3.4 Results from the NMFS Aleutian Islands Biennial Bottom Trawl Survey in 2016

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Abstract

In 2016, the International Pacific Halibut Commission (IPHC) participated for the third consecutive time in the National Marine Fisheries Service Aleutian Islands Biennial Bottom Trawl Survey. The survey covered the area surrounding the Aleutian Islands between Unimak Pass in the east and Stalemate Bank in the west. A total of 409 Pacific halibut (*Hippoglossus stenolepis*) were encountered by the IPHC-staffed vessel, *F/V Sea Storm*. Of those, 209 were sampled for length, age structures, sex, maturity, and prior hooking injuries. The remaining 200 were selected for the tagging sample, and of those, 170 were released with wire tags attached. The remaining were either outside the target size for tagging or were not deemed to be in good enough condition after capture, and all were subsequently measured and released. Both biomass and abundance of Pacific halibut were estimated at their lowest levels since 1986.

Introduction

In 2016 the International Pacific Halibut Commission (IPHC) participated in the National Marine Fisheries Service (NMFS) Aleutian Islands trawl survey for the third time since 2012 (the other year was 2014). This survey has taken place every two years since 2000 (except that no survey was conducted in 2008), and every three years prior to that, dating back to 1980. The IPHC uses the NMFS trawl survey to collect information on Pacific halibut (*Hippoglossus stenolepis*) that are not yet vulnerable to the gear used for the IPHC fishery-independent setline survey or commercial fishery, and as an additional data source and verification tool for stock analysis.

Objectives

The IPHC objectives were to:

- Sample 50% of the Pacific halibut caught on one of two vessels for length, sex, maturity, otoliths, and prior-hooking injuries;
- Wire tag and release U32 Pacific halibut (i.e., < 82 cm fork length) from the other 50% of the catch. Measure and release the remaining fish as soon as possible; and
- Obtain fin clip samples from all tagged Pacific halibut for a genetic study.

NMFS objectives included:

- Defining the distribution and relative abundance of the principal groundfish and commercially important invertebrate species inhabiting the Aleutian Islands region;
- Obtaining catch and effort data used to estimate the abundance of the groundfish species;
- Collecting data to measure biological parameters, such as size, sex, age, growth, length-weight relationships, feeding habits, and spawning condition for selected species;

- Monitoring and recording trawl performance information; and
- Collecting samples and data requested by other researchers or research groups.

Survey area, vessels, and timing

The survey operated from Unimak Pass (longitude 165°W) to Stalemate Bank west of Attu Island (longitude 170°E). Two vessels were chartered by NMFS: *F/V Alaska Provider* and *F/V Sea Storm*. The vessels each fished three survey legs and stayed within close proximity of one another throughout the survey, so that each vessel sampled throughout the survey range. An IPHC biologist was aboard the *F/V Sea Storm* for the duration of the survey. The survey was initiated on 4 June 2016 and sampling began on 7 June 2016. Sampling concluded 8 August and the vessel returned to Dutch Harbor and demobilized on 12 August 2016.

Survey design

The Aleutian Island bottom trawl survey conforms to U.S. National Protocols (Stauffer 2004) and was conducted in a similar manner to previous surveys (von Szalay et al. 2011, Raring et al. 2016). The survey design is a stratified random sampling scheme consisting of 420 stations selected randomly from a combination of successful tows completed during previous surveys and sites not previously trawled. The selected sampling sites were allocated to 45 sampling strata defined by geographic location, depth, and regulatory area, ranging from shallow nearshore depths to approximately 500 m on the continental slope. A 15-minute tow was typically conducted at each station.

Stations were sampled with the Resource Assessment and Conservation Engineering (RACE) Division's standard four-seam, high-opening poly Nor'Eastern survey trawl equipped with rubber bobbin roller gear (Stauffer 2004). This trawl has a 27.2 m headrope and 36.75 m footrope, and consists of a 24.9 m center section with adjacent 5.9 m flying wing extensions. Accessory gear for the poly Nor'Eastern trawl includes 54.9 m triple dandylines and 1.8 - 2.7 m steel V-doors weighing approximately 850 kg each.

