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INTERNATIONAL PACIFIC HALIBUT COMMISSION

Annual Report
2015

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

This report produced by IPHC staff
and Katherine Gustafson
2016

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.

Data in this report may be different than what was reported in the Report of Assessment and Research Activities (which is considered preliminary in many cases) or presented at the Annual Meeting. Data have been updated using all information received by IPHC through August 31, 2016 but may still change slightly in the future as more information is received. 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

Katherine Gustafson is a Seattle-based freelance writer and editor who has worked extensively with environmental nonprofits, including Conservation International, World Wildlife Fund, and Oceana. Her first book, Change Comes to Dinner, about positive change in the U.S. food industry, was published in 2012. This is Katherine's second year as co-producer of this report.

On the Cover

The photo on this year's cover was taken by Maria Yolanda Garcia Malavear, while deployed on the *F/V Bold Pursuit* as an IPHC sea sampler. This shot shows a vessel crewmember expertly pulling in a halibut from SE Alaskan waters.

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Introduction

While there is still concern about the state of the Pacific halibut (*Hippoglossus stenolepis*) resource, progress is positive. Population levels in some areas have dipped as low as they have ever been since fishery management began, but they are not at their lowest overall, and trends are level or improving in most areas. The International Pacific Halibut Commission (IPHC) manages this population using data collected throughout the range of the stock to support scientific assessment and analysis, which determine how much yield the stock can accommodate. The IPHC is implementing a range of research projects to support the annual stock assessment, which serves as a guide for establishing harvest levels most fitting for the species and the fishery. Work toward that end undertaken in 2015 is detailed in this report.

Makah fishing vessels heading out of Neah Bay for their first commercial halibut opener. Photo by Joe Petersen.

Even the best management is not a magic wand; many factors influence the level of any fish population. Recruitment—the number of young fish entering the population each year—is essential for maintaining fish stocks. Size-at-age, which determines how much yield is available for a given number of fish has been extremely important for the Pacific halibut stock. Fish are much smaller today than they were 40 years ago, but similar to those 80-90 years ago. Both recruitment and size-at-age can be influenced by a variety of stock and environmental factors, many of which are poorly understood.

Bycatch (halibut captured by fisheries targeting other species and not retained) is a major issue that the IPHC addresses in its work. Bycatch of this species has gone down by almost 25 percent coastwide over the last decade, and declined 13 percent from 2014 to 2015. While it is the case that the decline is only in part a function of declining stock levels (so that the percentage of halibut mortality due to bycatch versus other removals, has increased over the same period that bycatch overall has gone down), the trend means that measures to decrease the incidence of bycatch are increasingly successful. The IPHC continues to collaborate with the North Pacific and Pacific Fishery Management Councils (NPFMC, PFMC, respectively) and Fisheries and Oceans Canada (DFO) to address the situation. Likewise, wastage (halibut that die after being caught and not kept in the halibut fishery) is another source of mortality that is being addressed through enhanced observer coverage.

The IPHC and its partners are at the cutting edge of fisheries management. Collaboration is key: There are many stakeholders in managing Pacific halibut, and to meet the varied priorities takes a concerted effort from all involved.

Even though the percentage of halibut mortality due to bycatch (versus other removals) has increased over the past few years because of declining stocks, bycatch mortality itself has decreased indicating that measures to address halibut bycatch are measurable.

Director's Report

The start of 2015 saw an intensification of the issue of halibut bycatch mortality in non-target groundfish fisheries in the Bering Sea. The annual IPHC stock assessment identified very little available yield for the directed fisheries in the eastern Bering Sea but at the same time, the Commission was forced to deal with bycatch mortality of almost eight times the available yield to the directed fisheries. At the 2015 IPHC Annual Meeting, the Commission adopted a catch limit for Areas 4CDE that was well in excess of that identified in the current harvest policy. This catch limit was adopted in the context of a commitment by the U.S. National Marine Fisheries Service that it would act to reduce bycatch mortality in this area.

This massive disparity between the amounts of bycatch mortality and yield available to the directed halibut fishery garnered the attention of all fishery participants as well as a great deal of commentary from those who are outside the normal dealings of the Commission. Largely in response to the intensity of this discussion about the impacts of bycatch in the Bering Sea on the halibut stock and its fisheries, the Commission and the North Pacific Fishery Management Council held a joint February meeting, in an attempt to find common ground on bycatch reduction and control. The meeting produced a list of items for further

Bruce and IPHC port sampler, Jessica Marx, during a port tour in Homer, AK. Photo by Kirsten MacTavish.

consideration but only one, the Council's scheduled review of its halibut bycatch limit for the Bering Sea in June 2015, was of significance to changing the amount of halibut mortality in the groundfish fisheries.

In June 2015, the Council acted to reduce bycatch mortality limits for Bering Sea fisheries for the first time in many years. The changes in 2016 bycatch limits for most groundfish fisheries will be of little practical significance because the new limits are well in excess of current levels of bycatch. This means that the fisheries to which the limits apply will face no reduction in the amount of halibut mortality caused by those fisheries. One change, a 25% reduction of the bycatch limit for the on-bottom trawl fleet in the Bering Sea, would result in a

17% reduction of the actual bycatch over the existing (2014) level of bycatch. While this reduction will be welcome if it occurs, wider application of bycatch mitigation procedures such as deck-sorting of halibut would do much to reduce bycatch to lower levels. The progress in reducing halibut bycatch mortality using these techniques in a limited fashion during 2015 argues strongly that additional progress is highly probable.

The Commission and the Council are also pursuing the concept of abundance-based management of bycatch mortality. In such a framework, the removals from all sources would rise and fall with natural fluctuations in halibut abundance. While this approach offers some promise of a more rational framework for bycatch management, it is laden with a large number of policy issues concerning management objectives for halibut and groundfish fisheries, bycatch mortality starting points, indices of abundance to use in bycatch management, relative use of halibut by directed and bycatch fisheries, and the form of control rules that can be applied. Because of the normal migration of small halibut out of the Bering Sea, one of the largest issues is linking the measures of abundance of small halibut encountered as bycatch in Bering Sea trawl fisheries to the ultimate impact of the mortality of these small fish on the halibut stock and fisheries in other areas. These are very difficult issues but solving them is a fundamental management need for ensuring the health of the halibut resource and its fisheries.

Finally, this is my last such contribution to our Annual Reports. For almost two decades, I have had the privilege of working with an incredibly dedicated staff at the Commission, 24 equally-dedicated Commissioners, and a phenomenal group of harvesters and processors. You have all challenged me to do my best for the resource and you, as well as welcomed me into your communities, plants, and onto your vessels. I have been extremely lucky to have known so many people who are so hard to say goodbye to. Take care of the fish!

Bruce M. Leaman
Executive Director

Activities of the Commission

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

Annual Meeting 2015

At the 2015 Annual Meeting, the IPHC adopted an overall catch limit that was up 6.2 percent over the 2014 catch limit.

The IPHC held its 91st Annual Meeting in Vancouver, British Columbia, from January 26 through January 30. The Commission is made up of six members and this year Mr. Paul Ryall of Canada presided as chair of the meeting, and Dr. James Balsiger of the U.S. presided as vice-chair. The Commission reviewed finance and administration, discussed bycatch issues and minimum size limits, heard reports from IPHC staff about the health of the Pacific halibut population, considered the suggestions of stakeholder advisory groups, and solicited public comments before passing regulations and setting catch limits for 2015.

Catch limits and dates for 2015

The IPHC adopted catch limits for all individual regulatory areas (and for Area 4CDE combined). The Commission recommended to the governments of Canada and the United States that the total catch limit for 2015 should be 29,223,000 pounds, a 6.2 percent increase from the 2014 catch limit of 27,515,000 pounds. Note that for Areas 2A-3A, the number shown includes some portions of the recreational catch. The limit was divided among regulatory areas as follows:

Area 2A	970,000 pounds
Area 2B	7,038,000 pounds
Area 2C	4,650,000 pounds
Area 3A	10,100,000 pounds
Area 3B	2,650,000 pounds
Area 4A	1,390,000 pounds
Area 4B	1,140,000 pounds
Area 4C	596,600 pounds
Area 4D	596,600 pounds
Area 4E	91,800 pounds

While the Commission subdivides the coastwide stock by regulatory area, the domestic governments allocate the catch further in some areas and require Commission approval to implement these allocation plans. The Commission approved the PFMC catch-sharing plan that allocates the Area 2A catch among the non-treaty directed commercial fishery, non-treaty incidental fisheries, treaty

Commissioners listen to stakeholder comments during an IPHC Annual Meeting public session. Seated right to left: David Boyes (Can. Commissioner), Paul Ryall (Can. Commissioner, Ted Assu (Can. Commissioner), Donald Lane (U.S. Commissioner), James Balsiger (U.S. Commissioner), Robert Alverson (U.S. Commissioner), Bruce Leaman (Executive Director), Stephen Keith (Assistant Director). Photo by Tracee Geernaert.

Indian fisheries, and sport fisheries. The DFO commercial/sport allocation plan was also approved. The NPFMC catch-sharing plan allocating the catch for Areas 2C and 3A between commercial and charter sport sectors was approved with specific charter management measures. The NPFMC catch-sharing plan for Areas 4CDE again allocates catch among the subareas. More in-depth information on all of these subjects can be found in the following sections of this report.

The 2015 season for all Alaska and British Columbia quota share commercial fisheries was designated to open on March 14, and to close November 7. All commercial fishing in Washington, Oregon, California, and the Annette Islands Reserve in Alaska utilize shorter open periods, also within this period.

The Commission approved catch sharing plans that divided the catch limit between commercial and sport interests in Areas 2A, 2B, 2C, and 3A.

Other decisions made at the meeting

Charter Halibut Sector Management in Areas 2C and 3A

The Commission approved NPFMC-proposed charter halibut sector management measures for Areas 2C and 3A. The measures included bag limits, annual limits, size restrictions and fishing periods.

The commission approved a number of changes to the regulations concerning sport charter fishing in Areas 2C and 3A, including the following:

- A charter vessel guide is no longer required to be on board the same vessel as the charter angler. Anglers who receive assistance from a compensated guide will be required to follow charter-fishing regulations, and the harvest is to be counted within the charter allocation.
- The charter vessel guide shall be liable for any violations of IPHC regulations by an angler, whether on board the same vessel or not.
- All retained halibut are to remain on the vessel on which they are caught until the end of the chartered fishing trip.

- The IPHC no longer lists the regulation requiring a vessel to retain a filleted carcass on board until all fillets are offloaded. The requirement remains, but is listed in the U.S. federal regulations and is not needed in the IPHC regulations.

Participant-led Logbook Program

There is a lack of commercial logbook information in the Eastern Bering Sea (Area 4E) due to the high number of vessels that are less than 26 feet in length and therefore exempt from keeping logbooks. Commissioners agreed to support a participant-led logbook program to provide some much-needed information. IPHC staff will coordinate with fishers in that area to establish a program.

Interim Meeting

The IPHC's 2015 Interim Meeting on December 1 and 2 in Seattle, Washington, was an occasion to prepare for the 2016 Annual Meeting in January. The Commissioners and the public were able to hear IPHC staff presentations and discussion on topics including a review of the 2015 fisheries and stock assessment, and the 2016 harvest decision table. There was also discussion about the reduction in bycatch, changes in the spatial distribution of the stock, proposed sport regulation changes, a proposal for halibut retention in sablefish pot fisheries, budgeting and staffing issues, and various regulatory proposals.

Other topics covered included the progress of the Management Strategy Advisory Board (MSAB), the Scientific Review Board (SRB) report, a summary of bycatch-related meetings with the NPFMC and National Marine Fisheries Service (NMFS), a summary of NPFMC's draft halibut management framework, and other regulatory proposals.

For the third year, the entire meeting (with the exception of the Finance and Administration session) was webcast to allow for broader public participation. As last year, this year's meeting was held at the Hotel Deca in Seattle, which was able to accommodate members of the public who wished to attend.

Appropriations for the 2015 fiscal year amounted to just over $5 million which included funds earmarked to cover pension deficits.

IPHC Budget

The IPHC is funded jointly by the U.S. and Canadian governments. For fiscal year 2015, the U.S. appropriated $4.15 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 $95,508 to cover pension deficits, similar to that provided in the U.S. appropriations.

IPHC Regulatory areas for 2015

On its formation in 1923, IPHC established four regulatory areas, covering California northward through the Bering Sea. 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 an illustration of the boundaries, refer to the map on the inside front cover of this report.

Dividing the grounds into regulatory areas helps managers spread the catch over the geographical range of the fish.

Area 2A[1]—waters off the coasts of California, Oregon, and Washington.
Area 2B[1]—waters off the coast of British Columbia.
Area 2C[1]—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[2]—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[2]—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[2]—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."

[1]The Commission uses an equidistant line for the division between Areas 2A/2B and 2B/2C, attributing catch by each nation in the boundary area to that nation's allocation, in the absence of a boundary agreement between the two countries.
[2]The Commission manages 4CDE as a single area, and has defined Areas 4C, 4D, and 4E specifically, at the request of the NPFMC for its Catch Sharing Plan (catch allocation framework).

The closed area is a trapezoid-shaped body of water in the Bering Sea that is considered a halibut nursery area.

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.

Halibut prepared for landing. Photo by Levy Boitor.

COMMERCIAL FISHERY

The harvesters of today's Pacific halibut fishery rely on centuries-old knowledge developed over generations. Local fishers have long worked to mentally map the halibut's preferred gathering places, both in sheltered local grounds and the deep-sea banks, and that age-old wisdom helps today's modern fishers secure thousands of fish every year. The commercial halibut catch in 2015 (including those that were landed from the IPHC stock assessment surveys) was 24,673,000 pounds, up four percent from the 23,695,000 pounds caught in 2014. See Appendix I for detailed information. All poundage values in this section are provided as net-weight unless otherwise noted. Net-weight is defined as the weight of halibut without gills, entrails, and head, and washed (without ice and slime).

Seasons

At the 2015 Annual Meeting, the Commission continued its discussions on season length, including recommendations to open the fishery on a Saturday to facilitate marketing. Accordingly, the Canadian Individual Vessel Quota (IVQ) fishery in Area 2B and the United States Individual Fishing Quota (IFQ) and Community Development Quota (CDQ) fisheries in Areas 2C, 3A, 3B, 4A, 4B, and 4CDE commenced at 12 noon local time on March 14 (a Saturday) and closed at 12 noon local time on November 7 (also a Saturday). The Area 2A commercial fisheries, including the treaty Indian commercial fisheries, were required to occur during the same calendar period (March 14 to November 7).

For Area 2A, seven potential 10-hour fishing periods for the non-treaty directed commercial fishery were adopted: June 24, July 8, July 22, August 5, August 19, September 2, and September 16, 2015. All fishing periods were to begin at 8:00 AM and end at 6:00 PM local time, were further restricted by fishing period vessel-length catch limits, and each opening scheduled only until the commercial allocation was estimated to have been reached.

The IQ fisheries had an eight month season, opening on March 14 and closing on November 7.

IPHC biologist Kirsten MacTavish and biometrician Ray Webster, port sampling in Prince Rupert, B.C. Photo by Darlene Haugan.

Licensing, catch limits, and landings

The Area 2A catch limit is divided among two treaty Indian fisheries, three non-treaty commercial fisheries, and the sport fishery, via the PFMC catch sharing plan.

The 2015 coastwide commercial catch amounted to 23,922,000 pounds, which is 497,500 pounds below the 24,419,500-pound limit for the year. Catch limits are set by the Commission for all individual regulatory areas and for Area 4CDE combined. Domestic Catch Sharing Plans (CSPs) allocate catch limits by user groups in Areas 2A, 2B, 2C, and 3A and among sub-areas for Area 4CDE.

A variety of fisheries with unique catch limits comprise Area 2A. There are two treaty Indian fisheries: a ceremonial and subsistence use (C&S) fishery, which had a 2015 catch limit of 31,800 pounds; and a commercial fishery, with a limit of 307,700 pounds. There were three non-treaty commercial fisheries: the directed fishery, with a limit of 164,529 pounds; the incidental halibut fishery during the salmon troll season, with a limit of 29,035 pounds; and the incidental halibut fishery during the limited entry sablefish fishery, with a limit of 10,347 pounds. The area's three sport fishery catch limits (Washington, Oregon, and California) totaled 426,589 pounds. The total Area 2A landings (not including IPHC research) were 1,050,600 pounds in 2015, which was 8 percent above the catch limit.

The Area 2A licensing regulations for non-treaty fisheries remained the same as in 2014: all vessels required an IPHC license, harvesters were required to choose one license type, and the commercial fisheries license applications had a deadline date. For the second year, the license application deadline date for the incidental halibut in the salmon troll and the sablefish fisheries, was March 16 (changed from March 31), to accommodate earlier opening dates. The deadline date for the directed commercial fishery remained the same (April 30).

In Area 2B, the IPHC assigned the combined sport and commercial fisheries a catch limit of 7,038,000 pounds for 2015. DFO further allocated this limit by a ratio of 85 percent commercial to 15 percent sport. The total 2015 Area 2B combined commercial and sport catch was 7,024,000 million pounds, below the catch limit by less than one percent.

For the second year, the NPFMC recommended a CSP for Areas 2C and 3A that included the commercial and sport charter fisheries. Consequently, the Commission's adopted catch limits for Areas 2C (4,650,000 pounds) and 3A (10,100,000 pounds) included the commercial and charter fishery catch limits, plus discard and lost gear mortality estimates. The individual catch limits adopted for Regulatory Areas 4C (596,600 pounds), 4D (596,600 pounds), and 4E (91,800 pounds) are determined by a NPFMC CSP, and remained the same from the previous year. The NPFMC CSP and IPHC regulations allowed Area 4D CDQ to be harvested in Areas 4D or 4E, and Area 4C IFQ and CDQ to be harvested in Areas 4C or 4D.

Landings

When Pacific halibut are delivered to a port for processing, they are considered to be "landed" for tracking purposes. The following sections review commercial landings, seasons, and trends for each area, with data from the IPHC, NMFS, DFO, Metlakatla Indian Community, Washington treaty Indian tribal fisheries management departments, including the Northwest Indian Fisheries Commission, Makah, Lummi, Jamestown S'Klallam, Swinomish, Port Gamble S'Klallam, Quileute, and Quinault Indian tribes, and state agencies including

Swinomish tribal biologists sampling halibut in La Conner WA. Photo by Joan Forsberg.

Alaska Department of Fish and Game, Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and California Department of Fish and Wildlife (CDFW).

Area 2A (California, Oregon, and Washington)

The Area 2A directed commercial fishery south of Point Chehalis, Washington, closed after two 10-hour openings with fishing period vessel-length limits in 2015, during which time harvesters landed 196,400 pounds (19 percent over the catch limit of 164,529 pounds). Each H-class vessel (56 feet or longer) was allowed to bring in 9,000 pounds on June 24 and 6,000 pounds on July 8. Smaller vessel classes were limited to less poundage according to their length.

A total of 655 licenses were issued in Area 2A in 2015 compared to 724 in 2014.

Vessel licenses for Area 2A decreased in 2015 from the prior year, with IPHC issuing 655 total licenses. The directed commercial halibut fishery and the sablefish fishery accounted for 166 licenses (one fewer than in 2014). In addition, 364 (60 fewer than in 2014) licenses went to the salmon troll fishery for retaining incidental halibut caught, and 125 licenses (eight fewer than in 2014) went to sport charter vessels.

The period of incidental halibut retention during the salmon troll fishery ran from April 1 to August 21, with a total catch of 28,400 pounds, corresponding with the 29,035-pound catch limit. At the start of the season on April 1, the allowable incidental catch ratio of halibut during the salmon troll fishery was one halibut per four Chinook salmon (*Oncorhynchus tshawytscha*), plus an "extra" halibut per landing, and a vessel trip limit of 12 fish. On August 7th, the landing restrictions changed to one halibut per two Chinook salmon, plus an "extra" halibut per landing, and a vessel trip limit of two fish.

Incidental halibut retention during the limited-entry sablefish fishery, from April 1 to September 1, resulted in a total catch of 10,000 pounds (three percent under the catch limit of 10,347 pounds). The allowable landing ratio was 75 pounds of halibut to 1,000 pounds (net weight also) of sablefish, and up to two additional halibut in excess of the ratio limit (the same as the landing restrictions for 2014 and 2013).

In 2015, the total treaty Indian commercial catch for Area 2A-1 (north of Point Chehalis) was 317,000 pounds, three percent over the catch limit (307,700 pounds). The treaty Indian tribes allocated 75 percent of the commercial catch limit to an open-access fishery, and the remaining 25% to a restricted fishery with daily and vessel catch limits. There was one unrestricted, open-access fishery March 16-18; and one restricted fishery, with a vessel per-day limit of 500 pounds during the April 1-2 opening.

Area 2B (British Columbia)

During the 2015 season, the IVQ fisheries of British Columbia landed 5,884,000 pounds, which was two percent below the commercial catch limit of 5,974,450 pounds. As part of the groundfish Integrated Fisheries Management Plan, IVQ fisheries include quota shares for all hook-and-line and trap groundfish fisheries, transferability with limits among license holders, 100 percent at-sea and dockside monitoring, and vessel accountability for all catch, both landed and discarded. There is 100 percent monitoring through logbook records, video camera coverage, and dockside monitoring.

The number of both L and FL licenses issued in Area 2B in 2015 was 153; up slightly from 2014, but well below the 1999 high of 257.

DFO allocates each halibut vessel a fixed poundage limit for the season and designates each with either an "L" or "FL" license. L commercial licenses are limited and vessel-based. FL communal licenses are reserved for First Nations. The number of active halibut licenses, both L and FL, decreased from a 1999 high of 257 to a 2014 low of 146, then came up slightly to 153 in 2015. In addition, halibut can be landed as incidental catch in other licensed groundfish fisheries. Therefore, halibut was landed from a total of 240 active licenses in 2015, with 87 of these licenses from other fisheries. This is an increase from 222 active licenses in 2014.

U.S. port supervisor Lara Erikson samples a halibut in Homer, AK. Photo by Jessica Marx.

Areas 2C, 3, and 4 (Alaska)

In 2015, the total landings by the IFQ/CDQ halibut fisheries in the waters off Alaska, was 17,487,000 pounds, two percent under the catch limit. The commercial Quota Share (QS) catch was one percent below the catch limit in Area 3A, two percent below in Area 2C, three percent in Area 3B, and four and five percent below in Areas 4A and 4B respectively. As mentioned previously, the NPFMC CSP allowed Area 4D CDQ to be harvested in Areas 4D or 4E and Area 4C IFQ and CDQ to be fished in Areas 4C or 4D. These two regulations were the reason the catches in Area 4D exceeded the catch limit. However, the total Area 4CDE commercial catch of 1,173,000 pounds was nine percent under the Area 4CDE catch limit (1,285,000 pounds).

Area 2C includes the Annette Islands Reserve (just south of the city of Ketchikan), home to the Metlakatla Indian Community, which the U.S. Bureau of Indian Affairs has authorized to conduct a commercial halibut fishery within the Reserve. In 2015, there were 12 two-day openings between April 24 and September 27, resulting in a total catch of 67,112 pounds. This was almost 12,600 pounds lower than the 2014 catch, and within the historical catch range that has varied over time from a low of 12,000 pounds in 1998 to a high of 126,000 pounds in 1996.

Landing patterns

The landed catch in Alaska, weighing in at 17,487,000 pounds, accounted for the majority of the total commercial catch (73%). Area 3A again had the highest catch limit and landed catch level in 2015, with 41% of the Alaskan commercial catch landed in the ports of Homer, Kodiak, and Seward. Kodiak received the largest portion of the Alaskan commercial catch, with 2,745,000 pounds (16%), switching places with Homer, which received the most catch in 2014. In 2015, Homer received 2,556,000 pounds (15%) of catch, and 1,922,000 pounds (11%) were landed in Seward. In Southeast Alaska (Area 2C), Sitka, Juneau, and Petersburg, in that order, received the three largest commercial landed pounds.

