Information for Discussions

at the

Scientific and Technical Committee

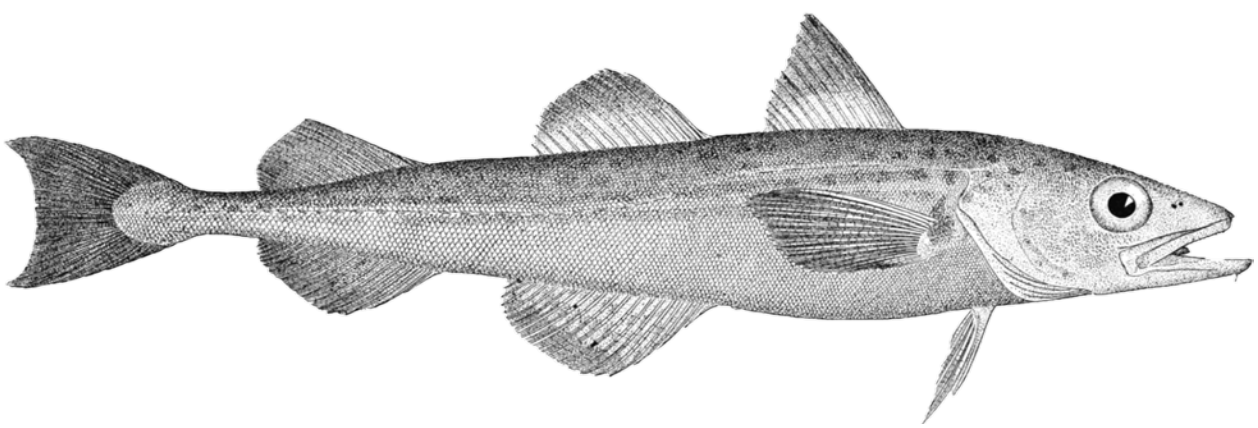
submitted by the

United States Party to the

2015 Annual Conference of the Parties

to the Convention on the Conservation

and Management of Pollock Resources in the Central Bering Sea



August 2015
Virtual session held by the United States of America

Table of Contents

Table 1. All-nation historical catch of pollock from the Bering Sea, in metric tons, 1977-2014

Year	Olyotorskiy-Karagin (W of 170W)	Navarin Region (E of 170W)	Donut Hole	Bogoslof	Aleutian Region	Eastern Bering Sea	Total Bering Sea
1977	265,000				7,625	978,370	1,250,995
1978	417,000				6,282	979,431	1,402,713
1979	546,000				9,504	935,714	1,491,218
1980	825,000				58,156	958,280	1,841,436
1981	1,133,000				55,516	973,502	2,162,018
1982	976,000				57,978	955,964	1,989,942
1983	1,006,000				59,026	981,450	2,046,476
1984	252,000	503,000	181,200		81,834	1,092,055	2,110,089
1985	134,000	488,000	363,400		58,730	1,139,676	2,183,806
1986	297,000	570,000	1,039,800		46,641	1,141,993	3,095,434
1987	349,000	463,000	1,326,300	377,436	28,720	859,416	3,403,872
1988	475,000	852,000	1,395,900	87,813	30,000	1,228,721	4,069,434
1989	345,000	684,000	1,447,600	36,073	15,531	1,229,600	3,757,804
1990	582,000	232,000	917,400	151,672	79,025	1,455,193	3,417,290
1991	326,000	178,000	293,400	264,760	78,649	1,217,301	2,358,110
1992	282,000	315,000	10,000	160	48,745	1,164,440	1,820,345
1993	288,000	389,000	1,957	885	54,074	1,198,790	1,932,706
1994	204,000	288,900	NA	556	53,224	1,197,224	1,743,904
1995	79,000	427,300	Trace	264	60,184	1,169,614	1,736,362
1996	34,000	753,000	Trace	389	26,597	1,102,579	1,916,565
1997	30,000	735,000	Trace	163	24,721	1,036,789	1,826,673
1998	25,000	719,000	Trace	8	22,053	1,058,288	1,824,349
1999	46,000	639,000	Trace	1	965	889,561	1,575,527
2000	15,000	507,000	Trace	29	1,174	1,019,067	1,542,270
2001	25,000	526,000	0	61	788	1,247,305	1,799,154
2002	8,000	370,000	0	22	1,134	1,331,416	1,710,572
2003	14,600	411,200	0	24	1,653	1,491,356	1,918,833
2004	6,200	424,500	0	0	1,150	1,493,394	1,925,244
2005	4,400	446,800	0	0	1,622	1,483,398	1,936,220
2006	3,900	462,500	0	0	1,736	1,486,414	1,954,550
2007	62,600	587,900	0	0	2,519	1,354,091	2,007,110
2008	50,632	507,127	0	9	1,277	990,314	1,549,359
2009	26,052	328,517	0	46	1,729	810,821	1,167,165
2010	43,352	319,543	0	176	1,285	810,195	1,174,551
2011	37,189	336,690	0	173	1,208	1,199,066	1,574,326
2012	26,300	390,040	0	79	975	1,205,371	1,622,765
2013	29,800	358,900	0	57	2,964	1,270,732	1,662,453
2014	15,100	330,600	0	427	2,375	1,297,409	1,645,911
2015*	4,700	161,000	0	727	698	831,737	998,862

Sources of Data

Reported by the Parties to the Convention

**US data through 18 August 2015, Russian data through 21 July 2015

Table 2. Estimated Biomass (mt) of Pollock in the Aleutian Basin region of the Convention Area based on assumption that the Bogoslof Survey biomass represents sixty percent of the Aleutian Basin biomass.

Year	Bogoslof Biomass from Surveys, mt	Basin Biomass (Extrapolated Biomass)	Catch mt	Exploitation Rate (%)
1984			181,200	?
1985			363,400	?
1986			1,039,800	?
1987			1,326,300	?
1988	2,396,000	3,993,333	1,395,900	35
1989	2,084,000	3,473,333	1,447,600	42
1990	No survey	No estimate	917,400	?
1991	1,283,000	2,138,333	293,400	14
1992	888,000	1,480,000	10,000	1
1993	631,000	1,051,667	1,957	0
1994	490,000	816,667	0	0
1995	1,020,000	1,700,000	0	0
1996	582,000	970,000	0	0
1997	342,000	570,000	0	0
1998	432,000	720,000	0	0
1999	393,000	655,000	0	0
2000	270,000	450,000	0	0
2001	208,000	346,667	0	0
2002	227,000	378,333	0	0
2003	198,000	330,000	0	0
2004	No survey	No estimate	0	0
2005	253,000	421,667	0	0
2006	240,000	400,000	0	0
2007	292,000	486,667	0	0
2008	No survey	No estimate	0	0
2009	110,000	183,333	0	0
2010	No survey	No estimate	0	0
2011	No Survey	No estimate	0	0
2012	67,000	111,667	0	0
2013	No survey	No estimate	0	0
2014	112,000	186,667	0	0
2015	No survey	No estimate	0	0

Table 3. Summary of Trial Fisheries on Pollock in the Central Bering Sea Donut Hole Area

Year	Dates	Nation	No. Vessels	Vessel Name	Vessel Days	No. hauls	Data Source (Annual Conference Report)	Pollock Catch (KG)	Catch Number
2008-15				No vessels participated					
2007		Korea	2	???	20	40	S&T, Appendix 3, 13th		2
2006	Jul 31-Aug 5	Korea	1	Oriental Angel (Keuk Dong Co)			12th	0.0	0
2006	Jul 31-Aug 8	Korea	1	Nambuk Ho (Nambuk Fish Co)			12th	0.0	0
2006	Jul 31-Aug 8	Korea	1	Joosung Ho (Hansung Enterprise Co)			12th	0.7	1
2003	Mar 12-26	Korea	2	Man Jeck No. 21, O Yang Ho - 2	27		9th	2.6	2
2003	Oct - Nov	Korea	1	O-Ryong 503	15		9th	0.0	2
2003	Nov 15-27	Russia	1	Pioner Nikolayeva	13		9th	1.6	1
2001	Nov 11-14	China	2	Ming Zhu, Kai Feng	8		7th	0.0	0
2001	Jun 7 - Jul 14	China	1	Kai Tuo	38		6th	*~24.0*	16
2000	Jan 12 - Feb 3	Korea	1	Oriental Discoverer	23		5th	0.0	0
2000	May 11-20	Korea	1	Oriental Angel	10		5th	0.0	0
2000	May 20 - Jun 28	China	1	Kai Chuang	40		5th	*~64.5*	43
1999	Aug 17-30	Poland	1	Homar	14	10	5th	2.3	2
1999	Apr 29 - May 3	Poland	1	Acamar	5	5	4th	2.9	2
1998	Sep 3-8	Poland	1	Acamar	6	5	4th	3.3	2
1997	Oct 12-15	Poland	1	Acamar	4	3	STC, Sep. 1998	0.0	0
1997	Aug 16-19	Russia	1	?	4		2nd	0.0	0
1997	Jun & Aug	China	2	?	8		2nd	*< 900.0*	*< 600*
1996	?	China	1	?	?		2nd	?	?
1996	Sep 1-11	Poland	1	Acamar	11	11	2nd	244.2	184
1995	Oct 18 - Nov 12	Poland	1	Acamar	25	16	1st	40.3	31
1995	Oct 13 - Nov 10	Poland	1	Homar	29	6		15.6	12
1993	Jul 2 - Sep 4	Poland	1	Adm. Arciszewski	63	69	Bull. SFI. 2(138) 1996	627,500	570,454
1993	Jun 6-14	Japan	1	?	9		unpub ms	?	?
1993	Jul 13-22	Japan	1	?	10		unpub ms	?	?
1993	Nov 12-17	Japan	1	?	6		unpub ms	?	?
1993	Dec 8-17	Japan	1	?	6		unpub ms	?	?

? indicates unknown

Italics indicate non-reported estimated numbers

Table 4. United States Pollock Catches in metric tons, 1993-2015

Year	E. Bering Sea	Aleutians	Bogoslof	Gulf of Alaska
1993	1,198,790	54,074	885	108,066
1994	1,197,224	53,224	556	110,890
1995	1,169,614	60,184	264	73,248
1996	1,102,579	26,597	389	37,106
1997	1,036,789	24,721	163	89,893
1998	1,058,288	22,053	8	123,805
1999	889,561	965	1	93,422
2000	1,019,067	1,174	29	23,643
2001	1,247,305	788	61	70,485
2002	1,331,416	1,134	22	50,712
2003	1,491,356	1,653	24	48,573
2004	1,493,394	1,150	50	60,929
2005	1,483,398	1,622	0	80,040
2006	1,486,414	1,736	0	68,950
2007	1,354,091	2,519	0	51,659
2008	990,314	1,277	9	50,697
2009	810,824	1,729	46	41,168
2010	810,195	1,285	176	73,530
2011	1,199,066	1,208	173	79,789
2012	1,205,371	975	79	101,356
2013	1,270,745	2,964	57	93,729
2014	1,297,409	2,375	427	140,260
Through 18 July 2015	831,737	648	727	86,609
Catch Quota for 2015	1,314,454	14,546	100	199,151
Remaining Quota*	482,717	13,898	-627	112,542

Note: (Data from http://www.fakr.noaa.gov/sustainablefisheries/catchstats.htm)

*As of 18 July 2015

Table 5. Pollock assessment numbers determined for management of the U.S. 2008-15 pollock fisheries

Year = 2008	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	1,440,000	1,000,000	1,000,000	1.00
Aleutians Region	34,000	28,200	19,000	0.67
Bogoslof	58,400	7,970	10	0.00
Gulf of Alaska	83,150	60,180	60,180	1.00

Year = 2009	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	977,000	815,000	815,000	1.00
Aleutians Region	32,600	26,900	19,000	0.71
Bogoslof	58,400	7,970	50	0.01
Gulf of Alaska	58,590	41,620	41,620	1.00

Year = 2010	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	918,000	813,000	813,000	1.00
Aleutians Region	40,000	33,100	19,000	0.57
Bogoslof	22,000	156	50	0.32
Gulf of Alaska	115,526	84,745	84,745	1.00

Year = 2011	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	2,450,000	1,270,000	1,252,000	0.99
Aleutians Region	44,500	36,700	19,000	0.52
Bogoslof	22,000	156	150	0.96
Gulf of Alaska	130,356	96,215	96,215	1.00

Year = 2012	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	2,474,000	1,220,000	1,200,000	0.98
Aleutians Region	39,600	32,500	19,000	0.58
Bogoslof	22,000	16,500	500	0.03
Gulf of Alaska	158,082	116,444	116,444	1.00

Year = 2013	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	2,550,000	1,375,000	1,247,000	0.91
Aleutians Region	45,600	37,300	19,000	0.51
Bogoslof	13,400	10,100	100	0.01
Gulf of Alaska	165,183	121,046	121,046	1.00

Year = 2014	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	2,795,000	1,369,000	1,280,650	0.94
Aleutians Region	42,811	35,048	5,350	0.15
Bogoslof	13,413	10,059	75	0.01
Gulf of Alaska	228,831	174,976	174,976	1.00

Year = 2015	**OFL**	**ABC**	**TAC**	**TAC/ABC**
Eastern Bering Sea	3,330,000	1,637,000	1,314,454	0.80
Aleutians Region	36,005	29,659	14,546	0.49
Bogoslof	21,200	15,900	100	0.01
Gulf of Alaska	273,378	203,934	199,151	0.98

Notations: OFL = Overfishing Level, ABC = Acceptable Biological Catch, TAC = Total Allowable Catch Note: Aleutians Region TAC can be reallocated mid-year the the Eastern Bering Sea if the resulting TAC does not exceed the Eastern Bering Sea ABC

Pollock stock status and summary in the U.S. EEZ of the Bering Sea-Aleutian Islands Management Areas

This summary on the status of pollock stocks in the Bering Sea-Aleutian Islands (BSAI) area is extracted from the SAFE (Stock Assessment and Fishery Evaluation) report of the North Pacific Fishery Management Council. Details of the stock evaluations can be found in the following website:
http://www.afsc.noaa.gov/refm/stocks/assessments.htm

Status of Stocks Information

The BSAI management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the US. For stock analyses, the dominant stock areas are the eastern Bering Sea, Aleutian Island region, and the Bogoslof area. The status and catch specifications (t) of walleye pollock in recent years are shown in the Table below. All units are in metric tons.

Area	Year	Age 3+ Pollock Biomass	Overfishing Level (t)	Acceptable Biological Catch (t)	Total Allowable Catch (t)	Catch (t)
1.E Bering Sea	2010	4,620,000	918,000	813,000	813,000	810,215
	2011	9,620,000	2,450,000	1,270,000	1,253,000	1,199,069
	2012	8,340,000	2,470,000	1,220,000	1,186,000	1,205,197
	2013	8,140,000	2,550,000	1,375,000	1,247,000	1,270,745
	2014	8,082,000	2,726,000	1,369,000	1,267,000	1,298,593
	2015	9,203,000	3,330,000	1,637,000	1,310,000	831,737*
2.Aleutians	2010	242,000	40,000	33,100	19,000	1,285
	2011	261,000	44,500	36,700	19,000	1,208
	2012	251,000	39,600	32,500	19,000	975
	2013	266,000	45,600	37,300	19,000	2,964
	2014	259,525	48,600	40,000	19,000	2,348
	2015	228,102	36,005	29,659	19,000	710*
3.Bogoslof	2010	110,000	22,000	156	50	176
	2011	110,000	22,000	156	150	140
	2012	110,000	22,000	16,500	500	79
	2013	67,100	13,400	10,100	100	54
	2014	67,100	13,413	10,059	75	428
	2015	106,000	21,200	15,900	100	727*

*The catches for 2015 are through 18 July 2015.

