Cruise report for the 2011 NOAA Fisheries Service Gulf of Alaska trawl survey

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Abstract

The NOAA Fisheries Service, Alaska Fisheries Science Center, conducted a bottom trawl survey of Gulf of Alaska groundfish and invertebrate resources in 2011 as a continuation of a series started in 1984. This survey is the seventh since changing the series from triennial to biennial in 1999. One IPHC biologist was deployed on one vessel for the duration of the survey to sample Pacific halibut for length, gender, maturity, otoliths, and prior hooking injuries. A total of 3,076 Pacific halibut was sampled for the general collection an additional 116 were sampled for the clean otolith archive collection.

Introduction

In 2011, the International Pacific Halibut Commission (IPHC) participated in the NOAA Fisheries Service (NFS) Gulf of Alaska (GOA) bottom trawl survey of groundfish and invertebrate resources. The survey was a continuation of a time series started in 1984. Two fishing vessels were chartered to carry out the survey, and each vessel was staffed with a crew of six scientists and a professional fishing crew and captain. The main objective was to gather data to extend this time series for monitoring trends in distribution, abundance, and biological condition of various groundfish stocks in the northeast Pacific Ocean. An IPHC sampler was aboard one of the vessels to specifically collect Pacific halibut (*Hippoglossus stenolepis*) data and to assist the NFS scientific crew in attaining their survey goals.

Beginning in 1999, the GOA survey schedule was changed from triennial to biennial, and depth range was extended to include the continental shelf and slope (from approximately 15 to 1000 m), similar to the 1984 and 1987 surveys. However, due to the fact that only two vessels were available for the survey instead of the usual three, the slope was not surveyed in depths greater than 700 m during 2011.

Objectives

The main objective of the IPHC was to collect growth and maturity information along with age structures from halibut along the Gulf of Alaska continental shelf to aid in stock assessment and year-class forecasting. The major objective of the survey as a whole was to monitor distribution, abundance, and biological condition of various groundfish species. The IPHC representative worked as an active member of a 6-person scientific team.

Survey area, vessels, and itinerary

The survey area stretched from the Islands of Four Mountains (170° W longitude) to Dixon Entrance (132° W longitude) between the depths of approximately 15 and 700 m (Fig. 1a). Two vessels were chartered by the NFS: the *F/V Sea Storm* and the *F/V Ocean Explorer*. The IPHC sampler was aboard the *F/V Ocean Explorer* (Fig. 1b).

The scientific crew boarded the *Ocean Explorer* on May 18th in Dutch Harbor, AK and spent several days setting up and calibrating equipment. The first survey tow was conducted on May 22nd. Four trips were made with ports of call and NFS staffing changes in Sand Point, Kodiak, Seward, and Ketchikan. The final tow was made on August 14th.

Survey design

The survey area was divided into 59 strata based on depth, major geographic features, and International North Pacific Fisheries Commission (INPFC) statistical areas (Fig 1). The survey design was a stratified random sampling scheme based on a Neyman optimum allocation strategy utilizing data from previous surveys. The number of samples to be taken within each stratum was based primarily on distribution and abundance estimates from prior surveys and the relative commercial value of the major groundfish species. At least two samples were required from each stratum. The entire survey area was overlaid with a 5□5 km (25 km^2) grid. The station locations within each stratum, larger than 5 km^2, were randomly selected without replacement from all grid cells, or portions of grid cells. Grid cells that had been deemed untrawlable in previous surveys were also excluded from the selection. The stations allocated to each stratum were then assigned to the two vessels. Trawl samples at each station consisted of a standard 15 minute (bottom duration) tow at a target speed of 3.0 knots. Both vessels started sampling at the western end of the survey area and proceeded eastward.

The bottom trawl used for all survey sampling was NMFS's standard Poly Nor'Eastern trawl equipped with rubber bobbin roller gear (Stauffer 2004). This trawl has a 27.2 m headrope and a 36.7 m footrope consisting of a 24.9 m center section with adjacent 5.9 m "flying wing" extensions. Accessory gear for the trawl includes 54.9 m triple dandylines and 1.8 x 2.7 m steel V-doors weighing 850 kg each.

Electronic equipment was attached to the trawl net to record data about each tow: Scanmar acoustic sensors recorded net height and width while fishing; a bathythermograph recorded temperature and depth; and a tilt sensor detected when the footrope was in contact with the bottom.

All tows were given a success rating based on whether the following operational guidelines for successfully completing a standard survey tow were met:

- Each tow's duration was at least 10 minutes (distance fished approximately 0.74 nmi (1.4 km) at a speed of approximately 3 knots).
- An appropriate length of trawl warp (towing wire) was deployed as specified in the standard survey scope table.
- The goal of each tow was to not exceed 10 m of depth change over the 15-minute towing period. In areas where this was not possible, trawl warp was adjusted during the tow to reflect the change in depth.
- Net mensuration indicated fishing gear was operating within normal limits, taking into account that the net width tends to increase and net height decreases with increased warp lengths.

- Survey gear maintained continuous contact with the bottom.
- There were no significant hang-ups, gear damage, or gear conflicts.

Halibut sampling

All halibut caught by the IPHC staffed vessel, *F/V Ocean Explorer*, were eligible to be sampled for length, gender, maturity, and prior hooking injuries (PHI) in line with a goal of 100% sampling. The second vessel was not staffed by IPHC, but all halibut caught were measured before they were released.

Otoliths were collected from all halibut brought aboard the *Ocean Explorer* except in the case of one sub-sampling situation where an estimated 100 halibut were randomly sampled from the tow and the remaining halibut were measured and discarded as soon as possible. The gender and maturity stage of each sampled fish were determined by macroscopic examination of the gonads. Female fish were classified into four stages of maturity: immature, ripening, ripe/spawning, and spent/resting. Males had only two maturity stages: immature and mature. Immature for both genders meant that the fish would not participate in the upcoming winter spawning season. The other stages represented various phases of the spawning process and fish in those categories were considered mature enough that they could participate in the upcoming spawning season.