Kodiak received the largest portion of the Alaska commercial catch in 2015, switching places with Homer who had the most landed pounds in 2014.

In Area 2B, as in 2014, two ports among the 12 on the British Columbia coast received 90 percent of the area's landed catch: Port Hardy and Prince Rupert/Port Edward. Port Hardy received 47 percent of the area's commercial landed catch (2,791,000 pounds), and Prince Rupert received 42 percent (2,487,000 pounds). Vancouver received three percent of the Area 2B commercial landed catch, with 162,000 pounds.

In Alaska, the QS landings were highest in May, with 22 percent of poundage from Alaska landed in that month, as in 2014. April was the busiest month in British Columbia, accounting for 15 percent of total poundage from Area 2B. In 2015, a total of 40 percent of the 2B landed catch was landed by the end of May. The 2015 landing of live halibut from Area 2B (allowed by the DFO since 1999 as a means to get halibut to certain markets in a fresher state) resulted in a total landed weight of 478 pounds; a drop of 84 percent from 3,010 pounds in 2014. This represents the lowest amount landed since 1999, when landings of live halibut reached a high of 103,821 pounds.

Commercial catch sampling

The IPHC staffs a number of ports full time and others part time in an effort to obtain a commercial halibut sample that is representative of the coastwide catch.

Sampling of the commercial catch is a key component to collecting data on Pacific halibut. Port samplers collect otoliths—fish earbones that, when read under a microscope, give the animal's age in years—in addition to recording halibut lengths, halibut weights, logbook information, and final landing weights. Any IPHC tags caught during fishing are also collected. Tags can provide information on migration, growth, exploitation rates, and natural and discard mortality.

Sampling protocols are designed to ensure that the sampled halibut are representative of the population of landed halibut; sampling times and places, and percentage of fish sampled are based on landing patterns and are reviewed annually. The protocols can vary slightly from port to port to achieve the appropriate sampling representation.

Considering that vessels travel to multiple regulatory areas and are not limited in where they may land their catch, IPHC samplers were stationed in halibut ports coastwide. In Area 2A, IPHC samplers were present in Newport (Oregon) and Bellingham (Washington). Samples were taken in several smaller treaty Indian ports in Washington by biologists from the treaty Indian fishery management offices. In Area 2B, IPHC samplers staffed Port Hardy, Prince Rupert, and Vancouver. In Alaska, samplers staffed a number of ports for the full IFQ season including: Dutch Harbor, Kodiak, Homer, Seward, Juneau, Sitka, and Petersburg. St. Paul and Sand Point were staffed for shorter periods of time, during the summer months.

Otoliths

Samplers aimed to collect 11,500 total halibut otoliths in 2015, with the target for each of Areas 2B through 4B and Areas4C&D (combined) set at 1000-2000. The target for Area 2A was set at 1,000; subdivided into a target of 650 for Area 2A-1 treaty Indian fisheries and 350 for Area 2A directed commercial fishery. Samplers exceeded their overall target, collecting 12,864 otoliths by sampling from 45 percent of the landed catch in the 811 landings sampled. In Area 2B 966 otoliths were collected. All other areas were above the targeted range, with the highest overage being Area 4A, where 2,242 otoliths were collected.

Prior to the 2015 season, a review of landings to assess if any statistical areas were being under-sampled revealed that there were statistical areas in Regulatory Area 3B where the proportion of landings into sampled ports was lower than their total contribution to the Area 3B harvest. This led to staffing Sand Point for three months during the 2015 season, which improved representative sampling by statistical area.

Samplers also collected specimens for the Clean Otolith Archive Collection (COAC), which comprises structures gathered from all IPHC otolith collection programs and other research opportunities; these are not used for age determination, but are cleaned, dried, and stored whole in climate-controlled conditions for future analysis. The COAC samples are supplied primarily by the Standardized Stock Assessment (SSA) survey. However, where there is a danger of falling short of the target, otoliths are also collected from the commercial landings. A total of 100 otoliths per area were targeted for collection in Areas 2A, 4B, and 4CD, and this number was exceeded in all three areas. Samplers collected a total of 118 COAC otoliths in Area 2A, 186 in Area 4B, and 171 in Area 4CD.

Port sampler Michelle Drummond prepares to sample a commercial load of halibut in Juneau, AK. Photo by Lara Erikson.

Logbooks

Alongside otolith samples, IPHC port samplers collected logbook information from harvesters, which totaled 2,539 logbooks. In total, 2,653 logs were collected in 2015. Of the latter number, 2,200 (83 percent) were collected from U.S. landings and 453 (17 percent) were collected from Canadian landings.

IPHC port samplers are transitioning to a remote data entry format using ruggedized electronic tablets.

Tags

In 2015, samplers collected 25 tags from tagged halibut, 22 of which originated in the 2013 tagging project that involved single- and double-tagging fish. Eight of the 22 tagged in 2013 were recovered in Seward, 10 in Homer, and four in Kodiak. Additionally, one tag from the 2010 Aleutian wire tagging study was recovered in Dutch Harbor, and two PAT tags were recovered in Southeast Alaska ports (one in Sitka and one in Juneau). See tagging studies under the research section for more details.

Electronic data collection

By and large, port sampling continues to be done using low-tech methods, namely paper and pencil. Ruggedized computing technology is helping the IPHC move forward on digitizing data collection to eliminate or reduce the need for post-collection data entry and increase the speed of data editing. In 2015, each IPHC port sampler in Alaska and Bellingham, Washington, used an electronic tablet to input data from paper logbooks into a remote data entry (RDE) application. In 2016, RDE of log data will continue to be a regular part of the port sampling program log collection protocol.

Length-weight

Length-weight project data were collected along with otoliths from the commercial landings (as detailed above) in most ports in 2015. These data can be used to estimate the relationship between fork length and net weight, including the estimation of adjustments necessary to convert head-on weight to net weight and adjust for the presence of ice and slime. Length-weight ratios vary by region and season, so the collections allow IPHC staff to review the patterns and degree of variability among regulatory areas or seasons. Data were collected in ports in Areas 2B, 2C, 3, and 4 throughout the 2015 season.

In 2015, the Dutch Harbor port sampler was provided with a scale, and the protocols used in other ports in 2014 were used in Dutch Harbor for the 2015 season. In the other full-season staffed ports, collection of weight data was integrated into the regular sampling methods, collecting associated fork length and weight for every fish from which an otolith was collected. This resulted in a significant increase in the number of length-weight records that were collected in 2015 compared to 2014: a total of 5,733 halibut were measured and weighed in 2015 compared to 2,351 in 2014 and 831 in 2013.

The length-weight project has brought to light a number of results, one of which is that on average, halibut are lighter weight in relation to length earlier in the season compared to later.

The results of the sampling showed strong evidence that in Areas 2B, 2C, and 3A, the standard IPHC relationship overestimates expected weight. There will likely be positive biases in the 2015 mean net weight of a halibut calculated from the standard relationship ranging from three percent (Area 2C) to eight percent (Area 3A). There is also strong evidence in all four areas that the length-net weight relationship varies seasonally, with halibut generally being lighter on average early in the year.

The proportion of the total halibut weight comprised by the head varies across the coast, with halibut in some areas having mean head proportions close to 0.15, much larger than the assumed value of 0.1 used in net weight calculations for halibut landings, while values in Areas 2B and 2C are close to the assumed value.

Age distribution of commercial fishery

In 2015, age distribution of halibut sampled from the commercial catch is based on 12,312 otoliths aged. Of the 12,864 otoliths received, ages could not be determined for 552 otoliths because they were crystallized, right-sided, or badly broken.

In the 2015 sample, 11-year-olds from the 2004 year class were the most abundant (2,049 fish, or 17 % of the total). Sixty-seven percent (8,297 fish) were 10- to 14-year-olds.

Average fork length for all areas combined increased by 0.5 cm in 2015, i.e. average fork length increased in Areas 2B, 3, and 4A, and decreased in Areas 2A, 2C, 4B, 4C, and 4D. The average age of fish sampled from Areas 2C, 3A, 4A, 4C, and 4D increased in 2015 relative to 2014, while average ages from all other areas decreased. The average age from all areas combined in 2015 (13.3 years) was the same as it was in 2014. The youngest and oldest halibut in the 2015 commercial samples were determined to be 5 and 44 years old, respectively.

Recreational fishery

The 2015 sport harvest of Pacific halibut was estimated at 6.92 million pounds, as estimated by the IPHC with help from state and federal agencies. The 2015 take was similar to 2014, continuing below the historic levels seen in 2004-2008 (when harvest averaged 10.7 million pounds). The regulations governing sport fishing of halibut were specifically geared to each regulatory area. Appendix II provides a summary of seasons and catch.

Area 2A (California, Oregon, and Washington)

Area 2A's sport fishers landed an estimated 444,808 pounds of Pacific halibut in 2015, exceeding the 426,587-pound allocation by 18,221 pounds. The allocation was subdivided into seven subareas: Washington Inside Waters (57,393 pounds), Washington North Coast (108,030 pounds), Washington South Coast (42,739 pounds), Columbia River (10,254 pounds), Oregon Central Coast (179,870 pounds), Oregon South of Humbug (3,081 pounds), and California (25,220 pounds). California was a full partner in the Area 2A catch sharing plan and conducted in-season management for the first time.

In 2015, sport-fishing harvests remained, as in previous years, dependent on the availability of salmon or albacore tuna. 2015 was noted as an especially good salmon year for recreational anglers. Each subarea was open between three and 184 days, depending on conditions. Notably, the Washington North Coast fishery was open for only three days, during which time 87.6 percent of the subarea's allocation was caught. Catch exceeded the allocation in Washington Inside Waters by 38,198 pounds (67%) and came in on target or within a few percentage points in three others (Washington South Coast, with catch 100 percent of allocation; Oregon Central Coast, with 99.6 percent; and California, with 98.8 percent).

Sport fishers clean their daily catch in Seward, AK. Photo by Lara Erikson.

More than 87% of the Washington north coast fishery allocation was taken in just three days.

Area 2B (British Columbia)

In 2015, the sport harvest in Area 2B was estimated by the DFO to total 993,820 pounds, an increase of eight percent (78,820 pounds) from the 915,000 harvest in 2014. The 1,064,000-pound allocation for 2015 represented 15 percent of the total catch limit for the area. DFO implemented several restrictions in 2015 to pace the harvest and lengthen the season within the constraints of the allocation. A maximum length restriction of 133 cm was in place, with a daily bag limit of one fish, and a possession limit of two fish, of which one halibut had to be smaller than 90 cm. DFO also continued an annual limit of six fish per angler.

From April 1 to December 31, 2015, sport fishing also occurred under an experimental recreational halibut (XRQ) program under which commercial quota could be leased to sport fishers. As of October 29, 2015, a total of 8,500 pounds (comprised of 3,089 pounds carried over from 2014 and 5,411 pounds transferred in 2015) were available in this program, and 4,682 pounds of it had been utilized.

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

Management of the charter fishery in 2015 was conducted with a NPFMC CSP for the charter sport and commercial fisheries for Pacific halibut in waters of IPHC Regulatory Areas 2C and 3A. IPHC implemented a reverse slot limit (RSL) for managing the 2015 charter fishery in Area 2C, based on a recommendation by the NPFMC, which restricted harvest to halibut less than or equal to 42 inches fork length and halibut greater than or equal to 80 inches. In Area 3A, charter anglers had a two fish daily bag limit but only one fish could be greater than 29 inches.

The Guided Angler Fish (GAF) program initiated in 2014 was continued in 2015. The halibut CSP authorized annual transfers of commercial halibut IFQ as GAF fish to charter halibut permit holders in IPHC Areas 2C or 3A for the charter halibut fishery. Charter vessel operators participating in the program could offer their clients the opportunity to harvest up to two halibut of any size per day. Charter anglers using GAF were subject to the harvest limits in place for unguided sport anglers in that area. In 2015, there was a two-fish daily bag limit for unguided sport anglers in Areas 2C and 3A.

Recreational harvest decreased slightly in both Areas 2C and 3A from 2014 levels.

In Area 2C, the sport harvest was estimated to be 1,924,000 pounds in 2015, down somewhat from the 1,953,000 million pounds caught in 2014. In Area 3A, the total estimated sport catch was 3,530,000 pounds, down slightly from 3,591,000 pounds caught in 2014. Charter anglers caught fewer fish in 2015 (160,353) than 2014 (174,351), and those caught in 2015 had a slightly higher average net weight (12.7 pounds) than those caught the prior year (11.7 pounds).

In Area 3B and Area 4, sport fishing is less common than in other parts of Alaska, due to the relative remoteness of the ports. The estimated 2015 harvests for these areas remained relatively low at 10,000 pounds in Area 3B and 17,000 pounds in Area 4A. Estimates from these areas may be problematic in that the results relied on the numerical fish count from Alaska Department of Fish and Game (ADF&G)'s Statewide Harvest Survey, from which the IPHC estimates weight by applying the average weight of the combined charter and non-charter average of fish landed in Kodiak.

Incidental mortality of halibut in the commercial fishery (wastage)

In the commercial halibut fishery, some halibut are captured every year that are not kept and do not become part of the landed catch. Not all halibut caught and released at sea survive. Those halibut are subject to release mortality, otherwise known as "wastage."

Estimates of discard mortality due to wastage in 2015 amounted to 1,278,000 pounds (net weight), which is a decrease of about one percent from wastage in 2014. There are three main sources of wastage mortality accounted for by IPHC: (1) fish caught and never retrieved on lost or abandoned fishing gear; (2) the discard of fish that measure below the legal size limit of 32 inches (U32) and subsequently die; and (3) the discard of O32 fish for regulatory reasons, such as a vessel exceeding its trip limit. Each of these categories uses different mortality information and so requires different methods to account for it.

Wastage is the estimated amount of halibut killed incidentally in the commercial halibut fishery.

This halibut was caught on standard halibut longline gear during the IPHC survey. U32 fish like this one are discarded when caught during the commercial fishery and a portion of them do not survive their capture. Photo by Daniella Griffay.

Wastage from lost or abandoned gear

In the 1980s and early 1990s in Alaska and B.C., a 'derby' fishery with extremely short fishing periods led to fishers competing to catch as many halibut as quickly as possible. This frenzy resulted in a considerable quantity of lost fishing gear, which accidentally kills fish. Fishery-wide estimates about the amount of missing gear were then extrapolated to total catch values using standardized logbook catch and effort statistics. Standardization corrects for differences in the length of skates and hook spacing.

The rate of O32 loss by lost or abandoned gear was calculated by

first figuring out the ratio of effective skates lost to effective skates hauled aboard the vessels for which there was a log, then multiplying that number by the total landed catch. "Effective skates" refers to those that include all requisite data (such as skate length, hook spacing, and number of hooks per skate), and for which the gear type met the standardization criteria. The ratio included both snap gear and fixed-hook gear in all areas. U32 wastage from lost gear was calculated in a similar manner incorporating the U32:O32 ratio calculations for discarded U32 halibut as described below.

It is estimated that 16 percent of the halibut discarded in the IQ commercial fisheries, die as a result of their capture.

Wastage from discarded U32 halibut

The weight of discarded U32 halibut must be measured indirectly where direct observation and electronic monitoring are not available. Of all the areas, the British Columbian fishery (Area 2B) offers the most accurate accounting due to direct observation; fishers there self-report their discards and are monitored by video on their vessels. In all other Areas, considering that the setline survey uses similar fishing gear, the survey data have been used as a proxy for the expected encounter rates by area and year. Results are filtered to use setline survey stations with a higher catch rate (by weight) of O32 halibut, similar to those observed in the commercial fishery. A universal mortality rate of 16 percent has been applied to all halibut discards from the individual quota fisheries (Canada and Alaska). For derby fisheries in previous years in B.C. and Alaska, and for the Area 2A directed fishery, a mortality rate of 25 percent is applied. Accordingly, the amount of discarded U32 halibut in a commercial fishery is estimated by multiplying the ratio of U32 to O32 halibut by the landed commercial catch then by the mortality rate for that fishery.

Wastage from discard mortality for regulatory reasons

In Area 2A, the commercial fishery is still managed by derby fishing periods in which the quantity of fish that can be caught by each vessel is limited by a fishing period limit. This results in catches that may exceed the vessel or trip limits, so that "excess" O32 halibut are discarded. Some vessels logged the amount of discards, which were then compared to the landed catch of halibut for the vessels for which there were logs to estimate O32 halibut discards for these vessels and arrive at a ratio of landed halibut to O32 discarded halibut. This ratio was then applied to all landed catch reported on fish tickets to determine the discard of O32 halibut for all landings to which the mortality rate of 25% was applied. U32 halibut were accounted for in a similar manner incorporating the U32:O32 ratio calculations for discarded halibut. The amount of halibut retained by the Area 2A salmon and sablefish fisheries was not included in these numbers, however, as they were accounted for under bycatch mortality estimates. Finally, quota share fisheries in British Columbia and Alaska were not included in these numbers. These fishers typically discard small amounts of fish (if any) on the last fishing trip of the season.

Personal use (subsistence) harvest

Halibut that are caught by those that have traditionally relied on halibut as a critical food source or for customary purposes are classified as "personal use," as opposed to sport or commercial catch. Personal use harvest is barred from resale, so by nature does not make up a part of the commercial catch. The IPHC defines personal harvest 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 C&S fisheries in Washington state; and 4) U32 halibut retained by commercial fishers in Areas 4DE under IPHC regulations. In the latter case, IPHC permits U32 halibut to be retained because of its history of customary use in the area and because the remote location makes it unlikely that these fish will end up being commercially traded. State and federal regulations require that 'take-home' halibut caught during commercial fishing be recorded as part of the commercial catch on the landing records, so those fish caught within the commercial fisheries and not sold are accounted for as commercial catch and are not included in the estimates here.

Estimated harvests by area

The subsistence harvest estimates lag by one year so the 2015 estimates are not yet final. However, preliminary estimates show that the catch may be up slightly from 2014.

The 2015 coastwide personal use catch rose again after hitting its lowest point in 2013 since the Alaska subsistence program began in 2003. The 2015 estimate of 1,204,800 pounds is up slightly from the 2014 estimate of 1,202,700 pounds. The estimates for the subsistence halibut harvest typically lag by a year, so the 2015 estimates are not yet complete.

Area 2A (California, Oregon, and Washington)

The personal use allocation in Area 2A consists of the C&S fishery that the Treaty tribes have subdivided within their catch limit. The 2014 final estimate of C&S was 31,800 pounds, and this catch estimate became the 2015 C&S allocation. In 2015, an estimated 33,900 pounds were harvested.

Area 2B (British Columbia)

The FSC fishery constituted British Columbia's DFO-sanctioned personal use harvest. The IPHC used to estimate the harvest via some logbook and halibut landing information supplied by the DFO. The insufficient data supplied by that system led the IPHC to rely instead on the DFO's estimate, which has held at 405,000 pounds since 2007.

Areas 2C, 3 and 4 (Alaska)

The 2015 estimate for Alaska, carried over from the 2014 harvest, was 765,900 pounds of Pacific halibut, an increase from 697,000 pounds in 2013 and 707,200 pounds in 2012. Regulations on the personal use fishery in Alaska set by the NMFS include a registration program, and specifications on type of gear, number of hooks, and daily bag limits. The IPHC sets the fishing season. According to ADF&G's voluntary annual survey, conducted in 2014 and carried forward to apply to 2015, Area 2C pulled in the most halibut, at 428,200 pounds,

followed closely by Area 3A, at 231,300 pounds. The remaining regulatory areas accounted for a small fraction of these two, with Area 3B claiming 18,300 pounds, while the combined Area 4 pulled in 82,600 pounds.

Retention of U32 halibut in the CDQ fishery

The IPHC allows commercial halibut vessels fishing for certain CDQ organizations in Area 4DE (Bering Sea) to retain U32 halibut under an exemption requested by the NPFMC. The CDQ harvest supplements the Alaskan personal use catch. In 2015, retention of U32 halibut in the CDQ fishery was 4,666 pounds, a decrease from the 5,533 pounds of halibut caught in 2014. Changes in harvest each year tend to reflect the amount of effort by local fishing fleets and the availability of fish in their nearshore fisheries.

Bristol Bay Economic Development Corporation

The Bristol Bay Economic Development Corporation (BBEDC), the southernmost of the three CDQ organizations, comprises 17 member villages on the shores of Bristol Bay: 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 BBEDC aims to use sustainable fish harvesting to improve community life and livelihoods in its member communities. The BBEDC reported a catch of 3,460 pounds of halibut in 2015, a 29 percent decrease from 2014. The average weight of the 299 U32 halibut caught was 8.2 pounds, and 97 percent of the fish measured at least 26 inches long. As in 2014, vessels out of Togiak landed the majority of halibut, followed by those at Dillingham.

CDQ communities in Area 4DE can retain U32 halibut as personal use. The CDQ organizations - BBEDC, CVRF, and NSEDC - submit catch reports to IPHC each year detailing this catch.

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. It comprises 20 remote coastal villages: 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. In 2015, CVRF reported that their fishers landed zero halibut and no fish were received by their facilities in Chefornak, Hooper Bay, Kipnuk, Mekoryuk, Toksook Bay, and Tununak. This is a 100 percent decrease from the 963 pounds reported in 2014, which in turn was an 81.7 percent decrease from 5,250 pounds landed in 2013.

Norton Sound Economic Development Corporation

The NSEDC is the northernmost of the three organizations, centered on Nome. The NSEDC's purpose is to provide fishing opportunities for its 15 member communities, which are primarily on the coast of the Seward Peninsula, bounded by Kotzebue Sound on the north and Norton Sound on the south: 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. In 2015, the area's only plant, at Nome, processed 2,206 pounds (net) of halibut, with an average weight per fish of 9.9 pounds. The amount retained in 2015 was an increase of 98 percent over 2014.

Incidental mortality of halibut (bycatch)

Incidental catch, or "bycatch" refers to the unintended capture of Pacific halibut by other fisheries. Regulations require such fish be returned to the ocean but many perish from injuries sustained during capture. This section summarizes the estimated mortality across fisheries and areas.

There has been a declining trend in bycatch mortality over the last few decades, with 2015 representing a 20-year low. According to NMFS estimates, in 2015 there were 7,789,000 pounds of Pacific halibut bycatch mortality, representing a 12.7 percent decrease from the 8,922,000 pounds lost in 2014. Today's level is less than half of the high of 20,293,000 pounds recorded in 1992. Estimates for 2015 are preliminary and subject to change as new information becomes available.

2015 was the third year of the redesigned observer program in Alaska which is intended to reduce bias by assigning observers to vessels at a given time instead of allowing vessel operators to choose when to take an observer.

Sources of bycatch information

The IPHC relies on observer programs run by U.S. and Canadian government agencies for bycatch information. NMFS monitors trawl fisheries off the coast of Alaska and the U.S. west coast, while DFO monitors fisheries off British Columbia. Estimates of bycatch mortality off Alaska for 2015 were based on reports filed through October 28 from the NMFS Alaska Region website and projected through the remainder of the year. Off the U.S. west coast, 100 percent fishery monitoring coverage for the IFQ trawl fishery is mandatory, so all vessels must carry an observer. The varied methods used for recovering bycatch information for British Columbia include catch sampling and 100 percent at-sea monitoring. In 2015, for the third year, a new method was used to choose which vessels in federal fisheries off Alaska would be monitored. This selection process was designed to reduce bias by assigning observers to vessels at any given time. The previous method, in place from 1990 to 2012, allowed vessel operators to

Halibut are caught incidentally in a variety of fisheries. Photo by Paul Logan.

volunteer for observation. The plan does not apply to vessels in fishery programs that already implement 100 percent observer coverage, such as the Gulf of Alaska Rockfish Program, the American Fisheries Act pollock cooperative, the Bering Sea and Aleutian Islands (BSAI) CDQ fisheries, and the BSAI Amendment 80 fishery cooperative.

