Walleye Pollock (*Theragra chalcogramma*) midwater abundance on the eastern Bering Sea shelf and slope during June-July, 1999

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Schedule

Jun 7-11	Embark scientists in Kodiak; sphere calibration in Ugak Bay, Alaska. Transit to Bering Sea.. Equipment tests.
Jun 12-Jul 3	Echo integration-trawl survey of the EBS shelf (transects 1-18).
Jul 4-5	Inport Dutch Harbor.
Jul 6-Aug 4	Sphere calibrations in Captains Bay. Continue echo integration-trawl survey of the EBS shelf (transects 19-29). Echo integration-trawl survey of the "horseshoe area."
Aug 5	Inport Dutch Harbor.

Methods

Scientists of the Alaska Fisheries Science Center conducted an echo integration-trawl (EIT) survey of walleye pollock (*Theragra chalcogramma*) on the eastern Bering Sea shelf June 12-July 29 aboard the NOAA ship *Miller Freeman*. The survey design consisted of north-south transects spaced 20 nmi apart (except in the "horseshoe" area where transects 9-12 were lengthened and spacing was 10 nmi) and proceeded from east to west starting at longitude 160° 20' W and ending at longitude 178° 55' W. Acoustic data were collected continuously along transects between sunrise and sunset; night operations were devoted mainly to collecting pollock target strength data and Methot trawl sampling for age-0 pollock/zooplankton. Biological samples of echosign across the Bering Sea shelf comprised 98 midwater, 14 bottom, 4 Marinovich, and 48 Methot trawls. We obtained water temperature profiles at each haul location and other select locations, as well as continuous surface thermosalinograph data.

Preliminary Results

Pollock acoustic backscatter (from 14 m below the surface to within 0.5 m of the bottom) was absent or very low in the east, but then increased around 165° W northwest of Unimak Island. Pollock backscatter was lower between 166°-167° W and then increased again, remaining relatively continuous from about 168° W westward to the U.S./Russia border. The highest pollock concentrations were at approximately 173° W and 177° W (Figure 1). West of the Pribilof Islands, pollock were rarely found in water shallower than 100 m bottom depths. In

1999, the center of pollock distribution was southward and slightly westward from that of previous years, and more pollock were found in the Pribilof Island area (Figures 1-4). Thermosalinograph data indicated that surface water temperatures were cool (Figure 5) relative to previous years. Bottom temperatures were much lower in 1999 than in 1998 (Figures 6-7[1]). Vertical distribution of echosign (Figure 8) weighted by total acoustic return, averaged about 63% off bottom (10 m off to the surface) and 37% near bottom (0.5 m to 10 m off bottom). Pollock captured in midwater/bottom trawls ranged from 9-79 cm in length. Adult pollock (>=30 cm in length) were found throughout the shelf; most smaller fish (<30 cm) were encountered north of the Pribilofs, and again west of 172° W and south of about 60° 30' N (Figures 9 and 10). Pollock smaller than 20 cm (age 1 pollock) were only occasionally captured. East of the Pribilofs, pollock modal lengths were 36, 47, and 25 cm; west of the Pribilofs modal lengths were smaller--30, 45, and 22 cm, respectively (Figure 11).

Estimated EBS shelf pollock abundance between the surface and 3 m off-bottom was 3.35 million tons and 9.7 million fish for the total survey area, including extended transects in the horseshoe area. Of this, about 11 % (0.36 million t), was located in the Critical Habitat (CH) area, 17 % (0.58 million t) was east of 170° W outside of the CH, and 72 % (2.41 million t) was west of 170° W. These percentages were similar to what we observed in surveys during 1994, '96, and '97. Matching the 1999 area surveyed to that surveyed in 1994, 96, and 97--i.e. excluding extra horseshoe-area transect sections added in 1999-- estimated pollock biomass was 3.29 million tons, and 9.6 billion pollock. Estimates of pollock biomass and abundance at age will be added to this analysis as soon as the ageing results from 1999 become available.

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[1] Contour plots of bottom temperature data provided by T. Sample, AFSC, Seattle, from the 1999 and 1998 Bering Sea groundfish bottom trawl surveys.

