Information submitted to the Scientific and Technical Committee

by the United States Party

for the 8th Annual Conference of the Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea

Portland, 15-18 September 2003

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Section I

Table 1. United States Pollock Catches in metric tons, 1993-2003

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
(Through Aug 2, 2003)	887,828	1,514	24	26,787

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

Table 2. Historical catch of pollock from the Bering Sea, in metric tons, 1977-2003

Year	Western Bering Sea	Donut Hole	Navarin Region	Bogoslof	Aleutian Region	Eastern Bering Sea	Total Bering Sea
1977	265000				7625	978370	1,250,995
1978	417000				6282	979431	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	755,000	181,200	503,000		81,834	1,092,055	2,613,089
1985	662,000	363,400	488,000		58,730	1,139,676	2,711,806
1986	867,000	1,039,800	570,000		46,641	1,141,993	3,665,434
1987	812,000	1,326,300	463,000	377,436	28,720	859,416	3,866,872
1988	1,327,000	1,395,900	852,000	87,813	30,000	1,228,721	4,921,434
1989	1,029,000	1,447,600	684,000	36,073	15,531	1,229,600	4,441,804
1990	814,000	917,400	232,000	151,672	79,025	1,455,193	3,649,290
1991	504,000	293,400	178,000	264,760	78,649	1,217,301	2,536,110
1992	597,000	10,000	315,000	160	48,745	1,164,440	2,135,345
1993	677,000	1,957	389,000	885	54,074	1,198,790	2,321,706
1994	492,900	NA	288,900	556	53,224	1,197,224	2,032,804
1995	506,300	Trace	427,300	264	60,184	1,169,614	2,163,662
1996	787,000	Trace	753,000	389	26,597	1,102,579	2,669,565
1997	765,000	Trace	735,000	163	24,721	1,036,789	2,561,673
1998	744,000	Trace	719,000	8	22,053	1,058,288	2,543,349
1999	685,000	Trace	639,000	1	965	889,561	2,214,527
2000	522,000	Trace	507,000	29	1,174	1,019,067	2,049,270
2001	551,000	Trace	526,000	61	788	1,247,305	2,325,154
2002	378,000	Trace	370,000	22	1,134	1,331,416	2,080,572
2003*	265,000			24	1,514	887,828	1,154,366

* U.S. data for 2003 is through August 2, 2003; Russian data through Aug 31, 2003

Sources of Data

U.S. Data, 1979-1992 from Pollock stock assessment document at 7th Annual Conference
1993-2003 data from web site: www.fakr.noaa.gov
Navarin Data, 1994-2001 (from Russian pollock stock assessment document presented by the Russian Party at the 6th annual conference in Poland)
Navarin Data, 1984-1993 (from The Aleutian Basin Pollock Stock in 2001 written by TINRO and presented at 6th annual conference)
Western Bering Sea data from Balykin (1996)

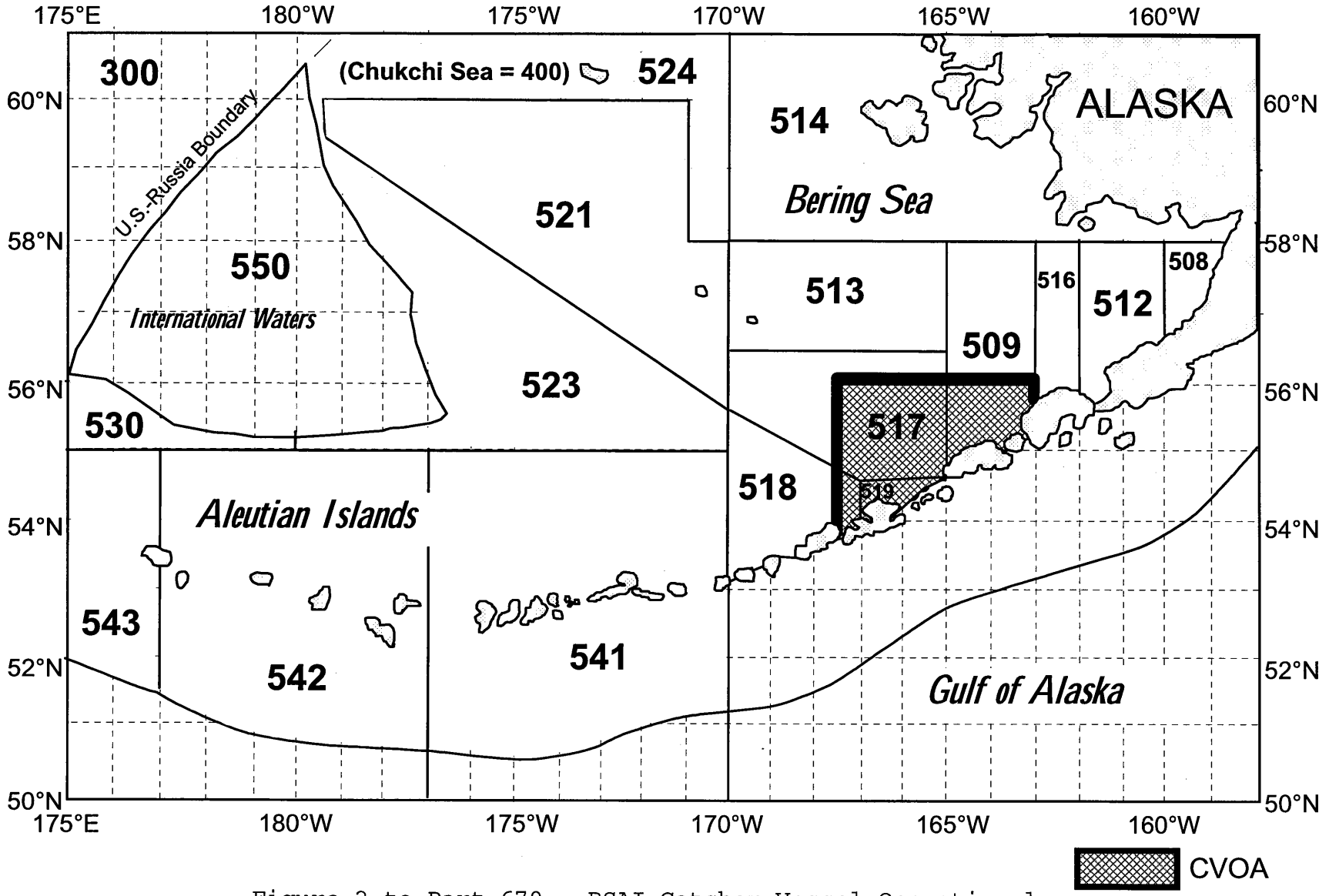

Figure 2 to Part 679. BSAI Catcher Vessel Operational Area (CVOA) (South of 56°00' N lat between 163°00' W and 167°30' W long)

NORTH PACIFIC FISHERY MANAGEMENT COUNCIL RECOMMENDATIONS

DRAFT

Bering Sea and Aleutian Islands

2002 Specifications and Recommendations for Final 2003 Specifications (mt)

Species	Area	2002 Biomass	2002 OFL	2002 ABC	2002 TAC	2002 Catch *	2003 Biomass	2003 OFL	2003 ABC	2003 TAC
Pollock	EBS	9,800,000	3,530,000	2,110,000	1,485,000	1,484,927	11,100,000	3,530,000	2,330,000	1,491,760
	AI	106,000	31,700	23,800	1,000	1,041	175,000	52,600	39,400	1,000
	Bogoslof	232,000	46,400	4,310	100	38	227,000	45,300	4,070	50
Pacific cod	BSAI	1,540,000	294,000	223,000	200,000	184,937	1,680,000	324,000	223,000	207,500
Yellowfin sole	BSAI	1,597,000	136,000	115,000	86,000	74,861	1,550,000	136,000	114,000	83,750
Greenland turbot	BSAI	208,000	36,500	8,100	8,000	2,753	112,000	17,800	5,880	4,000
	BS			5,427	5,360	2,287				2,680
	AI			2,673	2,640	466				1,320
Arrowtooth flounder	BSAI	671,000	137,000	113,000	16,000	11,443	597,000	139,000	112,000	12,000
Rock sole	BSAI	1,850,000	268,000	225,000	54,000	41,621	877,000	132,000	110,000	44,000
Flathead sole	BSAI	695,000	101,000	82,600	25,000	15,419	550,000	81,000	66,000	20,000
Alaska plaice	BSAI	1,110,000	172,000	143,000	12,000	12,291	1,080,000	165,000	137,000	10,000
Other flatfish	BSAI	78,300	21,800	18,100	3,000	2,628	107,000	21,400	16,000	3,000
Sablefish	EBS	28,000	2,900	1,930	1,930	893	31,000	4,290	2,900	2,900
	AI	39,000	3,850	2,550	2,550	994	39,000	4,590	3,100	3,100
Pacific Ocean Perch	BSAI	377,000	17,500	14,800	14,800	11,221	375,000	18,000	15,100	14,100
	Bering Sea			2,620	2,620	642			2,410	1,410
	Eastern			3,460	3,460	2,758			3,500	3,500
	Central			3,060	3,060	2,971			3,340	3,340
	Western			5,660	5,660	4,850			5,850	5,850
Northern rockfish	BSAI	150,000	9,020	6,760			156,000			
	BS				19	109		161	121	121
	AI				6,741	3,951		9,332	6,980	5,879
Shortraker/rougheye	BSAI	48,000	1,369	1,028			32,000	1,290	967	
	BS				116	99				137
	AI				912	474				830
Other rockfish	EBS	6,880	482	361	361	399	18,000	1,280	960	960
(incl. sharpchin)	AI	12,900	901	676	676	547	15,000	846	634	634
Atka mackerel	AI	439,700	82,300	49,000	49,000	43,993	358,300	99,700	63,000	60,000
	Eastern			5,500	5,500	5,002			10,650	10,650
	Central			23,800	23,800	20,947			29,360	29,360
	Western			19,700	19,700	18,044			22,990	19,990
Squid	BSAI	n/a	2,620	1,970	1,970	784	n/a	2,620	1,970	1,970
Other Species	BSAI	667,000	78,900	39,100	30,825	26,467	695,000	81,100	43,300	32,309
BS/AI TOTAL		**19,655,780**	**4,974,242**	**3,184,085**	**2,000,000**	**1,922,532**	**19,774,300**	**4,867,309**	**3,298,792**	**2,000,000**

EBS = eastern Bering Sea
BSAI = Bering Sea & Aleutians
BS = Bering Sea
AI = Aleutian Islands

OFL = overfishing level
ABC = acceptable biological catch
TAC = total allowable catch

*through 11/02/02 including CDQ harvest

Gulf of Alaska
2002 Specifications and Council's Final 2003 Specifications (mt)

SPECIES	Area	2002 Biomass	2002 OFL	2002 ABC	2002 TAC	2002 Catch*	2003 Biomass	2003 OFL	2003 ABC	2003 TAC
Pollock[1]	W (61)			17,730	17,730	17,381			16,788	16,788
	C (62)			23,045	23,045	20,380			19,685	19,685
	C (63)			9,850	9,850	10,809			10,339	10,339
	WYAK	726,600	75,480	1,165	1,165	1,818	670,410	69,410	1,078	1,078
	EYAK/SE	28,710	8,610	6,460	6,460	2	28,710	8,610	6,460	6,460
	TOTAL	755,310	84,090	58,250	58,250	50,390	699,120	78,020	54,350	54,350
Pacific Cod	W			22,465	16,849	15,327			20,600	15,450
	C			31,680	24,790	25,094			29,000	22,690
	E			3,455	2,591	103			3,200	2,400
	TOTAL	428,000	72,100	57,600	44,230	40,524	452,000	70,100	52,800	40,540
Deep water flatfish[2]	W			180	180	19			180	180
	C			2,220	2,220	530			2,220	2,220
	WYAK			1,330	1,330	2			1,330	1,330
	EYAK/SEO			1,150	1,150	7			1,150	1,150
	TOTAL	68,263	6,430	4,880	4,880	558	68,260	6,430	4,880	4,880
Rex sole	W			1,280	1,280	398			1,280	1,280
	C			5,540	5,540	2,611			5,540	5,540
	WYAK			1,600	1,600	0			1,600	1,600
	EYAK/SEO			1,050	1,050	0			1,050	1,050
	TOTAL	71,326	12,320	9,470	9,470	3,009	71,330	12,320	9,470	9,470
Shallow water flatfish[3]	W			23,550	4,500	241			23,480	4,500
	C			23,080	13,000	6,599			21,740	13,000
	WYAK			1,180	1,180	2			1,160	1,160
	EYAK/SEO			1,740	1,740	0			2,960	2,960
	TOTAL	349,992	61,810	49,550	20,420	6,842	349,990	61,810	49,340	21,620
Flathead sole	W			9,000	2,000	419			16,420	2,000
	C			11,410	5,000	1,689			20,820	5,000
	WYAK			1,590	1,590	0			2,900	2,900
	EYAK/SEO			690	690	0			1,250	1,250
	TOTAL	170,915	29,530	22,690	9,280	2,108	132,260	51,560	41,390	11,150
Arrowtooth flounder	W			16,960	8,000	6,100			17,990	8,000
	C			106,580	25,000	14,674			113,050	25,000
	WYAK			17,150	2,500	56			18,190	2,500
	EYAK/SEO			5,570	2,500	111			5,910	2,500
	TOTAL	1,760,000	171,060	146,260	38,000	20,941	1,302,000	181,390	155,140	38,000
Sablefish	W			2,240	2,240	1,780			2,570	2,570
	C			5,430	5,430	6,120			6,440	6,440
	WYAK			1,940	1,940	1,548			2,320	2,320
	SEO			3,210	3,210	2,798			3,560	3,560
	TOTAL	188,000	19,350	12,820	12,820	12,246	182,000	20,020	14,890	14,890
Other Slope rockfish	W			90	90	222			90	90
	C			550	550	481			550	550
	WYAK			260	150	37			270	150
	EYAK/SEO			4,140	200	31			4,140	200
	TOTAL	107,960	6,610	5,040	990	771	107,960	6,610	5,050	990

