. McEwen, and Richard Van Cleve. 32 p. (1936).
11. Variations in the meristic characters of flounder from the northeastern Pacific. Lawrence D. Townsend. 24 p. (1936).
12. Theory of the effect of fishing on the stock of halibut. William F. Thompson. 22 p. (1937).
13. Regulation and investigation of the Pacific halibut fishery in 1947 (Annual Report). IFC. 30 p. (1948).
14. Regulation and investigation of the Pacific halibut fishery in 1948 (Annual Report). IFC. 30 p. (1949).
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17. Pacific Coast halibut landings 1888 to 1950 and catch according to areas of origin. F. Heward Bell, Henry A. Dunlop, and Norman L. Freeman. 47 p. (1952).
18. Regulation and investigation of the Pacific halibut fishery in 1951 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, and George W. Nickerson. 29 p. (1952).
19. The production of halibut eggs on the Cape St. James spawning bank off the coast of British Columbia 1935-1946. Richard Van Cleve and Allyn H. Seymour. 44 p. (1953).
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21. Regulation and investigation of the Pacific halibut fishery in 1953 (Annual report). IPHC. 22 p. (1954).
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24. Regulation and investigation of the Pacific halibut fishery in 1955 (Annual Report). IPHC 15 p. (1956).

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35. Investigation, utilization and regulation of the halibut in southeastern Bering Sea. Henry A. Dunlop, F. Heward Bell, Richard J. Myhre, William H. Hardman, and G. Morris Soutward. 72 p. (1964).
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42. Mortality estimates from tagging experiments on Pacific halibut. Richard J. Myhre. 43 p. (1967).
43. Growth of Pacific halibut. G. Morris Southward. 40 p. (1967).
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49. Regulation and investigation of the Pacific halibut fishery in 1968 (Annual report). IPHC. 19 p. (1969).
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51. Gear selection and Pacific halibut. Richard J. Myhre. 35 p. (1969).
52. Viability of tagged Pacific halibut. Gordon J. Peltonen. 25 p. (1969).

Scientific Reports

53. Effects of domestic trawling on the halibut stocks of British Columbia. Stephen H. Hoag. 18 p. (1971).
54. A reassessment of effort in the halibut fishery. Bernard E. Skud. 11 p. (1972).
55. Minimum size and optimum age of entry for Pacific halibut. Richard J. Myhre. 15 p. (1974).
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60. The incidental catch of halibut by foreign trawlers. Stephen H. Hoag and Robert R. French. 24 p. (1976).
61. The effect of trawling on the setline fishery for halibut. Stephen H. Hoag. 20 p. (1976).
62. Distribution and abundance of juvenile halibut in the southeastern Bering Sea. E.A. Best. 23 p. (1977).
63. Drift, migration, and intermingling of Pacific halibut stocks. Bernard Einar Skud. 42 p. (1977).
64. Factors affecting longline catch and effort: I. General review. Bernard E. Skud; II. Hookspacing. John M. Hamley and Bernard E. Skud; III. Bait loss and competition. Bernard E. Skud. 66 p. (1978). [Out of print]
65. Abundance and fishing mortality of Pacific halibut, cohort analysis, 1935-1976. Stephen H. Hoag and Ronald J. McNaughton, 45 p. (1978).
66. Relation of fecundity to long-term changes in growth, abundance and recruitment. Cyreis C. Schmitt and Bernard E. Skud. 31 p. (1978).
67. The Pacific halibut resource and fishery in regulatory Area 2; I. Management and biology. Stephen H. Hoag, Richard J. Myhre, Gilbert St-Pierre, and Donald A. McCaughran. II. Estimates of biomass, surplus production, and reproductive value. Richard B. Deriso and Terrance J. Quinn, II. 89 p. (1983).
68. Sampling Pacific halibut (*Hippoglossus stenolepis*) landings for age composition: History, evaluation, and estimation. Terrance J. Quinn, II, E.A. Best, Lia Bijsterveld, and Ian R. McGregor. 56 p. (1983).
69. Comparison of efficiency of snap gear to fixed-hook setline gear for catching Pacific halibut. Richard J. Myhre and Terrance J. Quinn, II. 37 p. (1984).
70. Spawning locations and season for Pacific halibut. Gilbert St-Pierre. 46 p. (1984).
71. Recent changes in halibut CPUE: Studies on area differences in setline catchability. Stephen H. Hoag, Richard B. Deriso, and Gilbert St-Pierre. 44 p. (1984).
72. Methods of population assessment of Pacific halibut. Terrance J. Quinn, II, Richard B. Deriso, and Stephen H. Hoag. 52 p. (1985).
73. Recent studies of Pacific halibut postlarvae in the Gulf of Alaska and eastern Bering Sea. Gilbert St-Pierre. 31 p. (1989).
74. Evaluation of Pacific halibut management for Regulatory Area 2A, I. Review of the Pacific halibut fishery in Area 2A, II. Critique of the Area 2A stock assessment. Robert J. Trumble, Gilbert St-Pierre, Ian R. McGregor and William G. Clark. 44 p. (1991).
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76. Mark recapture methods for Pacific halibut assessment: a feasibility study conducted off the central coast of Oregon. Patrick J. Sullivan, Tracee O. Geernaert, Gilbert St-Pierre, and Steven M. Kaimmer. 35 p. (1993).

