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Results of the March 2005 Echo Integration-trawl Survey of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise MF2005-03

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Results of the March 2005 Echo Integration-Trawl Survey of Walleye Pollock (*Theragra chalcogramma*) Conducted in the Southeastern Aleutian Basin Near Bogoslof Island, Cruise MF2005-03

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INTRODUCTION

Scientists from the Midwater Assessment and Conservation Engineering Program of the Alaska Fisheries Science Center (AFSC) regularly conduct echo integration-trawl (EIT) surveys to estimate spawning walleye pollock (*Theragra chalcogramma*) abundance in the southeastern Aleutian Basin (McKelvey and Williamson 2003, Honkalehto et al. 2002). These surveys were conducted annually between 1988 and 2005 with the exception of 1990 and 2004. The biomass estimate for pollock within the Central Bering Sea (CBS) Convention Specific Area[1] obtained during these surveys provides an index of abundance for the Aleutian Basin pollock stock (Honkalehto and Williamson, 1995). The results presented here are from the EIT survey carried out 7-13 March 2005 aboard the NOAA ship *Miller Freeman*, Cruise MF2005-03. This report summarizes observed pollock distribution and biological composition, and provides a biomass estimate. It also summarizes oceanographic observations and acoustic system calibration results.

METHODS

Itinerary

5 Mar	Embark scientists in Dutch Harbor, AK.
7-13 Mar	Calibration of acoustic system in Captains Bay. EIT survey of the southeastern Aleutian Basin near Bogoslof Island.
13 Mar	In port Dutch Harbor, AK.

[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."

Acoustic Equipment

Acoustic data were collected with a Simrad EK500[2] echo sounding system using a 38 kHz split beam transducer, and with a Simrad ER60 echo sounding system using 18, 120, and 200 kHz split beam transducers (Simrad 2001, Bodholt et al. 1989, Bodholt and Solli 1992). The transducers were installed on the NOAA ship *Miller Freeman*, a 66-m stern trawler equipped for fisheries and oceanographic research, on the bottom of a retractable centerboard extending 9 m below the water surface. Data from all four frequencies were logged with SonarData EchoLog 500 (v. 3.25). Raw data for the 18, 120 and 200 kHz frequencies were also logged using ER60 software (v.2.1.1). Echo integration-trawl survey methods used were similar to methods described and recommended in MacLennan and Simmonds (1992). The EK500 38 kHz data were analyzed using SonarData Echoview (v. 3.25.54) PC-based post-processing software. Results presented here were based on the EK500 38 kHz data.

Trawl Gear

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 32-mm (1.25-in) nylon mesh codend liner. In a few cases, a 13-mm (0.5-in) liner was used. 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]. Vertical net opening and depth were monitored with either a WESMAR third wire or Furuno wireless netsounder system attached to the trawl headrope. The net opening ranged from 20.5 to 43 m and averaged 32 m while fishing.

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[2] Reference to trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

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).

Survey Design

The survey began 7 March north of Unalaska Island at about 167°W longitude, proceeded west to the Islands of Four Mountains near 170°W, and concluded on 13 March near Dutch Harbor (Fig. 1). A random start position was generated for the first transect, within +/- 2.5 nautical miles (nmi) of the "historical" first transect start location. This resulted in a new start location 1.8 nmi west of the historical trackline. From that point, the survey followed 22 north-south, parallel transects spaced 5 nmi apart that covered 3,112 nmi^2 of the CBS Convention Specific Area. The average transecting speed was 11 knots. Echo integration data were collected 24 hours a day between 14 m from the surface 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 (Table 1) were based on results from acoustic system calibrations from this and prior surveys. Trawl hauls were conducted to identify echosign and to provide biological samples. 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) v.1.6 and stored in a relational database. Pollock tissue and gamete samples were collected for on-going research by AFSC and other scientists. Whole fish were retained for studies of forage

fish and for training fisheries observers. Visual counts of seabird species present were made after each trawl haul.

Standard sphere acoustic system calibrations (Foote et al. 1987) were made before and after the Bogoslof Island area survey to measure acoustic system performance. During calibration, the *Miller Freeman* was anchored at bow and stern. Weather, sea state conditions, and acoustic system settings were recorded. A tungsten carbide sphere (38.1 mm diameter) and a copper sphere (64 mm diameter) were suspended below the centerboard-mounted transducers. The tungsten carbide sphere was used to calibrate the 38, 120 and 200 kHz systems. The copper sphere was used to calibrate the 18 kHz system. After each sphere was centered on the acoustic axis, split beam target strength and echo integration data were collected. Transducer beam characteristics were modeled by moving each sphere through the acoustic beam while collecting target strength data using Simrad EKLOBES software.

Data Analysis

The abundance of pollock was estimated by combining echo integration and trawl data. Echosign that was identified as pollock was stored in a database, binned at 0.5 nmi horizontal by 20 m vertical resolution. Pollock length data from the 14 hauls that captured sufficient pollock (more than 75 individuals/haul) were combined into three length strata based on geographic proximity of hauls, and similarity in size composition data. Mean target strength per fish (dB) was estimated for each stratum by using the pollock target strength (TS) to length relationship (TS = 20 log FL – 66, where FL is fork length (cm); Traynor 1996). Mean fish weight-at-length was estimated from the trawl data when there were five or more pollock for that length; otherwise it was estimated from a linear regression of the natural logs of all the length and weight data. Numbers and biomass for each stratum were estimated as:

$$\text{Numbers} = \sum N_i = \sum \frac{\bar{s}_A \times A}{4 \times \pi \times 10^{\overline{TS_i}/10}}, \text{ for length } i, \text{ and}$$

$$\text{Biomass} = \sum \left(N_i \times \frac{\overline{W_i}}{1000} \right), \quad \text{metric tons,}$$

where N_i is numbers at length i, $\bar{s}_A$ (m^2/nmi^2, nautical area scattering coefficient, NASC; MacLennan et al. 2002) is echo integrated backscatter from pollock in the water column, A is length stratum area (nmi^2), $\overline{TS}_i$ is mean target strength (dB, per fish) of pollock for length i (cm), and $\overline{W}i$ is mean weight of individual fish (kg) for length i. Total biomass was estimated by summing the strata biomasses. Numbers and biomass at age were then estimated using an age-length key from the observed trawl haul data.

In the Bogoslof Island area, pre-spawning pollock aggregations are often densely packed and vertically and/or horizontally stratified by sex (Schabetsberger et al. 1999). Therefore it is not always possible to obtain an unbiased sample of lengths from these aggregations to estimate population size composition with the trawling equipment at hand. For example, if females are densely schooled across the top of the aggregation, the trawl haul may contain mostly females and few males even though males were abundant in lower layers. 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, the sample sex ratio was assumed to be 50:50 and the abundance was estimated 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 1). The EK500 38-kHz collection system showed no significant differences in gain parameters or transducer beam pattern characteristics before and after the Bogoslof Island area survey, thus confirming that the acoustic system was stable throughout the survey.

Oceanographic Conditions

Water temperature profiles at most of the trawl haul sites indicated a well-mixed water column with little variation in temperature between the surface and deeper waters. Temperatures in the upper 500 m of the water column ranged from about 3.6º to 4.5ºC and averaged 4.2ºC (Fig. 2). These were among the warmest temperatures observed over the last 6 years. Most trawl haul sites occurred where surface waters were warmer than 4.3ºC (Fig. 1). Between about 300 and 600 m depths, where pollock traditionally occur in Bogoslof, temperatures averaged between 3.6º and 4.1ºC. The coldest surface waters were observed at the two northwesterly haul locations (hauls 13 and 14).

Biological Sampling

Biological data and specimens were collected from 19 trawl hauls (Tables 2 and 3; Fig. 1). Walleye pollock dominated the trawl catches by weight (94.3%; Table 4). Pacific ocean perch (POP, *Sebastes alutus*) contributed 4% of the total catches by weight. Most POP were captured in trawl hauls 2 and 19 which targeted fish aggregations at the southern ends of transects 4 and 2, respectively. The catch composition (by weight) of haul 2 was 84% POP and 16% pollock; haul 19 was 66% POP and 27% pollock. Although only a minor component of the overall catch by weight, myctophids comprised most of the catch from hauls l3 and 14.

Length measurements ranging between 37 and 73 cm FL were collected from 4,095 pollock specimens (Table 3) to create the three length strata for scaling the acoustic data and computing

size-specific population estimates (Fig. 3). Stratum 1 "Unalaska" (hauls 2 and 19) pollock comprised relatively low-density aggregations adjacent to schools of POP along transects 1 through 4. Most pollock sampled in stratum 2 "Umnak" (hauls 3 to 5, 15 and 16) were between 40 and 50 cm in length. This represented high-density pollock aggregations off Cape Idak, Umnak Island, and lower density aggregations along the north side of the island (transects 5 through 11). Pollock length distributions in stratum 3 "Samalga" (hauls 6 to 12) were more uniform across the length range than in those in Umnak, and had higher proportions of larger fish at around 60 cm FL. This represented the Samalga Pass region (transects 12 through 22). Trawl catch sex ratios among hauls capturing more than 75 pollock ranged from 11% to 89% male. As we have observed in previous years, higher proportions of male pollock were captured in deeper layers of the water column (Fig. 4).

Maturity stage data and length-weight data were collected for 1,101 pollock specimens, and otoliths from 1,012 specimens (Table 3). The unweighted maturity composition for all pollock sampled showed that 63% of the female and 27% of the male pollock were in pre-spawning condition. One percent of the females and about 68% of the males were actively spawning. Pollock maturity composition by length stratum (Fig. 5a) indicated that a greater proportion of spawning males were captured in Umnak and Samalga than in Unalaska, and that a greater proportion of pre-spawning females were encountered in Samalga than elsewhere. These patterns were similar among trawl hauls in a stratum, regardless of exact timing of the haul. The average gonado-somatic index (GSI: ovary weight/body weight) for pre-spawning mature female pollock was 0.18 (Fig. 5b), 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 observed mean body weight to length relationship for sexes combined (Fig. 5c) was estimated directly from the data where more than five pollock were measured. For lengths where fewer than five pollock were weighed, mean weight at length was estimated by Weight (g) = .001609 * Fork Length (cm) $^{3.394077}$.