SPECIES	Area	2002 Biomass	2002 OFL	2002 ABC	2002 TAC	2002 Catch	2003 Biomass	2003 OFL	2003 ABC	2003 TAC
Northern rockfish	W			810	810	337			890	890
	C			4,170	4,170	2,998			4,640	4,640
	E			0 [4]	0 [4]	NA			0 [4]	0 [4]
	TOTAL	94,350	5,910	4,980	4,980	3,335	108,830	6,560	5,530	5,530
Pacific ocean perch	W		3,110	2,610	2,610	2,723		3,220	2,700	2,700
	C		9,760	8,220	8,220	8,263		10,120	8,510	8,510
	WYAK			780	780	748			810	810
	SEO		2,800	1,580	1,580	1		2,900	1,640	1,640
	TOTAL	293,240	15,670	13,190	13,190	11,735	298,820	16,240	13,660	13,660
Shortraker/rougheye	W			220	220	260			220	220
	C			840	840	628			840	840
	E			560	560	403			560	560
	TOTAL	70,890	2,340	1,620	1,620	1,291	66,830	2,340	1,620	1,620
Pelagic shelf rockfish	W			510	510	183			510	510
	C			3,480	3,480	2,680			3,480	3,480
	WYAK			640	640	448			640	640
	EYAK/SEO			860	860	7			860	860
	TOTAL	62,489	8,220	5,490	5,490	3,318	62,500	8,220	5,490	5,490
Demersal Shelf Rockfish		15,615	480	350	350	182	17,510	540	390	390
Atka Mackerel	GW	unknown	6,200	600	600	84	unknown	6,200	600	600
Thornyhead rockfish	W			360	360	368			360	360
	C			840	840	504			840	840
	E			790	790	253			800	800
	TOTAL	77,840	2,330	1,990	1,990	1,125	85,760	3,050	2,000	2,000
Other Species	GW		NA	NA	11,330	3,748	NA	NA	NA	11,260
GOA TOTAL		4,514,190	504,450	394,780	237,890	162,207	4,005,170	531,410	416,600	236,440

* Catch through 11/02/02

1/ The pollock ABC has been reduced by 1,700 mt to accommodate the expected Prince William Sound State harvest.

2/ Deep water flatfish includes dover sole, Greenland turbot and deepsea sole.

3/ "Shallow water flatfish" includes rock sole, yellowfin sole, butter sole, starry flounder, English sole, Alaska plaice, and sand sole.

4/ The EGOA ABC for northern rockfish has been included in the WYAK ABC for other slope rockfish.

NOTE:

W = Western Gulf C = Central Gulf E = Eastern Gulf WYAK = West Yakutat EYAK/SEO = East Yakutat/Southeast

GW means Gulfwide.

TABLE 3.–2003 ALLOCATIONS OF THE POLLOCK TAC AND DIRECTED FISHING ALLOWANCE (DFA) TO THE INSHORE, CATCHER/PROCESSOR, MOTHERSHIP, AND CDQ COMPONENTS[1]
[Amounts are in mt]

Area and Sector	2003 Allocations	A Season[1]		B Season[1]
		A season DFA (40% of Annual DFA)	SCA harvest limit[2]	B season DFA (60% of Annual DFA)
Bering Sea subarea	1,491,760	----------	----------	----------
CDQ	149,176	59,670	41,769	89,506
ICA[3]	46,990	----------	----------	----------
AFA Inshore	647,797	259,119	181,383	388,678
AFA Catcher/Processors[4]	518,237	207,295	145,106	310,942
Catch by C/Ps[4]	474,187	189,675	----------	284,512
Catch by CVs[4]	44,050	17,620	----------	26,430
Restricted C/P cap[5]	2,591	1,036	----------	1,555
AFA Motherships	129,559	51,824	36,277	77,736
Excessive harvesting share[6]	226,729	----------	----------	----------
Aleutian Islands ICA[7]	1,000			
Bogoslof District ICA[7]	50			

[1] After subtraction for the CDQ reserve (10 percent) and the ICA (3.5 percent), the pollock TAC is allocated as a DFA: inshore component - 50 percent, catcher/processor component - 40 percent, and mothership component - 10 percent. Under § 679.20(a)(5)(i)(A), the CDQ reserve for pollock is 10 percent. The A season, January 20 - June 10, is allocated 40 percent of the DFA and the B season, June 10 - November 1, is allocated 60 percent of the DFA.

[2] No more than 28 percent of each sector's annual DFA may be taken from the SCA before April 1. The remaining 12 percent of the annual DFA allocated to the A season may be taken outside of SCA before April 1 or inside the SCA after April 1. If 28 percent of the annual DFA is not taken inside the SCA before April 1, the remainder is available to be taken inside the SCA after April 1.

[3] The pollock ICA for the BS subarea is 3.5 percent of the TAC after subtraction of the CDQ reserve.

[4] Under § 679.20(a)(5)(i)(A)(4)(i) and (ii), NMFS will allocate 91.5 percent of the catcher/processor sector allocation to AFA catcher/processors engaged in directed fishing for pollock and 8.5 percent of the catcher/processor sector allocation to AFA catcher vessels delivering to catcher/processors unless changed by the cooperative contracts.

[5] Under § 679.20(a)(5)(i)(A)(4)(iii), unlisted AFA catcher/processors are limited to harvesting not more than 0.5 percent of the catcher/processor sector allocation of pollock.

[6] Under § 679.20(a)(5)(i)(A)(6), NMFS establishes an excessive harvesting share limit equal to 17.5 percent of the sum of the directed fishing allowances established under paragraphs (a)(5)(i) and (a)(5)(ii) of this section.

[7] The Aleutian Islands subarea and the Bogoslof District are closed to directed fishing for pollock. The amounts specified are for incidental catch amounts only, and are not apportioned by season or sector.

Section II

Alaska
Fisheries Science
Center

National Marine
Fisheries Service

U.S DEPARTMENT OF COMMERCE

AFSC PROCESSED REPORT 2003-09

Results of the March 2003 Echo Integration-trawl Survey of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise MF2003-04

August 2003

II-1

Results of the March 2003 Echo Integration-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise MF2003-04

by Denise McKelvey and Neal Williamson

August 2003

INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering Program of the Alaska Fisheries Science Center (AFSC) have conducted echo integration-trawl (EIT) surveys in the southeastern Aleutian Basin near Bogoslof Island to estimate midwater pollock (*Theragra chalcogramma*) distribution and abundance annually since 1988, with the exception of 1990. The biomass estimate for pollock within the Central Bering Sea (CBS) Convention Specific Area[1] obtained during these surveys provide an index of abundance for the Aleutian Basin pollock stock (Honkalehto and Williamson, 1995). The results presented here are from the echo integration-trawl (EIT) survey carried out 8-14 March 2003 aboard the NOAA ship *Miller Freeman*, Cruise MF2003-04.

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[1] The "specific area" is defined in the Annex to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea as "the area south of a straight line between a point at 55° 46' N lat. and 170° W long. and a point at 54° 30' N lat., 167° W long. and between the meridian 167° W long. and the meridian 170° W long. and the north of the Aleutian Islands and straight lines between the islands connecting the following coordinates in the order listed: 52° 49.2 N 169° 40.4 W, 52° 49.8 N 169° 06.3 W, 53° 23.8 N 167° 50.1 W, 53° 18.7 N 167° 51.4 W."

METHODS

Itinerary

7 Mar	Embark scientists in Dutch Harbor, AK.
8 Mar	Calibration of acoustic system in Captains Bay, AK.
9-13 Mar	EIT survey of the southeastern Aleutian Basin, near Bogoslof Island.
13-14 Mar	Survey operations suspended due to bad weather.
14-15 Mar	Transit to Shelikof Strait, AK.

Acoustic Equipment

Acoustic data were collected with Simrad EK500[2] and Simrad EK60 quantitative echo-sounding systems (Simrad, 2001; Bodholt et al. 1989, Bodholt and Solli 1992) on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research. Three split-beam transducers (38 kHz, 120 kHz, and 200 kHz) were mounted on the bottom of the vessel's retractable centerboard extending 9 m below the water surface. System electronics were housed inside the vessel in a permanent laboratory space dedicated to acoustics. Simrad EK 500 data (38 and 120 kHz) and Simrad EK60 data (200 kHz) were logged with SonarData EchoLog 500. The 38 kHz data were analyzed using SonarData Echoview (V 2.25.109) PC-based post-processing software. Echo integration and target-strength (TS) data were collected simultaneously at all frequencies. Results presented here are based on the 38 kHz data.

Trawl Gear

Midwater and near-bottom echosign was sampled using an Aleutian Wing 30/26 Trawl (AWT). 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. The net was fitted with a

[2] Reference to trade names or commercial firms does not constitute U.S. Government endorsement.

32-mm (1.25-in) codend liner. The AWT was fished with 82.3 m (270 ft) of 1.9-cm (0.75-in) diameter (8 ×19 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]. Vertical net opening and depth were monitored with a WESMAR third wire netsounder system attached to the trawl headrope; the net opening ranged from 24 to 37 m, and averaged 30 m, while fishing.

Oceanographic Equipment

Physical oceanographic data collected during the cruise included temperature/depth profiles obtained with a Sea-Bird Electronics temperature-depth probe (SBE-39) attached to the trawl headrope and conductivity-temperature-depth (CTD) observations collected with a Sea-Bird CTD system at calibration sites. Sea surface temperature, salinity, and other environmental data were collected using the *Miller Freeman's* Scientific Computing System (SCS). Ocean current profile data were obtained using the vessel's centerboard-mounted acoustic Doppler current profiler system operating continuously in water-profiling mode.

Survey Design

The Bogoslof Island area echo integration-trawl survey began 9 March 2003 north of Unalaska Island at about 167°W longitude, and proceeded west towards the Islands of Four Mountains near 170°W, concluding on 13 March. The 22 north-south parallel transects were spaced 5 nautical miles (nmi) apart and covered a 2,993 nmi^2 area (Fig. 1), within the CBS Specific Area. Average transecting speed was about 11 knots. Echo integration data were collected 24 hours a day between 14 m from the surface (5 m below the centerboard-mounted transducer) and 0.5 m off the bottom, unless the bottom exceeded 1,000 m, the lower limit of data collection. Acoustic system settings used during the collection were based on results from acoustic system calibrations and on experience from prior surveys (Table 1A). Trawl hauls were conducted to identify echosign, and to provide biological samples for the primary goals of the survey and for additional research projects (e.g., fecundity studies, parasite studies). Average trawling speed was approximately 3 knots. Pollock were sampled to determine sex, fork length (FL), body weight, age, maturity, and ovary weight of selected females. Fork lengths were measured to the nearest centimeter (i.e., a fish measuring between 49.5 cm and 50.5 cm was recorded as

50 cm). An electronic motion-compensating scale was used to weigh individual pollock specimens. For age determinations, pollock otoliths were collected and stored in 50% ethanol-water solution. Maturity was determined by visual inspection and categorized as immature, developing, pre-spawning, spawning, or post-spawning. All data were recorded electronically using the Fisheries Scientific Computing System (FSCS) and stored in a relational database. Samples of pollock tissue, ovaries, and gametes were collected for ongoing research by AFSC scientists. Whole fish were retained for training fisheries observers.

Standard sphere acoustic system calibrations were made prior to the Bogoslof Island area survey to measure acoustic system performance for the EK500 at 38 and 120 kHz, and for the EK60 at 200 kHz. During calibrations, the *Miller Freeman* was anchored at bow and stern. Weather, sea state conditions, and acoustic system settings were recorded. Three calibration spheres were suspended below the centerboard-mounted transducers. Two were copper calibration spheres of 23 mm (120-kHz sphere, TS = -40.3 dB) and 60 mm (38-kHz sphere, TS = -33.6 dB) diameter, and the third was a tungsten carbide sphere of 38.1 mm (200-kHz sphere, TS = -39.5 dB) diameter. After each sphere was centered on the acoustic axis, split-beam target-strength and echo integration data were collected to determine acoustic system gain parameters. The average on-axis target strength and on-axis integration values were measured and recorded. Transducer beam characteristics were measured using a Simrad software program (EKLOBES). Each sphere was pulled through its corresponding transducer beam, target-strength data were collected on a grid of angle coordinates, and beam pattern was estimated (Foote et al. 1987).

