

Age distribution of Pacific halibut in the 2011 IPHC stock assessment setline survey

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Abstract

The age distribution of halibut sampled during the 2011 International Pacific Halibut Commission (IPHC) standard setline stock assessment survey is summarized. Fish ranging from four to 51 years old were captured, with 12-year-olds comprising the largest age group in the overall catch. Average age was higher and average fork length was lower for males than females in all regulatory areas.

Age distribution

The age distribution of Pacific halibut sampled from the 2011 standard stock assessment survey is summarized in Tables 1-3. The 1999 year class (12-year-olds) accounted for the largest proportion (in numbers) of sampled halibut for all areas and sexes combined (Table 1). The next most abundant year classes were 2000 and 2001 (11- and 10-year-olds), respectively.

Twelve-year-olds were the most abundant age class for female halibut sampled in Regulatory Areas 2 and 3A, as well as for females from all areas combined (Table 2). The second and third most abundant age classes for sampled females were 11- and 10-year-olds, respectively.

The 1999 year class (12-year-olds) was the largest for male halibut from Areas 2 and 3, as well as from all areas combined (Table 3). The second and third most abundant age classes for sampled males were 11- and 10-year-olds, respectively.

Mean age and fork length (FL) by regulatory area of sampled setline survey halibut for the years 2002-2011 are presented in Table 4. Average length was calculated only from halibut that were aged. Average age was higher and average fork length was lower for males than females in all areas for all years with the exception of Area 4C in 2008, where average age was slightly lower for males than females.

The youngest and oldest halibut in the 2011 setline survey samples were determined to be four and 51 years old (Table 5). There were two four-year-olds: a female from Area 3B measuring 51 cm FL and a male from Area 4C that was 68 cm FL. There was one 51-year-old: a female from Area 4B with a fork length of 159 cm. The maximum fork length recorded for setline survey-caught halibut in 2011 was 200 cm: a female from Area 2C determined to be 39 years old. The smallest halibut sampled in the 2011 setline survey measured 42 cm in fork length: a female from Area 4C aged at six years.

Ten percent of annual setline survey otoliths are aged a second time by a different reader as a measure of quality control. Between-reader percent agreement for setline survey ages from 2002 through 2011 is presented in Table 6.

Collection of otoliths for future use (clean otolith archive)

The otoliths collected annually for the stock assessment are cleared in glycerin solution prior to aging to make them readable. Current otolith research is trending toward study of isotopic

and elemental composition of otoliths; otoliths used for such studies must not be exposed to contaminants or additional chemicals (such as glycerin) during or following collection. For this reason, a separate collection of otoliths was begun in 2010 (Wischniowski and Forsberg 2012). These “clean otolith archive” otoliths are collected on an annual basis and are stored dry so that future researchers will have a time series of structures to work with. The IPHC collected 479 otolith pairs for the clean otolith archive on the 2011 setline surveys.

Reference

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. Age distribution of halibut collected in the 2011 setline survey (male, female, and unknown sex combined).

Age (years)	Number by Regulatory Area									Total
	2A	2B	2C	3A	3B	4A	4B	4C	4D	
4					1			1		2
5		2	1		5	5				13
6	3	26	18	22	24	20	20	8	8	149
7	24	85	77	58	71	56	71	22	17	481
8	58	112	148	115	151	109	163	80	64	1,000
9	126	231	214	142	214	252	220	157	119	1,675
10	180	234	242	180	242	242	260	162	105	1,847
11	210	301	246	241	356	251	205	97	119	2,026
12	234	323	315	350	382	213	151	79	87	2,134
13	99	153	232	281	205	181	94	44	62	1,351
14	88	100	161	180	115	71	63	19	49	846
15	31	36	98	164	88	54	68	10	26	575
16	19	45	77	144	73	42	96	11	29	536
17	11	29	57	106	45	31	75	3	25	382
18	8	9	38	53	31	14	79	3	22	257
19	1	6	19	43	18	6	63	2	20	178
20	6	7	13	41	17	13	31		17	145
21	3	4	5	35	8	10	22	3	13	103
22	3	6	9	37	10	20	17	2	19	123
23	6		5	35	11	18	32	3	19	129
24	1	8	2	31	16	20	30	4	18	130
25	6	1	5	31	3	9	20	2	13	90
≥26		5	7	26	7	23	145	3	63	279
Total	1,117	1,723	1,989	2,315	2,093	1,660	1,925	715	914	14,451

Table 2. Age distribution of female halibut collected in the 2011 setline survey.