Pollock Distribution and Abundance

The spatial distribution of pollock in the survey area was similar to that observed in recent years (Fig. 6). Pollock were primarily concentrated just north of Samalga Pass at about 300-600 m below the surface. They were also concentrated along the shelf break at the northeast end of Umnak Island, off Cape Idak, between about 300 and 650 m below the surface, but were otherwise sparsely distributed within the Bogoslof area. The observed pollock biomass was more evenly split between Samalga and the Umnak-Unalaska area in 2005 than it was in recent year's surveys. In 2005, for example, 66% of the biomass was in the Samalga Pass area, in contrast to 2001, 2002, and 2003, when 76%, 74% and 84% of the biomass, respectively, was in Samalga.

The abundance estimate for pollock in the Bogoslof area was 225 million fish weighing 0.253 million metric tons (Tables 5, 6, 7, Figs. 7 and 8). This was the highest abundance estimated since the 2000 Bogoslof EIT survey. The size composition was bimodal (Figs. 7 and 9) with major modes at about 45 and 61 cm FL. The average fork length for the population was 51.2 cm, shorter than the 53 to 55 cm FL that have characterized the Bogoslof spawning pollock population since about 1997. Based on the 1D analysis, the relative estimation error of the abundance estimate was 16.7% (Table 5).

Age composition data from the 2002, 2003 and 2005 Bogoslof Island area surveys (Fig. 10) showed that average length at age was greater for females than males for most ages. After about age 11, Bogoslof pollock appear to grow very slowly with age. The estimated 2005 age composition (Tables 8 and 9, Fig. 11) illustrated relatively strong recruitment of the 2000, and secondarily, the 1999 year classes (45 cm length mode). The remainder of the population was a mixture of older fish, primarily from the 1996, 1989, and 1990 year classes (61 cm length mode).

DISCUSSION

The Bogoslof spawning pollock population has declined from 2.40 million t when it was first surveyed in 1988 to 0.25 million t in 2005 (Fig. 8). The decline has occurred even though

commercial fishing was terminated in this part of the U.S. Exclusive Economic Zone in 1992. Between 1988 and 2000 (in addition to fishing mortality prior to 1992), the decline was probably due to natural mortality of first the 1978 and then the 1989 year classes (Fig. 11). Since 2000, biomass has remained at a relatively low level, between 0.20 and 0.25 million t.

Results from the Bogoslof EIT survey time series suggest that this spawning population has been characterized by three periods, with reference to geographic distribution (Fig. 12), dominant year class (Figs. 9 and 11), and total biomass (Table 5, Fig. 8). In the first period, the earliest EIT surveys (1988-93), pollock covered a wide geographic area surrounding Bogoslof Island and the population was dominated by the 1978 year class. The average estimated biomass in the "specific area" was about 1.456 million t. During the second period, 1994-99, the primary spawning location shifted from near Bogoslof Island to inside Samalga Pass, and the population was dominated by the 1989 year class. The average estimated biomass declined to about 0.543 million t. During the third period, 2000-present, the primary spawning locations were Samalga Pass and to a lesser extent, northeast Umnak Island. Year-class dominance has alternated between the 1989 and younger year classes (1992, 1996, and 2000), and the average biomass is about 0.231 million t.

Winter 2005 marked the first major recruitment of the 2000 year class to the Bogoslof area. This year class was observed to be relatively strong on the Bering Sea shelf (Ianelli et al. 2004). At an estimated 81 million pollock (0.05 million t), the 2000 year class was more numerous in Bogoslof than most other 5-year old pollock cohorts in this time series, and was similar in numbers to the estimated 1989 year class at age 5 (Fig. 13). If peak recruitment occurs at 6 to 7 years old, as has been true throughout the EIT survey time series, than the 2000 year class has not yet reached its peak contribution level to the Bogoslof area.

The 2005 survey was also characterized by trawl haul catches of POP mixed with some pollock at the start of the survey off Unalaska Island. Pacific ocean perch have been caught in this area before during the summer Aleutian Islands bottom trawl survey (Zenger 2004). They had been encountered during previous Bogoslof EIT surveys, but until this year they had not been caught in

higher numbers than pollock in a trawl haul. Between the late 1990s and 2003, Bogoslof surveys have used approximately the same transects. In 2005, the location of the starting transect of the survey was randomized, so it is possible that a very localized area where POP aggregate was encountered for the first time in 2005.

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Table 1.--Simrad EK500 38 kHz acoustic system description and settings during the winter 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area and results from standard sphere acoustic system calibrations conducted before and after the survey.

		Calibrations		
	Survey system settings	10-Feb Three Saint's Bay, Alaska	8-Mar Captain's Bay, Alaska	3-Apr Ugak Bay, Alaska
Echosounder:	Simrad EK 500	--	--	--
Transducer:	ES38B	--	--	--
Frequency (kHz):	38	--	--	--
Transducer depth (m):	9.15	--	--	--
Absorption coefficient (dB/km):	10	--	--	--
Pulse length (ms):	1.0 (medium)	--	--	--
Band width (kHz):	3.8 (Wide)	--	--	--
Transmitted power (W):	2000	--	--	--
Angle sensitivity:	21.9	--	--	--
2-Way beam angle (dB):	-20.8	--	--	--
TS transducer gain (dB):	25.50	25.64	25.72	25.78
Sv transducer gain (dB):	25.43	25.66	25.50	25.53
3 dB beamwidth (deg)				
Along:	7.1	6.82	6.89	6.86
Athwart:	6.8	6.80	6.86	6.85
Angle offset (deg)				
Along:	0	-0.38	-0.36	-0.36
Athwart:	0	0.02	-0.02	0.00
Range (m):	1000	--	--	--
Post-processing Sv threshold (dB):	-70	--	--	--
Standard sphere TS (dB)	--	-42.22	-42.19	-42.18
Sphere range from transducer (m):	--	23.1	20.2	20.3
Water temp (^{o}C):				
at transducer:	--	4.6	4.2	4.1
at sphere:	--	5.3	4.5	4.1

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 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Haul	Gear	Date	Time	Duration	Start position		Depth (m)		Temp. (C)		Profile	Catch		
												Pollock		Other
No.	Type[1]	(GMT)	(GMT)	(minutes)	Latitude (N)	Longitude (W)	Footrope	Bottom	Gear[2]	Surface	No.	(kg)	Number	(kg)
1	AWT	8-Mar	12:00	10.7	53 52.21	167 13.11	340	589	4.6	4.1	301	9	11	7
2	AWT	8-Mar	19:08	8.9	53 39.18	167 30.05	367	375	4.4	4.1	302	76	88	395
3	AWT	9-Mar	2:44	21.2	53 33.56	167 38.20	453	581	4.6	3.9	303	747	952	30
4	AWT	9-Mar	6:04	2.8	53 34.10	167 47.00	375	608	4.7	4.1	304	443	474	9
5	AWT	9-Mar	13:54	1.9	53 37.32	167 55.06	467	794	4.6	4.1	305	829	752	9
6	AWT	10-Mar	19:02	10.1	53 07.22	169 02.53	398	542	4.5	4	306	363	196	2
7	AWT	10-Mar	20:38	8.7	53 09.19	169 02.54	583	668	4.4	3.6	307	1,099	1,011	4
8	AWT	11-Mar	13:13	20.5	53 04.54	169 27.52	375	736	4.5	4.1	308	172	97	3
9	AWT	11-Mar	16:26	8.7	53 02.09	169 10.54	558	770	4.6	3.8	309	2,210	2,148	12
10	AWT	11-Mar	19:06	9.2	53 01.43	169 10.54	508	738	4.5	3.8	310	1,037	917	5
11	AWT	11-Mar	21:12	4.3	53 02.58	169 07.60	405	444	4.7	3.9	311	5,250	2,814	-
12	AWT	11-Mar	23:51	3.8	53 06.42	169 03.14	444	605	4.6	3.8	312	1,002	696	2
13	AWT	12-Mar	8:01	30.0	53 24.09	169 53.18	321	1464	4.1	4.1	313	-	-	14
14	AWT	12-Mar	14:23	31.8	53 27.22	169 44.33	283	1482	-	4.1	314	-	-	22
15	AWT	12-Mar	22:27	4.7	53 37.51	167 53.51	521	807	-	3.8	315	661	1,085	35
16	AWT	13-Mar	1:04	11.8	53 36.00	167 47.37	475	920	-	-	316	439	606	42
17	AWT	13-Mar	4:35	28.4	53 41.56	167 30.16	454	851	4.7	4	317	43	54	22
18	AWT	13-Mar	6:49	15.1	53 41.12	167 30.02	388	768	4.5	4.1	318	24	24	29
19	AWT	13-Mar	11:05	28.4	53 53.38	167 11.40	304	366	4.5	4.3	319	87	84	231

[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 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Haul No.	Pollock Lengths	Pollock Weights and Maturity	Pollock Ovary weights	Pollock Otoliths	Tissue/Fluid samples	Seabird observations	Myctophid lengths	POP lengths
1	11	11	3	11	-	y	15	-
2	88	88	42	88	-	y	-	123
3	313	80	11	80	y	y	14	-
4	275	80	22	80	-	y	14	-
5	273	66	51	66	y	y	-	-
6	196	64	54	63	-	y	25	-
7	417	75	24	75	y	y	22	-
8	97	62	45	62	-	-	22	-
9	413	75	31	75	-	y	18	-
10	421	86	26	86	-	y	-	-
11	295	52	34	52	-	y	-	-
12	395	60	6	60	-	y	-	-
13	-	-	-	-	-	-	41	-
14	-	-	-	-	-	-	22	-
15	387	79	28	79	-	y	-	-
16	352	81	17	81	-	y	55	-
17	54	54	28	54	-	y	-	-
18	24	24	2	-	-	-	-	-
19	84	64	22	-	-	y	-	-
Totals	4095	1101	446	1012			248	123

Table 4.--Catch by species from 19 midwater trawl hauls during the winter 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area.