Eastern Bering Sea

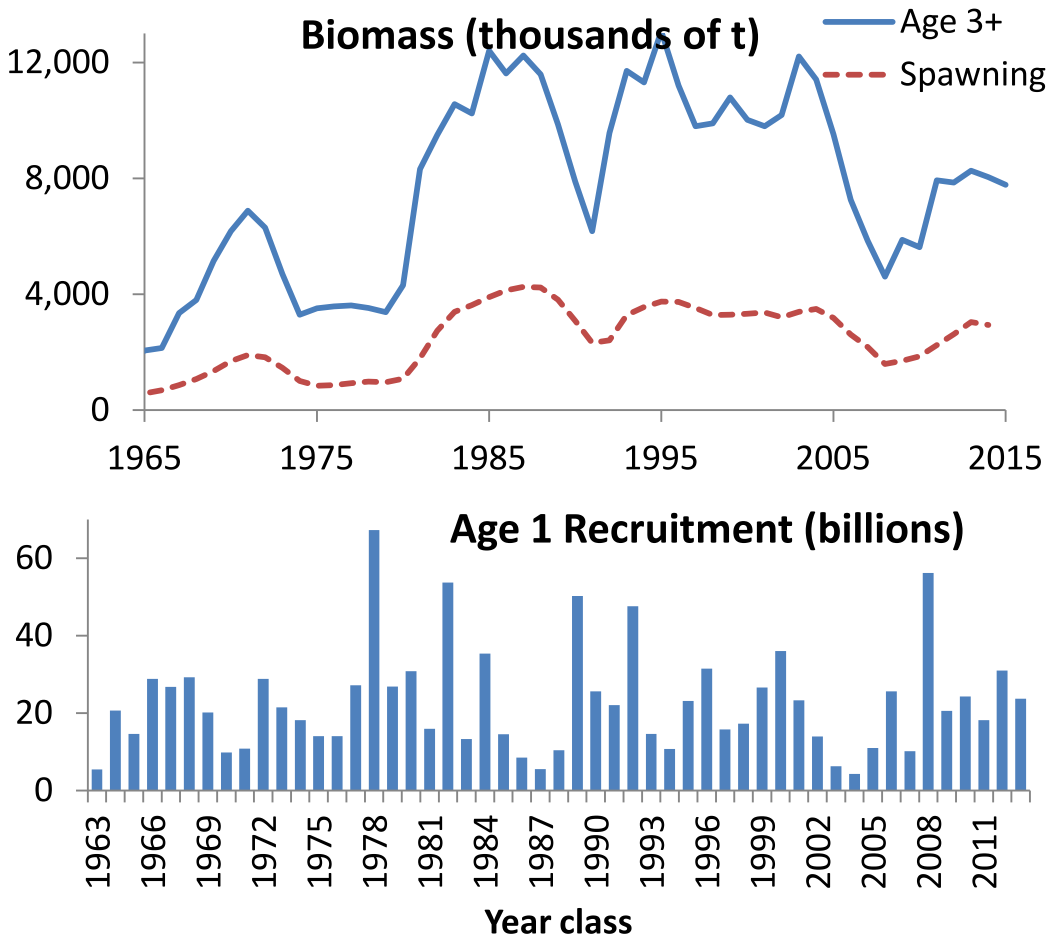


Figure 1. The top panel is the estimated biomass levels (solid line is for exploitable biomass that are age 3 and above) and the dashed line is the spawning biomass. Units are in thousands of tons. The lower panel is the year-class magnitude measured in billions of fish at age 1.

Biomass and Recruitment Trends – The biomass trends tends reflect recruitment patterns as catch levels have been set to reflect acceptable biological catch levels determined from the levels of exploitable biomass. The 2008 low was the result of poor recruitment from 4-conssecutive 2002-2005 year classes. Recruitment levels improved and the biomass levels have improved.

Status determination – According to criteria used by the fishery management Council process, the pollock stock in the EBS is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Aleutian Islands

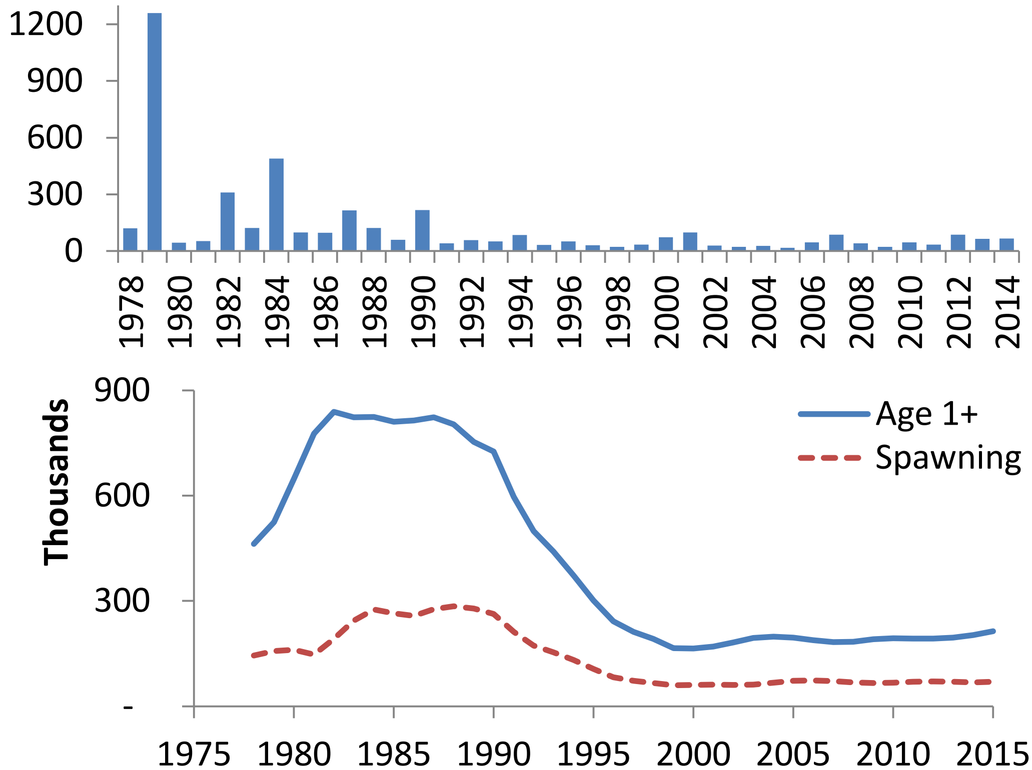


Figure 2. The top panel is the recruitment trend of age 2 pollock in millions of fish. The bottom panel is the estimated biomass levels (top solid line is the biomass line for pollock age 1 and above). The lower line is the spawning biomass. Units are in thousands of tons.

Biomass and Recruitment Trends – There was a very strong 1978 year class that built up the biomass of Aleutians pollock from 1980-1985. Since that strong year class, recruitment levels have declined drastically and remained at low levels. Consequently, the biomass levels have declined from 1985. There has been a general slow increase of biomass from 1999. These increases have resulted more from a dramatic decreases in harvest levels rather than from good recruitment.

Status determination – The pollock stock in the Aleutian Islands is not being subjected to overfishing, is not overfished, and is not approaching an overfished condition.

Bogoslof Island

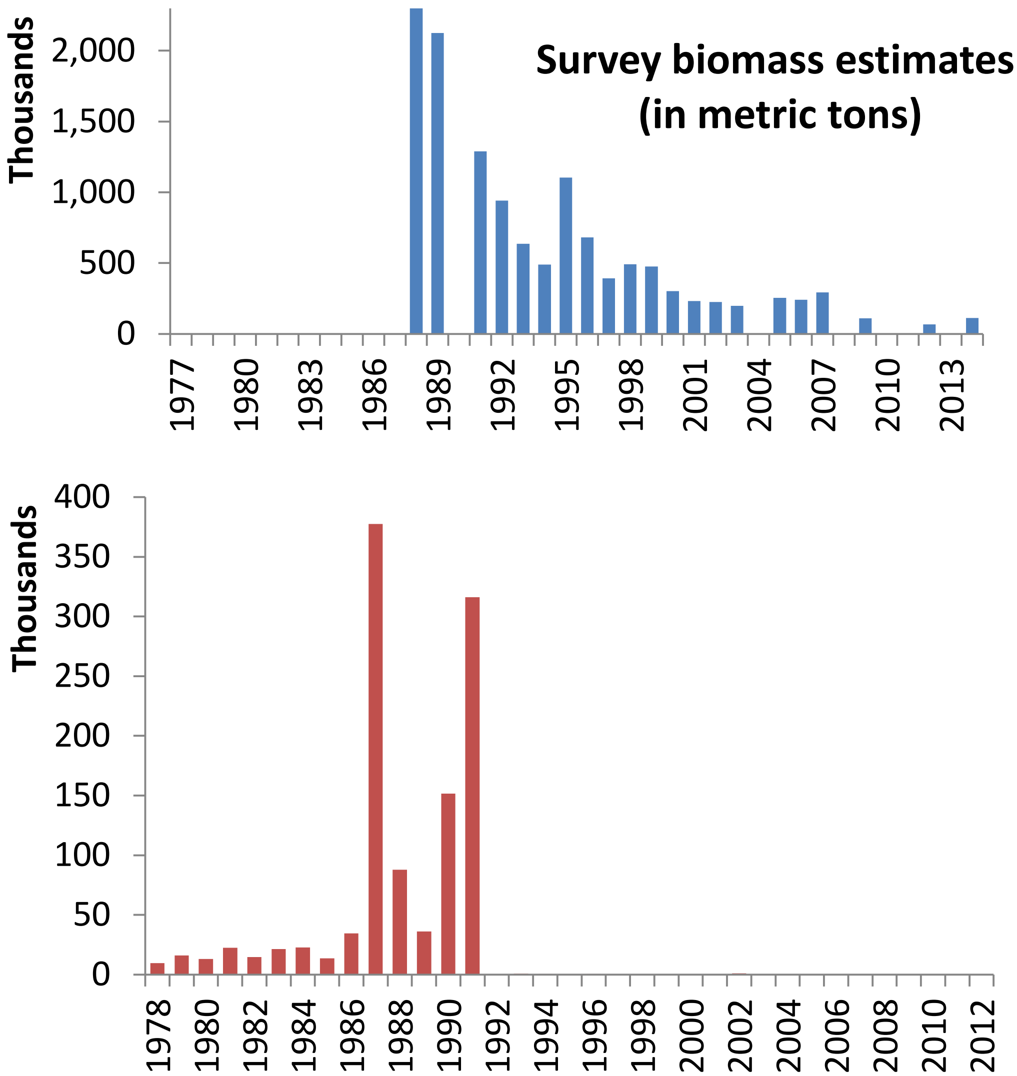


Figure 3. The top panel is the estimated survey biomass conducted mainly by the United States. The bottom panel is the catch trend. All units are in thousands of metric tons.

Biomass Trend – The general trend in estimated biomass in the Bogoslof Island area has been steadily trending down. The 2 million plus metric tonnage biomass levels were achieved only in 1988 and 1989. The latest survey (2014 by the NOAA ship *Oscar Dyson*) indicated an estimated biomass at 112,000 metric tons. There have been no directed fisheries on the stock from 2002 as set by the Convention on the Conservation of Pollock Resources in the central Bering Sea.

Status determination – The pollock abundance in the Bogoslof Island area is considered low. However, while low in biomass, it is not being subjected to overfishing as catches have been set at zero. However it is not possible to determine whether this stock is overfished or whether it is approaching an overfished condition since there is insufficient information about the population dynamics of the stock.

Alaska
Fisheries Science
Center

National Marine
Fisheries Service

U.S DEPARTMENT OF COMMERCE

AFSC PROCESSED REPORT 2015-06

Results of the March 2014 Acoustic-Trawl Survey of Walleye Pollock (*Gadus chalcogrammus*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise DY2014-02

July 2015

This report does not constitute a publication and is for information only.
All data herein are to be considered provisional.

This document should be cited as follows:

McKelvey, D., and S. Steinessen. 2015. Results of the March 2014 acoustic-trawl survey of walleye pollock (*Gadus chalcogrammus*) conducted in the southeastern Aleutian Basin near Bogoslof Island, Cruise DY2014-02. AFSC Processed Rep. 2015-06, 43 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Available at http://www.afsc.noaa.gov/Publications/ProcRpt/PR2015-06.pdf

Reference in this document to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

Results of the March 2014 Acoustic-Trawl Survey of Walleye Pollock (*Gadus chalcogrammus*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise DY2014-02

by

Denise McKelvey and Sarah Stienessen

THIS INFORMATION IS DISTRIBUTED SOLELY FOR THE PURPOSE OF PRE-DISSEMINATION PEER REVIEW UNDER APPLICABLE INFORMATION QUALITY GUIDELINES. IT HAS NOT BEEN FORMALLY DISSEMINATED BY NOAA FISHERIES/ALASKA FISHERIES SCIENCE CENTER AND SHOULD NOT BE CONSTRUED TO REPRESENT ANY AGENCY DETERMINATION OR POLICY

July 2015

INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering (MACE) Program of the Alaska Fisheries Science Center (AFSC) regularly conduct acoustic-trawl (AT) surveys in late February and early March to estimate the abundance of pre-spawning walleye pollock (*Gadus chalcogrammus*; hereafter referred to as "pollock") in the southeastern Aleutian Basin near Bogoslof Island (Honkalehto et al. 2008a). These surveys were conducted annually between 1988 and 2007 (with the exception of 1990 and 2004), and biennially starting in 2009 (with the exception of 2011). The biomass estimate for pollock within the Central Bering Sea Convention Specific Area obtained during these AT surveys provides an index of abundance for the Aleutian Basin pollock stock[1]. This report summarizes observed pollock distribution and biological information from the winter 2014 AT survey, and provides an abundance estimate (Ianelli et al. 2014a), and it summarizes water temperature observations, and acoustic system calibration results.

METHODS

MACE scientists conducted the acoustic-trawl survey between 7 and 11 March 2014 (Cruise DY2014-02) aboard the NOAA ship *Oscar Dyson*, a 64-m stern trawler equipped for fisheries and oceanographic research. Surveys followed established AT methods as specified in NOAA protocols for fisheries acoustics surveys and related sampling[2]. The acoustic units used here are defined in MacLennan et al. (2002).

[1] Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea, Annex (Part 1), Treaty Doc. 103-27. 1994. Hearing before the Committee on Foreign Relations U.S. Senate, 103rd Congress, 2nd Session. Washington: U.S. Government Printing Office.

[2] National Marine Fisheries Service (NMFS) 2013. NOAA protocols for fisheries acoustics surveys and related sampling (Alaska Fisheries Science Center), 23 p. Prepared by Midwater Assessment and Conservation Engineering Program, Alaska Fish. Sci. Center, Natl. Mar. Fish. Serv., NOAA. Available online: http://www.afsc.noaa.gov/RACE/midwater/AFSC%20AT%20Survey%20Protocols_Feb%202013.pdf

Acoustic Equipment, Calibration, and Data Collection

Acoustic measurements were collected with a Simrad EK60 scientific echosounding system (Simrad 2008; Bodholt and Solli 1992). Five split-beam transducers (18-, 38-, 70-, 120-, and 200-kHz) were mounted on the bottom of the vessel's retractable centerboard extending 9 m below the water's surface. System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics.

Standard sphere acoustic system calibrations were conducted about 2 weeks before and after the survey to measure acoustic system performance. During calibrations, the *Oscar Dyson* was anchored at the bow and stern. Weather, sea state conditions, and acoustic system settings were recorded. A tungsten-carbide sphere (38.1 mm diameter) was suspended below the centerboard-mounted transducers and used to calibrate the 38-, 70-, 120-, and 200-kHz systems. The tungsten-carbide sphere was replaced with a copper sphere (64 mm diameter) to calibrate the 18-kHz system. After each sphere was centered on the acoustic axis, split-beam target-strength and echo-integration measurements were collected to estimate transducer gains following methods of Foote et al. (1987). Transducer beam characteristics were modeled by moving each sphere through a grid of angular coordinates and recording target-strength measurements using the ER60's calibration utility (Simrad 2008). The gain and beam pattern parameters measured in February were used during the survey, and the final values were used to calculate the abundance and biomass estimates for pollock (Table 1).