Discard mortality rates

If observers are present, they can calculate DMRs based on halibut viability criteria. If no observer is present, a pre-determined DMR is applied.

The percentage of halibut that die as a result of being caught (called discard mortality rate or DMR) varies by both fishery and area. If observers are present they can calculate DMRs by judging the likelihood of survival for the halibut they see from pre-set criteria. For fisheries without observers, assumed DMRs are used, which are based on the similarity of fisheries to those in other areas where data are available.

In Area 2A, observers on bottom trawl vessels inspected each halibut for viability which results in mortality estimates used by IPHC. Direct data to determine DMRs for other fisheries are not available, so estimates are based on fisheries with known DMRs. The sablefish hook-and-line fishery was assigned a DMR rate of 16 percent, the pot fishery a DMR of 18 percent, and the catcher/processor midwater fishery for Pacific hake a DMR of 100 percent.

In Area 2B, DFO provides mortality estimates to the IPHC based on observer based viability assessments.

Bycatch mortality by regulatory area

Area 2A (California, Oregon and Washington)

Reporting for this area lags by one year, so the numbers for 2015 are not yet available. The results from 2014 are reported here as projections for 2015, and will be updated when final estimates become available. Area 2A bycatch mortality in 2015 was 95,000 pounds, which represents a large increase from 2013, the lowest figure recorded since 1998. Even so, bycatch in the area remains substantially below levels seen in the pre-IFQ fishery period. As in prior years, the bottom trawl fishery and hook-and-line fishery for sablefish were responsible for the bulk of the bycatch.

Bycatch mortality in the 2014 hook-and-line fisheries was estimated at 50,000 pounds, which was a substantial increase from the 2013 estimate of 9,000 pounds but was more in line with previous years (2013 being particularly low). The PFMC set the 2013 and 2014 Individual Quota (IQ) mortality limit for halibut in the coastwide groundfish trawl fishery at 194,033 pounds. This total constituted 177,495 pounds reserved for trawl fisheries operating north of 40°10’ N (Cape Mendocino, just south of Eureka, California) and 16,538 pounds reserved for fisheries operating south of that latitude.

Area 2B (British Columbia)

DFO staff at the Pacific Biological Station estimated bycatch mortality for the bottom trawl fishery in Area 2B to be 340,000 pounds, up 38 percent from 2014, and hitting its highest level since 2005. In contrast to prior years, the amount of halibut bycatch was relatively constant throughout the first nine months of 2015. In previous years, the highest bycatch occurred during the summer months. Monthly bycatch amounts were highest in March and April,

Trawl gear. Photo by Tim Loher.

reaching 70,000 and 81,000 pounds, respectively. Bycatch was also high in July, at 61,000 pounds.

Area 2C (Southeast Alaska)

NMFS reported bycatch by hook-and-line vessels fishing in the outside waters for the federal waters of Area 2C in 2015. The vessels in this area were mostly targeting Pacific cod and rockfish in open access fisheries, and sablefish in the IFQ fishery. In the aggregate, these fisheries resulted in roughly 12,000 pounds of bycatch mortality in 2015.

Fisheries in this area that take bycatch include pot fisheries for red and golden king crab, and tanner crab. Bycatch in these fisheries has been fairly low, with most (typically 90 percent) of the mortality from pot fisheries occurring in the tanner crab fishery. Since 2011, however, the tanner crab fishery has accounted for only about 60 percent of bycatch due to the growth of the red king crab fishery. Since 1995, annual estimates of bycatch in the crab pot fisheries have been less than 35,000 pounds, and frequently lower than 21,000 pounds, especially since 2004.

The largest drop in 10 years was seen in the Area 3B trawl fishery.

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

A preliminary estimate of halibut bycatch mortality for Area 3 in 2015 amounts to 2,698,000 pounds (including 2,258,000 pounds from the groundfish trawl fishery), a six percent decrease from 2014's level of 2,862,000 pounds. Bycatch mortality increased in 2015 in Area 3A, from 1,888,000 pounds in 2014 to 1,967,000 pounds in 2015. In Area 3B, however, bycatch mortality decreased in 2015 from 974,000 pounds to 731,000 pounds. In 3A, the hook-and-line fishery (both IFQ and non-IFQ) and the groundfish pot fishery saw increases in bycatch, but bycatch decreased for all fisheries in Area 3B. Notably, there was a large drop in trawl fishery bycatch mortality in 3B, to 600,000 pounds, which is the lowest seen in the past ten years. This may have been related to the non-pollock, non-rockfish trawl fishery closure (due to salmon PSC) from May through August.

There was an 18 percent decrease in halibut bycatch mortality in Area 4 compared with 2014.

Area 4 (Bering Sea/Aleutian Islands)

Halibut bycatch mortality in Area 4 was estimated at 4,648,000 pounds in 2015, an 18 percent decrease from 5,704,000 pounds in 2014. This estimate for 2015 is the second lowest since 2000, and is below the 2005-2015 mean of 5,800,000 pounds. Trawl fishery bycatch was estimated at 4,000,000 pounds, more than 60 percent of which was due to flatfish fisheries targeting rock sole

and yellowfin sole. Bycatch mortality in the cod fishery, which was the biggest source of halibut bycatch as recently as 2006, had declined to just 15 percent of bycatch from the trawl sector in 2015. Hook-and-line bycatch mortality in 2015 was estimated at 600,000 pounds, a 16 percent decrease from the 720,000 pounds estimated for 2014. Bycatch rates for pot fisheries are quite low, resulting in an estimated 5,000 pounds for 2015.

Within the Bering Sea, bycatch has typically been the highest in Area 4CDE due to the flatfish ground fishery in the area. In 2015, bycatch in Area 4CDE accounted for 81 percent of the total Bering Sea bycatch.

Alaska shellfish fisheries

Bycatch in commercial fisheries for crab, shrimp, and scallops managed by the State of Alaska has declined precipitously over the last few decades, falling from approximately one million pounds annually in 1992-1994 to less than 0.1 million pounds coastwide. Crab fishery bycatch mortality occurs wherever the fisheries operate, but is highest in Area 4CDE. Crab fisheries in Area 2C (i.e., Tanner crab) are a large contributor. Halibut are rarely observed in shrimp trawl and pot fisheries in Area 2C and eastern 3A, in part due to the use of finfish excluders in trawls and very small tunnel openings in pots. Scallop fishery bycatch, occurring mainly in the Gulf of Alaska, with most taken around Kodiak Island, is low but is increasing. Since 2009, scallop fishery bycatch has grown to a similar magnitude to Area 2C crab fishery bycatch.

Bycatch from the Prohibited Species Donation program

Since inception, the Prohibited Species Donation program has handled more than half a million pounds of halibut amounting to over 1.5 million meals for food banks.

Through the Prohibited Species Donation (PSD) program managed by SeaShare, an organization based on Bainbridge Island, Washington, Pacific halibut caught by trawl vessels in the Bering Sea/Aleutian Islands and the Gulf of Alaska, are processed into steaks and donated to food banks throughout the United States. The amount of landed halibut bycatch handled in the program has totaled 506,709 pounds (net weight) since program inception, representing over 1.5 million meals, based on a 1/3rd pound serving size.

After a variety of cooperating cold-storage companies weigh, inspect, steak, and repack the fish, SeaShare sends it out to hunger relief programs. Food banks receiving this fish in 2014 were The Glory Hole (Juneau), Kenai Peninsula Food Bank (Soldotna), Brother Francis Shelter (Kodiak), Kodiak Baptist Mission (Kodiak), Nana Corp. (Kotzebue), Kawerak, Inc. (Nome), Food Bank of Alaska (Anchorage), St. Herman's Seminary (Kodiak), and San Francisco Food Bank (California).

The 36,672 pounds of halibut bycatch landed by vessels fishing groundfish off Alaska in 2015 (through September 30) came from both Bering Sea (mostly from Akutan) and Gulf of Alaska (mostly Kodiak). Processors in Bering Sea ports received 2,500 pounds, and processors in Gulf of Alaska ports received 34,172 pounds. The preliminary figures showed a continuation in 2015 of the majority (93%) of the halibut coming from Gulf of Alaska processors. SeaShare expects a significant amount from Dutch Harbor from the pollock "B" season, which has yet to be tallied, so final 2015 figures should be more in line with previous years.

Survey activities

Every year the IPHC conducts a standardized setline survey and participates in NMFS-run trawl surveys. Activities during these cruises include collection of biological and oceanographic data, tagging and release of fish, and other projects. Fishing activities are summarized here and other projects are summarized in the Research section of this report

IPHC Standardized Stock Assessment Survey

IPHC operates an annual longline survey that encompasses the North American range for Pacific halibut.

The Standardized Stock Assessment Survey (also called the "setline survey" or SSA) gathers catch-rate information and biological data such as the size, age, and sex-composition of halibut, and is used to monitor changes in biomass, growth, and mortality in adult and sub-adult components of the halibut population. The survey team uses standardized methods, bait, and gear during summer months to gain a balanced picture that can be compared year to year. When other species are caught in these surveys, their presence provides data about bait competition and the rate of bait attacks. They can also provide an indication of abundance over time, making them valuable to the assessment, management, and avoidance of bycatch species.

The survey data are independent of those provided by the commercial fishery and can serve as a useful point of comparison. Commercial fisheries judge halibut populations based on their perception of fish numbers in the areas where halibut are most highly represented, whereas the survey allows the assessment of the fish's presence across a wide area.

***F/V Kema Sue* crewmember, Victoria Lamore, dressing halibut during the IPHC setline survey. Photo by Levy Boitor.**

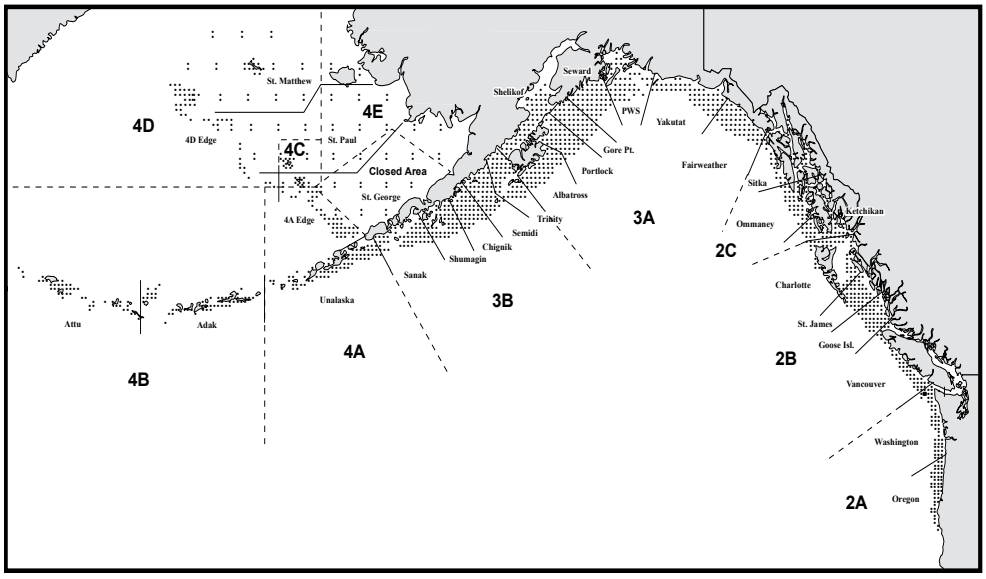
Design and procedures

The 2015 setline survey covered both nearshore and offshore waters of southern Oregon, Washington, British Columbia, southeast Alaska, the central and western Gulf of Alaska, Aleutian Islands, and the Bering Sea continental shelf. The IPHC chartered 14 commercial longline vessels for survey operations. During a combined 73 trips and 736 charter days, these vessels fished 30 charter regions. Each region required between 12 and 43 days to complete.

The survey was conducted via stations arranged in a square grid reflecting the depth range occupied by Pacific halibut during summer months (20-275 fm in most areas). In 2015, the IPHC conducted a standardized grid survey in the eastern Bering Sea (EBS) as a continuation of the multi-year coastwide effort to expand the survey depth profile and update calibration with other surveys. A total of 83 EBS stations were fished in 2015, of which 82 consisted of the original stations fished in the 2006 survey, with one new station east of Nunivak Island completed. The other three new stations were scouted and deemed too shallow to fish.

Seven skates of baited gear were set at each SSA survey station in all charter regions. Survey sampling work involved each vessel setting from one to four stations every day, with boats setting gear as early as 5:00 a.m. and allowing it to soak for at least five hours (but not overnight, if possible) before hauling. Data from gear soaked longer than 24 hours were discarded from the survey, as were sets for which predetermined limits for lost gear, snarls, predation, or displacement were exceeded. 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. Each hook was baited with 0.25 to 0.33 pounds of chum salmon.

Thank you to the captains and crews of the 14 vessels that carried out the 2015 setline survey. They are fishing vessels:
Bold Pursuit
Clyde
Free to Wander
Kema Sue
La Porsche
Norcoaster
Pacific Surveyor
Pender Isle
Polaris
Saint Peter
Seymour
Star Wars II
Vanisle
Waterfall



In 2015, the IPHC survey spanned the area from southern Oregon to the Bering Sea, where an expanded survey took place on the Bering Sea shelf. In the figure above, each dot indicates a fishing station.

Sampling protocols

Following protocols set by the SSA Survey Manual, shipboard biologists (also known as sea samplers) assessed the functionality of bird avoidance devices during setting of the gear, and also recorded the number of hooks set and baits lost per skate. During gear retrieval, the biologists recorded hook status (whether hooks were pulled up empty and what species were captured) for the first 20 consecutive hooks of each skate. However, processing needs for fish from previous skates, particularly in areas with high catch rates, occasionally affected where in the 100-hook sequence of the skate the sample was taken. In specific northern stations of Area 2A, 3A (as part of a special project described below), and all of Area 2B, samplers recorded the status of all hooks in the order in which they were hauled, in lieu of 20-hook counts.

Samplers assessed the sex and maturity, prior hooking injury (PHI) severity, and evidence of depredation for each fish captured. They also collected otoliths from a randomized subsample of halibut for later age determination. The male fish were deemed to be either mature or immature, and the females were categorized as 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 or was already dead upon hauling. All other sublegal fish were measured and released alive.

Special projects

Taking advantage of the survey platform, a number of special projects are conducted each year in addition to the standard data.

While executing the SSA survey, biologists are also able to take on projects that are not directly associated with halibut stock assessment. The following is a brief summary of projects, and more information can be found on several of them in the Research section of this report.

Seabird occurrence

The stock assessment survey gives researchers an excellent opportunity to record observations of seabirds during summer months over waters off Oregon northward to Alaska. Tracking seabirds is important because fisheries can be shut down due to overly high mortality of endangered seabirds, such as the short-tailed albatross. At the end of each survey haul, samplers recorded the number of seabirds present within a 50-meter radius of the vessel's stern so as to judge where and when they gather in most abundance. More information on this project can be found in the Research section of this report.

Rockfish sampling in Regulatory Area 2A

IPHC sea samplers recorded where and at what depth all rockfish were captured in Area 2A. They individually marked and brought them all to port, recording the station and skate of capture. Biologists from WDFW and ODFW then collected additional data, like sex, weight, length, and maturity, as well as otoliths and fin clips for genetic analysis of each fish. In 2015, state biologists sampled 288 rockfish that were captured in Area 2A.

In 2015, as in 2014, eight rockfish index (RI) stations were added to the standard SSA stations. Only three skates were set at these locations in order to reduce pressure on the rockfish population. Halibut that were caught on these rockfish skates were measured and released alive and without removing otoliths, and none of those data were used in the halibut stock assessment.

In conjunction with U.S. state agencies and DFO, special rockfish sampling takes place in Areas 2A, 2B, 2C, and 3A.

Rockfish sampling in Regulatory Area 2B

The sampling of rockfish has occurred annually since 2003 (with the exception of 2013), and is expected to continue indefinitely. IPHC samplers analyze and record the round weight, length, sex, and maturity for all rockfish caught in Area 2B. They also collect otoliths according to the sampling criteria in the 2015 Bycatch Sampling Manual. Samplers collected biological data from 1,697 rockfish (representing 15 different species), and collected otoliths from 1,696 rockfish. IPHC shared these data and otoliths with DFO.

Yelloweye rockfish enumeration in Alaska

At the request of the Commercial Fisheries Division of the ADF&G, IPHC samplers recorded the details of all yelloweye rockfish pulled in by survey vessels in Area 2C and in the Fairweather charter region of Area 3A. In 2015 that involved collecting data for a total of 1,322 yelloweye rockfish, which were sent to ADF&G for analysis.

Oceanography

IPHC deployed water column profilers at every survey station for the seventh consecutive year in 2015 unless prevented by rough weather or poor conditions. The goal is to measure chlorophyll, pH, temperature, depth, salinity, and dissolved oxygen (DO) concentration throughout the water column and on the halibut grounds. More information on this project can be found in the Research section of this report.

Environmental contaminant sampling

IPHC samplers contributed to an ongoing study on environmental contaminants in halibut, undertaken in conjunction with the Alaska Department of Environmental Conservation (ADEC). Flesh samples from Pacific halibut caught by survey vessels are collected from a range of sizes at stations that corresponded to areas of high commercial catch. In 2015, a total of 71 samples were collected in the Shelikof survey region, 83 samples were collected in the Adak region, and 76 samples were collected in the St. Matthew region. Samples are subsequently tested for a range of environmental contaminants, including organochlorine pesticides, dioxins, furans, polybrominated diphenyl ethers, polychlorinated biphenyl congeners, methyl mercury, and heavy metals (arsenic, selenium, lead, cadmium, nickel, and chromium).

Icthyophonus sampling

In 2015, the IPHC continued its research into how widespread the microscopic protozoan parasite called *Ichthyophonus* is in the Pacific halibut population. *Ichthyophonus* are from the class Mesomycetozoea, a highly diverse group of organisms with characteristics of both animals and fungi, and has been identified in many marine fish. The 2015 project resampled the three geographically distinct areas that have been sampled since 2011: Oregon, Prince William Sound, and Bering Sea charter regions. The latest results about the prevalence of *Ichthyophonus* over time are not yet complete.

IPHC sea sampler Hesper Kohler and summer intern, Nick Wong, enjoy calm weather in Prince William Sound, AK aboard the *F/V Waterfall*. Photo by Bonnie Gauthier.

At-sea weights pilot study

In 2015, IPHC commenced a study to look at the relationship of weight to fork length. As a fundamental concept that the IPHC uses for stock assessment, apportionment, and all facets of halibut management, net weight is a key metric, but the data are a result not only of natural variation but also of variable processing procedures that occur after the fish is caught. This project complements an on-going project, in which portions of commercial deliveries are measured and weighed at the dock.

In order to get a handle on the relationship between weight and length of a halibut, the IPHC launched a project in 2015 looking at at-sea versus shoreside landed weights.

During portions of three trips, crew on the *F/V Vanisle* pilot tested a motion-compensated scale to collect round and dressed halibut weights at sea. The scale has a maximum load of 60 kg with 20 g accuracy. Unfortunately, problems with the scale and a custom measuring cradle cut the project short. However, the data collection procedures were adequately tested and considered a success, and aside from a manufacturing defect that has since been repaired, the scale performed adequately, confirming that future data collection made using the scale will be suitable for this investigation.

Spiny dogfish sampling

In 2015, IPHC samplers collected data on the sex and length of 2,825 spiny dogfish as part of a multi-year study requested by NMFS Auke Bay Laboratories. The study aims to compare IPHC's survey catch rates with those from NMFS sablefish (*Anoplopoma fimbria*) longline surveys. The results will shed light on species distribution and test the hypothesis that there may be two biological stocks of dogfish—one in southeast Alaska's inside waters, and one in coastal waters elsewhere. These data will be used to develop a length-based population dynamics model for the annual dogfish stock assessment.

Pacific cod length frequencies

The IPHC shared data with NMFS Alaska Fisheries Science Center on Pacific cod captured during surveys in the Bering Sea continental shelf edge. In 2015, the collection range was extended to include IPHC stations west of Seguam pass on the Aleutian Archipelago. In 2015, samplers aboard the *F/V Kema Sue, F/V Free to Wander, F/V Norcoaster,* and *F/V St. Peter* collected 9,724 Pacific cod lengths collectively.

Depredation tracking

Pacific halibut, once hooked by the commercial fishery, are vulnerable to on-hook attack by marine mammals such as killer whales, sperm whales, seals, and sea lions. During gear retrieval, samplers recorded all damaged and missing hooks to establish a baseline rate of gear damage against which to compare stations with suspected interference from depredating species. Some of this type of interference can be difficult to detect and quantify. If sea samplers observed any toothed whales or pinnipeds within 100 meters of a survey vessel, the samplers identified the individuals to species level, recorded the number present, position (in relation to the vessel, the gear, and the offal discharge), the hook number at first and last sighting, and the duration of the encounter. Samplers noted all damaged halibut and damaged bycatch retrieved during these encounters. A station is considered ineffective due to whale depredation if the sum of damaged gear and damaged catch is greater than 10% of the hooks set. In 2015 no stations were considered ineffective as a result of whale depredation.

Orca whales are often sighted targeting the longline catch. Photo by Sam Parker.

IPHC worked with the PSMFC to test electronic monitoring equipment for species identification and handling on fixed gear vessels.

Electronic monitoring project

The IPHC cooperated with the Pacific States Marine Fisheries Commission (PSMFC) in a project to help in the background testing of new electronic monitoring (EM) techniques. In 2015, the *F/V Bold Pursuit* and *F/V La Porsche* each carried EM system hardware, as well as an extra IPHC sea sampler who recorded 100 percent hook-by-hook observations. Comparing the EM data with the sea samplers' data will help technicians assess the efficacy of EM systems for species identification, enumeration of catch and discards, identification of fishing methods and catch handling, and fish length estimation. This information will inform decisions about how to integrate EM systems into the Alaskan Observer Program for fixed gear vessels.

Bait purchases

To ensure consistency from year to year, the bait used for the setline survey is always No. 2 semi-bright (Alaska Seafood Marketing Institute grades A through E), headed and gutted, and individually quick-frozen chum salmon. For the 2015 survey, IPHC procured 305,000 pounds of chum from four suppliers in the US prior to the start of the season, plus an additional 52,000 pounds from three US processors during the season. The bait quality was monitored throughout the season and was found to meet the IPHC's standards for the survey.

Fish sales

O32 Pacific halibut caught for analysis during survey work are generally kept and sold as a way to offset the cost of the survey. Most vessel contracts provided the vessel a lump sum payment along with a 10 percent share of the halibut proceeds. Rockfish and Pacific cod landed incidentally during the survey are also kept, in part because they rarely survive the trauma of capture and release. Proceeds from retained bycatch captured in U.S. waters are divided equally between the vessel (for handling expenses) and the appropriate state management agency. For boats in Canadian waters, the DFO kept all the bycatch proceeds, but paid a bycatch handling fee to those boats. The IPHC does not keep any of the proceeds from selling the bycatch species.

During the 2015 survey, IPHC's chartered vessels delivered a total of 751,340 pounds of halibut to 25 different ports. The coastwide average price per pound was $6.55 ($U.S.), amounting to a sales total of $4.9 million (U.S.).

IPHC halibut fetched an average of $6.55 per pound. Proceeds from the sale of halibut caught during the survey go directly back into funding the survey program.