Age (years)	Number by Regulatory Area									Total
	2A	2B	2C	3A	3B	4A	4B	4C	4D	
4					1					1
5		1	1		2	3				7
6	1	20	14	14	16	10	11	5	5	96
7	21	70	64	40	49	38	43	14	9	348
8	48	88	103	80	97	70	92	54	36	668
9	87	146	153	89	141	150	102	112	61	1,041
10	135	159	154	111	142	160	124	128	65	1,178
11	143	177	159	156	214	147	75	75	75	1,221
12	160	178	219	226	205	112	79	61	56	1,296
13	64	97	163	162	89	82	38	38	37	770
14	62	65	116	97	43	27	19	15	30	474
15	24	24	65	66	19	20	23	6	17	264
16	11	27	54	47	14	9	32	5	19	218
17	6	16	36	34	7	6	22	1	14	142
18	4	5	27	14	1	4	23	1	13	92
19	1	3	14	8	3		20	1	10	60
20	3	4	5	4	1	3	10		6	36
21	1	2	4	8		2	4		8	29
22	3	4	7	8		1	7		7	37
23	4		3	8	1	4	5	2	7	34
24		3		4	2	3	4		6	22
25	2		4	5			6	1	5	23
≥26		4	6	3	2	3	23	1	21	63
Total	780	1,093	1,371	1,184	1,049	854	762	520	507	8,120

Table 3. Age distribution of male halibut collected in the 2011 setline survey.

Age (years)	Number by Regulatory Area									Total
	2A	2B	2C	3A	3B	4A	4B	4C	4D	
4								1		1
5		1			3	2				6
6	1	6	4	8	8	8	9	3	3	50
7	3	14	12	18	22	17	27	8	8	129
8	9	23	44	32	53	38	70	26	28	323
9	37	80	59	52	72	99	117	45	58	619
10	40	72	86	68	98	79	134	34	38	649
11	62	120	84	85	139	104	124	22	43	783
12	70	140	94	123	171	100	72	17	30	817
13	34	55	67	119	116	98	55	6	24	574
14	25	35	43	83	72	44	43	4	18	367
15	7	12	32	96	67	34	41	4	9	302
16	7	18	21	96	57	32	63	6	10	310
17	5	12	20	72	37	25	53	2	11	237
18	4	4	11	39	30	10	56	2	9	165
19		3	5	35	15	6	43	1	10	118
20	3	3	8	36	16	10	21		10	107
21	2	2	1	27	8	8	18	3	5	74
22		2	2	29	10	19	10	2	12	86
23	2		2	27	10	14	27	1	11	94
24	1	5	2	27	14	17	26	4	11	107
25	4	1	1	26	3	9	14	1	8	67
≥26		1	1	23	5	20	122	2	41	215
Total	316	609	599	1,121	1,026	793	1,145	194	397	6,200

Table 4. Mean age (in years) and mean fork length (in centimeters) of sampled setline survey halibut by sex and regulatory area, 2002-2011 (F = female, M = male).