Acoustic data were collected between 16 m from the ocean surface to 1,100 m, 24 hours/day. Raw acoustic data from the five frequencies were logged using ER60 software (v. 2.2.1) and acoustic telegram data were logged using Myriax EchoLog 500 (v. 5.22). The average sounder-detected bottom line was calculated from 3 to 5 frequencies, depending on the depth (Jones et al. 2011).

Trawl Gear and Oceanographic Equipment

The *Oscar Dyson* was equipped with an Aleutian wing 30/26 trawl (AWT) to sample midwater organisms. This trawl was constructed with full-mesh nylon wings, and polyethylene mesh in the codend and aft section of the body. The headrope and footrope each measured 81.7 m (268 ft).

Mesh sizes tapered from 325.1 cm (128 in) in the forward section of the net to 8.9 cm (3.5 in) in the codend, which was fitted with a single 12 mm (0.5 in) codend liner. A permanently attached, small-mesh recapture net was affixed to the bottom panel of the AWT to provide an index of trawl escapement relative to fish length (Williams et al. 2011). The AWT was fished with 82.3 m (270 ft) of 1.9-cm (0.75 in) diameter (8 H19 wire) non-rotational dandylines, 226.8-kg (500 lb) or 340.2-kg (750-lb) tom weights on each side, and 5 m^2 Fishbuster trawl doors [1,247 kg (2,750 lb) each]. Trawl depth and vertical net opening were monitored using a Simrad FS70 third-wire net netsounde attached to the trawl headrope; the vertical net opening ranged from 21 to 38 m, averaging 26.2 m while fishing.

Physical oceanographic measurements were collected throughout the cruise. Temperature-depth profiles were obtained at trawl sites with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope. Surface temperature was measured continuously using the Furuno T-2000 external probe attached to the hull, located mid-ship, approximately 1.4 m below the surface of the water. Other environmental measurements (e.g., surface salinity) were also recorded using the ship's sensors interfaced with the ship's Scientific Computing System (SCS). Surface temperatures were averaged to 0.5-nmi intervals for analysis.

Survey Design

The survey design consisted of 35 north-south parallel transects that were systematically spaced 3 nmi apart from Unalaska Island at about 167°W longitude to the Islands of Four Mountains near 170°W. The first transect's start location (longitude) was randomly generated to add an element of randomness to an otherwise systematic transect design (Rivoirard et al. 2000). Although the longitude for the first transect was randomly assigned, it was constrained to be within ≤ 3 nmi (transect spacing) of the start location used in 2003, the last year that start locations were not randomized. This resulted in a new start location 0.14 nmi east of the start location used in 2003. The survey began with transect 1 at the new location and progressed westerly, through transect 16. Because of deteriorating weather conditions, transects were surveyed in a different order than originally planned. After transect 16, transects 26-30, and south-extended section of transect 31 were completed, transects 17-25 were surveyed in reverse order. Transects 32-35 and most of 31 were dropped. The average transecting speed was 11.3 knots. The survey covered 1,150 nmi^2 of the CBS Convention Specific Area. Survey activities were conducted 24 hour/day.

Trawl hauls were conducted to identify the species composition of observed acoustic scattering layers, and to provide biological samples. Trawling speed averaged 3.0 knots. Organism lengths were measured to the nearest 1 millimeter (mm) using an electronic measuring board (Towler and Williams 2010). Pollock were sampled to determine sex, fork length (FL), body weight, age, gonad maturity, and ovary weights. Smaller forage fish such as lanternfishes (family Myctophidae) were measured to the nearest 1 mm standard length. An electronic motion-compensating scale (Marel M60) was used to weigh individual specimens to the nearest 2 g. Pollock otoliths were collected and stored in 50% glycerin/thymol-water solution for age determinations. Gonad maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning[3]. Gonado-somatic-indices (GSI) were computed as ovary weight/body weight for pre-spawning mature female pollock. Trawl station and biological measurements were electronically recorded and stored in the Catch Logger for Acoustic Midwater Surveys relational database.

Pollock ovaries were collected to support research by other investigators. Ovaries were collected from pre-spawning walleye pollock to investigate interannual variation in fecundity of mature females (Sandi.Neidetcher@noaa.gov), and from female walleye pollock of all maturity stages for a histological study (Martin.Dorn@noaa.gov).

Data Analysis

Pollock abundance was estimated by combining acoustic backscatter at 38 kHz and trawl information. Acoustic backscatter was identified as pollock, rockfish, fish, or macrozooplankton based on trawl catch information from nearby trawl hauls, and by the aggregation appearance using Myriax Echoview software (v. 5.4.100.24718). Pollock backscatter at 38 kHz was integrated at 0.5 nmi horizontal by 20 m vertical resolution, exported to a database, and converted to abundance

3 ADP Codebook. 2013. Unpublished document. RACE Division, AFSC, NMFS, NOAA; 7600 Sand Point Way NE, Seattle, WA 98115. Available online http://www.afsc.noaa.gov/RACE/groundfish/adp_codebook.pdf

using pollock length and weight information. A minimum S_v threshold of -70 decibels (dB) re 1 m^{-1} was used for both echogram display and echo integration.

Pollock length measurements from different hauls were combined into length strata based on geographic proximity and the similarity in size composition data. In the Bogoslof Island area, pre-spawning pollock aggregations are often densely packed and vertically stratified by sex (Schabetsberger et al. 1999). Female pollock are usually observed in the shallower layers, while males are abundant in deeper layers. This stratified layering makes sampling the deeper layers difficult without oversampling the shallower layer. Because female pollock are longer than males after about 5 years of age, biased estimates of sex composition from hauls can result in biased estimates of population size and age composition. As in previous Bogoslof surveys, the sample sex ratio was assumed to be 50:50. Thus, to lessen the impact of any one haul's contribution of males or females, a male size composition was derived by averaging proportions-at-length for each haul in the length stratum and the same was done for female fish. The resultant male and female size compositions were then averaged to provide a sexes-combined size composition for each length stratum.

Pollock mean fish weight-at-length was estimated using data from all trawl catches. Weight-at-length measurements from individual pollock were used to estimate mean fish weight-at-length for each length interval (to the nearest 1.0 cm) when there were six or more pollock for that length interval; otherwise, weight at a given length interval was estimated from a linear regression of the natural logs of the length and weight data (De Robertis and Williams 2008).

Walleye pollock abundance was estimated by dividing the acoustic measurements of area backscattering coefficient by the mean backscattering cross section of pollock (MacLennan et al. 2002) using an acoustic target strength (TS) to length relationship of TS = 20 log10 (FL) - 66 (Traynor 1996). Numbers and biomass for each regional length stratum were estimated as in Honkalehto et al. (2008b). Total abundance was estimated by summing the stratum estimates.

Relative estimation errors associated with spatial structure observed in the acoustic data were derived using a one-dimensional (1D) geostatistical method (Petitgas 1993, Williamson and Traynor 1996, Rivoirard et al. 2000, Walline 2007). Relative estimation error is defined as the ratio of the square root of the estimation variance to the estimate of biomass. Geostatistical methods were used for computation of error because they account for the observed spatial structure. These errors quantify only transect sampling variability. Other sources of error (e.g., target strength, trawl sampling) were not included.

For each 0.5-nmi distance interval, average pollock depth (weighted by biomass) was compared to the average bottom depth at that same interval (Fig. 5). Average pollock depth for each 0.5-nmi interval was computed as

$$Average\ pollock\ depth = \frac{\sum_D D + B}{\sum_D B}$$

where D is the midpoint depth (m) of each 20 m depth layer, and B is biomass in the 20 m depth layer. Average bottom depth was the average sounder-detected bottom depth in each interval. In areas of extreme slope, the average pollock depth was sometimes deeper than the average sounder-detected bottom depth; in these cases, the maximum-depth of the pollock backscatter was used as the average bottom depth.

RESULTS

Calibration

Pre- and post-survey calibration measurements of gain and transducer beam pattern were similar, confirming that the ER60 38-kHz acoustic system was stable throughout the survey (Table 1). Because the difference in integration gain (i.e., gain + Sa correction) measured before and after the survey was < 0.1 dB, and transducer beam pattern measurements were similar, the average of the logarithmic gain values from both calibration results was taken in the linear domain and used for the final analysis.

Water Temperature

Water temperatures measured during the 2014 survey were warmer than temperatures measured in 2012. In 2014, mean surface-temperatures ranged from 3.5 º to 5.0 ºC (Fig. 1), whereas in 2012, mean surface-temperatures ranged from 2.0 º to 3.3 ºC. The coolest surface-temperatures measured in 2014 were observed in the easternmost transects, which was consistent with 2012. Below the surface, water temperatures at trawl sites were warmer throughout the water column compared to 2012, especially in the upper 200 m (Fig. 2). Between 300 and 600 m, where most of the pollock were vertically distributed in the Bogoslof area in 2014, temperatures averaged between 3.5 º and 3.9 ºC, which was similar to 2012, when temperatures at these depths averaged between 3.4 º and 3.8 °C (Fig. 2). When compared to temperature profiles observed from previous Bogoslof surveys, the profile in 2014 was most similar to that observed in 2001.

Trawl Samples

Biological data and specimens were collected from seven trawl sites in the survey region (Tables 2-4, Fig. 1). By weight, pollock dominated most all trawl catches and represented 88.2% of the total catch. By number, pollock accounted for 7.4% of the total catch, with myctophid (i.e., lanternfish) species accounting for 51.3% and northern smoothtongue, *Leuroglossus schmidti*, accounting for 31.7% (Table 4).

Of the random pollock length measurements collected (Table 4), 1,852 were used to convert the acoustic data to estimates of biomass and numbers at length. The length measurements ranged from 13-70 cm FL and were used to create length strata representing two geographic areas in the survey region. Length measurements from hauls 2-4 were used to convert the acoustic data to abundance estimates for the Umnak stratum (transects 1-20) and measurements from hauls 5-7 were used to convert the acoustic data for the Samalga stratum (transects 21-31). Although juvenile pollock measuring 13-14 cm were captured in the Samalga stratum (haul 6), most of the pollock measurements were from adult pollock. The range of adult length measurements collected in the two strata were similar (Umnak: 37-70 cm; Samalga: 38-69 cm), but the measurements had dissimilar modes (Umnak mode at 45 cm FL; Samalga bimodal at 47 and 58 cm FL). Trawl catch sex ratios varied among strata from 3% to 61% females in Umnak and 43% to 67% females in Samalga.

The maturity composition of pollock in the Umnak stratum was markedly different than in the Samalga stratum. Pollock in the Samalga stratum were mostly in the pre-spawning stage, whereas pollock in the Umnak stratum were more broadly distributed among developing, pre-spawning, spawning, and post-spawning maturity stages (Fig. 3a). Specifically, in the Samalga stratum, 89% of the female fish were in pre-spawning condition; whereas in the Umnak stratum, 21% of females were developing, 18% pre-spawning, 21% spawning, and 40% post-spawning.

The average gonado-somatic-index (GSI) for pre-spawning mature female pollock was computed for each stratum, and for both strata combined. The average GSI was 0.13 for Umnak, and 0.14 for Samalga. Although the sample size was exceptionally small in Umnak (n = 14; Fig 3b). The GSI estimated for combined strata was 0.14, which was lower than the 0.18 observed in 2012.

Pollock biomass -at-length, and –at-age estimates were computed using observed mean fish weight-at-length measurements (Honkalehto et al., 2008b) for most of the pollock lengths encountered (Fig. 3c). Because of the small sample size for the smallest and largest pollock encountered, these 8 length-intervals were estimated by using weight (g) = 0.001303 × FL (cm) $^{3.44}$ and corrected for a small bias due to back-transformation (Miller 1984).

Distribution and Abundance

About half of the pollock biomass was observed in the Umnak stratum and about half was observed in the Samalga stratum (Fig. 4). Most of the fish in the Umnak stratum were highly concentrated (>1,000 t/0.5 nmi) along the southern end of transect 10-11, whereas fish in the Samalga stratum were observed across several transects (26-30). This pattern was also observed in 2009 and 2012. Vertically, pollock were distributed midwater between about 100 and 700 m (Fig. 5). Fish generally stayed close to the bottom until bottom depths reached about 400 m. Where the bottom depths were greater than 400-500 m, fish were observed farther off bottom, forming pelagic layers which were slightly shallower in the Umnak stratum (300-550 m) than in the Samalga stratum (400-650 m).

The abundance estimate for pollock in 2014 was 113 million fish weighing 112 thousand metric tons (t) for the entire surveyed area (Tables 5-7; Fig. 6). These 2014 estimates represent a 133% increase in abundance, and a 67% increase in biomass from the 2012 survey estimates. Based on the 1D geostatistical analysis, the relative estimation error for the biomass estimate was 11.8% (Table 5).

The overall size composition for pollock was bimodal with prominent modes at 45 and 58 cm FL (Figs. 7-8). Over half (64%) of the 2014 population was 50 cm or smaller, contributing to the population's overall mean length of 49.6 cm (Table 6). Thirty-six percent of the population measured 40-45 cm FL, which was a substantial increase from the 4% observed at these lengths during the 2012 survey. Most of these smaller fish (40-45 cm) were observed in the Umnak stratum, making up 53% of the fish observed in that region; whereas, most of the fish larger than 50 cm were observed in the Samalga stratum (Fig. 7).

In 2014, the estimated age composition ranged from 1 to 18 years of age, but was dominated by younger pollock by-number, and by-weight (Tables 8-9; Fig. 9). Eighty percent of the estimated abundance and 64% of the estimated biomass was less than 9 years of age. Fifty-eight percent of the overall pollock abundance was 5- and 6-year-old fish (2009 and 2008 year classes) and 12% were 8-year-old fish (2006 year class). As noted earlier, the Umnak stratum was dominated by smaller fish in the 40-45 cm length range. Age results conclude that in the Umnak stratum, 42% of the fish were 5 year olds averaging 42.9 cm FL, and 33% were 6 year olds averaging 45.7 cm FL (Fig. 10). The 75% 5-6 year olds in the Umnak stratum provides a striking comparison with the last two Bogoslof surveys, when in 2009, < 1% of the Umnak stratum were 5-6 year olds, and in 2012, about 53% were 5-6 year olds (Fig. 10).

DISCUSSION

The 113 million fish estimated in the Bogoslof region from the 2014 acoustic-trawl survey brings the population back up to the 2009 level of abundance (McKelvey and Stienessen, 2012; Fig.6), though it remains extremely low compared to late 1980s and early 1990s. This was a young pollock population relative to previous years, with relatively few older fish observed (Fig. 9). The surge of fish from the 2008-2009 year classes contributed greatly to the population increase. It is interesting that although the 2008 year class was relatively strong on the Bering Sea shelf, the 2009 year class was not (Ianelli et al. 2014b).

The percentage of fish in spawning and post-spawning condition in the Umnak area was high (61.3%), but not unprecedented in this survey time series (Table 10). Since 1988, the Bogoslof survey has generally occurred in late-February – early March to survey the pre-spawning pollock aggregations in the southeast Aleutian region, and a large percentage of fish in these late-stage spawning conditions have been observed in some areas, and in some years. If pollock move out of the survey area after spawning, a negative bias in survey abundance estimates could result when the percent spawning/spent is high (Wilson 1994), but it is not clear that this is true for the Bogoslof survey. Further analysis of the Bogoslof survey time-series is warranted to determine 1) whether the percent spawning/spent is associated with a negative bias in survey abundance estimates, and 2) whether the percent spawning/spent can be predicted based on factors such as calendar date, population size, average fish length, location, or environmental conditions (Lawson and Rose, 2000).