Pacific halibut sampling

All Pacific halibut caught by both vessels were measured. All Pacific halibut caught by the *F/V Sea Storm* were randomly put into two groups; 50% were selected for biological sampling and the other 50% were selected for the tagging sample. Information collected on Pacific halibut in the biological sample was length, sex, maturity, and otolith structures. Female maturity stages included immature, ripening, ripe/spawning, and spent/resting. Male maturity stages included immature and mature. For both sexes, an immature fish is one that will not participate in the upcoming spawning season. The other stages represent various phases of the spawning process, and fish in those categories are considered mature enough that they could participate in the upcoming spawning season. An additional piece of information collected is prior hooking injuries. Information concerning injuries to the eyes, mouth, or jaw resulting from being released from longline gear has been collected since the 1990s as part of an IPHC special project. The objective is to assess the types of hooking injuries a fish might sustain and still survive, as well as tracking the prevalence and severity of injuries.

Of the Pacific halibut selected for the tagging sample, those that were < 82 cm fork length and assessed as being in either *excellent* or *poor* condition based on NMFS observer criteria were outfitted with a wire tag and released (Forsberg et al. 2016). Pacific halibut > 82 cm or assessed in *dead* condition were measured and released as soon as possible after capture. Tagged fish were also fin-clipped with a biopsy punch in the dorsal fin for a future IPHC genetics study. The tagging effort is part of a larger multi-year project to tag and release U32 Pacific halibut throughout the Pacific halibut range. Tag recovery information is reported annually in the IPHC Report of Assessment and Research Activities (e.g., Forsberg 2017).

Results

The two survey vessels remained in close proximity to one another during the survey and conducted tows from Unimak Pass to Stalemate Bank. Four hundred nineteen stations were successfully completed. The number of tows per day ranged from one to seven, and averaged four to five. Figure 1 illustrates the catch of Pacific halibut during the 2016 survey for the two vessels. Pacific halibut were encountered throughout the Aleutian chain, but there were clearly fewer Pacific halibut encountered as the survey progressed to the west.

The IPHC-staffed vessel, the *F/V Sea Storm,* conducted 210 successful tows and caught 409 Pacific halibut (Fig. 2). A total of 209 fish were selected for the biological sample and 200 for the tagging sample.

Females accounted for 39% (82) of the biological sample and males were 61% (127), which are the same proportions encountered during the 2014 survey. Most (88%) of the females were immature and 12% were ripening. No Pacific halibut were actively spawning or considered spent/resting. The majority of the males were considered mature, with just 13% assessed as immature (Table 1). Prior-hooking injuries were found on 15 (3.7%) of the Pacific halibut. Of those, six were minor injuries, and nine were moderate.

Of the 200 Pacific halibut selected for the tagging sample, 170 met the tagging criteria. Those fish were fitted with a wire tag, submitted a fin clip, and were subsequently released. The remaining 30 were either too large for the sample or their condition was too poor to be expected to survive the tag and release process. In those cases, the fish were measured and released as soon as possible without a tag attached.

Abundance and biomass estimates

Following each survey, NMFS scientists estimate the biomass and abundance for the sampled area. These estimates are based upon the swept-area technique (Wakabayashi et al. 1985), do not account for catchability or selectivity, and should be considered as a relative index of abundance (Clark et al. 1997). The Pacific halibut population index peaked in 1997 with a biomass estimate of 146 million pounds (66,224 t) and steadily declined through 2012 to about 70 million pounds (31,751 t). After a slight increase to 74 million pounds (33,566 t) in 2014, the population index declined to 63 million pounds (28,576 t) in 2016. This is the lowest since 1986 when the biomass was estimated at 60 million pounds (27,216 t) (Fig. 3).

With few exceptions, overall abundance trends have matched biomass trends for Pacific halibut over the time series. As for biomass, the swept-area abundance estimate of 7.0 million fish in 2016 was the lowest calculated since 1986 (5.4 million fish). Both the 40-79 cm and 80+ cm size class abundance estimates decreased in 2016 compared to 2014, but the smallest size class (0-39 cm) was up slightly (Fig. 3).

The most frequently encountered Pacific halibut on the IPHC-staffed vessel in 2014 were the 9- and 10- year olds (average sample age of 9.8 years), which represent the 2005 and 2004 year classes, respectively (Table 2). These same two year classes were the most frequently encountered in the 2012 sample as well, and also showed very strongly at younger ages in the Bering Sea trawl survey. The relative size of these year classes has been inconclusive as they have grown to larger sizes, however, having appeared only slightly above average in other indices such as the Pacific halibut commercial fishery and IPHC setline surveys. Otoliths from the 2016 survey had not yet been analyzed as of the writing of this report.

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Table 1. Maturity of Pacific halibut sampled during the NMFS Aleutian Islands trawl survey in 2016 aboard the *F/V Sea Storm*, as assessed by the IPHC sea sampler on board. For females: 1=immature, 2=ripening, 3=ripe/spawning, and 4=spent/resting. For males: 1=immature, 2=mature. Note that the *Sex Unknown* category includes those fish in the tagging sample.