Species name	Scientific name	Weight (kg)	Percent by weight	Number
walleye pollock	*Theragra chalcogramma*	14,489.28	94.3	12,009
Pacific ocean perch	*Sebastes alutus*	616.51	4.0	625
northern lampfish	*Stenobrachius leucopsarus*	68.42	0.4	5,759
brokenline lampfish	*Lampanyctus jordani*	48.16	0.3	1,760
unidentified squid	Teuthoidea (order)	26.46	0.2	296
unidentified lanternfish	Myctophidae (family)	21.64	0.1	1,993
chinook salmon	*Oncorhynchus tshawytscha*	19.27	0.1	12
northern smoothtongue	*Leuroglossus schmidti*	15.71	0.1	2,082
shortraker rockfish	*Sebastes borealis*	10.99	0.1	1
smooth lumpsucker	*Aptocyclus ventricosus*	10.05	0.1	5
giant grenadier	*Albatrossia pectoralis*	9.40	0.1	2
jellyfish unident.	Scyphozoa (class)	5.78	<0.1	117
California headlightfish	*Diaphus theta*	4.10	<0.1	305
Pacific lamprey	*Lampetra tridentata*	3.83	<0.1	9
arrowtooth flounder	*Atheresthes stomias*	3.59	<0.1	9
unidentified sea anemone	Actiniaria (order)	1.71	<0.1	2
unidentified shrimp	Decapoda (order)	1.66	<0.1	679
eulachon	*Thaleichthys pacificus*	1.58	<0.1	32
viperfish unident.	Chauliodontidae (family)	1.27	<0.1	51
popeye grenadier	*Coryphaenoides cinereus*	0.73	<0.1	3
unidentified snailfish	Elassodiscus sp.	0.71	<0.1	1
robust blacksmelt	*Bathylagus milleri*	0.15	<0.1	6
slender barracudina	*Lestidiops ringens*	0.09	<0.1	3
bluethroat argentine	*Nansenia candida*	0.07	<0.1	1
unidentified dreamer	Oneirodes sp.	0.04	<0.1	2
unidentified fish larvae	Osteichthyes (class)	0.02	<0.1	4
unidentified fish	Osteichthyes (class)	0.02	<0.1	3
Total		15,361.24		25,771

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 2005.

	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
2004	--	No survey	--	--	--
2005	0.253	3,112	16.7	0.253	16.7

Table 6.--Numbers-at-length estimates (millions) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency. Lengths are in centimeters.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
10	0	0	--	0	0	0	0	<1	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
12	0	0	--	0	0	0	0	1	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
14	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0
15	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
17	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
19	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
21	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
23	0	0	--	2	0	0	0	0	0	0	0	0	0	0	<1	0	--	0
24	0	0	--	1	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
26	0	0	--	<1	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
28	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
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	<1	0	--	0
31	0	0	--	0	<1	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
33	0	0	--	0	<1	0	0	0	0	0	0	0	0	0	<1	<1	--	0
34	0	0	--	0	0	0	0	<1	<1	0	<1	0	0	0	<1	<1	--	0
35	0	0	--	0	0	0	0	<1	0	<1	0	0	0	0	<1	0	--	0
36	0	0	--	0	<1	0	0	<1	<1	<1	<1	0	0	0	1	0	--	0
37	9	3	--	<1	0	0	0	<1	<1	<1	<1	0	0	0	1	<1	--	<1
38	6	0	--	2	<1	1	0	1	1	<1	1	0	0	<1	1	<1	--	1
39	16	4	--	5	0	2	<1	4	1	1	3	<1	<1	<1	2	<1	--	2
40	24	3	--	7	1	4	3	12	4	1	7	1	<1	1	3	<1	--	7
41	27	4	--	19	3	5	6	20	8	2	9	6	1	1	4	<1	--	11
42	48	23	--	23	7	7	9	40	14	3	11	8	1	1	2	<1	--	12
43	118	33	--	31	14	6	14	40	17	4	11	13	3	1	5	1	--	11
44	179	54	--	36	18	7	21	41	21	5	10	13	3	2	5	2	--	11
45	329	159	--	46	28	8	21	50	23	7	9	17	4	4	7	3	--	13
46	488	177	--	55	32	13	21	53	31	10	11	19	5	4	5	5	--	11
47	547	389	--	79	42	22	18	40	36	14	9	14	6	5	9	5	--	11
48	476	434	--	130	68	28	17	55	36	15	12	11	6	5	7	7	--	10
49	389	431	--	168	102	46	16	47	37	18	15	10	5	6	6	6	--	8
50	248	366	--	205	129	69	39	52	40	21	20	16	6	7	5	7	--	8
51	162	279	--	189	144	76	46	58	45	24	23	11	8	6	5	4	--	9
52	80	168	--	160	118	73	52	78	52	26	28	20	10	7	4	4	--	7

Table 6. Continued.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
53	48	85	--	122	106	73	49	81	52	26	35	17	13	7	6	4	--	7
54	19	50	--	63	67	66	43	88	53	31	41	21	16	8	7	3	--	7
55	12	13	--	40	41	50	37	81	48	28	38	33	21	12	9	5	--	8
56	4	5	--	17	27	29	26	69	40	24	35	38	20	13	12	7	--	6
57	3	8	--	8	13	14	17	58	37	22	30	33	24	17	13	7	--	7
58	1	1	--	4	6	9	10	47	28	17	27	36	23	15	14	10	--	6
59	0	0	--	1	5	3	6	31	19	13	18	23	16	13	12	9	--	8
60	0	0	--	1	1	1	3	17	12	12	13	15	13	11	12	13	--	7
61	2	0	--	1	<1	1	2	7	6	6	8	18	10	9	8	9	--	9
62	0	0	--	<1	<1	<1	1	4	2	3	5	13	7	6	6	7	--	7
63	0	0	--	0	0	0	<1	2	1	1	3	4	4	4	4	5	--	7
64	0	0	--	0	1	<1	0	1	<1	1	1	3	2	3	3	5	--	5
65	0	0	--	<1	0	0	0	<1	<1	<1	1	1	1	1	1	3	--	4
66	0	0	--	0	0	0	0	<1	0	<1	1	<1	<1	1	1	1	--	2
67	0	0	--	0	0	0	0	0	0	0	0	1	<1	<1	<1	1	--	2
68	0	0	--	0	0	0	0	1	0	0	<1	0	<1	<1	<1	<1	--	1
69	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	0	<1	--	<1
70	0	0	--	0	0	0	0	0	0	0	0	0	0	<1	<1	0	--	<1
71	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1
72	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1
73	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	<1
Total	3,236	2,687	--	1,419	975	613	478	1,081	666	337	435	416	229	171	181	134	--	225

Table 7.--Biomass-at-length estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency. Lengths are in centimeters.

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
10	0	0	--	0	0	0	0	<1	0	0	0	0	0	0	0	0	--	0
11	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0	--	0
12	0	0	--	0	0	0	0	5	0	0	0	0	0	0	0	0	--	0
13	0	0	--	0	0	0	0	2	0	0	0	0	0	0	0	0	--	0
14	0	0	--	0	0	0	0	1	0	0	0	0	0	0	0	0	--	0
15	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
17	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
19	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
21	0	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	--	0
23	0	0	--	70	0	0	0	0	0	0	0	0	0	0	38	0	--	0
24	0	0	--	61	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
26	0	0	--	26	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
28	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
30	0	0	--	0	0	0	0	0	0	0	0	0	0	0	7	0	--	0
31	0	0	--	0	37	0	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	--	0
33	0	0	--	0	48	0	0	0	0	0	0	0	0	0	9	2	--	0
34	0	0	--	0	0	0	0	53	35	0	29	0	0	0	48	2	--	0
35	0	0	--	0	0	0	0	93	0	29	0	0	0	0	73	0	--	0
36	0	0	--	0	68	0	0	42	96	18	32	0	0	0	204	0	--	0
37	3,199	846	--	115	0	0	0	113	109	84	92	0	0	0	456	16	--	39
38	2,304	0	--	768	84	260	0	435	465	173	395	0	0	19	508	6	--	323
39	6,365	1,461	--	1,843	0	634	202	1,697	562	507	1,250	258	168	149	823	7	--	942
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	--	3,143
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	--	5,257

Table 7.--Continued

Length	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
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	--	6,158
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	--	6,318
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	--	6,398
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	--	8,145
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	--	8,122
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	--	8,682
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	--	7,934
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	--	7,115
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	--	7,453
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	--	9,035
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	--	7,711
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	--	8,074
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	--	8,735
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	--	11,061
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	--	8,930
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	--	9,814
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	--	9,735
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	--	13,976
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	--	13,186
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	--	16,771
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	--	13,268
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	--	14,025
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	--	10,001
65	0	0	--	938	0	0	0	495	578	1,096	1,156	1,833	1,660	2,730	2,463	7,281	--	9,033
66	0	0	--	0	0	0	0	163	0	329	1,251	403	534	1,132	1,515	3,582	--	5,120
67	0	0	--	0	0	0	0	0	0	0	0	863	520	715	583	1,954	--	5,161
68	0	0	--	0	0	0	0	2,570	0	0	276	0	403	426	777	746	--	2,157
69	0	0	--	0	0	0	0	0	0	0	0	0	0	55	0	391	--	933
70	0	0	--	0	0	0	0	0	0	0	0	0	0	100	61	0	--	381
71	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	99
72	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	118
73	0	0	--	0	0	0	0	0	0	0	0	0	0	0	0	0	--	109
Total	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	--	253,459

Table 8.--Numbers-at-age estimates (millions) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency.

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

Table 9.--Biomass-at-age estimates (metric tons) from February-March echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. No surveys were conducted in 1990 or 2004. The 1999 survey was conducted by the Japan Fisheries Agency.