Reg. Area	Year																				
	2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	
2A	Age	12.2	12.4	10.9	11.4	10.8	12.8	10.7	13.4	10.4	12.7	11.3	13.1	11.3	11.4	10.3	11.0	11.0	11.1	11.4	12.0
	Length	100.1	85.6	96.1	82.2	96.5	86.1	92.6	87.0	91.6	84.4	94.6	83.5	90.3	78.8	89.5	79.4	93.1	79.1	95.6	81.5
2B	Age	11.8	12.5	10.7	11.9	10.7	11.0	10.5	11.0	9.6	10.4	9.7	10.5	10.6	11.1	11.2	11.8	10.9	11.4	11.1	11.6
	Length	100.9	83.4	95.3	80.6	96.8	79.8	94.3	79.0	89.7	77.4	89.7	76.6	91.0	77.2	93.5	77.4	93.8	78.2	94.6	78.5
2C	Age	12.5	12.7	12.0	12.3	11.2	11.5	11.3	11.4	10.4	10.6	10.5	11.5	11.4	11.5	10.9	11.7	11.0	11.5	11.9	12.0
	Length	104.0	85.3	100.9	84.3	97.5	82.0	98.1	81.3	93.8	79.1	92.3	80.2	93.4	78.8	90.6	78.2	91.0	77.0	96.9	79.8
3A	Age	13.2	14.5	13.3	14.9	13.0	15.3	13.4	16.5	12.8	15.7	12.3	15.4	12.9	16.0	11.7	14.6	12.1	15.0	12.2	14.9
	Length	101.6	83.2	100.2	82.6	97.7	82.3	97.9	83.2	96.6	82.6	94.5	82.3	93.7	81.8	89.5	79.6	89.4	78.7	87.6	78.3
3B	Age	13.1	15.5	11.8	14.5	11.2	13.9	11.5	14.6	11.3	14.9	11.0	14.4	11.1	14.4	10.6	13.5	10.7	13.0	10.8	12.9
	Length	97.4	86.2	91.8	82.1	89.9	80.2	88.5	80.3	87.9	81.1	87.6	81.6	83.0	78.1	82.3	77.6	81.8	75.9	81.5	74.2
4A	Age	12.4	14.3	12.9	14.7	12.0	14.0	12.2	14.4	11.7	13.3	10.7	12.9	10.7	13.5	10.5	12.6	10.6	12.7	10.8	13.2
	Length	96.0	84.4	98.6	84.4	95.1	83.4	94.0	83.3	91.5	80.7	85.2	79.8	82.4	78.6	84.1	77.6	82.6	76.6	83.4	76.5
4B	Age	14.4	16.3	13.8	16.2	12.7	14.9	12.7	15.6	12.5	14.8	12.2	14.1	12.6	15.8	13.1	15.9	12.2	14.9	12.2	15.2
	Length	110.7	96.0	109.9	96.2	105.7	93.7	107.2	94.5	107.1	92.6	102.5	90.1	103.4	92.1	103.8	92.7	100.3	90.3	98.4	89.7
4C	Age	---	---	---	---	---	---	---	---	9.3	11.2	9.8	10.8	10.5	10.4	9.6	10.8	10.2	10.8	10.5	11.2
	Length	---	---	---	---	---	---	---	---	87.9	76.4	89.4	76.0	88.0	72.7	84.1	75.1	84.3	73.8	82.0	72.8
4D	Age	16.7	18.1	16.1	18.0	15.5	17.3	14.8	16.5	13.7	15.8	13.2	15.8	13.4	16.1	13.8	16.6	14.4	17.4	13.2	14.9
	Length	110.1	95.2	109.3	94.7	106.3	93.0	101.8	89.1	102.2	88.6	99.0	88.9	93.8	85.3	94.4	86.7	96.6	87.3	88.4	80.9
4E	Age	---	---	---	---	---	---	---	---	10.4	14.6	---	---	---	---	---	---	---	---	---	---
	Length	---	---	---	---	---	---	---	---	92.5	83.6	---	---	---	---	---	---	---	---	---	---
4EE	Age	---	---	---	---	---	---	---	---	7.6	8.8	---	---	---	---	---	---	---	---	---	---
	Length	---	---	---	---	---	---	---	---	92.8	79.4	---	---	---	---	---	---	---	---	---	---
CLS	Age	---	---	---	---	---	---	---	---	9.3	12.3	---	---	---	---	---	---	---	---	---	---
	Length	---	---	---	---	---	---	---	---	82.3	79.6	---	---	---	---	---	---	---	---	---	---

Table 5. Maximum and minimum age (in years) and fork length (in centimeters) of halibut collected in the 2011 setline survey, for which sex was determined, by regulatory area and sex.

Reg. Area	Sex	Max. age	Min. age	Max. length	Min. length
2A	Female	25	6	150	64
2A	Male	25	6	118	58
2B	Female	34	5	182	60
2B	Male	27	5	115	56
2C	Female	39	5	200	57
2C	Male	26	6	120	51
3A	Female	27	6	173	55
3A	Male	33	6	126	50
3B	Female	28	4	175	51
3B	Male	28	5	111	48
4A	Female	32	5	150	45
4A	Male	35	5	117	43
4B	Female	51	6	194	53
4B	Male	48	6	148	52
4C	Female	26	6	158	42
4C	Male	33	4	118	46
4D	Female	34	6	175	53
4D	Male	40	6	148	49

Table 6. Between-reader percent agreement for setline survey ages 2002-2011. (CV = coefficient of variation, APE = average percent error, % -bias = % of ages where the second age estimated for a fish (age 2) was younger than the initially-estimated age (age 1), % +bias = % of ages where age 2 > age 1).

Year	Total aged	Number aged twice	% agreement (± 1 year)	CV (%)	APE	% -bias	% +bias
2002	13,635	2,229	81.2	4.3	3.0	24.8	33.6
2003	12,613	1,633	83.3	4.3	3.0	22.0	29.3
2004	14,474	1,257	83.3	4.8	3.4	18.5	38.8
2005	14,552	1,361	85.1	3.9	2.8	20.4	30.2
2006	14,977	1,556	90.4	3.2	2.2	23.7	18.8
2007	16,022	1,566	87.2	4.5	3.2	28.1	28.6
2008	15,545	1,579	89.5	3.4	2.4	25.8	21.3
2009	15,706	1,567	91.1	3.4	2.4	26.2	19.0
2010	14,080	1,407	92.8	2.8	2.0	23.7	19.5
2011	14,451	1,448	89.8	3.7	2.6	30.3	19.3