Field personnel

The 2015 survey vessels were crewed by a combination of seasonal hires and IPHC staff. A group of 27 seasonal hires worked a total of 2,073 person days, including travel days, sea days, and debriefing days. Additionally, participating biologists included an IPHC port sampler, the summer intern, and three permanent staff members.

Two samplers are typically aboard each survey vessel. At a given time, one biologist handles fish, collects data, and samples on deck, and one sampler records data and stores samples in a portable shelter. Low catch rates in Regulatory Area 2A required only one sampler for all but the first trip in the northern portion of the Washington charter region (which was staffed by two samplers for eight days).

Setline survey results

The 14 chartered vessels —seven Canadian and seven U.S.—fished a combined 73 trips accounting for 736 charter days. The fishing covered 1,368 survey stations, of which 1,360 (99.4 %) were considered effective for stock assessment analysis.

As always, the IPHC targeted the summer months—June, July, and August—for survey fishing, and the vast majority (92%) of all stations were fished in those months. Only 90 stations (8%) were fished during the last full week of May. The early part of the survey season saw the greatest activity; coastwide activity declined during August and was fully completed by the end of the month.

Weight and number per unit effort (WPUE)

As a result of including both commercial and non-commercial fishing grounds, the SSA results have an average WPUE for all regulatory areas below that of the commercial fleet. The average total WPUE figures for the regulatory areas (not including expansion stations in the eastern Bering Sea) were:

- Area 2A (31 pounds/skate)
- Area 2B (89 pounds/skate)
- Area 2C (207 pounds/skate)
- Area 3A (103 pounds/skate)
- Area 3B (79 pounds/skate)
- Area 4A (49 pounds/skate)
- Area 4B (56 pounds/skate)
- Area 4C (50 pounds/skate)
- Area 4D (30 pounds/skate).
- Area 4E only fished as part of EBS expansion.

Six regulatory areas—2A, 2C, 3B, 4B, 4C, and 4D—increased in WPUE in 2015; the other three declined. Although weight is the primary unit of measure when studying population and removals, the number of halibut is also a critical measure. Numbers per unit effort increased in 2015 compared to 2014, with a four percent increase in the catch rates of O32 halibut, and an 11 percent increase in the numbers of U32 halibut. In 2015, there were 44 percent more U32 halibut captured than O32, which is an 18 percent increase in the difference from 2014. In Area 3A there was a decrease in O32, but an increase in U32 halibut average numbers. Area 4A showed a slight decrease in both sizes. Area 4B had a slight increase in O32 rate of capture, with a slight decrease in U32. Area 3B continues to have the largest gap between O32 and U32 halibut, with a difference of 54 percent between the two.

Otolith collection

Collection of halibut otoliths for aging is a major activity of the SSA survey. In 2015, the otolith collection goal was 2,000 per regulatory area (with a minimum target of 1,500 per area). Samplers removed a total of 16,243 otoliths from 92,380 halibut, an 18 percent 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 high sampling rates. A total of 597 pairs of otoliths were collected in most regulatory areas for the clean otolith archive (COAC), which will be used in the future for projects not yet identified.

IPHC records bycatch during the surveys and catalogued 129 species of fish and invertebrates in 2015.

Bycatch

As a result of the survey, around 129 species of fish and invertebrates were captured as bycatch. Despite precautionary measures taken by skippers to avoid marine mammal and bird catch, four black-footed albatross (*Phoebastria nigripes*) were captured in Area 3A and were provided to the Oikonos organization for genetic sampling. No marine mammals were caught on survey.

While halibut was the most frequently caught species coastwide during the survey, as expected, a range of other species were captured incidentally, most commonly sharks, followed by Pacific cod. Dogfish were the most commonly caught shark species in Areas 2A, 3A, and 2B. Pacific cod was the most frequent

Crewmember John Stevens of the *F/V Kema Sue,* coils the gear during the IPHC setline survey. Photo by Levy Boitor.

bycatch in Areas 3B, 4A, 4C, and 4D. In Areas 2C, 4B, and 4E, a large range of "other species" were commonly captured as bycatch, most commonly arrowtooth flounder *(Atheresthes stomias),* lingcod *(Ophiodon elongates),* longnose skates *(Raja rhina),* redbanded rockfish *(Sebastes babcocki),* white-blotched skates *(Bathyraja maculata),* yellow Irish lord sculpins *(Hemilepidotus jordani),* and yelloweye rockfish *(Sebastes ruberrimus).*

More than half of the halibut caught on the survey are smaller than the commercial size limit of 32 inches (~82 cm). Likewise, the coastwide median length is 78 cm (~31 inches) although this varies by region.

Halibut distribution

Just upwards of 59 percent of halibut caught during the survey were smaller than the current commercial legal size limit (U32) with a median length of 78 cm. In 2015, median length increased in Areas 2C, 4B, and 4D; decreased in Areas 2A, 3A, 4A, and 4C; and did not change in Areas 2B and 3B. Most of the western survey regions (Areas 3A, 3B, 4A, and 4C) had U32 median halibut lengths. As in 2014, the largest median length was again in Area 2A (87 cm).

The sex composition of survey-caught O32 halibut varied widely among areas, ranging from 40 percent to 85 percent female. As in the prior year, Area 4B had the lowest percentage of females in the catch—not surprising considering this area has had less than 50 percent females consistently since 1998. Meanwhile, Area 4C showed the highest concentration of females, as usual and increasingly so over the last few years. Most female halibut caught during the survey period were in the ripening stage and expected to spawn in the upcoming season.

Age distribution

The stock assessment survey analyzes the distribution of halibut age by examining the rings in otoliths removed from the fish. Of the otoliths collected during the survey 15,815 were successfully aged. The most commonly occurring

year class for both males and females was 2005 (10-year-olds), with 3,061 caught. Next most common were the years 2004 (11-year-olds), with 2,531 caught, and 2003 (12-year-olds), with 1,912 caught.

In 2015, the youngest and oldest halibut caught in the setline survey samples were four and 45 years old. There were six four-year-old fish caught: two from Area 3B measuring 42 and 48 cm forklength, and one each from Areas 2B, 2C, 3A, and 4C measuring between 46 and 68 cm forklength. The 45-year-old was a male captured in Area 4B with a fork length of 127 cm. The smallest and largest halibut caught in the survey samples were 42 cm and 210 cm, respectively. The largest was a 28-year-old female from Area 4C. The smallest was a four-year-old male from Area 3B.

Setline survey expansion and complementary data sources

In 2015, the second of a six-year expansion plan was completed. The expansion– different each year– addresses gaps in the survey.

The IPHC has planned a six-year setline survey with the primary purpose of reducing the potential for bias in the indices of halibut density and abundance. The expansion, begun in 2014 in Areas 2A and 4A, and set to complete in 2019, moves the survey into deep (275-400 fathoms) and shallow (10-20 fathoms) waters, and into gaps in the 20-275 fathom waters not covered by the standard 10 nautical mile station grid. Observations have shown there to be significant commercial harvest in deep waters, particularly in Area 4A, and in shallow waters in some areas. It is apparent that the current survey range does not cover the entirety of halibut habitat. Other gaps within the 20-275 fathom range are at times substantial, particularly in Areas 2B and 4.

To address these gaps, the IPHC has proposed a number of expansions to current and future survey efforts. In 2015 expansion efforts occurred in the EBS. Future expansion plans include Area 4D in 2016, Area 4B in 2017, Areas 2B and 2C in 2018 and Areas 3A and 3B in 2019.

Setline survey expansions in 2015

In 2015, the IPHC carried out the second year of its setline survey expansion, with new survey work in the EBS. This region was designated the highest priority for expansion following the 2014 expansion in Areas 2A and 4A. Revisiting the EBS region, which had previously been surveyed in 2006, became particularly important when biomass estimates in recent years came close to the point of closing the commercial fishery after accounting for other removals (particularly bycatch mortality). The 2006 survey, which provided data for calibration and scaling of the annual NMFS trawl survey in the region, allowed for the computation of a WPUE time series for the region. With this area making up 68 percent of the Area 4CDE bottom area, any change in calibration or scaling since 2006 could greatly affect the Area 4CDE WPUE index and consequently its estimates of the apportioned share of the biomass.

The EBS setline survey in 2006 consisted of 41 pairs of stations set on a 60 nmi grid, based on NMFS's 20 nmi grid used for its annual trawl survey. For the 2015 EBS setline survey, the IPHC examined whether the grid could be further expanded into shallow waters of Bristol Bay and around Nunivak Island, as well as just east of Nunivak and in Kuskokwim Bay. Charter vessels fishing these stations found that the Kuskokwim Bay stations were too shallow, and only the

southern station of the Nunivak pair was deeper than 10 fm. Therefore, the 2015 EBS setline survey fished 83 stations, the original 82 stations fished in 2006, and one new station east of Nunivak Island.

Two vessels completed the sampling of the expansion stations, in 2015. Compared to neighboring areas that are covered by the standard annual survey grid (Area 4A and 4D edge, Bering Sea island stations, Area 3B), catch rates in the EBS were very low. Hook count data showed that, as in 2006, Pacific cod, sea stars, and Alaska skates were the most frequently encountered bycatch species.

NMFS Bering Sea trawl survey

This year marked the IPHC's 18th straight year of participation in the NMFS annual trawl survey on the eastern Bering Sea shelf. The 2015 survey took place from May 28 to August 3. Two chartered fishing vessels, *F/V Vesteraalen* and *F/V Alaska Knight*, were each staffed by six scientific crew, who carried out objectives related to stock assessment and year-class strength estimation for numerous species. An IPHC field biologist was deployed on *F/V Alaska Knight* to collect biological information on the halibut caught and to carry out a wire tagging pilot project.

NOAA chartered survey vessel *Alaska Knight*. Photo by Sam Parker.

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 218 tows in three trips, and caught a total of 1,072 halibut of which 566 were sampled for length, otoliths, sex, maturity, and prior hooking injuries. Of those, 54 percent were female and 46 percent were male. Ninety-eight percent of the female fish and three percent of the males were assessed to be immature. The remaining 506 were selected for tagging, although only 486 of those were determined to be viable and were actually tagged and released. More information on the tagging project can be found in the Research section of this report.

An IPHC sea sampler rode along during the NMFS Bering Sea trawl survey for the 18th straight year. The IPHC sampler handles all halibut brought aboard one vessel and also helps process the rest of the catch.

Size and age composition

To determine the abundance (numbers) of halibut in the survey area, researchers use results from the area-swept by the trawl and extrapolate out to the entire area. (This measurement is distinct from biomass, which represents the total weight of all those fish). The NMFS survey time series 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. The abundance estimate for the Bering Sea in 2015 was 64.2 million halibut, a slight uptick from the 62.8 million halibut estimated for 2014.Biomass increased in 2015 to 379.6 million pounds

(from 377 million pounds in 2014). It is important to keep in mind that these numbers include halibut of all sizes, many of which are substantially smaller than those caught either in the commercial fishery or during the setline survey.

NMFS Gulf of Alaska trawl survey

In 2015, the IPHC participated in the NMFS Gulf of Alaska bottom trawl survey of groundfish and invertebrate resources, spanning the area from the Islands of Four Mountains in the western Gulf to Dixon Entrance in southeast Alaska. This survey is a continuation of an effort started in 1984 and is the eigth installment since the series changed from triennial to biennial in 1999. IPHC has participated in this survey since 1996. Survey trawl gear tends to select for smaller size halibut on average than those captured on longline gear, making the data collected difficult to include directly in the halibut stock assessment generated by the IPHC, although efforts continue. In the meantime results still provide a glimpse into the dynamics of year classes approaching the commercial fishery.

Every other year, NMFS conducts a trawl survey of the Gulf of Alaska between the Islands of Four Mountains in the west and Dixon Entrance in the east.

The main objective of the survey as a whole was to gather data to extend this time series for monitoring trends in distribution, abundance, and biological

The *F/V Sea Storm* was one of three vessels chartered by NOAA to conduct the Gulf of Alaska trawl survey. Photo by Paul Logan.

condition of various groundfish stocks in the northeast Pacific Ocean. In 2015, three fishing vessels were chartered to carry out the survey: *F/V Alaska Provider, F/V Cape Flattery,* and *F/V Sea Storm*. Each vessel was staffed with a crew of six to seven scientists and a professional fishing crew and captain. The survey lasted from May 19 to August 2. The surveyors completed a total of 772 stations, and all depths to 1,000 meters were surveyed for the first time since 2009. The three vessels collectively caught 7,851 halibut.

One IPHC biologist was aboard the *F/V Sea Storm* for the duration to sample Pacific halibut for length, sex, maturity, otoliths, and prior hooking injuries, and to carry out a wire tagging pilot project. The biologist collected biological samples from 1,642 of the 3,285 Pacific halibut caught by that vessel. Of the halibut in the biological sample, 39 percent were female and 61 percent were male. Of the females sampled, 9.9 percent were coded as mature, similar to previous years. A total of 91.4 percent of the male halibut were coded as mature. Of the remaining 1,643, those in suitable condition were tagged and released, resulting in 1,491 total releases. More information on this project can be found in the Research section of this report.

Both the abundance and biomass estimates showed a fairly consistent decline from 2003 to 2013 (except for 2009). In 2015, these estimates increased by 24 percent and 16 percent, to 130.1 million halibut and 752.6 million pounds, respectively. Abundance levels for all size classes increased, with the 40-79 cm size class continuing to dominate the catch.

Indexing southern Area 2A using trawl survey data

In 2014, the IPHC conducted a southern expansion of the setline survey to 39°N, an extent that still falls short of covering the entirety of Area 2A, which runs between the Canadian and Mexican maritime borders. While there are no plans to expand the setline survey even further south, commercial, recreational, and NMFS survey data show that small amounts of Pacific halibut have been caught south of 39°N. Therefore, it proved to be desirable to devise a method to ensure the IPHC's indices of density account for all halibut in these southern areas outside of setline survey coverage.

The IPHC survey extends to the California/Oregon border in most years and into northern California during some expansion years. However, catch data from other sources suggests small amounts of halibut reside further south.

In 2015, the IPHC looked at how to use of NMFS West Coast trawl survey data for indexing halibut density in parts of southern Area 2A that have not been covered by the setline survey. In general, catch rates on the trawl survey are very low, and in areas where it overlaps the setline survey, trawl survey catch rates do not provide an annual index of density that is consistent with the setline survey. Addressing this problem required calculating the mean ratio of trawl weight per unit effort in the region not covered by the setline survey to the mean ratio of trawl weight per unit effort in the area covered by the setline survey. This scales the overall setline survey index so that it accounts for halibut south of the setline survey limit and increases the Area 2A biomass index by approximately three percent from previous estimates.

Prior hook injuries

Prior hook injuries (PHI), the result of fish being released in an injured state after becoming caught by hook and line gear and subsequently released, have been tabulated during the SSA surveys since 1997. IPHC studies show that moderate to severe injuries increase halibut mortality.

All halibut captured during the 2015 IPHC SSA survey were examined for the presence of PHIs. In all, 5,802 halibut were found to have a prior injury. The percentage of all halibut with a prior hook injury averaged 4.5 percent coastwide (ranging from a low of 2.6 percent in Area 4A-Bering Sea to a high of 18.3 percent in (Area 4D). This coastwide average is lower than the 6.1 percent

The eventual goal is to develop models that relate PHI rates to fishing efforts.

average observed in 2014 and the 7.5 percent average observed in 2013. Areas that saw increased PHIs in 2015 were 2A, 2B, 4C, and 4D, while PHI stayed about the same in Areas 3A and 4B, and decreased in all other areas.

The overall incidence of PHI among U32 halibut (fork length less than 32 inches or 82 cm) examined during the SSA survey was 2.8 percent, a notable decrease from the 6.1 percent observed in 2014. U32 PHI incidence decreased the most in Area 4A-Bering Sea (2.2 percent in 2015 vs. 11.9 percent in 2014), and increased dramatically this year in Areas 4C (12.9 percent vs. 8.8 percent in 2014) and 4D (11.7 percent vs. 7.3 percent in 2014). The highest occurrence of U32 PHI (12.9 percent) was observed in Area 4C.

The samplers aboard the NMFS trawl surveys in the Bering Sea (annual survey) and the Gulf of Alaska (biennial survey) also gathered PHI data. In the 2015 Bering Sea trawl survey, 566 halibut were inspected (less than typical as roughly half of the halibut encountered where tagged and released without PHI assessment), and PHI rates were determined to be 5.4 percent, up slightly from the 4.4 percent seen in 2014. The Gulf of Alaska survey inspected 1,642 halibut and determined a PHI rate of 2.4 percent, which was lower than in 2013.

This halibut has both fresh and prior hooking wounds. Photo by Paul Logan.

All hook and line fisheries, halibut and other targets, can cause PHIs. The collected data probably underestimate the severity of the problem, considering that the IPHC's PHI observations reflect only the number of injured halibut that lived to be caught again. Many halibut cannot survive moderate to severe hooking injuries, and survivors may stop growing or grow more slowly.

Changes in the PHI incidence observed in a given year may reflect the magnitude of careful release techniques being used. A large percentage of hook removal injuries are minor, and have little if any effect on survival after careful return to the sea. An increase in the PHI rate for example, at least in the rate of minor injuries, may not necessarily reflect poor handling by fishers, and could in fact indicate more careful release techniques, and correspondingly higher survivorship. To better understand this dynamic, the IPHC is working to analyze PHI data time series to figure out whether there are relationships (with respect to space or time) of injury rates related to fishing effort. The IPHC plans to develop models relating injury rates to commercial and sport fishing efforts.

Population assessment

Since 1923, one of the IPHC's primary tasks has been to assess the population (or stock) of Pacific halibut, a complex undertaking that requires some explanation. This section covers two main topics that have bearing on the population assessment process: (1) the importance of data sources, and (2) the assessment process and its results. The harvest policy and apportionment are other important elements of the work, and are covered in their own sections immediately following this one.

Data sources

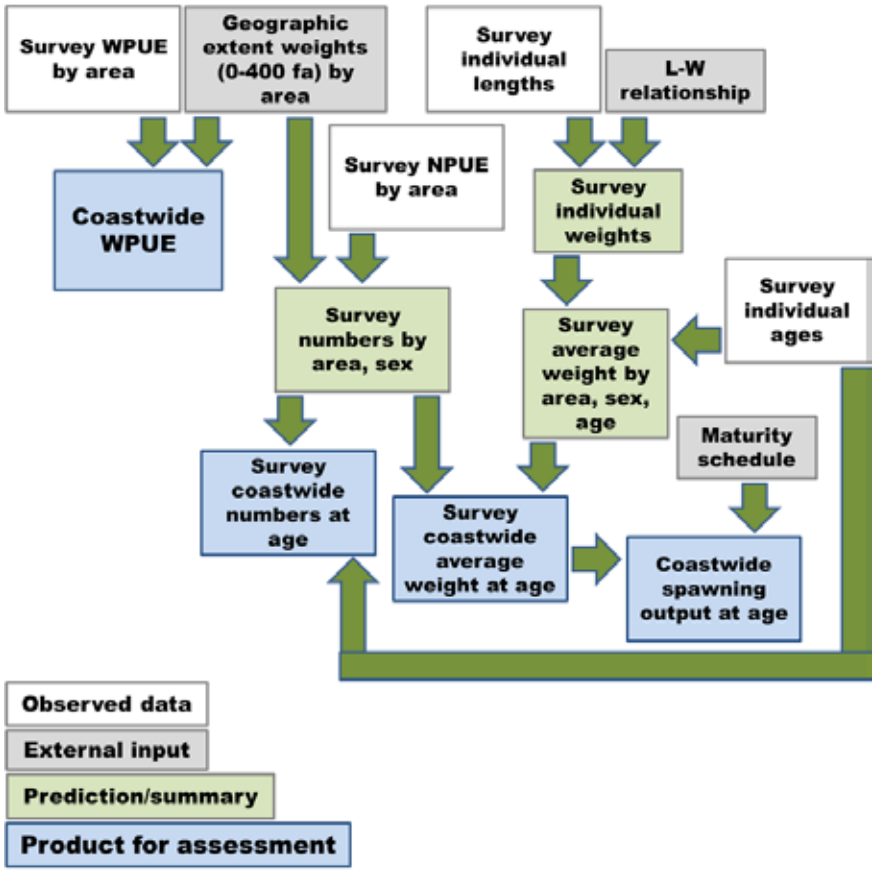
The data for the stock assessment is of three primary types: fishery-independent data, fishery-dependent data, and auxiliary data. Additionally, since 2013, the IPHC has been including historical data in the assessment, which allows scientists to better identify cyclical trends of import to an accurate count of the current population. While data collection has continuously improved and is now the best it has ever been, the historical data are incomplete and/or imperfect, limiting the conclusions that can be drawn.

Fishery-independent data

The IPHC setline survey generates the fishery-independent data, which covers the majority of Pacific halibut habitat from the northern BSAI to California, and depths of 20-275 fathoms. The survey provides catch-rate information, as well as biological information from random sampling: sex, length, age, and maturity. The stock assessment relies primarily on this information, along with that from the commercial catch. In 2015, fishery-independent data included six measures: 1) survey NPUE, 2) survey age distributions, 3) sublegal survey age distributions, 4) survey weight-at-age, 5) spawning output-at-age, and 6) NMFS trawl surveys in Alaska.

The IPHC setline survey provides fishery-independent information about the Pacific halibut stock.

Crewmember Sofia Echevario of the *F/V Kema Sue* sets gear for the IPHC setline survey. Photo by Levy Boitor.



General schematic of the processing of the setline survey data.

The number-per-unit effort and age distributions are just two of the key pieces of information gleaned from the setline survey.

The first measure of fishery-independent data—the NPUE—indicates abundance and is calculated based on the catch in numbers relative to the amount of gear deployed at each station. The processing of survey NPUE 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—survey age distributions—comes from otoliths, the sampling rates for which are adjusted annually to produce parity across regulatory areas. All otoliths collected during survey activities are read each year by IPHC age-readers. The age frequencies across areas tend not to show much deviation. Nine-year-old female halibut represented the largest proportion of survey catch in all areas except Area 4B (where age-9 males were most prevalent) in 2015. Halibut aged 10-11 comprised a larger fraction of the total in Areas 4A-4CDE consistent with the observation of relatively large numbers of these cohorts in the Bering Sea trawl survey over recent years.

The third measure—sublegal survey age distributions—was used in 2015 as a means to approximate the halibut comprising commercial wastage, or halibut captured as part of the commercial fishery, discarded, and a portion of which are assumed to subsequently die. These data showed a remarkably protracted age-distribution, with both male and female halibut age-10 and greater making

appreciable contributions to the total, particularly in Areas 3A-4A. The age-distribution for the two sexes also differed importantly, with U32 females present in appreciable numbers from roughly age 7 to 11, and U32 males from age 7 to well beyond age 15 in some years. The protracted age structure of U32 fish illustrates the recent variability in size-at-age: some fish from each cohort reaching the minimum size limit by age-6, and others (particularly males) many years later.

The fourth measure—survey weight-at-age—is obtained via individual length observations on all halibut captured. These are then converted to estimated weights via the currently used length-weight equation. For each regulatory area each year, calculations of average weight-at-age by area, sex, and year are made. Results for ages with insufficient number of samples can be interpolated. Inevitable discrepancies among the areas require 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. There do not appear to be consistent or strong trends from 2010-2015 in the area-specific data.

The fifth measure—spawning output-at-age—indicates the population-level weight-at-age and spawning biomass. Unlike the survey index calculation, where interannual sampling variability is logically included, the true population level quantities should be smoother than the raw observations. Applying a smoother across years within each age produces results more consistent with those expected for population level values; these summaries most clearly show the population-level decline in weight-at-age observed for both male and female halibut over the recent time series available from the survey.