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
0	0	0	--	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	0	0	--	0
2	0	0	--	170	0	0	0	0	0	0	0	0	0	0	40	0	--	0
3	0	0	--	0	162	284	0	681	0	0	0	0	0	0	4,598	4	--	0
4	0	2,184	--	715	782	18,809	13,028	3,411	322	87	78	1,809	324	437	2,551	7,084	--	3,176
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	2,004	5,348	--	52,268
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	34,118	6,229	--	25,162
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	10,107	26,066	--	13,540
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	8,993	12,179	--	14,542
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	8,020	6,085	--	28,927
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	9,149	8,361	--	10,152
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	12,298	7,257	--	5,999
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	22,821	18,366	--	9,132
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	47,965	14,288	--	7,966
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	14,573	47,035	--	9,890
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	12,209	11,354	--	20,887
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	14,701	8,207	--	24,633
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	8,186	5,448	--	11,130
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	6,112	10,134	--	8,390
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	3,425	1,804	--	5,338
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	2,545	782	--	1,464
21	0	0	--	1,341	15,240	10,167	8,866	5,433	4,023	1,885	5,376	3,574	1,566	0	0	1,820	--	425
22	0	0	--	0	3,186	1,329	2,011	7,728	1,974	947	1,078	2,668	1,810	0	0	0	--	0
23	0	0	--	0	1,287	598	2,323	6,696	661	419	0	514	0	493	470	0	--	0
24	0	0	--	0	0	0	860	2,758	0	888	0	0	526	493	572	0	--	437
25	0	0	--	0	0	0	0	0	0	0	0	0	0	0	255	0	--	0
Total	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	225,712	197,851	--	253,459

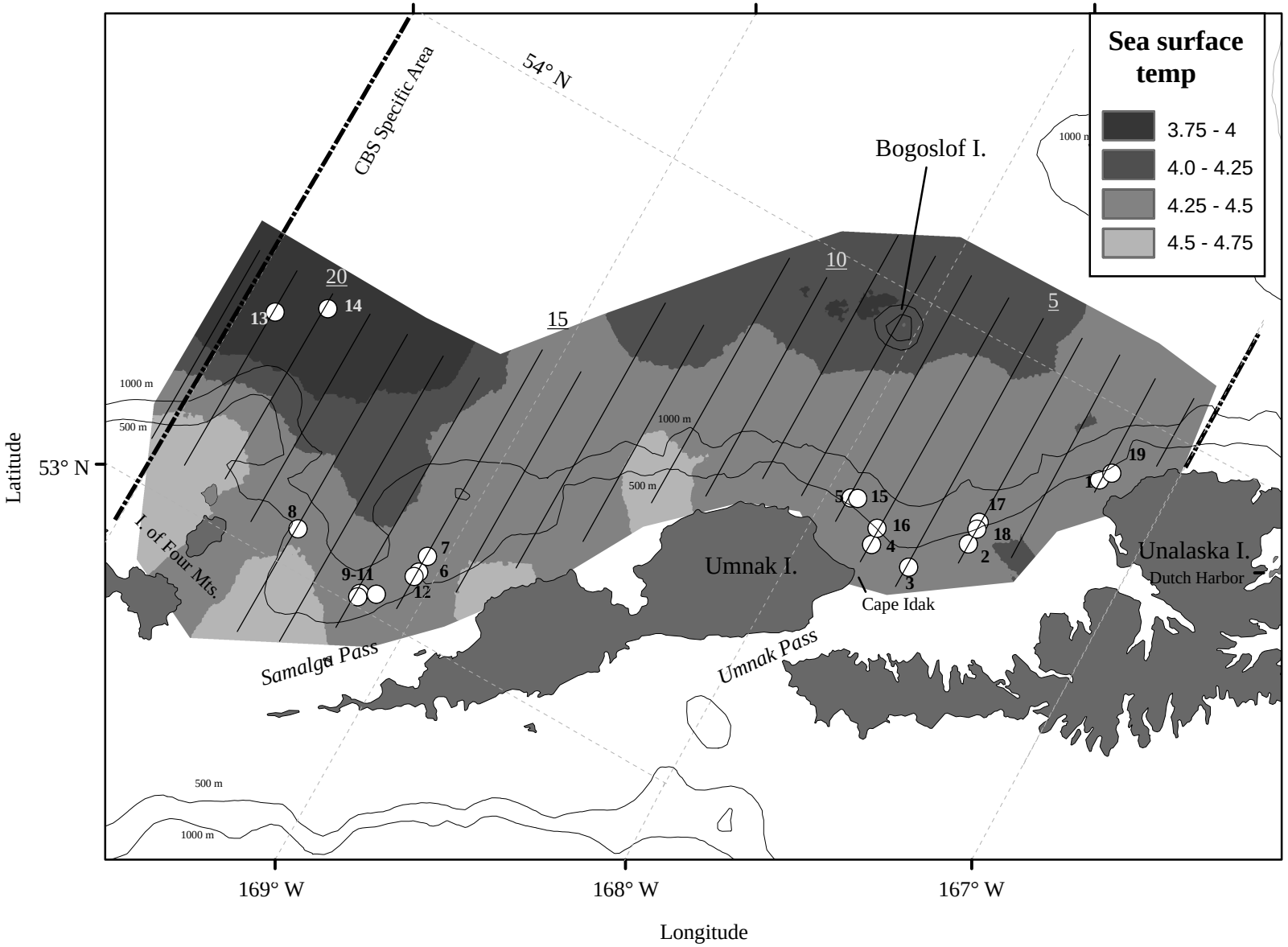

Figure 1.--Transects, haul locations, and contours (°C) of sea surface temperature measurements taken during the winter 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area. Hauls are indicated by circles. Transect numbers are underlined. The dash-dotted line indicates the Central Bering Sea Specific Area.

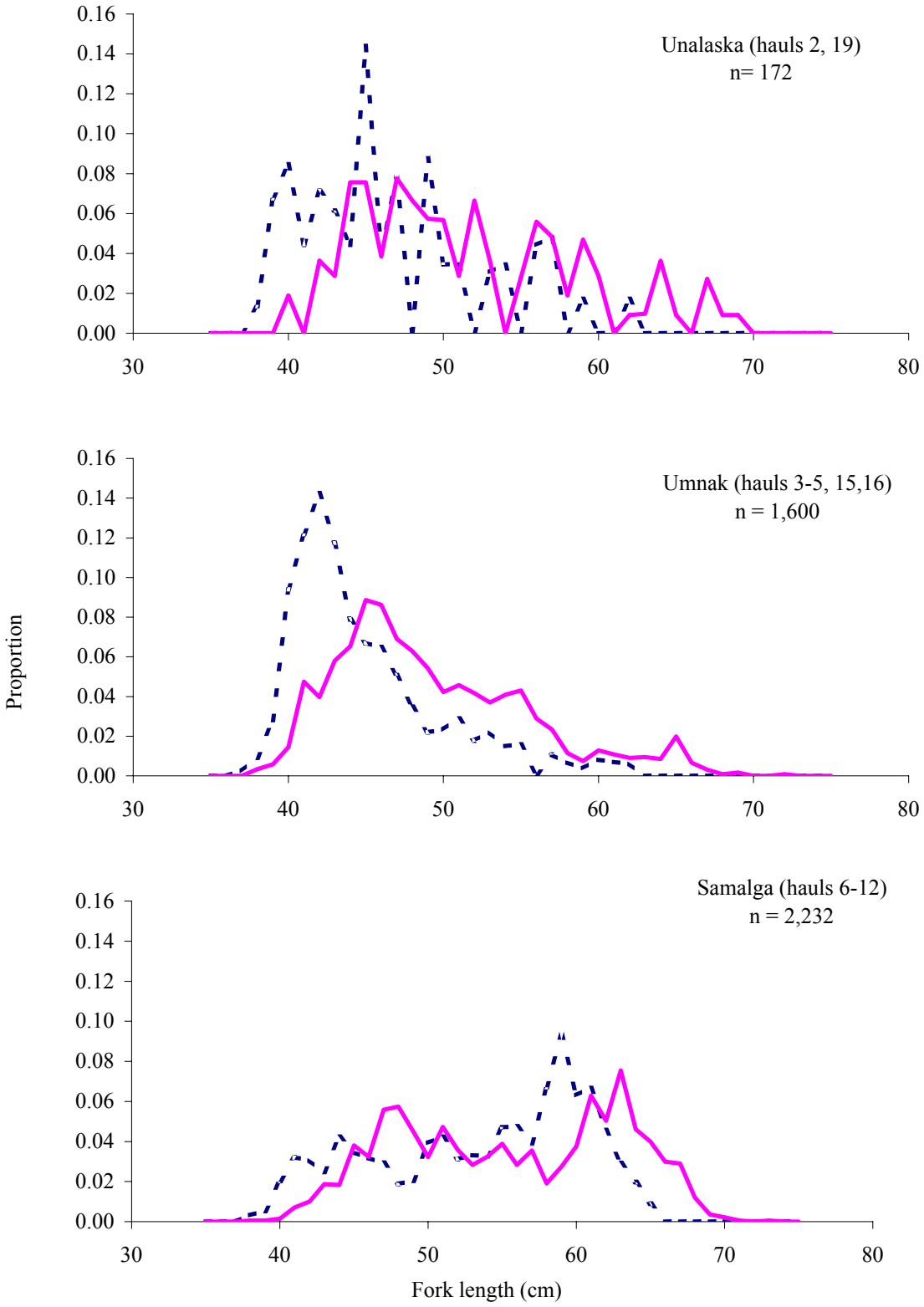

Figure 3.-- Pollock proportion at length (males: dashed line, females: solid line) for strata 1-3 during the winter 2005 echo integration-trawl survey of the Bogoslof Island area.

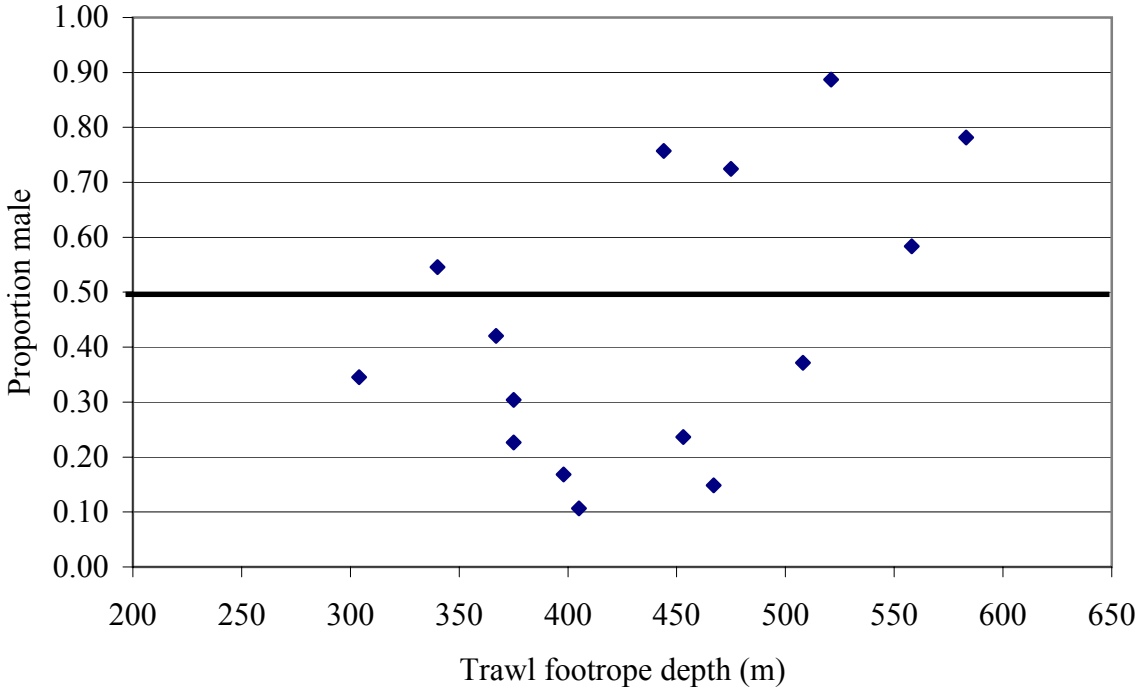

Figure 4.--Average footrope depth (m) and the proportion male observed in the random length sample for each trawl haul in which at least 75 pollock were captured, from the 2005 echo integration-trawl survey of the Bogoslof Island area.

