

2.7 Sampling commercial landings

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Abstract

This paper describes the 2016 International Pacific Halibut Commission commercial catch sampling program for Pacific halibut in Alaska, British Columbia, Washington, and Oregon. Commercial catch sampling involves collecting Pacific halibut otoliths, fork lengths, logbook information, and final landing weights. The collected data are used in stock assessment and other research and the collected otoliths provide age composition. Lengths of sampled Pacific halibut provide the basis for estimates of mean weight and, in combination with age data, size-at-age analyses. Mean weights are combined with final landing weights to estimate catch in numbers. Logbook information provides weight per unit effort data, fishing location for the landed weight, and data for research projects. Finally, tags are collected to provide information on migration, exploitation rates, and natural mortality.

Introduction

Individual quota systems (QS) for Pacific halibut (*Hippoglossus stenolepis*) remained in place in Alaska and British Columbia during 2016. The Pacific halibut commercial fisheries off Washington, Oregon, and California (Area 2A) were allocated catch limits by the Pacific Fishery Management Council (PFMC) which were a subdivision of the overall catch limit for the area adopted by the International Pacific Halibut Commission (IPHC). The PFMC allocates Pacific halibut within Area 2A among the sport, commercial, and treaty Indian (designated as Area 2A-1) user groups using a Catch Sharing Plan (CSP). Due to mechanisms in the PFMC CSP and the adopted 2016 total Area 2A catch limit that exceeded 900,000 pounds (408 t), there was a non-treaty incidental Pacific halibut catch during the limited-entry sablefish (*Anoplopoma fimbria*) longline fishery in 2016. The Area 2A directed commercial fishery was restricted to waters south of Point Chehalis, Washington (46°53'18" N latitude), while the incidental Pacific halibut catch during the sablefish fishery and the treaty Indian tribes' commercial fisheries were prosecuted north of Point Chehalis.

Sampling objectives and procedures

One of the primary objectives in sampling landings of commercially caught Pacific halibut is to obtain samples composed of sagittal otoliths and corresponding fork length measurements, which are representative of all commercial Pacific halibut landings. To accomplish this, random sampling techniques are applied, and an equal proportion of the catch (by weight) is sampled within each IPHC regulatory area over the entire landing period, using prescribed sampling rates that vary among areas and sometimes ports. In addition to sampling the catch, other objectives include collecting recovered tags, and copying information from fishing logs along with the respective landed weights, for as many Pacific halibut trips as possible throughout the entire season.

Inherent in the sampling program is the positioning of field sampling staff in ports where there is an opportunity to sample a majority of the catch for each regulatory area. To ensure that

proportional sampling occurs by regulatory area and port, landing patterns are reviewed annually, sampling protocols are established based on the weights landed, and sampling days are assigned to each port. In some cases, different sampling rates for a given regulatory area are assigned by port. Finally, sampling priorities by regulatory area are assigned on a port level to address situations in which multiple concurrent landings preclude the IPHC port sampler's ability to obtain samples from all vessels.

Selection of sample days

Sampling protocols are designed to maximize the number of landings available for sample selection and ensure that the sampled Pacific halibut are representative of the population of landed Pacific halibut. To this end, the weekly sampling schedule (six days a week; one day off) for each port was randomized so that catch landed on each day had an equal chance of being selected for sampling. A restriction to the weekly sampling schedule was that one day per week was set aside for logbook collection only.

Small landings

Small landings contribute a substantial proportion of the total landed catch in some ports. The potential impact of not sampling what is considered a small landing (which differs by port) was assessed, differences identified (see Webster et al. 2014), and small landings have been sampled since 2010. For reference, in 2016, small landings were defined and sampled in the following Alaskan ports: Petersburg, Sitka, and Juneau landings less than 2,000 lb (907 kg); and St. Paul less than 1,000 lb (454 kg).