Catching juvenile pollock (13-14 cm FL; Fig.7) is unusual during a Bogoslof survey. Juvenile fish < 15 cm FL have not been caught during this survey since 1995 (Table 6). In 1995, the juveniles were caught in several hauls east of 168º 30’ longitude in the Umnak stratum at depths > 400 m. During the 2014 survey, the juveniles were also caught at > 400 m water depth, but they were captured west of 169º longitude in the Samalga stratum.

At the beginning of the survey, we planned for acoustic backscatter measurements to be collected across all 35 transects starting from the east and progressing west. Due to poor weather conditions we changed the transect order to prioritize coverage in areas where historically high pollock have been observed (Samalga strata, transects 26-30), and we did not survey the five most westerly transects (31-35). Because the pollock backscatter observed during the 2014 survey was in nearly the same areas as observed during the 2009 and the 2012 surveys, we assume that the backscatter along the westernmost lines was also similar. Survey coverage in 2009 and 2012 for this westernmost survey area was 252 and 200 nmi^2, with about 632 and 550 thousand fish, respectively, and represented about 1% of the abundance for each year. Assuming pollock were distributed with similar proportional abundance in this area during 2014 as they were in 2009 and 2012, we likely underestimated the overall 2014 abundance estimate by about 1%.

ACKNOWLEDGMENTS

The authors would like to thank the officers and crew of the NOAA ship *Oscar Dyson* for their contribution to the successful completion of this work. Thanks also to the scientific party aboard the ship as well as the MACE staff on land who worked tirelessly in support of our work.

CITATIONS

Bodholt, H., and H. Solli. 1992. Split beam techniques used in Simrad EK500 to measure target strength, p. 16-31. *In* World Fisheries Congress, May 1992, Athens, Greece.

De Robertis, A., and K. Williams. 2008. Weight-length relationships in fisheries studies: the standard allometric model should be applied with caution. Trans. Am. Fish. Soc. 137:707–719.

Foote, K. G., H. P. Knudsen, G. Vestnes, D. N. MacLennan, and E. J. Simmonds. 1987. Calibration of acoustic instruments for fish density estimation: a practical guide. ICES Coop. Res. Rep. 144, 69 p.

Honkalehto, T., D. McKelvey, and K. Williams. 2008a. Results of the March 2007 echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) conducted in the southeastern Aleutian Basin near Bogoslof Island, cruise MF2007-03. AFSC Processed Rep. 2008-01, 37 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE., Seattle WA 98115.

Honkalehto, T., N.Williamson, D.Jones, A.McCarthy, and D. McKelvey. 2008b. Results of the echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) on the U.S. and Russian Bering Sea shelf in June and July 2007. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-190, 53 p.

Ianelli, J.N., S.J. Barbeaux, D. McKelvey, and T. Honkalehto. 2014a. Assessment of walleye pollock in the Bogoslof Island Region. Section 1, p. 237-254. *In* Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. N. Pac. Fish. Mgmt. Council, 605 W. 4th Ave, Anchorage, AK 99501.

Ianelli, J.N., T. Honkalehto, S. Barbeaux, S. Kotwicki, K. Aydin, and N. Williamson. 2014b. Assessment of the walleye pollock stock in the Eastern Bering Sea. Section 1, p. 55-156. *In* Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions. N. Pac. Fish. Mgmt. Council, 605 W. 4th Ave, Anchorage, AK 99501.

Jones, D. T., A. De Robertis, and N. J. Williamson. 2011. Statistical combination of multifrequency sounder-detected bottom lines reduces bottom integrations. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-219, 13 p.

Lawson, G. L., G.A. Rose. 2000. Small-scale spatial and temporal patterns in spawning of Atlantic cod (*Gadus morhua*) in coastal Newfoundland waters. Can. J. Fish. Aquat. Sci. 57:1011-1024

MacLannan, D. N., P. G. Fernandes, and J. Dalen. 2002. A consistent approach to definitions and symbols in fisheries acoustics. ICES J. Mar. Sci. 59:365-369.

McKelvey, D., and S. Steinessen. 2012. Results of the March 2012 acoustic-trawl survey of walleye pollock (*Theragra chalcogramma*) conducted in the southeastern Aleutian Basin near Bogoslof Island, cruise DY2012-02. AFSC Processed Rep. 2012-08, 36 p. Alaska Fish. Sci. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way NE., Seattle WA 98115.

Miller, D. M. 1984. Reducing transformation bias in curve fitting. The Am. Stat. 38:124-126.

Petitgas, P. 1993. Geostatistics for fish stock assessments: a review and an acoustic application. ICES J. Mar. Sci. 50: 285-298.

Rivoirard, J., J. Simmonds, K.G. Foote, P. Fernandez, and N. Bez. 2000. Geostatistics for estimating fish abundance. Blackwell Science Ltd., Osney Mead, Oxford OX2 0EL, England. 206 p.

Schabetsberger, R., R.D. Brodeur, T. Honkalehto, and K. L. Mier. 1999. Sex-biased cannibalism in spawning walleye pollock: the role of reproductive behavior. Environ. Biol. Fishes 54:175-190.

Simrad. 2008. ER60 scientific echo sounder software reference manual. 220 pp. Simrad AS, Strandpromenenaden 50, Box 111, N-3191 Horten, Norway.

Towler, R., and K. Williams. 2010. An inexpensive millimeter-accuracy electronic length measuring board. Fish. Res. 106:107-111.

Traynor, J.J. 1996. Target strength measurements of walleye pollock (*Theragra chalcogramma*) and Pacific whiting (*Merluccius productus*). ICES J. Mar. Sci. 64:559-569.

Walline, P. D. 2007. Geostatistical simulations of eastern Bering Sea walleye pollock spatial distributions, to estimate sampling precision. ICES J. Mar. Sci. 64:559-569.

Williamson, N., and J. Traynor. 1996. Application of a one-dimensional geostatistical procedure to fisheries acoustic surveys of Alaskan pollock. ICES J. Mar. Sci. 53: 423-428.

Wilson, C.D. 1994. Echo integration-trawl survey of pollock in Shelikof Strait Alaska in 1994. In Stock Assessment and Fishery Evaluation Report for the 1994 Gulf of Alaska Groundfish Fishery, November 1994, Supplement, pp 1-39. Prepared by the Gulf of Alaska Groundfish Plan Team, North Pacific Fishery Management Council, P.O. Box 103136, Anchorage, AK 99510.

Itinerary

Alaska Standard Time

1 March	Embark scientists in Kodiak, AK
3-4 March	Transit towards southeast Aleutian Basin, Alaska
4-5 March	Return to Kodiak, AK for medical emergency
5-7 March	Transit to southeast Aleutian Basin, Alaska
7-11 March	Acoustic-trawl survey of the Bogoslof Island area
11 March	Disembark scientists in Dutch Harbor, Alaska

Scientific Personnel

Name	Position	Organization
Denise McKelvey	Chief Scientist	AFSC
Taina Honkalehto	Fishery Biologist	AFSC
Rick Towler	Info. Tech. Specialist	AFSC
Sarah Stienessen	Fishery Biologist	AFSC
Elaina Jorgensen	Fishery Biologist	AFSC
Sandi Neidetcher	Fishery Biologist	AFSC
William Floering	Fishery Biologist	AFSC

AFSC Alaska Fisheries Science Center, Seattle WA

List of Tables and Figures

Table 10. -- Percentage of walleye pollock females in spawning and post-spawning maturity condition by region* during Bogoslof survey years 1988-2014. Only hauls that contributed to survey abundance estimates were included. In some years, the survey was completed in several separate, but discrete time periods; data for these are indicated by italics. Percentages greater than 50% are shaded

Figure 1. -- Transects, haul locations, and sea-surface temperatures observed transects during the winter 2014 acoustic-trawl survey of walleye pollock in the southeast Aleutian Basin near Bogoslof Island. Transect numbers are underlined, trawl haul locations are indicated by circles, and the Central Bering Sea Specific area is indicated by a dash-dotted line. The Umnak stratum includes transects 1-20, and the Samalga stratum includes transects 21-31.

Figure 2. -- Average temperature (^{o}C) by 50-m depth intervals observed during hauls from the winter 2000-2003, 2005-2007, 2009, 2012, and 2014 acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. The horizontal bars represent temperature ranges observed during the 2014 survey. Note: Temperature data from the 2003 survey were collected from only three locations.

Figure 3. -- Walleye pollock maturity stages by region and sex (A), gonado-somatic index (GSI) by region for pre-spawning females as a function of fork length (B), and observed mean weight-at-length for adult fish, with fitted regression line for combined regions and sexes (C), observed during the winter 2014 acoustic-trawl survey of the Bogoslof Island area. In panel C, hollow circles indicate fewer than five fish were measured and vertical bars indicate +/- one standard deviation.

Figure 4. -- Transects, haul locations, and walleye pollock biomass density (t/nmi^2) observed along transects during the winter 2014 acoustic-trawl survey of walleye pollock in the southeast Aleutian Basin near Bogoslof Island. Transect numbers are underlined, trawl haul locations are indicated by circles, and the Central Bering Sea Specific area is indicated by a dash-dotted line. The Umnak stratum includes transects 1-20, and the Samalga stratum includes transects 21-31.

Figure 5. -- Average walleye pollock depth (weighted by biomass) versus bottom depth (m), per 0.5 nmi sailed distance for the Umnak and Samalga strata during the winter 2014 acoustic-trawl survey of walleye pollock in the Bogoslof Island area. Bubble size was scaled to the maximum biomass/0.5 nmi interval (Umnak stratum 5,164 t). The diagonal line indicates where the average pollock depth equals bottom depth. Note that bottom depth measurements were limited to 1,100 m.

Figure 6. -- Biomass estimates obtained during winter acoustic-trawl surveys for walleye pollock in the Bogoslof Island area, within and outside the Central Bering Sea (CBS) specific area, 1988-2014. The United States conducted all but the 1999 survey, which was conducted by Japan. There were no surveys in 1990, 2004, 2008, 2010-2011, or 2013. Total pollock biomass (million metric tons) for each survey year is indicated on top of each bar.

Figure 7. -- Numbers-at-length (top) and biomass at length (bottom) estimates by stratum and total from the winter 2014 acoustic-trawl primary survey of walleye pollock in the Bogoslof Island area.

Figure 8. -- Numbers-at-length estimates (millions) from winter acoustic-trawl surveys of spawning pollock near Bogoslof Island. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by Japan. Note: Y-axis scales differ.

Figure 9. -- Numbers-at-age estimates (millions) from acoustic-trawl surveys of pollock near Bogoslof Island. Major year classes on the Bering Sea shelf are indicated at the top. No surveys were conducted in 1990, 2004, 2008, 2010-2010, or 2013.

Figure 10. -- Numbers-at-age estimates (millions) by stratum for pollock observed during the Bogoslof Island acoustic-trawl surveys conducted in 2009, 2012, and 2014

Table 1. -- Simrad ER60 38 kHz acoustic system description and settings used during the winter 2014 acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. Also presented are results from standard sphere acoustic system calibrations conducted in association with the survey, and final values used to calculate biomass and abundance data.

	Bogoslof Survey System Settings	21 Feb Uyak Bay Alaska	23 Mar Izhut Bay Alaska	Final Analysis Parameters
Echosounder	Simrad ER60	--	--	Simrad ER60
Transducer	ES38B	--	--	ES38B
Frequency (kHz)	38	--	--	38
Transducer depth (m)	9.15	--	--	9.15
Pulse length (ms)	1.024	--	--	1.024
Transmitted power (W)	2000	--	--	2000
Angle sensitivity along	22.83	--	--	22.83
Angle sensitivity athwart	21.43	--	--	21.43
2-way beam angle (dB re 1 steradian)	-20.77	--	--	-20.77
Gain (dB)	22.75	22.75	22.73	22.74
Sa correction (dB)	-0.62	-0.62	-0.63	-0.63
Integration gain (dB)	22.13	22.13	22.10	22.11
3 dB beamwidth along	6.74	6.74	6.74	6.74
3 dB beamwidth athwart	7.15	7.15	7.12	7.14
Angle offset along	-0.05	-0.05	-0.07	-0.06
Angle offset athwart	-0.04	-0.04	-0.06	-0.05
Post-processing S_v threshold (dB re 1 m^{-1})	-70	--	--	-70
Standard sphere TS (dB re 1 m^2)	--	-42.49	-42.21	--
Sphere range from transducer (m)	--	21.72	24.86	--
Absorption coefficient (dB/m)	0.0099	0.0099	0.0100	0.0099
Sound velocity (m/s)	1466.0	1462.3	1462.3	1466
Water temp at transducer (ºC)	--	3.2	4.5	--

Note: Gain and beam pattern terms are defined in the Operator Manual for Simrad ER60 Scientific echosounder application, which is available from Simrad Strandpromenaden 50, Box 111, N-3191 Horten, Norway.

Table 2.--Trawl station and catch data summary from the winter 2014 acoustic-trawl survey of walleye pollock in the Bogoslof Island area.

Haul No.	Stratum	Date (GMT)	Time (GMT)	Duration (minutes)	Start position: Latitude (N)	Start position: Longitude (W)	Depth (m): Footrope	Depth (m): Bottom	Water temp. (^oC): Headrope	Water temp. (^oC): Surface[1]	Catch: Pollock (kg)	Catch: Pollock Number	Catch: Other (kg)
1	Umnak	8-Mar	2:43	25	53° 56.65'	167° 10.90'	446	517	3.9	4.2	3	6	27.0
2	Umnak	8-Mar	12:55	31	53° 39.94'	167° 33.02'	296	342	4.0	4.4	224	265	41.1
3**	Umnak	8-Mar	22:11	1	53° 31.59'	167° 51.06'	442	621	3.8	4.4	172	267	91.3
4	Umnak	9-Mar	0:41	12	53° 35.06'	167° 46.46'	494	675	3.7	4.4	930	1,632	92.3
5	Samalga	9-Mar	16:03	28	53° 3.25'	169° 12.84'	533	868	3.5	4.3	295	357	24.1
6	Samalga	10-Mar	0:07	31	52° 59.65'	169° 21.92'	499	865	3.8	4.3	313	203	49.5
7	Samalga	10-Mar	3:54	24	52° 58.31'	169° 17.09'	510	629	3.5	4.3	937	711	61.0

[1]Temperature from hull-mounted Furuno T-2000, 1.4 m below surface

**Third wire failed so the tow was retrieved early.

Table 3.--Catch by species, and numbers of length and weight measurements taken from individuals captured in seven midwater trawl hauls during the winter 2014 acoustic-trawl survey of walleye pollock in the Bogoslof Island area.

		Catch				Individual Measurements	
Species name	Scientific name	Weight (kg)	%	Number	%	Length	Weight
walleye pollock	*Gadus chalcogrammus*	2,874.9	88.2	3,439	7.4	1,867	364
lanternfish unidentified	Myctophidae (family)	136.1	4.2	14,272	30.8	116	62
lanternfish unidentified	*Stenobrachius* (genus)	95.3	2.9	9,511	20.5	112	36
northern smoothtongue	*Leuroglossus schmidti*	60.1	1.8	14,674	31.7	127	31
Pacific ocean perch	*Sebastes alutus*	38.3	1.2	41	0.1	33	12
shining tubeshoulder	*Sagamichthys abei*	14.7	0.5	485	1.0	6	6
smooth lumpsucker	*Aptocyclus ventricosus*	12.9	0.4	7	<0.1	7	7
Gonatus squid	Gonatidae (family)	4.6	0.1	966	2.1	10	-
chinook salmon	*Oncorhynchus tshawytscha*	4.1	0.1	3	<0.1	3	1
Pacific lamprey	*Lampetra tridentata*	3.1	0.1	7	<0.1	7	5
squid unidentified	Teuthoidea (order)	2.7	0.1	201	0.4	12	-
jellyfish unidentified	*Scyphozoa* (class)	2.5	0.1	18	<0.1	-	-
magistrate armhook squid	*Berryteuthis magister*	2.5	0.1	69	0.1	12	4
Berry armhook squid	*Gonatus berryi*	2.5	0.1	3	<0.1	3	-
Pacific glass shrimp	*Pasiphaea pacifica*	2.0	0.1	1,550	3.3	24	-
viperfish unidentified	*Chauliodus* (genus)	1.6	<0.1	401	0.9	-	-
specklemouth eelpout	*Lycodapus psarostomatus*	1.2	<0.1	198	0.4	39	10
squid unidentified	*Gonatopsis* (genus)	0.7	<0.1	16	<0.1	14	4
shrimp unidentified	Decapoda (order)	0.7	<0.1	471	1.0	19	-
eulachon	*Thaleichthys pacificus*	0.2	<0.1	4	<0.1	4	4
sea nettle	*Chrysaora melanaster*	0.1	<0.1	1	<0.1	-	-
moon jelly	*Aurelia* (genus)	0.1	<0.1	1	<0.1	1	1
age-1 walleye pollock	*Gadus chalcogrammus*	0.1	<0.1	2	<0.1	2	2
longfin dragonfish	*Tactostoma macropus*	<0.1	<0.1	1	<0.1	-	-
Total		3,261.1		46,341		2,418	549

Table 4.--Numbers of walleye pollock measured and biological samples collected during the winter 2014 acoustic-trawl survey in the Bogoslof Island area.