Data Analysis

The abundance of pollock was estimated by combining echo integration and trawl data. Echosign identified as pollock was stored in a database. Pollock length data from 5 hauls were aggregated into three analytical strata based on echosign type, geographic proximity of hauls, and similarity in size composition data. Average pollock volume backscattering strength along each 0.5 nmi of transect was multiplied by transect width to estimate area backscattering strength for transect segments. Area backscattering segments were summed to compute total pollock area backscattering for each analytical

stratum. Stratum totals were then summed and scaled using a previously derived relationship between target strength and fish length (TS = 20 Log FL - 66; Traynor 1996) and the length composition data, resulting in an estimate of numbers of pollock by size. A length-weight relationship observed from trawl data was applied to estimate pollock biomass for each length category. Age data for winter 2003 were not available when this analysis was completed.

In the Bogoslof Island area, pre-spawning pollock aggregations are often densely packed and vertically and/or horizontally stratified by sex. Therefore it is not always possible to obtain an unbiased sample of lengths from these aggregations to estimate population size composition. At ages older than about 5 years, female pollock are longer than male pollock. Thus, biased estimates of sex composition from trawl hauls can result in biased estimates of population size and age composition. As in previous Bogoslof surveys, we assumed that the sex ratio that we sampled was 50:50 and estimated abundance under this assumption.

Relative estimation errors for the acoustic data were derived using a one-dimensional (1D) geostatistical method as described by Petitgas (1993), Williamson and Traynor (1996), and Rivoirard et al. (2000). Relative estimation error is defined as the ratio of the square root of the estimation variance to the estimate of acoustic abundance. Geostatistical methods are 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) are not included.

RESULTS

Calibration

Acoustic system calibrations were conducted before, between, and after the winter EIT surveys in the Bering Sea and Gulf of Alaska (Table 1B). The EK500 38-kHz and 120 kHz collection systems showed no significant differences in gain parameters or transducer beam pattern characteristics before and after the Bogoslof Island area survey.

Oceanographic Conditions

Temperature profiles from the basin region at three sites (Table 2) indicated well-mixed water columns with little variation in temperature between the surface and deeper waters. Temperatures in the upper 500 m of the water column ranged from 3.6° to 5.1°C and averaged 4.4°C.

Biological Sampling

Biological data and specimens were collected from 5 trawl hauls (Tables 2 and 3; Fig. 1). Poor weather conditions precluded additional trawl sampling. Walleye pollock dominated the trawl catches by weight (97.9%; Table 4). Lanternfish (Myctophidae) and Pacific ocean perch (*Sebastes alutus*) each contributed about 1% of the total catch by weight.

Length measurements were collected from about 1,800 pollock specimens (Table 3, Fig 2) for scaling the acoustic data and computing size-specific population estimates. Pollock sampled in trawl hauls ranged from 33 to 69 cm FL. Length compositions varied over the region surveyed and were grouped into three strata (Fig. 3). Pollock lengths from hauls 1 and 2 were unimodal with the mode at 48-49 cm FL; they were combined to represent the Umnak Pass region, stratum 1. Pollock lengths from haul 3 were more evenly dispersed between 44 and 67 cm FL and were considered to represent the Umnak Island region, stratum 2. Length compositions from hauls 4 and 5 were bimodal with modes at about 48-50 and 59-60 cm. These hauls were combined to represent the Samalga Pass region, stratum 3. Trawl catch sex ratios ranged from 12% to 92% male.

Maturity stage data, length-weight data, and otoliths were collected from 346 pollock specimens. The unweighted maturity composition showed that 81% percent of the female and 25% of the male pollock were in pre-spawning condition (Fig. 4a). Seven percent of the females and about 63% of the males were actively spawning. The average gonado-somatic index (GSI: ovary weight/body weight) for pre-spawning mature female pollock was 0.17 (Fig. 4b), which was similar to the average GSI observed during recent years . This suggests that the survey's timing was similar to previous years in relation to peak spawning. The regression equation of total body weight to length for sexes combined was $W = 0.003 \times FL^{3.2238}$, where FL is fork length (cm) and W is weight (g) (Fig. 4c).

Pollock Distribution and Abundance

The spatial distribution of pollock in the survey area was similar to that observed in recent years. Pollock were primarily concentrated just north of Samalga Pass about 300-400 m below the surface, with lesser concentrations along the shelf break at the northeast end of Umnak Island (Fig. 1).

The abundance estimate for pollock in the Bogoslof area between 14 m below the surface and 1,000 m was estimated at 0.134 billion fish weighing 0.198 million metric tons (Table 5, Fig. 5). The size composition was bimodal; 38% of the pollock by numbers (25% of the biomass) were 54 cm or smaller in length, and of those, the average fork length was 48.9 cm. The remaining 62% of the estimated pollock numbers (75% of the biomass) were larger than 54 cm, and of those, the average fork length was 59.9 cm. Based on the 1D analysis, the relative estimation error of the Bogoslof pollock biomass estimate is 21.5%. The abundance estimates and relative estimation error for pollock inside the CBS Specific Area are the same as for the total area (Table 5).

DISCUSSION

In 2003, as in recent years, pollock were highly concentrated in Samalga Pass (84% of biomass in 2003, 74% in 2002, 76% in 2001), and were otherwise sparsely distributed within the Bogoslof area. Poor weather conditions towards the end of the survey limited trawl sampling to only two hauls in the Samalga Pass region. Length composition data are used to scale acoustic data to total abundance and then, combined with age data, to partition total abundance into year class. If the size composition in the Samalga Pass area was biased due to inadequate sampling, the effect on total abundance would be relatively small because the target strength-to-length relationship changes little over the observed size range of approximately 45-65 cm. However, resultant biases in estimates of size-at-age compositions might be of concern. The bimodal length composition of 48-50 and 59-60 cm observed this year, was consistent with the bimodal length composition observed in this region during the 2002 survey (i.e., 45-47 cm, 56-60 cm) (Fig. 6).

There has been little change in population biomass since 2000 (Table 5, Fig. 7) and little recruitment to the spawning population since the 1992 year class first appeared as 6-year olds in 1998 (Fig. 8). Even though age data from the 2002 and 2003 surveys are not yet available, a comparison of the abundance of small fish (e.g., smaller than 50 cm FL) estimated from this year's survey results with the abundance of small fish estimated from previous survey results suggests that the incoming 1996 year class is not strong (Table 6).

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CITATIONS

Bodholt, H., H. Nes, and H. Solli. 1989. A new echo sounder system. Proc. Instit. of Acoust. 11(3):123-130.

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.

Honkalehto, T. and N. Williamson. 1995. Echo integration-trawl survey of walleye pollock (*Theragra chalcogramma*) in the southeast Aleutian Basin during February and March, 1994. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-52, 39 p.

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 Cooperative Research Reports, Int. Counc. Explor. Sea Coop. Res. Rep. No.144, 69 p.

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

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.

Simrad. 2001. Simrad EK60 Scientific echo sounder instruction manual - base version. Simrad AS, Strandpromenenaden 50, Box 111, N-3191 Horten, Norway.

Traynor, J. J. 1996. Target strength measurements of walleye pollock (*Theragra chalcogramma*) and Pacific whiting (*Merluccius productus*). ICES J. Mar. Sci. 53: 253-258.

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.

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Table 1. Acoustic system description and settings during the winter 2003 echo integration-trawl survey of walleye pollock in the Bogoslof Island area (A) and results from standard sphere acoustic system calibrations conducted before, during, and after the survey (B).

	(A)		(B)					
	8-14 Mar System Setting		6-Feb, Alitak Bay, AK		8-Mar, Captains Bay, AK		30-Mar, Sea Otter Bay, AK	
Echosounder:	Simrad EK 500		Simrad EK 500		Simrad EK 500		Simrad EK 500	
Transducer:	ES38B	ES120-7C	ES38B	ES120-7C	ES38B	ES120-7C	ES38B	ES120-7C
Frequency (kHz):	38	120	38	120	38	120	38	120
Transducer depth (m):	9.15	9.15						
Absorption coefficient (dB/km):	10	29						
Pulse length (ms):	1.0 (medium)	0.3 (medium)						
Band width (kHz):	3.8 (Wide)	1.2 (narrow)						
Transmitted power (W):	2000	1000						
Angle sensitivity:	21.9	21.9						
2-Way beam angle (dB):	-20.7	-20.7						
TS transducer gain (dB):	25.9	26.5	25.9	26.8	25.8	26.7	25.8	26.7
Sv transducer gain (dB):	25.6	26.7	25.8	27.0	25.5	26.8	25.5	26.7
3 dB beamwidth (deg)								
Along:	6.90	6.80	--	--	6.98	6.85	6.96	6.85
Athwart:	6.80	6.80	--	--	6.87	6.68	6.85	6.81
Angle offset (deg)								
Along:	-0.08	-0.06	--	--	-0.10	-0.24	-0.11	-0.24
Athwart:	0.03	0.07	--	--	-0.02	0.11	-0.01	0.07
Range (m):	1000	250	--	--	--	--	--	--
Post-processing Sv threshold (dB):	-70	--	--	--	--	--	--	--
Sphere range from transducer (m):	--	--	25.5	20.0	36.3	27.5	33.3	23.1
Water temp (°C):								
at transducer:	--	--	3.0	3.0	4.6	4.6	5.4	5.4
at sphere:	--	--	3.0	3.0	4.9	4.9	5.4	5.4

Note: Gain and Beam pattern terms are defined in the "Operator Manual for Simrad EK500 Scientific Echo Sounder (1993)" available from Simrad Subsea A/S , Strandpromenaden 50, P.O. Box 111, N-3191 Horten, Norway.

Table 2. Trawl station and catch data summary from the winter 2003 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Haul	Gear		Time	Duration	Start Position		Depth (m)		Temp. (C)		Profiler	Catch		
												Pollock		Other
No.	Type[1]	Date	(GMT)	(minutes)	Latitude (N)	Longitude (W)	Footrope	Bottom	Gear[2]	Surface	No.	(kg)	Number	(kg)
1	AWT	9-Mar	18:24	36	53 42.48	167 27.90	304	-	3.9	3.8	301	244.4	295	51.6
2	AWT	10-Mar	4:30	20	53 33.48	167 45.78	521	640	3.6	4.4	302	1,249.7	1,364	67.8
3	AWT	10-Mar	19:32	11	53 37.08	168 09.12	240	639	4.8	4.7	303	862.8	628	4.8
4	AWT	13-Mar	5:08	3	53 02.28	169 08.16	301	416	-	3.2	-	2,214.5	1,194	1.5
5	AWT	13-Mar	7:56	4	53 03.42	169 09.36	380	602	-	3.7	-	1,376.2	1,033	0.3

[1]Gear type: AWT = Aleutian Wing Trawl

[2]Gear temperature was measured at the trawl headrope depth.

Table 3. Numbers of biological samples and measurements collected during the winter 2003 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Haul		Fish Weights, Otoliths,	Ovary	Ovary	Vitellogenin	Muscle Tissue	Gamete	Whole Fish
No.	Lengths	Maturity	Weight	Collection[1]	Study[2]	Collection[3]	Collection[4,5]	Collections[4,6]
1	295	70	28	11	5	25	-	X
2	338	67	8	2	10	11	X	-
3	314	70	54	1	11	20	-	-
4	393	67	39	9	6	10	-	-
5	464	72	34	5	5	4	-	-
Totals	1,804	346	163	28	37	70	1 site	1 site

[1] Pollock ovaries sampled for a fecundity study (B. Megrey)

[2] Pollock ovaries and serum sampled for a reproductive hormone study (B. Megrey)

[3] Pollock muscle collections taken for parasite studies (F. Morado)

[4] "X" indicates a collection was made, but numbers were not specified.

[5] Pollock gametes propagated for early life history investigations (A. Brown)

[6] Whole fish retained for identification training (S. Corey)

Table 4. Catch by species from 5 midwater trawl hauls during the winter 2003 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Species Name	Scientific Name	Weight (kg)	Percent by weight	Numbers
walleye pollock	*Theragra chalcogramma*	5,947.6	97.9	4,514
lanternfish unidentified	Myctophidae	55.7	0.9	5,098*
Pacific ocean perch	*Sebastes alutus*	45.1	0.7	62
squid unidentified	Teuthoidea (order)	7.6	0.1	35
smooth lumpsucker	*Aptocyclus ventricosus*	6.4	0.1	2
chinook salmon	*Oncorhynchus tshawytscha*	4.0	0.1	2
Pacific lamprey	*Lampetra tridentata*	3.5	0.1	9
capelin	*Mallotus villosus*	2.3	< 0.1	-
arrowtooth flounder	*Atheresthes stomias*	1.0	< 0.1	1
hatchetfish unidentified	Sternoptychidae	0.3	< 0.1	6
shrimp unidentified	Decapoda (order)	0.1	< 0.1	65*
jellyfish unidentified	Scyphozoa (class)	< 0.1	< 0.1	1
northern smoothtongue	*Leuroglossus schmidti*	< 0.1	< 0.1	5
Totals		6,073.6		9,800

** lantern fish and shrimp numbers for one haul were estimated by using the average weight of each from other hauls in the area.