The sixth measure—NMFS trawl surveys in Alaska—was used to augment the assessment data. These surveys provide valuable information on the size and abundance of halibut in the EBS, and the data were used to estimate size-at-age for young halibut not frequently encountered in the IPHC survey, as well as trends in abundance and age structure. These data were evaluated in the context of the existing assessment models and spatial analyses currently in development.

Fishery-dependent data

Fishery-dependent data is dominated by halibut landings from the directed fishery.

The fishery independent data are composed of several elements: catches from each source, directed fishery WPUE, fishery age distributions, and fishery weight-at-age. The stock assessment requires an analysis of total mortality of halibut from all sources. Fishery-dependent data accounts for intentional and unintentional halibut removals from commercial, sport, and personal use fisheries.

Fishery-dependent data is dominated by halibut landings from the commercial fishery, which since 1981 are reported to IPHC by way of commercial fish tickets. Due to insufficient data collection methods used until 1980, 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. While reported landings of halibut began in 1888; it seems that the commercial fishery may have already been pulling in at least a million pounds per year by then. The government agencies responsible for managing the sport fisheries are responsible for reporting recreational removals to the IPHC. These include (from south to north) the CDFW, ODFW, WDFW, DFO, and ADF&G. There is an assumption 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.

Since 1991, the DFO and NMFS have provided estimates of subsistence (or personal use) harvests. These estimates are not made every year in all cases, so in some instances they must be interpolated for intervening years.

Wastage of halibut in the commercial fishery has risen and fallen, hitting a peak in the early 1980s and then undergoing another high period between 1995 and 2010. During the latter period, the size-at-age of halibut declined and fish reached the minimum size limit at older ages. Prior to 1981, wastage in Area 4 couldn't be delineated among regulatory areas, though it is believed that little wastage actually occurred then.

NMFS and DFO estimate bycatch of halibut from non-halibut fisheries and report it annually to the IPHC, though this estimation varies widely in quality depending upon the year, fishery, type of estimation method, and many other factors. The peak occurred in 1992, with over 20 million pounds caught, and has mostly declined since then, with an estimated 7.7 million pounds caught in 2015 (a slight decrease from the 9.3 million pounds caught in 2014).

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.

Port samplers collect both lengths and otoliths, with lengths converted into individual weight estimates where needed. Ports staffed by the IPHC have samplers gather otoliths in proportion to landings in order to estimate recent fishery ages, a method that allows the direct aggregation of raw ages within each area and year. 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 year 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.

Another source of information, fishery weight-at-age, measures the average weight of halibut at a given age, allowing for the tracking of fish size over time. A picture of coastwide weight-at-age since the 1930s was constructed by considering the historical weight-at-age for each regulatory area in relation to the number of fish in the landings for that area. This method revealed increasing fish size all the way through the 1970s, followed by a decline in size that continues to the present. For 2015, the same methods from previous analyses were used to estimate trends in weight-at-age, but separated by geographic areas (2, 3, 4, and 4B). The results indicate that changes in Area 2 have been less pronounced than the very large decrease in fish size observed for Area 3 from the 1950s through the 1990s and that Area 4 has shown a much more muted historical pattern. The relative scalar for Area 4 is only slightly above a value of one for most of the historical period, and the smallest values occur in the most recent years.

Historical weight-at-age shows an increasing trend from the 1930s through the 1970s followed by a decline to the present.

Auxiliary inputs

The population assessment includes a number of additional information sources that are treated as data, even though they represent the products of analyses themselves. These are: 1) weight-length relationship, 2) maturity

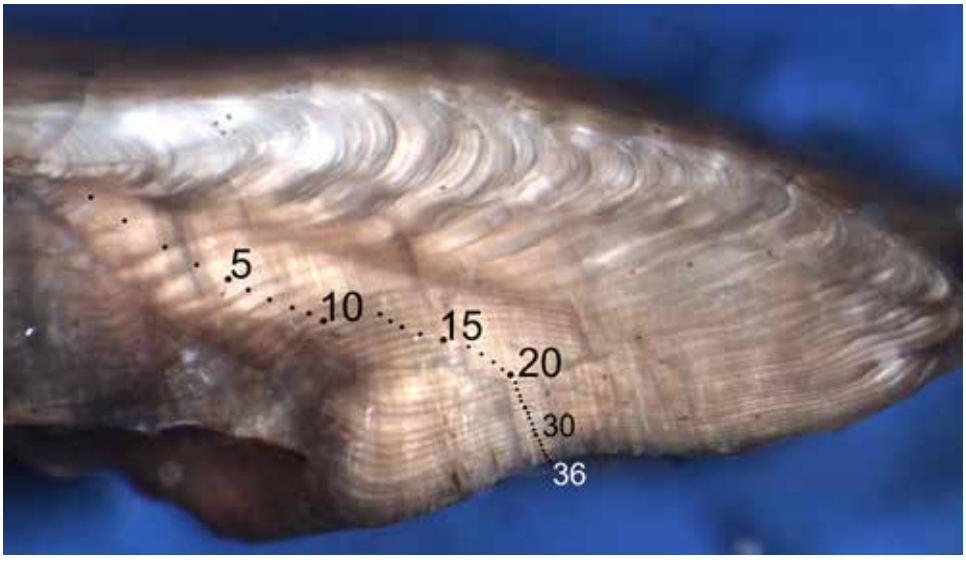
schedule, 3) ageing bias and imprecision, 4) movement rates among geographic regions, and 5) Pacific Decadal Oscillation (PDO). Details of these data sources are as follows.

1) The headed and gutted weight (net pounds) of a Pacific halibut can be estimated via a simple equation of weight-length relationship that uses fork length (in centimeters) as its variable. As length increases, weight corresponds at a rate slightly greater than cubic increase.

2) Female halibut are estimated to become sexually mature on a set schedule that has been proved stable through regular historical investigations. Across all regulatory areas, half of all female halibut become sexually mature by 11.6 years, and nearly all fish are mature by age 17.

Female halibut age at maturity has been stable over time. It is estimated that 50% of all female halibut are mature by the time they reach 11.6 years old.

3) Age estimates are based on the counting of rings on an otolith, a method that is by nature subject to bias and imprecision, however slight. That being said, it is relatively easy to estimate the age of halibut (compared to other groundfish), and analysis shows that the current aging method—referred to as "break-and-bake"—is remarkably precise.



Otolith of a 36-year-old halibut aged using the break-and-bake aging method. Photo by Chris Johnston.

4) Development of spatially explicit stock assessment and Management Strategy Evaluation (MSE) operating models requires an understanding of the rates of movement among geographic regions. Varied data sources provided information that was assembled into a single framework representing the IPHC's current working hypothesis regarding movement-at-age among regions, which is that appreciable emigration is estimated to occur from Area 4, decreasing with age. Halibut age-2 to age-4 move from Area 3 to Area 2 and from Area 4B to Areas 3 and 2, and some movement of older halibut is estimated to occur from Area 2 back to Area 3.

5) The PDO is a pattern of Pacific climate variability that changes about every 30 years. Research has shown that during the 20th century these environmental conditions have been correlated with the recruitment of halibut. In "positive" phases of PDO (through 1947, and 1977-2006), the stock saw an increase in younger halibut. The PDO's longest "negative" phase since the late 1970s started in 2006 and continues today. These poor conditions result in less recruitment of juvenile halibut.

Notable data processing changes for 2015

In 2015, there were some important changes to previously employed methods. These included the following:

- Average weight-at-age was reconstructed by geographic region.
- Recreational age distributions from Area 3A were evaluated in 2015.
- Bycatch length frequencies were converted to age distributions using the age-length data collected from trawl surveys in order to directly inform selectivity in the stock assessment.
- Length-frequency data collected by the North Pacific Observer Program have been updated to include the most recent complete year of sampling (2014), and for 2015 they have been weighted by target fishery and gear to better represent the sampling design. These data are important for use in delineating the proportion of the bycatch estimated to be above and below 26 inches for the harvest policy calculations.
- Bycatch estimates for 2012-2015 were provided by the NMFS Regional Office. These estimates were assigned to IPHC regulatory areas based on observer data using the Catch Accounting System, rather than simply assigning each statistical area to a single unique IPHC area even where boundaries were mismatched.
- Migration rates among areas were summarized from a reanalysis of the PIT tagging data as well as various other studies and life-history information for use in constructing spatially explicit models.

Over the past century, halibut removals from all sources have averaged about 63 million pounds.

Population assessment at the end of 2015

Over the last century, halibut removals from all sources have ranged annually from 34 to 100 million pounds, with an average of 63 million pounds. Total removals in 2015 were 42 million pounds, down slightly from 2014 and below the 100-year average. The 2015 setline survey coastwide legal (O32) and total (O32+U32) WPUE were five percent higher than values observed in 2014. Age distributions in 2015 from both the survey and fishery remained similar to those observed in 2011-2014, indicating a relatively stable stock, and no clear evidence of recent strong coastwide recruitments. At the coastwide level, individual size-at-age remains low relative to the rest of the time series, although there has been little change over the last several years.

Assessment

The methods for undertaking the population assessment for Pacific halibut have changed many times over the last 30 years due to a continual effort to improve model assumptions and analysis approaches, and to eliminate recurring

retrospective biases. Changes in 2012's methods ended the most recent retrospective bias problem, and in 2013 a method called the "ensemble approach" was introduced as a way to 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 robust risk assessment can only be achieved with the inclusion of multiple models in the estimation of management quantities (and the uncertainty about these quantities).

This basic assessment approach used in 2014 remains unchanged, although the 2015 scientific review process produced a number of important recommendations that have been incorporated into the assessment. The 2015 assessment continues to make use of the extensive historical time series of data, as well as integrating both structural and estimation uncertainty via an ensemble of individual models.

Uncertainty in the stock estimate is addressed by using an ensemble of individual models.

The 2015 assessment also included a complete reprocessing of all inputs, updating mortality estimates from all sources, and the addition of several new sources of information. Important improvements included: generating weight-at-age estimates by geographic region, improving the weight-at-age calculations for young halibut (< age-7) rarely encountered in the setline survey using data from NMFS trawl surveys, summarizing index variances and age composition sample sizes (particularly by area for the Areas as Fleets (AAF) models), adding age information to directly inform the selectivity curves for bycatch, sport, and sublegal discard removals, and extending all age-data arrays to include ages 2-25 (instead of 6-25, used in historical analyses). The treatment of these new and improved sources of information was reviewed by the SRB in June, 2015. In aggregate, the historical time series represents a range of data sources and relative quality, with the most complete information available only in recent years.

The *F/V Star Wars II* began participating in the IPHC setline survey in 1999. IPHC photo archive.

The ensemble approach allows for continual and transparent improvement, as additional models and refinements can be incorporated as they become available. In 2013 and 2014, each of the models in the ensemble was given equal weight, and their integration allowed for a more complete representation of the uncertainty. In 2015, the SRB reviewed alternative weighting approaches, but did not recommend any changes at this time. In future years, weighting may be refined based on various factors, and spatially explicit models may be incorporated into the ensemble to enhance understanding and analytical insight.

The risk analysis and decision table include the full probability distribution from the assessment. Therefore, key quantities such as reference points and stock size are reported as cumulative distributions, such that the entire plausible range can be evaluated. Where necessary, point estimates reported in this assessment correspond to median values from the ensemble.

Biomass, recruitment, and reference point results

The long time series models showed that halibut recruitment is better during periods of postive PDO phases than during negative phases.

The 2015 assessment results indicate that the Pacific halibut stock was subject to a gradual decline for much of the decade prior to 2010, and has been relatively stable or increasing since then. Recruitment trends and size-at-age also decreased during that period. The two long time-series models provided different perceptions of current versus historical stock sizes, highlighting the uncertainty in these estimates. The first model estimated the stock is currently 39 percent of the equilibrium unfished stock size, and that current spawning biomass is at 140 percent of the minimum values estimated for the 1970s. The second model estimated that the stock is 54 percent of the equilibrium and 236 percent of the minimum 1970's values. The discrepancies are likely due to the separation of signals from each region, and the allowance for different properties in each region's fishery and survey. The long time-series models also showed that halibut recruitment was estimated to be highest during periods of favorable PDO conditions, and that the highest level of recruitment observed historically occurred from 1977 to 2006, which led to much larger stock sizes and therefore greater fishery yields during those years.

Current stocks are estimated to be 43 percent of what they would be in the absence of fishing, with a 10 percent chance that the stock is below the 30 percent harvest threshold. Estimated harvest intensity for 2015 generally corresponds with target rates for many similar stocks.

Sources of uncertainty

The halibut population assessment, like any statistical model, includes a significant level of uncertainty due to estimations, data treatment, structure of selectivity, natural mortality, and other differences among the models. The spatial structure of the assessment model and the spatial processes in the underlying stock are important sources of uncertainty, particularly in regards to the distribution of recruitment and the fishes' movement rates among regulatory areas as they grow. With SRB approval, the staff is working to develop additional alternative models using explicit spatial structure for future stock assessments, as well as refinement of available models.

Two primary uncertainties continue to hinder our current understanding of the Pacific halibut resource: 1) the sex-ratio of the commercial catch (not sampled due to the dressing of fish at sea), which serves to set the scale of the estimated abundance in tandem with assumptions regarding natural mortality, and

2) the treatment of spatial dynamics and movement rates among regulatory areas, have very strong implications for the current stock trend. Ongoing efforts to test methods for direct marking of fish at sea will continue in 2016 via voluntary marking, collection of genetic samples, and development of a genetic assay. The SRB endorsed the staff's plans to continue development of a spatially explicit model during 2016.

Recruitment variability remains a significant source of uncertainty in current stock estimates, and natural mortality has been an important source of uncertainty included in the assessment since 2012. Other sources of potential uncertainty are bycatch estimation, discard mortality rates, and other unreported sources of removals in either directed or non-directed fisheries, which might create significant bias in this assessment.

Recruitment variability, natural mortality rates, and reporting errors are all sources of uncertainty in the halibut stock assessment.

Sensitivity analyses conducted in 2013 using the coastwide long time-series model are applicable to 2015 results. The sex ratio of the commercial catch remains the most influential source of uncertainty, followed by uncertainty surrounding types of halibut removals via bycatch, sport discards, and commercial wastage. The results of sensitivity analysis on removals indicated, as expected, that significantly heightened or reduced bycatch levels did not make a large difference in stock trends, but that a greater number of removals was indicative of a larger stock.

Each of the models contributing to this assessment underwent a retrospective analysis, with neither coastwide model revealing any strong pattern in the most recent years. All model's estimates for the terminal three years of the retrospective analysis were within the currently estimated confidence intervals.

Forecasts and the decision table

Stock projections were conducted using the integrated results from the stock assessment ensemble, summaries of the 2015 fishery, and other sources of mortality, as well as the results of apportionment calculations and the target

			Stock Trend				Stock Status			
			Spawning biomass				Spawning biomass			
			in 2015		in 2017		in 2015		in 2017	
Total removals (M lb)	Fishery CEY (M lb)	Harvest rate	is less than 2014	is 5% less than 2014	is less than 2014	is 5% less than 2014	is less than 30%	is less than 20%	is less than 30%	is less than 20%
Benefits			Risk							

The decision table allows Commissioners and stakeholders to see the potential risks and rewards of various harvest limits before making the final decision. Pictured here is a partial table without any of the specific metrics.

harvest rates from the current IPHC harvest policy. The projections required apportioning the coastwide estimate of exploitable biomass according to the survey catch rates in each regulatory area; applying area-specific harvest rates to estimate yield and removals, and calculating the total mortality and projecting the stock trends both one and three years into the future. This is explained detail in the following sections.

Projections indicate that the stock should increase gradually between 2017 and 2019 for any amount of removals up to 40 million pounds. The projections level out at that level of removals, after which the risk of stock declines begin to increase relatively rapidly. The decision table includes a range of harvest levels and risk assessments, but the Blue Line is the level of removals that corresponds with the Commission's existing harvest policy. In 2014, the Blue Line amounted to 38.7 million pounds of total removals, corresponding to a 19/100 chance of stock decline in 2017 and a 45/100 chance through 2019, a conclusion slightly more optimistic than recent assessment results have been.

Future research

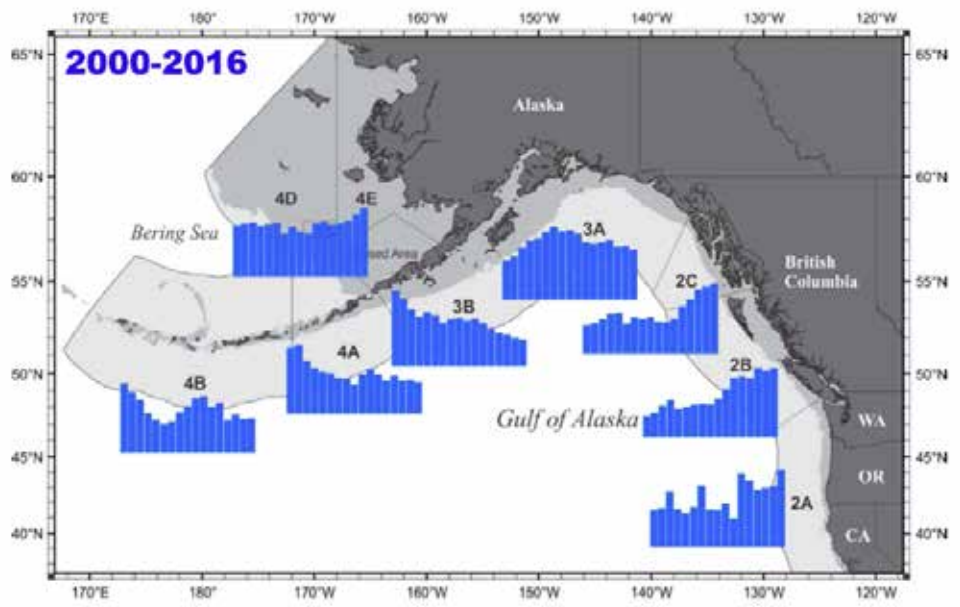
Future plans include, among other things, continuing to refine the existing models, trying out new models, and conducting research that potentially provides clarity of uncertainty.

The data and model exploration undertaken in 2015, combined with recommendations from the SRB, will direct future research to the following areas:

1) Continued expansion of the ensemble of models used in the stock assessment
2) Development of the technical specifications for evaluation and diagnosis of each individual model
3) Continued development of methods for sampling the sex-ratio of the commercial catch
4) Further investigation of the factors contributing to recruitment strength, recruitment distribution, and the information available from trawl surveys, particularly in the Bering Sea.
5) Exploration of methods for including uncertainty in wastage and bycatch estimates
6) Exploration of Bayesian methods for fully integrating parameter uncertainty into the models
7) Integration of the assessment analyses with ongoing development of the harvest policy and Management Strategy Evaluation process.

AREA APPORTIONMENT

With the assessment of the Pacific halibut population complete, the stock is apportioned to each regulatory area, then the target harvest rates are applied to generate target removals for harvesters. Estimated distribution of the stock among regulatory areas is achieved using the setline survey mean WPUE index of halibut density, weighted by bottom area. To account for factors that are known to affect survey catch rates of halibut, two adjustments are made including for (1) survey timing and (2) hook competition by smoothing out differences among regulatory areas in these two factors.



Trends in estimated O32 halibut apportionment percentages over the last 17 years (2000-2016). Note that the bar scales are the same within an area, but differ across areas.

The catch is apportioned based on the IPHC setline survey, with some adjustments.

Revisions in 2015

In 2015, the input data driving apportionment experienced two important revisions. The IPHC surveyed the eastern Bering Sea flats for the first time since 2006, which provided additional data for calibration with the annual NMFS trawl survey in that region and the scaling of the calibrated trawl time series. That survey also provided a direct observation of setline WPUE for the current year, and therefore the calibrated trawl index was not used as a density estimate for 2015 for the eastern Bering Sea.

In addition, data from the NMFS West Coast trawl survey were used to compute a density estimate for habitat south of 40°N, a region of very low density that is not part of the annual setline coverage. Previously, the bottom-area estimate for Area 2A used in apportionment calculations covered the region as far south as 39°N, so this revision also included an expansion of the Area 2A bottom area. This area now extends to 37.75°N, just south of the most southern Pacific halibut caught on the NMFS trawl survey. The new bottom area estimate for Area 2A is 19,593 nmi^2, up from the 17,507 nmi^2 used in 2014.

Survey timing

The timing of the setline survey relative to the fishery can affect its results. Most notably, a high proportion of early-season fishery removals in an area can result in lower survey WPUE relative to areas where removals occur later in the season. Area 2A is of particular concern because at least 80 percent of fishing activity there occurs early--the catch is mostly already in before the setline survey's mean date. To account for this, the IPHC staff standardizes the WPUE of a regulatory area to its expected value if 50 percent of all O32 removals have been taken before the mean date of the setline survey in that area. All data inputs for calculating the timing standardization have been updated in 2015, but the effect of the survey timing standardization on the WPUE index was small in all areas in 2015.

Hook competition

The measure of "hook competition" accounts for competition from all species including other halibut. Adjusting for the presence of such competition reduces bias in the observed WPUE index of density into survey results. This factor of the survey is measured using the fraction of bait not taken by halibut or other species from the survey gear within each regulatory area. If a smaller-than-average number of baited hooks are retrieved in a given area, researchers adjust that area's relative WPUE index upwards to account for the presence of increased competition against the halibut there. Conversely, if more baits than average are returned then the WPUE index is adjusted downwards to signify lower competition.

Three-year weighting

The survey smooths the WPUE for apportionment using a 75:20:5 reverse-weighted average of the current and previous two years' adjusted WPUE values for each area. This weighting is done to improve precision and stability of the WPUE estimates without introducing significant bias from including past observations.

The O32 halibut biomass was estimated to be about one third in Area 2, one third in Area 3A, and the remainder in Area 3B and westward.

Apportionment results

For the 2015 fishery, the exploitable biomass for Pacific halibut was apportioned as follows: Area 2A (2.2%), Area 2B (14.7%), Area 2C (15.0%), Area 3A (33.4%), Area 3B (12%), Area 4A (6.7%), Area 4B (3.8%), and Area 4CDE (12.2%). The O32 halibut biomass was estimated to be roughly divided into thirds: one-third in Area 2 (2A, 2B, and 2C), one-third in Area 3A, and one-third in Areas 3B-4CDE. This distribution represents a large shift towards Area 2 from Areas 3B-4CDE in the last 15 years; in year 2000, about two-thirds of the stock was in Areas 3B-4CDE, and only 12.4 percent was in Area 2. The shift in the center of the stock distribution towards Area 2 continued in 2015, and it was estimated that 33.8 percent was in Area 2, a total of 31.2 percent in Area 3A, and 34.5 percent in Areas 3B-4CDE. The value for Areas 3B-4CDE was stable compared to 2014, while Area 3A was down and all three components of Area 2 were up. Thus, these changes represent a shift from Area 3A to Area 2. Regarding the effects of the two adjustments for survey timing and hook competition, these have notably adjusted the index upwards in Area 2A, and downwards in Area 4B and Area 4CDE.

Harvest policy

The current harvest policy for Pacific halibut is based on two harvest targets: the distribution of harvest among regulatory areas, and the scale of that harvest at the coastwide level. Only O26 removals are explicitly included in these calculations; however, the target harvest rates implicitly include a constant level of U26 mortality consistent with the period over which the rates were developed. The current target harvest rates are area-specific: 21.5 percent in Areas 2A, 2B, 2C and 3A, and 16.125 percent to Areas 3B, 4A, 4B, and 4CDE.