	Walleye pollock				
Haul no.	Random lengths	Lengths & weights	Maturities & otoliths	Ovary weights	Ovary preserved
1	6	6	6	1	1
2	265	59	59	23	22
3	267	64	50	13	13
4	479	56	56	6	6
5	357	60	60	35	23
6	203	62	62	25	24
7	282	59	59	23	24
Totals	1,859	366	352	126	113

Table 5.--Walleye pollock biomass (metric tons (t)) estimated by survey area and management area from February-March acoustic-trawl surveys in the Bogoslof Island area between 1988 and 2014.

Bogoslof Survey Area				**Central Bering Se Specific Area**	
Year	**Biomass (million t)**	**Area (nmi^2)**	**Relative estimation error (%)**	**Biomass (million t)**	**Relative estimation error (%)**
1988	2.396	--	--	2.396	--
1989	2.126	--	--	2.084	--
1990	--	No survey	--	--	--
1991	1.289	8,411	11.7	1.283	--
1992	0.940	8,794	20.4	0.888	--
1993	0.635	7,743	9.2	0.631	--
1994	0.490	6,412	11.6	0.490	--
1995	1.104	7,781	10.7	1.020	--
1996	0.682	7,898	19.6	0.582	--
1997	0.392	8,321	14.0	0.342	--
1998	0.492	8,796	19.0	0.432	19.0
1999	0.475	Conducted by Japan Fisheries Agency		0.393	--
2000	0.301	7,863	14.3	0.270	12.7
2001	0.232	5,573	10.2	0.208	11.8
2002	0.226	2,903	12.2	0.226	12.2
2003	0.198	2,993	21.5	0.198	21.5
2004	--	No survey	--	--	--
2005	0.253	3,112	16.7	0.253	16.7
2006	0.240	1,803	11.8	0.240	11.8
2007	0.292	1,871	11.5	0.292	11.5
2008	--	No survey	--	--	--
2009	0.110	1,803	19.2	0.110	19.2
2010	--	No survey	--	--	--
2011	--	No survey	--	--	--
2012	0.067	3,656	9.8[1]	0.067	9.8*
2013	--	No survey	--	--	--
2014	0.112	1,150	11.8	0.112	11.8

*The relative error for 2012 was computed for the primary survey area (1,455 nmi^2).

Table 6.--Numbers-at-length estimates (millions), and average fork length (cm) from February-March acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by the Japan Fisheries Agency.

Length (cm)	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2005	2006	2007	2009	2012	2014
10	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
14	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	2	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0
24	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0
31	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	<1	0	0	0	0	0	0	0	0	0	<1	<1	0	0	0	0	0	0
34	0	0	0	0	0	0	<1	<1	0	<1	0	0	0	<1	<1	0	0	0	0	0	0
35	0	0	0	0	0	0	<1	0	<1	0	0	0	0	<1	0	0	0	0	0	0	0
36	0	0	0	<1	0	0	<1	<1	<1	<1	0	0	0	1	0	0	0	0	0	0	0
37	9	3	<1	0	0	0	<1	<1	<1	<1	0	0	0	1	<1	<1	0	0	0	0	<1
38	6	0	2	<1	1	0	1	1	<1	1	0	0	<1	1	<1	1	<1	0	0	0	<1
39	16	4	5	0	2	<1	4	1	1	3	<1	<1	<1	2	<1	2	<1	<1	0	0	<1
40	24	3	7	1	4	3	12	4	1	7	1	<1	1	3	<1	7	2	0	0	0	2
41	27	4	19	3	5	6	20	8	2	9	6	1	1	4	<1	11	5	1	<1	<1	5

Table 6.--Continued.

Length (cm)	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2005	2006	2007	2009	2012	2014
42	48	23	23	7	7	9	40	14	3	11	8	1	1	2	<1	12	10	2	<1	<1	8
43	118	33	31	14	6	14	40	17	4	11	13	3	1	5	1	11	16	4	<1	<1	9
44	179	54	36	18	7	21	41	21	5	10	13	3	2	5	2	11	20	8	<1	<1	8
45	329	159	46	28	8	21	50	23	7	9	17	4	3	7	3	13	23	11	<1	1	9
46	488	177	55	32	13	21	53	31	10	11	19	5	4	5	5	11	23	17	<1	2	7
47	547	389	79	42	22	18	40	36	14	9	14	6	5	9	5	11	18	17	1	2	7
48	476	434	130	68	28	17	55	36	15	12	11	6	5	7	7	10	17	20	1	2	6
49	389	431	168	102	46	16	47	37	18	15	10	5	6	6	6	8	14	14	2	2	5
50	248	366	205	129	69	39	52	40	21	20	16	6	6	5	7	8	9	18	2	3	7
51	162	279	189	144	76	46	58	45	24	23	11	8	6	5	4	9	9	15	5	3	2
52	80	168	160	118	73	52	78	52	26	28	20	10	7	4	4	7	7	13	5	2	2
53	48	85	122	106	73	49	81	52	26	35	17	13	8	6	4	7	5	12	6	2	4
54	19	50	63	67	66	43	88	53	31	41	21	16	9	7	3	7	5	10	8	2	2
55	12	13	40	41	50	37	81	48	28	38	33	21	13	9	5	8	3	9	8	2	2
56	4	5	17	27	29	26	69	40	24	35	38	20	13	12	7	6	6	8	8	2	3
57	3	8	8	13	14	17	58	37	22	30	33	24	16	13	7	7	5	6	6	3	4
58	1	1	4	6	9	10	47	28	17	27	36	23	14	14	10	6	7	7	6	3	4
59	0	0	1	5	3	6	31	19	13	18	23	16	12	12	9	8	5	7	5	3	4
60	0	0	1	1	1	3	17	12	12	13	15	13	12	12	13	7	7	6	2	4	3
61	2	0	1	<1	1	2	7	6	6	8	18	10	10	8	9	9	5	8	2	2	3
62	0	0	<1	<1	<1	1	4	2	3	5	13	7	6	6	7	7	5	7	1	2	2
63	0	0	0	0	0	<1	2	1	1	3	4	4	4	4	5	7	4	4	2	3	2
64	0	0	0	1	<1	0	1	<1	1	1	3	2	3	3	5	5	2	4	1	2	1
65	0	0	<1	0	0	0	<1	<1	<1	1	1	1	1	1	3	4	2	3	<1	<1	<1
66	0	0	0	0	0	0	<1	0	<1	1	<1	<1	<1	1	1	2	2	3	<1	1	<1
67	0	0	0	0	0	0	0	0	0	0	1	<1	<1	<1	1	2	1	2	<1	1	<1
68	0	0	0	0	0	0	1	0	0	<1	0	<1	<1	<1	<1	1	1	1	<1	<1	<1
69	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	<1	<1	<1	1	<1	0	<1
70	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	0	<1	<1	<1	<1	0	<1
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	<1	<1	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	<1	<1	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	<1	0	0
Total	3,236	2,687	1,419	975	613	478	1,081	666	337	435	416	229	170	181	134	225	239	236	73	49	113
Average length	47.2	48.7	49.6	50.6	51.4	51.0	50.9	51.4	52.8	52.5	53.4	55.0	55.1	53.1	55.7	51.2	49.7	52.3	55.3	55.5	49.6

Table 7.--Biomass-at-length estimates (1,000 t) from February-March acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by the Japan Fisheries Agency. Lengths are in centimeters.

Length	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2005	2006	2007	2009	2012	2014
10	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
14	0	0	0	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	<1	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0	0	0
24	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
31	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	<1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	<1	0	0	0	0	0	0	0	0	0	<1	<1	0	0	0	0	0	0
34	0	0	0	0	0	0	<1	<1	0	<1	0	0	0	<1	<1	0	0	0	0	0	0
35	0	0	0	0	0	0	<1	0	<1	0	0	0	0	<1	0	0	0	0	0	0	0
36	0	0	0	<1	0	0	<1	<1	<1	<1	0	0	0	<1	0	0	0	0	0	0	0
37	3	1	<1	0	0	0	<1	<1	<1	<1	0	0	0	<1	<1	<1	0	0	0	0	<1
38	2	0	1	<1	<1	0	<1	<1	<1	<1	0	0	<1	1	<1	<1	<1	0	0	0	<1
39	6	1	2	0	1	<1	2	1	1	1	<1	<1	<1	1	<1	1	<1	<1	0	0	<1
40	11	1	3	<1	2	1	6	2	1	3	1	<1	<1	2	<1	3	1	0	0	0	1
41	13	2	8	1	2	3	10	4	1	4	6	1	<1	2	<1	5	2	<1	<1	<1	2

Table 7.--Continued.

Length	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2005	2006	2007	2009	2012	2014
42	24	11	11	3	4	5	21	7	1	6	7	1	<1	1	<1	6	5	1	<1	<1	4
43	64	17	16	7	3	8	22	9	2	6	12	2	1	3	<1	6	9	2	<1	<1	5
44	105	30	20	10	4	13	25	13	3	6	12	2	2	4	1	6	12	5	<1	<1	5
45	207	94	28	16	5	14	33	15	5	6	16	3	2	5	2	8	15	7	<1	1	6
46	329	113	36	21	9	15	37	22	7	8	18	3	3	4	4	8	17	12	<1	1	5
47	395	268	57	29	17	14	30	26	11	7	14	5	4	7	4	9	14	13	1	1	5
48	367	323	101	52	22	14	45	29	12	10	11	5	4	6	6	8	15	17	1	2	5
49	321	346	141	84	40	14	40	32	16	13	11	5	5	6	6	7	13	13	2	2	4
50	218	315	187	116	64	36	48	36	20	19	18	5	6	5	7	7	9	18	2	3	6
51	152	258	186	140	76	46	57	43	24	23	12	8	6	5	4	9	10	16	5	3	2
52	80	166	171	124	78	56	82	54	29	29	23	11	8	4	5	8	7	15	6	2	2
53	51	90	140	120	83	55	90	57	30	39	20	15	9	6	5	8	6	15	8	3	4
54	21	57	78	82	79	52	104	62	38	49	25	19	11	8	4	9	6	13	11	2	2
55	14	16	53	53	64	48	102	59	36	47	39	27	17	12	6	11	5	13	13	2	3
56	6	6	24	39	40	35	92	53	33	48	47	27	17	16	11	9	10	13	12	2	5
57	4	11	12	20	21	24	82	52	32	43	41	35	24	19	11	10	7	10	9	4	6
58	1	1	7	9	14	16	71	41	26	41	45	34	22	22	16	10	11	11	10	5	7
59	0	0	1	8	4	10	49	29	21	28	28	26	20	19	15	14	9	10	9	5	7
60	0	0	3	3	2	5	28	20	21	22	18	22	20	21	23	13	11	13	5	6	4
61	3	0	2	1	2	4	12	11	11	14	23	19	18	15	17	17	8	14	5	4	5
62	0	0	1	1	<1	2	8	4	6	10	15	13	12	12	15	13	10	15	2	4	4
63	0	0	0	0	0	<1	4	3	3	6	5	7	8	8	11	14	8	9	4	6	4
64	0	0	0	1	<1	0	1	1	1	2	3	4	6	6	11	10	6	9	2	4	3
65	0	0	1	0	0	0	<1	1	1	1	2	2	3	2	7	9	4	7	1	<1	2
66	0	0	0	0	0	0	<1	0	<1	1	<1	1	1	2	4	5	5	6	1	2	2
67	0	0	0	0	0	0	0	0	0	0	1	1	<1	1	2	5	3	5	<1	2	1
68	0	0	0	0	0	0	3	0	0	<1	0	<1	<1	1	1	2	2	3	<1	<1	<1
69	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	<1	1	1	3	<1	0	<1
70	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	0	<1	<1	1	<1	0	<1
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	<1	1	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	<1	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<1	0	0	0	0	0
Total	2,396	2,126	1,289	940	635	490	1,104	682	392	492	475	301	232	226	198	253	240	292	110	67	112

Table 8.--Numbers-at-age estimates (millions) from February-March acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by the Japan Fisheries Agency. Ages are in years.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	0
1	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0	--	0	0	0	--	0	--	--	0	--	<1
2	0	0	--	4	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0	--	0	--	--	0	--	0
3	0	0	--	0	1	1	0	2	0	0	0	0	0	0	9	<1	--	0	0	0	--	0	--	--	0	--	<1
4	0	6	--	2	2	33	21	6	<1	<1	<1	2	1	1	5	8	--	5	4	1	--	0	--	--	<1	--	1
5	28	15	--	12	27	17	86	75	6	4	11	5	6	14	3	6	--	81	55	8	--	1	--	--	1	--	34
6	327	58	--	46	54	44	26	278	96	16	61	29	4	12	41	7	--	31	104	92	--	1	--	--	15	--	31
7	247	363	--	213	97	46	38	105	187	55	34	77	14	10	11	25	--	13	18	70	--	7	--	--	10	--	11
8	164	147	--	93	74	48	36	68	85	88	70	34	30	10	8	11	--	11	6	17	--	23	--	--	2	--	14
9	350	194	--	160	71	42	36	80	40	38	77	50	16	14	6	4	--	22	6	3	--	26	--	--	1	--	7
10	1,201	91	--	44	55	28	17	53	37	28	32	75	28	12	7	5	--	7	9	3	--	8	--	--	2	--	3
11	288	1,105	--	92	57	51	27	54	24	16	25	29	45	18	8	4	--	3	3	8	--	1	--	--	7	--	<1
12	287	222	--	60	33	25	23	19	24	16	21	27	21	31	14	10	--	5	2	4	--	1	--	--	8	--	1
13	202	223	--	373	34	27	13	59	12	13	19	25	16	13	30	8	--	4	4	1	--	1	--	--	1	--	5
14	89	82	--	119	142	42	9	32	36	7	18	16	11	7	9	26	--	5	5	5	--	<1	--	--	<1	--	4
15	27	90	--	41	164	92	45	12	18	13	9	12	11	9	7	6	--	11	8	5	--	<1	--	--	<1	--	2
16	17	30	--	38	59	47	36	31	4	5	15	10	9	8	9	5	--	12	5	3	--	1	--	--	<1	--	0
17	7	60	--	29	8	25	28	103	16	4	5	8	3	5	5	3	--	6	7	6	--	1	--	--	<1	--	<1
18	3	0	--	32	15	11	16	60	35	12	8	6	6	1	4	5	--	4	2	4	--	<1	--	--	<1	--	<1
19	0	0	--	56	22	11	4	18	26	12	10	3	3	3	2	1	--	3	1	3	--	1	--	--	<1	--	0
20	0	0	--	4	42	11	4	5	12	7	15	4	2	1	2	<1	--	1	2	1	--	<1	--	--	0	--	0
21	0	0	--	2	13	10	8	5	3	2	4	3	1	0	0	1	--	<1	<1	<1	--	<1	--	--	0	--	0
22	0	0	--	0	3	1	2	6	2	1	1	2	1	0	0	0	--	0	0	1	--	0	--	--	0	--	0
23	0	0	--	0	1	1	2	6	1	<1	0	<1	0	<1	<1	0	--	0	0	0	--	0	--	--	0	--	0
24	0	0	--	0	0	0	1	2	0	1	0	0	<1	<1	<1	0	--	<1	0	1	--	0	--	--	0	--	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0	--	0	--	--	0	--	0
Total	3,236	2,687	--	1,419	975	613	478	1,081	666	336	435	416	229	170	181	134	--	225	239	236	--	73	--	--	49	--	113