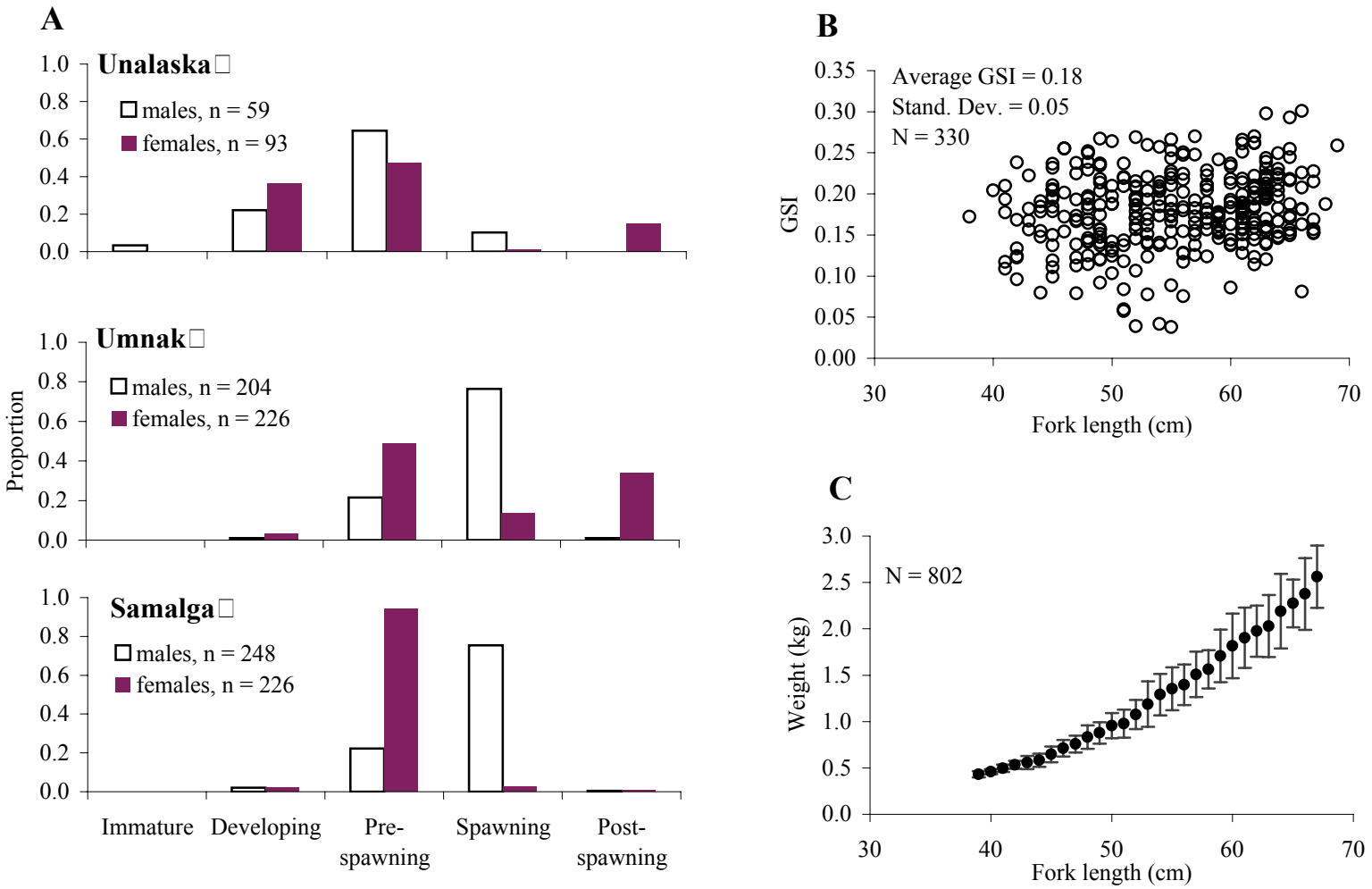

Figure 5.--Pollock maturity stages for strata 1-3 (A), gonado-somatic index (GSI) for pre-spawning females as a function of fork length (cm) (B), and mean weight at length, where at least five fish were measured (sexes combined) (C) observed during the winter 2005 echo integration-trawl survey of the Bogoslof Island area. Vertical bars indicate one standard deviation.

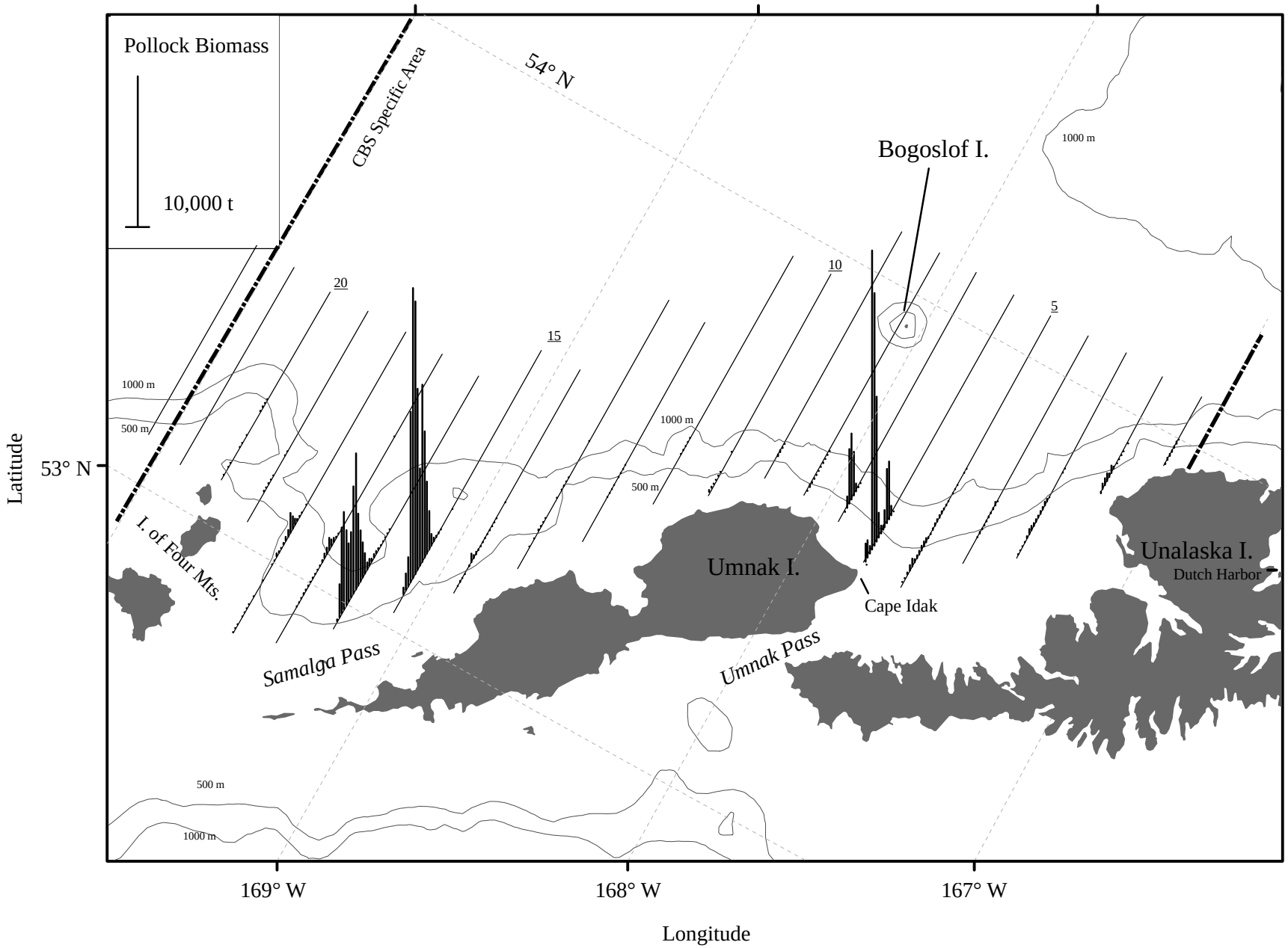

Figure 6.--Pollock biomass in metric tons (t) along tracklines from the winter 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area. The Central Bering Sea Specific Area is indicated by dash-dotted line.