Table 5. Estimates of walleye pollock biomass (in metric tons (t)) by survey area and management area from February-March echo integration-trawl surveys in the Bogoslof Island area between 1988 and 2003.

	Bogoslof Survey Area			Central Bering Sea 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	0.227	2,903	12.2	0.227	12.2
2003	0.198	2,993	21.5	0.198	21.5

Table 6. Numbers-at-length estimates (millions) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No survey was conducted in 1990. The 1999 survey was conducted by the Japan Fisheries Agency.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
10	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0
11	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0
12	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0
13	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0
14	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0
15	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
17	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
19	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
21	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
23	0	0	--	2	0	0	0	0	0	0	0	0	0	0	<1	0
24	0	0	--	1	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
26	0	0	--	<1	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
28	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
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0
31	0	0	--	0	<1	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
33	0	0	--	0	<1	0	0	0	0	0	0	0	0	0	<1	<1
34	0	0	--	0	0	0	0	<1	<1	0	<1	0	0	0	<1	<1
35	0	0	--	0	0	0	0	<1	0	<1	0	0	0	0	<1	0
36	0	0	--	0	<1	0	0	<1	<1	<1	<1	0	0	0	1	0
37	9	3	--	<1	0	0	0	<1	<1	<1	<1	0	0	0	1	<1
38	6	0	--	2	<1	1	0	1	1	<1	1	0	0	<1	1	<1
39	16	4	--	5	0	2	<1	4	1	1	3	<1	<1	<1	2	<1
40	24	3	--	7	1	4	3	12	4	1	7	1	<1	1	3	<1
41	27	4	--	19	3	5	6	20	8	2	9	6	1	1	4	<1
42	48	23	--	23	7	7	9	40	14	3	11	8	1	1	2	<1
43	118	33	--	31	14	6	14	40	17	4	11	13	3	1	5	1
44	179	54	--	36	18	7	21	41	21	5	10	13	3	2	5	2
45	329	159	--	46	28	8	21	50	23	7	9	17	4	4	7	3
46	488	177	--	55	32	13	21	53	31	10	11	19	5	4	5	5
47	547	389	--	79	42	22	18	40	36	14	9	14	6	5	9	5
48	476	434	--	130	68	28	17	55	36	15	12	11	6	5	7	7
49	389	431	--	168	102	46	16	47	37	18	15	10	5	6	6	6
50	248	366	--	205	129	69	39	52	40	21	20	16	6	7	5	7
51	162	279	--	189	144	76	46	58	45	24	23	11	8	6	5	4
52	80	168	--	160	118	73	52	78	52	26	28	20	10	7	4	4

Table 6. Continued.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
53	48	85	--	122	106	73	49	81	52	26	35	17	13	7	6	4
54	19	50	--	63	67	66	43	88	53	31	41	21	16	8	7	3
55	12	13	--	40	41	50	37	81	48	28	38	33	21	12	9	5
56	4	5	--	17	27	29	26	69	40	24	35	38	20	13	12	7
57	3	8	--	8	13	14	17	58	37	22	30	33	24	17	13	7
58	1	1	--	4	6	9	10	47	28	17	27	36	23	15	14	10
59	0	0	--	1	5	3	6	31	19	13	18	23	16	13	12	9
60	0	0	--	1	1	1	3	17	12	12	13	15	13	11	12	13
61	2	0	--	1	<1	1	2	7	6	6	8	18	10	9	8	9
62	0	0	--	<1	<1	<1	1	4	2	3	5	13	7	6	6	7
63	0	0	--	0	0	0	<1	2	1	1	3	4	4	4	4	5
64	0	0	--	0	1	<1	0	1	<1	1	1	3	2	3	3	5
65	0	0	--	<1	0	0	0	<1	<1	<1	1	1	1	1	1	3
66	0	0	--	0	0	0	0	<1	0	<1	1	<1	<1	1	1	1
67	0	0	--	0	0	0	0	0	0	0	0	1	<1	<1	<1	1
68	0	0	--	0	0	0	0	1	0	0	<1	0	<1	<1	<1	<1
69	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	0	<1
70	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	<1	0
Totals	3,236	2,687	--	1,419	975	613	478	1,081	666	337	435	416	229	171	181	134

Table 7. Biomass-at-length estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No survey was conducted in 1990. The 1999 survey was conducted by the Japan Fisheries Agency.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
10	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0
11	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0
12	0	0	--	0	0	0	0	5	0	0	0	0	0	0	0	0
13	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0
14	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0
15	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
17	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
19	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
21	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	--	13	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	--	70	0	0	0	0	0	0	0	0	0	0	38	0
24	0	0	--	61	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
26	0	0	--	26	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
28	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
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	7	0
31	0	0	--	0	37	0	0	0	0	0	0	0	0	0	0	0
32	0	0	--	0	42	0	0	0	0	0	0	0	0	0	0	0
33	0	0	--	0	48	0	0	0	0	0	0	0	0	0	9	2
34	0	0	--	0	0	0	0	53	35	0	29	0	0	0	48	2
35	0	0	--	0	0	0	0	93	0	29	0	0	0	0	73	0
36	0	0	--	0	68	0	0	42	96	18	32	0	0	0	204	0
37	3,199	846	--	115	0	0	0	113	109	84	92	0	0	0	456	16
38	2,304	0	--	768	84	260	0	435	465	173	395	0	0	19	508	6
39	6,365	1,461	--	1,843	0	634	202	1,697	562	507	1,250	258	168	149	823	7
40	10,573	1,116	--	2,801	451	1,776	1,190	5,510	1,857	634	3,208	1,242	195	315	1,716	80
41	12,697	1,532	--	7,940	1,235	2,276	2,855	9,777	3,637	851	4,484	5,598	575	403	1,919	170

Table 7. Continued

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
42	24,360	10,704	--	10,812	3,316	3,571	4,990	20,730	7,012	1,387	5,652	7,223	674	464	1,307	251
43	64,253	16,516	--	15,540	6,760	3,089	8,021	22,332	9,190	2,158	6,407	12,079	1,511	770	2,885	437
44	104,733	29,588	--	20,103	9,877	4,006	12,963	24,863	12,735	3,018	6,048	11,877	1,622	1,562	3,642	1,166
45	206,586	93,899	--	28,059	16,329	4,818	13,823	32,817	14,927	4,824	5,592	16,278	2,848	2,966	5,117	2,128
46	328,735	113,092	--	36,235	20,645	8,835	15,081	37,303	21,637	7,399	7,774	17,678	3,289	3,218	4,174	4,079
47	394,741	268,496	--	56,880	29,146	16,669	13,565	30,184	26,425	10,786	6,653	13,933	5,002	4,095	7,420	3,823
48	367,368	323,170	--	101,488	51,983	22,214	13,658	44,572	28,658	12,233	9,528	11,280	5,191	4,548	6,062	5,873
49	320,630	345,632	--	141,399	84,329	39,811	14,414	40,477	31,599	15,951	12,766	10,698	4,659	5,654	5,646	5,747
50	217,890	314,778	--	187,006	115,614	63,571	36,256	47,785	35,907	19,593	18,837	18,373	5,466	6,794	4,904	6,956
51	152,084	258,067	--	186,358	140,004	75,524	46,297	57,291	43,272	23,896	23,203	12,204	8,364	6,361	5,004	4,232
52	79,654	166,322	--	170,855	124,034	77,721	55,851	81,793	53,696	28,549	29,109	23,427	10,816	7,605	3,992	4,883
53	50,739	89,721	--	139,671	120,309	83,189	55,151	90,342	57,294	29,783	39,234	20,486	14,509	8,203	6,504	4,764
54	21,211	56,681	--	77,905	82,110	79,461	52,329	104,021	61,504	38,168	48,567	25,270	19,059	10,064	8,249	4,115
55	14,191	16,270	--	52,506	53,286	64,342	47,770	102,318	59,033	35,853	47,461	39,463	27,179	16,246	12,509	6,435
56	5,580	6,059	--	23,541	38,564	39,556	35,451	91,962	52,765	33,144	47,627	46,764	27,212	17,977	16,277	10,745
57	3,886	10,681	--	12,470	19,710	20,781	24,453	81,885	52,000	31,736	42,594	40,641	34,562	24,987	19,422	10,852
58	1,395	1,220	--	6,603	9,188	14,391	15,826	70,522	40,581	26,309	41,160	44,788	34,255	23,153	21,834	15,700
59	0	0	--	1,284	7,872	4,376	9,546	48,878	28,918	21,031	28,241	28,362	26,252	20,390	19,158	14,905
60	0	0	--	2,743	2,631	1,989	4,716	28,240	19,749	20,509	21,604	18,174	22,075	19,263	20,581	23,011
61	2,561	0	--	2,195	562	1,756	3,644	11,855	10,762	11,428	14,301	22,618	18,519	16,883	14,659	17,326
62	0	0	--	780	600	372	1,826	7,951	3,578	6,439	9,748	15,120	12,972	11,334	12,296	14,954
63	0	0	--	0	0	0	200	3,978	2,835	2,999	6,344	5,181	7,033	7,722	8,207	11,240
64	0	0	--	0	1,363	415	0	1,074	863	1,489	1,777	3,198	4,277	5,489	5,719	10,540
65	0	0	--	938	0	0	0	495	578	1,096	1,156	1,833	1,660	2,730	2,463	7,281
66	0	0	--	0	0	0	0	163	0	329	1,251	403	534	1,132	1,515	3,582
67	0	0	--	0	0	0	0	0	0	0	0	863	520	715	583	1,954
68	0	0	--	0	0	0	0	2,570	0	0	276	0	403	426	777	746
69	0	0	--	0	0	0	0	0	0	0	0	0	0	55	0	391
70	0	0	--	0	0	0	0	0	0	0	0	0	0	100	61	0
Totals	2,395,735	2,125,851	--	1,289,008	940,197	635,403	490,078	1,104,118	682,279	392,403	492,398	475,311	301,402	231,795	226,548	198,403

Table 8. Numbers-at-age estimates (millions) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No survey was conducted in 1990. The 1999 survey was conducted by the Japan Fisheries Agency. Age data are not yet available for 2002 and 2003.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
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
2	0	0	--	4	0	0	0	0	0	0	0	0	0	0
3	0	0	--	0	1	1	0	2	0	0	0	0	0	0
4	0	6	--	2	2	33	21	6	<1	<1	<1	2	1	1
5	28	15	--	12	27	17	86	75	6	4	11	5	6	14
6	327	58	--	46	54	44	26	278	96	16	61	29	4	12
7	247	363	--	213	97	46	38	105	187	55	34	77	14	10
8	164	147	--	93	74	48	36	68	85	88	70	34	30	10
9	350	194	--	160	71	42	36	80	40	38	77	50	16	14
10	1,201	91	--	44	55	28	17	53	37	28	32	75	28	12
11	288	1,105	--	92	57	51	27	54	24	16	25	29	45	18
12	287	222	--	60	33	25	23	19	24	16	21	27	21	31
13	202	223	--	373	34	27	13	59	12	13	19	25	16	13
14	89	82	--	119	142	42	9	32	36	7	18	16	11	7
15	27	90	--	41	164	92	45	12	18	13	9	12	11	9
16	17	30	--	38	59	47	36	31	4	5	15	10	9	8
17	7	60	--	29	8	25	28	103	16	4	5	8	3	5
18	3	0	--	32	15	11	16	60	35	12	8	6	6	1
19	0	0	--	56	22	11	4	18	26	12	10	3	3	3
20	0	0	--	4	42	11	4	5	12	7	15	4	2	1
21	0	0	--	2	13	10	8	5	3	2	4	3	1	0
22	0	0	--	0	3	1	2	6	2	1	1	2	1	0
23	0	0	--	0	1	1	2	6	1	<1	0	<1	0	<1
24	0	0	--	0	0	0	1	2	0	1	0	0	<1	<1
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0
Totals	3,236	2,687	--	1,419	975	613	478	1,081	666	336	435	416	229	171