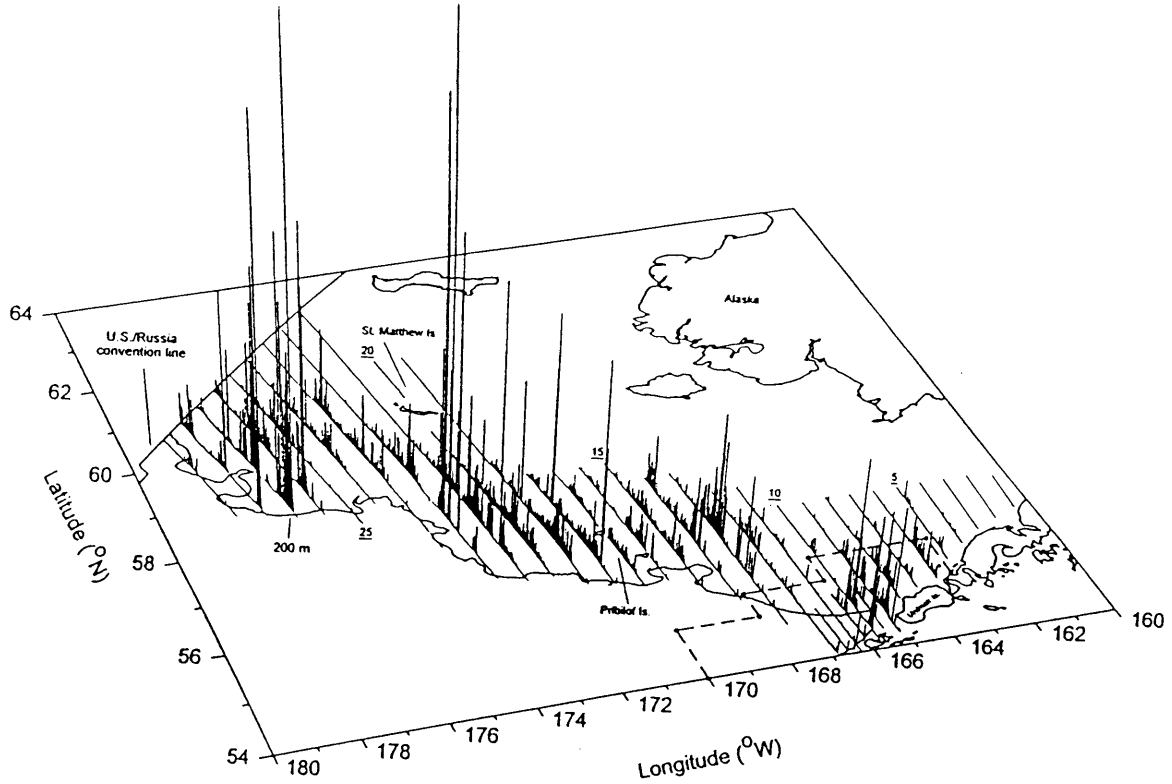


Figure 1. Pollock acoustic backscatter along trackline during the summer 1999 acoustic-trawl survey of the eastern Bering Sea shelf. Transect numbers are underlined, and the Critical Habitat area is outlined.

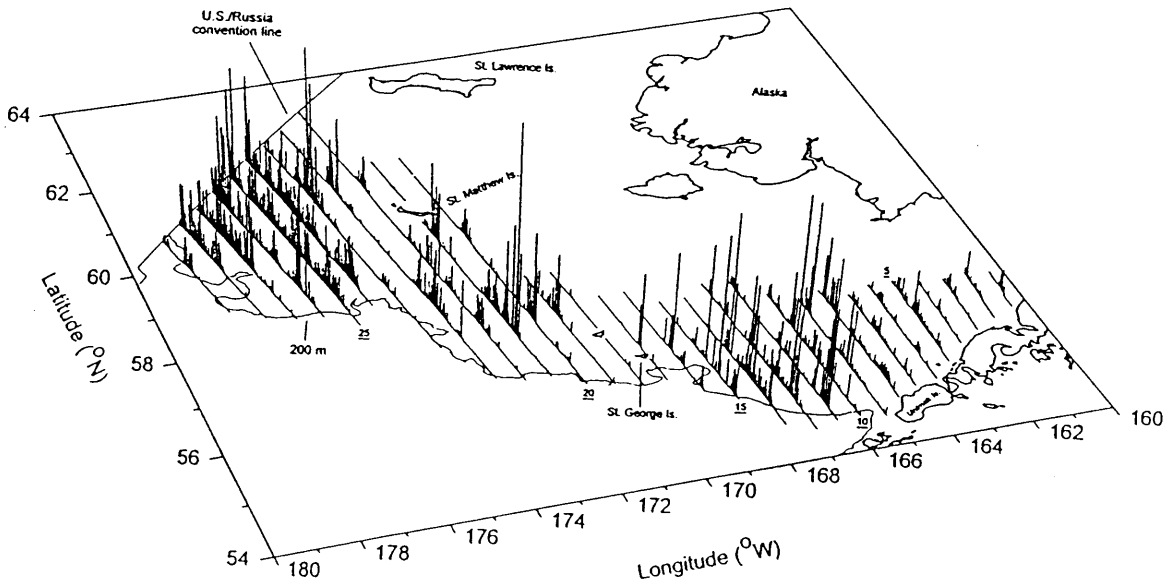


Figure 2 Pollock acoustic backscatter along trackline during the summer 1997 acoustic-trawl survey of the eastern Bering Sea shelf. Transect numbers are underlined.