Table 9.--Biomass-at-age estimates (1,000 t) from February-March acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by the Japan Fisheries Agency. Ages are in years.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2014
0	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	0	0	0	--	0	--	--	0	0
1	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0	0	0	--	0	--	--	0	<1
2	0	0	--	<1	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0	--	0	--	--	0	0
3	0	0	--	0	<1	<1	0	1	0	0	0	0	0	0	5	<1	--	0	0	0	--	0	--	--	0	<1
4	0	2	--	1	1	19	13	3	<1	<1	<1	2	<1	<1	3	7	--	3	2	1	--	0	--	--	<1	1
5	15	7	--	6	21	12	60	49	4	2	7	6	4	12	2	5	--	52	36	6	--	1	--	--	1	19
6	192	41	--	25	38	39	22	208	69	11	38	28	3	11	34	6	--	25	85	80	--	1	--	--	15	23
7	156	241	--	143	67	43	40	83	165	50	30	78	12	10	10	26	--	14	19	86	--	9	--	--	11	10
8	115	111	--	75	59	47	39	72	76	95	74	37	30	12	9	12	--	15	7	25	--	33	--	--	3	19
9	251	149	--	149	67	44	40	96	46	44	94	60	18	18	8	6	--	29	8	4	--	39	--	--	1	12
10	910	68	--	44	57	31	21	64	45	38	40	90	40	16	9	8	--	10	15	6	--	13	--	--	4	5
11	226	895	--	94	61	59	32	71	31	23	36	35	63	26	12	7	--	6	4	14	--	2	--	--	12	<1
12	233	187	--	59	36	27	28	26	33	22	29	33	32	50	23	18	--	9	3	7	--	2	--	--	14	1
13	167	194	--	378	37	30	17	77	17	18	27	30	25	20	48	14	--	8	6	1	--	2	--	--	2	10
14	82	72	--	116	150	47	11	42	49	11	26	19	18	11	15	47	--	10	9	11	--	1	--	--	<1	8
15	23	81	--	39	169	107	53	17	24	20	13	14	16	14	12	11	--	21	15	12	--	1	--	--	1	3
16	16	24	--	38	63	54	43	38	6	7	22	13	15	14	15	8	--	25	9	6	--	2	--	--	<1	<1
17	7	52	--	31	9	28	32	131	21	5	8	10	6	7	8	5	--	11	13	12	--	2	--	--	1	<1
18	3	0	--	32	15	11	18	74	43	17	10	7	8	2	6	10	--	8	3	8	--	1	--	--	<1	1
19	0	0	--	55	23	14	5	22	32	17	13	3	5	5	3	2	--	5	2	6	--	1	--	--	<1	0
20	0	0	--	4	44	12	5	6	14	9	19	4	3	2	3	1	--	1	3	2	--	<1	--	--	0	0
21	0	0	--	1	15	10	9	5	4	2	5	4	2	0	0	2	--	<1	1	1	--	<1	--	--	0	0
22	0	0	--	0	3	1	2	8	2	1	1	3	2	0	0	0	--	0	0	2	--	0	--	--	0	0
23	0	0	--	0	1	1	2	7	1	<1	0	1	0	<1	<1	0	--	0	0	0	--	0	--	--	0	0
24	0	0	--	0	0	0	1	3	0	1	0	0	1	<1	1	0	--	<1	0	1	--	0	--	--	0	0
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0	--	0	0	0	--	0	--	--	0	0
Total	2,396	2,126	--	1,289	940	635	490	1,104	682	392	492	475	301	232	226	198	--	253	240	292	--	110	--	--	67	112

Table 10.-- Percentage of walleye pollock females in spawning and post-spawning maturity condition by region* during Bogoslof survey years 1988-2014. Only hauls that contributed to survey abundance estimates were included. In some years, the survey was completed in several separate, but discrete time periods; data for these are indicated by italics. Percentages greater than 50% are shaded

	Sample	Samalga		Umnak		Unalaska	
Year	Date (AST)	n	%	n	%	n	%
1988	22 Feb - 2 Mar	1,583	56	1,274	42		
1989	4-6 Mar	133	87	97	89		
1991	24 Feb - 3 Mar	281	21	273	10		
	24-27 Feb	*163*	*9*	*206*	*6*		
	1-3 Mar	*118*	*36*	*67*	*21*		
1992	29 Feb - 8 Mar	101	1	462	1	41	2
1993	1 - 12 Mar	160	5	501	15		
	1 - 4 Mar	*160*	*5*	*404*	*3*		
	12 Mar			*97*	*67*		
1994	28 Feb - 8 Mar	170	15	816	6	64	-
1995	25 Feb - 8 Mar	296	14	235	17	117	12
	25 Feb - 3 Mar	*127*	*24*	*141*	*12*	*117*	*12*
	6-8 Mar	*169*	*7*	*94*	*25*		
1996	27 Feb - 7 Mar	368	3	220	2	100	-
1997	1-11 Mar	254	17	225	19	130	14
	1-7 Mar	*224*	*15*	*125*	*4*	*31*	-
	9-11 Mar	*30*	*30*	*100*	*37*	*99*	*18*
1998	2-9 Mar	294	5	199	14	85	2
2000	3-12 Mar	218	1	118	2	24	4
2001	6-9 Mar	350	2	110	1		
2002	4-9 Mar	358	2	148	23		
2003	9-12 Mar	69	9	111	15		
2005	8-13 Mar	225	4	275	37		
2006	5-9 Mar	329	7	214	60		
2007	4-7 Mar	313	21	213	27		
2009	9-13 Mar	119	1	105	5		
2012	9-11 Mar	115	5	92	10		
2014	8-10 Mar	91	8	75	61		

*Regions defined:

Samalga:	west of 168° 30' W, and south of 55° N
Umnak:	between 168° 30' W and 167° W, and south of 55° N
Unalaska:	between 167° W and 165° W, and south of 55° N

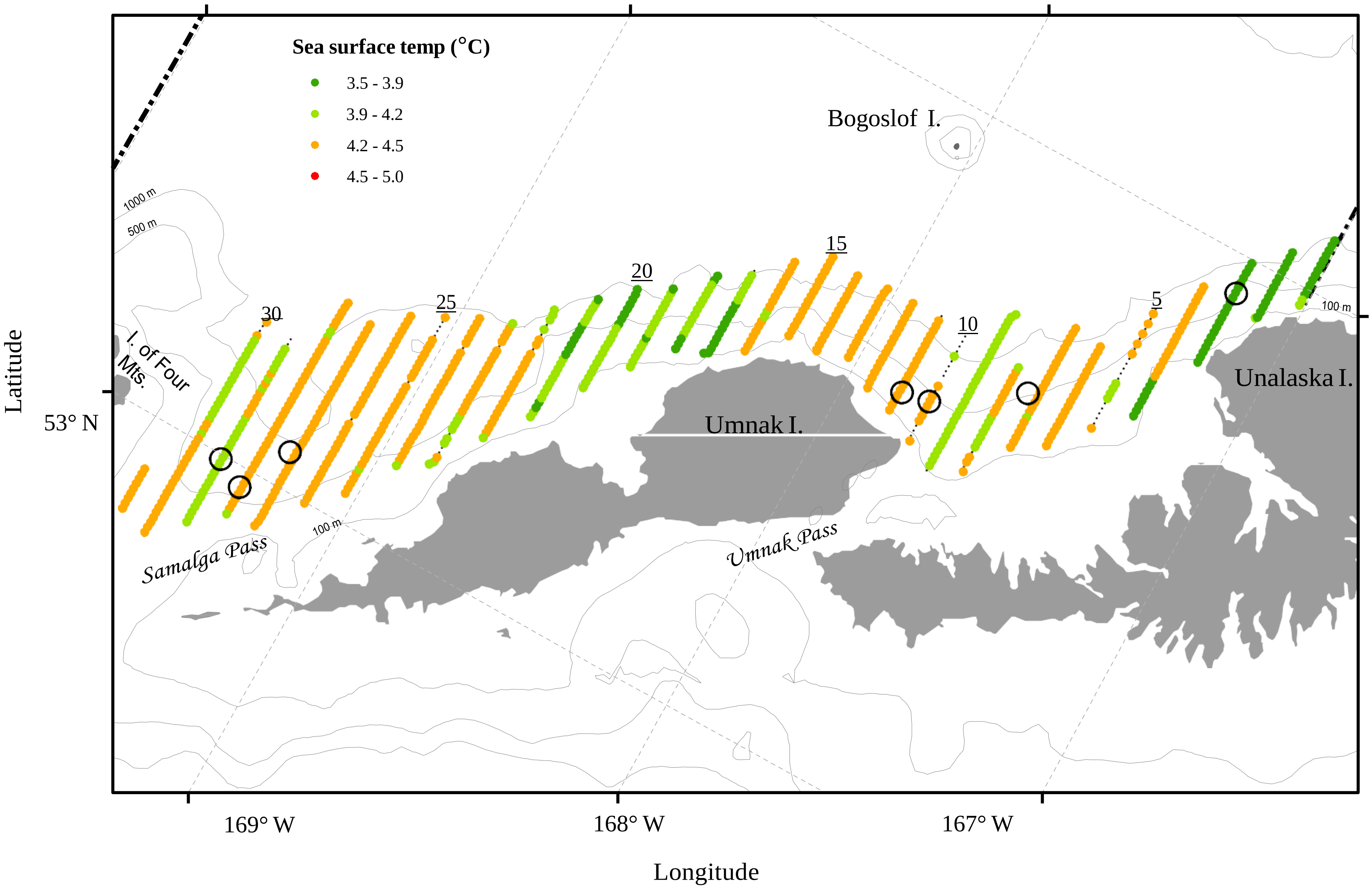


Figure 1.--Transects, haul locations, and sea-surface temperatures observed along transects during the winter 2014 acoustic-trawl survey of walleye pollock in the southeast Aleutian Basin near Bogoslof Island. Transect numbers are underlined, trawl haul locations are indicated by circles, and the Central Bering Sea Specific area is indicated by a dash-dotted line. The Umnak stratum includes transects 1-20, and the Samalga stratum includes transects 21-31.

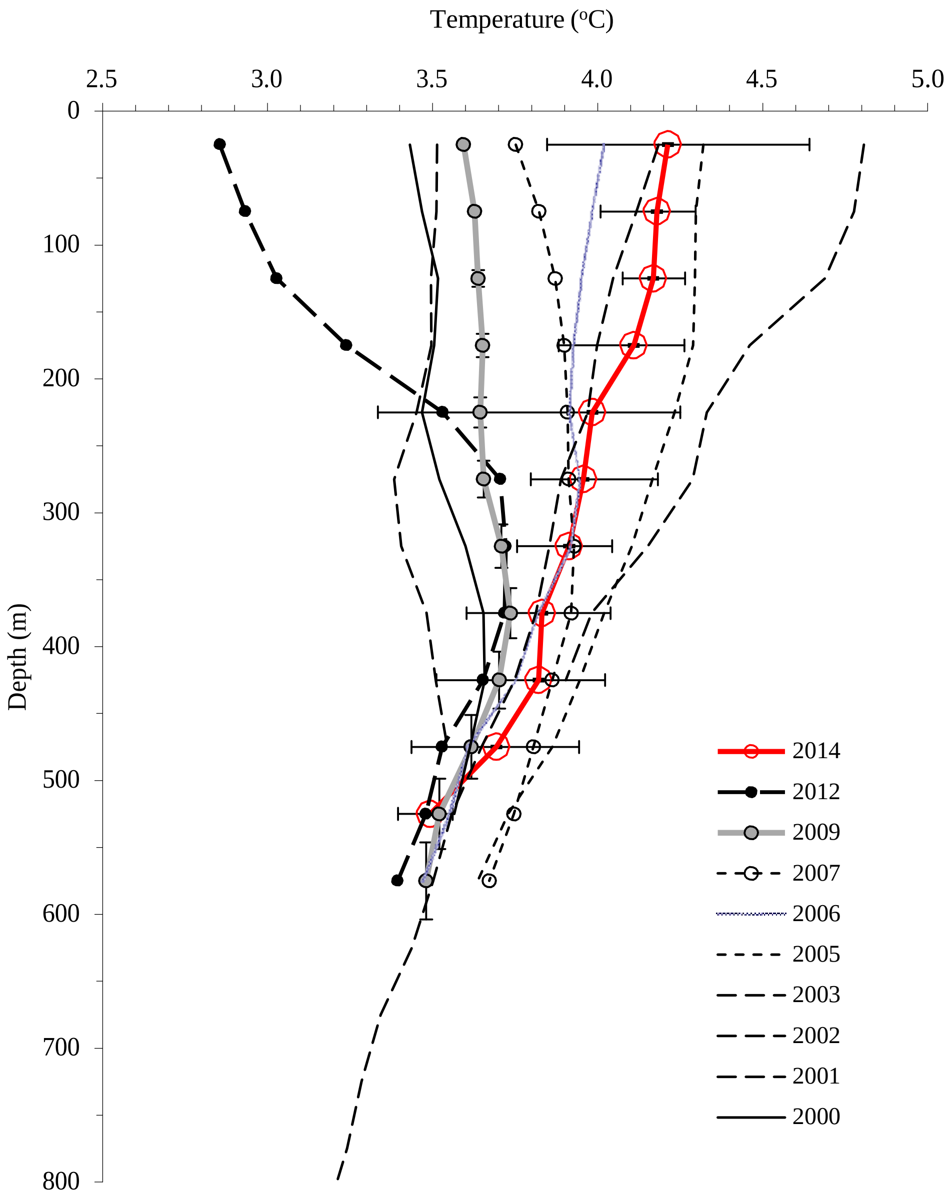


Figure 2.--Average temperature (ºC) by 50-m depth intervals observed during hauls from the winter 2000-2003, 2005-2007, 2009, 2012 and 2014 acoustic-trawl surveys of walleye pollock in the Bogoslof Island area. The horizontal bars represent temperature ranges observed during the 2014 survey. Note: Temperature data from the 2003 survey were collected from only three locations.