Sampling rates and priorities

Sampling rates for each regulatory area are port specific ([Table 1](#)). The sampling rates are applied to the hailed weight from each trip prior to offload to determine the sample size (in pounds) for that offload. The number of days per week on which sampling should occur for landings from a regulatory area are also port specific. Differences in sampling rates among ports within regulatory areas were due to uneven distributions of projected landings among those ports. Small landings in Petersburg, Sitka, Juneau, and St. Paul, Alaska were sampled on assigned days at 10% of the hailed weight.

Samplers used their own judgment, based on a hierarchy of objectives, to determine which landings to sample when there were conflicts that precluded sampling all of the landings prescribed by their sampling schedule. For example, it is a frequent occurrence that more than one boat unloads simultaneously from the same regulatory area within a port. In such cases, the vessel with the higher poundage was usually sampled. In instances when this did not occur, a sampler may have been working at a facility where there was a constant stream of Pacific halibut offloads. The sampler would therefore opt to stay at the one plant rather than travel to another location. Sampling conflicts also arose from simultaneous landings of Pacific halibut from different regulatory areas within a port. Sampling priorities by regulatory area were assigned to resolve these conflicts. In Alaskan ports and in Bellingham, Washington, Area 4 landings had the highest sampling priority, followed by Area 2C (and 2A in Bellingham), then Area 3B, and finally Area 3A. The priority scheme for Area 4 catches was to sample Area 4B first, followed by Areas 4C and 4D, and then Area 4A.

Otolith sampling targets

An objective of the catch sampling program is to collect a target number of otoliths and corresponding fish lengths from each regulatory area. Otolith sampling rates are established to optimize work effort and achieve target sample sizes. In 2016, a target of $1,500 \pm 500$ otoliths and Pacific halibut fork lengths was set for each of IPHC Regulatory Areas 2B, 2C, 3A, 3B, 4A, 4B, and Areas 4C and 4D combined (Tables 2a and 2b). In Area 2A, the target was 1,000 otoliths with corresponding fork lengths. The Area 2A target was further subdivided to obtain adequate sample sizes from the Area 2A-1 treaty Indian fisheries and the directed commercial fishery, relative to each fishery component's proportion of the overall 2A catch limit. This division resulted in a target of 650 otoliths/lengths from the treaty Indian fishery and 350 otoliths/lengths from the non-treaty directed commercial fishery and incidental retention of Pacific halibut in the sablefish fishery. The sampling rates detailed above were calculated to meet sampling targets and to obtain otoliths and data from an equal proportion of the catch within areas.

Weight measurements

There is a need to collect data coastwide throughout the season in order to estimate spatial and seasonal variation in the length to weight relationship (Webster and Erikson 2017). Fish may be weighed head-on and head-off, washed and unwashed.

In 2016, all IPHC samplers, except those in Newport, OR, were provided with an Intelligent Weighing Technology's¹ TitanH 300-16 scale. All samplers used the same protocol, which integrated weighing into the standard otolith sampling procedure, i.e., for every fish from which an otolith was collected, an associated fork length and weight were also collected. The goal in 2017 is to expand coverage of the weighing procedure coastwide by including Newport and all tribal samplers in Area 2A.

A total of 10,192 Pacific halibut were measured and weighed in 2016 compared to 5,733 in 2015, two thousand three hundred and fifty-one in 2014, and 831 in 2013. Analysis of these data can be found in Webster and Erikson (2017).

Electronic log remote data entry (RDE)

Port sampling vessel-based data collection methods are still based on pencil and paper technology. With recent advancements in the field of ruggedized computing, the IPHC is exploring ways to integrate the new technology to enhance this data collection program. The primary impetus for this project is to create a process that will eliminate or reduce the need for post-collection data entry and increase the speed of data editing. Consequently, the data will be provided to the end users (i.e., stock assessment and research scientists) earlier than in the past, allowing more time for data analysis. This also provides greater precision, verification, and timeliness in the collected log data.