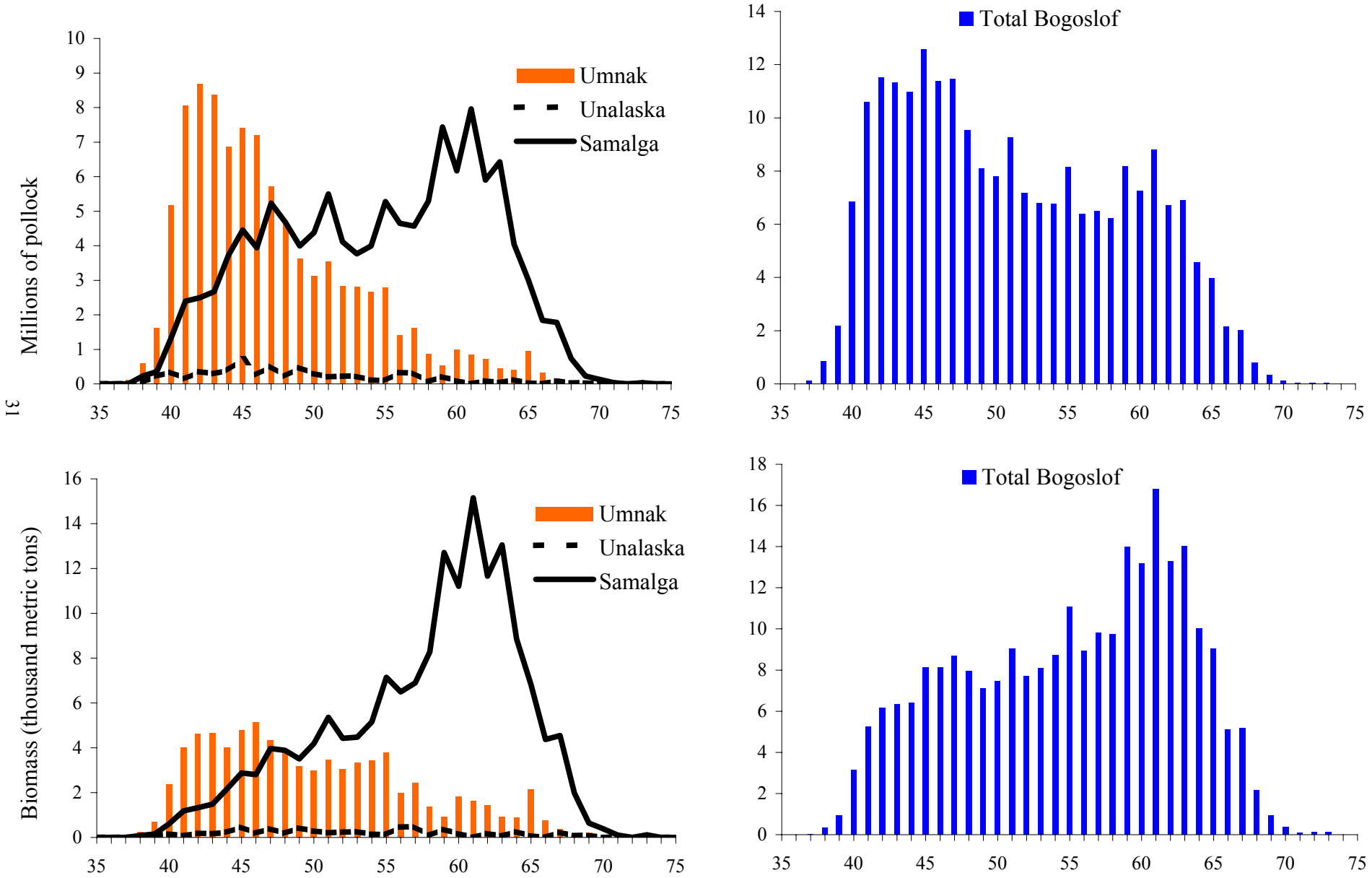

Figure 7.--Population at length (top) and biomass at length (bottom) estimates from the winter 2005 echo integration-trawl survey of walleye pollock in the Bogoslof Island area. Note Y-axis differences.

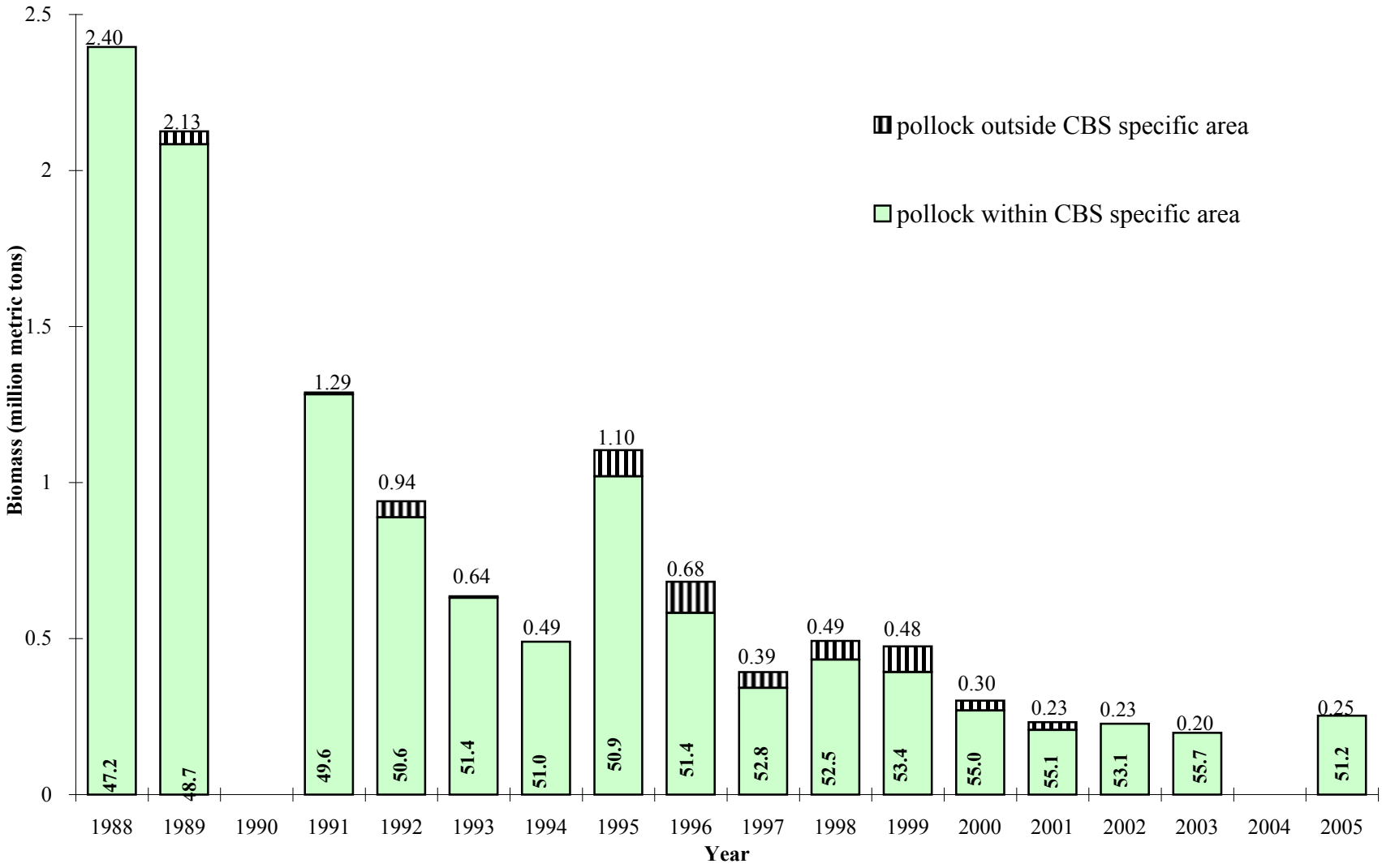

Figure 8.--Biomass estimates and average fork lengths obtained during winter echo integration-trawl surveys for walleye pollock in the Bogoslof Island area, 1988-2005. The United States conducted all but the 1999 survey, which was conducted by Japan. There were no surveys in 1990 or 2004. Total pollock biomass for each survey year is indicated on top of each bar and average fork length (cm) is indicated inside each bar.

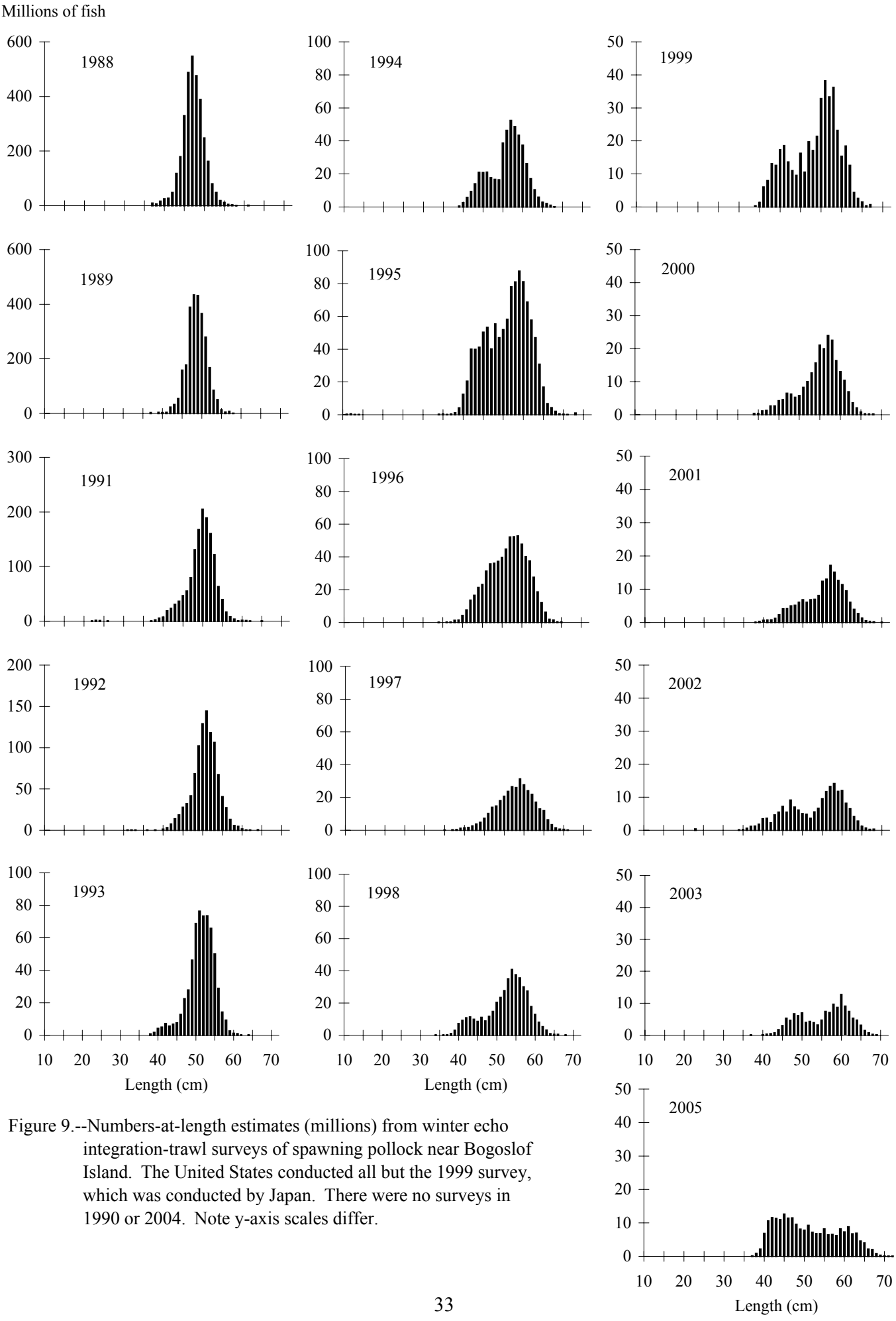

Figure 9.--Numbers-at-length estimates (millions) from winter echo integration-trawl surveys of spawning pollock near Bogoslof Island. The United States conducted all but the 1999 survey, which was conducted by Japan. There were no surveys in 1990 or 2004. Note y-axis scales differ.