Because the harvest policy is defined at the area-specific level, the results of apportionment calculations (previous section) are needed to evaluate the harvest intensity, even though the assessment is conducted at a coastwide scale. Specifically, the coastwide assessment of exploitable biomass is first apportioned to area, and then area-specific catch limits are aggregated back to the coastwide total.

The current target harvest rates are 21.5 percent in Areas 2 and 3A, and 16.125 percent in areas further west.

The harvest policy also includes a Harvest Control Rule, which does not change the distribution of harvest among regulatory areas, but reduces the target harvest rates (for all areas) at low stock sizes. Specifically, if the stock is estimated to have fallen below 30 percent of the equilibrium stock size in the absence of fishing (SB30%; defined relative to historically good size-at-age and recruitment in a relatively unproductive environmental regime), the target harvest rates are decreased linearly such that there would be no fishing mortality below 20 percent relative spawning biomass. This policy was designed to provide a constant harvest rate that would avoid decreasing the stock below SB30% with a relatively high frequency, and still provide a large fraction of the maximum sustainable yield available. The stock is current above the SB30% level, so the full target harvest rates are applied to the current estimates of biomass.

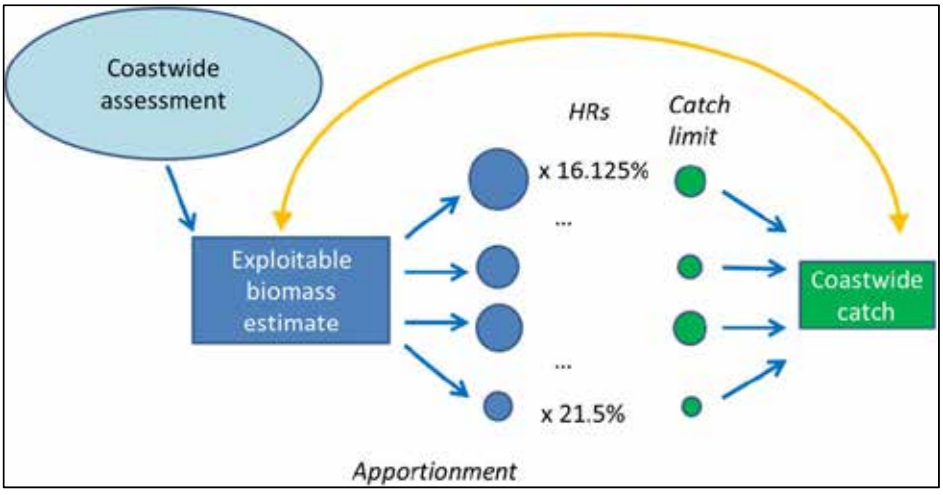


Illustration of the method for calculating the coastwide harvest rate target based on the IPHC's current harvest policy.

Management Strategy Evaluation

Management Strategy Evaluation (MSE) is a formal process in which to evaluate the performance of alternative management procedures for the Pacific halibut stock against a range of scenarios that encompass observation and process uncertainty in stock assessments, as well as alternative hypotheses about stock dynamics and structural assumptions. It is an interactive process which includes stakeholders and managers involved in the resource and provides products that are evaluated against objectives defined by all of the parties involved. This evaluation is considered by Commissioners when planning a harvest policy.

Management Strategy Advisory Board governance

A new governance structure was implemented for the MSAB in 2015 which includes elected co-chairs and a contracted facilitator to help free up staff resources.

The MSAB, formed to help guide the MSE process, held two meetings in 2015—in May and October. The primary outcome of the May 2015 meeting of the MSAB was the development of a new governance structure for the Board and the recommendation to engage professional facilitation services for the meetings. The Board elected U.S. and Canadian co-chairs and an Agenda Committee. IPHC staff subsequently conducted an open bidding process to select a facilitation firm.

Compass Resources facilitated the October 2015 meeting, including completing the draft summary minutes of the meeting and developing an outreach strategy for the Board to evaluate. The Board will eventually adopt and implement an outreach strategy, as modified through this evaluation. The changes for the October meeting resulted in a more coherent and effective meeting process, with greater engagement of MSAB members, and a renewed enthusiasm for the MSE process. The new meeting process also allowed IPHC staff to concentrate on technical and resourcing issues rather than the logistics of conducting the meeting.

The MSAB meets at the IPHC office in Seattle, WA. Photo by Tracee Geerneart.

MSAB objectives

The MSAB is comprised of harvesters (commercial, sport, and subsistence), fisheries managers (DFO and NMFS), processors, and IPHC commissioners, supported by IPHC staff. It works interactively with analysts on the Commission staff to initially define clear measurable objectives for this fishery, define candidate management procedures (MP) for testing within the MSE framework, and define the performance measures to evaluate alternative MPs. A management procedure constitutes the entire decision-making process, starting with what data to be used in stock assessment, a stock assessment method to interpret the data, a harvest control rule in which to compute yield options, and a projection model in which to evaluate impacts of alternative yield options on the stock. A series of quantitative metrics must be defined in which to evaluate how well each MP performs relative to perfect information and to the management objectives. The central role of the MSAB is to define fishery objectives, develop candidate management procedures, develop performance metrics, and evaluate the performance of the procedures at satisfying the objectives.

Fishery footprint concept

A "fishery footprint" is the measure of the amount of halibut spawning capital required to replace the mortality associated with that fishery.

A new concept was introduced in 2015, termed the *Fishery Footprint*, as a measure of the fisheries demand on the resource, or the amount of spawning capital used. This is analogous to the ecological footprint; a measure of human demand on the natural capital used each year. A common type of ecological footprint is the amount of land and sea area needed to supply the resources consumed. A fishery footprint is defined as the amount of spawning capital required to replace the mortality associated with that fishery. The Spawning Potential Ratio (SPR) and relative Mortality Per Recruit (MPR) from each fishery are used to assess the footprint of each fishery. This concept is essential for the purposes of quantifying the relative impacts of each fishery on the future productivity of Pacific halibut and for setting sector specific harvest rates.

Abundance-based management of halibut bycatch in the Bering Sea/Aleutian Islands

A “sloping harvest control rule” (HCR) for setting annual catch limits is used by the IPHC for the directed halibut fishery and by the NPFMC for other target fisheries that are managed by the Council. There is no formal harvest control rule specified for setting annual Prohibited Species Catch (PSC) bycatch limits. The Council instead sets static PSC limits for Pacific halibut, which means they are not based on the current abundance of Pacific halibut. The implied harvest rate associated with fixed PSC limits is opposite of the sloping HCR used to set annual catch limits for directed fisheries, and implies that bycatch fisheries are given priority access over directed fisheries.

Adopting an abundance-based PSC limit could potentially resolve the problem of increasing bycatch mortality rates during periods of low halibut abundance. Key features that would need to be specified include: (1) the minimum and maximum harvest rate, (2) the stock-status limits and thresholds

that specify transitions in the harvest rates, (3) the stock-status limit where the bycatch fishery would be severely restricted, or even closed.

The SPR is a unique metric in that it integrates all sources of fishing-related mortality into a single metric, and it has been widely adopted throughout the United States since the mid-1990s as the basis for fisheries reference points. SPR-based reference points are commonly used in developing harvest control rules because they require less information than maximum sustainable yield-based reference points. The definition of SPR is: the average fecundity of a recruit over its lifetime when the stock is fished divided by the average fecundity of a recruit over its lifetime when the stock is subject only to natural mortality (i.e., unfished). In other words, it is a measure of how the spawning potential of the stock changes with fishing. SPR takes into account the size- or age-selection of the fisheries, and if the composition of the catch shifts towards smaller fish (i.e., reducing the minimum size limit) then the harvest rate that would maintain the same target SPR would have to decrease to accommodate the increase in mortality rates on younger fish.

In setting annual abundance-based PSC limits, the harvest rates for each sector would be determined by a harvest control rule, but the first question is what should be used as the index of abundance in the control rule? The Eastern Bering Sea trawl survey is a potential source of fishery-independent data, and model-based estimates of abundance from the stock assessment or by integrating additional fishery-dependent data with the stock assessment model are other alternatives to calculating an index of abundance.

The MSE is a vehicle for evaluating the performance of alternative harvest control rules in relation to objectives defined by stakeholders and managers.

A second question when setting annual abundance-based PSC limits would be: what harvest rate should be used to calculate the PSC limit once the abundance index has been established? Answering this question is a policy decision, not a scientific one, which requires understanding the impacts of different fisheries and the interactions between them. The *Fishery Footprint* concept can provide insight into answering this question. Additionally, looking at yield equivalence (if the yield in one fishery was not taken, how much would another fishery gain) is useful, although is dependent on a number of factors including the harvest policy and various biological variables. Finally, MSE is a powerful tool to evaluate the performance of alternative harvest control rules and catch sharing plans for setting PSC limits against objectives defined by stakeholders and managers.

RESEARCH

Biological research projects are conducted to add to the knowledge base about Pacific halibut that support the halibut stock assessment and fisheries. The two largest data gathering projects at the IPHC, the setline survey and commercial sampling, are described earlier in this report. Research described in this section encompasses a variety of other projects that address short and long term objectives and can be modified each year to respond to the shifting priorities of scientists and policymakers. In 2015, these projects included oceanographic monitoring; observing trends in seabird occurrence; tagging studies, including wire tagging of small halibut in the Bering Sea; and deployment and reporting of pop-up archival transmitting (PAT) tags in the Salish Sea.

The setline survey serves as a platform for a number of other projects in addition to its core objectives.

Oceanographic monitoring on the setline survey

A coastwide profiler project designed to collect oceanographic data on halibut grounds went into its seventh consecutive year in 2015. The project aims 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

Retrieving the profiler aboard the *F/V Vanisle*. Photo by Aaron Ranta.

in water temperature, salinity, and dissolved oxygen (DO), among other environmental factors.

The IPHC used water column profilers at all setline survey stations ranging from Northern California to the Aleutian Islands and into the Bering Sea. This area of investigation has gained momentum in recent years as scientists and stakeholders try to understand the direct and indirect effects on fisheries. In 2015, the IPHC chartered 14 fishing vessels, each outfitted with a Seabird™ Seacat19*plus* V2 profiling unit, a laptop computer, and accessory gear. Since 2011, IPHC has been operating with 13 profiler units, but added an additional unit with auxiliary sensors in 2015 to make a total of 14 units. Out of 1,368 possible stations coastwide, 1,217 useable casts of environmental data were collected, resulting in an 89 percent success rate.

A water column profiler is deployed just prior to hauling at each survey station.

Deployment of the profiler happens in the same way at each survey station. Prior to hauling up fishing gear at each station, an anchor is lowered into the water followed by the profiler and cage, and then the buoy line and buoys. After acclimatization, the instrument is allowed to drop freely to the bottom while taking measurements four times every second. A pump ensures consistent water flow past the sensors. Each profiler takes a snapshot of a specific column of seawater, measuring depth, temperature, salinity, DO, pH, and chlorophyll *a* concentration. Once the anchor hits bottom, the profiler is immediately hauled back aboard, cleaned and prepped for the next station. Approximately once a day, the captured data are uploaded onto a laptop computer and sent back to the Seattle office either electronically or through data storage cards at each port stop.

Data access

The data are edited, compiled, and sent to NOAA's Pacific Marine Environmental Laboratory for review. Once reviewed, they are posted for use by scientists all over the world at http://www.ecofoci.noaa.gov/projects/IPHC/efoci_IPHCData.shtml.

Habitat results

Off the U.S. West Coast, there were a few very deep stations where near-bottom waters were hypoxic (< 1.4 ml/L), but the hypoxic zone typically seen near the bottom at the more shallow stations since 2002 was not detected during the survey for the second year in a row. Coastwide, the lowest near-bottom DO concentration detected (0.533 ml/L) was in the western Gulf of Alaska at 506 m depth. Both the coldest and the warmest near-bottom conditions coastwide were found in the Bering Sea at expansion stations. The coldest water was north of St. Matthew Island at -1.45°C and the warmest was at the shallow, nearshore stations in northern Bristol Bay at about 14°C. The highest chlorophyll concentration was found in the eastern Aleutian Islands, Shelikof Strait, and the U.S. West Coast, with less intense concentrations elsewhere.

IPHC has been collecting the counts on the occurrence of seabirds since 2002 on the setline survey.

Observing trends in seabird occurrence

Since 2002, the IPHC has recorded the occurrence of more than 804,000 seabirds (composed of 36 unique species) in 18,137 observations taking place during the survey. In 2015, 66,170 seabirds (comprising 20 unique species) were recorded during 1,280 observations as part of the setline survey. Northern fulmar

Seabird observations have been collected during the IPHC survey since 2002. Photo by Collin Winkowski.

In 2015, there were 45 sightings of the endangered short-tailed albatross, which is more than twice the average.

(Fulmarus glacialis), glaucous-winged gulls *(Larus glaucescens),* black-footed albatross *(Phoebastria nigripes),* and fork-tailed storm petrels *(Oceanodroma furcata)* were the most commonly sighted species. While the observed number of unidentified gulls has decreased year after year, the number of observations of glaucous-winged gulls and herring gulls *(L. argentatus)* has increased, likely a result of better training of samplers on gull identification.

In 2015, Northern fulmar observations rebounded to 43,383 from last year's all-time low of 27,305. Laysan albatross numbers have remained relatively constant since 2013 but fork-tailed petrel numbers dropped in 2015 to an all-time low of 649 (from 1,309 in 2014). On a positive note, 2015 saw an all-time high of endangered short-tailed albatross *(Phoebastria albatrus)*, with 45 sightings, which is well above the average of 22 sightings per year.

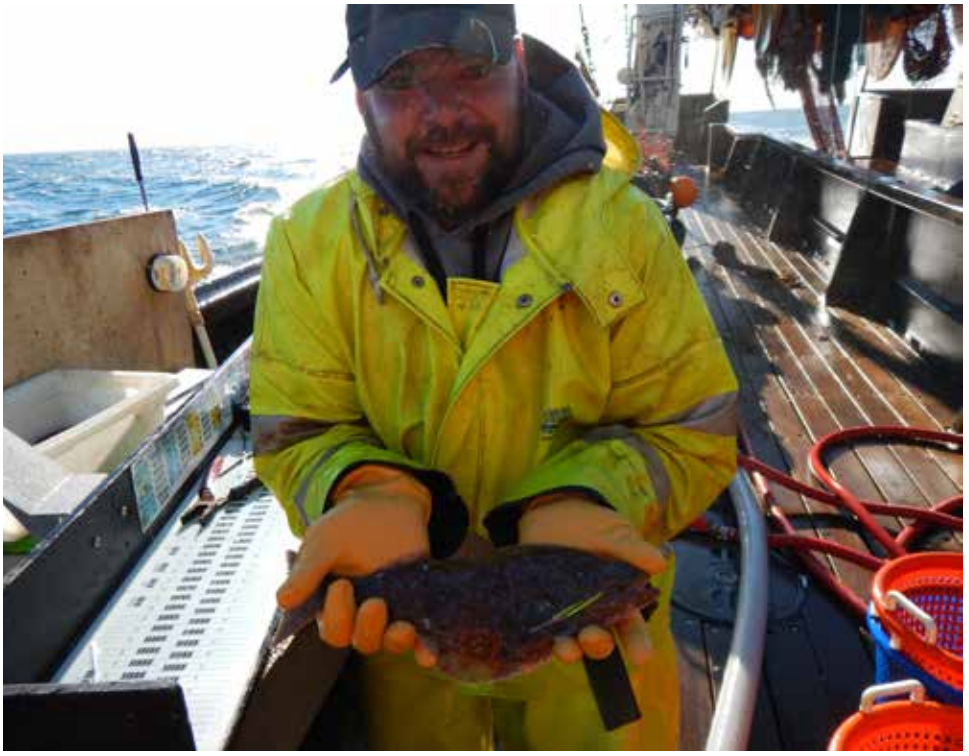
A concerning finding is the all-time low number of observations of fork-tailed storm petrels and the potentially related observation in 2015 of large numbers of dead birds associated with algae blooms in the Albatross charter region. It is not unheard of to see large seabird die-offs, and these short-term changes in observed abundance might not necessarily reflect changes in population abundance, but could instead be a sign of shifts in distribution.

Tagging studies

Since 1925, the IPHC has tagged and released more than 450,000 halibut, from which more than 50,000 tags have been recovered. The purpose of tagging studies has been to investigate patterns of migration, utilization of habitat, age, growth, and mortality. The tags have taken different forms over the years, due both to experimental requirements and to technological advancements.

Wire tagging small halibut in the Bering Sea

In 2015, the IPHC piloted a program to wire-tag small Pacific halibut during the NMFS groundfish trawl surveys. The goal of the project is to tag, over a number of years, halibut that are expected to migrate from nursery areas to adult feeding grounds. The study will assess both movement and growth. Migration information on adult halibut has been well documented in recent tagging studies, but less is known about young halibut movement. Tag recoveries from this project will be very helpful in increasing the IPHC's understanding of juvenile halibut movement in the Bering Sea and Gulf of Alaska.



Sea sampler Paul Logan tags a small halibut aboard the NMFS Bering Sea trawl survey. Photo credit: Paul Logan.

A pilot project to tag juvenile halibut on the NMFS trawl surveys was successful in 2015 so there are plans to continue the effort for the next several years.

Samplers aboard the NMFS trawl vessels evaluated various aspects of the tagging protocol put together by IPHC staff, with the goals of minimizing halibut mortality that occurs because of the tagging process, as well as minimizing disruption to the other survey activities taking place. A total of 1,977 halibut were tagged and released; 1,491 in the Gulf of Alaska and 486 in the Bering Sea. Halibut were tagged on the eyed-side operculum (cheek) using conventional plastic-coated wire tags. Fork length, tag number, fish viability, and time on deck were recorded for each fish that was tagged and released. Fork length of fish in the samples ranged from 15 to 136 cm in the Gulf, and 22 to 137 cm in the Bering Sea. Halibut in the tagging sample were assessed for condition which included three categories: Excellent, Poor, and Dead. These categories and the criteria used to assess condition were the same as those used in the observer program to assess halibut viability on commercial trawl vessels. The

fish were tagged and released if they were assessed as being in either *Excellent* or *Poor* condition. Those assessed as *Dead* were measured but not tagged. Not unexpectedly, halibut in the smallest size groups had higher percentages of *Dead* and *Poor* assessments than those of larger sizes, but there were also *Excellent* category fish even at the smallest lengths. Overall, the majority of fish in the samples were assessed to be in *Excellent* condition.

The 2015 pilot study was considered successful, and the IPHC plans to continue the effort for at least the next several years on the Bering Sea, Gulf of Alaska, and Aleutian Islands NMFS groundfish trawl surveys. Additionally, there are plans to possibly extend this program to parts of the setline survey in 2016.

Deployment and reporting of PAT tags in the Salish Sea

Scientists have speculated that halibut residing in the southern Salish Sea might be a distinct stock component from those found elsewhere in IPHC Regulatory Area 2A. There have been few data available to address this question, so during the summer and fall of 2014, IPHC deployed fishery-independent pop-up archival transmitting tags at four locations in the U.S. waters (Area 2A) of the southern Salish Sea: the Strait of Georgia, Boundary Pass, eastern and south-central Strait of Juan de Fuca. The tags contained sensors for light, depth (pressure), and temperature, as well as programming circuitry and a satellite transmitter.

A total of 12 large female halibut were PAT tagged in the Salish Sea in order to study migration and spawning behavior.

Tags were deployed on a total of 12 large female halibut and were programmed to release from their host fish either during the mid-January spawning season (8 tags) or in late spring of 2015 (4 tags). This timing was set to allow researchers to assess whether the tagged halibut would remain in the Salish Sea to spawn, and whether those that might leave the Salish Sea in winter would return the following summer. Data from the tags (transmitted to the U.S. NOAA's polar-orbiting satellites, administered by the Advanced Research and Global Observation System) included temperature and depth data, depth-temperature profiles, and light-based geoposition estimates.

Tag recoveries in 2015

In 2015, a total of 36 halibut from various IPHC tagging projects were recovered, as well as 24 tags from sport tagging programs implemented by third parties.

- Two wire tags were recovered from the 2010 Aleutian wire tagging experiment, a study designed to identify potential future tagging sites for archival tag releases in Area 4B. Three fish tagged during the 2015 NMFS trawl survey were recovered; all three fish had been released in the Bering Sea and had been at large for between 17 and 63 days.
- Tags from 28 fish stemming from the 2013 dummy archival tag experiment in Regulatory Area 3A were returned in 2015 (27 recovered in 2015, one recovered in 2014). Nineteen of these fish had been tagged with both a dummy archival dart tag and a plastic-coated wire cheek tag, and nine had been tagged with only an external dummy archival tag attached to the operculum.
- Three pop-up satellite transmitting archival (PAT) tags were recovered in 2015—two from the 2014 Salish Sea PAT tag study, and one from the 2008 Bering Sea Dispersal experiment.

- Every year, the IPHC supplies tags to the Homer Jackpot Halibut Derby and the Seward Halibut Tournament. The Homer Derby released 115 tags in 2015, thirteen of which were recovered. Additionally, seven tags from previous Homer derbies were recovered in 2015—four from 2014, two from 2013, and one from 2009 (all recovered by sport fishers during the derby). The Seward Tournament—now in its fourth year—released 40 tags in 2015. Four tags were recovered during the derby—three from the 2015 releases and one from the 2014 tournament.
- The port sampler in Juneau processed one PAT tag from a halibut that was not released from an IPHC research charter; this fish was from a 2013 study conducted in Glacier Bay by our collaborators at the University of Alaska Fairbanks, in Juneau.

Results of the Salish Sea tagging project showed that halibut there are connected to the broader population in outside waters.

Salish Sea PAT tag recoveries

In total, the endpoint locations for nine fish were determined on dates ranging from October 7, 2014 (due to premature release of one of the tags) to June 1, 2015. The results obtained show that the Salish Sea halibut population is connected with the broader outside-waters population of Area 2, at fish sizes that are commercially exploitable. The individuals that emigrated from the Salish Sea conducted migrations that were consistent with spawning migrations documented in the Gulf of Alaska, and arrived at locations that are consistent with outside-waters spawning groups. Depths visited during the peak of the spawning season were consistent with those from which active spawning is known to be initiated. As such, it appears that halibut that feed in the Salish Sea during summer months contribute to spawning groups in both British Columbian and southeast Alaskan waters, at the very least, and may seasonally migrate from the Salish Sea at rates that are generally consistent with those that have been documented for halibut tagged on outer-coastal feeding grounds of Area 2A.

However, it remains unclear whether the migration of mature female halibut from the Salish Sea is a cyclic annual phenomenon, wherein fish that emigrate in winter to spawn return to the Salish Sea in following summer(s), or whether it represents a one-way migratory process by which those individuals that feed and grow to maturity in the Salish Sea depart permanently upon reaching sexual maturity. Similarly, these data are inconclusive regarding whether the Salish Sea might support active spawning. Resolution of questions regarding the potential for halibut to spawn within the Salish Sea, and the nuances of adult connectivity between the Salish and outside waters, will require additional research.

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 Bering Sea and Gulf of Alaska NOAA/NMFS/RACE division groups for saving us a spot on their groundfish trawl surveys and assisting with the trawl survey halibut tagging pilot study in 2015.
- 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.
- The many processing plant personnel who assist the IPHC port sampling and survey programs by storing and staging equipment and supplies.
- The NMFS Observer program for collecting, documenting, and forwarding tags recovered during observer deployments on commercial vessels.
- Jamestown S'Klallam, Lummi, Makah, Port Gamble S'Klallam, Quinault, and Swinomish biologists for port sampling Area 2A tribal commercial fisheries.
- CDQ managers for providing the total number and weight of undersized halibut taken and retained by authorized persons and the methodology used to collect these data.
- 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 and survey biologists are in town.
- State and federal agency staffs, as well as government contractors for their assistance in the provision of data for sport and personal use fisheries, commercial fisheries, as well as the provision of halibut bycatch estimates, and for their assistance in conducting the setline survey.
- Charter vessels, skippers and crews, plant personnel, and those individuals from outside agencies, whose dedicated contributions and efforts made the 2015 IPHC survey operations a success.