Table 9. Biomass-at-age estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No survey was conducted in 1990. The 1999 survey was conducted by the Japan Fisheries Agency. Age data are not yet available for 2002 and 2003.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	0	0	--	0	0	0	0	0	0	0	0	0	0	0
1	0	0	--	0	0	0	0	10	0	0	0	0	0	0
2	0	0	--	170	0	0	0	0	0	0	0	0	0	0
3	0	0	--	0	162	284	0	681	0	0	0	0	0	0
4	0	2,184	--	715	782	18,809	13,028	3,411	322	87	78	1,809	324	437
5	14,997	7,275	--	6,067	21,455	11,939	59,938	48,690	3,668	2,083	6,771	5,688	4,060	11,581
6	192,324	41,140	--	24,911	38,081	39,100	21,530	208,409	69,106	10,598	37,697	28,096	2,884	11,166
7	155,569	241,301	--	143,024	67,027	43,049	39,768	82,680	165,354	49,598	29,637	77,751	12,065	9,698
8	114,725	111,156	--	74,575	59,445	46,874	39,107	72,294	75,658	94,580	73,714	37,210	30,361	11,576
9	251,417	149,143	--	149,035	67,358	43,976	39,539	96,260	45,732	44,076	94,394	59,688	17,797	18,033
10	910,016	68,495	--	43,519	56,969	30,688	20,520	64,202	45,360	37,822	40,417	90,284	39,852	16,273
11	226,380	894,895	--	94,020	61,394	59,294	31,589	70,646	31,116	22,942	35,706	35,240	63,335	26,491
12	232,810	187,280	--	59,273	36,293	27,008	27,506	26,482	33,262	22,497	29,180	32,724	31,891	49,843
13	167,054	193,548	--	377,521	37,218	29,947	17,038	77,225	16,950	18,074	26,690	29,864	24,979	20,032
14	81,596	71,920	--	116,171	150,237	46,997	10,896	42,417	48,990	10,713	26,304	18,915	17,620	11,025
15	22,969	81,447	--	38,750	168,966	107,062	52,899	16,595	24,443	19,768	13,230	14,207	16,150	14,340
16	16,336	24,342	--	37,870	63,304	54,401	42,771	37,907	5,538	6,659	21,631	12,723	14,740	13,925
17	6,681	51,725	--	30,696	9,342	27,577	32,128	131,396	20,782	5,470	8,218	9,635	5,637	7,351
18	2,863	0	--	32,392	15,467	10,736	17,911	74,010	43,092	16,894	10,212	7,020	8,460	2,106
19	0	0	--	55,116	23,380	13,607	4,768	22,292	31,760	17,174	13,047	3,357	4,798	5,264
20	0	0	--	3,840	43,605	11,963	5,081	5,902	14,486	9,228	19,016	4,343	2,547	2,043
21	0	0	--	1,341	15,240	10,167	8,866	5,433	4,023	1,885	5,376	3,574	1,566	0
22	0	0	--	0	3,186	1,329	2,011	7,728	1,974	947	1,078	2,668	1,810	0
23	0	0	--	0	1,287	598	2,323	6,696	661	419	0	514	0	493
24	0	0	--	0	0	0	860	2,758	0	888	0	0	526	493
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0
Totals	2,395,737	2,125,851	--	1,289,006	940,198	635,405	490,077	1,104,124	682,277	392,402	492,396	475,311	301,402	232,170

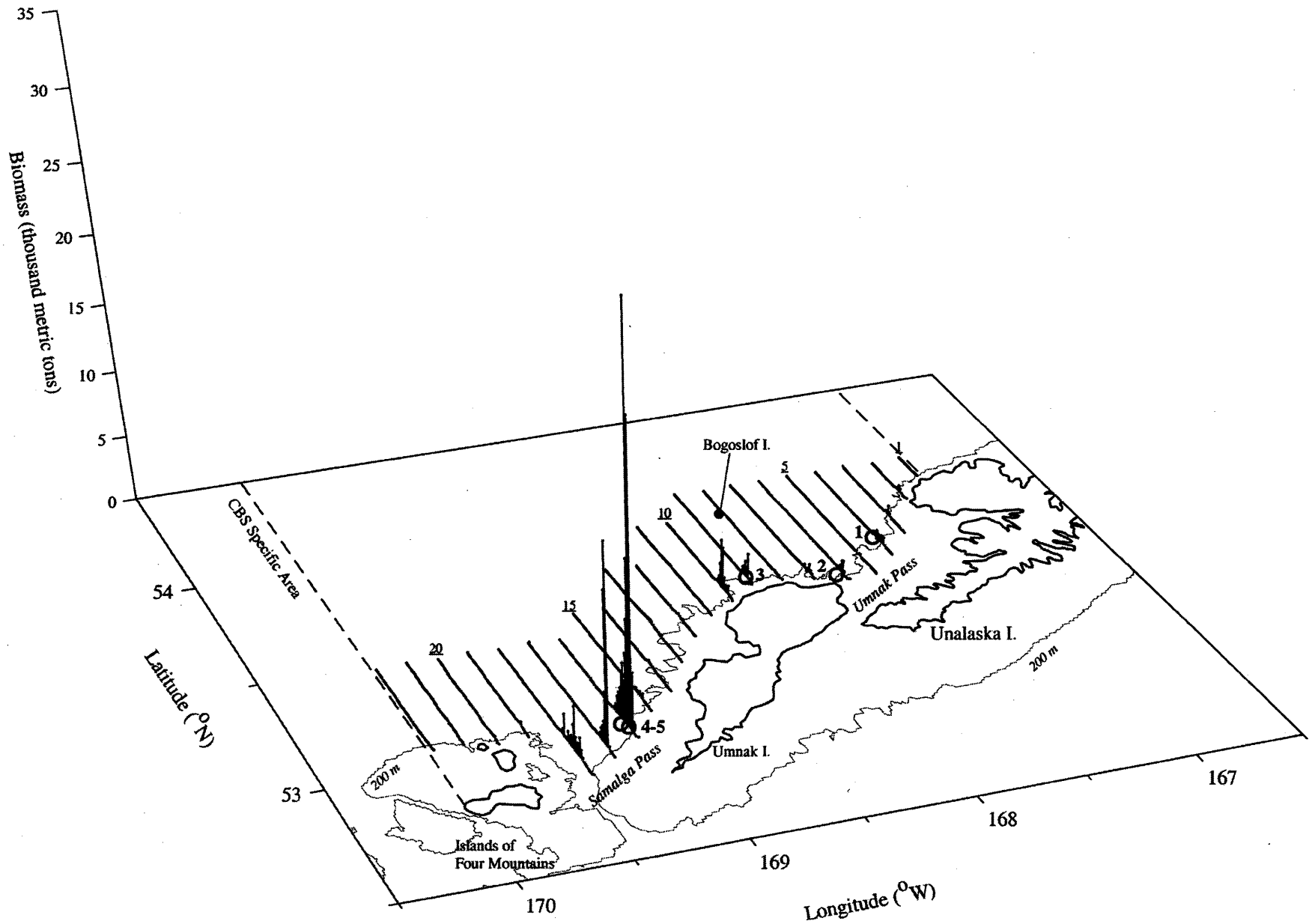


Figure 1. Trawl haul location (numbered circles) and biomass (1000 metric tons) attributed to pollock observed during the winter 2003 echo integration-trawl survey in the Bogoslof Island area. Transect numbers are underlined and the CBS Specific Area is indicated.

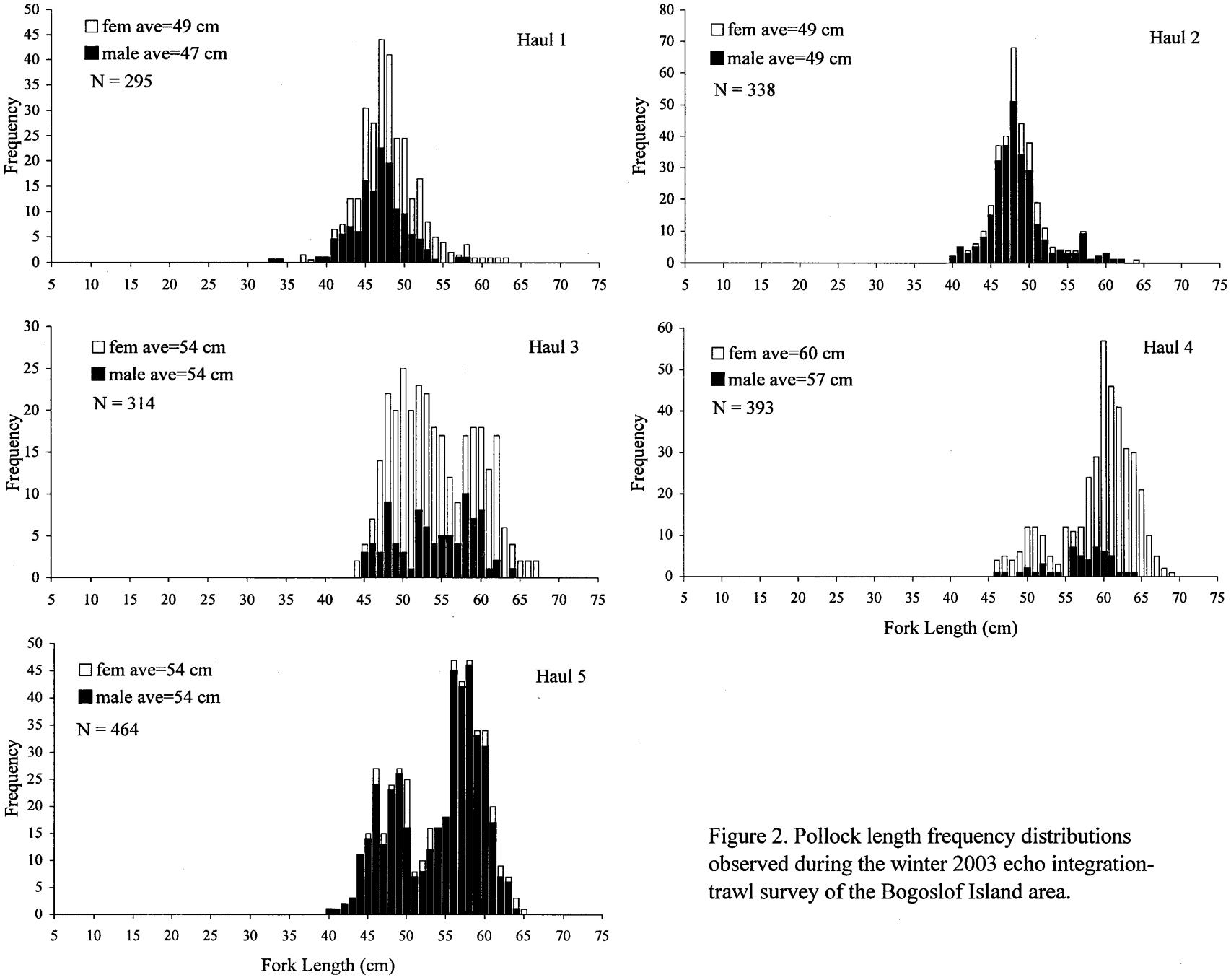


Figure 2. Pollock length frequency distributions observed during the winter 2003 echo integration-trawl survey of the Bogoslof Island area.

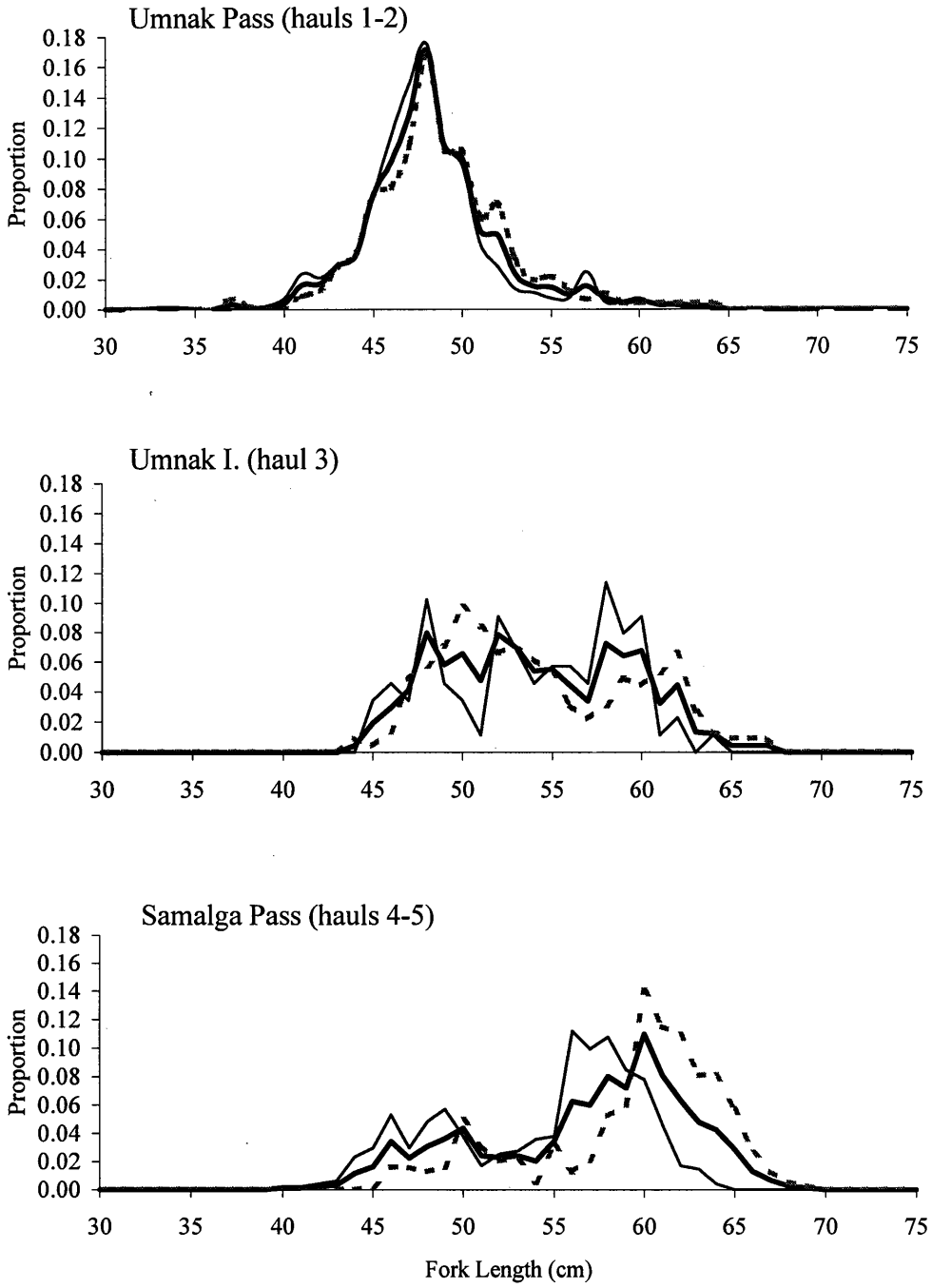
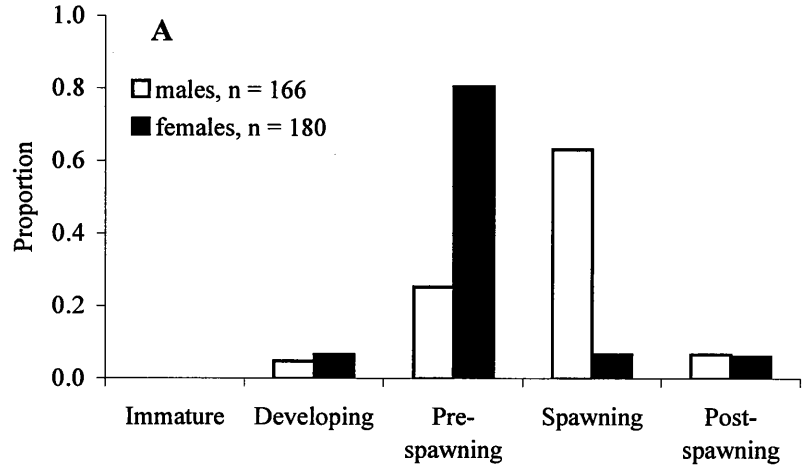
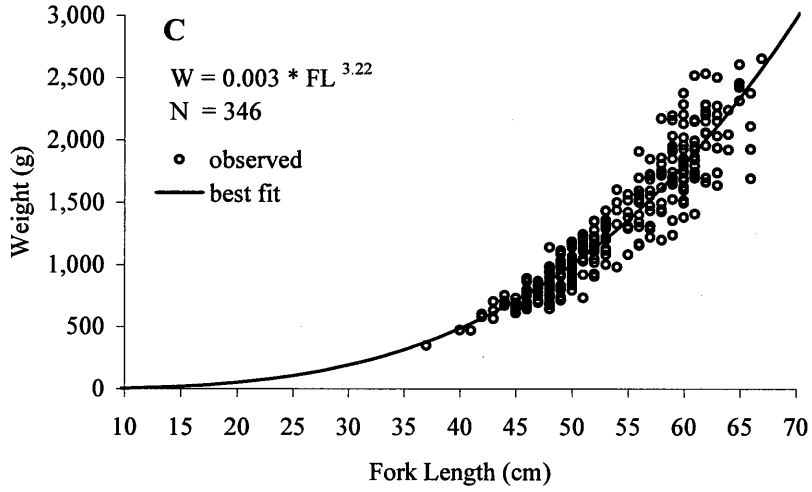