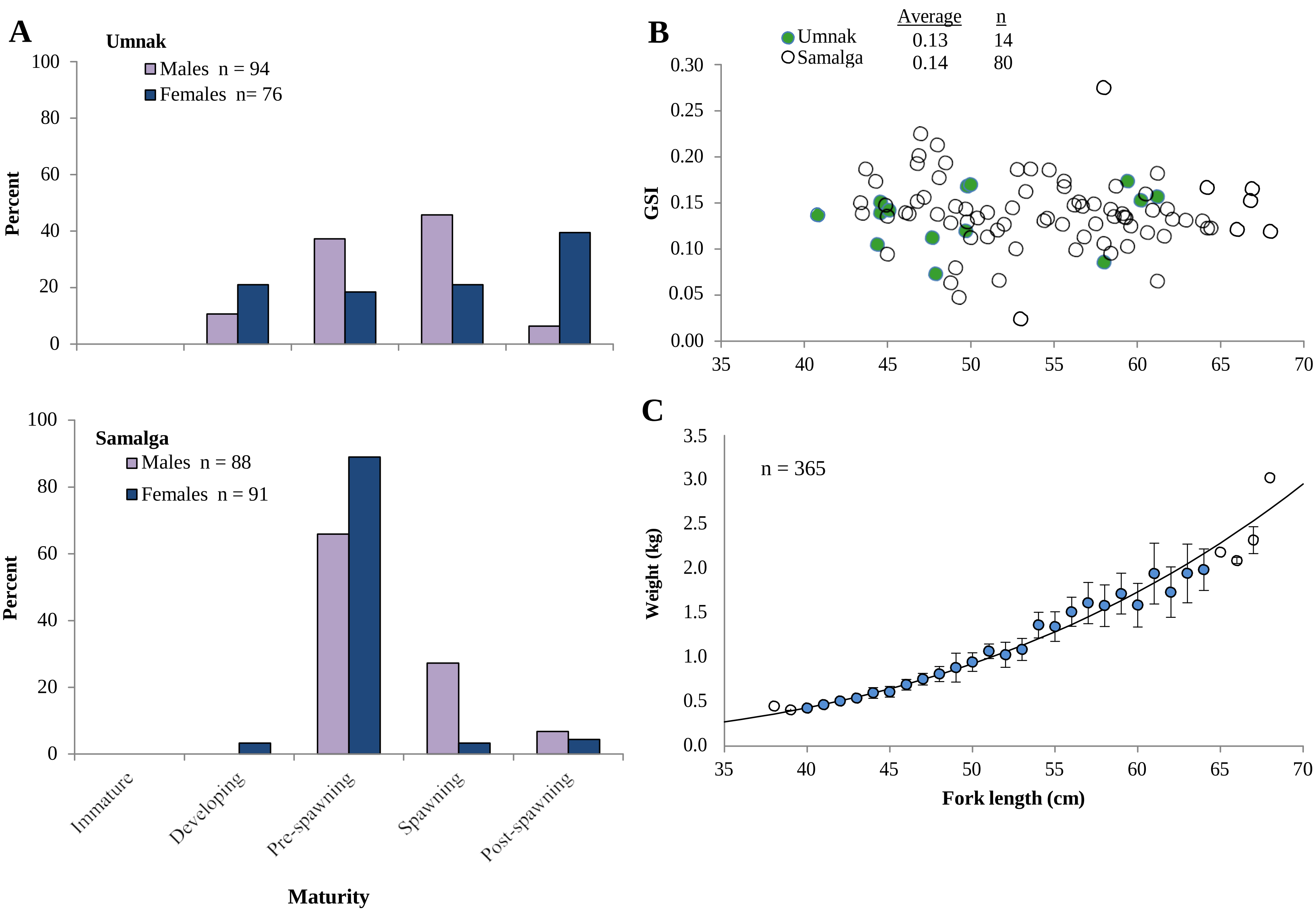


Figure 3.--Walleye pollock maturity stages for fish > 35 cm, by region and sex (A), gonado-somatic index (GSI) by region for pre-spawning females as a function of fork length (B), and observed mean weight-at-length for adult fish, with fitted regression line for combined regions and sexes (C), observed during the winter 2014 acoustic-trawl survey of the Bogoslof Island area. In panel C, hollow circles indicate fewer than five fish were measured and vertical bars indicate +/- one standard deviation.

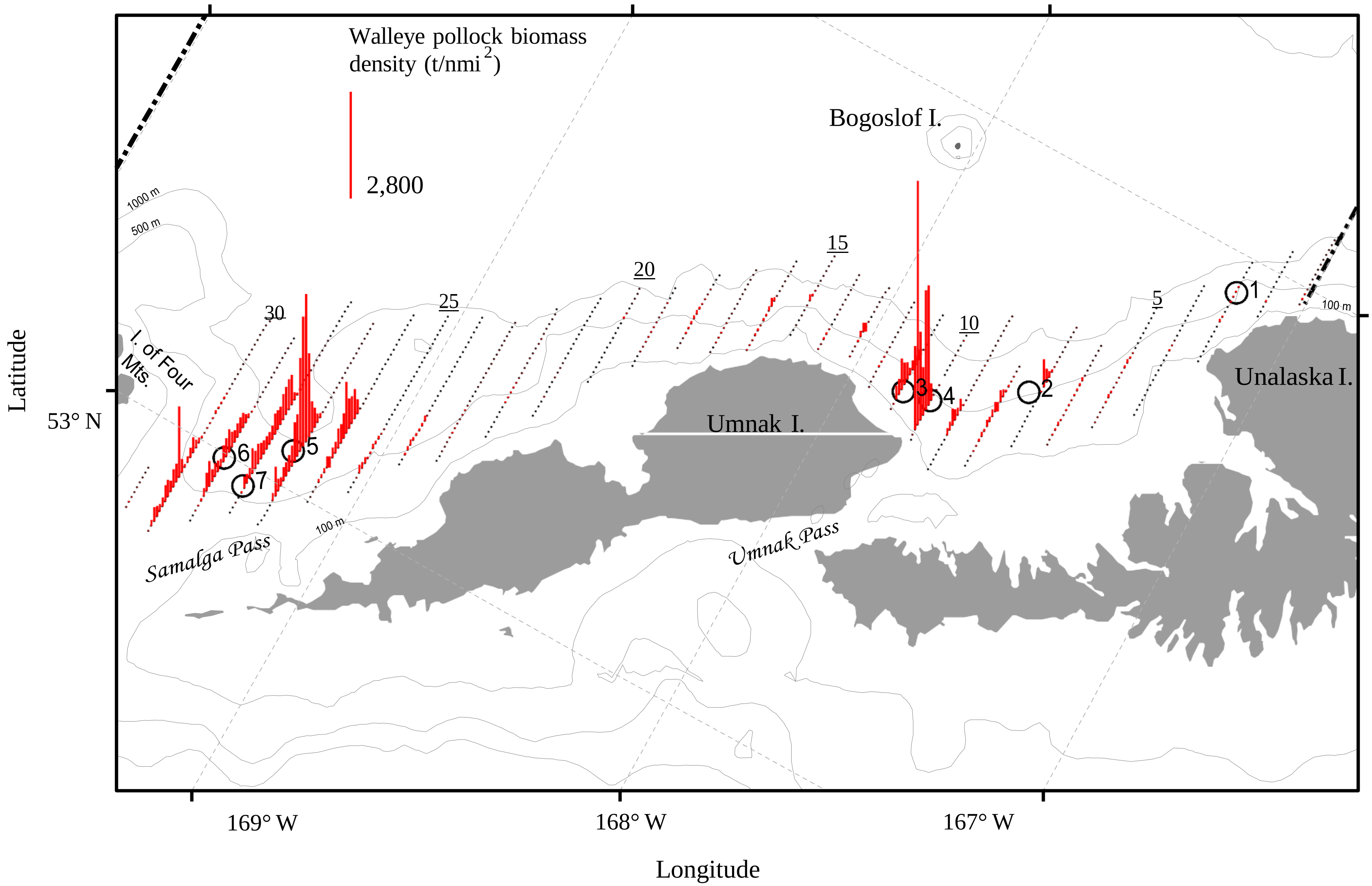


Figure 4.--Transects, haul locations, and walleye pollock biomass density (t/nmi^2) observed along transects during the winter 2014 acoustic-trawl survey of walleye pollock in the southeast Aleutian Basin near Bogoslof Island. Transect numbers are underlined, trawl haul locations are indicated by circles, and the Central Bering Sea Specific area is indicated by a dash-dotted line. The Umnak stratum includes transects 1-20, and the Samalga stratum includes transects 21-31.

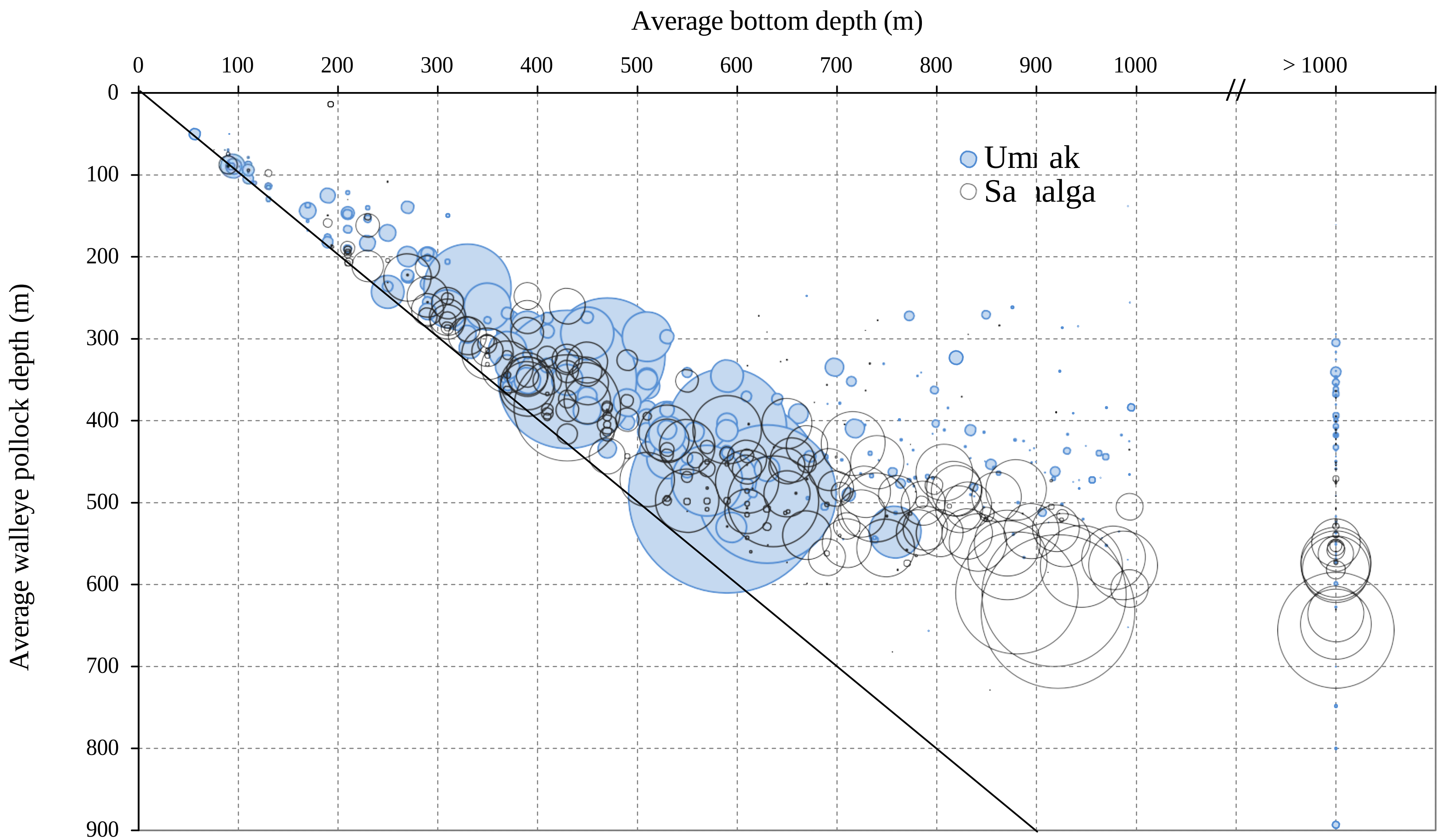


Figure 5.--Average walleye pollock depth (weighted by biomass) versus bottom depth (m), per 0.5 nmi sailed distance for the Umnak and Samalga strata during the winter 2014 acoustic-trawl survey of walleye pollock in the Bogoslof Island area. Bubble size was scaled to the maximum biomass/0.5 nmi interval (Umnak stratum 5,164 t) . The diagonal line indicates where the average pollock depth equals bottom depth. Note that bottom depth measurements were limited to 1,100 m.

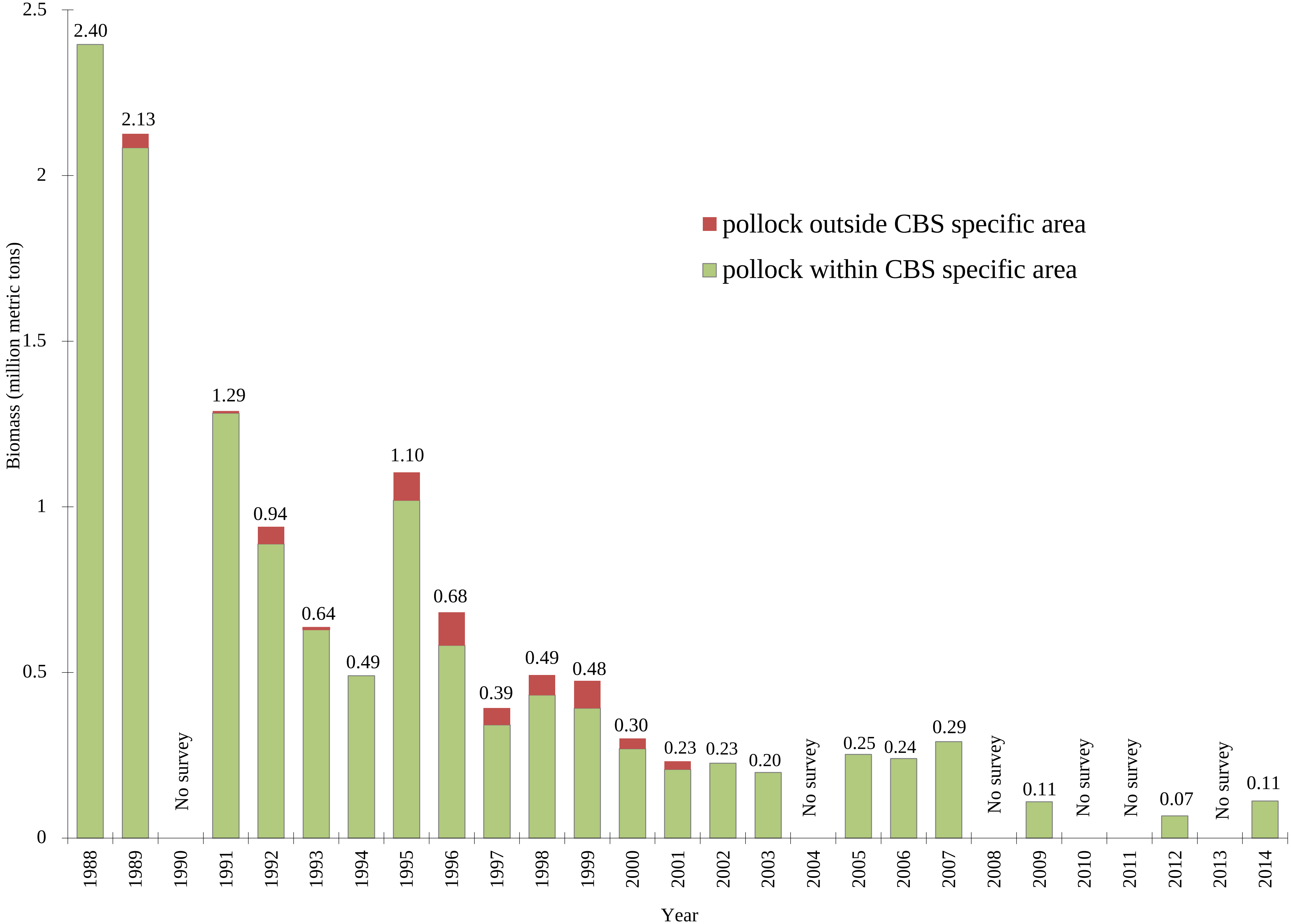


Figure 6.--Biomass estimates obtained during winter acoustic-trawl surveys for walleye pollock in the Bogoslof Island area, within and outside the Central Bering Sea (CBS) specific area, 1988-2014. The United States conducted all but the 1999 survey, which was conducted by Japan. There were no surveys in 1990, 2004, 2008, 2010-2011, or 2013. Total pollock biomass (million metric tons) for each survey year is indicated on top of each bar.