In 2016, an electronic tablet was provided to port samplers in each Alaskan port and in Bellingham, WA, for entry of fishing data from the IPHC hard cover logbooks directly into the remote data entry (RDE) application that was designed by IPHC programmers to capture all necessary logbook details. Samplers were tasked with entering data from as many of the logs they collected as priorities and time allowed during the course of their regular port sampling duties.

¹Intelligent Weighing Technology, 4040 Adolfo Road, Camarillo, CA 93012, USA.

Modifications and enhancements to the application are still in progress. In 2017, RDE of log data will continue to be a regular part of the port sampling program log collection protocol.

In British Columbia, samplers were provided with a field version of the log entry program used by the IPHC's data transcription staff in Seattle. The samplers were tasked with entering as many Canadian logs as time permitted, though priority was given to other tasks such as biological sampling and entry of setline survey data.

Modifications to sampled ports

Prior to the 2016 season, landings for past years were reviewed, comparing deliveries into sampled and unsampled ports by IPHC statistical area, to ascertain whether any statistical areas were being under-sampled. Good coverage was found in Areas 2B, 2C, 3A, 4C, and 4D. However, there were statistical areas in Regulatory Area 3B where the proportion of landings into sampled ports was lower than their total contribution to the Area 3B harvest. Despite this under-representation, Sand Point, AK was removed from the list of staffed ports due to logistical and budget considerations.

Sampling rate calculations

Sampling rate calculations, the 2016 average Pacific halibut weight, and the proportion of catch landed in sampled ports for 2016 for the different regulatory areas are shown in [Tables 2a](#) and [2b](#). The rates were calculated using the following equations:

$$PG = (TSS \cdot \bar{w}) / (PS \cdot CL)$$

where PG = the overall ratio of the landings to be sampled by area in sampled ports;
 TSS = the otolith target for each respective area;
 \bar{w} = the average Pacific halibut weight for each area;
 PS = the proportion of landings that were expected to be landed in sampled ports;
 CL = the available catch limit set by the IPHC; and

$$sr = PG / ps$$

where sr = the sampling rate to be used for each area;
 PG = the overall ratio of the landings to be sampled by area in sampled ports;
 ps = the previous year's proportion of landed weights with otolith sampling.

Sampling results

Alaskan Individual Fishing Quota fishery

To meet Alaskan sampling objectives, the ports of Dutch Harbor, Kodiak, Homer, Seward, Juneau, Sitka, Petersburg, and Bellingham were staffed throughout the entire 2016 Individual Fishing Quota (IFQ) season (19 March through 7 November). St. Paul was staffed from 6 July through 19 August, during the height of the Area 4C Community Development Quota (CDQ) and IFQ fisheries. A sampling effort summary is presented in [Table 3](#). Otolith and length samples for each Alaskan regulatory area met the targets.

[Table 4](#) presents the proportion of sampled weight to landed weight in each sampled port. In 2016, there was similar variation in these proportions for each area among ports as in 2015. Regulatory area information on a Prior Notice of Landing (PNOL) list aids in minimizing this variation. The PNOL list was compiled from National Oceanic and Atmospheric Administration (NOAA) Restricted Access Management Division data on vessels notifying NOAA's Office of Law Enforcement of their intention to land IFQ fish. The PNOL list included poundage of Pacific halibut and sablefish to be landed by vessel name, along with the accompanying Alaska Department of Fish and Game number, the unloading port, and the unloading location, date, and time. The advance knowledge of which regulatory area the catch was coming from helped samplers set sampling priorities. For landings of catch taken from multiple regulatory areas, the knowledge of the amount of catch from each regulatory area for a given landing would further reduce these variations in proportions.

IPHC samplers copied approximately 2,028 Alaskan fishing logs from ports where the IPHC had a presence, and another 194 logs for Alaskan landings delivered to other ports ([Table 5](#)). Samplers had an opportunity to collect logs from other locations when they encountered transient Pacific halibut vessels in their own ports.