Figure 3. Pollock proportion-at-length (sexes combined: bold line, males: medium line, females: dashed line) derived for strata 1-3 during the winter 2003 echo integration-trawl survey of the Bogoslof Island area.





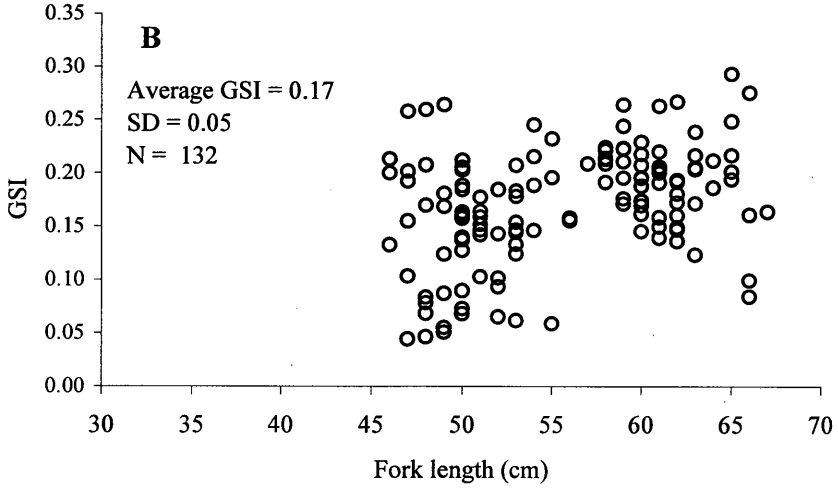


Figure 4. Pollock maturity stages (A), gonado-somatic index (GSI) for pre-spawning females as a function of fork length (cm) (B), and length-weight relationship (sexes combined) (C) observed during the winter 2003 echo integration-trawl survey of the Bogoslof Island area.

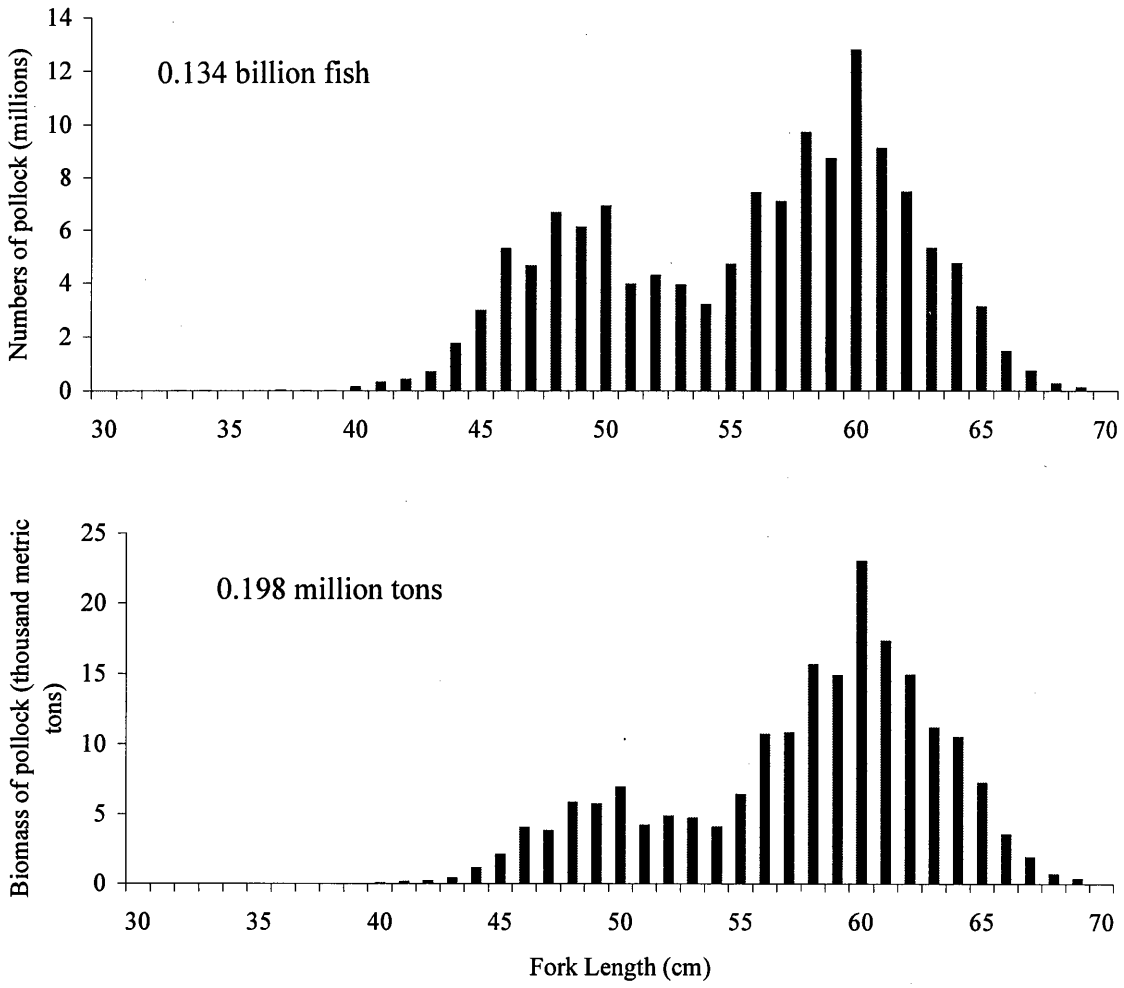


Figure 5. Population-at-length (top) and biomass-at-length (bottom) estimates from the winter 2003 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

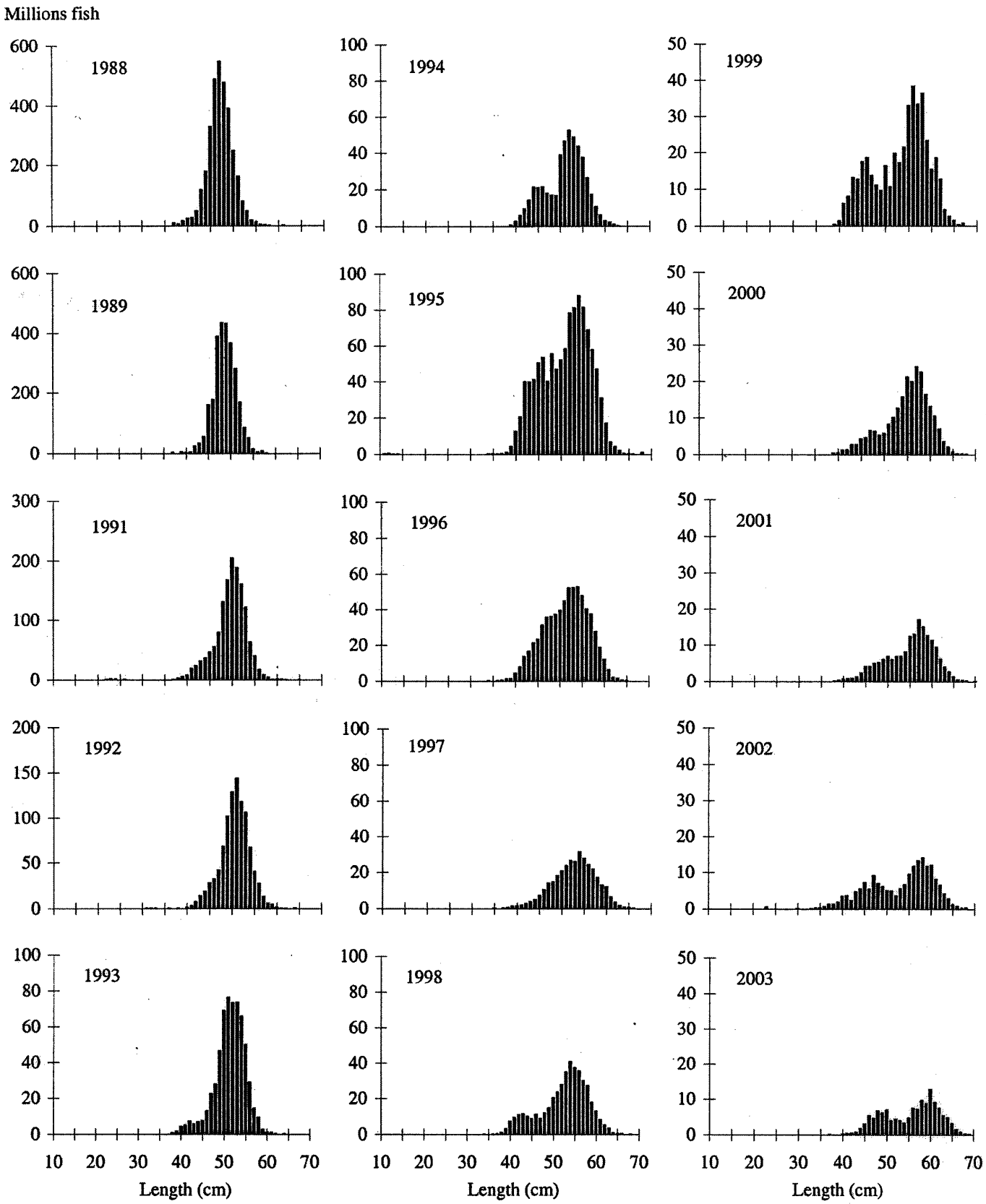


Figure 6. Numbers-at-length estimates (millions) from echo integration-trawl surveys of spawning pollock near Bogoslof Island in winter 1988-2003. The United States conducted all but the 1999 survey, which was conducted by Japan. There was no survey in 1990. Note y-axis scales differ.