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78. Pacific halibut bycatch in the groundfish fisheries: Effects on and management implications for the halibut fishery. Patrick J. Sullivan, Robert J. Trumble, and Sara A. Adlerstein. 28 p. (1994).
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81. Microsatellite screening in Pacific halibut (Hippoglossus stenolepis) and a preliminary examination of population structure based on observed DNA variation. Lorenz Hauser, Ingrid Spies, and Timothy Loher. 28 p. (2006).
82. Seasonal migration and environmental conditions experienced by Pacific halibut in the Gulf of Alaska, elucidated from Pop-up Archival Transmitting (PAT) tags [Appendices included in attached compact disk]. Timothy Loher and Andrew Seitz. 40 p. (2006).
83. Assessment and management of Pacific halibut: data, methods, and policy. William G. Clark and Steven R. Hare. 104 p. (2006).
84. Seasonal movements and environmental conditions experienced by Pacific halibut in the Bering Sea, examined by pop-up satellite tags. Andrew C. Seitz, Timothy Loher, Jennifer L. Nielsen. (2007).
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2. Recruitment investigations: Trawl catch records Gulf of Alaska, 1967. Edward A. Best. 32 p. (1969).
3. Recruitment investigations: Trawl catch records Eastern Bering Sea, 1968 and 1969. Edward A. Best. 24 p. (1969).
4. Relationship of halibut stocks in Bering Sea as indicated by age and size composition. William H. Hardman. 11 p. (1969).
5. Recruitment investigations: Trawl catch records Gulf of Alaska, 1968 and 1969. Edward A. Best. 48 p. (1969).
6. The Pacific halibut. F. Heward Bell and Gilbert St-Pierre. 24 p. (1970). [Out of print]
7. Recruitment investigations: Trawl catch records Eastern Bering Sea, 1963, 1965,and 1966. Edward A. Best. 52 p. (1970).
8. The size, age and sex composition of North American setline catches of halibut (*Hippoglossus stenolepis*) in Bering Sea, 1964-1970. William H. Hardman. 31 p. (1970).
9. Laboratory observations on early development of the Pacific halibut. C.R. Forrester and D.G. Alderdice. 13 p. (1973).
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11. Juvenile halibut in the eastern Bering Sea: Trawl surveys, 1970-1972. E.A. Best. 32 p. (1974).
12. Juvenile halibut in the Gulf of Alaska: Trawl surveys, 1970-1972. E.A. Best. 63 p. (1974).
13. The sport fishery for halibut: Development, recognition and regulation. Bernard Einar Skud. 19 p. (1975).
14. The Pacific halibut fishery: Catch, effort, and CPUE, 1929-1975. Richard J. Myhre, Gordon J. Peltonen, Gilbert St-Pierre, Bernard E. Skud, and Raymond E. Walden, 94 p. (1977).
15. Regulations of the Pacific halibut fishery, 1924-1976. Bernard E. Skud. 47 p. (1977).
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17. Size, age, and frequency of male and female halibut: Setline research catches, 1925-1977. Stephen H. Hoag, Cyreis C. Schmitt, and William H. Hardman. 112 p. (1979).
18. Halibut assessment data: Setline surveys in the north Pacific Ocean, 1963-1966 and 1976-1979. Stephen H. Hoag, Gregg H. Williams, Richard J. Myhre, and Ian R. McGregor. 42 p. (1980).
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23. Incidental catch and mortality of Pacific halibut, 1962-1986. Gregg H. Williams, Cyreis C. Schmitt, Stephen H. Hoag, and Jerald D. Berger. 94 p. (1989).
24. Egg and yolk sac larval development of Pacific halibut (*Hippoglossus stenolepis*). G.A. McFarlane, J.O.T. Jensen, W.T. Andrews and E.P. Groot. 22 p. (1991).
25. Report of the Halibut Bycatch Work Group. S. Salveson, B.M. Leaman, L. L-L. Low, and J.C. Rice 29 p. (1992).
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27. Regulations of the Pacific halibut fishery, 1977-1992. Stephen H. Hoag, Gordon J. Peltonen, and Lauri L. Sadorus. 50 p. (1993).
28. The 1987 Bristol Bay survey and the Bristol Bay halibut fishery, 1990-1992. Heather L. Gilroy and Stephen H. Hoag. 18 p. (1993).
29. Estimating Sex of Pacific Halibut (*Hippoglossus stenolepis*) using Fourier shape analysis of otoliths. Joan E. Forsberg and Philip R. Neal. 20 p. (1993).
30. A Bibliography on Atlantic halibut (*Hippoglossus hippoglossus*) and Pacific halibut (*Hippoglossus stenolepis*) culture, with abstracts. Robert R. Stickney and Damon Seawright. 36 p. (1993).
31. Movements of juvenile halibut in IPHC regulatory Areas 2 and 3. Ray Hilborn, John Skalski, Alejandro Anganuzzi, and Annette Hoffman. 44 p. (1995).
32. Changes in commercial catch sampling and age determination procedures for Pacific halibut 1982 to 1993. Heather L. Gilroy, Joan E. Forsberg, and William G. Clark. 44 p. (1995).
33. Re-evaluation of the 32-inch commercial size limit. William G. Clark and Ana M. Parma. 34 p. (1995).
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35. Evaluation of two methods to determine maturity of Pacific halibut. Cyreis C. Schmitt and Gilbert St-Pierre. 24 p. (1997).
36. Bottom area estimates of habitat for Pacific halibut. Stephen H. Hoag, Gilbert St-Pierre, and Joan E. Forsberg. 28 p. (1997).
37. Estimates of halibut abundance from NMFS trawl surveys. William G. Clark, Gilbert St-Pierre, and Eric S. Brown. 52 p. (1997).
38. Age dependent tag recovery analyses of Pacific halibut data. Kenneth H. Pollock, Heidi Chen, Cavell Brownie, and William L. Kendall. 32 p. (1998).
39. Specific dynamics of Pacific halibut: A key to reduce bycatch in the groundfish fisheries. Sara A. Adlerstein and Robert J. Trumble. 94 p. (1998).
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41. Pacific halibut tag release programs and tag release and recovery data, 1925 through 1998. Stephen M. Kaimmer. 32 p. (2000).