Canadian Individual Vessel Quota fishery

IPHC samplers staffed the ports of Vancouver, Port Hardy, and Prince Rupert from 19 March through 7 November 2016. Most of the Area 2B catch (93%) was landed in the three sampled Canadian ports combined ([Table 2a](#)). The samplers collected 1,737 otoliths and fork length samples, within the target range of 1,000-2,000 ([Table 3](#)). The percentage of the catch sampled, by weight, in all of Area 2B in 2016 was 30%, three percent more than in 2015 ([Table 3](#)). [Table 4](#) presents the proportion of sampled weight to landed weight in each sampled port. The proportions of sampled weight to landed weight decreased from last year in Port Hardy, from 0.38 to 0.33; increased in Prince Rupert, from 0.18 to 0.28; and increased in Vancouver, from 0.50 to 0.60 ([Table 4](#)). IPHC samplers collected 435 Canadian logs from ports where the IPHC has a presence, and 15 logs for Canadian landings delivered to other ports in British Columbia ([Table 5](#)).

Washington and Oregon

Treaty Indian managers worked cooperatively with the IPHC and sampled the Area 2A-1 catch. In 2016, the Jamestown S'Klallam, Port Gamble S'Klallam, Swinomish, Lummi, Makah, Quileute, and Quinault tribes in Washington State participated in the IPHC's sampling program. In the past, one sampling rate for all the tribes was used to simplify the protocol for the tribal biologists; in 2012, for example, the sampling rate was set at 10% for all tribes. Since 2013, sampling rates have been calculated for each tribe based on the sampling rate calculation used for all non-tribal ports. The sampling rates for the tribes are listed in [Table 1](#). The 2016 otolith and length collections totaled 568, which were just shy of the target of 650 otoliths, and the tribal samplers collected otoliths from 50% of the total tribal commercial catch ([Table 3](#)). Sampling by the tribes can only be done opportunistically and is dependent on availability of tribal fisheries staff. The number of fishing logs collected from the treaty Indian fisheries increased from 137 in 2015 to 161 in 2016 ([Table 5](#)).

In 2016, the Area 2A non-treaty commercial sampling collections were 314 and below the target of 350 otoliths ([Table 3](#)). The majority (72%) of the Area 2A non-treaty commercial sampling was conducted in Newport, Oregon, during the 22 June and 6 July directed commercial fishery

openings. The rest of the samples (28%) were obtained in Bellingham, Washington during the incidental retention of Pacific halibut in the sablefish fishery.

In 2016, samplers collected 36 logs from the directed commercial fishery ([Table 5](#)), two more than in 2015. In 2016, 29 logs were collected from the incidental retention of Pacific halibut in the sablefish fishery north of Point Chehalis, Washington, 17 more than in 2015.

Pacific halibut tag collection

Port samplers collected tags from 24 tagged Pacific halibut in 2016. Eighteen of these tag recoveries were from the 2013 tagging project in which Pacific halibut were either double-tagged with an internal ‘dummy’ archival tag and a pink wire cheek tag, or tagged with a single external dummy archival tag on the cheek. Tagged fish from the 2013 dummy archival study were recovered in Sitka (one fish), Seward (three fish), Homer (seven fish), and Kodiak (seven fish). Four tags from the 2010 Aleutian wire tagging study were recovered: one in Kodiak and three in Dutch Harbor. In 2015, Pacific halibut were tagged during the NMFS trawl survey; two of these tags were recovered in Homer in 2016. Tag data collected dockside included fork lengths, otoliths, and capture location of the recovered tagged fish. Additional tag information can be found within this volume (Forsberg 2017).

Additional biological sampling and data collection projects

This section describes biological sampling projects for which the port samplers were tasked with outside of their typical port sampling collection duties. Details on each project are presented below.