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 and meetings that enhance knowledge, contributing expertise to the broader scientific community through participation on committees outside of the IPHC, and seeking further education and training. This section highlights some of those activities.

Committees and organization appointments

- 19th Western Groundfish Conference organizing committee - Kirsten MacTavish, Claude Dykstra
- Steering Committee for the NMFS Workshop on developing a national action plan for Release Mortality Science - Bruce Leaman
- NPFMC Working Group on Halibut Discard Mortality Rates - Bruce Leaman
- NPFMC Gulf of Alaska Plan Team - Ian Stewart
- Committee of Age Reading Experts - Joan Forsberg, Chris Johnston, Dana Rudy
- Technical Subcommittee of the Canada US Groundfish Committee - Claude Dykstra, Kirsten MacTavish
- NPFMC Electronic Monitoring Working Group - Heather Gilroy, Bruce Leaman, Claude Dykstra
- NMFS Stock Assessment Review (STAR) Panel Review for widow rockfish and kelp greenling - Ian Stewart

Conferences, meetings, and workshops

- American Fisheries Society 145th Annual Meeting, Portland, OR - Lauri Sadorus, Joan Forsberg, Ed Henry, Robert Tobin, Dana Rudy
- iREC Review Meeting, Nanaimo, B.C. - Ray Webster
- Lowell Wakefield Symposium, Anchorage, AK - Steve Martell
- WA/BC chapter AFS Annual General Meeting, Richmond, BC - Steve Keith, Ed Henry
- Microsoft Dynamics GP User Group Conference - Michael Larsen
- International Fisheries Commissions Pension Society - Bruce Leaman, Michael Larsen
- Alaska Marine Science Symposium, Anchorage, AK - Steve Martell
- Joint Statistical Meeting, Seattle, WA - Ray Webster
- Climate change vulnerability assessment workshops, Seattle, WA - Lauri Sadorus
- Scientific and Statistical Committee workshop, Honolulu, HI - Steve Martell
- North American Dendroecological field week (NADEF) workshop, Maine - Dana Rudy
- AD Model Builder's Workshop, Honolulu, HI - Steve Martell
- ISSF International Sustainable Seafood, Monterey, CA - Steve Martell
- NOAA Recruitment Processes Alliance Research Eastern Bering Sea Program Review, Seattle, WA - Lauri Sadorus
- CAPAM workshop, San Diego, CA - Ian Stewart

Awards, training, and certifications

- Certificate in Social Media Technologies & Implementation from University of Washington - Ed Henry
- User-centered Design Cetificate Program at University of Washington's School of Human Centered Design and Engineering - Eric Soderlund
- Managing Laboratory Chemicals Program, University of Washington Department of Environmental Health and Safety - Ed Henry

Outreach and education

- Booth at Pacific Marine Expo ('Fish Expo') in Seattle, WA - Claude Dykstra, Ed Henry, Steve Keith, Dana Rudy, Lauri Sadorus
- Booth at Pacific Northwest Sportsmen's Show in Portland, OR - Steve Keith, Dana Rudy
- Fishermen's Fall Festival, Seattle, WA - Dana Rudy, Tracee Geernaert
- Stock assessment workshop for ISMAR and other European scientists, Ponza, Italy - Ian Stewart
- Makah Chibud Recreational Fishing Project Volunteer, Neah Bay, WA - Claude Dykstra, Ed Henry
- Presentation on Halibut Management to the innaugural Homer Halibut Festival, Homer, AK - Bruce Leaman
- The Fisheries Leadership and Sustainability Forum, East Coast Forum invited speaker, Beaufort, NC - Ian Stewart
- Collaborative field research in the Gulf of St. Lawrence with researchers from Memorial University of Newfoundland, Fisheries and Oceans Canada, and the Fishermen, Food and Allied Workers Union - Tim Loher
- Collaborative field research in Glacier Bay with researchers from the University of Alaska, Fairbanks - Tim Loher
- University of Victory Co-op and Career Fair, Victoria, BC - Ed Henry
- Discover Science Weekend, Seattle Aquarium, Seattle, WA - Ed Henry, Dana Rudy
- Graduate Student Committee Member, University of Washington, Seattle, WA - Ian Stewart
- Graduate Student Committee Member, University of Alaska Fairbanks, AK - Tim Loher
- Seattle Aquarium beach naturalist, Seattle, WA - Claude Dykstra

IPHC biologists Tracee Geernaert and Dana Rudy help kids decorate halibut cookies at the Fishermen's Fall Festival. Photo by Ed Henry.

APPENDICES

The tables in Appendix I provide catch information for the 2015 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 2015 estimates of total removals (thousands of pounds, net weight), 2015 catch limits and catch of Pacific halibut by regulatory area.

Table 2. The Area 2A 2015 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (pounds, net weight).

Table 3. The 2015 Area 2B catch limits as allocated by the Canadian Department of Fisheries and Oceans and estimated catches (thousands of pounds, net weight).

Table 4. Areas 2C and 3A catch limits, including incidental mortality, as allocated by the North Pacific Fishery Management Council Catch Sharing Plan and estimated landings, incidental mortality, and totals (thousands of pounds, net weight).

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2015 commercial fishery, including IPHC research catch, by regulatory area and month.

Table 6. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2015 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 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2015 Pacific halibut commercial fishery.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2015 by statistical area and regulatory area.

Table 9. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2015.

Table 10. The fishing period limit (pounds, net weight) by vessel class used in the 2015 directed commercial fishery in Area 2A.

Table 11. Metlakatla community fishing periods, number of vessels, and halibut catch (pounds, net weight), 2015.

Appendix II.

Appendix I.

Table 1. The 2015 estimates of total removals (thousands of pounds, net weight), and 2015 catch limits and catch of Pacific halibut by regulatory area[1].

Area	2A	2B	2C	3A	3B	4	Total
Commercial Landings	551	5,884	3,602	7,722	2,574	3,589	23,922
Commercial Incidental Mortality	31	238	119	521	213	156	1,278
Sport landings[2]	445	994	1,924	3,530	10	17	6,920
Sport landings from commercial leasing[3]	-	5	28	5	-	-	38
Sport mortality[4]	2	35	67	70	-	10	184
Bycatch Mortality	95	337	12	1,967	731	4,648	7,790
Personal Use (Subsistence)[5]	34	405	428	231	18	88	1,204
IPHC Research	21	106	169	245	123	88	751
Total Removals[6]	1,179	8,004	6,349	14,291	3,669	8,596	42,087
2015 Catch Limits[7]	970[8]	7,038[9]	4,650[10]	10,100	2,650	3,815	29,223
2015 Catch	1,030[8]	7,283[9]	5,954[10]	11,483	2,602	3,694	32,046

[1]Columns and rows may not add to totals due to rounding.
[2]Alaska and Area 2B sport estimates are preliminary.
[3]Fish landed against transfers from commercial quota fisheries (XRQ in Area 2B, and GAF in Areas 2C and 3A)
[4] Area 2A and 2B based on previous year estimates.
[5] Includes 2014 Alaskan subsistence harvest estimates (tribal and rural SHARC holders). Area 4 includes 4,666 pounds of U32 halibut retained in the 2015 Area 4DE Community Development Quota.
[6] Includes pounds discarded at the dock
[7] Does not include pounds from the underage/overage programs in Area 2B or Alaska.
[8] Includes commercial, sport, and treaty subsistence allocations and catch.
[9] Includes commercial and sport allocations and catch.
[10]Includes both commercial and sport guided fishery catch and incidental mortality.

Appendix I.

Table 2. The Area 2A 2015 catch limits allocated by the Pacific Fishery Management Council Catch Sharing Plan and catch estimates (pounds, net weight).

Area	Catch Limit	Catch
Non-treaty directed commercial	164,529	196,400
Non-treaty incidental commercial with salmon troll fishery	29,035	28,400
Non-treaty incidental commercial with sablefish fishery	10,347	9,800
Treaty Indian commercial	307,700	316,800
Treaty Indian ceremonial and subsistence	31,800	33,900
Sport fisheries	426,589	444,808
Total allocation/catch	**970,000**	**1,030,108**
IPHC research catch		20,500
Grand Total	**970,000**	**1,050,608**

Table 3. The 2015 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[1]	5,974	5,884
Sport fishery	1,064	1,034[2]
Total allocation/catch	**7,038**	**6,918**
IPHC research catch		106
Grand Total	**7,038**	**7,024**

[1] Includes 60,000 pounds allocated to Commercial Use of Fish.

[2] The Experimental Recreational Halibut Fishery pilot program (XRQ) allowed sport operators to lease quota (8,500 pounds) from commercial operators; sport catch included 4,682 pounds from the XRQ program, discard mortality of 35,000 pounds, and 993,820 pounds from the recreational fishery.

Appendix I.

Table 4. Areas 2C and 3A catch limits, including incidental mortality, as allocated by the North Pacific Fishery Management Council Catch Sharing Plan and estimated landings, incidental mortality, and total pounds (thousand, net weight).

Area 2C	**Allocation[1]**	**Catch + incidental mortality: total**
Commercial fishery	3,799	3,602 + 114 = 3,716
Guided sport fishery	851	800 + 67= 867
Total allocation and catch	**4,650**	**4,583**
IPHC research		169
Total	**4,650**	**4,752**
Area 3A	**Allocation**	**Catch**
Commercial fishery	8,210	7,722 + 493 = 8,215
Guided sport fishery	1,890	2,035 + 70=2,105
Total allocation and catch	**10,100**	**10,320**
IPHC research		245
Total	**10,100**	**10,565**

[1] The combined total includes estimated mortality from regulatory discards of sublegal halibut and lost gear in the commercial fishery, plus discard mortality in the guided sport fishery, as mandated in the U.S. catch sharing plan.

[2] This does not include adjustments, made to the commercial fishery catch limit as a result of the carryover from the previous year's underage/overage plan or the guided angler fishing (GAF) program allowing sport quided operators to lease quota from commercial operators.

Appendix I.

Table 5. The total catch (thousands of pounds, net weight) of Pacific halibut from the 2015 commercial fishery, including IPHC research catch, by regulatory area and month.

	March	April	May	June	July	August	Sept.	Oct.	Nov.	Grand Total
2A[1]	240	78	15	133	101	5		-	-	572
2B	777	913	697	870	823	753	512	564	80	5,990
2C	606	561	945	411	312	322	416	172	25	3,771
3A	338	1,363	1,989	973	742	838	1,133	535	55	7,967
3B	52	171	601	346	334	515	413	230	34	2,697
4A	-	15	230	285	175	282	245	110	30	1,372
4B[2]	-		151	296	142	246	180	85	11	1,111
4C[3]	-	-	-	25	238	141	10		-	413
4D[4]	-	-	105	124	77	143	98	138		685
4E[5]	-	-		47	8	40		-	-	96
Alaska Total	996	2,110	4,021	2,507	2,028	2,527	2,495	1,270	155	18,112
Grand Total	2,014	3,170	4,667	3,508	2,952[6]	3,282[6]	3,009	1,823	248	24,673

For confidentiality:
[1]Area 2A catch in September was combined with August.
[2]Area 4B catch in April was combined with May.
[3]Area 4C catch in October was combined with September.
[4]Area 4D catch in November was combined with October.
[5]Area 4E catch in May was combined with June; September was combined with August.
[6]Area 4E includes research catch from the Closed Area.
Columns and rows may not add due to rounding.

Appendix I.

Table 6. Number of vessels and catch (thousands of pounds, net weight) of Pacific halibut by vessel length class in the 2015 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	18	434	72	168
0 to 25 ft.	0	0	85	237
26 to 30 ft.[1]	0	0	59	341
31 to 35 ft.[1]	14	189	160	1,914
36 to 40 ft.	29	708	96	777
41 to 45 ft.	36	953	113	1,503
46 to 50 ft.	24	885	103	1,948
51 to 55 ft.	23	1,099	63	1,350
56 + ft.	31	1,721	213	9,873
Total	175	5,990	964	18,112

	Area 2C		Area 3A	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	55	86	14	55
0 to 25 ft.	41	75	21	81
26 to 30 ft.	29	118	12	46
31 to 35 ft.	71	487	71	867
36 to 40 ft.	58	317	39	353
41 to 45 ft.	57	422	59	841
46 to 50 ft.	58	554	53	673
51 to 55 ft.	46	588	32	549
56 + ft.	90	1,123	165	4,502
Total	505	3,771	466	7,967

	Area 3B		Area 4	
Overall Vessel Length	**No. of Vessels**	**Catch (000's lbs.)**	**No. of Vessels**	**Catch (000's lbs.)**
Unk. Length	5	27	0	0
0 to 25 ft[1]			22	81
26 to 30 ft.[1]			18	176
31 to 35 ft.[1]	28	169	23	391
36 to 40 ft.	6	41	4	66
41 to 45 ft.	24	177	5	63
46 to 50 ft.	26	260	9	462
51 to 55 ft.	7	68	3	145
56 + ft.	104	1,955	53	2,293
Total	200	2,697	137	3,677

For confidentiality reasons:
[1]Vessels 0 to 30 ft in Area 3B were combined with 26 to 30 ft vessels

Appendix I.

Table 6. Continued.

Overall Vessel Length	Area 2A Directed Commercial No. of Vessels	Area 2A Directed Commercial Catch (000's lbs.)
Unk. Length	0	0.0
0 to 25 ft.	3	0.2
26 to 30 ft.[1]		
31 to 35 ft.[1]	8	5.9
36 to 40 ft.	8	12.4
41 to 45 ft.	12	36.3
46 to 50 ft.	19	72.0
51 to 55 ft.	4	9.6
56 + ft.	14	60.1
Total	68	196.5

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[2]			0	0.0
0 to 25 ft.[2]	10	2.3	0	0.0
26 to 30 ft.	7	1.9	0	0.0
31 to 35 ft.	20	3.3	0	0.0
36 to 40 ft.[3]	32	3.4		
41 to 45 ft.[3]	41	8.1	3	3.1
46 to 50 ft.[4]	29	6.9		
51 to 55 ft.[4]	7	1.6		
56+ ft.[4]	6	0.9	5	6.7
Total	152	28.4	8	9.8

For confidentiality reasons:

[1]Vessels 26 to 30 ft. in the Area 2A Directed Commercial fishery were combined with 31 to 35 ft. vessels.
[2]Vessels of unknown length in the Area 2A Incidental Commercial (Salmon Troll) fishery were combined with 0 to 25 ft. vessels.
[3]Vessels 36 to 40 ft. in the Area 2A Incidental Commercial (Sablefish) fishery were combined with 41 to 45 ft. vessels.
[4]Vessels 46 to 55 ft. in the Area 2A Incidental Commercial (Sablefish) fishery were combined with 56+ ft. vessels.

Appendix I.

Table 7. Commercial fishing periods, number of fishing days, catch limit, commercial, research and total catch (thousands of pounds, net weight) by regulatory area for the 2015 Pacific halibut commercial fishery.

Area 2A	Fishing Period	Catch Limit	No. of Days	Commercial Catch	Research Catch	Total Catch
Treaty Indian	Unrestricted: 3/16 – 3/18		48 hours	239		
	Restricted 4/1 – 4/2		30 hours	78		
Total		307.7		317		317
Incidental in Salmon Fishery	4/1 – 8/21	29.0	143 days	28		28
Incidental in Sablefish Fishery	4/1 – 8/21	10.3	152 days	10		10
Directed[1]	6/24		10 hours	112		
	7/8		10 hours	84		
Directed Total		164.5		196		196
2A Total		**511.5**		**551**	**21**	**572**

Area	Fishing Period	Catch Limit	Adjusted Catch Limit[2]	Commercial Catch	Research Catch	Total Catch
2B	3/14 – 11/7	5,974	5,869	5,884[3]	106	5,990
2C	3/14 – 11/7	3,679	3,720	3,602[4]	169	3,771
3A	3/14 – 11/7	7,790	7,867	7,722	245	7,967
3B	3/14 – 11/7	2,650	2,679	2,574	123	2,697
4A	3/14 – 11/7	1,390	1,399	1,336	36	1,372
4B	3/14 – 11/7	1,140	1,168	1,080	32	1,111
4C	3/14 – 11/7	596.6	603.4	407	6	413
4D	3/14 – 11/7	596.6	598.5	673[5]	12	685
4E	3/14 – 11/7	91.8	91.8	93[6]	3	96
Alaska Total		17,934	18,126.7	17,487	625	18,112
Grand Total[7]		24,419.5	24,507.2	23,922	751	24,673

[1]Fishing period limits by vessel class.
[2]Includes adjustments from the underage/overage programs, and in 2B, quota held by DFO for First Nations through relinquishment processes and the quota leased through the Experimental Recreational Halibut Fishery (XRQ) pilot program.
[3]Includes the pounds that were landed by Native communal commercial licenses (FL licenses).
[4]Includes the pounds taken in the Metlakatla fishery within the Annette Island Reserve.
[5]Area 4C IFQ and CDQ could be fished in Area 4D by NMFS and IPHC regulations.
[6]Area 4D CDQ could be fished in Area 4E by NMFS and IPHC regulations.
[7]Includes Area 2A.
Columns and rows may not add due to rounding

Appendix I.

Table 8. Commercial halibut catch (thousands of pounds, net weight) in 2015 by statistical area[1] and regulatory area.

Stat Area	Catch			Regulatory Area	Catch for Reg Area
	Commercial	Research	Total		
006-009	7	1	9	2A	572
010	45	3	48		
020	104	3	107		
030	10	3	12		
040	58	4	62		
050	327	6	334		
060	176	6	182	2B	5,990
061	8	0	8		
070	135	4	139		
080	132	3	135		
081	2	0	2		
090	137	4	141		
91	355	7	362		
92	29	0	29		
100	491	0	492		
102	881	25	906		
103	44	0	44		
110	47	2	49		
112	962	24	986		
114	71	0	71		
120	32	0	32		
121	199	7	207		
122	30	0	30		
130	410	8	417		
131	556	4	561		
132	387	5	392		
133	213	3	216		
134	97	1	99		
135	488	1	489		
140	20	17	37	2C	3,771
141	6	11	17		
142	66	14	81		
143	132	5	136		
144	26	1	27		
150	147	37	185		
151	216	14	230		
152	349	6	356		
153	55	3	59		
160	549	20	569		
161	125	5	130		
162	679	9	688		
163	78	1	79		
170	168	8	177		
171	139	2	142		
173	61	2	63		
174	37	0	37		
181	344	11	354		
182	242	1	242		
183	55	1	56		
184	107	0	107		

Appendix I.

Table 8. Continued.

185	651	13	664		
190	387	15	402		
200	651	32	683		
210	583	20	603		
220	731	18	749		
230	233	13	247		
232	65	3	68		
240	574	14	588	3A	7,967
242	152	5	157		
250	1,307	23	1,330		
260	631	28	659		
261	369	6	375		
270	641	25	666		
271	152	7	159		
280	544	18	562		
281	51	4	56		
290	1,225	23	1,247		
300	515	34	549		
310	153	22	175	3B	2,697
320	379	16	396		
330	185	17	202		
340	118	11	129		
350	98	5	100		
360	257	2	259		
370	72	2	74		
380	93	6	99		
390/395	24	1	25		
400	113	0	113		
410	81	4	85	4	3,677
420	60	3	63		
430	35	2	37		
440	187	2	189		
450-470	1	2	2		
480	0	2	2		
490/500	68	4	72		
Bering Sea	2,504	53	2,557		
Grand Total	23,922	751	24,673		

[1] Statistical areas as defined in IPHC Technical Report No. 49.
Columns and rows may not add due to rounding

Appendix I.

Table 9. Commercial landings (thousands of pounds, net weight) of Pacific halibut by port and vessel nationality; and IPHC research catch for 2015.

IPHC Group	Canada	United States	IPHC Research	Grand Total
CA & OR	-	189	10	199
Bellingham/Seattle	-	561	3	564
WA	-	311	7	318
Vancouver	162	-	-	162
Port Hardy	2,791	-	38	2,829
Southern BC	238	-	17	255
Prince Rupert & Port Ed.	2,487	-	113	2,600
Northern BC	205	-	-	205
Ketchikan, Craig, Metlakatla	-	309	14	323
Petersburg, Sitka, Kake	-	2,324	85	2,409
Juneau, Hoonah, Excursion, Pelican	-	1,509	39	1,548
Southeast AK	-	694	-	694
Cordova	-	411	16	427
Seward	-	1,922	62	1,984
Homer	-	2,556	5	2,561
Kenai	-	14	-	14
Kodiak	-	2,745	103	2,848
Central AK	-	1,469	135	1,604
Akutan & Dutch Harbor	-	1,922	51	1,973
Bering Sea	-	1,101	54	1,155
Grand Total	5,884	18,038	751	24,673

Columns and rows may not add due to rounding

Appendix I.

Table 10. The fishing period limit (pounds, net weight) by vessel class used in the 2015 directed commercial fishery in Area 2A.

Vessel Class		Fishing Period & Limits	
Letter	**Feet**	June 24	July 8
A	0-25	755	505
B	26-30	945	630
C	31-35	1,510	1,010
D	36-40	4,165	2,780
E	42-45	4,480	2,990
F	46-50	5,365	3,575
G	51-55	5,985	3,990
H	56+	9,000	6,000

Table 11. Metlakatla community fishing periods, number of vessels, and halibut catch (pounds, net weight), 2015.

Fishing Period Dates	Number of Vessels	Catch (Pounds)
April 24 – 26	14	2,371
May 8 – 10	18	6,592
May 22 – 24	22	5,679
June 5 – June 7	19	7,206
June 19 – 21	18	7,268
July 3 – 5	12	6,540
July 17 – 19	12	6,036
July 31 – August 2	6	1,834
August 14 – 16	15	6,221
August 28 – 30	14	6,945
September 11 – 13	11	5,853
September 25 – 27	9	4,567
12 Fishing Periods		67,112

Appendix II.

Table 1. Harvest of halibut by sport fishers (millions of pounds, net weight) by IPHC regulatory area, 2001-2015.

Year	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	Total
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	0.478	1.613	2.937	5.606	0.007	0.053	10.694
2005	0.476	1.841	2.798	5.672	0.014	0.050	10.851
2006	0.511	1.752	2.526	5.337	0.014	0.046	10.186
2007	0.503	1.556	3.049	6.283	0.025	0.044	11.460
2008	0.487	1.536	3.264	5.320	0.026	0.040	10.673
2009	0.484	1.098	2.382	4.758	0.030	0.024	8.776
2010	0.397	1.156	1.971	4.285	0.024	0.016	7.849
2011	0.401	1.220	1.029	4.408	0.014	0.017	7.089
2012	0.465	1.156	1.583	3.626	0.022	0.028	6.880
2013	0.501	0.822	2.123	3.966	0.015	0.009	7.436
2014	0.476	0.915	1.954	3.567	0.007	0.009	6.928
2015[1]	0.445	0.994	1.924	3.530	0.010	0.017	6.920
2014-2015 change							
Pounds	-0.031	0.079	-0.029	-0.037	0.003	0.008	-0.008
Percent	-6.5%	+8.6%	-1.5%	-1.0%	+42.9%	+88.9%	-0.1%

[1] IPHC Regulatory Areas 2B, 2C, 3A, 3B, 4 sport catch estimates are preliminary.

Appendix II.