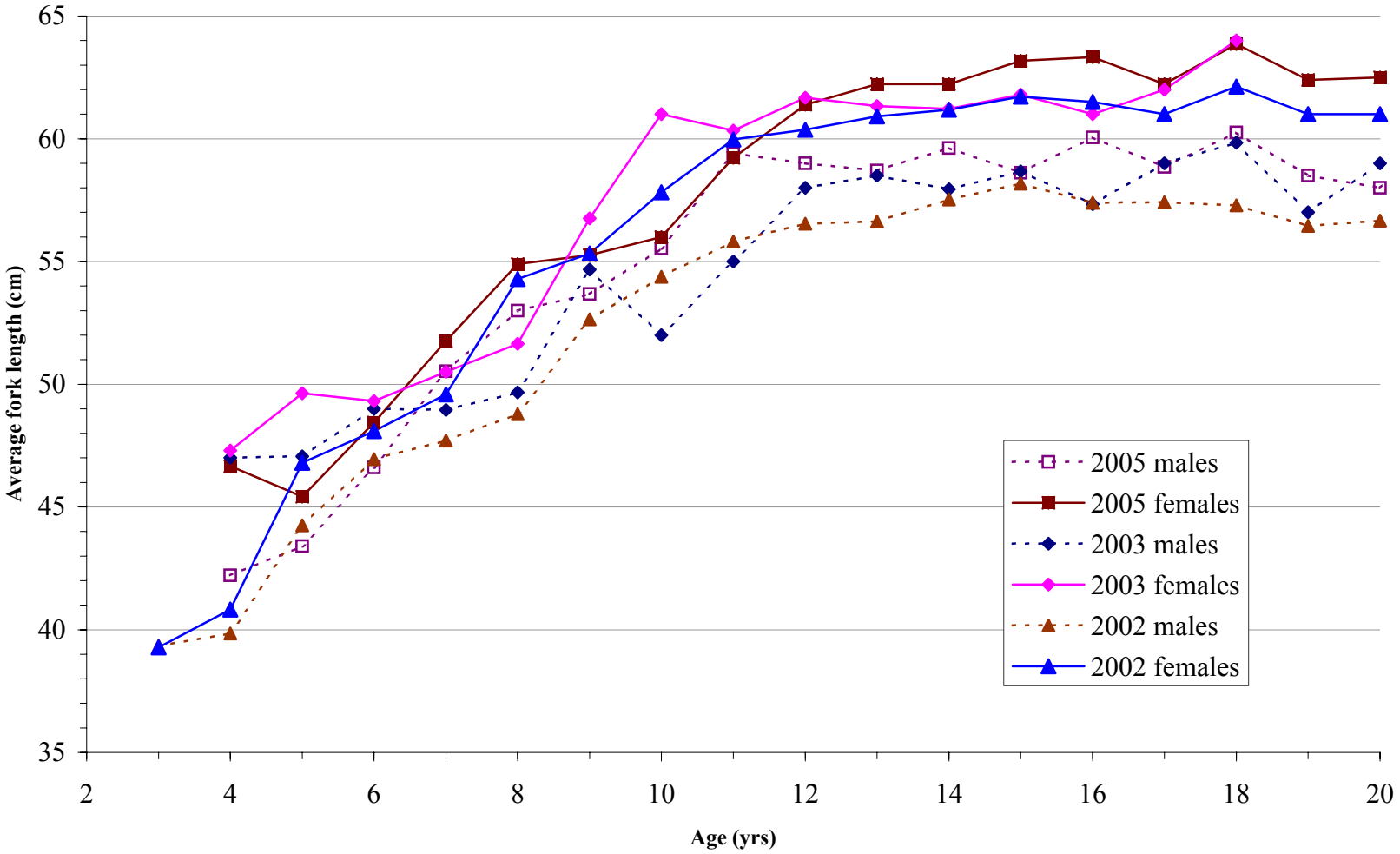

Figure 10.--Average length at age for pollock from the winter 2002, 2003 and 2005 echo integration-trawl surveys of the Bogoslof Island area.

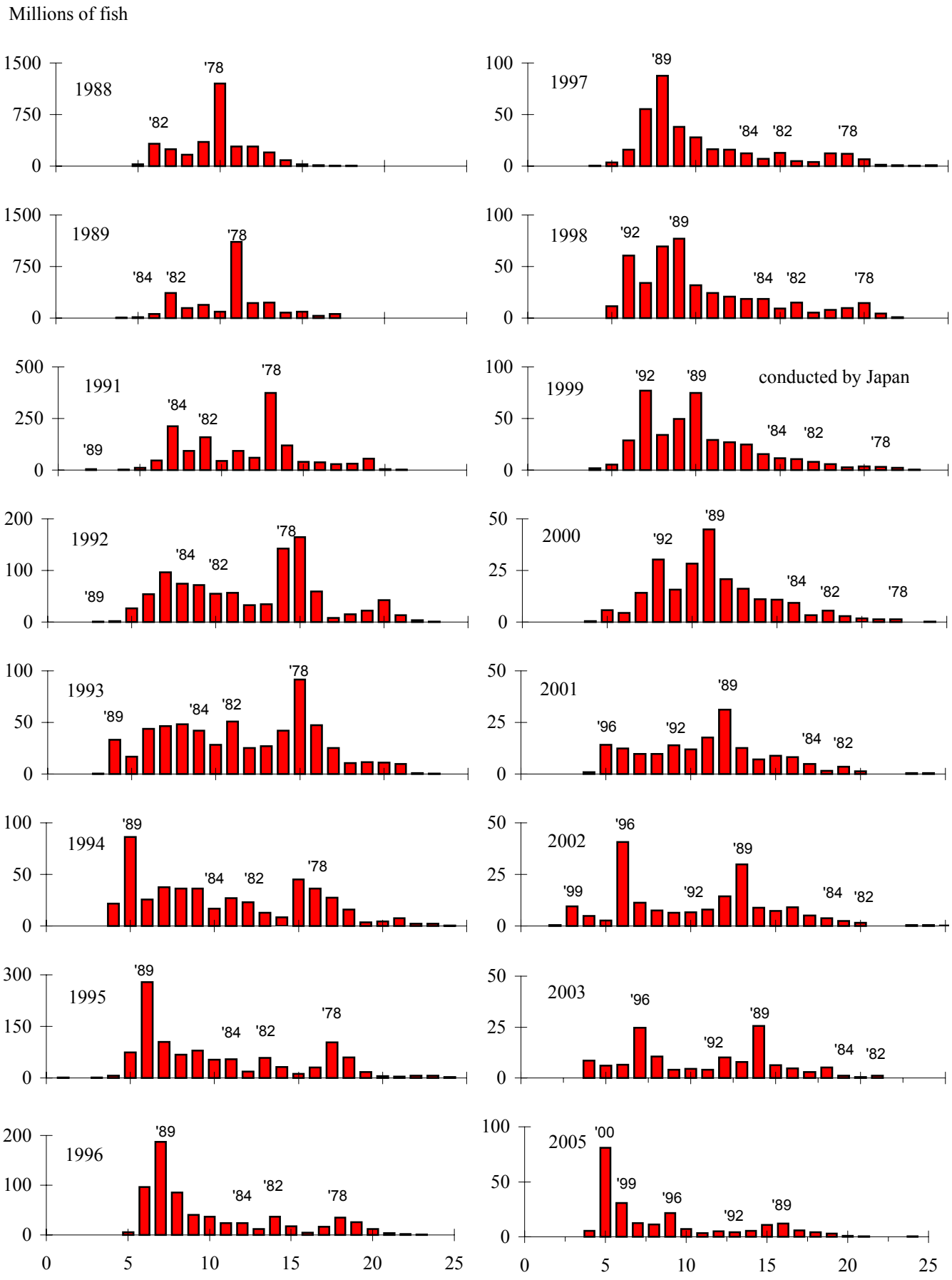

Figure 11.--Numbers-at-age estimates (millions) from echo integration-trawl surveys of pollock near Bogoslof Island. Major year classes on the E. Bering Sea shelf are indicated. No surveys were conducted in 1990 or 2004.