Clean otolith archive collection (COAC)

Otoliths for the Clean Otolith Archive Collection (COAC) will not be used for age determination, but are cleaned, dried, and stored whole in climate-controlled conditions for future analysis (Tobin and Forsberg 2017). The COAC is primarily supplied via the IPHC fishery-independent setline survey; however, in Areas 2A, 4B, and 4CD the otolith sampling rate for the 2016 survey is 100%. For this reason, samples from the commercial fleet were collected in these three areas to supply the COAC. In 2016, the target of 100 otoliths was exceeded in Areas 2A and 4B, but was not met in 4CD ([Table 6](#)).

Commercial sex-marking project in British Columbia

A key element missing from the IPHC’s stock assessment is the sex ratio of the Pacific halibut in the commercial landings. By regulation, Pacific halibut are to be dressed (eviscerated) before delivery; gonads are therefore unavailable for visual inspection of sex. In 2014, a system of external marking was developed to denote sex: two knife cuts in the dorsal fin for female, a single cut in the white-side gill plate for male (McCarthy 2015). After a small trial in Homer in 2015, which involved three vessels, it was decided to expand the project to the regulatory area scale in 2016. The IPHC approached the Pacific Halibut Management Association of British Columbia to ask its members to voluntarily mark their catch. Port samplers in Port Hardy, Prince Rupert, and Vancouver recorded the external sex mark and took a tissue sample, in addition to the length/weight measurement and otolith collection, during the standard market sampling procedure when possible. A total of 21 sex-marked landings were sampled. The findings of this study are described in Loher et al. (2017).

References

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Table 1. 2016 sampling rates and days by regulatory area and port.

Regulatory Area	Sampling Rate (%)	Port(s)	No. Sampling Days Per Week
2A	10	Bellingham, Newport	All days
2A-1	10	Bellingham	As many as possible
	10	LaConner	
	5	Neah Bay, Sequim, Port Angeles	
	5	Taholah, Westport	
2B	3.5	Prince Rupert	5 days
	1.5	Port Hardy, Vancouver	
2C	4	All ports	5 days
3A	1	Bellingham	3 days
	1.5	Sitka	5 days
	1	Seward, Kodiak	4 days
	1	All other ports	5 days
3B	10	Seward, Dutch Harbor	5 days
	2.5	All other ports	
4A	5	All ports	5 days
4B	15	Dutch Harbor	5 days
	10	All other ports	
4C&D	6	St. Paul	4 days
		All other ports	5 days

Table 2a. 2016 otolith targets and data used in determining the sampling rates for IPHC Regulatory Areas 2B, 2C, 3A, and 3B.

	Regulatory Areas			
	2B	2C	3A	3B
Otolith target (no.) (<i>TSS</i>)	1,500	1,500	1,500	1,500
2015 Average Pacific halibut weight (lbs) (\bar{w})	23.92	30.74	20.14	19.54
Sample size (000 lbs) ($TSS * \bar{w}$)	35.8	46.1	30.2	29.3
2016 Catch limit (000 lbs) (<i>CL</i>)	6,199	3,924	7,336	2,710
2015 Landings into sampled ports (000 lbs)	5,444	2,520	6,333	2,325
Proportion landed in 2015 sampled ports (<i>PS</i>)	0.916	0.710	0.824	0.894
Overall ratio to be sampled in 2015 (<i>PG</i>)	0.006	0.017	0.005	0.012
Proportion of 2015 landed weight with otolith sampling (<i>ps</i>)	0.297	0.491	0.503	0.486
Sampling ratio for estimated weight available for sampling in 2016 (<i>sr</i>)	0.020	0.035	0.010	0.025
2015 Final sampling rates (%)	1.5	4.0	1.0	2.5
2016 Average Pacific halibut weight	22.6	29.9	19.5	21.8
2016 proportion landed in sampled ports	0.936	0.721	0.823	0.815

Table 2b. 2016 otolith targets and data used in determining the sampling rates for IPHC Regulatory Areas 2A-1, 2A, 4A, 4B, and 4C&D.