	Females			Males			Sex	
Length (cm)	1	2	Total	1	2	Total	unknown	Total
20-24	1		1					1
25-29							1	1
35-39	3		3	5	3	8	12	23
40-44	9		9	8	3	11	25	45
45-49	7		7		5	5	12	24
50-54	3		3	2	6	8	12	23
55-59	3		3		10	10	14	27
60-64	12		12		13	13	24	49
65-69	7		7		21	21	24	52
70-74	9		9	1	18	19	21	49
75-79	7	1	8		13	13	19	40
80-84	7	1	8		7	7	12	27
85-89					3	3	5	8
90-94	1	1	2		3	3	5	10
95-99	1		1		1	1	1	3
100-104					2	2	5	7
105-109	1	1	2		2	2	2	6
110-114							1	1
115-119	1	1	2		1	1		3
120-124		2	2				1	3
125-129		1	1				1	2
130-134		1	1				1	2
140-144		1	1					1
145-150							2	2
Total	72	10	82	16	111	127	200	409

Table 2. Age composition for Pacific halibut caught during the 2014 NMFS Aleutian Islands trawl survey and subsequently aged.

Age (years)	Mean fork length (cm)	Std. Dev. of fork length	Sample size	Year class
3	35.2	2.17	5	2011
4	46.1	5.12	26	2010
5	51.2	5.27	13	2009
6	54.5	4.41	28	2008
7	59.7	7.66	23	2007
8	62.1	5.73	56	2006
9	65.5	8.79	101	2005
10	70.2	7.10	85	2004
11	75.2	8.77	43	2003
12	82.1	11.85	32	2002
13	81.9	10.62	20	2001
14	85.9	7.66	11	2000
15	95.7	15.61	7	1999
16	98.0	n/a	1	1998
17	90.8	4.21	5	1997
18	88.4	9.79	5	1996
19	98.0	12.73	2	1995
20+	118.3	26.19	11	1994 & earlier
Total	**68.8**	**16.14**	**474**	

