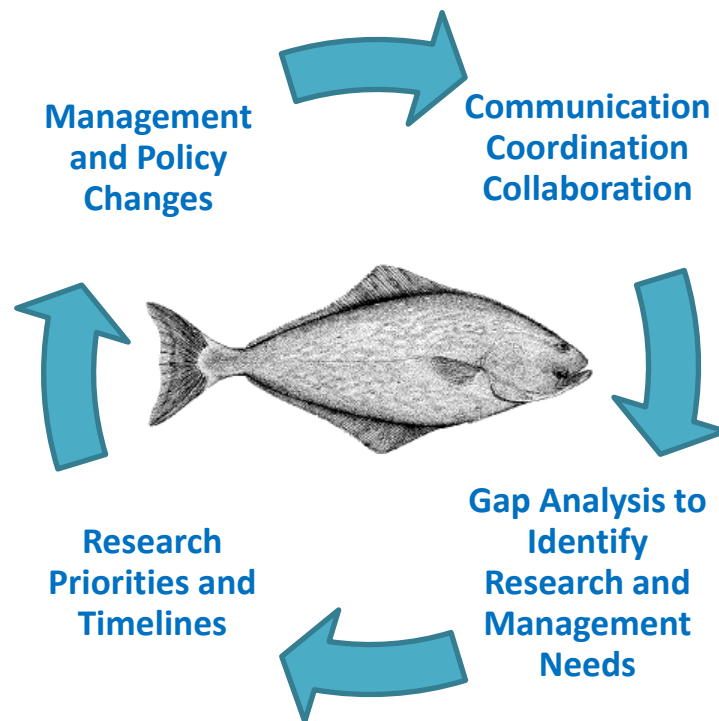


Halibut Management Framework



North Pacific Fishery Management Council



September 2016

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Halibut Management Framework

1 Introduction

In conjunction with its June 2015 action to reduce halibut PSC limits in the BSAI groundfish fisheries, the Council discussed several aspects of halibut management, and committed to developing a more explicit ‘framework’ for consideration of halibut management overall, including enhanced coordination with the IPHC process. Citing from the Council’s June 2015 newsletter:

“The Chair and the Executive Director will evaluate ways to integrate the variety of halibut management and research activities currently underway, and develop a framework for improving coordination between the Council and IPHC. Council and agency staff, including the IPHC, and State representatives on the Council, will be consulted. Both Council members and the public highlighted a need for better alignment of the two management bodies when dealing with halibut needs among the various directed fishery and bycatch user groups. The intention is to outline a process to ensure progress continues on issues both that were raised at this meeting, and were outcomes of the joint Council-IPHC meeting in February. These include, among others, a discussion of the Council’s management objectives with respect to the tension between the needs of the directed halibut fishery and halibut bycatch needs in the groundfish fishery; the role of stakeholder working groups to develop a more surgical resolution to halibut use conflicts; and a common understanding of available data and the science of various halibut stock and life history issues, such as growth and migration. The Chair and Executive Director will bring back recommendations for the Council in October, which may be followed by a public scoping session, and the consideration of specific actions by the Council in December.”

Halibut management, whether bycatch in the groundfish fisheries, or harvest in the directed longline, recreational, charter and subsistence fisheries, is one of the most significant issues of interest among stakeholders, and the Council continues to recognize its responsibility to balance the objectives of all resource users. The Council also acknowledges that while the MSA, National Standard Guidelines, the Halibut Convention between the U.S. and Canada, and the Halibut Act, outline those responsibilities, they may not clearly or thoroughly articulate how best to balance these competing uses of halibut.

The overall goal of this Framework is to identify, define, and track the most important issues, topics, and questions necessary to guide the Council’s decisions about halibut management, and to inform Council interactions with the IPHC.

The overall goal of this Framework is to identify, define, and track the most important issues, topics, and questions necessary to guide the Council’s decisions about halibut management, and to inform Council interactions with the IPHC. It also serves as a record or catalog of ongoing Council activities and stakeholder involvement, research and management projects, and the interaction among Council, NFMS management and AFSC, Plan teams, the IPHC, and stakeholders. It would describe what we are doing collectively and how these efforts interact; it would identify areas of uncertainty, misunderstanding and disagreement; it would identify areas where further analysis and research may be warranted; and it would suggest actions and timelines for addressing various aspects of halibut management. With this framework, the Council would be more proactive and directly engaged in its management authority and responsibility for halibut for the benefit of all users. A key aspect of this Framework is to articulate how a particular issue/topic or question relates to decision-making (process-wise and time-wise) by either the Council or the IPHC.

The Framework is built around several key assumptions. First, the Council and the IPHC will continue to operate under their respective authorities. There is no intent to create a joint decision making process with the IPHC. However, the Framework process may inform development of recommendations from one

body to the other. Second, the IPHC is in the process of developing new understanding and capabilities (stock assessment, SPR, total mortality accounting, MSE process, etc.) which will affect how both the Council and the IPHC understand and develop halibut management. Lastly, the Framework is intended to be comprehensive, include consideration of all user groups, and be applicable to the BSAI and the GOA.

2 Purpose and Objectives

This Framework has three main purposes:

- 1 **To catalog current work/research/activities that are underway**, or that have been identified but not started, so that priorities and timelines can be set (or recommended, for activities under the purview of the IPHC) for the Council and NMFS.
- 2 **To identify gaps in our understanding of halibut**, and deficiencies/shortcomings in the way halibut research and management has been addressed. These are potentially new areas of work for the Council to pursue, possibly in coordination with the IPHC and NMFS.
- 3 **To improve research and management coordination and communication** between the Council, NMFS, the IPHC, and stakeholders.

The Council views this Framework as a strategic planning and coordination document. This document recognizes that the Council must consider projects or issues against the full range of potential halibut management issues (bycatch and otherwise), and prioritize among them. It also establishes, as one of its main purposes, a more proactive and informed approach to halibut management overall. Although primarily viewed as an action-informing document (rather than an action-forcing document), the Framework provides a structure for prioritizing and facilitating future actions through the identification of new initiatives based on management needs or new scientific information. Examples of new initiatives include further specification of DMRs, as well as exploration of an abundance-based PSC management approach.

An important aspect of the Framework is to drive a more deliberative and proactive approach to all halibut management issues (which will, again, require identification and prioritization of short and long term objectives), and foster a stronger collaboration among the Council, stakeholders, and other management agencies including the IPHC. With a more explicit (and proactive) approach to address the various science and management issues surrounding the halibut resource, the Framework will provide the Council and the IPHC, as well as other management agencies, a more informed platform for improved coordination in general, and help both bodies identify the timing and nature for more direct interactions (such as the Joint Council/IPHC meeting).

Another important aspect of the Framework is that it identifies the major research activities underway relative to halibut science and management, highlights the most critical information gaps, outlines the primary management (or related) activities affecting halibut decision-making, and identifies the process for improved coordination and communication with the IPHC. One benefit of this Framework process may be to more explicitly, and proactively, guide the various research elements underway, and thereby promote more timely resolution for management consideration. The Framework process may also be an integral part of funding requests through NMFS or ADF&G for priority research that might otherwise never be undertaken.

Beginning with its inception in June 2015, much of the discussion around the Framework has been in the context of “the Council’s management objectives” with regard to halibut. While the immediate genesis of

the Framework was in the context of halibut bycatch, the Council has articulated an intent for this document to serve a broader purpose regarding overall halibut management.

Many of the 46 objectives from the GOA and BSAI FMPs and our programmatic SEIS are directly, or indirectly, related to halibut bycatch management (see Attachment 1). For example, under the category of “Manage Incidental Catch and Reduce Bycatch and Waste”, there are 9 specific objectives which could be characterized as ‘directly’ relevant to halibut bycatch management, including #20 which states “Control the bycatch of prohibited species through PSC limits or other appropriate measures”. Objective #7 is “promote management measures that, while meeting conservation objectives, are also designed to avoid significant disruption of existing social and economic structures. Objective #32 states “provide economic and community stability to harvesting and processing sectors through fair allocation of fishery resources”. While this specific objective was developed in the context of allocations of groundfish under our FMPs, it could well be argued that this objective lies at the heart of the issue of setting halibut PSC limits (i.e., an allocation between directed and bycatch users). In that sense, the Council made a decision at its June 2015 meeting regarding such allocation, though they indicated this was only a first step in a larger consideration of halibut bycatch management.

At the December 2015 meeting, the Council adopted several objectives to guide activities under this Framework (and to consider as appropriate in any ongoing BSAI and GOA management actions being considered by the Council. **Note that one of the original objectives was to pursue an abundance-based approach to halibut bycatch, and this action has since been initiated.** The remaining four overarching objectives are as follows:

- 1 **Manage halibut bycatch** in the groundfish fisheries **and harvests** in the commercial, guided and non-guided recreational, and subsistence fisheries **consistent with the Council’s MSA conservation objectives.**
- 2 **Manage halibut bycatch to balance the objectives of directed users and bycatch users** in both the BSAI and GOA.
- 3 **Provide for the sustained participation** of historic participants and fishery dependent communities.
- 4 **Maintain monitoring and catch accounting programs** for halibut users in the BSAI and GOA in order to provide the data necessary for management needs.

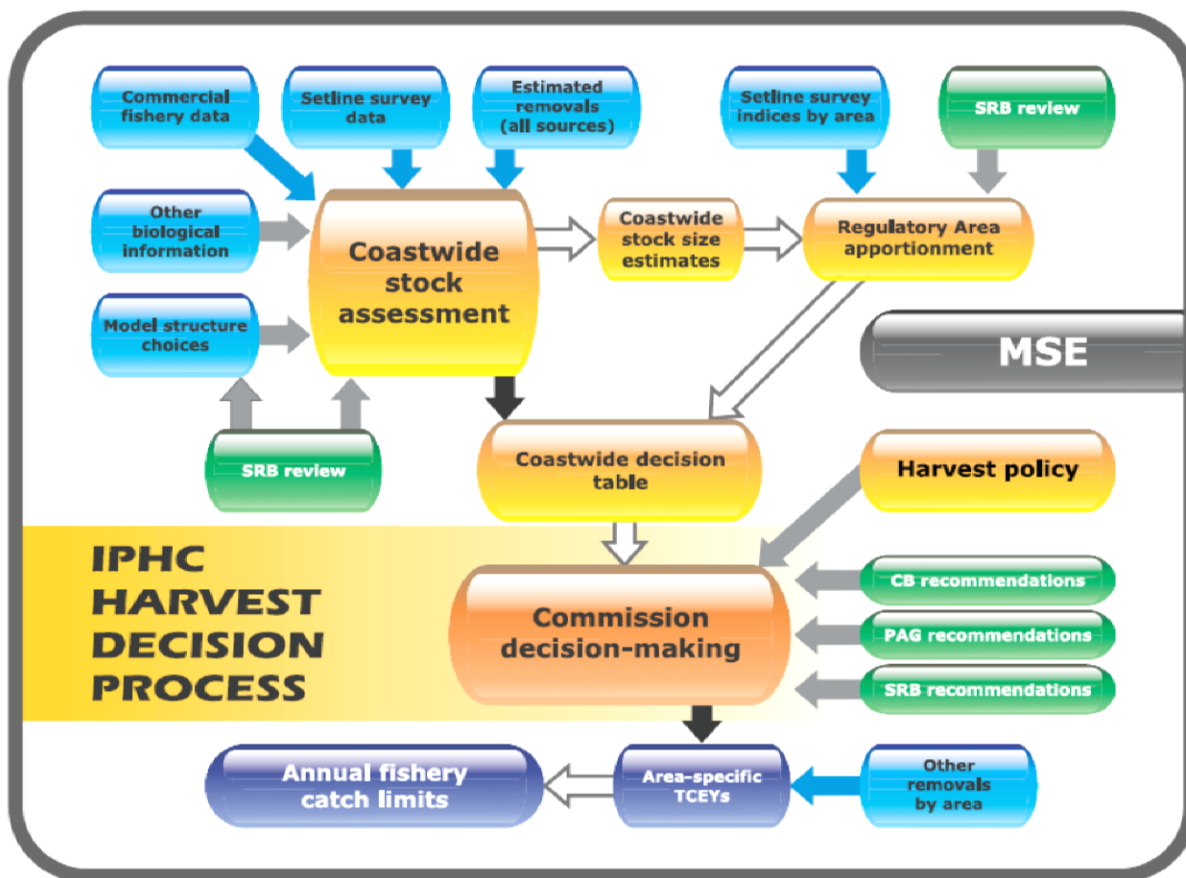
3 Background

3.1 Halibut Stock Assessment

The IPHC staff prepares an annual stock assessment using an ensemble of models using the stock synthesis software as a modeling platform. The ensemble approach to its coastwide stock assessment for the Pacific halibut stock includes multiple models in the estimation of management quantities, and uncertainty about these quantities. For the 2016 assessment, these included two coastwide models and two areas-as-fleets models, one using more comprehensive data available only since 1996, and the other using the full historical record.

The most recent assessment can be found in the annual IPHC bluebook:
http://www.iphc.int/publications/bluebooks/IPHC_bluebook_2016.pdf

The Council's motion from February 2016 included a request to the IPHC to "provide a conceptual model of the stock assessment workflow with explanations of how information about migration, natural mortality, size/weight at age, and DMRs are parameterized on influence the assessment". This figure provides a general conceptualization of the IPHC process. A more detailed explanation to address the

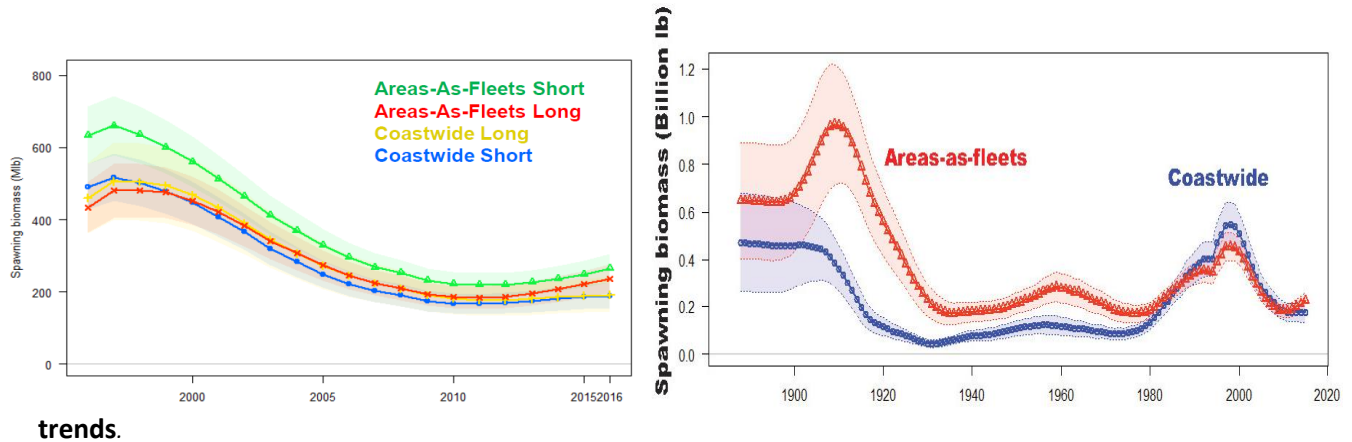


Council's request is pending. Some of the information in the Council's request can be found on the IPHC website, but a full conceptual model is not currently available, as the IPHC is in the process of researching and refining some of the key parameters (migration, etc) in that assessment process.

3.2 Status of the Halibut Stock

The results of the 2016 assessment indicate that the exploitable stock declined continuously from the late 1990s to around 2010. That trend is estimated to have been a result of decreasing size-at-age, as well as recent recruitment strengths that are much smaller than those observed through the 1980s and 1990s. Since that time period, the estimated female spawning biomass appears to have stabilized near 200 million pounds, with flatter trajectories estimated in coastwide models and slightly increasing trends in areas-as-fleets models.

Figure. Trends in Halibut Spawning Biomass, 2016 assessment models showing recent and long term

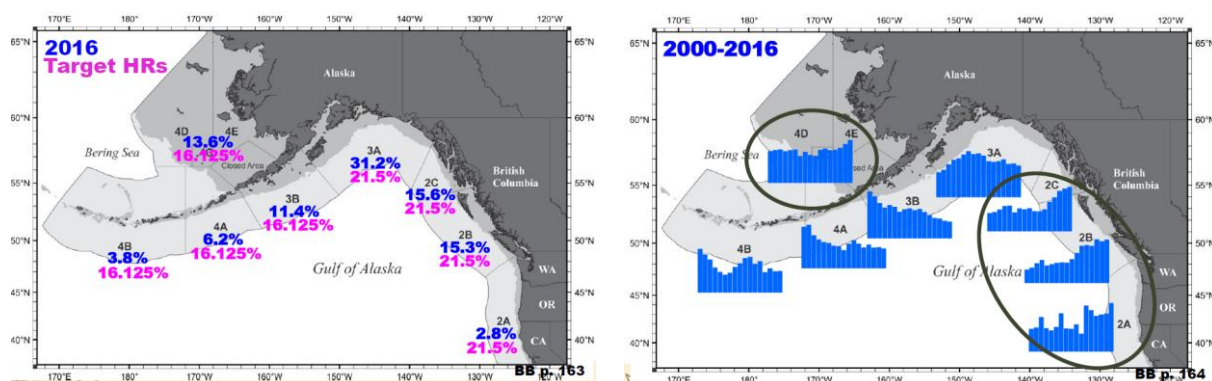


The Halibut Act does not define “overfishing” or require that an overfishing limit be defined. However, the halibut stock is currently managed conservatively, in a manner that is not likely to result in a chronic long term decline in the halibut resource due to fishing mortality (from all sources of removals).

The current level of spawning biomass for halibut is estimated to be 43 percent of the equilibrium condition in the absence of fishing ($B_{43\%}$), with a 1 out of 10 chance that the stock is below $B_{30\%}$. The IPHC’s harvest policy sets a threshold reference point of $B_{30\%}$ and the limit reference point of $B_{20\%}$ as triggers of reductions in halibut harvest rates. Generally speaking, the current harvest rates are considered risk-averse and safe relative to short or long term halibut resource sustainability.

The IPHC’s harvest policy is based on the exploitable biomass of halibut, or fish that are accessible in the IPHC setline survey and to the commercial halibut fishery (generally halibut over 26 inches in length (O26)). Spatial apportionment of the coastwide exploitable biomass, from the stock assessment, is estimated on the basis of the annual setline survey results. The adjacent figure illustrates the estimated distribution of the halibut stock greater than 32 inches in length (O32) across the IPHC regulatory areas. The observed distribution of the stock available to the directed fisheries in each year will reflect not only the historical fishing effort in each regulatory area, but also the interaction of recruitment distribution and movement rates.

Figure. Estimated distribution of the halibut stock for fish over 32 inches in length, by regulatory area for 2016, based on the IPHC setline survey weight per unit effort, and trends for 2000 to 2016.



3.3 Halibut Bycatch in Groundfish Fisheries

The Council manages the groundfish fisheries of the BSAI under the authority of the MSA and the BSAI FMP. National Standard 9 of the MSA requires that fishery conservation and management measures shall, to the extent practicable: (1) minimize bycatch; and (2) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. The Council and NMFS have established limits on removals of halibut, called halibut PSC limits to minimize halibut bycatch and bycatch mortality. Halibut PSC refers to the total bycatch mortality of halibut in the groundfish fisheries, based on discard mortality rates and catch, and described in terms of metric tons, round weight.

Regulations to control halibut PSC have been included in the BSAI FMP since its implementation over thirty years ago. Regulated measures that have reduced halibut bycatch include halibut PSC limits, seasonal and area allocations of groundfish quotas for selected target species, seasonal and year-round area closures, gear restrictions, careful release requirements, public reporting of individual bycatch rates, and gear modifications. Additionally, catch limits on groundfish in both the BSAI and GOA have been set well below the ABC levels due to halibut bycatch constraints.