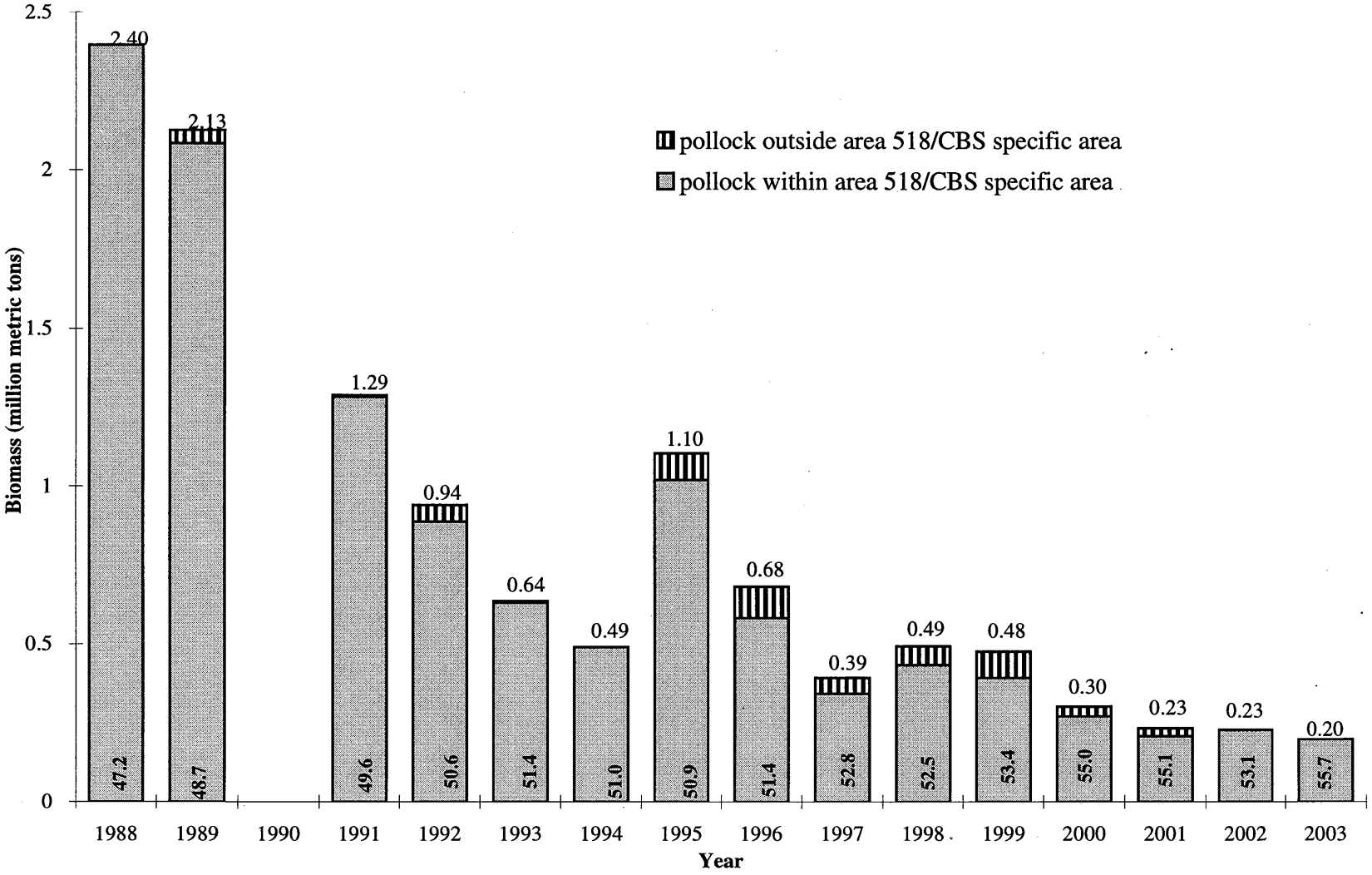


Figure 7. Biomass estimates and average fork lengths obtained during winter echo integration-trawl surveys for walleye pollock in the Bogoslof Island area, 1988-2003. The U.S. conducted all but the 1999 survey, which was conducted by Japan. There was no survey in 1990. Total pollock biomass for each survey year is indicated on top of each bar and average fork length (cm) is indicated inside each bar.

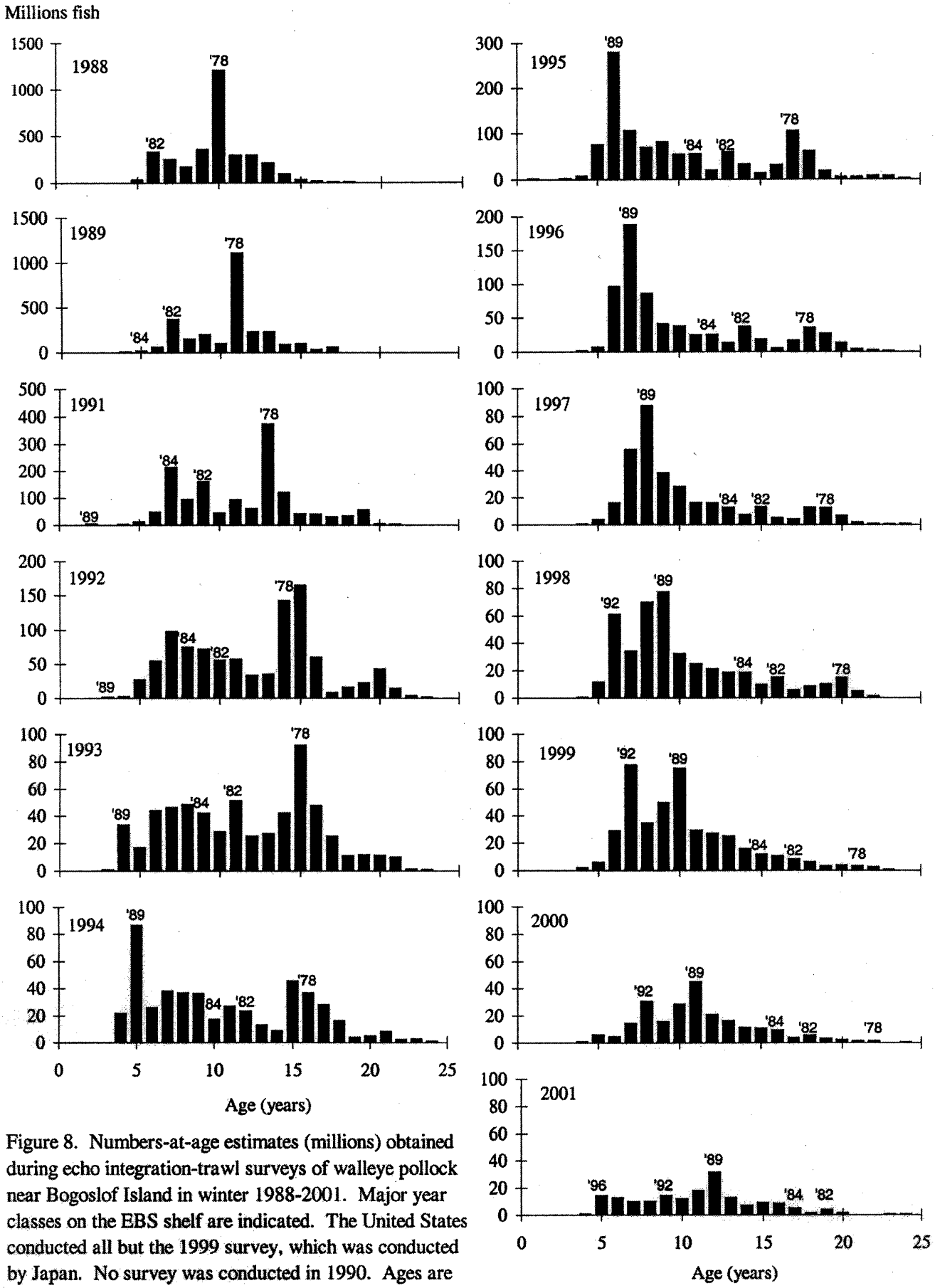
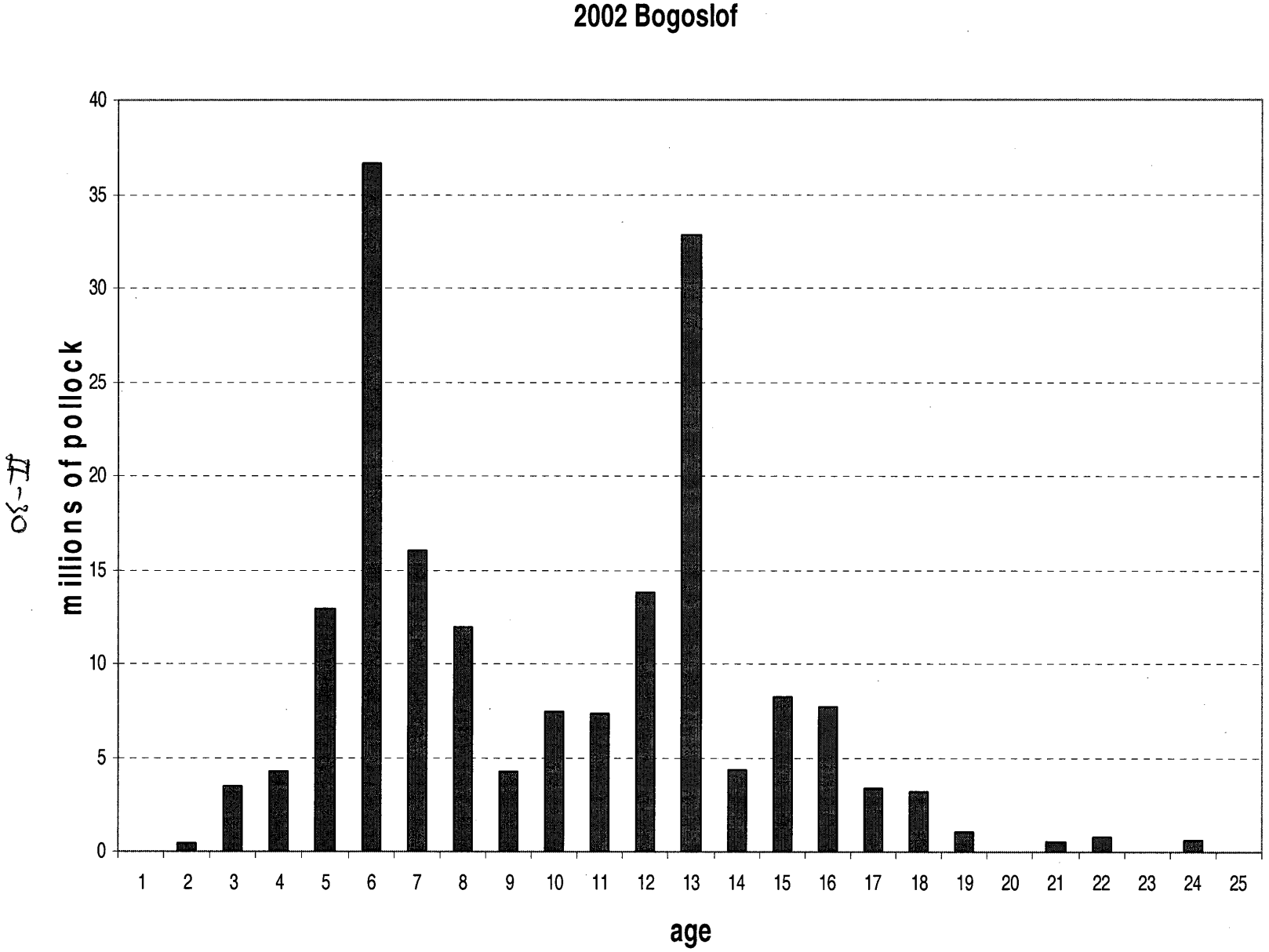


Figure 8. Numbers-at-age estimates (millions) obtained during echo integration-trawl surveys of walleye pollock near Bogoslof Island in winter 1988-2001. Major year classes on the EBS shelf are indicated. The United States conducted all but the 1999 survey, which was conducted by Japan. No survey was conducted in 1990. Ages are not yet available for 2002 and 2003. Note y-axis scales differ.