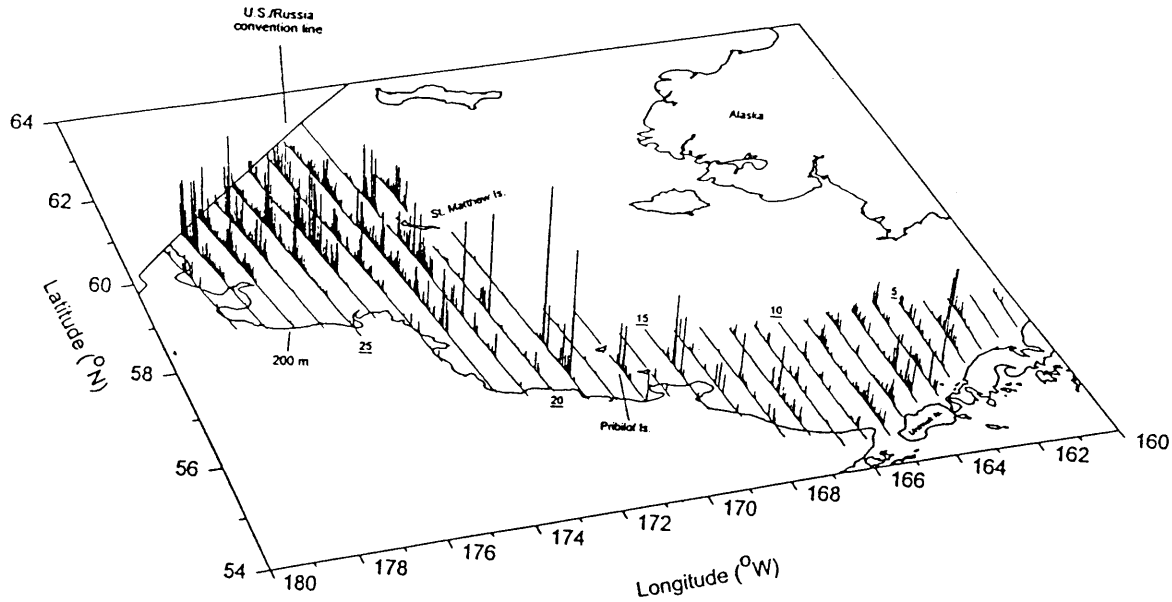


Figure 3 Pollock acoustic backscatter along trackline during the summer 1996 acoustic-trawl survey of the eastern Bering Sea shelf. Transect numbers are underlined.

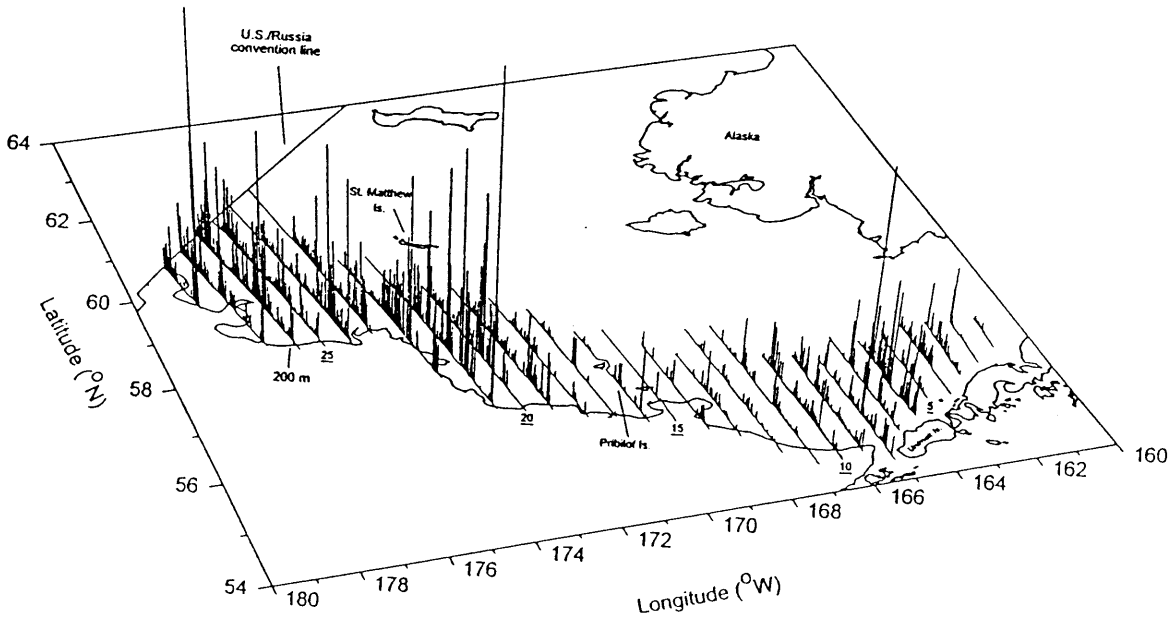


Figure 4 Pollock acoustic backscatter along trackline during the summer 1994 acoustic-trawl survey of the eastern Bering Sea shelf. Transect numbers are underlined.