42. A review of IPHC catch sampling for age and size composition from 1935 through 1999, including estimates for the years 1963-1990. William G. Clark, Bernard A. Vienneau, Calvin L. Blood, and Joan E. Forsberg. 40 p. (2000).
43. Diet of juvenile Pacific halibut, 1957-1961. Gilbert St-Pierre and Robert J. Trumble. 16 p. (2000).
44. Chalky halibut investigations, 1997 to 1999. Stephen M. Kaimmer. 24 p. (2000).
45. A study of the dynamics of a small fishing ground in British Columbia. Tracee Geernaert and Robert J. Trumble. 20 p. (2000).
46. Aging manual for Pacific Halibut: procedures and methods used at the International Pacific Halibut Commission (IPHC). Joan E. Forsberg. 56 p. (2001).
47. I. Age validation of Pacific halibut. II. Comparison of surface and break-and-burn otolith methods of ageing Pacific halibut. Calvin L. Blood. 32 p. (2003).
48. 1998 gear and bait experiments. Stephen M. Kaimmer. 36 p. (2004).
49. Definition of IPHC statistical areas. Thomas M. Kong, Heather L. Gilroy, and Richard C. Leickly. 72 p. (2004).
50. Investigating the roles of temperature and exercise in the development of chalkiness in Pacific halibut. Robert J. Foy, Charles A. Crapo, and Donald E. Kramer. 24 p. (2006).
51. A pilot study to evaluate the use of electronic monitoring on a Bering Sea groundfish factory trawler. Howard I. McElderry, Rhonda D. Reidy, and Dale F. Pahti. 29 p. (2008).
52. Diet of Pacific halibut (Hippoglossus stenolepis) in the northwestern Pacific Ocean. I. N. Moukhametov, A. M. Orlov, and B. M. Leaman. 24 p. (2008).
53. Special setline experiments 1985-1994 objectives, data formats, and collections. Stephen M. Kaimmer. 33 p. (2011).
54. Changes in commercial catch sampling for Pacific halibut 1994 to 2009. Lara M. Erikson, and Thomas Kong. 35 p. (2011).
55. Regulations and management decisions of the Pacific halibut fisheries, 1993-2009. Heather L. Gilroy, Thomas Kong and Kirsten MacTavish. 112 p. (2011).
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57. Report of the 2010 Halibut Bycatch Work Group. T. Karim, A. Keizer, S. Busch, J. DiCosimo, J. Gasper, J. Mondragon, J. Culver, and G. Williams (principal authors).64 p. (2012).
58. IPHC Setline Charters 1963 through 2003. Eric Soderlund, Daniel L. Randolph, and Claude Dykstra. 264 p. (2012).