	Regulatory Areas				
	2A-1	2A	4A	4B	4C&D ¹
Otolith target (no.) (<i>TSS</i>)	650	350	1,500	1,500	1,500
2015 Average Pacific halibut weight (lbs) (\bar{w})	18.92	18.49	21.76	23.25	20.41
Sample size (000 lbs) ($TSS * \bar{w}$)	12.3	6.5	32.64	34.88	30.62
2016 Catch limit (000 lbs) (<i>CL</i>)	365	22	1,390	1,140	1,467
2015 Landings into sampled ports (000 lbs)	278	110	1,125	433	892
Proportion landed in 2015 sampled ports (<i>PS</i>)	1.00	0.67	0.853	0.401	0.814
Overall ratio to be sampled in 2016 (<i>PG</i>)	0.033	0.042	0.027	0.081	0.026
Proportion of 2015 landed weight with otolith sampling (<i>ps</i>)	0.566	0.684	0.703	0.707	0.436
Sampling ratio for estimated weight available for sampling in 2016 (<i>sr</i>)	0.059	0.062	0.039	0.115	0.059
2016 Final sampling rates (%)	10	10	5.0	10.0	6.0
2016 Average Pacific halibut weight	19.3	20.9	23.7	22.8	22.1
2016 proportion landed in sampled ports	0.895	0.614	0.698	0.498	0.924

¹4C&D includes CDQ

Table 3. Summary of 2016 otolith targets, collected otoliths, landings sampled, and the percentage of the total landed weight, represented by the weight of landings, from which otoliths were sampled.

Regulatory Area	Otolith Target	Collected otoliths	No. landings sampled	Percent of catch sampled
2A-1 ¹	650	568	172	43
2A ¹	350	314	36	40
2B	1,500	1,737	109	30
2C	1,500	1,759	135	31
3A	1,500	1,473	120	38
3B	1,500	1,549	42	41
4A	1,500	1,638	64	57
4B	1,500	1,466	15	23
4C&D	1,500	1,420	43	39
Totals	11,500	11,924	736	36

¹2A-1 refers to tribal fisheries and 2A refers to non-tribal fisheries in IPHC Regulatory Area 2A

Table 4. Proportion of total 2015 Pacific halibut landings represented by the weight of landings from which otoliths were sampled, separated by IPHC Regulatory Area, and listed by key ports.

Port	2A	2B	2C	3A	3B	4A	4B	4C&D
Newport	0.63							
Bellingham	0.48		0.28	0.42				
Treaty Indian ¹	0.50							
Vancouver		0.60						
Port Hardy		0.33						
Prince Rupert		0.28						
Petersburg			0.52	0.65				
Sitka			0.42	0.30				
Juneau			0.34	0.48				
Seward				0.47	0.37			
Homer				0.52	0.50	0.97		
Kodiak				0.42	0.54	0.74	0.86	0.92
Dutch Harbor					0.86	0.80	0.41	0.78
St. Paul								0.26

¹Area 2A-1 tribes that participated in the commercial sampling program.

Table 5. The number of Pacific halibut fishing logs collected by IPHC port samplers from landings into key ports in 2016, and the total number of logs collected from all ports.

Key Ports	US	Canada	
Newport	36		
Bellingham	48		
Treaty Indian ¹	161		
Port Hardy		176	
Prince Rupert		246	
Vancouver		13	
Petersburg	251		
Sitka	300		
Juneau	177		
Seward	319		
Homer	294		
Kodiak	344		
Dutch Harbor	128		
St. Paul	193		
			Grand total
Total key ports	2,251	435	2,686
Total all ports	2,445	450	2,895

¹Area 2A-1 tribes that participated in the commercial sampling program.

Table 6. Summary of 2016 COAC targets and collections.

Year	Regulatory Area	Otolith Target	Collected otoliths
2016	2A	100	178
2016	4B	100	145
2016	4CD	100	40