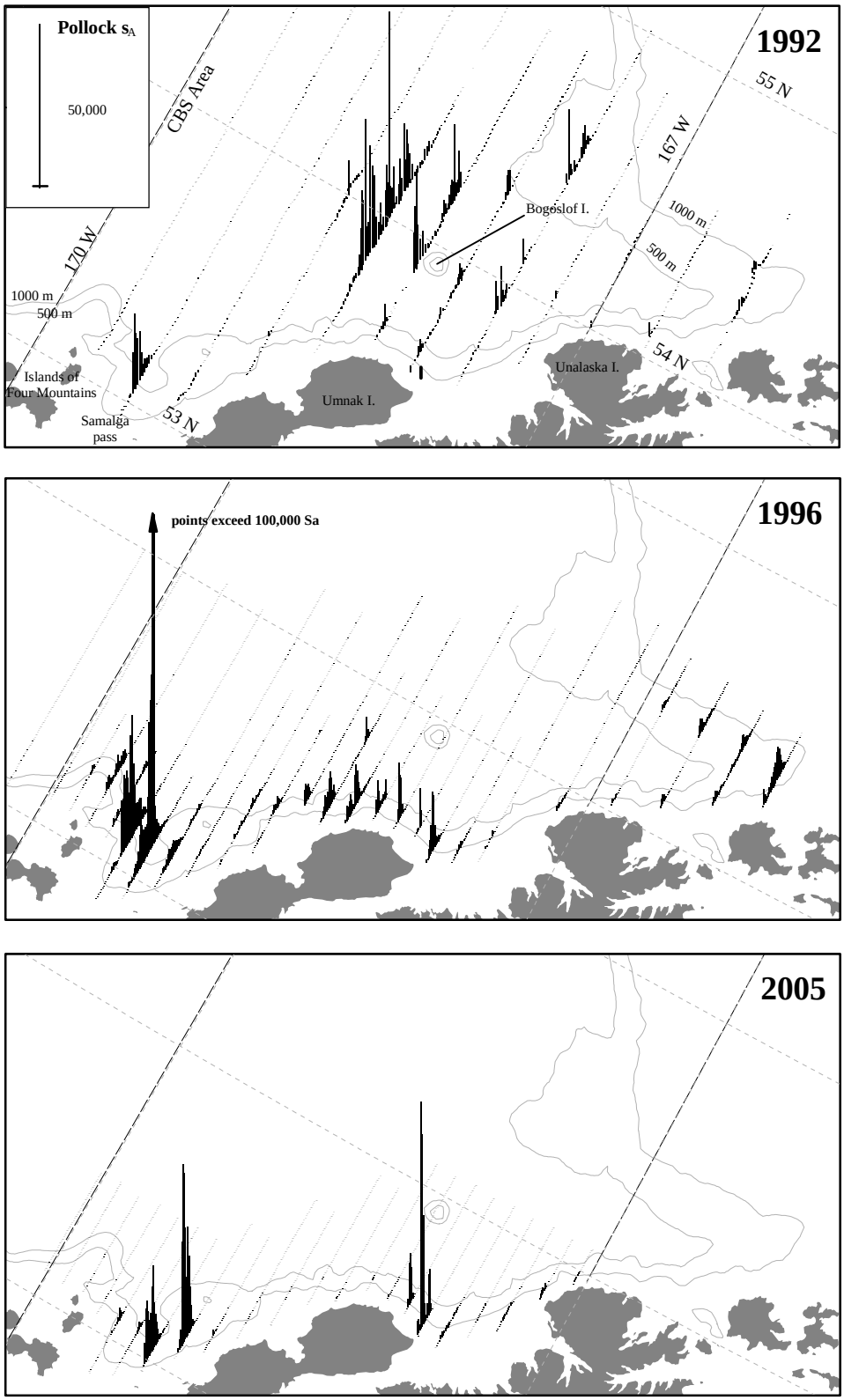

Figure 12.-- Pollock backscatter (s_A) along tracklines from three winter echo integration-trawl surveys of the Bogoslof Island area. The Central Bering Sea specific area is indicated by dash-dotted lines.

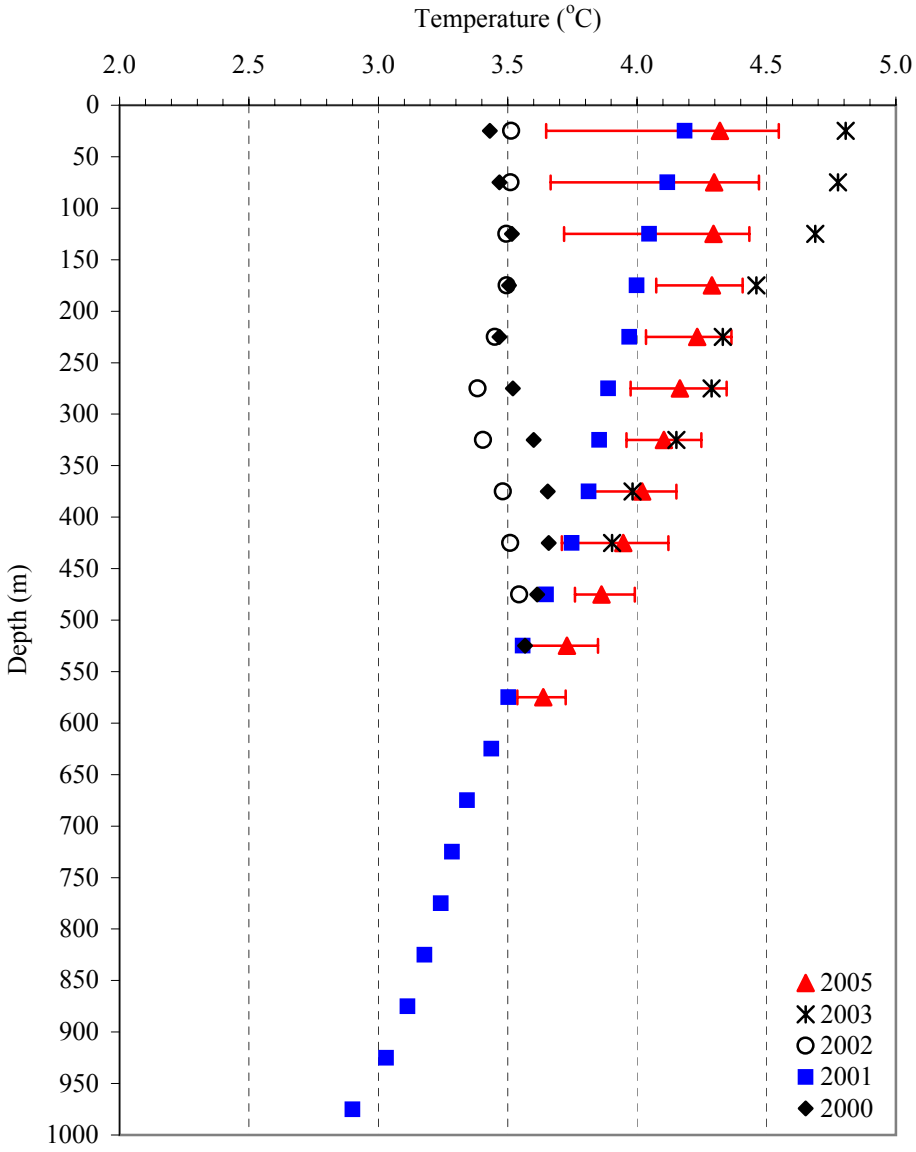

Figure 2.--Average temperature (°C) (symbols) by 50-m depth intervals observed during the winter 2000-2003, and 2005 echo integration-trawl surveys of walleye pollock in the Bogoslof Island area. The horizontal bars represent temperature range observed during the 2005 survey. Note: Temperature data from the 2003 survey were collected from only three locations.

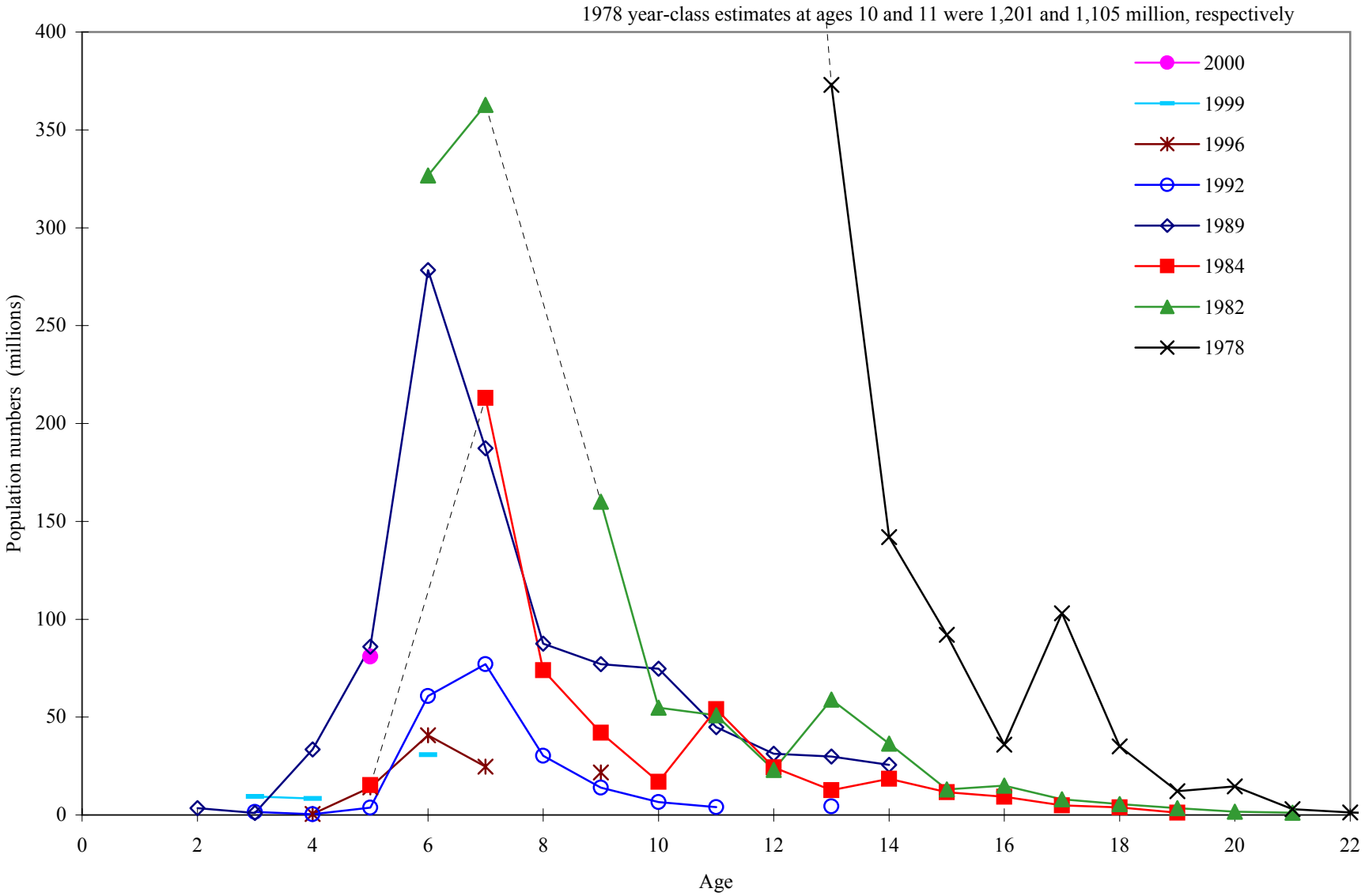

Figure 13.--Estimated population numbers at age for dominant year classes observed in winter echo integration-trawl surveys of Bogoslof Island area spawning pollock. Data are from surveys conducted between 1988 and 2005. The United States conducted all but the 1999 survey, which was conducted by Japan. No surveys were conducted in 1990 (dashed lines) or 2004.