PSC limits are managed to optimize total groundfish harvest within those PSC limits, taking into consideration the anticipated amounts of incidental halibut catch in each directed fishery. They are apportioned by target fishery, gear type, and season. Essentially, these limits provide an incentive for specific fisheries to operate in times and areas where the highest volume or highest value target groundfish species may be harvested with minimal halibut PSC. Reaching a PSC limit results in closure of an area or a groundfish directed fishery, even if some of the groundfish total allowable catch (TAC) for that fishery remains unharvested. The overall halibut PSC limits for trawl and non-trawl gear are set in regulation, and have been reduced several times since implementation in 1987 for domestic fisheries.

In the BSAI, halibut PSC limits were most recently reduced by Amendment 111, which became effective in May 2016. Amendment 111 reduced the PSC limits by 21% to 3,515 mt overall, apportioned as follows:

1,745 mt for the Amendment 80 sector (a 25% reduction)

745 mt for the BSAI trawl limited access sector (a 15% reduction)

710 mt for the non-trawl sector (a 15% reduction)

315 mt for the Western Alaska CDQ Program (a 20% reduction)

The limits are annually apportioned to specific fishery categories, for fisheries other than CDQ and Amendment 80, and may also be apportioned seasonally, through the annual groundfish harvest specifications process (guidelines are published in regulation at 50 CFR 679.21). When an annual or seasonal PSC limit is reached, all vessels fishing in that fishery category must stop fishing for the remainder of the year or season. The exception is for the PSC limit applying to the pollock/Atka mackerel/“other species” fishery category for trawl gear, where reaching the PSC limit does not result in closure of these fisheries.

In the GOA, halibut PSC limits were most recently reduced by Amendment 95, which became effective in 2013. This action reduced the GOA halibut trawl PSC limit by from 2000 mt to 1,705 mt, phased in over three years. PSC limits were reduced by 15% for the groundfish trawl gear sector and groundfish catcher vessel (CV) hook-and-line gear sector. PSC limits were reduced by 7 % for catcher processor (CP) hook and line gear, for an overall (CV/CP) hook and line limit of 256 mt overall. An additional halibut PSC limit of 9 mt is set for the demersal shelf rockfish fishery. The PSC limit for trawl gear is further

apportioned into shallow water groundfish and deepwater groundfish targets. The limits for both trawl and hook and line gear are apportioned seasonally.

Although by regulation, the non-trawl PSC limit could also be apportioned to vessels using pot gear, jig gear, or fishing in the hook-and-line sablefish IFQ fishery, in practice, the Council has chosen to exempt vessels fishing in these categories from halibut PSC limits, given the limited bycatch mortality associated with these fisheries.

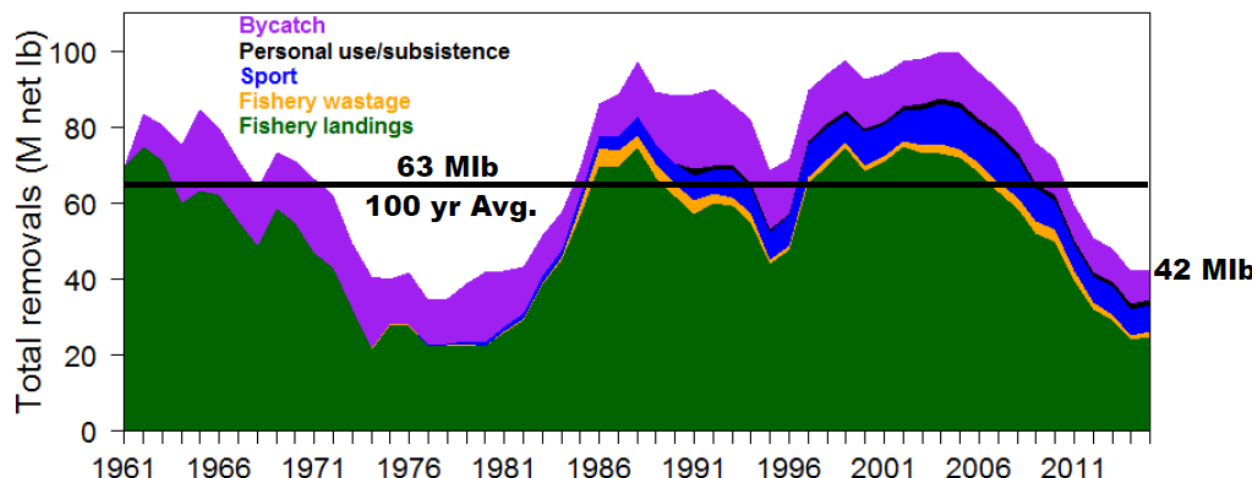
Halibut bycatch mortality in groundfish fisheries has been greatly reduced over time due to Council and NMFS regulations. Since the peak in 1992, under fully domestic fisheries, halibut bycatch in Alaska fisheries (in Areas 2C, 3A, 3B, and 4) had been reduced by nearly 60%, from 10,919 mt to 4,493 mt in 2015, while maintaining groundfish catches averaging 2,100,000 mt/year throughout the timeseries. Further reductions will occur in 2016 and beyond with implementation of Amendment 111.

Estimates (thousands of pounds, net weight and metric tons, round weight) of the bycatch mortality of Pacific halibut (*Hippoglossus stenolepis*) from all sources by IPHC regulatory area, since 1990. Estimates for 2015 are preliminary and subject to change as new information becomes available.

Year	Thousands of Pounds, net weight							Metric Tons, round weight						
	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	TOTAL	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4	TOTAL
1990	408	1,679	856	4,114	2,045	8,580	17,682	246	1,013	516	2,481	1,233	5,175	10,665
1991	408	1,992	733	4,843	1,671	10,022	19,669	246	1,202	442	2,921	1,008	6,045	11,864
1992	444	1,745	736	4,668	1,982	10,718	20,293	268	1,053	444	2,816	1,195	6,465	12,240
1993	444	1,661	742	4,291	1,062	7,764	15,964	268	1,002	448	2,588	641	4,683	9,629
1994	444	1,219	528	3,907	1,387	9,466	16,951	268	735	318	2,357	837	5,710	10,224
1995	614	1,522	348	2,963	1,760	8,726	15,933	370	918	210	1,787	1,062	5,263	9,610
1996	614	299	345	2,743	1,957	8,507	14,465	370	180	208	1,655	1,180	5,131	8,725
1997	614	215	397	2,965	1,443	7,880	13,514	370	130	239	1,788	870	4,753	8,151
1998	1,082	213	361	2,662	1,389	7,725	13,432	653	128	218	1,606	838	4,660	8,102
1999	987	193	358	2,885	1,737	7,684	13,844	595	116	216	1,740	1,048	4,635	8,350
2000	822	230	395	2,892	1,510	7,441	13,290	496	139	238	1,744	911	4,488	8,016
2001	837	177	341	3,009	1,675	7,120	13,159	505	107	206	1,815	1,010	4,295	7,937
2002	635	244	340	2,194	1,924	7,273	12,610	383	147	205	1,323	1,161	4,387	7,606
2003	256	244	341	3,180	1,734	6,822	12,577	154	147	206	1,918	1,046	4,115	7,586
2004	286	251	70	3,431	1,224	6,485	11,747	173	151	42	2,069	738	3,912	7,086
2005	535	346	50	2,978	1,076	7,432	12,417	322	209	30	1,796	649	4,483	7,490
2006	575	294	53	2,733	1,350	6,446	11,452	347	177	32	1,649	814	3,888	6,908
2007	386	320	62	2,599	1,065	6,872	11,304	233	193	37	1,567	642	4,145	6,818
2008	426	143	62	2,819	1,303	6,101	10,854	257	86	37	1,700	786	3,680	6,547
2009	514	213	48	2,481	1,247	6,037	10,540	310	128	29	1,496	752	3,642	6,357
2010	345	181	58	2,296	1,097	5,717	9,694	208	109	35	1,385	662	3,448	5,847
2011	102	232	49	2,488	1,120	4,472	8,463	62	140	30	1,501	675	2,697	5,104
2012	128	189	41	1,724	1,142	5,987	9,211	77	114	25	1,040	689	3,611	5,556
2013	65	225	34	1,630	887	5,989	8,831	39	136	21	983	535	3,613	5,326
2014	95	245	17	1,888	974	5,704	8,922	57	148	10	1,139	587	3,441	5,382
2015	95	337	12	1,967	731	4,648	7,789	57	203	7	1,186	441	2,803	4,698

Source: Williams, G.H. 2016. Incidental catch and mortality of Pacific halibut, 1962-2015. Int. Pac. Halibut Comm., Report of Assessment and Research Activities 2015:xxx.

Figure. Removals of halibut from different fisheries, 1960-2015.



4 Current Research and Management Issues

The Council and the IPHC identified a variety of research, management and data collection issues of interest at the joint meeting held in February 2015. Attachment 2 provides a summary of these issues and their current status. To further coordinate and collaborate halibut research and management with the IPHC, the Council could take the next step of reviewing and refining these issues as needed to determine prioritization of specific staff tasking or requesting analysis from other bodies such as the NMFS, AFSC and IPHC as necessary, and drafting a projected timeline for their completion or resolution. In essence the Council would develop a more explicit work plan in collaboration with NMFS and the IPHC for various halibut research and management issues that would inform the public and guide Council actions or recommendations (recognizing that many of these issues are directly, or indirectly, within the purview of the IPHC).

It's important to note that the Council may have close agreement with the IPHC on the pursuit and prioritization of some, but not all of the issues in Attachment 2, given the differences in overarching management objectives and responsibilities of the two bodies. For example, there may be close agreement on the need for developing an abundance based approach to halibut management (item #3), and perhaps how best to achieve it. On the other hand, the Council may choose to retain authority and responsibility for monitoring standards and programs for its fisheries, and determine how best to meet the IPHC's data needs within those programs through discussion, rather than jointly agreeing to all fisheries monitoring standards with the IPHC (item #15).

4.1 Gap Analysis for Council Decision-Making

As part of this Framework, it will be useful to consider the biological/scientific issues as well as those related more to management and policy, and identify those most important for the Council (and IPHC) decision-making process. Although there are many interesting scientific questions to ask about the life history and biology of halibut and how these features might respond to environmental change, as stated earlier a key element of this Framework is to identify those activities which are most critical for management decisions by the Council. A list of issues for which there are varying degrees of uncertainty, disagreement and/or misunderstanding is provided. Some of these additional priorities are much more policy and management decisions than representing a biological/scientific research issue.

- Migration of halibut between areas, and associated implications. Although there have been extensive tagging studies conducted by the IPHC, the only information on movement of young halibut to/from the Bering Sea is based on a small number of tags, and did not produce quantitative movement rates. The IPHC is developing explicitly spatial models, but these rates are an important source of uncertainty. Tagging of halibut on the NMFS Bering Sea trawl survey was begun in 2015 to establish whether migratory pathways observed in historical studies still indicate transfer from the Bering Sea to all other areas, however the sample sizes, and anticipated returns are unlikely to be large enough to produce quantitative movement rates. Movement rates (along with stock recruitment connectivity) are the primary drivers of how the management within each regulatory affects other areas. Additional information on movement patterns could help with the refinement of assessment models, and with the development of operating models for MSE, as the MSE is likely to be the primary tool for changes to the harvest policy.
- Discard mortality rates in all fisheries, as well as overall bycatch estimation in all fisheries (and associated observer sampling validity). There are two rate issues: 1) The weighted average and how the viability analysis is done; 2) The actual rates (e.g., 3.5% discard mortality rate that is applied to the excellent category in H&L) need to be updated. Over a million individual halibut are assumed to die due to bycatch mortality, and the discard mortality rates in H&L fisheries are all based on experiments conducted in 1958 and 1960 (Peltonen, 1969), where the base rate is 3.5%. The Council is in the process of evaluating modifying how halibut DMRs are established and will review a discussion paper in October 2016 to facilitate improvements in the DMR process. There are concerns with the uncertainty of bycatch magnitude estimates (particularly in the GOA) given observer coverage rates. Any changes in the estimation of halibut bycatch (mortality rates or magnitude) would have implications on the estimated mortality of halibut from the groundfish fisheries and thus the resulting amount available to the directed fishery. This work is already ongoing and depends heavily on observer coverage rates. The Council has also requested (February 2016) that this evaluation process include: 1) efforts to assess discard mortality rates in situ, including evaluation of sample sizes, data collection, and the use of advanced technology; 2) work to evaluate methods to reduce discard mortality (e.g. excluders, deck sorting); and, 3) efforts to improve information about what is actually being discarded in all fisheries(size, sex,age, maturity, release mortality rates (e.g. sport fishery), etc).
- Reconciliation of NMFS trawl survey abundance estimates with IPHC survey estimates: The IPHC uses the geographically extensive Bering Sea trawl survey data to supplement their setline survey data. This is of particular importance in the EBS where the setline survey covers only a portion of Area 4CDE on the shelf. A survey calibration experiment was conducted in 2006 and has been used as the link between the setline survey and the time series from the NMFS trawl survey data. This NMFS survey covers 68% of the total Area 4CDE bottom area and any change in the inter-calibration of the indices could affect the Area 4CDE index series. This would in turn affect the area's apportioned share of the coastwide biomass. This survey was repeated in 2015 using similar methods as used in 2006. The apportionment estimates produced in 2015 will reflect the updated calibration experiment as well as the newest data from both surveys. Survey results will be released to the public at the IPHC interim meeting on December 1-2, 2015. There is some interest in using the EBS survey as the abundance index for setting annual PSC limits. There is a negative relationship between this index and estimates of recruitment from the IPHC stock assessment model (lagged over any number of years). Additional research to address this would be useful for evaluation of abundance-based PSC limits and evaluation of bycatch and directed fisheries.

- Effect of BSAI bycatch on downstream direct harvests, in light of uncertainty about abundance and movement and treatment of different sized halibut: This issue addresses resolving the estimation and implications of bycatch impacts on directed harvests in both the BSAI/GOA as well as between Canadian and U.S. harvests. The default assumption is that all BSAI PSC mortality, had it not occurred, would have become available to the halibut fishery (after accounting for growth and mortality). However, there is considerable uncertainty and apparent variability in processes related to the EBS halibut including movement, natural mortality, and survey catchability. Environmental conditions likely play a role in both the survival of young-of-year halibut as well as their distribution and propensity for directed movement. Projects addressing these types of questions are underway at IPHC and remain priorities for research.
- Impacts of short term, medium term, and long term changes in the environment relative to key aspects of halibut life history: As with uncertainty in environmental conditions listed above, this priority relates to environmental conditions that could impact changes in halibut size-at-age specifically and the extent harvest policy might best change. The IPHC's current harvest policy is based on analyses that includes both environmentally driven changes in recruitment as well as changes in size-at-age, but needs revisiting. The current Management Strategy Evaluation process is exploring the effects of such environmentally driven factors, and uncertainty, on harvest policy. The use of SPR-based reference points, could be used to adequately reflect the current size-at-age but still requires plausible hypotheses about how it may change in the future. This research priority will inform better understanding of environmental impacts on size at age, and may provide management/policy changes in harvest policies.
- Natural mortality variability with age/size/sex/density, to understand the effects of bycatch, wastage, and discards on the spawning biomass and harvestable biomass. Differential natural mortality would have implications for estimating the impact of bycatch on overall population and spawning biomass. For example, if natural mortality rates are very high for young halibut and bycatch by the trawl industry is primarily on young halibut, then the implications for the impact to the directed fishery is lower than under the currently assumed (relatively low) natural mortality rate. However, if the rates are lower than currently assumed for those age classes then the overall impact of trawl bycatch on the directed fishery would be higher. Estimating natural mortality rates is challenging in general, extending to estimate age or size-dependent rates would be even more difficult. In lieu of these issues, evaluating the sensitivity of impacts over plausible ranges of M values by size could help assess the relative risks. Obtaining reliable estimates of variability in natural mortality with age/size/sex/density will likely be difficult, even if given a high priority for research. The Council acknowledges the SSC statements regarding how difficult it is to estimate age-specific natural mortality rates, and that this research priority may not be cost-effective, prudent, or appropriate to pursue. The IPHC has expressed a similar position in this regard. Therefore, this is presumed to be a lower priority than the others listed in this Framework document.
- An integrated decision-making framework that addresses biological, economic, and social issues as identified by the June 2015 SSC minutes. Note that explicit language of an 'integrated decision-making framework' is not in the SSC's minutes from June 2015. The SSC did, however, recommend a 'horizon-based programmatic evaluation for action performance' and that scientific work to support such a review be initiated to identify critical data gaps. However, this comment appears to be specifically in the context of the Council's June 2015 BSAI halibut PSC reduction action. The SSC also indicated that issues of declining size- and weight-at-age on halibut exploitable biomass in the BSAI are not well understood but 'critical for identifying a long-term solution to the halibut PSC reduction effort'. In discussions with individual SSC

members and inferring from SSC minutes, it appears that some sort of framework is envisioned which would be developed to provide a holistic approach to bycatch reduction considering the direct effects on the stock, the industry, communities and other stakeholders and that such an integrated framework could be used to help design appropriate management measures for consideration by the Council. A proposal along these lines has apparently been funded through the Saltonstall-Kennedy Grant Program.

- Development of abundance based approaches to management, in particular Dr. Martell's MPR approach, and implications for Council and IPHC decision making: Such an approach may propose some form of catch share decision framework in allocation between bycatch and directed removals which would involve decision making by both the Council and IPHC. A discussion paper is being prepared for the December 2015 Council meeting on this topic. Approaches to be outlined in the paper include: 1) tradeoffs and how they are affected by fixed PSC limits versus abundance based limits; 2) Alternative harvest control rules for setting abundance based PSC limits; 3) What should be used for an abundance index in the BSAI PSC limit calculations; 4) How the incentive landscape differs under allocations based on yield versus spawning capital; 5) Yield equivalence, bycatch compared with yield in the directed fisheries and how this relationship changes with changes in harvest policy. While this is a management initiative and policy-level decision, rather than a research issue per se, it is currently listed within the suite of research issues.

This list of issues is based on the views expressed by many stakeholders, managers, Council members and others during numerous Council meetings, as well as the February 2015 Joint meeting with the IPHC. The intent is to highlight areas of scientific uncertainty and disagreement that affect Council decision making. Public review of these issues may inform the Council about relative priorities, plans for further work by NMFS, ADF&G, and the IPHC, and whether there are other issues to add. For those issues over which there is extensive disagreement or uncertainty, but which have significant implications for halibut management by the Council, the peer review process may at some point in time provide an avenue for resolution. The Council may also wish to assess these issues in the context of fisheries management objectives and annual research priorities for the groundfish and halibut fisheries, in consultation with NMFS/AFSC, ADF&G and the IPHC.

4.2 Research Priorities

The Council has identified the following as research priorities:

- **Development of the technical methods to index PSC limits to abundance**, including evaluation of potential ecosystem-level impacts of alternative methods to index halibut PSC limits based on yield or spawning potential.
Note: Council reviewed Martell discussion paper and established interagency staff workgroup to further pursue this and other approaches abundance-based PSC management, with a report in October 2016.
- **Migration of halibut between areas** and associated implications for management decisions.
Note: The Council encourages industry to work with the AFSC or other appropriate agencies/organizations to consider development of collaborative research and tagging programs (i.e., wire, PIT or CWT) which could produce important information on halibut movement and the relationship between viability and discard mortality in the near term.
- **Discard mortality rates** in all fisheries, as well as overall bycatch estimation in all fisheries.

Note: An interagency staff working group, in coordination with the groundfish Plan Teams, is developing a discussion paper/preliminary analysis for Council review in October 2016.

- **An integrated decision-making framework** that addresses biological, economic, and social issues. *Note: This item was identified based in part upon comments from the June 2015 SSC report on the BSAI halibut bycatch agenda item, and may be further specified through pending research grants from S-K or other funding sources.*
- **Impacts of short term, medium term, and long term changes in the environment on key aspects of halibut life history**, including factors potentially affecting size-at-age (prey abundance, competition with other species, fishing, and other factors).
Note: This item is identified in the gap analysis and was added to the research priority list in February 2016.

4.3 Other Research Projects

In addition to identifying the key scientific questions that affect Council and IPHC decision making, currently there are ongoing halibut related research projects conducted by the AFSC, and the IPHC, as described in Attachments 3 and 4. These projects are cataloged with other research/science issues within the Framework to inform stakeholders of the extent of halibut related research, even if they are not addressing the most immediately critical management or science questions.