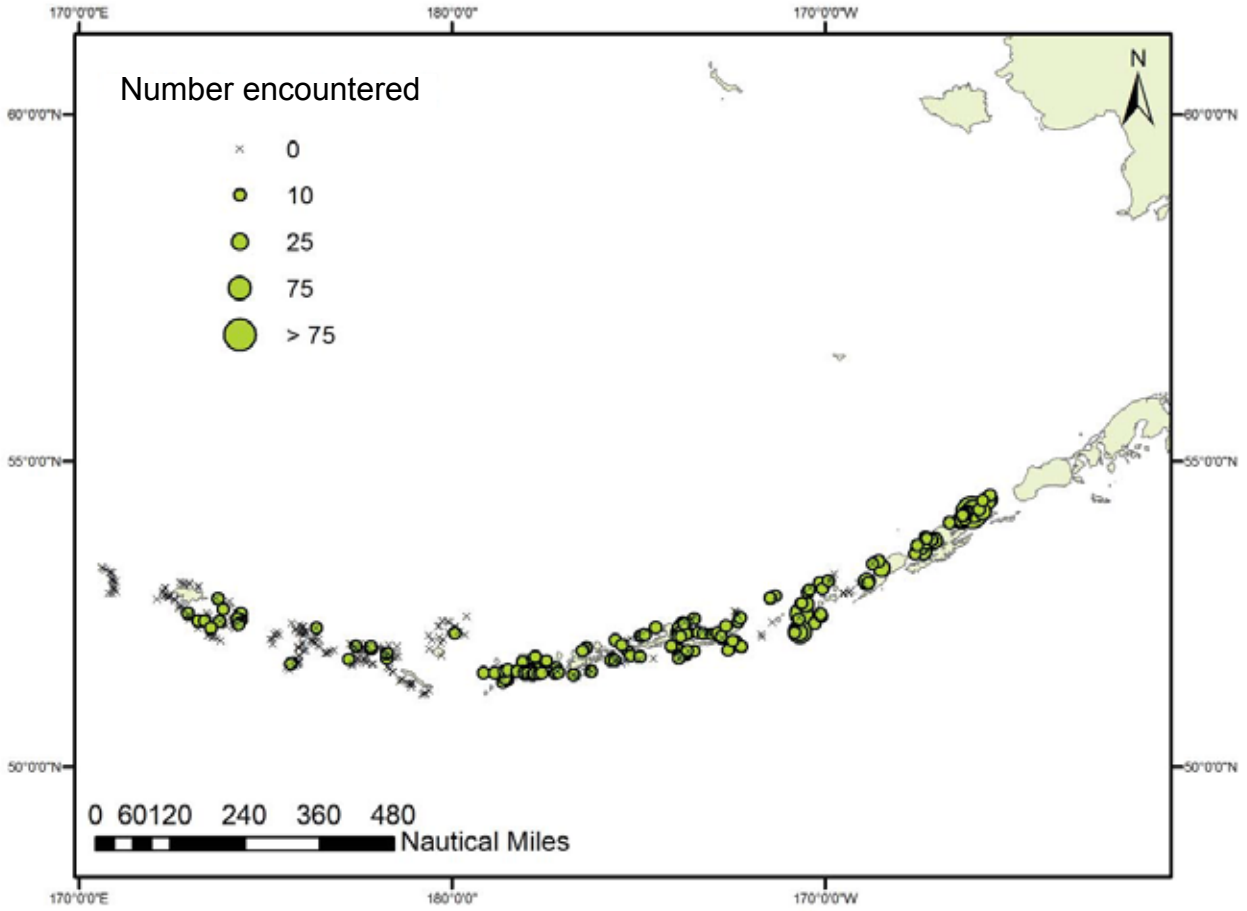

Figure 1. Pacific halibut encountered across the Aleutian Islands survey area from both vessels during the 2016 NMFS bottom trawl survey.