A PHI is an injury to the mouth, jaw, or eye caused from longline gear. PHI assessments have been collected for several years as part of an IPHC special project designed to look at types of hooking injuries a fish might sustain and still survive as well as to obtain injury rates in relation to geography and proximity to other fisheries. Each fish is given an injury rating (which includes none, minor, moderate, and severe) based on pre-determined criteria. More details and full results from this project can be found in Kaimmer (2012).

In addition to the general collection, a small subset of halibut were retained and sampled as part of a clean otolith archive that is being constructed by the IPHC for future research (Wischniowski and Forsberg 2012).

Results

The *F/V Ocean Explorer* conducted 355 tows over the course of the survey, and 334 of these were successful for biomass estimation. The stations ranged in depth from 28 to 668 m. Two to eight tows were attempted daily. A total of 3,545 halibut were caught and measured for fork length. Out of those, 3,076 were retained for the general sample of which 1,290 were female and 1,786 were male. Table 1 shows the number of halibut sampled by length category and gender. An additional 116 halibut were measured then sampled for the clean otolith archive and are not included in Tables 1 or 2.

All halibut caught were examined for PHI: 48 showed minor damage, 51 showed evidence of moderate damage, and two were severely damaged yielding a PHI rate of 3.3%. This rate is very close to rates seen in recent years in this area.

Of the females sampled, 10.2% were coded mature, which is somewhat higher than in previous years but not dramatically so (Table 2). However, the average size of mature females has been steadily dropping and this may be of some importance. Of the males, 99.2% were coded mature and they too have experienced a sustained drop in average length in recent years.

References

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Stauffer, G. D. (compiler). 2004. NOAA Protocols for Groundfish Bottom Trawl Surveys of the Nation's Fishery Resources. U. S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-65: 205 p.

Wischniowski, S. and Forsberg, J. 2012. Clean otolith archive collection. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2011: 453-458.

Table 1. Frequency of halibut sampled by 5-cm length category, trip, and gender (female (F) and male (M)), aboard the *F/V Ocean Explorer* during the 2011 NFS Gulf of Alaska trawl survey.

	Trip 1			Trip 2			Trip 3			Trip 4			Grand
Length	F	M	Total	F	M	Total	F	M	Total	F	M	Total	Total
15-19	2		2										2
20-24				2	3	5							5
25-29		3	3	5	9	14	1	2	3				20
30-34	8	13	21	11	8	19	2	5	7				47
35-39	24	34	58	16	29	45	2	9	11	1		1	115
40-44	47	80	127	57	95	152	4	13	17	2		2	298
45-49	76	175	251	72	164	236	18	18	36	3	3	6	529
50-54	88	128	216	118	98	216	20	38	58	7	19	26	516
55-59	53	66	119	74	103	177	39	30	69	14	39	53	418
60-64	32	44	76	61	65	126	28	37	65	12	34	46	313
65-69	15	24	39	42	65	107	14	43	57	11	24	35	238
70-74	11	17	28	39	41	80	16	26	42	2	15	17	167
75-79	11	13	24	25	34	59	24	30	54	9	5	14	151
80-84	5	1	6	24	22	46	30	18	48	4	1	5	105
85-89	8	2	10	14	9	23	15	10	25	4	3	7	65
90-94	7	1	8	4	4	8	9	6	15	2	2	4	35
95-99				8	3	11	5	1	6	2		2	19
100-104	1		1	6		6	3		3		1	1	11
105-109				3		3	2		2	2	1	3	8
110-114	2		2	1		1	2		2	1		1	6
115-119	1		1							1		1	2
120-124	2		2	1		1							3
140-144				1		1				1		1	2
145-149										1		1	1
Grand Total	393	601	994	584	752	1,336	234	286	520	79	147	226	3,076

Table 2. Maturity of Pacific halibut sampled during the NFS Gulf of Alaska trawl survey in 2011, aboard the *F/V Ocean Explorer*, as assessed by the IPHC sea sampler. For females: 1 = immature, 2 = ripening, 3 = ripe/spawning, and 4 = spent/resting. For males: 1 = immature, 2 = mature, and U = unknown/couldn't tell.

	Females				Males				Grand
Length (cm)	1	2	4	Total	1	2	U	Total	Total
15-19	2			2					2
20-24	2			2	2	1		3	5
25-29	6			6	4	9	1	14	20
30-34	21			21	2	22	2	26	47
35-39	43			43	4	66	2	72	115
40-44	110			110	2	185	1	188	298
45-49	169			169		360		360	529
50-54	233			233		283		283	516
55-59	180			180		238		238	418
60-64	133			133		180		180	313
65-69	82			82		156		156	238
70-74	58	3	7	68		99		99	167
75-79	43	3	23	69		82		82	151
80-84	36	6	21	63		42		42	105
85-89	22	8	11	41		24		24	65
90-94	5	8	9	22		13		13	35
95-99	4	5	6	15		4		4	19
100-104	3	1	6	10		1		1	11
105-109	3		4	7		1		1	8
110-114	2		4	6					6
115-119		2		2					2
120-124	1		2	3					3
140-144		1	1	2					2
145-149		1		1					1
Grand Total	1,157	38	94	1,290	14	1,765	6	1,786	3,076

Figure 1a. All stations fished during the 2011 NMFS GOA bottom trawl survey.

Figure 1b. Stations fished by the *F/V Ocean Explorer* during the 2011 NMFS GOA bottom trawl survey.