5 Coordination and Communication with the IPHC

The Council will periodically review the manner and the schedule by which it formally and informally communicates with the IPHC, to determine if there is additional information or times during the year or types of communications that would foster improved coordination and collaboration. The main instrument for communicating to the IPHC has been through a management report (which includes recommendations for charter halibut management measures), prior to the IPHC's annual meeting. It should be noted that documents for the annual IPHC meeting that occurs in January are typically not available for review and comment by the Council in December. However, the Council could still consider providing additional information about halibut management activities, make recommendations to the IPHC regarding management proposals or other aspects of the IPHC's stock assessment review and catch limit setting process when appropriate. For example, the Council could provide comments on such issues as improving abundance estimates of halibut in the BSAI, or the effect of lowering the 32" size limit on stock biomass. The extent to which the Council provides additional information and comment to the IPHC should be governed by the goal of improving coordination and collaboration, for the purpose of achieving management objectives of the respective bodies. The Council also provides recommendations and comments directly to the US Commissioners to the IPHC, which focus more specifically on issues that are relevant to broader US domestic fishery management objectives.

In many ways, the Council and the Commission have a very similar decision making process. Both the NPFMC and IPHC base decisions on scientific analyses prepared by professional staff, receive scientific and management advice from advisory bodies, and take public input through oral and written public testimony. Additionally, the management authority and responsibility for both the IPHC and NPFMC is set forth in statute, and both bodies provide recommendations to the Federal government for approval and implementation. The Council makes recommendations to the Secretary of Commerce, and the Commission to the US Government through the Secretary of Commerce and Secretary of State and to the Canadian Government through Department of Fisheries and Oceans and the Department of Foreign Affairs and Trade Development.

5.1 Process to Receive Public Input

Council: The Council receives public input through both written and oral comments at every stage in the process. Written comments are received via mail and email (npfmc.comments@noaa.gov), and those received by the published deadline are included in the meeting briefing materials. The comments must identify the submitter by legal name, affiliation, and date, and must also identify the specific agenda item by number (C1 for example). Persons may also provide written comment if and when they provide oral testimony. Public testimony is taken on each separate agenda item, following staff report and SSC and AP reports, before the Council begins its deliberations on that agenda item. Sign-up sheets are available at the registration table for those wishing to provide public comments on a specific agenda item. Groups and associations are given six minutes and individuals and businesses are allowed three minutes for their testimony. These meetings in their entirety (with the exception of executive sessions) are also webcast. The Council's statement of organization, practices, and procedures is here: <http://www.npfmc.org/wp-content/PDFdocuments/membership/SOPPs412.pdf>

Public testimony is taken in a similar fashion at the SSC and AP meetings. Members of the public wishing to testify before the AP or SSC are called for after staff reports on a given agenda item. Sign-up sheets are provided in a special notebook located at the back of the room. The time available for individual and group testimony will be based on the number registered and determined by the SSC or AP Chairman.

At Plan Team meetings, the public is generally allowed to interact in a more informal manner throughout the discussions. Public comment is also normally allowed at all meetings of the Councils standing and ad hoc committee meetings and limited at the discretion of the committee chair.

Commission: The Commission moved to a more public meeting format in 2014. All of the staff presentations and discussion are open to public attendance, and public sessions are also webcast for those unable to attend in person. The executive sessions and finance and administration sessions are not open to the public. The webcast recordings and the meeting presentations are posted on the website following the meeting. The Commission takes public comments and questions from the audience as directed by the Chair. The Commission rules of procedure are here: http://www.iphc.int/documents/admin/IPHC_Rules_of_Procedure_Sept_2014.pdf

Meetings of the Conference Board and Processor Advisory Group (PAG) are open to the public, and oral public comment can also be taken at the discretion of the Chairs. Written statements also may be submitted prior to the meeting. There is no public participation or comment period at meetings of the Management Strategy Advisory Board (MSAB) or Scientific Review Board (SRB).

Both the Council and Commission have industry advisory groups that provide an opportunity for fishermen and other industry participants to give advice on matters to the decision-makers. A summary of these groups is provided in this section.

Council Management Advisory Groups

The **Advisory Panel** (AP/FIAC) is appointed by the Council and is composed of 20 or so recognized experts from the fishing industry and several related fields, and which represents a variety of gear types, industry and related interests as well as a spread of geographic regions of Alaska and the Pacific Northwest having major interest in the fisheries off Alaska. The Council relies on the AP for comprehensive advice on how various fishery management alternatives will affect the industry and local

economies, as well as ways to address potential conflicts between user groups of a given fishery resource or area. Halibut stakeholders are well represented on the Advisory Panel (including 9 halibut IFQ fishermen/representatives, 2 CDQ halibut fishermen/representatives, 1 charter halibut representative, and 5 representatives from the different groundfish harvesting and processing sectors that are directly limited by halibut bycatch caps).

The Council also has several Standing Committees and Ad Hoc Committees that may include voting or non-voting Council members and knowledgeable members of the public. The Council Chair may also appoint standing or ad hoc Committees that include only industry representatives or other participants to address specific management issues or programs.

Relative to management of halibut fisheries, the **Halibut Management Committee**, a new committee consisting of three US IPHC Commissioners and three Council members, will allow better alignment of internal US halibut management interests within the Council process, through the Halibut Management Framework strategic planning document. The Committee will also serve to improve communication and coordination of management and research activities with the IPHC, so that each body can support the other in fulfilling its respective mission.

Other committees that provide halibut management related advice include the Electronic Monitoring Workgroup and Observer Advisory Committee that provide advice to the Council on comprehensive fishery monitoring, including the halibut fishery. The Charter Management Implementation Committee and the IFQ Committee provides advice on management changes for the charter halibut and directed halibut fisheries, respectively. A Sablefish Gear Committee provides advice on the development of a sablefish pot fishery, particularly with respect to interactions with a directed halibut longline fishery and retention of halibut in sablefish pots. A Recreational Quota Entity Committee has been appointed to provide recommendations on development of a new GAF quota pool/bank for halibut funded by charter fishermen. The Enforcement Committee provides advice to the Council on developing proposals and programs relative to enforcement of regulations.

IPHC Management Advisory Groups

The **Conference Board** is an IPHC advisory panel created by the Commission in 1931 to obtain advice and recommendations from halibut harvesters on conservation measures and halibut management. The Board also reviews staff reports and recommendations and provides its advice concerning these items to the Commission at its Annual Meeting, or on other occasions as requested. The Board is self-regulating in terms of membership and in 2013 there were 64 voting members. Its members are designated by unions, vessel owner organizations, and associations of harvesters throughout the halibut range and include commercial, sport, and tribal interests. The Conference Board rules of procedure are here: http://www.iphc.info/Public%20Docs/CB_ROP_January2015.pdf

The **Processor Advisory Group** is an IPHC advisory panel representing the Canadian and United States processing industry to advise the Commission on issues related to the management of halibut resources. Since 1995 the PAG has provided comprehensive industry advice on potential conflicts within a given fishery resource or area, as well as potential resolutions related to current or future issues. The Halibut Association of North America (HANA) continues to serve as the PAG's organizational, administrative, communications, and recruitment facilitator, and is also responsible for creating and distributing the PAG's annual report. Any company or association, including sole-proprietorships, corporation, or partnerships whose direct business is purchasing, processing and selling Pacific Halibut caught in Alaska, British Columbia, Washington, Oregon, or California is eligible for PAG membership. There were 20

members present at the 2015 meeting. The PAG rules of procedure are here:
http://www.iphc.info/PAG%20Documents/PAG_ROP_Sept2014.pdf

In 2013, the Commission formed a **Management Strategy Advisory Board (MSAB)** to oversee the development of a Management Strategy Evaluation (MSE) process and to advise the Commission and Staff on the development and evaluation of candidate objectives and strategies for managing the fishery. The MSE process will help the Commission develop and thoroughly test alternative management procedures, prior to actually implementing any management changes for the fishery. The Commission selected a Board of 15 official and 8 ex-officio members representing viewpoints from commercial, sport, processing, Tribal/First Nations, and Fisheries Councils and managers. The MSAB has met several times since 2013, and the information is available here: <http://www.iphc.info/Pages/msab.aspx>

Lastly, the IPHC also has a **Research Advisory Board** to provide the Commission with insight on research issues of concern to the halibut industry. It is composed of any harvester or processor interested in contributing. The RAB normally reports to the Commission at its annual meeting.

5.2 Process to Review Scientific Information

Council Science Review Groups

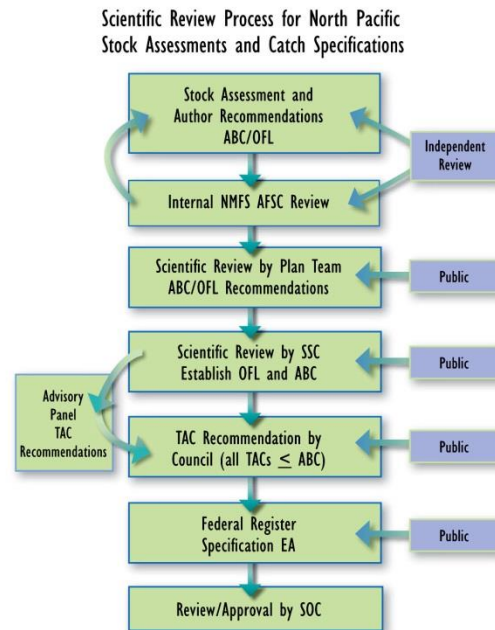
Plan Teams are appointed by the Council for each of the major fishery management plans (FMPs). Members of each team are selected from those agencies and organizations and universities having a role in the research and/or management of fisheries. Appointments to the team are made by the Council with recommendations from the SSC. The Plan Teams review stock assessment information and assist in the preparation of the annual Stock Assessment and Fishery Evaluation (SAFE) documents including formulation of recommendations on annual Acceptable Biological Catch (ABC) levels for groundfish, crab, and scallop species under jurisdiction of the Council. The Teams may also assist in preparation and/or review of analytical documents for the Council, SSC and AP, evaluate the effectiveness of management measures in achieving the plan's objectives, and make recommendations to the Council.

The Council's **Scientific and Statistical Committee (SSC)** provides peer review of scientific analyses that form the foundation of decision making by the Council, as well as establishes the annual catch limits for FMP fisheries. The structure of the SSC and its peer review procedures are established in the NPFMC Statement of Organization, Practices, and Procedures. The SSC currently consists of 16 members from a variety of disciplines: fisheries ecology and population dynamics, fisheries economics, marine affairs and social anthropology, and seabirds and marine mammal specialists. The SSC normally meets five times per year and where possible, in the same hotel as the Council and its Advisory Panel. The SSC convenes for 3 days (typically Monday through Wednesday), fully concurrent with the Advisory Panel meeting and overlapping with the Council meeting on the third day.

The primary functions of the SSC are: 1) to provide peer review of biological and economic analyses prepared for Council decision making, and 2) to establish annual catch limits for groundfish stocks. Additionally, the SSC provides guidance to the Council on data collection programs and provides other ongoing scientific advice, prepares comments on national standard guidelines and biological opinions, and develops 5-year research priorities. Lastly, the SSC serves as the peer review body for influential scientific information pursuant to the Information Quality Act.

Approximately three weeks before the meeting, SSC members receive notice from the Council office that analyses are ready for review and posted on the Council's website. At this point, the SSC Chair assigns 2-3 members to be leads for each particular agenda item. The leads are responsible for understanding the details of the analysis, leading the SSC discussion and deliberation of the issue, and preparing the first draft of the written summary of the deliberations and SSC recommendations. At the meeting, the process begins with a presentation of the issue by staff, and clarification questions are asked by SSC members. Public testimony is taken, followed by SSC deliberation. The Chair summarizes the SSC comments, and a written summary is prepared and reviewed by the full SSC the first thing in the morning the following day (or later in the day for agenda items on the last day of the meeting).

The SSC reviews all technical analyses for proposed plan or regulatory amendments to ensure that the best available scientific information is provided for public comment and final decision-making. In reviewing any analysis, the SSC focuses on appropriateness of the input data, methodology applied, and conclusions drawn. The SSC provides comments and recommendations to the analyst to improve the analysis. The SSC also makes a recommendation to the Council as to its adequacy; i.e., whether or not the analysis is ready to be released for public review. When an analysis is deemed deficient and major revisions are required, the SSC will recommend that the analysis not be released, with the expectation that a revised analysis will be reviewed by the SSC for adequacy at a subsequent meeting.



Flow chart depicting the scientific review process for stock assessments and establishment of catch specifications in the North Pacific region. Catch specifications include the overfishing level (OFL), the acceptable biological catch level (ABC), and total allowable catch limits (TAC), where $TAC < ABC < OFL$.

Scientific review of stock assessments begins with a review by the Plan Teams, who consist of biologists, economists, and fishery managers from the federal and state fisheries agencies as well as university academics. The SSC provides the final level of peer review for stock assessments, and sets the annual overfishing level (OFL) and Acceptable Biological Catch levels.

The SSC provides both oral and written reports to the Council. The written report reflects the general consensus of the SSC. The draft minutes are finalized at the conclusion of the SSC meeting, and are copied and distributed to the Council and public when completed, and posted on the website: <http://www.npfmc.org/meeting-minutes/>. The oral report to the Council is given by the SSC Chair (or designee) for each individual agenda item, following the staff summary of the analysis, and prior to public testimony. Usually, there are questions from the Council regarding the SSC deliberations or recommendations. Due to lengthy Council meetings, and in consideration of the SSC Chair, the Council may take the remainder of the oral SSC report well before the Council addresses all of its agenda items.

IPHC Science Review Groups

At the 2013 Annual Meeting, the International Pacific Halibut Commission approved the formation of a **Scientific Review Board (SRB)** to provide an independent scientific review of Commission science products and programs, and to support and strengthen the stock assessment process. In the near term, this standing peer review process is expected to focus on a review of the annual stock assessment model and harvest policy prepared by the IPHC staff. Over time, this emphasis will shift to a broader review of

scientific programs, including outputs from the Research Advisory Board and the Management Strategy Advisory Board, in addition to the annual stock assessment results and advice. The SRB will also conduct other key reviews as directed by the Commission, on topics such as research plans, updates and changes to survey methodology, and white papers on selected critical issues.

The SRB currently consists of three independent fisheries science experts approved by the Commission, listed below. Two more members will be added over the next two years to bring the Board up to a full complement of five. The SRB members' terms will be staggered in order to facilitate continuity while regularly bringing in fresh scientific viewpoints.

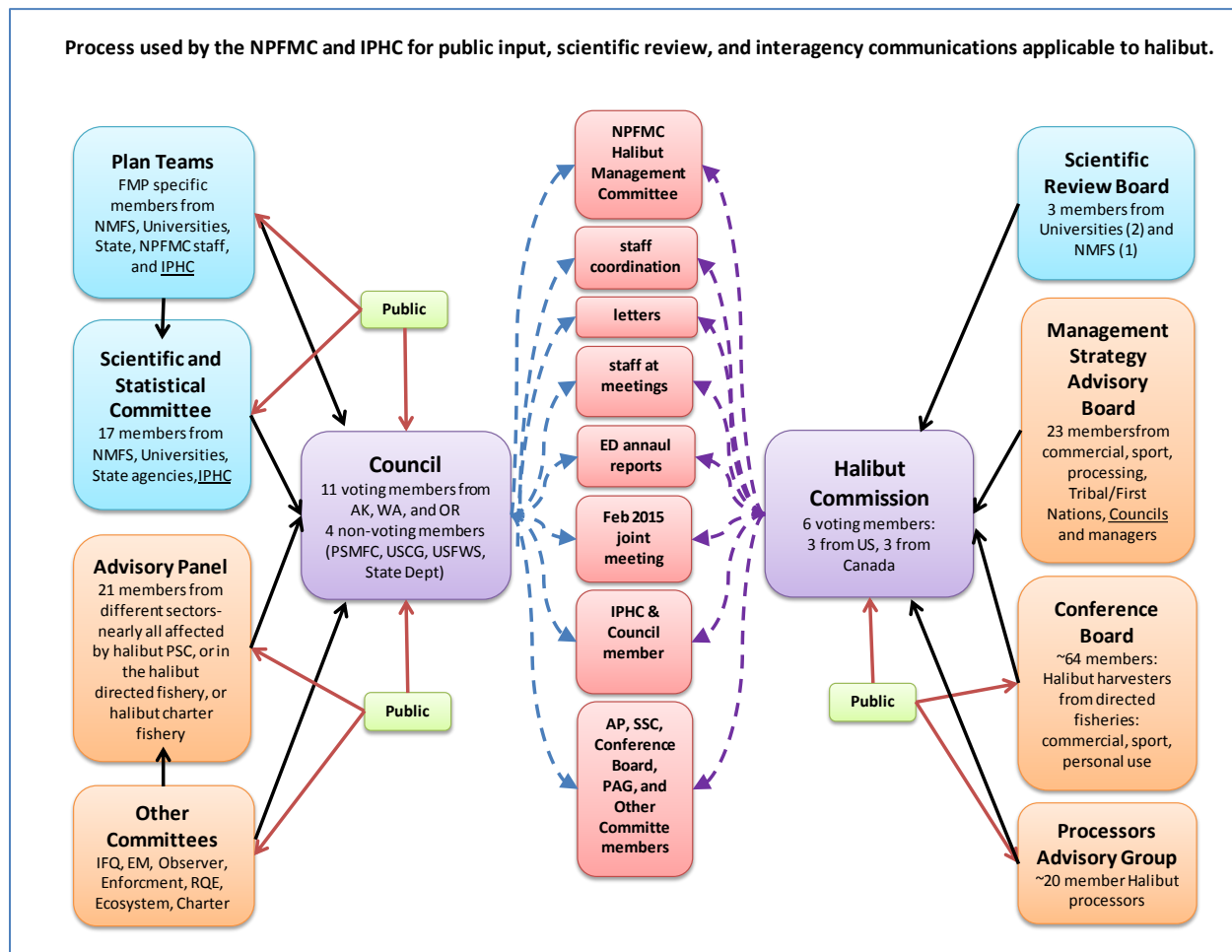
The three current SRB members are: Dr. Sean Cox is Associate Professor of Fisheries Science and Management at Simon Fraser University, and is a fisheries scientist focusing on aquatic conservation and management of human impacts on aquatic ecosystems. Dr. James Ianelli is a senior assessment scientist at the NOAA Fisheries Alaska Fishery Science Center, where he is an active member of the Center's stock assessment team and has authored numerous analytical documents applied to the management of important groundfish species in the North Pacific. Dr. Marc Mangel is Distinguished Research Professor of Mathematical Biology at the University of California Santa Cruz and Director of the Center for Stock Assessment Research, which is a joint training program between UCSC and the NOAA Fisheries Laboratory in Santa Cruz where students and post-doctoral colleagues learn the quantitative methods needed for ecosystem-based fishery management.

The SRB has been meeting three times per year (June, October, and December), and provides an oral report to the Commission at its annual meeting. Summaries of the most recent meetings, results, and announcements, along with notices of upcoming meetings are posted on its webpage:

<http://www.iphc.info/Pages/Previous-SRB-Meetings.aspx>

5.3 Process for Council and IPHC Communication

The figure below illustrates the process for public input and advisory body recommendations to the Council and IPHC, as well as the current ways the Council and Commission exchange information and advice.



The existing means to formally exchange information include:

Halibut Management Committee: In December 2015, the Council established a new committee consisting of three US IPHC Commissioners and three Council members to better align internal US halibut management interests within the Council process, through the Halibut Management Framework strategic planning document. The Council has also identified a need to improve communication and coordination of management and research activities with the IPHC, so that each body can support the other in fulfilling its respective mission. The purpose of the Council's Halibut Management Committee can best be described as pursuing these two areas of work or discussion, to inform both the full Council and the IPHC.

Staff Coordination: Staff from both the IPHC and Council work together on analytical issues. For example, Council staff contributed to the the IPHCs Halibut Byatch Working Group. Similarly, IPHC staff has contributed data and anlysis of proposed management actions (e.g., BSAI halibut bycatch amendment, analysis of DMRs).