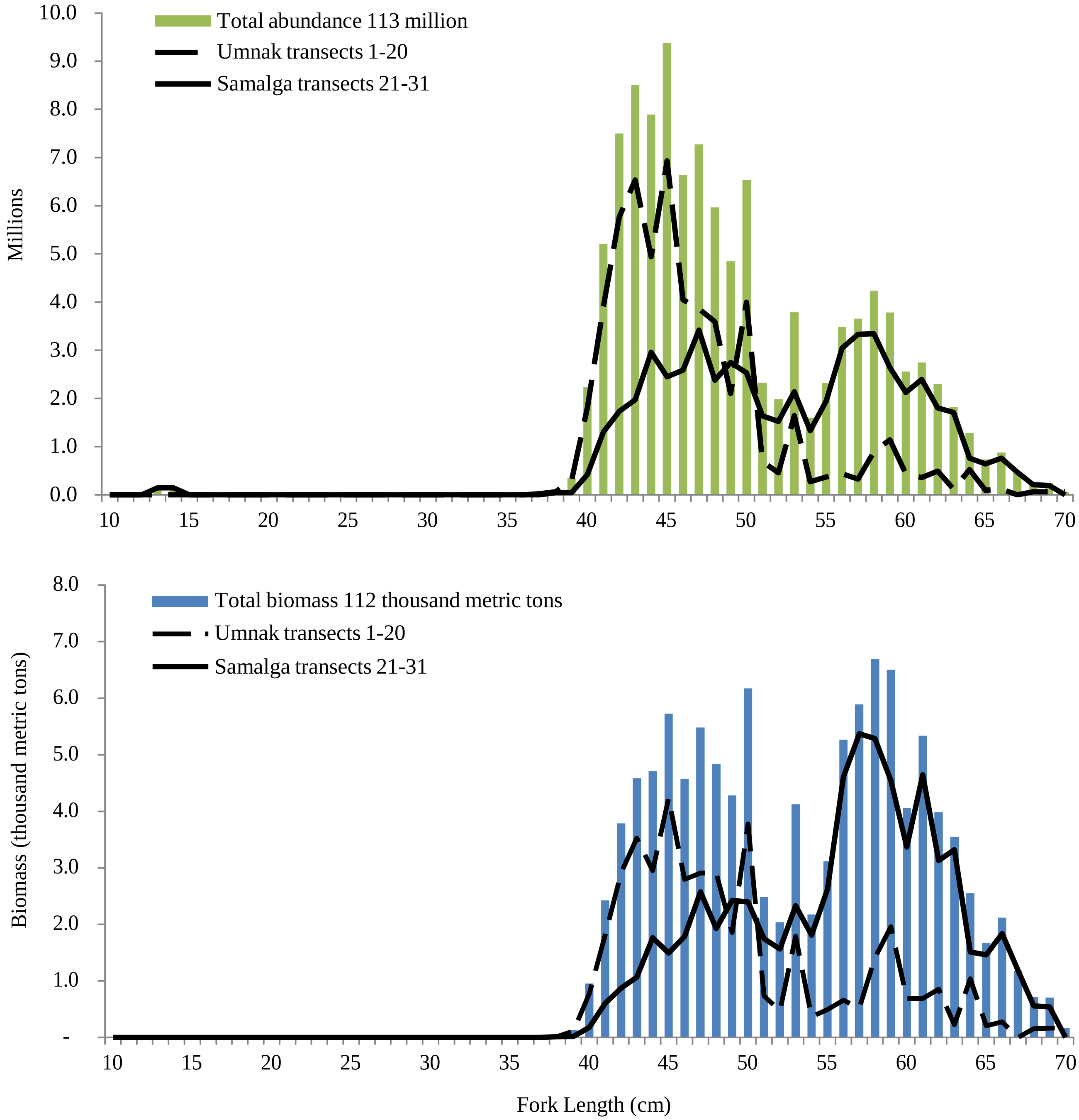


Figure 7.-- Numbers-at-length (top) and biomass at length (bottom) estimates by stratum and total from the winter 2014 acoustic-trawl primary survey of walleye pollock in the Bogoslof Island area.

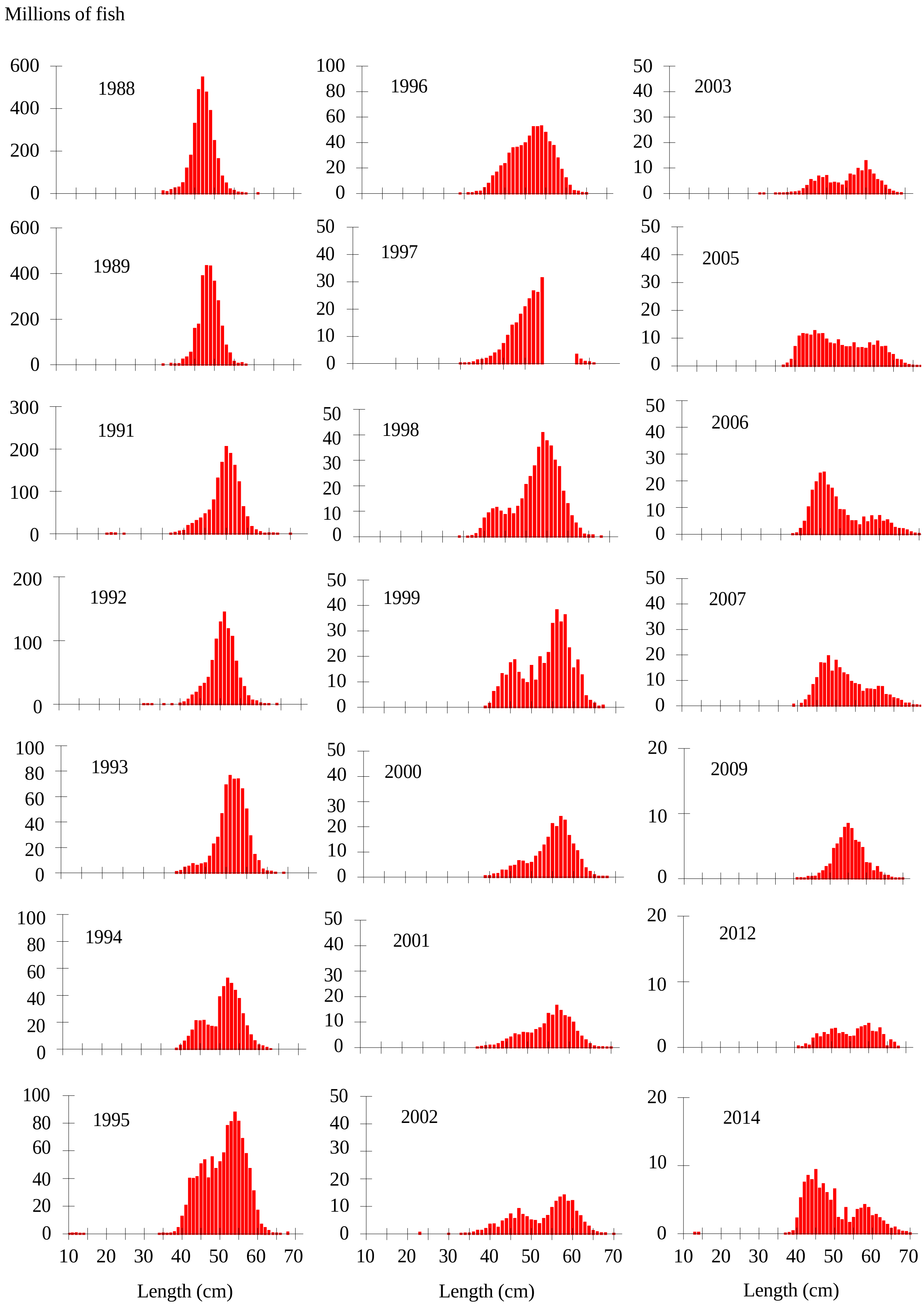


Figure 8.--Numbers-at-length estimates (millions) from winter acoustic-trawl surveys of spawning pollock near Bogoslof Island. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013. The 1999 survey was conducted by Japan. Note: Y-axis scales differ.

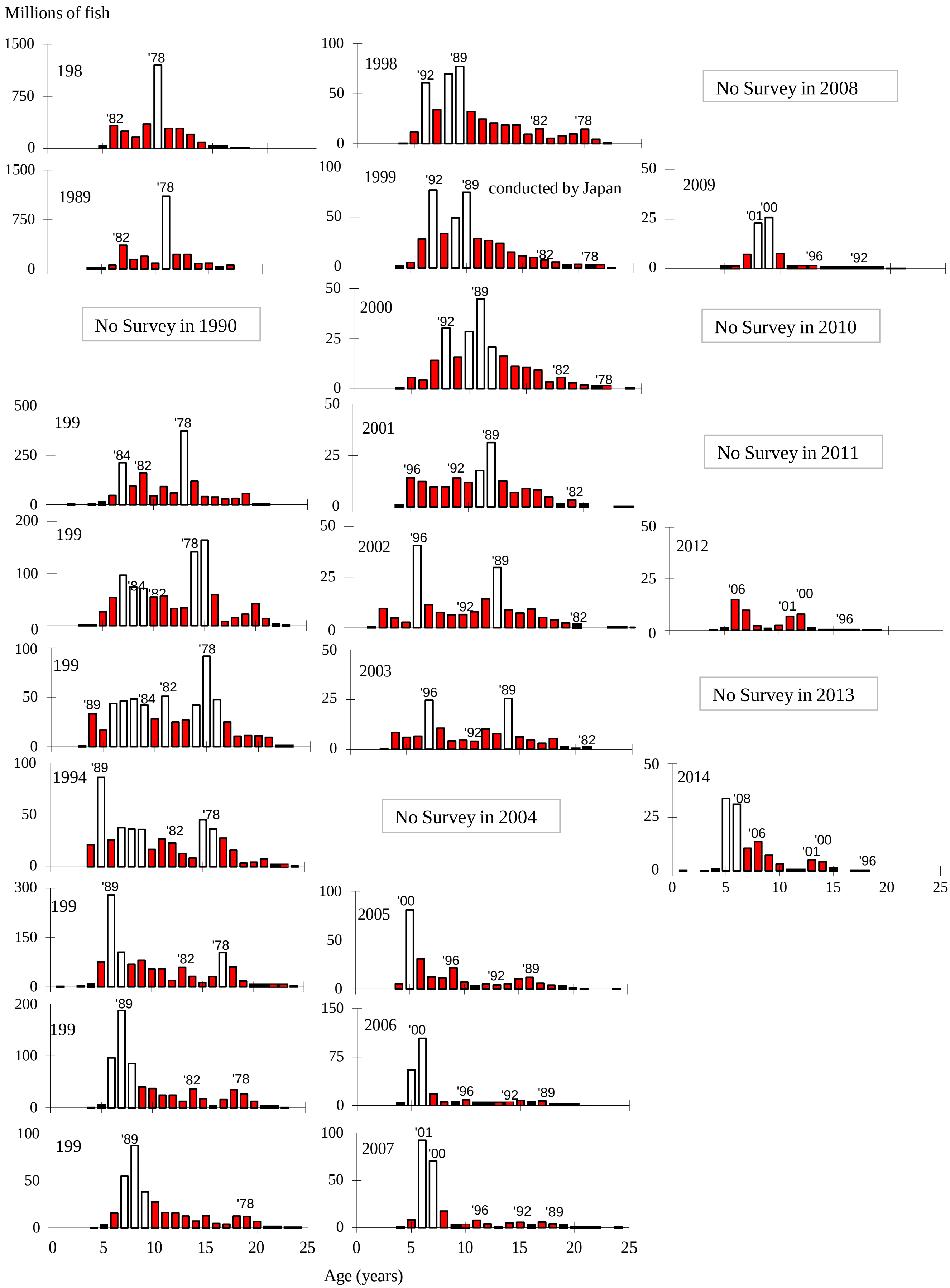


Figure 9.--Numbers-at-age estimates (millions) from acoustic-trawl surveys of pollock near Bogoslof Island. Major year classes on the Bering Sea shelf are indicated at the top. No surveys were conducted in 1990, 2004, 2008, 2010-2011, or 2013.

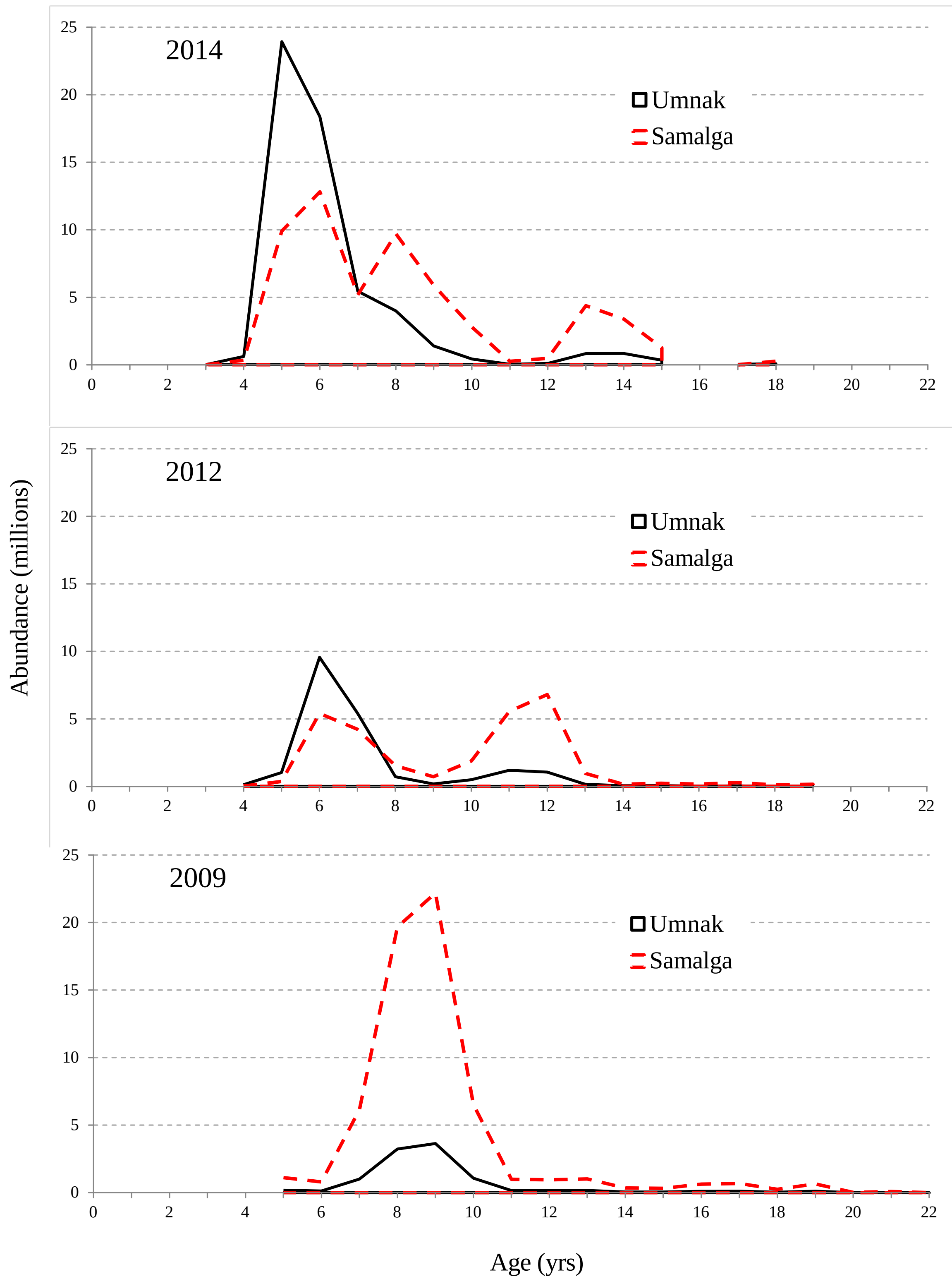


Figure 10.-- Numbers-at-age estimates (millions) by stratum for pollock observed during the Bogoslof Islnad acoustic-trawl surveys conducted in 2009, 2012, and 2014.