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.

SPECIAL THANKS

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 thank you goes to the following.

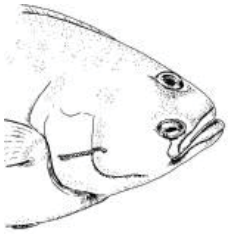
• The NOAA National Marine Mammal Laboratory for providing us space at their St. Paul residence facility when our field biologists are in town.
• The NOAA Office of Law Enforcement for providing us space at their Dutch Harbor residence when our relocated field biologist was in need.
• CDFW for their assistance with acquiring the necessary permits and clearances to conduct the setline survey offshore of California.
• The many processing plants who assist the IPHC port sampling and survey programs by storing and staging equipment and supplies.
• The Bering Sea and Gulf of Alaska NOAA/NMFS/RACE division groups for saving us a spot on their groundfish surveys.
• Makah, Quinault, Lummi, Jamestown S'Klallam, Port Gamble S'Klallam, and Swinomish biologists for port sampling Area 2A tribal commercial fisheries.
• The staffs of the PFMC and NPFMC for their courtesy in accommodating IPHC presentations, submissions, and consultations.
• Trident Seafoods for renting us space (room and board) at their Sand Point facility when our field biologist is in town.
• 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.

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

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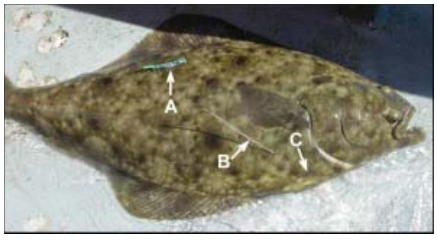
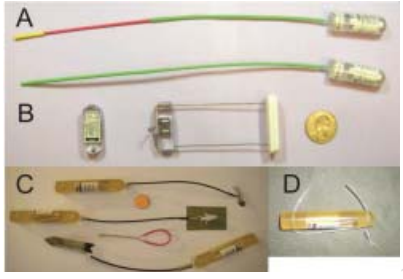
Electronic archival tags



- May be either an external electronic “backpack tag” or 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).
- Some fish have both internal and external tag. $500 reward for the return of each tag type so keep and return both tags.

"Dummy" archival tags



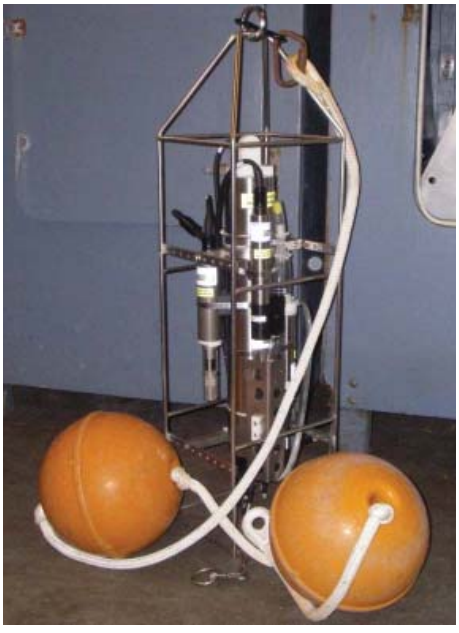
- Fish with internal dummy archival tag or external dummy tag attached near the dorsal also has pink wire tag in the cheek.
- Internal "gut" tag has the tag body inside the abdominal cavity with the stalk protruding outside the fish (A).
- There are two general types of externally mounted tags that are 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 each tag type (dummy archival and wire).

$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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