Agency Letters: Formal recommendations and information from either body are communicated in writing via official letters. For example, the Council prepares an annual letter to the Commission on annual management changes for the IFQ and charter halibut fishery regulations, as well as any initiatives related to halibut bycatch in groundfish fisheries.

Meeting Attendance by members and staff: The IPHC Executive Director and/or another IPHC staff person normally attends Council meetings when halibut issues are discussed, and are frequently brought to the table to provide clarifications regarding halibut assessments or management issues. Additionally, other members of the Commission frequently attend Council meetings. Similarly, the Council Executive Director and other Council staff normally attends the IPHC meetings, also to present Council viewpoints and address questions to assist the Commission with its decision-making. Several Council members\, including the Chair, have also started to attend IPHC meetings. And lastly, the NMFS staff also provide a nexus for interagency communications by the IPHC and NPFMC by attending meetings of both groups.

The Council has expressed a desire to have a staff member specifically dedicated to halibut issues. At this time, due to limitations on staff resources, halibut related issues are divided among available staff, but are coordinated overall by the Executive Director.

Annual Reports to Council and Commission: The IPHC Executive Director provides an official agency report to the Council at each February Council meeting. This report usually covers the status of the stock, reviews the Commission decisions for annual catch limits, and provides a summary of ongoing research and management concerns. Similarly, the Council Executive Director presents the annual management letter issues to the Commission at its interim and annual meetings.

Joint Meetings of the IPHC and NPFMC: The Council has met formally with the IPHC only infrequently (i.e., October 1998, October 1999, and February 2015). In February 2015, the Council and Commission met for a day-long meeting in Seattle, in conjunction with the Council meeting that week. The objectives of the meeting were to gain a better understanding of the respective authorities and responsibilities of the respective management bodies, to facilitate improved communications, and to facilitate a more collaborative approach to overall management of the halibut resources, including objectives relative to management of both the directed fisheries and Council managed fisheries which take halibut as bycatch. The meeting was well attended and public comment was received from nearly 40 persons. The discussions between the Council and the IPHC Commissioners resulted in the identification of a number of common themes, as well as identification of several items for future analysis and consideration. While a formal schedule for future joint meetings was not identified, it was agreed that future collaboration on these issues will be beneficial to both management bodies.

Under the auspices of this Framework, the Council has also pursued the potential establishment of Joint Protocol committee with the IPHC, similar to that with the Alaska Board of Fish. After further discussions, and communication with the IPHC, it was determined that a Joint Protocol committee would not provide substantial marginal benefit to the process; rather, it will be more useful for the Council and IPHC to meet in full when it is mutually agreed to be an appropriate time for such joint meeting.

NPFMC Member and IPHC Commissioner: The Northern Pacific Halibut Act¹ specifies that one of the IPHC Commissioners must be a voting member of the Council.² The NMFS Regional Director is both a

¹ <http://legcounsel.house.gov/Comps/Northern%20Pacific%20Halibut%20Act%20Of%201982.pdf>

² Of the Commissioners— (1) one shall be an official of the National Oceanic and Atmospheric Administration; and (2) two shall be knowledgeable or experienced concerning the Northern Pacific halibut fishery; of these, one shall be a resident of Alaska and the other shall be a nonresident of Alaska. Of the three commissioners

Council and a U.S. Commissioner on the IPHC. As such, he is able to represent the interests of each body during meetings, is knowledgeable about the process and current management issues being addressed, and thus provides a primary mechanism for communication across the two management bodies.

Shared membership and participation on many committees: Many people are involved in both the Council and Commission process. For example, there is an IPHC staff person on the SSC and Groundfish Plan Teams. Some AP and other Council committee members (or their companies or associations) also sit on the PAG or Conference Board. Two IPHC commissioners are members of the Councils IFQ committee and IPHC staff assist the EM Workgroup. And the Council chair is a member of the IPHCs MSAB. These are just a few examples of overlapping membership.

6 Ongoing Activities by the Council, Committees, Stakeholder Groups

As discussed in section 5, there are a number of other ongoing activities and initiatives in the Council (and the IPHC) process that are related to halibut management. Most of them will likely be informed by the critical scientific and management questions in the framework. For example, the Council depends on stakeholder committees for detailed review and recommendation regarding management programs and activities as well as research priorities related to the management of groundfish and shellfish.

6.1 Committees and Stakeholder Groups

The Council has a number of halibut related stakeholder committees and initiatives, organized to provide recommendations or reports to the Council on management programs and issues, that are likely to be informed by the work described in this outline of the Framework. The Council depends on these stakeholder groups for detailed review and recommendation on regulatory and FMP amendments, as well as problem solving. In some cases, the Council's approach has been to delegate some responsibility for achieving management objectives to sectors, particularly those operating within cooperatives, with specific guidance and direction. The halibut management Framework intends to describe or identify these groups and their roles, and the Council may consider how best to task them in addressing various halibut management issues as they arise. They include:

- The BSAI AM80 Cooperatives. As part of the annual cooperative reports, the Council has requested the AM80 cooperatives provide halibut bycatch management plans to minimize bycatch and bycatch mortality (with numerous specific reporting provisions).
- IFQ Committee. The committee would be informed by, and could comment and review, or develop IFQ program changes generated by other actions within the halibut management framework. (For example, DMRs, 32" size limits). The committee could also have a role in the upcoming IFQ Programmatic Review and any possible IFQ program changes that may develop from that review.
- Charter Halibut Management Committee. While the task of this group is to recommend annual management measures for the charter sector, they would also be informed by other actions within the halibut management framework
- CATCH Committee. As it reviews and comments on the proposed CATCH program, this Committee will also be informed by actions in the framework.

described in paragraphs (1) and (2), one shall be a voting member of the North Pacific Fishery Management Council. Also, the Secretary of State, in consultation with the Secretary, may designate from time to time alternate United States Commissioners to the Commission. An Alternate United States Commissioner may exercise, at any meeting of the Commission, all powers and duties of a United States Commissioner in the absence of a duly designated Commissioner for whatever reason.

- Council's Rural Outreach Committee. This committee could have relevance in context of community and subsistence related concerns.
- Voluntary reporting of halibut bycatch avoidance by different groundfish sectors, as requested by the Council. Future requests for reporting are likely to depend on progress or outcomes of different parts of the framework.

6.2 Other Activities Within the Council Process

- Council initiation of discussion paper to allow CDQ entities to lease halibut IFQ in Areas 4B and 4CDE in years with low directed harvest quotas.
- Halibut/sablefish IFQ program review (as mandated by the MSA) – Council is scheduled to review the outline/workplan for this review at its December 2015 meeting.
- Halibut deck sorting EFPs intended to facilitate timely release and reduce bycatch mortality – could result in regulatory action to allow deck sorting.
- Development and implementation of EM for the small boat longline fleet to meet fishery monitoring objectives.
- Review of pending information on 2015 groundfish fisheries halibut bycatch performance.
- Council action to develop and establish a Social Science Plan Team, which may identify and summarize information on human dimensions for inclusion in the SAFE documents as well as for use in policy analysis.
- Council initiation of a discussion paper to evaluate potential ways to create an abundance-based PSC limit for BSAI groundfish fisheries.
- Evaluation of data to refine estimates of discard mortality rates (DMRs) for the different groundfish fisheries.

ATTACHMENT 1. Groundfish Management Objectives Related to Halibut (bycatch)

The Groundfish Programmatic SEIS establishes a suite of 45 management objectives (46 for BSAI) for both groundfish FMPs within the context of 10 broad management goals. There are no “halibut bycatch management objectives”, per se, in the FMPs, however, many of the objectives connect directly or indirectly to the Council’s current concerns related to halibut bycatch. By identifying management objectives, the Council recognizes and communicates specific avenues of action that it may explore in the fulfillment of the goals. For example, Objective 14, “Continue and improve current incidental catch and bycatch management program” indicates a commitment to existing bycatch reduction efforts as well as the potential to enhance and improve those efforts as necessary should the Council identify a need for additional bycatch reductions above what is currently being accomplished. Other management objectives are less directly connected to bycatch concerns, but indirectly reflect the larger context which the Council will consider when taking actions. For example, Objective 7: “Promote management measures that, while meeting conservation objectives, are also designed to avoid significant disruption of existing social and economic structures” recognizes both the primacy of conservation obligations and the need for balance with regard to potential social and economic outcomes of conservation efforts. Still other management objectives address issues separated by multiple linkages from the issue of halibut bycatch, for example “safety at sea” and are, therefore minimally connected to halibut bycatch. The table below contains the complete list of BSAI and GOA management objectives with comments added as to whether the objectives may directly, indirectly or minimally connect to the issue of halibut bycatch.

Beyond the umbrella of the groundfish FMPs’ management objectives, several specific management measures are identified in the FMPs that do name halibut and address mechanisms by which halibut bycatch reduction in particular can be strengthened:

Prohibited Species. Pacific halibut is identified among the FMPs’ “ecosystem components” and within that category as “prohibited species”. Prohibited Species are those species and species groups the catch of which must be avoided while fishing for groundfish, and which must be returned to sea with a minimum of injury except when their retention is required or authorized by other applicable law (see also Prohibited Species Donation Program).

Prohibited Species Catch Limits. When a target fishery, as specified in regulations implementing the FMP, attains a prohibited species catch (PSC) limit apportionment or seasonal allocation as described in the FMP (Section 3.6.2) and specified in regulation implementing the FMP, the bycatch zone(s) or management area(s) to which the PSC limit apportionment or seasonal allocation applies (described in Section 3.6.2.2) will be closed to that target fishery (or components thereof) for the remainder of the year or season, whichever is applicable.

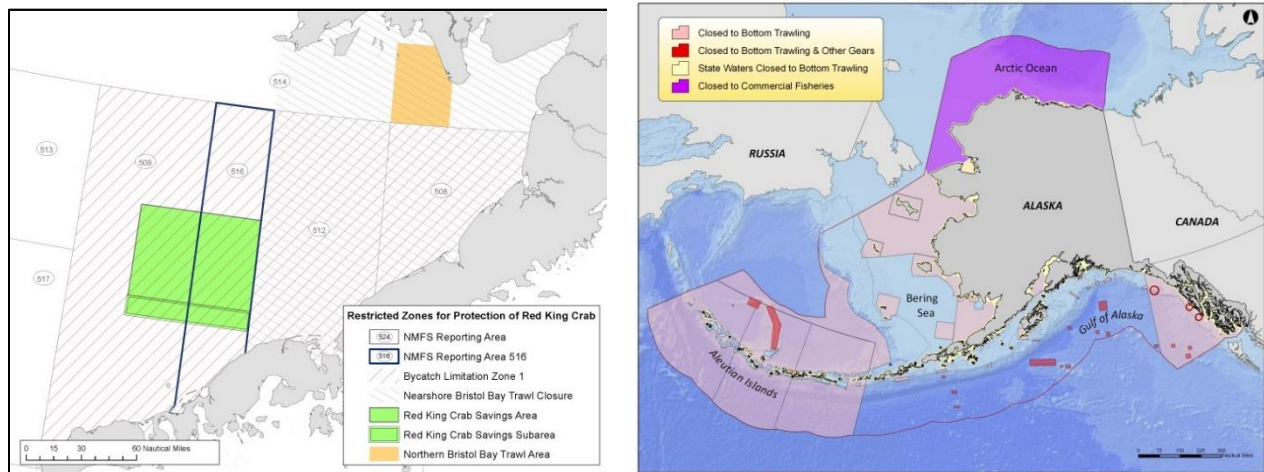
Halibut PSC Limits. Annual BSAI-wide Pacific halibut bycatch mortality limits for trawl and non-trawl gear fisheries will be established in regulations and may be amended by regulatory amendment. When initiating a regulatory amendment to change a halibut bycatch mortality limit, the Secretary, after consultation with the Council, will consider information that includes:

1. estimated change in halibut biomass and stock condition;
2. potential impacts on halibut stocks and fisheries;
3. potential impacts on groundfish fisheries;
4. estimated bycatch mortality during prior years;
5. expected halibut bycatch mortality;
6. methods available to reduce halibut bycatch mortality;
7. the cost of reducing halibut bycatch mortality; and
8. other biological and socioeconomic factors that affect the appropriateness of a specific bycatch mortality limit in terms of FMP objectives.

Prohibited Species Donation Program. The Prohibited Species Donation Program authorizes the distribution of specified prohibited species, taken as bycatch in the groundfish trawl fisheries off Alaska, to economically disadvantaged individuals through a NMFS-authorized distributor selected by the Regional Administrator in accordance with regulations that implement the FMP. The program is limited to Pacific salmon and Pacific halibut.

Bycatch Reduction Incentive Programs. The Secretary of Commerce, after consultation with the Council, may implement by regulation measures that provide incentives to individual vessels to reduce bycatch rates of prohibited species for which PSC limits are established. The intended effect of such measures is to increase the opportunity to harvest groundfish TACs before established PSC limits are reached.

Time and Area Restrictions. A number of area closures are in place either year-round or seasonally to minimize the effects of directed fishing on habitat, protected resources, or PSC species (halibut and non-halibut). Protections are provided in part by seasonal closures. In particular, the former “Crab and Halibut Protection Zone” established in the BSAI FMP includes restriction areas in the subsequent RKC Bycatch Limitation Zone 1 and additional area included in the Nearshore Bristol Bay Trawl



Closure.

Annual Process for Apportionment and Seasonal Allocation of [Halibut] PSC. Apportionments of PSC limits to target fishery categories established in Section 3.6.2.3.1 and seasonal allocations of those apportionments may be determined annually by the Secretary of Commerce, after consultation with the Council, using the following procedure:

1. **Prior to the October Council meeting.** The Plan Team will provide the Council the best available information on estimated prohibited species bycatch and mortality rates in the target groundfish fisheries, and estimates of seasonal and annual bycatch rates and amounts.
2. **October Council meeting.** While recommending proposed groundfish harvest levels under Section 3.2.2, the Council will also review the need to control the bycatch of prohibited species and will recommend appropriate apportionments of PSC limits to fishery categories as bycatch allowances. Fishery bycatch allowances are intended to optimize total groundfish harvest under established PSC limits, taking into consideration the anticipated amounts of incidental catch of prohibited species in each fishery category. The Council may recommend exempting specified non-trawl fishery categories from the non-trawl halibut bycatch mortality limit restrictions after considering the same factors (1) through (8) set forth under Section 3.6.2.1.4. The Council will also review the need for seasonal apportionments of fishery bycatch allowances.

The Council will consider the best available information when recommending fishery apportionments of PSC limits and seasonal allocation of those apportionments. Types of information that the Council will consider relevant to seasonal allocation of fishery bycatch quotas include:

- a. seasonal distribution of prohibited species;
 - b. seasonal distribution of target groundfish species relative to prohibited species distribution;
 - c. expected prohibited species bycatch needs on a seasonal basis relevant to changes in prohibited species biomass and expected catches of target groundfish species;
 - d. expected bycatch rates on a seasonal basis;
 - e. expected changes in directed groundfish fishing seasons;
 - f. expected start of fishing effort; and
 - g. economic effects of establishing seasonal halibut allocations on segments of the target groundfish industry.
3. As soon as practicable after the Council's October meeting, the Secretary will publish the Council's recommendations as a notice in the *Federal Register*. Information on which the recommendations are based will also be published in the *Federal Register* or otherwise made available by the Council. Public comments will be invited by means specified in regulations implementing the FMP.
 4. Prior to the December Council meeting. The Plan Team will prepare for the Council a final SAFE report under Section 3.2.3.1.2 which provides the best available information on estimated prohibited species bycatch rates in the target groundfish fisheries, recommendations for halibut PSC limits and apportionments thereof among the target fisheries and gear types, and also may include an economic analysis of effects of the apportionments.
 5. December Council meeting. While recommending final groundfish harvest levels, the Council reviews public comments, takes public testimony, and makes final decisions on apportionments of PSC limits among fisheries and seasons, using the factors (a) through (g) set forth under (2) above. The Council also makes final decisions on the exemption of any non-trawl fishery category from halibut bycatch mortality restrictions using the factors (1) through (8) set forth under Section 3.6.2.1.4.
 6. As soon as practicable after the Council's December meeting, the Secretary will publish the Council's final decisions as a notice in the *Federal Register*. Information on which the final recommendations are based will also be published in the *Federal Register* or otherwise made available by the Council.

Management Objectives for the BSAI and GOA Groundfish FMPs as established through the Programmatic SEIS.

	Prevent Overfishing	Effect on halibut bycatch	Comments
1	Adopt conservative harvest levels for multi-species and single species fisheries and specify optimum yield.	Minimal	All of these objectives reference actions that may be taken to prevent overfishing of species “in the fishery” as defined in the FMPs. Halibut and other PSC species are defined in the FMPs as “ecosystem components” and, thus, are not the focus of these objectives.
2	Continue to use the existing optimum yield cap for the [BSAI and GOA] groundfish fisheries.	Minimal	
3	Provide for adaptive management by continuing to specify optimum yield as a range.	Minimal	
4	Provide for periodic reviews of the adequacy of F_{40} and adopt improvements, as appropriate.	Minimal	
5	Continue to improve the management of species through species categories.	Minimal	
	Promote Sustainable Fisheries and Communities	Effect on halibut bycatch	Comments
6	Promote conservation while providing for optimum yield in terms of the greatest overall benefit to the nation with particular reference to food production, and sustainable opportunities for recreational, subsistence, and commercial fishing participants and fishing communities.	Minimal	
7	Promote management measures that, while meeting conservation objectives, are also designed to avoid significant disruption of existing social and economic structures.	Indirect	Objective 7 connects indirectly to halibut bycatch inasmuch as they highlight that the Council desires to take action through the groundfish FMPs in consideration of the needs and concerns of communities. Consideration of the range of community needs is part of the rationale for developing a halibut framework (See objective 32 below).
8	Promote fair and equitable allocation of identified available resources in a manner such that no particular sector, group or entity acquires an excessive share of the privileges.	Minimal	
9	Promote increased safety at sea.	Minimal	
	Preserve Food Web	Effect on halibut bycatch	Comments
10	Develop indices of ecosystem health as targets for management.	Indirect	Objectives 10 and 13 can be thought of as connecting indirectly to halibut bycatch in the sense that the condition of the halibut resource as well as that of other ecosystem components contributes to ecosystem health.
11	Improve the procedure to adjust acceptable biological catch levels as necessary to account for uncertainty and ecosystem factors.	Minimal	
12	Continue to protect the integrity of the food web through limits on harvest of forage species.	Minimal	
13	Incorporate ecosystem-based considerations into fishery management decisions, as appropriate.	Indirect	

	Manage Incidental Catch and Reduce Bycatch and Waste	Effect on halibut bycatch	Comments
14	Continue and improve current incidental catch and bycatch management program.	Direct	Objective 14 identifies the existence of a bycatch management program for the BSAI and GOA. Operationally, this consists of the suite of tools and measures in place to reduce and minimize bycatch in the regions. The objective also indicates a commitment to continual improvement of that suite of tools and measures.
15	Develop incentive programs for bycatch reduction including the development of mechanisms to facilitate the formation of bycatch pools, vessel bycatch allowances, or other bycatch incentive systems.	Direct	Objective 15 indicates that a primary tool in achieving objective 14 is the use of programs that incentivize fishery operations to reduce halibut bycatch and therefore harvest groundfish TACs before PSC limits are reached.
16	Encourage research programs to evaluate current population estimates for non-target species with a view to setting appropriate bycatch limits, as information becomes available.	Direct	Objective 16 reflects the need to continually improve the quality of information regarding the status of non-target stocks such as halibut in order to more appropriately define bycatch limits in the context of population status.
17	Continue program to reduce discards by developing management measures that encourage the use of gear and fishing techniques that reduce bycatch which includes economic discards.	Direct	Objective 17 is similar to, but more general than objective 15 in that it reflects intent to identify and implement through the groundfish FMPs practical measures that would reduce halibut bycatch.
18	Continue to manage incidental catch and bycatch through seasonal distribution of total allowable catch and geographical gear restrictions.	Direct	Objective 18 allows for time and area restrictions to reduce halibut bycatch.
19	Continue to account for bycatch mortality in total allowable catch accounting and improve the accuracy of mortality assessments for target, prohibited species catch, and non-commercial species.	Direct	Objective 19 prioritizes accurate halibut bycatch estimation and continual improvement of methods for generating bycatch estimates.
20	Control the bycatch of prohibited species through prohibited species catch limits or other appropriate measures.	Direct	Objective 20 identifies PSC limits as a tool for achieving halibut bycatch reduction.
21	Reduce waste to biologically and socially acceptable levels.	Direct	Objective 21 addresses the biological and social tolerances associated with discard mortality. Reduction of regulatory discards might be seen as fitting into this objective.
22	Continue to improve the retention of groundfish where practicable, through establishment of minimum groundfish retention standards (<i>Not in GOA FMP</i>)	Minimal	This prioritizes gear efficiency for target species, not halibut
	Avoid Impacts to Seabirds and Marine Mammals	Effect on halibut bycatch	Comments
23	Continue to cooperate with the U.S. Fish and Wildlife Service (USFWS) to protect ESA-listed species, and if appropriate and practicable, other seabird species.	Minimal	
24	Maintain or adjust current protection measures as appropriate to avoid jeopardy of extinction or adverse modification of critical habitat for ESA-listed Steller sea lions.	Minimal	
25	Encourage programs to review status of endangered or threatened marine mammal stocks and fishing interactions and develop fishery management measures as appropriate.	Minimal	
26	Continue to cooperate with NMFS and USFWS to protect ESA-listed marine mammal species,	Minimal	