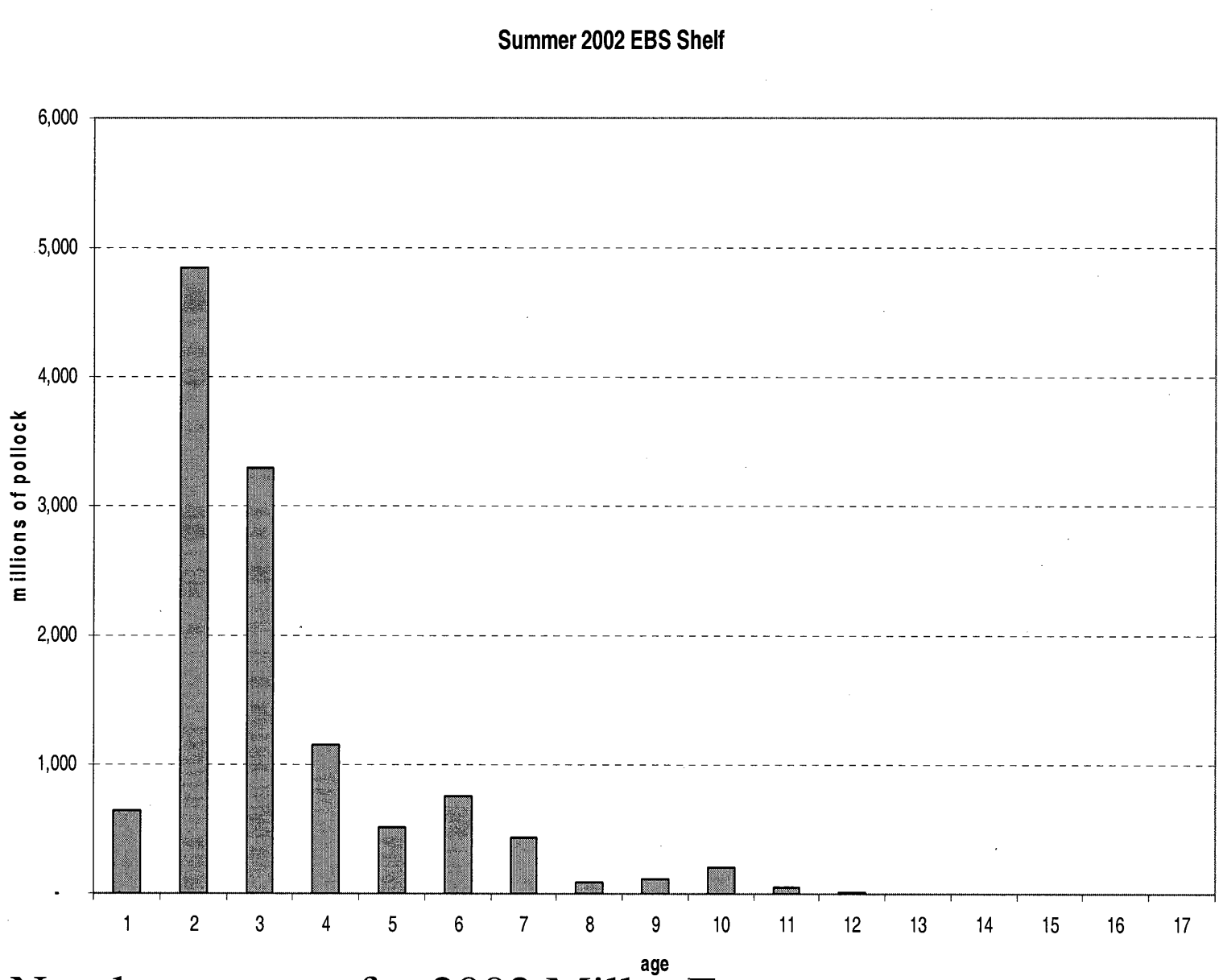
Update of results from winter 2002 acoustic-trawl survey of Bogoslof region



Age (yr)	millions of pollock
1	0
2	0
3	3
4	4
5	13
6	37
7	16
8	12
9	4
10	7
11	7
12	14
13	33
14	4
15	8
16	8
17	3
18	3
19	1
20	0
21	1
22	1
23	0
24	1
25	0
Total	181

Preliminary numbers-at-age for 2002 Miller Freeman survey of Bogoslof.
Age data from A. Nishimura (JFA). U.S. ageing results not yet available

Update of results from summer 2002 acoustic-trawl survey of EBS shelf (US EEZ)



Age (yr)	millions of pollock
1	635
2	4,850
3	3,295
4	1,155
5	507
6	757
7	437
8	91
9	110
10	205
11	52
12	18
13	3
14	6
15	0
16	0
17	0
18	0
19	0
20	0
21	0
22	0
23	0
24	0
25	0
Total	12,122

Numbers-at-age for 2002 Miller Freeman summer survey of EBS Shelf. These numbers represent midwater abundance – i.e. 14 m from surface to 3 m off bottom.

Section III

Eastern Bering Sea
Walleye Pollock Stock Assessment
(2002)

James N. Ianelli, Steve Barbeaux,
Taina Honkalehto, Gary Walters, and Neal Williamson

Alaska Fisheries Science Center
National Marine Fisheries Service

Summary

The primary focus of this chapter is on the eastern Bering Sea region. The Aleutian Islands region and Bogoslof Island area are treated separately in Sections 1.15 and 1.16.

Changes in the input data
The 2002 NMFS bottom-trawl survey estimates of population numbers-at-age were available for analysis in this assessment. The biomass estimate for 2002 is 4.82 million tons, an increase of 16% from the 2001 estimate of 4.14 million tons. For the echo-integration trawl (EIT) surveys the 2002 biomass estimate for the region is 3.6 million tons, an 18% increase over the 2000 estimate (the last year an EIT survey was conducted). Samples of pollock otoliths from the bottom trawl survey were examined for age determination and an estimate of the numbers-at-age from this survey were computed and used in the analysis. For the EIT survey, the otolith samples have not yet been processed. Therefore, we applied the age-length key constructed from the bottom-trawl survey collections to the EIT length composition estimates. We used these preliminary estimates of the 2002 numbers-at-age from the EIT survey within the assessment analysis.

The NMFS observer samples of pollock age and size composition were evaluated for the 2001 fishery and these data were included in the analyses. The estimates of average weight-at-age from the fishery were also revised. The total catch estimate was updated for 2001. For 2002, we assumed that the catch is equal to the 2002 TAC (1,485,000 t).

Changes in the assessment model
No major changes to the assessment model were made this year. As in past years, an array of model alternatives were performed and evaluated for contrast.

Changes in the assessment results
Compared to last year's estimates, the 2001 biomass level is about 6% higher due to increases in the estimates of the age 9 and older pollock. Also, the estimates of the 1999 and 2000 year classes increased and appear to be average or above-average in magnitude.

The 2003 maximum ABC alternatives based on the $F_{40\%}$ and F_{msy} are 2,322 and 2,327 thousand tons, respectively for the reference model (F_{msy} harvests based on the harmonic mean value). As with last year, a lower value for the F_{msy} value reflects the level of uncertainty about stock size. The 2003 overfishing level (OFL) alternatives for the reference model are 2,869 and 3,532 thousand tons corresponding to $F_{35\%}$ and F_{msy} (arithmetic mean). Stock levels appear to be relatively high for EBS pollock, but a large degree of uncertainty in the estimates remains.

In the summer of 2002, NMFS conducted a bottom-trawl survey throughout the Aleutian Islands region. The estimate of on-bottom pollock in the Aleutians from this survey is **175,283 t**, up considerably from the 2000 estimate of 105,554 t. This gives **ABC** and **OFL values of 39,438 t** and **52,585 t,** respectively.

For the Bogoslof region, we followed the SSC recommendations and compute maximum permissible ABC and OFL based on Tier 5. This results in **33,982 t** and **45,309 t** for ABC and OFL, respectively. Following SSC recommendations reduced the ABC relative to the target stock size (2 million tons). This gives a 2003 ABC of **4,074 t** for the Bogoslof Island region.

Section IV

Section IV (for Agenda Item 5.7– Methodologies to determine AHL)

Formulation and Determination of ABC/AHL Procedure

Summary by

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At the May 19-21, 2003 Central Bering Sea Pollock Workshop held in Pusan, the participants agreed that an Acceptable Biological catch (ABC) could be calculated according to scientific procedures as an intermediate step to determine Allowable Harvest levels (AHLs). The Convention is very specific on how AHL is determined. It was suggested that the ABC procedures used by the North Pacific Fishery Management Council (NPFMC), or modifications thereof, could be a good a good start to determine ABC for central Bering Sea pollock.

The NPAFC has a process to determine the ABC of groundfish fishery resources in the U.S. EEZ off Alaska that is dependent on the best estimate of the stock biomass and its appropriate exploitation rate. The choice of the procedure is dependent upon information according to 6 different tiers of data quality on the stock.

For the estimation of biomass, Jim Ianelli has evaluated a simplified age-structured model based on recent Bogoslof population trends. The Council's Scientific and Statistical Committee (SSC) determined that the age-structured model to be inappropriate to estimate the biomass of Pollock for the Bogoslof area since it covered only part of the stock and concurred with the Fishery Plan Team of the Bering Sea-Aleutians groundfish resources on placing Bogoslof pollock in Tier 5 of the ABC determination process.

Since 1999 The Plan Team has presented 2 alternative methods for computing ABC values for the Bogoslof region to the North Pacific Fishery Management Council. They include:

1. A Plan Team-preferred method that is a straight-forward application of the Tier 5 ABC calculation method where F_{ABC} =0.75*M; and
2. A Council SSC-preferred method that assumes from historical survey biomass trends that 2 million mt represents the best estimate of a target $B_{40\%}$ level.

Both calculations of ABCs for the Bogoslof area will be shown below. Both procedures depend upon the biomass estimated in the Bogoslof Island area by research survey vessels using the Echo-integration survey technique of the U.S. R/V *Miller Freeman* and the Japanese R/V *Kaiyo maru.*

The biomass estimates made by echo-integration-trawl (EIT) surveys since 1988 are shown in the Fig 1.1 and the table below as follows:

							Biomass (million mt)							
1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
2.4	2.1	-	1.3	0.9	0.6	0.49	1.1	0.68	0.39	0.49	0.48	0.30	0.23	0.23

Plan Team-Preferred Procedure 1 -- Tier 5 computations use the most recent survey biomass estimate applied to an adjusted natural mortality for the Bogoslof pollock stock. This gives a 2002 ABC estimate of **33,982 t** (2001 survey biomass $\times M \times 0.75$) at a biomass of 226,548 t (with $M = 0.2$). The OFL is **45,309 t**.

SSC-Preferred Procedure 2 -- Given the survey estimate of exploitable biomass of 0.232 million t and M = 0.2 and based on the SSC discussions for further reductions in ABC based on considerations of a target stock size of 2 million tons, the F_{ABC} recommendation is computed as:

$$F_{abc} \leq F_{40\%} \times \left(\frac{B_{2002}}{B_{40\%}} - 0.05 \right) \Big/ (1 - 0.05) = 0.27 \times \left(\frac{226,000}{2,000,000} - 0.05 \right) \Big/ (1 - 0.05) = 0.018$$

Using a fishing mortality rate of 0.018 translates to an exploitation rate of 0.018 which when multiplied by 226,548 t, gives a **2002 ABC of 4,074 t** for the Bogoslof region.

Both procedures of calculation were presented each year to the North Pacific Fishery Management Council and the Council has always selected the SSC-preferred procedure.

Preliminary Computation of 2003 ABC for Bogoslof Pollock

Jim Ianelli

Alaska Fisheries Science Center, NMFS

Since 1999 The Plan Team has presented 2 alternative methods for computing ABC values for the Bogoslof region to the North Pacific Fishery Management Council. They include:

3. A Plan Team-preferred method that is a straight-forward application of the Tier 5 ABC calculation method where F_{ABC} =0.75*M; and
4. A Council SSC-preferred method that assumes from historical survey biomass trends that 2 million mt represents the best estimate of a target $B_{40\%}$ level.

Both calculations of ABCs for the Bogoslof area will be shown below. Both procedures depend upon the biomass estimated in the Bogoslof Island area by research survey vessels using the Echo-integration survey technique of the U.S. R/V *Miller Freeman* and the Japanese R/V *Kaiyo maru.*

The biomass estimates made by echo-integration-trawl (EIT) surveys since 1988 are shown in the Fig 1.1 and the table below as follows:

Biomass (million mt)														
1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
2.4	2.1	-	1.3	0.9	0.6	0.49	1.1	0.68	0.39	0.49	0.48	0.30	0.23	0.23

2003 CBS Specific area Pollock biomass = 198,000 mt

Plan Team-Preferred Procedure 1 -- Tier 5 computations use the most recent survey biomass estimate applied to an adjusted natural mortality for the Bogoslof pollock stock. This gives a 2003 ABC estimate of **29,760 t** (2003 survey biomass $\times M \times 0.75$) at a biomass of 198,400 t (with $M = 0.2$). The OFL is **39,680 t.**

SSC-Preferred Procedure 2 -- Given the survey estimate of exploitable biomass for the CBS specific area of 0.198 million t and M = 0.2 and based on the SSC discussions for further reductions in ABC based on considerations of a target stock size of 2 million tons, the F_{ABC} recommendation is computed as:

$$F_{abc} \le F_{40\%} \bullet \left(\frac{B_{2003}}{B_{40\%}} - 0.05 \right) \Big/ (1-0.05) = 0.27 \bullet \left(\frac{198{,}403}{2{,}000{,}000} - 0.05 \right) \Big/ (1-0.05) = 0.014$$

Using a fishing mortality rate of 0.014 translates to an exploitation rate of 0.014 which when multiplied by 198,000 t, gives a **2003 ABC of 2,774 t** for the Bogoslof region.

Both procedures of calculation were presented each year to the North Pacific Fishery Management Council and the Council has always selected the SSC-preferred procedure.

Section V

Section V (for Agenda Item 7 – Other matters and recommendations)
Web Site information of Convention reports

Web Site Information

for

Parties to the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea

Temporary Website:

http://www.afsc.noaa.gov/refm/cbs/convention_conferences.htm

The following records are currently in the Website:

Description of the Convention
Records of the Annual Conferences
Records of Workshops
Documents and Data Records
Key Contact person from each Party

Suggestions:

1. This website is in a temporary location in NOAA-REFM Division computer.
2. We need to move this website to neutral computer, such as a commercial Website Host
3. Who will pay for hosting? Cost estimate is about $20 per month.
4. Who will be custodian for maintenance of website?