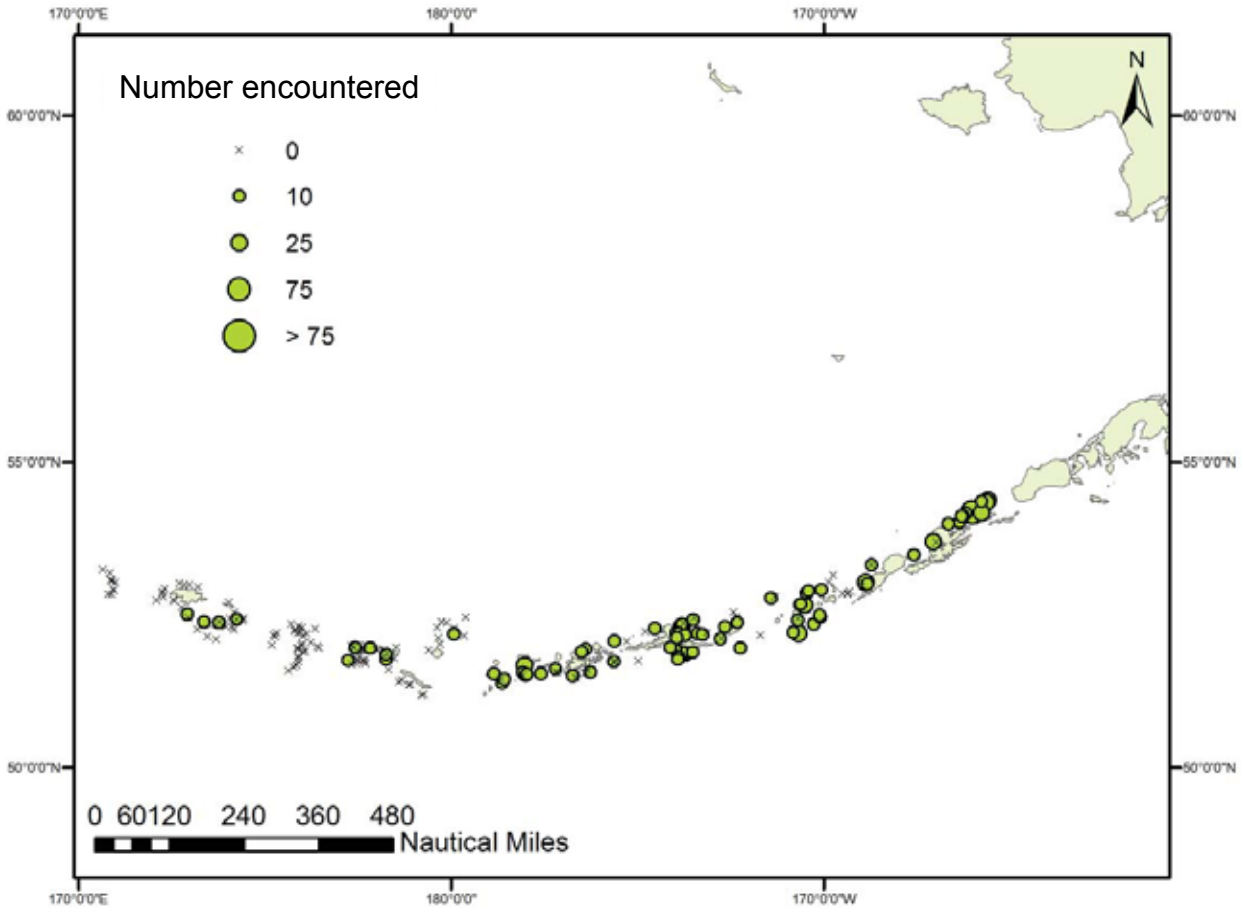

Figure 2. The number of Pacific halibut encountered and subsequently sampled or tagged from the *F/V Sea Storm* during the 2016 NMFS Aleutian Islands bottom trawl survey.

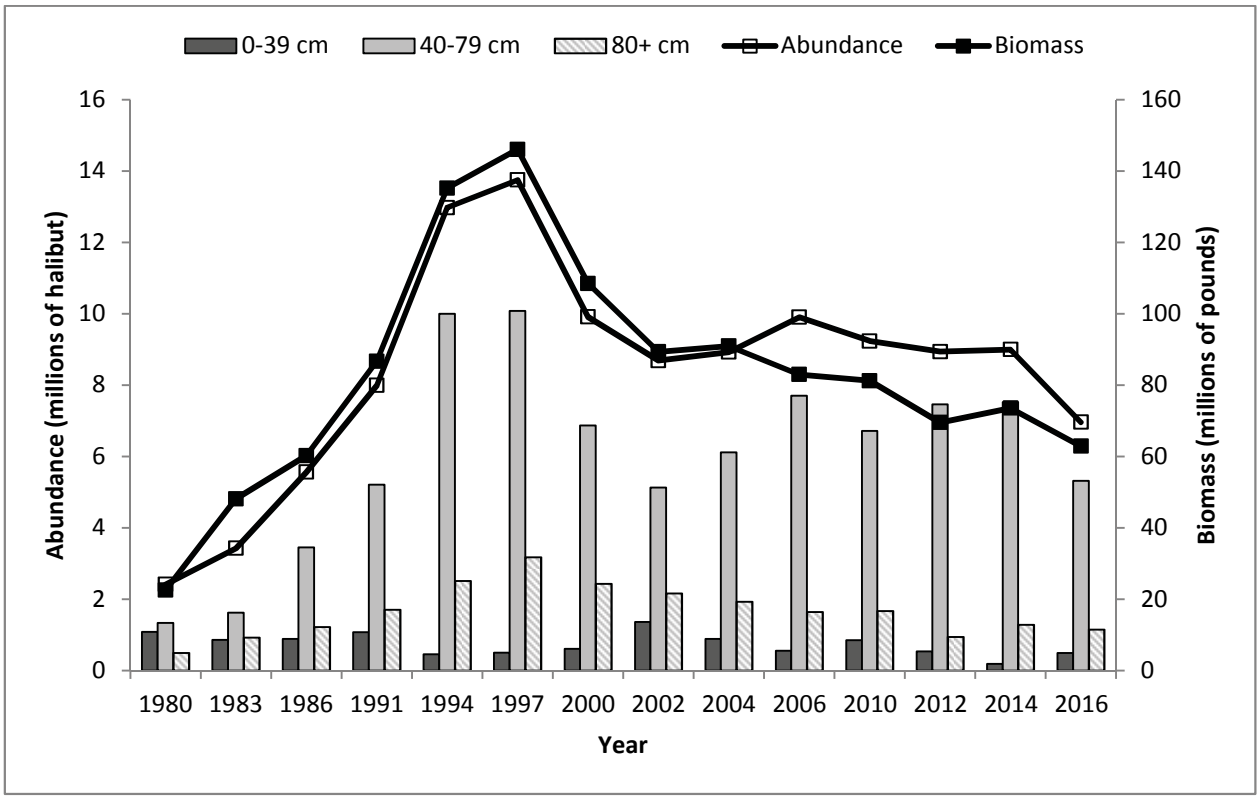

Figure 3. Pacific halibut estimated total abundance (numbers of fish; line with closed symbols) and abundance by size category (bars) along with total biomass (pounds; line with open symbols) for the survey years 1980-2016 as estimated using the NMFS Aleutian Islands bottom trawl survey data.