	Reduce and Avoid Impacts to Habitat	Effect on halibut bycatch	Comments
27	Review and evaluate efficacy of existing habitat protection measures for managed species.	Minimal	
28	Identify and designate essential fish habitat and habitat areas of particular concern pursuant to Magnuson-Stevens Act rules, and mitigate fishery impacts as necessary and practicable to continue the sustainability of managed species.	Minimal	
29	Develop a Marine Protected Area policy in coordination with national and state policies.	Minimal	
30	Encourage development of a research program to identify regional baseline habitat information and mapping, subject to funding and staff availability.	Minimal	
31	Develop goals, objectives and criteria to evaluate the efficacy and suitable design of marine protected areas and no-take marine reserves as tools to maintain abundance, diversity, and productivity. Implement marine protected areas if and where appropriate.	Minimal	
	Promote Equitable and Efficient Use of Fishery Resources	Effect on halibut bycatch	Comments
32	Provide economic and community stability to harvesting and processing sectors through fair allocation of fishery resources.	Direct	Relative to bycatch, there is allocation of halibut PSC among sectors. Overall, the Council specifies a total halibut PSC that is functionally an allocation between the halibut directed fishery and the halibut bycatch fisheries.
33	Maintain the license limitation program, modified as necessary, and further decrease excess fishing capacity and overcapitalization by eliminating latent licensees and extending programs such as community or rights-based management to some or all groundfish fisheries.	Minimal	
34	Provide for adaptive management by periodically evaluating the effectiveness of rationalization programs and the allocation of access rights based on performance.	Indirect	Objective 33 connects indirectly to halibut bycatch in that the effectiveness of rationalization programs can be measured in terms of the success of the program in achieving bycatch reduction goals.
35	Develop management measures that, when practicable, consider the efficient use of fishery resources taking into account the interest of harvesters, processors, and communities.	Minimal	
	Increase Alaska Native Consultation	Effect on halibut bycatch	Comments
36	Continue to incorporate local and traditional knowledge in fishery management.	Minimal	
37	Consider ways to enhance collection of local and traditional knowledge from communities, and incorporate such knowledge in fishery management where appropriate.	Minimal	
38	Increase Alaska Native participation and consultation in fishery management.	Minimal	

	Improve Data Quality, Monitoring and Enforcement	Effect on halibut bycatch	Comments
39	Increase the utility of groundfish fishery observer data for the conservation and management of living marine resources.	Direct	Provides for the central data source on overall fleet catches of halibut for the purpose of in-season management as well as data for estimating halibut DMRs.
40	Develop funding mechanisms that achieve equitable costs to the industry for implementation of the North Pacific Groundfish Observer Program.	Minimal	
41	Improve community and regional economic impact costs and benefits through increased data reporting requirements.	Minimal	
42	Increase the quality of monitoring and enforcement data through improved technology.	Direct	Provides for improvement of data quality associated with monitoring and enforcing halibut bycatch incidence
43	Encourage a coordinated, long-term ecosystem monitoring program to collect baseline information and compile existing information from a variety of ongoing research initiatives, subject to funding and staff availability.	Minimal	
44	Cooperate with research institutions such as the North Pacific Research Board in identifying research needs to address pressing fishery issues.	Direct	Provides opportunity for highlighting research needs with regard to halibut bycatch
45	Promote enhanced enforceability.	Direct	Regulations and prohibitions regarding halibut retention are enforceable management measures
	Improve Data Quality, Monitoring and Enforcement	Effect on halibut bycatch	Comments
46	Continue to cooperate and coordinate management and enforcement programs with the Alaska Board of Fish, Alaska Department of Fish and Game, and Alaska Fish and Wildlife Protection, the U.S. Coast Guard, NMFS Enforcement, International Pacific Halibut Commission, Federal agencies, and other organizations to meet conservation requirements; promote economically healthy and sustainable fisheries and fishing communities; and maximize efficiencies in management and enforcement programs through continued consultation, coordination, and cooperation.	Direct	IPHC is specifically named. Flow of information between Council and other agencies appears to be an intended component of framework.

ATTACHMENT 2. Issues from February 2015 Joint Council/IPHC Meeting

Status report on 2/5/15 NPFMC/IPHC meeting issues for further consideration: Updated November 2015

Issue for further consideration	Action/Timelines	Primary Responsibility
1. The need to review and update DMRs for all fisheries, including development of a table which summarizes current DMRs, how the rates were derived for each fishery, and the level of 'certainty' (if possible) associated with each DMR.	Underway - IPHC staff/Gregg Williams under contract currently developing table per request. Will need to coordinate with Observer Program to promulgate potential changes.	IPHC (Council and NMFS follow up) – Plan Teams to review in Fall 2015
2. Recognizing that the Commission has its own scientific review process, the Council expressed a desire for the Council's SSC to review ongoing research by the IPHC under an NPRB grant, and for the SSC to review (when appropriate) the ongoing development of the Commission's total mortality accounting approach (including the application of Spawning Potential Ratio (SPR) and associated management implications).	Ongoing – SSC (and Council) will have opportunity for review as updated documents become available.	IPHC – timelines are uncertain depending upon progress on specific aspects
3. Both bodies recognize that there are potential benefits to abundance-based management of all removals from the halibut stock and supported continued investigation of this approach.	Council requested discussion paper on abundance-based limits – IPHC already working on updating their February 2015 paper, which is now scheduled for review at Council's December 2015 meeting. This will serve as discussion paper and Council can provide direction and next steps in December.	IPHC (at least until December 2015 Council meeting)
4. The need to further reconcile bycatch and wastage accounting and calculation between the IPHC and NMFS, and identify any implications for setting TCEY.	Ongoing - NMFS/IPHC staff met again in July 2015 to further define appropriate procedures for using NMFS data in IPHC process. Spatial resolution needed. IPHC annual data needs from Observer Program will first occur between Observer Program, NMFS AK Region, and IPHC staff.	IPHC/ NMFS/AkFin
5. Further information on the IPHC 'closed area', including implications with regard to potential changes in that closed area (i.e., area allocations, access to the area, and associated changes to existing catch share plans).	If the closed area were to be eliminated or modified, there will be implications for Council management of IFQ fisheries and the Area 4CDE CSP, which would require Council examination. The IPHC has discussed but not moved forward with changing the closed area for directed halibut fishing. The Council has not initiated any action to consider closing this area to other gear groups.	N/A (unless IPHC decides to pursue elimination or modifications for directed halibut fishing).
6. The need to address the 'tendering' issue in the GOA as it relates to application of observer coverage.	Council has initiated an amendment to address this issue, with initial review scheduled for February 2016. The Council has also initiated a discussion paper on 100% observer coverage in the GOA (for October 2015).	Council
7. The need to further refine a common understanding of science and process, as well as a common vocabulary (for example, Blue Line vs ABC vs OFL?).	Ongoing – IPHC developing an expanded 'glossary'; some information/clarification was included in the BSAI Halibut PSC analysis.	IPHC took lead, draft under internal review, will submit for December 2015 Council meeting
8. Recognition that, subject to stock conservation, it is a domestic choice of how to allocate available halibut in each country's waters.	No action required. However, see #11 which refers to determining the point at which allocation becomes conservation issue.	N/A

Issue for further consideration	Action/Timelines	Primary Responsibility
9. A coordinated prioritization of research in areas of mutual concern.	Initial determination of priorities of mutual interest should be discussion between NMFS, IPHC, and Council staffs.	IPHC/NMFS And Council
10. A recognition of the potential benefits of IBQ-type management programs for effecting bycatch reductions.	No specific action required. Council to discuss various options for Gulf of Alaska management in October 2015.	Council
11. A lack of understanding of migration of halibut makes it difficult to determine the extent to which bycatch is an allocation vs conservation issue, and determine the relative impacts across all management areas (and the desire to prioritize migration research).	Ongoing research by IPHC, spatial modelling, etc. relates to item #9. Key issue is recognition that halibut movement out of BSAI areas creates extended impacts of management actions in BSAI in those other areas.	IPHC
12. The importance of the Council's BSAI bycatch decision (this year) relative to the Commission's decisions in 2016.	Council took actions in June 2015 to reduce halibut PSC caps in BSAI.	Council
13. Potential Council review of its management objectives relative to the directed halibut fisheries.	Ongoing, Council can review indirectly through its annual programmatic review of goals and objectives, or possibly consider specific review (in conjunction with MSA mandated review of IFQ program?)	Council
14. Reconciliation of survey information for Area 4B relative to observations from fishermen.	Ongoing, through IPHC research, discussions with Area 4B fishermen, and targeted survey of Area 4B in 2016	IPHC
15. Potential development of monitoring standards for all fisheries, including directed halibut fisheries.	Ongoing - Council/NMFS working on monitoring standards through groundfish/halibut observer program and EM. No specific plan to jointly develop such standards with IPHC.	Council/NMFS
16. Recognition of the potential disparities between the fishery and management contexts when making comparisons to bycatch reductions in Area 2B and U.S. west coast fisheries (apples and oranges) relative to managing expectations.	No action required, but short discussion paper may provide useful context. Council received informative written testimony at its June 2015 meeting on this issue. Need to determine need/priority for additional analysis.	NMFS/Council
17. Development of a more formal meeting schedule, or possible Joint Protocol, between the Council and the Commission.	Part of ongoing dialogue. Should be issue driven, rather than routine. Will assess in fall 2015 to determine need for next joint meeting.	shared
18. Potential direction to staff and/or Plan Teams to effect the issues listed above.	See above.	N/A

ATTACHMENT 3. NMFS Alaska Fisheries Science Center Halibut Research

Ongoing AFSC Research related to Pacific Halibut

- *International Pacific Halibut Commission Data Exchange:* The AFSC contracts with the IPHC to collect and edit sablefish logbook data, use IPHC survey data in some AFSC stock assessments, provide the IPHC with data from the AFSC's annual longline survey, and regularly communicate with IPHC assessment scientists on methodology based on the similarity of the sablefish and halibut fisheries. The AFSC has worked with the IPHC to collect halibut food habits data since 1990; the IPHC has provided the AFSC with a research permit to collect 500-1000 stomachs annually during groundfish surveys, and the resulting data are used by both agencies. ***Collaboration with IPHC***
- *Scientific Review and Support to the IPHC from AFSC Scientists:* The AFSC provides the Science Advisor to the Halibut Commission. The Advisor provides science research oversight and reviews all the documents submitted for publication by the Commission. The AFSC provides other scientific expertise to the Halibut Commission on a as need basis. Examples are observer sampling issues, surveys issues, advisor on the ad-hoc Scientific Review Board, and serving as an external member of the hiring committee to hire a new lead scientist for the IPHC. ***Collaboration with IPHC***
- *Fish Ageing:* The AFSC is working with IPHC staff on developing a new bomb-radiocarbon reference chronology in the Bering Sea and evaluating halibut age determination bias. Historically collected otoliths from early IPHC longline surveys are being used, as well as and using bomb-radiocarbon assays to evaluate ageing bias of other species. ***Collaboration with IPHC***
- *Halibut Discard Mortality Rates:* The AFSC is working with the trawl Industry to develop an EFP to test the efficacy of on-deck sorting and discard of halibut in real time to decrease time out-of-water reduce discard mortality rates. A camera chute system and flow scale will be used to image, count, length and/or weigh each individual fish prior to discard with information transmitted in real time.
- *Improving Halibut Estimates:* The AFSC is conducting electronic monitoring (EM) with the NPFMC EM work group and the IPHC to evaluate the efficacy of EM systems to deliver scientific data that can be used to estimate halibut and groundfish discard in the small-vessel fixed gear IFQ fleet. ***Collaboration with IPHC***
- *Halibut visual impairment:* The AFSC is currently using electro-physiological and behavioral techniques to study recovery from light-induced visual impairment of Pacific halibut.
- *Socioeconomics of quota leasing market:* Under the Halibut Catch Sharing Plan (CSP) that formalizes the process of allocating catch between the commercial and charter sectors, there is now an allowance for leasing commercial halibut quota by eligible charter businesses to relax harvest restrictions for their angler clients. A survey developed by the AFSC will be fielded in 2015, collecting data from the eligible participants in this market to determine their attitudes towards, and behavior in, the lease market and attitudes and preferences towards alternative programs.
- *Socioeconomics of charter boat fisheries:* The AFSC is conducting an ongoing survey of anglers who utilize the for-hire charter boat recreational fishing sector in Alaska that is being subjected to new bag/possession and halibut size limits. The goal is to provide insights into how economic values for charter boat fishing trips are affected by these regulations.

- *Impacts of active participation measures:* The AFSC is assessing the impacts of active participation measures in the Alaskan halibut and sablefish individual fishing quota (IFQ) program, including a prohibition on IFQ leasing, limitations on the acquisition of quota shares by non-individual entities (corporations, partnerships, etc.), and restrictions on the use of hired skippers.
- *Targeting behavior:* A study is underway to examine how vessels in the Amendment 80 (A80) fishery develop different targeting strategies to attempt to maximize revenue from target species while not exceeding halibut prohibited species catch (PSC) limits. This modeling work is a pilot project that will contribute to the spatial economics toolbox for fisheries (FishSET).
- *Efficacy of Halibut Excluders:* The AFSC is currently working with the pollock fleet in the Bering Sea to examine the efficacy of a new halibut excluder design made by Greenline Fishing Gear.
- *Flatfish Settlement Success:* An NPRB project predicting settlement success of two slope-spawning flatfish (halibut and Greenland turbot) in the Bering Sea is underway. Collaboration with OSU.
- *Bioenergetics and Ecosystem Modeling:* An NPRB project is underway to study fishery, climate, and ecological effects on halibut Size-at-age. Including diet analyses and bioenergetics modeling. ***IPHC collaboration.***
- *Fishery Technical Interactions:* The AFSC is developing a management strategy evaluation with a multispecies groundfish fishery technical interactions model for the Bering Sea that includes halibut bycatch as a constraint in determining Annual Catch Limits for groundfish.
- *Spatial Connectivity:* The AFSC is studying the connectivity between spawning and nursery areas of halibut over the EBS slope and shelf.
- *Larval Transport:* The AFSC is investigating climate-mediated oceanographic variability of currents modulating transport of halibut larvae/juveniles over the Bering Sea shelf. ***IPHC collaboration.***
- *Settlement and Recruitment:* The AFSC is studying factors influencing settling and age-0 recruitment success of halibut in the Bering Sea.

Previous AFSC Research Related to Pacific Halibut

- *Halibut excluder development:* The AFSC, IPHC, and industry developed video systems to observe fish (particularly halibut) behavior in trawls, starting in 1990. The AFSC documented behavior of halibut and target species encountering conventional and modified trawls, demonstrating differences both ahead of and within the net. Halibut excluders were developed through industry collaboration and are routinely used and improved in many trawl fisheries. ***IPHC collaboration.***
- *On-deck measurements:* The AFSC cooperated with the Amendment 80 fleet to evaluate the efficacy of length-ing and imaging halibut on the deck of a factory trawler using a camera chute system.
- *Visual impairment of halibut:* The AFSC conducted a laboratory study of halibut recovery time after light-induced visual impairment, showing that bright light (such as on the deck of a boat on a sunny day) can impair halibut vision, potentially influencing survival of discards.
- *Sport Fishing Economics:* AFSC surveyed Alaska saltwater anglers in 2007 and 2012 and estimated (1) demand for and economic value of saltwater sport fishing trips for halibut, salmon, and other

primary sport fish species, (2) the value of charter boat fishing trips targeting halibut under alternative harvest restrictions for halibut (e.g., bag/possession and size limits). Economic impacts associated with changes to angler harvest restrictions were estimated.

- *Economic Impacts of IFQs*: The AFSC and UC Davis researched the economic efficiency impacts resulting from features of the Alaskan halibut and sablefish individual fishing quota (IFQ) program, such as blocking and vessel class restrictions on quota share.
- *Charter Boat Economics*: AFSC conducted surveys of Alaska charter boat businesses to study the economics of the guided sport sector. Collected costs, earnings, and employment information were collected for the 2011-2013 fishing seasons. Population-level estimates for total costs, revenues, and employment were generated to provide information about the sector; firm-level modeling is expected to provide insights into how behavior may change under alternative management actions.
- *Catch share evaluation*: An extensive set of economic data tables on halibut was reported in the 2013 Economic SAFE. (Section 4, Tables 51-63); economic performance metrics for the halibut IFQ program were calculated and reported in the 2013 Economic SAFE (Section 7.2).

Future AFSC Research Related to Pacific Halibut (planned and/or pending funding availability):

- *Survey Improvements*: Collaborative work with the IPHC comprised of an extended IPHC survey in the Bering Sea connected to the AFSC trawl survey with the goal of improved density of IPHC survey stations and improved estimates of halibut catchability by size/age classes in our trawl survey.
- *Efficacy of Halibut Excluders*: The AFSC plans to work cooperatively with the pollock fleet to study the efficacy of currently used halibut excluder devices by using underwater video cameras to monitor the escape hole in the excluder device and to count the fish escaping in the video. This work is expected to occur in late January to March 2015, during A season for pollock. (Submitted to AFSC Cooperative Research RFP)
- *Scientific Review and Support to the IPHC from AFSC Scientists*: The AFSC provides the Science Advisor to the Halibut Commission. The Advisor provides science research oversight and reviews all the documents submitted for publication by the Commission. The AFSC provides other scientific expertise to the IPHC on a as need basis. Examples are observer sampling issues, surveys issues, stock assessments, impacts of halibut interactions with groundfish resources and the environment.
- *Fishery Technical Interactions and Spatial Modeling*: Multi-species, spatial, technical interaction management strategy evaluation (MSE) to study potential impacts of alternative halibut management strategies on groundfish fisheries in the GOA and BSAI. (Funding source not identified).
- *Spatio-Temporal Overlap of halibut and other groundfish*: Conduct a study using generalized additive models (GAMs) to evaluate spatio-temporal overlap of halibut and other groundfish species in the GOA and BSAI. This information could be used to evaluate whether “rolling hot-spot closures” may have the potential to reduce halibut bycatch in groundfish trawl fisheries. (This work can be accomplished by the AFSC through internal prioritization of tasking.)
- *Bioenergetics and Multispecies/Ecosystem Modeling*: Add halibut to an existing multispecies statistical model for the Bering Sea, to examine the effects of halibut (including bycatch specifically) in a multispecies fishery. (Funding source not identified).