Table 2. Summary of the 2015 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 15-16	2 (Fri-Sat)	2	1
	May 21-24	4 (Thu-Sun)	4	1
	May 29-30	2 (Fri-Sat)	2	1
Low Point to Sekiu River	May 8-9	2 (Fri-Sat)	2	1
	May 15-16	2 (Fri-Sat)	2	1
	May 21-24	4 (Thu-Sun)	4	1
	May 28-30	3 (Thu-Sat)	3	1
WA North Coast (Sekiu R. to Queets R.)	May 14,16	2 (Thu, Sat)	2	1
	May 23[a]	1 (Sat)	1	1
WA South Coast (Queets R. to Leadbetter Pt.)				
All depths	May 3,5,10,12	4 (Sun,Tue)	4	1
Northern nearshore	May 4 – July 19	7 (Sun-Sat)	77	1
Columbia R. (Leadbetter Pt. to C. Falcon)				
All depths	May 1 - 31	4 (Thu-Sun)	19	1
Nearshore	May 4 – June 10	3 (Mon-Wed)	18	1
Nearshore	June 22- Sep 30	7 (Mon-Sun)	101	1
OR Central Coast (Cape Falcon - Humbug Mtn.)				
All depths - Spring	May 14 –Jun 27 (biweekly)	3 (Thu-Sat)[b]	12	1
All depths - Summer	Aug 7 – Oct 31 (biweekly)	2 (Fri-Sat)[c]	14	1
Less than 40 fathoms	July 1 – Oct 31	7 (Sun-Sat)	123	1
Southern OR	May 1 – Oct 31	7 (Sun-Sat)	184	1
CA	May 1 – Aug 12[d] (first ½ of month)	7 (Sun-Sat)	57	1
Area 2B - British Columbia	Feb 1 – Dec 31	7 (Sun-Sat)	334	1[e]
Area 2C - Alaska				
Guided anglers	Feb 1 – Dec 31	7 (Sun-Sat)	334	1[f]
Unguided anglers	Feb 1 – Dec 31	7 (Sun-Sat)	334	2
Area 3A – Alaska				
Guided anglers	Feb 1 – Dec 31	7 (Sun-Sat)[g]	334	2[h]
Unguided anglers	Feb 1 – Dec 31	7 (Sun-Sat)	334	2
Areas 3B and 4 – Alaska	Feb 1 – Dec 31	7 (Sun-Sat)	334	2

[a] Due to successful catch rates on the first two days in the WA North Coast fishery, the second week was curtailed to one day of fishing effort, May 23.

[b] Fishing was prohibited May 21-23, June 4-6, 18-20.

[c] Fishing was prohibited August 14-15, 28-29, September 11-12, 25-26, October 9-10, 23-24.

[d] Fishing was permitted the first half of each month (1st – 15th) until closed.

[e] The daily limit was one fish with a maximum length of 133 cm and a possession limit of two fish, but only one fish could be greater than 90 cm. An annual limit of six fish was also in effect.

[f] A reverse slot limit defining retained halibut as ≤42 inches or ≥80 inches in total length was in effect.

[g] No halibut retention (except GAF) on Thursdays from June 15 to August 31.

[h] Charter anglers could only keep two fish per day, and only one could be could be greater than 29 inches total length.

Appendix II.

Table 3. 2015 Area 2A sport harvest allocations and harvest estimates (pounds, net weight) by subarea.

Area	Allocation	Harvest Estimate	Percent Taken	Pounds Over/(Under)
WA Inside Waters	57,393	95,591	167.0	38,198
WA North Coast	108,030	94,698	87.7	(13,332)
WA South Coast	42,739	42,733	100.0	(6)
WA/OR Columbia River	10,254	9,340	91.1	(914)
OR Central Coast	175,633	174,957	99.6	(676)
OR Southern	7,318	2,583	35.3	(4,735)
CA	25,220	24,906	98.8	(314)
Total	**426,587**	**444,808**[a]	**104.3**	**18,221**

[a] Does not include 2,000 pounds of discard mortality.

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, 2003–2015. Also shown is the GHL applicable to the guided fishery.

	Area 2C				Area 3A			
Year	Private	Charter	Total	GHL	Private	Charter	Total	GHL
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	1.361	0.762	2.123	0.788	1.452	2.514	3.966	2.734
	Private	Charter	Total	Quota	Private	Charter	Total	Quota[2]
2014	1.170	0.783	1.953	0.761	1.533	2.034	3.567	1.782
2015[1]	1.124	0.800	1.924	0.851	1.495	2.035	3.530	1.890

[1] Preliminary.

[2] In 2014, the guideline harvest levels (GHL) for Areas 2C and 3A were replaced by sector quotas for the guided sport harvests.

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 2015 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.

2015 research publications

International Pacific Halibut Commission (IPHC). 2015. Annual Report 2014.

Kastelle, C. R., Helser, T. E., Wischniowski, S., Loher, T., Goetz, B. J., and Kautzi, L. A. 2015. Incorporation of bomb-produced 14C into fish otoliths: a novel approach for evaluating age validation and bias with application to yellowfin sole and northern rockfish. Ecological Modelling 320:71-91. doi: 10.1016/j.ecolmodel.2015.09.013

Martell, S., Stewart, I., and Sullivan, J. 2015. Implications of bycatch, discards, and size limits on reference points in the Pacific halibut fishery. In Fisheries bycatch: Global issues and creative solutions. G.H. Kruse, H.C. An, J. DiCosimo, C.A. Eischens, G. Gislason, S., D.N. McBride, C.S. Rose and C.E. Siddon. Eds. Alaska Sea Grant, University of Alaska Fairbanks.

Stewart, I. J., and Martell, S. J. D. 2015. Reconciling stock assessment paradigms to better inform fisheries management. ICES Journal of Marine Science. 72(8): 2187-2196.

Wilderbuer, T., Leaman, B. M., and Zhang, C. I. 2015. Pacific Flatfish Fisheries. pp. 395-417. In Gibson, R.N., Nash, R.D.M., Geffen, A.J., and Van der Veer, H.W. (Eds.) Flatfishes: Biology and Exploitation. 2nd Edtn. Wiley Blackwell Scientific Ltd. London. 542 p.

Wischniowski, S., Kastelle, C. R., Loher, T., and Helser, T. E. 2015. Incorporation of bomb-produced 14C into fish otoliths. An example of basin-specific rates, from the North Pacific Ocean. Canadian Journal of Fisheries and Aquatic Sciences 72(6):879-892. doi: 10.1139/cjfas.2014.0225

IPHC Publications 1930-2015

Reports

1. Report of the International Fisheries Commission appointed under the Northern Pacific Halibut Treaty. John Pease Babcock, William A. Found, Miller Freeman, and Henry O' Malley. 31 p. (1931).[Out of print]
2. Life history of the Pacific halibut. Marking experiments. William F. Thompson and William C. Herrington. 137 p. (1930).
3. Determination of the chlorinity of ocean waters. Thomas G. Thompson and Richard Van Cleve. 14 p. (1930).
4. Hydrographic sections and calculated currents in the Gulf of Alaska, 1927 and 1928. George F. McEwen, Thomas G. Thompson, and Richard Van Cleve. 36 p. (1930).
5. History of the Pacific halibut fishery. William F. Thompson and Norman L. Freeman. 61 p. (1930).
6. Biological statistics of the Pacific halibut fishery. Changes in the yield of a standardized unit of gear. William F. Thompson, Harry A. Dunlop, and F. Heward Bell. 108 p. (1930). [Out of print]
7. Investigations of the International Fisheries Commission to December 1930, and their bearing on the regulation of the Pacific halibut fishery. John Pease Babcock, William A. Found, Miller Freeman, and Henry O'Malley. 29 p. (1930). [Out of print]
8. Biological statistics of the Pacific halibut fishery, Effects of changes in intensity upon total yield and yield per unit of gear. William F. Thompson and F. Heward Bell. 49 p. (1934). [Out of print]
9. Life history of the Pacific halibut - Distribution and early life history. William F. Thompson and Richard Van Cleve. 184 p. (1936). [Out of print]
10. Hydrographic sections and calculated currents in the Gulf of Alaska. 1929. Thomas G. Thompson, George F. McEwen, and Richard Van Cleve. 32 p. (1936).
11. Variations in the meristic characters of flounder from the northeastern Pacific. Lawrence D. Townsend. 24 p. (1936).
12. Theory of the effect of fishing on the stock of halibut. William F. Thompson. 22 p. (1937).
13. Regulation and investigation of the Pacific halibut fishery in 1947 (Annual Report). IFC. 30 p. (1948).
14. Regulation and investigation of the Pacific halibut fishery in 1948 (Annual Report). IFC. 30 p. (1949).
15. Regulation and investigation of the Pacific halibut fishery in 1949 (Annual Report). IFC. 24 p. (1951).
16. Regulation and investigation of the Pacific halibut fishery in 1950 (Annual Report). IFC. 16 p. (1951).
17. Pacific Coast halibut landings 1888 to 1950 and catch according to areas of origin. F. Heward Bell, Henry A. Dunlop, and Norman L. Freeman. 47 p. (1952).
18. Regulation and investigation of the Pacific halibut fishery in 1951 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, and George W. Nickerson. 29 p. (1952).
19. The production of halibut eggs on the Cape St. James spawning bank off the coast of British Columbia 1935-1946. Richard Van Cleve and Allyn H. Seymour. 44 p. (1953).
20. Regulation and investigation of the Pacific halibut fishery in 1952 (Annual Report). Edward W. Allen, George R. Clark, Milton C. James, George W. Nickerson, and Seton H. Thompson. 29 p. (1953).
21. Regulation and investigation of the Pacific halibut fishery in 1953 (Annual report). IPHC. 22 p. (1954).
22. Regulation and investigation of the Pacific halibut fishery in 1954 (Annual Report). IPHC. 32 p. (1955).
23. The incidental capture of halibut by various types of fishing gear. F. Heward Bell. 48 p. (1955).
24. Regulation and investigation of the Pacific halibut fishery in 1955 (Annual Report). IPHC 15 p. (1956).

25. Regulation and investigation of the Pacific halibut fishery in 1956 (Annual Report). IPHC. 27 p. (1957).
26. Regulation and investigation of the Pacific halibut fishery in 1957 (Annual report). IPHC. 16 p. (1958).
27. Regulation and investigation of the Pacific halibut fishery in 1958 (Annual Report). IPHC. 21 p. (1959).
28. Utilization of Pacific halibut stocks: Yield per recruitment. IPHC Staff. 52 p. (1960).
29. Regulation and investigation of the Pacific halibut fishery in 1959 (Annual Report). IPHC. 17 p. (1960).
30. Regulation and investigation of the Pacific halibut fishery in 1960 (Annual Report). IPHC. 24 p. (1961).
31. Utilization of Pacific halibut stocks: Estimation of maximum sustainable yield, 1960. Douglas G. Chapman, Richard J. Myhre, and G. Morris Soutward, 35 p. (1962).
32. Regulation and investigation of the Pacific halibut fishery in 1961 (Annual Report). IPHC. 23 p. (1962).
33. Regulation and investigation of the Pacific halibut fishery in 1962 (Annual Report). IPHC. 27 p. (1963).
34. Regulation and investigation of the Pacific halibut fishery in 1963 (Annual Report). IPHC. 24 p. (1964).
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).
36. Catch records of a trawl survey conducted by the International Pacific Halibut Commission between Unimak Pass and Cape Spencer, Alaska from May 1961 to April 1963. IPHC. 524 p. (1964).
37. Sampling the commercial catch and use of calculated lengths in stock composition studies of Pacific halibut. William H. Hardman and G. Morris Southward, 32 p. (1965).
38. Regulation and investigation of the Pacific halibut fishery in 1964 (Annual Report). IPHC 18 p. (1965).
39. Utilization of Pacific halibut stocks: Study of Bertalanffy's growth equation. G. Morris Southward and Douglas G. Chapman. 33 p. (1965).
40. Regulation and investigation of the Pacific halibut fishery in 1965 (Annual Report). IPHC. 23 p. (1966).
41. Loss of tags from Pacific halibut as determined by double-tag experiments. Richard J. Myhre. 31 p. (1966).
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).
44. Regulation and investigation of the Pacific halibut fishery in 1966 (Annual Report). IPHC 24 p. (1967).
45. The halibut fishery, Shumagin Islands westward not including Bering Sea. F. Heward Bell. 34 p. (1967).
46. Regulation and investigation of the Pacific halibut fishery in 1967 (Annual Report). IPHC. 23 p. (1968).
47. A simulation of management strategies in the Pacific halibut fishery. G. Morris Southward. 70 p. (1968).
48. The halibut fishery south of Willapa Bay, Washington. F. Heward Bell and E.A. Best. 36 p. (1968).
49. Regulation and investigation of the Pacific halibut fishery in 1968 (Annual report). IPHC. 19 p. (1969).
50. Agreements, conventions and treaties between Canada and the United States of America with respect to the Pacific halibut fishery. F. Heward Bell. 102 p. (1969). [Out of print]
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).
56. Revised estimates of halibut abundance and the Thompson-Burkenroad debate. Bernard Einar Skud. 36 p. (1975).
57. Survival of halibut released after capture by trawls. Stephen H. Hoag. 18 p. (1975).
58. Sampling of landings of halibut for age composition. G. Morris Southward. 31 p. (1976).
59. Jurisdictional and administrative limitations affecting management of the halibut fishery. Bernard Einar Skud. 24 p. (1976).
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).
75. Estimation of halibut body size from otolith size. William G. Clark. 31 p. (1992).
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).
77. Further studies of area differences in setline catchability of Pacific halibut. Steven M. Kaimmer and Gilbert St-Pierre. 59 p. (1993).
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).
79. The Pacific halibut stock assessment of 1997. Patrick J. Sullivan, Ana M. Parma, and William G. Clark. 84 p. (1999).
80. The efficacy of electronic monitoring systems: a case study on the applicability of video technology for longline fisheries management. Robert T. Ames. 64 p. (2005).
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).
85. Seasonal movements and environmental conditions experienced by Pacific halibut along the Aleutian Islands, examined by pop-up satellite tags. Andrew C. Seitz, Timothy Loher, and Jennifer L. Nielsen. 24 p. (2008).

Technical Reports

1. Recruitment investigations: Trawl catch records Bering Sea, 1967. Edward A. Best. 23 p. (1969).
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).
10. Otolith length and fish length of Pacific halibut. G. Morris Southward and William H. Hardman. 10 p. (1973).
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).
16. The Pacific halibut: Biology, fishery, and management. International Pacific Halibut Commission. 56 p. (1978). [Out of print]
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).
19. I. Reducing the incidental catch of prohibited species in the Bering Sea groundfish fishery through gear restrictions. Vidar G. Wespestad, Stephen H. Hoag, and Renold Narita. II. A comparison of Pacific halibut and Tanner crab catches (1) side-entry and top-entry crab pots and (2) side-entry crab pots with and without Tanner boards. Gregg H. Williams, Donald A. McCaughran, Stephen H. Hoag, and Timothy M. Koeneman. 35 p. (1982).
20. Juvenile halibut surveys, 1973-1980. E.A. Best and William H. Hardman. 38 p. (1982).
21. Pacific halibut as predator and prey. E.A. Best and Gilbert St-Pierre. 27 p. (1986).
22. The Pacific halibut: Biology, fishery, and management. International Pacific Halibut Commission. 59 p. (1987).
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).
26. The 1979 Protocol to the Convention and Related Legislation. Donald A. McCaughran and Stephen H. Hoag. 32 p. (1992).
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).
34. IPHC research and management of Pacific halibut in the Pribilof Islands through 1994. Lauri L. Sadorus and Gilbert St-Pierre. 35 p. (1995).
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).
40. The Pacific halibut: Biology, fishery, and management. International Pacific Halibut Commission. 64 p. (1998).
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).
56. Development of deployment and retrieval protocols for Passive Integrated Transponder (PIT) tags: Application to Pacific halibut. Stephen M. Kaimmer, Tracee O. Geernaert, and Joan E. Forsberg. 36 p. (2012).
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).
59. The Pacific Halibut: Biology, Fishery, and Management. International Pacific Halibut Commission. Stephen Keith, Thomas Kong, Lauri Sadorus, Ian Stewart, and Gregg Williams (editors). 60 p. (2014).

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.

Social media

In addition to maintaining a website (www.iphc.int), the IPHC disseminates information via a Facebook™ page (https://www.facebook.com/InternationalPacificHalibutCommission/) and Twitter™ account (https://twitter.com/iphcinfo). Both the Annual and Interim meetings are webcast live, and those remain accessible after the meetings via YouTube™.

Acronyms used in this report

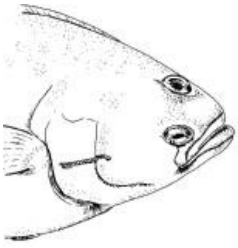
ADEC - Alaska Department of Environmental Conservation
ADF&G - Alaska Department of Fish and Game
BBEDC - Bristol Bay Economic Development Corporation
BSAI - Bering Sea and Aleutian Islands
CDFW - California Department of Fish and Wildlife
CDQ - Community Development Quota
CGOARP - Central Gulf of Alaska Rockfish Program
COAC - Clean Otolith Archive Collection
C&S - Ceremonial and Subsistence
CSP - Catch Sharing Plan
CVRF - Coastal Villages Regional Fund
DFO - Fisheries and Oceans Canada
DMR - Discard Mortality Rate
DO - Dissolved Oxygen
EBS - Eastern Bering Sea
EC - Electronic Monitoring
GAF - Guided Angler Fish
HCR - Harvest Control Rule
HARM - Halibut Angler Release Mortality
IFMP - Integrated Fisheries Management Plan
IFQ - United States Individual Fishing Quota
IPHC - International Pacific Halibut Commission
IQ - Individual Quota
IVQ - Canadian Individual Vessel Quota
MP - Management Procedure
MPR - Mortality Per Recruit
MSAB - Management Strategy Advisory Board
MSE - Management Strategy Evaluation
NMFS - National Marine Fisheries Service
NOAA - National Oceanic and Atmospheric Administration
NPFMC - North Pacific Fishery Management Council
NPUE - Numbers-Per-Unit-Effort
NSEDC - Norton Sound Economic Development Corporation
ODFW - Oregon Department of Fish and Wildlife
PAT - Pop-up Archival Transmitting
PDO - Pacific Decadal Oscillation
PFMC - Pacific Fishery Management Council
PHI - Prior Hook Injury
PSC - Prohibited Species Catch
PSMFC - Pacific States Marine Fisheries Commission
QS - Quota Share
RDE - Remote Data Entry
RI - Rockfish Index
RSL - Reverse Slot Limit
SRB - Scientific Review Board
SPR - Spawning Potential Ratio
SSA - Standardized Stock Assessment
WDFW - Washington Department of Fish and Wildlife
WPUE - Weight-Per-Unit-Effort
XRQ - Experimental Recreational Halibut

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 plastic-coated wire tags

- These tags come in various colors and are threaded through the operculum (cheek area) on the dark side of the body.
- The usual reward is $10 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.

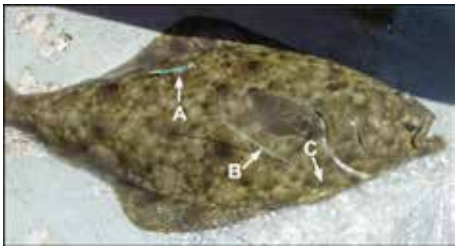
Spaghetti tags

- 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

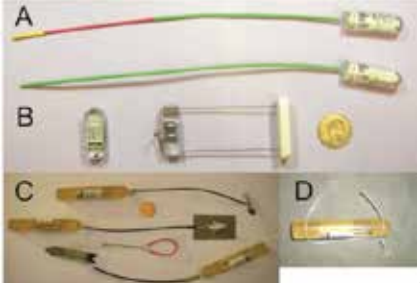
- Attached near the dorsal by a metal dart and leader.
- Rewards: $100 or $500 for tag body*, $50 for the leader and metal dart tag only, $10 or tag hat for leader only. *Note that these tags may be found attached to a halibut, floating, or washed ashore. Reward amount printed on tag.

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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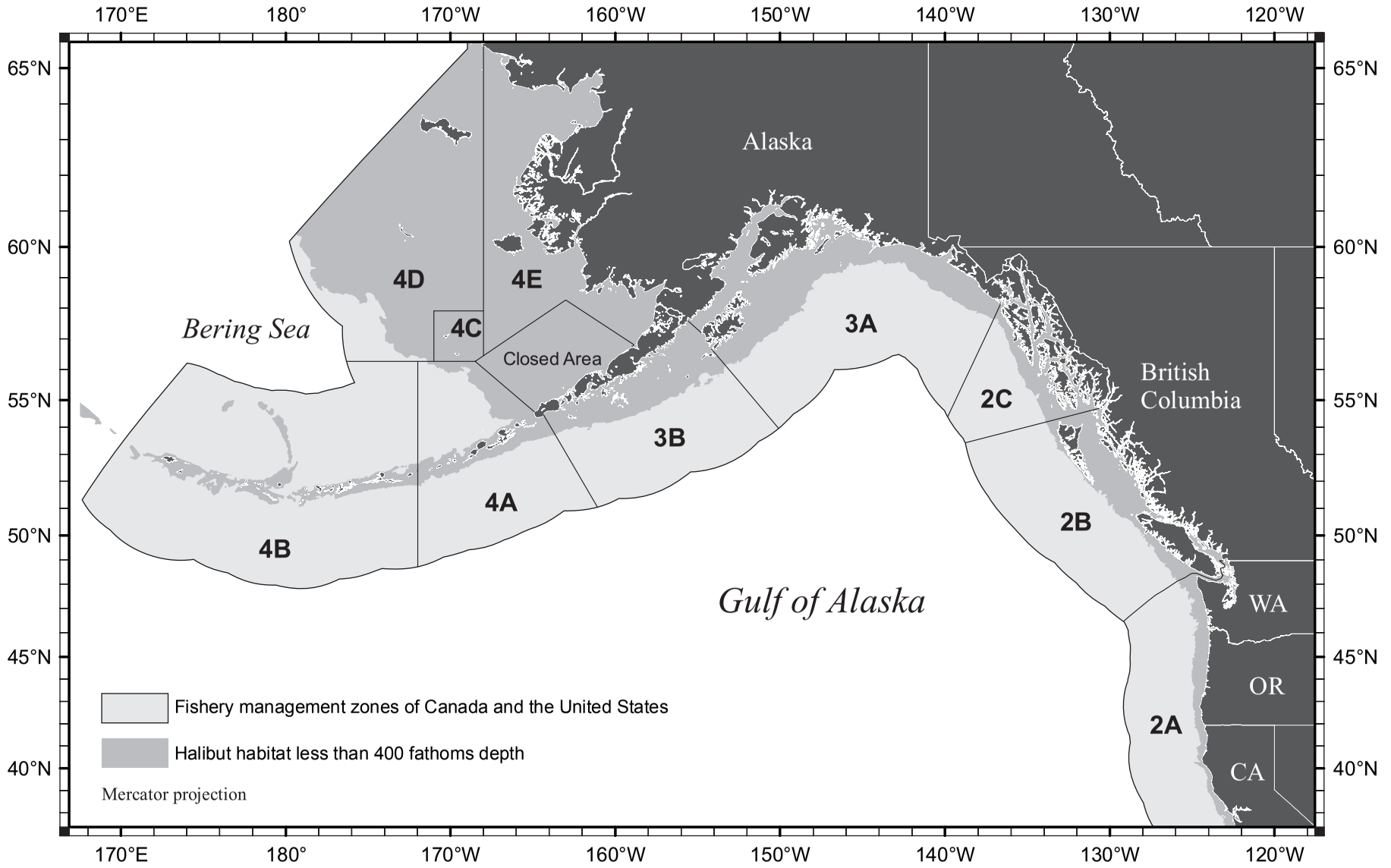

IPHC Regulatory Areas for 2015