- *Local Environmental Conditions and Halibut Bycatch Rates:* Evaluate relationships between environmental conditions and rates of halibut bycatch in the groundfish fisheries. Purchase and initiate the use of miniature data loggers to measure temperature and salinity at depth on longline and trawl groundfish fishing vessels operating in the Gulf of Alaska and Bering Sea and Aleutian Islands areas. (Submitted to AFSC Cooperative Research RFP).
- *Sport Fishery Socioeconomic Survey:* The AFSC plans to regularly conduct the survey of Alaska saltwater anglers to collect updated information on saltwater angler demand and economic values of fishing trips under current harvest restrictions. Funds have been requested to enable the survey to be conducted during 2016-2017. (Submitted to NMFS S/T)
- *Charter Sector Socioeconomic Survey:* The AFSC has received funding from the NMFS Office of Science and Technology to continue collecting costs, earnings, and employment information from the saltwater guided (charter) sector. The survey is expected to be fielded during 2016 and 2017 to collect data for the 2015 and 2016 fishing seasons. These data will be used to evaluate the economic effects of the implementation of the CSP on the charter sector. (Funded by NMFS S/T)
- *Halibut Growth Hot-Spots in Alaska:* The AFSC will apply a recently developed bioenergetics model for Pacific Halibut (Holsman and Aydin in prep) to identify Pacific halibut growth hot-spots in AK. Survey-based diet and temperature data for the GOA, AI, and EBS ecosystems will be used. (Funding source not identified).
- *Modeling Alaska Flatfish Recruitment-Environment Linkages:* A two-year modeling effort with IPHC, UW, and UMass Dartmouth collaboration that has been submitted to the Fisheries and the Environment (FATE) program is the use of simulation testing to explore methods for incorporating recruitment-environment linkages into flatfish assessment models to evaluate methods of selecting among models, and to use the models developed to conduct forecasts of flatfish populations under future climate scenarios. (Submitted to FATE). **IPHC Collaboration**
- *Ecopath Food Web Models:* The AFSC plans to conduct an impact analysis of changes in the multispecies groundfish fishery (using Ecopath food web models currently containing bycatch by fleet and gear). (Funding source not identified).
- *Genetic Population Structure of Halibut:* The AFSC proposes using a next-generation sequencing technique, Restriction site Associated DNA (RAD tags), to provide a genomic assessment of population structure of halibut. (submitted to FATE).
- *Halibut Stomach Analysis:* The AFSC plans to collect and analyze halibut stomachs (there is no set funding for this, as these stomachs have generally been a lower priority compared to our other key groundfish). (Funding source not identified).
- *Diet Analysis to Inform Trophic Models:* The AFSC would like to examine diets of larval Pacific halibut and other fish in the Bering Sea and Gulf of Alaska that can be used to refine trophic models of energy transfer in the most vulnerable stages of the population.
- *Economic Metrics for Halibut:* An extensive set of economic data tables and economic performance metrics for the halibut IFQ program will be reported in future Economic SAFEs.

ATTACHMENT 4. IPHC Research

The IPHC staff has developed a series of research studies for 2016 which it recommends to the Commission for adoption through this Annual Research Plan. Several studies will contribute towards greater understanding of several important issues currently facing the Commission and industry stakeholders, notably the decline in size at age, understanding the sex ratio of the catch, the accurate characterization of the spawning biomass, and improving our understanding of the scope and timing of migration. Each of the recommended studies supports one or more of the four areas of study identified as primary research objectives in the IPHC Five-Year Research Plan:

- Objective 1: Stock identification, monitoring and assessment
- Objective 2: Harvest policy and management
- Objective 3: Biology, physiology, and migration
- Objective 4: Ecosystem interactions and environmental influences

For the past several years, two primary topics have been at the forefront of discussions about the halibut resource. The first has been the continuing decline in size at age, with the resulting effects and impacts on the harvest policy and stock status. The IPHC staff is continuing with an externally funded collaborative project examining multiple influences on halibut size at age. Allied with this is the need to accurately estimate the sex-specific removals from the stock through conversion of landed fish weight into the quantities required for the stock assessment. The second issue has been the migratory behavior of the stock, specifically seasonal and ontogenetic migration, including sex- and age-specific differences in spawning migration timing and duration. Research into both areas is of high priority for the Commission and staff. In the following section, studies for 2016 are presented which address both topics.

Research proposed for 2016

Research proposed by IPHC staff goes through an internal review process by the staff Research Review Board. This year, the Board met in late September to review staff proposals for 2016 research. For each proposal, the Board discussed the merits, objectives, design, and coherence with the Commission's research goals and objectives. The Principal Investigator (PI) subsequently joined the Board for a broad discussion of the project. Concerns, questions, and the need for refinements or revisions in the proposal, if any, were communicated to the PI at that time. Following a full review of all proposals, the Board assigned a priority rating to each project, based on the following criteria:

- **High** – Research which has a direct bearing on the assessment or its inputs, harvest policy, or current management structure. Postponement of a high priority project would have a significant and immediate impact on management or IPHC operation.
- **Medium** – Research which addresses an assessment issue or management question or need. Postponement would not have an immediate significant impact on fishery management or IPHC operation, but could have an impact on future analyses.
- **Low** – Research which addresses current issues of any subject, but is not considered having a timely need or being crucial to current IPHC management or operation.

Based on the Research Review Board discussions and the priorities previously outlined, the following subsections describe the upcoming proposed work by IPHC staff under each of the broad research objectives. Subsequent sections describe in detail the individual ongoing and proposed research studies recommended for funding in FY2016.

Objective 1: Stock identification, monitoring and assessment

Research in this area focuses on stock identification, monitoring, assessment, forecasting, and incorporation of uncertainty in both data and processes into management advice. The staff seeks to understand the underlying Pacific halibut stock structure and the influence of age, size, and sex on movement as they relate to stock components. Additionally, monitoring occurs through the IPHC port sampling program (fishery removals), the IPHC standardized setline stock assessment survey (fishery-independent stock indices), and the National Marine Fisheries Service (NMFS) trawl surveys (pre-recruits). The most significant work is the annual stock assessment, which produces estimates of abundance based on a comprehensive suite of fishery-dependent and -independent variables. The assessment also forecasts short-term trends in the stock to support the IPHC decision-making process. Assessment

staff also works at determining and reducing the level of uncertainty associated with stock assessments through advanced analytical techniques. Where needed, improved data collection or other studies are recommended.

For 2016, in addition to the annual assessment, the staff proposes to continue two high priority studies designed to develop a methodology for accurate determination of the sex ratio of the commercial catch. The stock assessment is highly sensitive to this ratio, but it cannot be determined directly because landed fish are dressed at sea. In order to collect data for direct estimation of this parameter, a method of marking commercially caught fish by sex is being tested (project 621.15) and a genetic method of determining the sex of fish is being developed as a validation tool (project 621.16).

A third ongoing study for 2016 continues the wire-tagging of juvenile halibut in the annual NMFS trawl surveys, which was piloted in 2015. This study is intended to continue for several years in order to learn more about juvenile halibut distribution and movement (project 670.11). The staff will continue with collection of juvenile abundance data from trawl surveys, which is incorporated into the annual assessment. Fishery-independent and -dependent data will be collected by the annual stock assessment survey and the commercial fishery port sampling program, respectively.

Objective 2: Harvest policy and management

Work to support this objective involves annual evaluations of IPHC's harvest policy with regard to the current stock dynamics and management goals. The staff develops stock projection procedures which incorporate a realistic range of alternative hypotheses about stock behavior, environmental influences, and fishing effects on halibut stock abundance and characteristics. The staff also provides harvest management advice to the Commission and user groups in a form which allows the consideration of uncertainty in the assessment and forecasting processes. Research by the staff and stakeholders on the harvest policy is ongoing through the Management Strategy Evaluation (MSE) effort with the Management Strategy Advisory Board (MSAB) and other staff work. In 2013 the Commission approved the formation of the MSAB to oversee the MSE process and to advise the Commission and staff on the development and evaluation of candidate objectives and strategies for managing the fishery. The MSAB has been working with staff over the past two years to develop candidate management objectives, procedures to achieve these objectives, and performance metrics with which to measure success. The Board has developed five overarching fishery management objectives and a number of specific stock and fishery objectives. Progress and results of the Board's meetings are posted on the MSAB website (<http://www.iphc.info/msab>) and are reported in Martell et al. (2016). The group is currently working on a coastwide operating model of the halibut stock, and in the future will develop more spatially explicit modeling.

For 2016 the staff proposes several ongoing studies and one new study related to this objective. Ongoing projects include the two studies to develop a methodology for accurate determination of the sex ratio of the commercial catch mentioned above (projects 621.15 and 621.16), plus an evaluation of macroscopic maturity stage assignments, which is expected to be completed this year (project 636.00).

Two other ongoing studies examine the length-weight relationship of halibut, which is important to accurate estimation of stock status and removals. This relationship was first estimated in 1926 and re-estimated in 1989, but more recent examination has suggested that the relationship may have changed, or that it may change regionally and/or seasonally. One study is conducted in the ports using the landed catch (project 665.11) and the other is conducted at sea using fish caught during the stock assessment survey (project 669.11). A new study proposes to investigate halibut movement on the far northern Area 4D Edge using pop-up archival transmitting (PAT) tags, taking advantage of the expanded stock assessment survey in that area planned for 2016 (project 2016-05).

Objective 3: Biology, physiology, and migration

Staff research within this objective seeks to collect and monitor primary biological characteristics of all sizes of halibut throughout the species' range. This includes directed studies but also involves incorporating studies monitoring the size at age of halibut within ongoing data programs wherever possible. IPHC also collaborates with other institutions and agencies to obtain biological and ecosystem information on halibut not otherwise available through IPHC programs and to incorporate that information into understanding and prediction of halibut population dynamics. Specific migration research objectives focus on the impacts of ontogenetic and seasonal movements on long-term yield, spatial distribution of spawning biomass, the impact of fishing seasons on interceptions, and temporal variations in fish movement.

In 2013 the IPHC embarked on an extensive set of studies to examine the recent decline in halibut size at age. The work encompasses several focused pieces of research, including those being conducted by IPHC staff and others in a collaborative study with NMFS, the University of Washington (UW), and the University of Alaska (UA), which is supported by the North Pacific Research Board (NPRB). Taking advantage of its extensive historical otolith archives dating to the 1920s, the IPHC's work on this project will continue in 2016 as measuring of growth increments begins on the re-aged decadal otolith samples extracted from the archives. Research specific to halibut migration and movement was requested by the Commission in 2001 (Leaman et al. 2002). Dr. T. Loher of the IPHC staff has designed a tag study to provide information on seasonal migration of halibut that can provide input for discussing appropriate fishing seasons. The study's four objectives will be accomplished by quantifying for the eastern Pacific halibut population, on regional bases:

- The active spawning season for Pacific halibut, defined as the period over which eggs are released into the water column;
- Depth-specific spawning habitat, defined as the range of bottom depths over which halibut initiate active spawning behavior;
- The fall and spring migratory periods, including estimates of the proportion of stock in a state of seasonal migration by date; and
- Where possible, timing of seasonal movement among regulatory areas, and the proportion of the spawning stock likely to be located out of area, by date.

Since 2009, the IPHC staff has actively engaged in a series of studies explicitly designed to establish protocols for the proposed tagging work. This includes selection of appropriate tag type, tagging attachment and location protocols on the fish, and reliable, cost-effective tag technology. Of these studies, the remaining field trial of tag attachment protocols continues in 2016 (project 650.18). Other ongoing projects related to this objective include the evaluation of macroscopic maturity stage assignments (project 636.00) and the two length-weight studies (projects 665.11 and 669.11) described above.

New studies proposed for 2016 include the deployment of PAT tags on the Area 4D Edge (project 2016-05) described above, as well as three physiological/genetic studies. These three studies involve the collection of field data and specimens to support examination of condition factors of halibut (project 2016-01), genetic markers of reproductive activity (project 2016-03), and screening of skeletal muscle and liver tissues for transcriptome markers associated with growth characteristics (project 2016-04). They are expected to help form the foundation for continuing work in understanding halibut biology from a physiological perspective. An additional new project for 2016 will focus on early life history by examining existing NFMS ichthyoplankton data on halibut distribution, survival, diet habits, and size and weight, and all of these factors in relation to environmental variables for halibut in life stages prior to metamorphosis (project 2016-02).

Objective 4: Ecosystem interactions and environmental influences

Research on this objective seeks to advance the understanding of the ecological context for halibut, including predation and competition, as well as fishing and environmental effects on recruitment and distribution. This also includes understanding the relationship between environmental influences and halibut distribution and behavior. This is primarily accomplished with broad-scale monitoring programs, some of which occur on IPHC research platforms. Additionally, IPHC seeks to share its environmental data set with other researchers and institutions. Collaborative research is sought whenever possible. IPHC is actively involved in an ongoing large-scale monitoring program from the setline assessment survey using water column profilers (project 610.13). The program is making environmental data available to other researchers through a public access portal with the Pacific Marine Environmental Laboratory (PMEL). Other ongoing monitoring also occurs from the survey platform, including an appraisal of contaminants in halibut (project 642.00) and the prevalence of *Ichthyophonus* (project 661.11). These three studies are proposed to continue in 2016. The three new physiological studies proposed for 2016 described above are also relevant to this objective: condition factor (project 2016-01), markers of reproductive activity (project 2016-03), and growth markers (project 2016-04).

Detailed description of ongoing IPHC projects for 2016

Project 610.13: Oceanographic monitoring of the north Pacific and Bering Sea continental shelf with water column profilers

Supports: Objective 4 – ecosystem interactions and environmental influences

Priority: Medium

Budget: \$ 91,700

Start date: 2009

Anticipated ending: Continuing

Personnel: L. Sadorus, J. Walker

The goal of this project is to measure oceanic properties in the waters over the Alaskan, B.C., and the U.S. west coast continental shelf that can be correlated to catch per unit effort (CPUE) of halibut as well as incidence of other groundfish species. The IPHC operates a survey that covers the area, and water column profilers that measure temperature, salinity, dissolved oxygen, pH, and fluorescence are deployed at each station. These data provide an annual snapshot of near-shore oceanic conditions as well as valuable observational data for studying halibut distributions in relation to environment, addressing environmentally related catchability in the survey, modeling, and biological studies on recruitment and growth variability. In particular, understanding the dynamics of the structure of the mixed layer depth – a major Global Ocean Ecosystem Dynamics (GLOBEC) goal – requires in-situ vertical profiling. Since 2001, IPHC has successfully deployed a SeaBird SBE-19 water column profiler during the annual stock assessment survey. A second profiler was added to the program in 2007. In 2009, a National Oceanographic and Atmospheric Administration (NOAA) grant provided for the complete outfitting of all chartered survey vessels, resulting in a complete coastwide deployment. Annual costs are directed towards maintenance and calibration of the profilers, and data preparation necessary for submission to the National Ocean Data Center. Funding for 2016 includes replacing one profiler, as well as maintenance and calibration of all units, plus replacement of two of the program's laptop computers. An ancillary element of the proposal includes the construction of an environmental database, including the profiler and other data, at the IPHC for direct use by IPHC staff.

Project 621.15: Commercial Sex Marking Pilot

Supports: Objective 1 – stock identification and assessment, Objective 2 – harvest policy and management

Priority: High

Budget: \$ 3,379

Start: 2015

Anticipated Ending: 2017

Personnel: T. Loher, I. Stewart, J. Marx

This project is part of a combined program with Project 621.16 to pair marks from commercially caught fish with a positive validation of sex via genetic means, at a much lower cost than direct estimation of the sex ratio of landings via genetic testing. This project has three primary objectives: a) test a single method of sex marking aboard increasingly larger samples of commercial fishing trips in order to determine its feasibility from a logistical perspective; b) evaluate the additional workload that processing sex-marked catch, and obtaining tissue samples for subsequent genetically-based QA/QC of the physical marking process, is likely to have upon the IPHC's port sampling program; c) generate a small tissue archive that can be subjected to subsequent genetic analysis as an element of Project 621.16. The 2016 field season will represent a scaling up of sampling relative to 2015. The 2015 design represented a single-port (~8 offload) effort, wherein vessels marked their fish in advance of offloads that they knew would be sampled. In 2016, we aim to sample 20-30 offloads, representing vessels associated with one of the fleet's fishing vessel owners associations, wherein all vessels from the association mark all of the fish retained during all trips, without prior knowledge of whether those trips will be sampled port-side. For each sampled offload, the port sampler will record the length and marked sex of each fish (including unmarked individuals) and collect and preserve a tissue sample. Analysis will include: a post-participation debrief with each harvester regarding the marking process, time requirements, ideas for alternate marks, and general willingness to participate again in the future; a comparison of the sex ratio at age among the sampled trips with the sex ratio at age among survey legs during the same year; storage of genetic samples pending the development of Single Nucleotide Polymorphisms (SNP) assays, which will allow the accuracy of fishermen's marks to be tested directly. Sample collection protocols are expected to change from prior years, at least in part, due to the requirements for shipping the tissue samples. Tissue samples will be archived until such time as a definitive genetically-based indicator of sex has been developed

and is ready for use. When ready, the samples will be subjected to analysis and the resultant sex ratios compared to those obtained by at-sea catch marking. Funding for 2016 includes equipment, supplies, and shipping for collecting samples.

Project 621.16: Genetic Sexing via Single Nucleotide Polymorphisms (SNPs)

Supports: Objective 1 – stock identification and assessment, Objective 2 – harvest policy and management

Priority: High

Budget: \$ 176,525

Start: 2015

Anticipated Ending: 2016

Personnel: T. Loher, L. Hauser (UW)

The work will allow for direct and reliable monitoring of sex ratios within the commercial catch. At present, the sex composition of the catch is estimated from IPHC survey data. The sequencing of Restriction site Associated DNA (RAD tags) has revolutionized genetics by allowing the discovery and genotype-calling of thousands of SNPs in multiple individuals at relatively low cost. The technique takes advantage of the large number of sequences (millions of reads per run) produced by the Illumina HiSeq 2000 sequencer. RAD tag sequencing focuses on sequencing the regions (tags) directly adjacent to specific restriction sites genome-wide. It is therefore possible to sequence a large and reproducible subsection of the genome in many individuals. Given the high success in sexing halibut with microsatellites, we expect to identify several dozen sex-specific SNPs that will allow the development of rapid assays for large samples. Once SNPs highly diagnostic for sex have been identified, we will develop high-throughput assays to allow the screening of larger samples. We will identify about 20 SNPs and re-sequence them in additional individuals. We will optimize these SNPs for use with low quality DNA, allowing the elimination of costly and laborious DNA extraction methods in routine sex surveys. In addition, we will minimize the number of SNPs necessary for 100% sex identification by picking highly discriminatory SNPs from our panel. Funding for 2016 supports the continuation of the IPHC-UW collaborative research agreement contract, which began late in 2015 and runs through July 2017.

Project 636.00: Evaluation of Pacific halibut macroscopic maturity stage assignments

Supports: Objective 2 – harvest policy and management, Objective 3 – biology, physiology, and migration

Priority: High

Budget: \$ 9,500

Start: 2008

Anticipated Ending: 2016

Personnel: K. MacTavish, other staff as needed

The staff believes it is necessary to re-evaluate our classification criteria for female gonad maturity stage. The method currently used on the assessment surveys is based on visual criteria established in the early 1990s and modified in 1995. These survey data combined with the age data are important components in the stock assessment model. Four maturity stages are presently assigned to female halibut; immature (F1), maturing (F2), spawning (F3), and resting (F4). The assumption is that once a female halibut has spawned, the gonad transitions to a resting phase, back to maturing, and then to spawning again. Our criteria for classification also assume that the F1 stage is only seen with immature fish, but we are seeing anomalies during the survey that suggest a fish may go back to this stage after achieving other maturity stages, and is therefore not truly immature. This study uses gonad samples collected in 2004. In 2016, research will include: Determining the maximum precision for oocyte diameter measurements by oocyte maturation stage; Conducting assessment of the prepared slides from the archived gonads using the sampling protocols developed in 2014; and Developing the sampling plan required to characterize seasonal maturation, including determination of the value of current summer assessment of halibut maturity stages. Funding for 2016 supports a temporary staff hire to assist with the work.

Project 642.00: Assessment of mercury and contaminants in Pacific halibut

Supports: Objective 4 – ecosystem interactions and environmental influences

Priority: Medium

Budget: \$ 4,900

Start Date: 2002

Anticipated ending: Continuing

Personnel: C. Dykstra, B. Gerlach (Alaska Department of Environmental Conservation)

The staff proposes to continue IPHC's collaboration with the Alaska Department of Environmental Conservation (ADEC) in 2016, collecting halibut tissue samples for analysis of heavy metal and organic pollutant loading. This work has been ongoing since 2002, when results from a collection of halibut samples that year led the Alaska Division of Public Health in 2003 to conclude that the concentrations of heavy metals in Alaskan Pacific halibut were not a public health concern. In 2004 the first results regarding organic pollutants (PCBs, pesticides) were released, demonstrating that halibut had the lowest concentrations of the five species (including salmon and sablefish) examined. IPHC and ADEC are continuing to qualify the data with physical parameters (age, size, and weight) and additional analyses will be done on the samples. Our involvement in the project has allowed us to provide input on study design and sampling protocols in the field, which will make the resultant information much more robust. Funding for 2016 includes sampling costs and travel.

Project 650.18: Archival tags: tag attachment protocols

Supports: Objective 3 – biology, physiology, and migration

Priority: High

Budget: \$ 3,500

Start Date: 2013

Anticipated ending: 2017

Personnel: T. Loher

Recovery rates of archival tags affixed to halibut using four different external mounting protocols (three dart-and-tether configurations; one wired to the operculum) are being tested in a field release of “dummy” archival tags. During the summer of 2013, a total of 900 fish were tagged off northern Kodiak Island (Area 3A), with an equal number of fish tagged with each tag attachment type. Fish carrying a dart-and-tether tag were also tagged with a bright pink cheek tag. Rewards of \$100 are given for all tags recovered. Expenses in 2016 will consist of tag rewards.

Project 661.11: *Ichthyophonus* prevalence in halibut

Supports: Objective 4 – ecosystem interactions and environmental influences

Priority: Low

Budget: \$ 500

Start Date: 2012

Anticipated ending: Ongoing

Personnel: C. Dykstra, P. Hershberger (U.S. Geological Survey)

Ichthyophonus is a protozoan parasite from the class Mesomycetozoa, a highly diverse group of organisms having characteristics of both animals and fungi. It has been identified in many marine fish, and is considered a causative agent in herring fishery collapses world-wide, and there is concern over its effects on the success of salmon spawning on major rivers such as the Yukon. During 2011-2013, samples were collected from halibut caught on the IPHC setline assessment survey over a broad geographic range, with a goal of describing the spatial and temporal distribution of *Ichthyophonus* prevalence. Limited sampling of small (<50 cm) halibut from the NMFS trawl survey recorded a very low prevalence rate of 2.4%, suggesting that infections establish after some ontogenetic shift in diet, habitat, or behavior. Sampling of larger, adult halibut have shown a wide range of rates, with Prince William Sound showing some of the highest observed in fish. The prevalence of infection is higher than that which has been observed in studies of other sympatric fish species, including other pleuronectids, suggesting that either susceptibility and/or infection pressures are higher in halibut. While ichthyophoniasis has been shown to reduce growth rate, decrease swimming stamina, and cause mortality in other fish hosts, its effects on Pacific halibut are unknown. Funds in 2016 are for processing of samples obtained during the IPHC stock assessment survey.

Project 665.11: Estimate of length/weight relationship and head/ice/slime adjustment

Supports: Objective 2 – harvest policy and management, Objective 3 – biology, physiology, and migration

Priority: High

Budget: \$ 6,950

Start: 2013

Anticipated Ending: Continuing

Personnel: R. Webster

The purpose of this study is to reexamine the relationship between fork length and net weight, including the estimation of adjustments necessary to convert head-on weight to net weight. The current length-net weight

relationship was estimated in 1926. If the relationship varies among regulatory areas, there may be systematic bias in regulatory area estimates of weight or WPUE derived from length measurements. Seasonal variation could affect weight estimates that are made from data collected during only a small part of the year. Therefore, we are collecting data coastwide throughout the season in order to estimate spatial and seasonal variation in the length to-weight relationship. Data will be collected in 2016 from ports staffed with IPHC samplers throughout the fishing season. The goal is to determine whether seasonal or area-specific length-weight relationships are warranted, or whether the effect of any variation can be incorporated via variation about the existing relationship. The current relationship used by IPHC between fork length and net weight also includes adjustments for the weight of the head, and of ice and slime: gross landed weight (guttled, with head, ice and slime) is assumed to include 12% head weight and 2% ice and slime, which combine to give a multiplier of 0.8624 to convert gross to net weight. However, the industry standard for head, ice and slime deduction is a total of 12%. Therefore we are also collecting data to provide direct estimates of adjustment factors to compare with the currently assumed values, and to assess variability in the weight of heads and ice and slime. Work will continue to be carried out within work schedules of existing staff as part of the port samplers' regular sampling protocol, and will not require additional funding of salaries. Funding for 2016 will be used to procure additional scales for the three ports that were not part of the project in 2015, plus additional supplies.

Project 669.11: Length-weight relationship at sea

Supports: Objective 2 – harvest policy and management, Objective 3 – biology, physiology, and migration

Priority: High

Budget: \$ 1,500

Start: 2015

Anticipated Ending: Ongoing

Personnel: E. Soderlund

This project integrates with the 665.11 port sampling project and obtains the two missing pieces of information on length-weight relationships: estimating shrinkage factors from fresh at sea lengths and weights to landed lengths and weights. It is particularly important for estimating removals from bycatch, recreational, and subsistence fisheries where no storage process occurs from capture to weight estimation. The purpose of this study is to collect data on IPHC's stock assessment survey for use in estimating the relationship between fork length and net weight, including the estimation of adjustments necessary to convert head-on weight to net weight, as well as estimation of shrinkage (potentially occurring in both length and weight) from time of capture to time of offload. This project will complement on-going project 665.11, in which samples from commercial deliveries are measured and weighed at the dock, by providing length-to-weight data that is not available at commercial offloads: from U32 fish, round fish, and freshly killed and dressed fish, as well as measurements of shrinkage from the time of capture to final weighing at the offload. The current relationship between fork length and net weight also includes adjustments for the weight of the head, and of ice and slime. We also plan to collect data to provide direct estimates of adjustment factors to compare with the currently assumed values, and to assess variability in the weight of heads and ice and slime to supplement data collected in project 665.11. Funding for 2016 includes repair of the sampling cradle and shipping costs.

Project 670.11: Wire tagging of juveniles on NMFS survey

Supports: Objective 1 – stock identification and assessment

Priority: High

Budget: \$ 6,500

Start: 2015

Anticipated Ending: Ongoing

Personnel: L. Sadorus, J. Forsberg

IPHC routinely participates in the NMFS groundfish trawl surveys in the Bering Sea (annual), Gulf of Alaska (biennial), and Aleutian Islands (biennial). Fish caught range in size from about 20 to 100 cm fork length. In response to bycatch-related requests at the 2015 Annual Meeting to learn more about juvenile halibut distribution and movement, IPHC staff launched a pilot project during the 2015 survey season to test the practicability of wire tagging halibut of all sizes aboard the trawl surveys. In 2015, samplers aboard both the Bering Sea and Gulf surveys wire tagged and released 50% of the viable halibut caught at each station. They were also asked to evaluate various aspects of the sampling plan as it was set forth and to report on ways that could make the tagging most effective without creating undue disruption to the survey deck work. Overall, the plan was very successful, with 487 and 1,497 halibut tagged in the Bering Sea and Gulf, respectively. Given that the pilot was successful and NMFS

personnel were receptive to the idea of tagging, we propose continuing the effort for the next several years. Funding for 2016 is for tag procurement and rewards for tag recoveries.

Detailed description of proposed new projects for 2016

Project 2016-01: Condition factor of halibut

Supports: Objective 3 – biology, physiology, and migration, Objective 4 – ecosystem interactions and environmental influences

Priority: High

Budget: \$ 7,700

Start: 2016

Anticipated Ending: Ongoing

Personnel: C. Dykstra, J. Planas

Tracking condition factors for the halibut population can provide information on the productivity of the stock in different areas, and can be coupled to reproductive information and/or energetics modeling as we develop our knowledge on these topics further under the guidance of Dr. Joseph Planas, who will be joining the staff in January 2016. This information is a component of understanding growth variation in halibut and is also valuable to the development of harvest policy. Funding for 2016 is for collection of field data on somatic, liver, and gonad weights.

Project 2016-02: Early life history studies

Supports: Objective 3 – biology, physiology, and migration

Priority: Medium

Budget: \$ 0

Start: 2016

Anticipated Ending: 2016

Personnel: L. Sadorus, I. Stewart, J. Duffy-Anderson (NMFS)

This project is a collaborative effort with NMFS to examine existing NFMS ichthyoplankton data on halibut distribution, survival, diet habits, size/weight, and all of these factors in relation to environmental variables for halibut in life stages prior to metamorphosis. Current efforts to develop more spatially explicit models for stock assessment and harvest policy analysis and to evaluate the potential factors influencing year-class strength would benefit from an improved understanding of early life history. This year's focus will be on analysis of components of connectivity between the Gulf of Alaska and the Bering Sea, using existing larval survey and oceanographic data, and is expected to require little or no additional cost to staff time. This effort may ultimately result in proposals for various experiments or other research in future years to fill identified data gaps.

Project 2016-03: RNA sequencing of gonads

Supports: Objective 3 – biology, physiology, and migration, Objective 4 – ecosystem interactions and environmental influences

Priority: High

Budget: \$ 10,000

Start: 2016

Anticipated Ending: 2017

Personnel: J. Planas

This project aims to provide important direct markers of reproductive activity in halibut gonads. Sex-specific genetic markers are important to the determination of spawning biomass. A small sample (4-6) of fish, balanced by sex, will be sampled at each maturity stage. Genetic sequencing will be conducted under contract with a commercial lab or UW. This project may be executed at lower cost (~\$6,000), pending alternative collection of specimen data in late 2015. Additional details and future direction for this and related follow-on projects will be developed after the arrival of Dr. Planas in January 2016.

Project 2016-04: RNA sequencing of skeletal/liver tissue

Supports: Objective 3 – biology, physiology, and migration, Objective 4 – ecosystem interactions and environmental influences

Priority: High

Budget: \$ 4,600

Start: 2016

Anticipated Ending: 2017

Personnel: J. Planas

This project will perform initial screening of skeletal muscle and liver tissue for transcriptome markers associated with growth characteristics. The project directly addresses the issue of determining causes of growth variation in halibut. A small sample (4-6) of fish, balanced by sex, will be sampled at each maturity stage. Genetic sequencing will be conducted under contract with a commercial lab or UW. This project is a pilot to determine future activities in experimental examination of the sources of halibut growth variation.

Project 2016-05: 4D Edge PAT tags

Supports: Objective 2 – harvest policy and management, Objective 3 – biology, physiology, and migration

Priority: Medium

Budget: \$ 4,405

Start: 2016

Anticipated Ending: 2017

Personnel: T. Loher

This project will help increase our understanding of the relationship of adult distribution and spawning contributions in the Bering Sea. The IPHC has a history of conducting PAT tagging in the Bering Sea and Aleutian Islands (BSAI) in order to investigate both seasonal and inter-annual dispersal. These studies have been aimed at gaining greater understanding of the timing of movements within this stock component, identifying winter spawning locations and investigating mixing among regulatory areas in a fishery-independent manner. The results of these experiments have complemented previous large scale Passive Integrated Transponder (PIT) tagging experiments. Notable gaps in spatial coverage of PAT tag deployments still exist, however, relative to areas fished by BSAI fleet components. The IPHC currently plans to extend its standardized stock assessment survey into two of these areas during the 2016 and 2017 surveys, presenting a unique opportunity to fill these gaps in understanding. This project will tag halibut at the far-northern 4D Edge expansion stations in 2016; this is to be followed by tagging on Bowers Ridge during the 2017 survey expansion. The work will be complementary to previous BSAI PAT tagging, using identical tagging and tag program protocols. A total of 32 halibut will be tagged at 4D Edge expansion stations, using PAT tags programmed to detach and report location and download archived environmental data. Funding for 2016 includes personnel, equipment, and contract costs to support the tagging effort.

Future research directions

The IPHC staff has identified the following major themes for future research:

1. Reproduction and recruitment.

- a. Better understanding of halibut reproductive biology, growth, swimming performance, and behavior from a physiological perspective.
- b. Application of environmental data to recruitment scenarios and year class strength.
- c. Recruitment drivers – processes that affect recruitment and their relative contributions.

2. Size composition and mortality of released/discarded fish. Currently, little is known about the size/age of discards for some directed fisheries or the appropriate discard mortality rate to be applied. In addition, the increasing use of size restrictions in sport fishery management to more fully achieve harvest goals increases discards, but data collection programs are lacking and implications to the IPHC harvest policy are unclear. Lastly, changes in harvest policy, such as changes in the minimum commercial size limit, require data collection programs so that the impact of the changes in management procedures can be assessed. New tag technology using accelerometers offers great potential for this effort.

3. Full catch accounting. Information on removals from all sources is needed for the best assessment of stock status. Identification of gaps in reporting programs and impediments to progress in achieving full accounting goals are necessary to reach these goals.

4. Migration studies.

- a. An improved understanding of U26 migration, i.e., rates and timing by area and size of fish, as well as inter- and intra-annual variability. The current wire tag study (Project 670.11) is part of this effort.

b. Improvements to archival tag technology for application to smaller halibut. Currently, pop-up satellite tags are limited to fish larger than 75 cm (~8 pounds), and archival tags to fish larger than 50 cm (~2.2 pounds). Being able to place similar or newer technology tags on smaller halibut would enable collection of movement data for a size range over which data are currently lacking.

- 5. Economic analyses. This would have a wide application, both within the MSE process in evaluation of alternative management scenarios, and in examining other fishery policy issues such as bycatch. The IPHC currently has no expertise in economic analysis on staff; previous studies have used contractors hired for specific one-time proposals. The Commission is engaging an outside group to conduct a study of the economic impacts of the halibut fishery, with results expected in 2017.

ATTACHMENT 5. Glossary of Terms Used by the IPHC and Other Agencies

The following was prepared by IPHC staff, dated December 2015. This document will evolve over time; the most up-to-date version will be posted on the IPHC website:

<http://www.iphc.int/research/glossary.html>.

\Introduction

There are a variety of fisheries management terms used by the International Pacific Halibut Commission (IPHC), National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (NPFMC), the Pacific Fishery Management Council (PFMC), and Fisheries and Oceans Canada (DFO). Some of these terms have the same definition in all three institutional processes, while others differ due to the regulatory framework and/or common usage. Some terms exist in only one or more process, and there may or may not even be clear analogs across processes. This complexity can lead to confusion regarding the interpretation of data, analyses, and management actions.

This table is intended to serve as an informal guide to commonly encountered terms and acronyms. It is annotated from the perspective of the IPHC, with additional description of terms and concepts not widely used outside the IPHC's process. However, key management terms from all processes are included, and are defined based on origin. Italicized entries are included for other processes to provide information for comparison and interpretation.

We thank the IPHC Science Advisors from the U.S. and Canada, as well as other contributors at NMFS and DFO for assisting with many of the individual entries.

List of terms

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Acceptable Biological Catch (ABC)	<i>There is no direct analog in the IPHC's current harvest policy.</i>	The upper limit of the annual TAC. It is based on the harvest rate that is estimated to produce the current maximum biological yield, with a reduction to account for scientific uncertainty in the probability that overfishing may occur (P* for the PFMC).	<i>Roughly equivalent to the catch that corresponds to the application of the HCR for a specific fishery.</i>
Accountability Measures (AM)	<i>There is no direct analog.</i>	Actions taken proactively to reduce the risk that overfishing will occur or reactively to respond to issues that led to overfishing.	<i>There is no direct analog.</i>
Advisory Panel (AP)	<i>The IPHC Commissioners similarly receive recommendations from the PAG and CB during the annual meeting.</i>	Stakeholder panel comprised of industry and user community representatives that provides fisheries management recommendations to the NPFMC process.	<i>DFO has various "advisory boards" or "advisory committees" serving a similar role.</i>
Annual Catch Limit (ACL)	<i>There is no direct analog in the IPHC's current harvest policy.</i>	May be equal to or less than the ABC due to including accountability measures to avoid overfishing. Also called the TAC in the NPFMC process.	<i>This is roughly equivalent to the TAC.</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Annual Catch Target (ACT)	<i>This is roughly equivalent to the IPHC's Blue Line.</i>	May be equal to or less than the ACL to account for management uncertainty. This equates to the TAC.	
Apportionment	Estimates of the stock distribution by IPHC regulatory area (for halibut greater than 32 inches in length) based on the catch rates observed in the IPHC's setline survey, adjusted for regional catchability differences, and bottom area from 0-400 fathoms.	<i>An analogous process is used to subdivide the TAC (or OY, and sometimes ABC) for species in the North Pacific and U.S. West Coast based on the geographical distribution of the species, inferred via the distribution of survey catch-rates or biomass estimates. Examples include sablefish, Pacific Ocean Perch, Pollock, and others.</i>	<i>An analogous process is used to subdivide the TAC for some species off British Columbia based on survey catch-rates or area-based assessment results.</i>
Bering Sea and Aleutian Islands (BSAI)	<i>This region is mismatched with IPHC regulatory areas, including a portion of 4A and all of 4B, and 4CDE (which includes the Closed area).</i>	The U.S. EEZ of the Bering Sea and Aleutian Islands region that is managed by the NPFMC (including an FMP defining groundfish catch and PSC limits).	
Biomass	A measure of population weight (in net pounds)	<i>A measure of population weight (in round weight).</i>	<i>A measure of population weight (in round weight).</i>
Blue Line	A row in the Decision Table, highlighted in blue, which provides the removals consistent with the Commission's current harvest policy.	<i>Roughly equivalent to the ACT(or ACL where no ACT is used)</i>	<i>Roughly equivalent to the TAC.</i>
Bycatch	Halibut incidentally caught by fisheries targeting other species and that cannot legally be retained. Bycatch mortality, or bycatch removals, refers only to those halibut that subsequently die due to capture.	<i>The MSA defines bycatch as all fish discarded (regardless if alive or dead). The FMP defines PSC as fish that cannot be legally retained. Halibut PSC is measured in terms of mt of mortality.</i>	<i>Used more generally to describe the incidental catch of species or life stages for which the harvester was not licensed for, but is required or permitted to retain, as well as all non-retained catch.</i>
Catch-Per-Unit-Effort (CPUE)	<i>See WPUE and NPUE.</i>	Basic measures of catch-rate for surveys and fisheries.	Basic measures of catch-rate for surveys and fisheries.
Catch Sharing Plan (CSP)	Management procedures in the U.S. and Canada which allocate some portions of the available yield among specific user groups or management areas. Allocations are often described as percentages of the Regulatory Area catch limits.	CSPs in the U.S. are implemented by the NPFMC (in Areas 2C and 3A) and the PFMC (in Area 2A).	These represent the allocation agreements in place in Canada.
Catch tables	Summary tables reporting detailed observed or projected removals by source and specific regulatory area.	<i>The catch tables corresponding to potential management decisions are roughly analogous to the annual "Specs" (specifications) tables in the Council systems.</i>	<i>Similar to tables describing TACs or removals by region.</i>
Cautious Zone	<i>This is analogous to the halibut spawning biomass being less than $SB_{30\%}$ but more than $SB_{20\%}$. Over this range of biomass the target harvest rate is reduced linearly to zero.</i>	<i>A similar approach is used for most species managed by the U.S. Fisheries Management Councils. The specific SB reference points used to define this zone depend on the species and Council system.</i>	The stock is considered to be in the Cautious Zone if the spawning biomass is less than the USR but greater than the LRP. Provisional values of 80% of B_{MSY} and 40% of B_{MSY} are recommended. However, alternative metrics may be used in species-specific contexts.

Term	IPHC	NMFS/NPFMC/PFMC	DFO
The Closed Area	A Region in the Eastern Bering Sea closed to the directed halibut fishery by the IPHC.	This area is not closed to fisheries targeting species other than halibut.	
Commission (IPHC)	Formed in 1923, the Commission is responsible for conducting research on and management of the stocks of Pacific halibut within the Convention waters of both nations.	<i>Similar organizations interacting with the U.S. Fisheries Management Councils include the Inter-American Tropical Tuna Commission and the Pacific Salmon Commission.</i>	<i>Similar organizations interacting with DFO include the Inter-American Tropical Tuna Commission and the Pacific Salmon Commission.</i>
Conference Board (CB)	An advisory body to IPHC composed of representatives of the directed halibut fisheries – commercial, recreational, and personal use.	<i>The AP (or GAP) in the Council processes operates similarly to the CB and the PAG combined.</i>	<i>DFO has various “advisory boards” or “advisory committees” serving a similar role.</i>
Constant Exploitation Yield (CEY)	A specific concept from the IPHC’s harvest policy: the Total CEY (TCEY) is the amount of yield of halibut greater than 26 inches in length, and Fishery CEY (FCEY), is the amount of yield for the directed halibut fisheries where applicable.	<i>Although ACLs or TACs, appear to be similar to CEYs, they are not equivalent because CEYs do not contain all sizes and sources of removals.</i>	<i>These are not equivalent to TACs, because CEYs do not contain all sizes and sources of removals.</i>
Critical Zone	<i>This is equivalent to a stock size less than $SB_{20\%}$ for halibut.</i>	<i>This is equivalent to a stock size less than the MSST defined for that species.</i>	The stock is considered to be in the Critical Zone if the spawning biomass is less than or equal to the LRP. A provisional value of 40% of B_{MSY} is recommended. However, alternative metrics may be used in species-specific contexts.
Centre for Science Advice Pacific Region (CSAP)	<i>The IPHC’s Scientific Review Board (SRB) provides independent peer-review in the same role.</i>	<i>Represents an analog to the SSCs and independent reviews supporting Council science.</i>	The regional body responsible for review and evaluation of scientific information on the status of living aquatic resources, their ecosystems and the biological aspects of stock management.
Decision Table	A table reporting the estimated probabilities of future stock and fishery risk metrics for a range of coastwide harvest levels. Since 2013, this has served as the primary basis for IPHC decision-making.	<i>There is no clear analog in the decision-making process, although decision tables that reflect scientific uncertainty and stock trends associated with alternative states of nature are sometimes produced in the annual SAFE documents.</i>	<i>Similar decision tables corresponding to potential management actions are included as a component of some stock assessment documents.</i>
Depletion	<i>See $SB_{xx\%}$.</i>	A term used to describe the level of female spawning biomass in a particular year relative to the average female spawning biomass in the absence of fishing.	A term used to describe the level of female spawning biomass in a particular year relative to the average female spawning biomass in the absence of fishing (B_0).

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Discard Mortality Rate (DMR)	The fraction of the halibut that are released/discarded and are estimated to subsequently die. This is the product of the estimated condition(s) or injury type(s) of those fish and the discard mortality probability associated with each condition or injury.	<i>Identical definition. Calculation and application of DMRs for halibut varies by fishery, and type of observer coverage. The NPFMC uses average values over a period of years. The PFMC uses estimates by vessel based on observers for the integrated trawl fishery. Historically, the IPHC has provided some or all parts of these estimates to the Council processes.</i>	<i>Identical definition. Calculation and application of DMRs for halibut varies by fishery, and type of observer coverage.</i>
Discard mortality probability	The estimated probability that a halibut with a particular injury type or condition category will die due to injuries sustained during capture.	Identical definition.	Identical definition.
Exclusive Economic Zone (EEZ)	The IPHC's jurisdiction includes the EEZs of both the United States and Canada in the eastern Pacific Ocean.	The waters for which the U.S. exercises legal jurisdiction of fisheries, extending to 200 miles from the coastline.	The waters for which Canada exercises legal jurisdiction of fisheries, extending to 200 miles from the coastline.
Exploitable biomass	A specific concept from the IPHC's harvest policy: the portion of the total stock biomass included in the current harvest policy calculations.	<i>There are no analogs frequently used for management, although vulnerable biomass is sometimes defined where there is only a single fishery and/or selectivity of all fisheries is similar.</i>	<i>There are no analogs frequently used for management, although vulnerable biomass is sometimes defined where there is only a single fishery and/or selectivity of all fisheries is similar.</i>
Fxx%	The level of fishing intensity that reduces the SPR to XX%.	<i>This is a common notation for describing fishing intensity.</i>	Identical definition; not in common use.
F_{MSY}	<i>There is currently no analog in the IPHC's harvest policy.</i>	The level of long-term constant fishing intensity estimated to produce MSY; this level may not represent a specific annual goal as stock status and trend may vary.	The level of long-term constant fishing intensity estimated to produce MSY; this level may not represent a specific annual goal as stock status and trend may vary.
Fishery Management Plan (FMP)	<i>The IPHC's current harvest policy serves in a similar, but not legally binding manner as FMPs.</i>	A formal plan that contains specific guidelines and measures for conserving and managing specific fisheries and fish stocks.	<i>Roughly analogous to Integrated Fishery Management Plans, which outline fishery objectives and the basic rules of the fishery and fishing season.</i>
Groundfish Advisory Panel (GAP)	<i>The IPHC Commissioners similarly receive recommendations from the PAG and CB during the annual meeting.</i>	Stakeholder panel that provides recommendations to the PFMC process.	<i>DFO has various "advisory boards" or "advisory committees" serving a similar role.</i>
Groundfish Management Team (GMT)	<i>There is no analog of managers directly advising the Commission.</i>	Managers and scientists from State, Federal, Academic and other organizations who are appointed by the Councils to provide analyses and recommendations to the decision making process.	<i>There is no clear analog.</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Guideline Harvest Level (GHL)	A precursor to the current CSP. Part of a program used by the North Pacific Fishery Management Council from 2003 to 2013 to manage the harvest by the sport charter halibut fishery in Areas 2C and 3A.	Identical definition.	<i>There is no clear analog.</i>
Gulf of Alaska (GOA)	<i>This region is mismatched with IPHC regulatory areas, including a portion of 4A and all of 2C, 3A, and 3B.</i>	The U.S. EEZ of the GOA region that is managed by the NPFMC (including an FMP defining groundfish catch and PSC limits).	
Harvest Control Rule (HCR)	A common element in harvest policies, the HCR is a method for determining a catch or fishing intensity target. The IPHC's current harvest policy does not contain an explicit limit for fishing intensity.	This is a common approach for management of most stocks, representing an explicit method for determining a catch or fishing intensity target or limit.	This is a common approach for management of most stocks, representing an explicit method for determining a catch or fishing intensity target or limit.
Harvest policy	A documented set of methods for fishery management.	Identical definition.	
Healthy Zone	<i>This is analogous to a halibut spawning biomass greater than $SB_{30\%}$. Over this range of biomass the target harvest rate is applied in the HCR.</i>	<i>A similar approach is used for most species managed by the U.S. Councils. The specific SB reference points used to define this zone depend on the species and Council system but generally correspond to SB_{MSY} or a proxy.</i>	The stock is considered to be in the Healthy Zone if the spawning biomass is higher than the USR. A provisional value of 80% of B_{MSY} is recommended. However, alternative metrics may be used in species-specific contexts.
Limit Reference Point (LRP)	<i>This is analogous to a halibut spawning biomass equal to $SB_{20\%}$.</i>	<i>The specific SB reference points used to define this zone depend on the species and Council system.</i>	The stock size at the boundary between the Critical and Cautious Zones.
Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, MSA, "Magnuson-Stevens Act")	<i>The Treaty provides the analogous legal authority for the IPHC to manage the Pacific halibut stock.</i>	This is the basic U.S. law for management of the EEZ. This law establishes the legal authority for the regional fishery management council system, and other provisions of U.S. marine fishery law for the 200-mile fishery conservation zone. It was first implemented in 1977, and has been modified in subsequent years.	<i>The Fisheries Act, the Oceans Act, and the Species at Risk Act create an analogous legal and policy framework covering the management of Canadian fisheries.</i>
Maximum Sustainable Yield (MSY)	<i>There is currently no analog in the IPHC's harvest policy.</i>	An estimate of the largest average long-term annual catch under prevailing ecological and environmental conditions. This quantity represents the limit or target (depending on stock size) for most U.S. federally managed fisheries, depending on the specific dynamics of each stock.	An estimate of the largest average long-term annual catch under prevailing ecological and environmental conditions.
Mt, t	<i>Used by the IPHC only for comparison with PSC limits. See Mlb and net weight.</i>	Metric tons, this is reported in round weight	Metric tons, this is reported in round weight
Millions of pounds (Mlb)	Measure of stock weight (almost always net).	<i>Often confused with metric tons round weight (almost never in net weight).</i>	<i>Often confused with metric tons round weight (almost never in net weight)..</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Minimum Stock Size Threshold (MSST)	<i>This is analogous to a halibut spawning biomass equal to $SB_{20\%}$.</i>	Defines the lower limit of the HCR in many fisheries; the specific value depends on the species and FMP.	This is the LRP in the Canadian management system.
Management Strategy Advisory Board (MSAB)	An advisory group appointed by the Commission, whose purpose is to define fishery management objectives and to provide technical input on the development of a Management Strategy Evaluation for the Pacific halibut fishery.	<i>There is no analog in these processes.</i>	<i>Management Strategy Evaluations in process for some BC fisheries have advisory boards with roles similar to the MSAB.</i>
Net weight	The weight of a halibut without gills and entrails, head-off, washed and without ice and slime. Interestingly, for management and modelling purposes all halibut exist in this state.	<i>Almost never used, and often confused with round weight.</i>	<i>Almost never used, and often confused with round weight.</i>
Numbers-Per-Unit-Effort (NPUE)	The catch (in numbers) of halibut per standardized skate of longline gear. This metric is used to measure temporal trends in catch-rates for the IPHC's setline survey within and among regulatory areas.	<i>See CPUE.</i>	<i>See CPUE.</i>
O26	Halibut greater than or equal to 26 inches in length. See U26.	<i>There are no analogous cut-offs for most U.S. managed fisheries, although some biomass estimates are reported based on age categories.</i>	<i>There are no analogous cut-offs for most Canadian fisheries.</i>
O32	Halibut greater than or equal to 32 inches in length. See U32.	<i>There are no analogous cut-offs for most U.S. managed fisheries, although some biomass estimates are reported based on age categories.</i>	<i>There are no analogous cut-offs for most Canadian fisheries, although some species are managed with size limits.</i>
Overfished	<i>This condition is roughly analogous to the halibut stock dropping below $SB_{20\%}$.</i>	The status that a fish stock's SB is below the defined LRP of MSST. This status determination is independent of the current level of fishing intensity.	<i>This condition is roughly analogous to the stock dropping below the LRP, but the term is not specifically used in Canada.</i>
Overfishing	<i>There is currently no analog in the IPHC's harvest policy.</i>	The status that a fish stock's level of fishing intensity is above the level estimated to produce MSY. This status determination is independent of the current level of biomass.	<i>Not defined in Canada.</i>
Overfishing Level/Limit (OFL)	<i>There is currently no analog in the IPHC's harvest policy.</i>	Maximum amount of removals that can be taken without creating a level of fishing intensity that would be considered overfishing.	<i>Not defined in Canada.</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Optimum Yield (OY)	<i>Roughly equivalent to the IPHC's Blue Line, as adjusted during the annual process.</i>	The amount of fish that will provide the greatest overall biological social and economic benefit (with respect to food production, recreational opportunities, and taking into account the protection of marine ecosystems), as reduced by relevant economic, social, and ecological factors. Also called the TAC depending on the process.	<i>Roughly equivalent to the TAC.</i>
P* ("P star")	<i>There is currently no analog in the IPHC's harvest policy; however, the estimated probabilities of multiple risk metrics are presented annually in the Decision Table.</i>	Probability of overfishing.	<i>There is no clear analog in the Canadian process.</i>
Processor Advisory Group (PAG)	An advisory body to IPHC composed of representatives from halibut processors.	<i>Along with the CB, this group serves a similar role as the AP or GAP for the NPFMC and PFMC processes.</i>	
Prohibited Species Catch (PSC)	<i>The IPHC refers to halibut catch in fisheries that cannot legally retain halibut as bycatch.</i>	The mortality of species that cannot legally be retained by a target fishery.	<i>For a few Canadian fisheries (such as groundfish trawl), "prohibited species" are defined in license conditions as species for which retention is not permitted.</i>
Plan Team (PT)	<i>There is no analog of managers directly advising the Commission, although the MSAB serves some similar functions with regard to harvest policy.</i>	A group of scientific, management, and other advisors appointed by the NPFMC to review stock assessments and fishery controls including OFLs, and ABCs. The duties of this group are similar in some respects to those of the GMT for the PFMC.	
Regulatory Areas	Eight management units for which the IPHC sets annual catch limits: 2A, 2B, 2C, 3A, 3B, 4A, 4B, and 4CDE (which includes the Closed Area).	<i>Mismatched with BSAI and GOA regulatory areas under the management of the NPFMC. Area 2A corresponds to the waters under the management of the PFMC.</i>	<i>Area 2B corresponds to the waters under the management of DFO.</i>
Report of Assessment and Research Activities (RARA)	This annual document provides a summary of research as well as the most recent stock assessment and harvest policy estimates.	<i>Similar to the SAFE documents describing annual analyses and results.</i>	<i>Similar to Canadian Science Advisory Secretariat (CSAS) research documents reporting stock assessments for individual groundfish stocks.</i>
Rebuilding Plan	<i>There is no analog in the IPHC's current harvest policy which does not have separate procedures or an overfished determination.</i>	A document that describes policy measures that will be used to rebuild a fish stock that has been declared overfished.	A document that describes rebuilding objectives, timelines, and management procedures that will be used to rebuild a fish stock that has been determined to be in the Critical Zone.
Removals	All fish that die due to capture either through retention or discarding. Synonymous with mortality.	Identical definition.	Identical definition.

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Removal reference	<i>There is no analog in the IPHC's current harvest policy which does not have an overfishing determination.</i>	<i>This is analogous to the OFL.</i>	The maximum removal rate (in fishing mortality, or some metric of fishing intensity) defined in the HCR for the stock including all mortality from all types of fishing. This value should be less than or equal to the removal rate associated with MSY.
Research Advisory Board (RAB)	An advisory body to the Commission staff, comprised of halibut fishing and processing industry representatives. The RAB provides input on research topics and direction.	<i>Similar in some respects to the Advisory Panel (AP).</i>	<i>Similar in some respects to the Halibut Advisory Board (HAB).</i>
Round weight	<i>Used by the IPHC only to provide comparison to PSC calculations. See net weight.</i>	<i>The standard metric for reporting; often confused with net weight.</i>	<i>The standard metric for reporting; often confused with net weight.</i>
Female Spawning Biomass (SB)	Female spawning biomass expected to contribute to reproductive output in a particular year.	<i>Also sometimes Spawning Stock Biomass (SSB) or mature biomass.</i>	<i>Also sometimes Spawning Stock Biomass (SSB) or mature biomass.</i>
SB_{xx%} (also relative spawning biomass)	The level of female spawning biomass corresponding to XX% of the average female spawning biomass in the absence of fishing.	<i>Also sometimes referred to as depletion.</i>	<i>Also sometimes referred to as depletion.</i>
SB_{100%}	The average long-term female spawning biomass in the absence of fishing.	<i>Equivalent to SB_{zero}, SB₀ or B₀.</i>	<i>Equivalent to SB₀ or B₀.</i>
SB_{MSY}	<i>This reference point is not explicitly included in the IPHC's current harvest policy. Instead, the target harvest level is less than MSY, based on a historical simulation analysis of both the long term yield and variability.</i>	The level of female spawning biomass estimated to produce MSY. This is often based on a proxy when the value is unknown for a particular species.	<i>Also B_{MSY}; the level of female spawning biomass estimated to produce MSY.</i>
Spawning Potential Ratio (SPR)	A commonly used metric of fishing intensity. SPR is the ratio of the equilibrium spawning biomass per recruit given some level of fishing and the equilibrium spawning biomass per recruit in the absence of fishing. Sometimes referred to as SBR, relative Spawning Biomass per Recruit.	<i>This metric is frequently used to describe fishing intensity and fishing intensity-based reference points.</i>	<i>Not commonly used in Canadian management, but consistent with DFO's Decision Making Framework.</i>
Scientific Review Board (SRB)	A group of independent scientists appointed by the Commission to provide ongoing independent review of the halibut stock assessment, harvest policy, and staff research.	<i>Represents an analog to the SSCs and independent reviews supporting Council science.</i>	<i>Represents an analog to the CSAP review committee.</i>
Scientific and Statistical Committee (SSC)	<i>The IPHC's Scientific Review Board (SRB) provides independent peer-review in the same role.</i>	A group of independent scientists and experts appointed by the Councils to provide review of scientific products.	<i>Represents an analog to the PSARC.</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Stock	The population unit defined for management purposes. For Pacific halibut this includes all fish in the territorial waters of the United States and Canada.	<i>Identical definition. Often used to define the portion of a population residing only in United States territorial waters.</i>	<i>Identical definition. Often used to define the portion of a population, or to indicate a population unit that is managed separately from other units of the same species residing in Canadian territorial waters.</i>
Stock Assessment and Fishery Evaluation (SAFE)	<i>The IPHC's RARA provides an equivalent documentation of annual research.</i>	Provides a summary of stock assessment and research products for use in the Council processes.	<i>Similar to Canadian Science Advisory Secretariat (CSAS) research documents reporting stock assessments for individual groundfish stocks.</i>
Total Allowable Catch (TAC)	<i>This is equivalent to the Catch Limits set by the IPHC.</i>	The target annual removals for a particular fishery. Also called the OY, depending on the process.	This is a catch limit for a particular species, sometimes defined for a particular fishery, or for all fisheries that catch that species.
Total mortality accounting	Reporting all sources and sizes of removals from the stock in the same framework (i.e., including the removals of U26 halibut). This was introduced in 2014 to make the IPHC's process more transparent and comprehensive.	<i>This is the standard approach for most fisheries.</i>	<i>This is the standard approach for most fisheries.</i>
The IPHC Treaty	Formally, the Convention Between Canada and the United States for the Preservation of the Halibut Fishery of the Northern Pacific Ocean and the Bering Sea. As an international convention, it supersedes domestic legislation.	<i>The U.S. legal analog is the Magnuson-Stevens Fishery Conservation and Management Act, creating the regulatory structure and authority for U.S. managed fisheries.</i>	<i>The Canadian analog is the combination of the Fisheries Act, the Oceans Act, and the Species at Risk Act which create a legal and policy framework covering the management of Canada's fisheries.</i>
U26	Halibut less than 26 inches in length. Removals of these fish are not explicitly included in annual harvest policy calculations.	<i>There are no analogous cut-offs for most U.S. managed fisheries, although some biomass estimates are reported based on age categories.</i>	<i>There are no analogous cut-offs for most Canadian fisheries.</i>
U32	Halibut less than 32 inches in length. This corresponds to the current minimum size limit imposed by the IPHC on the directed commercial fishery.	<i>There are no analogous cut-offs for most U.S. managed fisheries, although some biomass estimates are reported based on age categories.</i>	<i>There are no analogous cut-offs for most Canadian fisheries, although some species are managed with size limits.</i>
Upper Stock Reference Point (USR)	<i>This is analogous to a halibut spawning biomass equal to $SB_{30\%}$.</i>	<i>The specific SB reference points used to define this zone depend on the species and Council system.</i>	The stock size at the boundary between the Cautious and Healthy Zones.
Wastage	<i>The incidental mortality (net pounds) from the directed halibut fisheries due to regulatory discards, mandatory or voluntary release of halibut, and from lost or abandoned fishing gear (particularly important during the derby fisheries prior to ITQ implementation).</i>	<i>Discards, as estimated by observer programs, represent a portion of the wastage calculation. Mortality associated with lost gear is not generally included in such estimates.</i>	<i>Discards, as estimated by observer programs, represent a portion of the wastage calculation. Mortality associated with lost gear is not generally included in such estimates.</i>

Term	IPHC	NMFS/NPFMC/PFMC	DFO
Weight-Per-Unit-Effort (WPUE)	The catch (in net pounds) of halibut per standardized skate of longline gear (1,800-foot skate of gear, with 100 hooks at an 18-foot spacing). This metric is used to compare catch-rates between the IPHC's setline survey and the directed commercial halibut fishery and temporal trends in each.	<i>See CPUE.</i>	<i>See CPUE.</i>

For more information

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