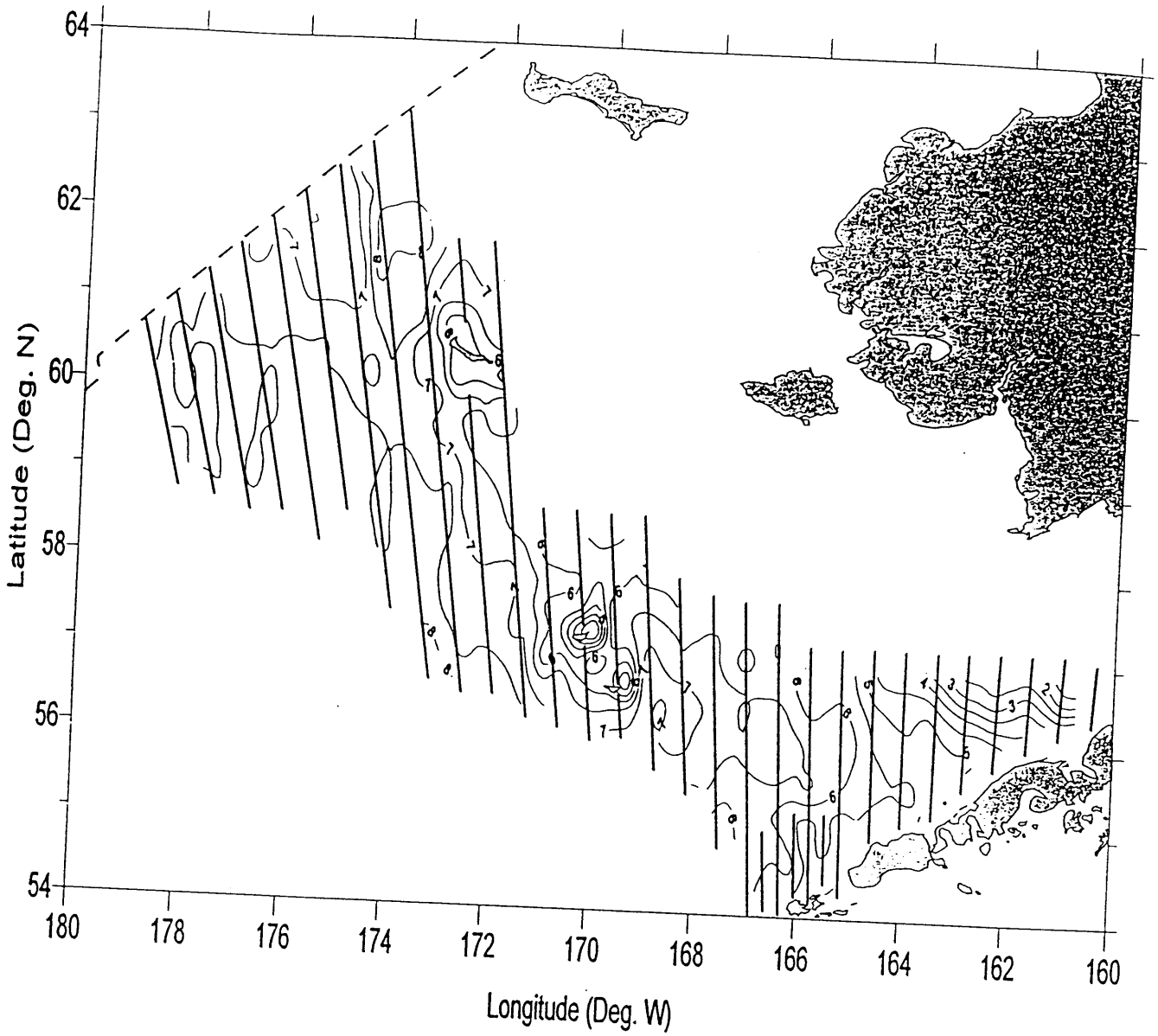


Figure 5 Transect lines with surface temperature contours (in degrees C) during the summer 1999 acoustic-trawl survey of the eastern Bering Sea shelf.

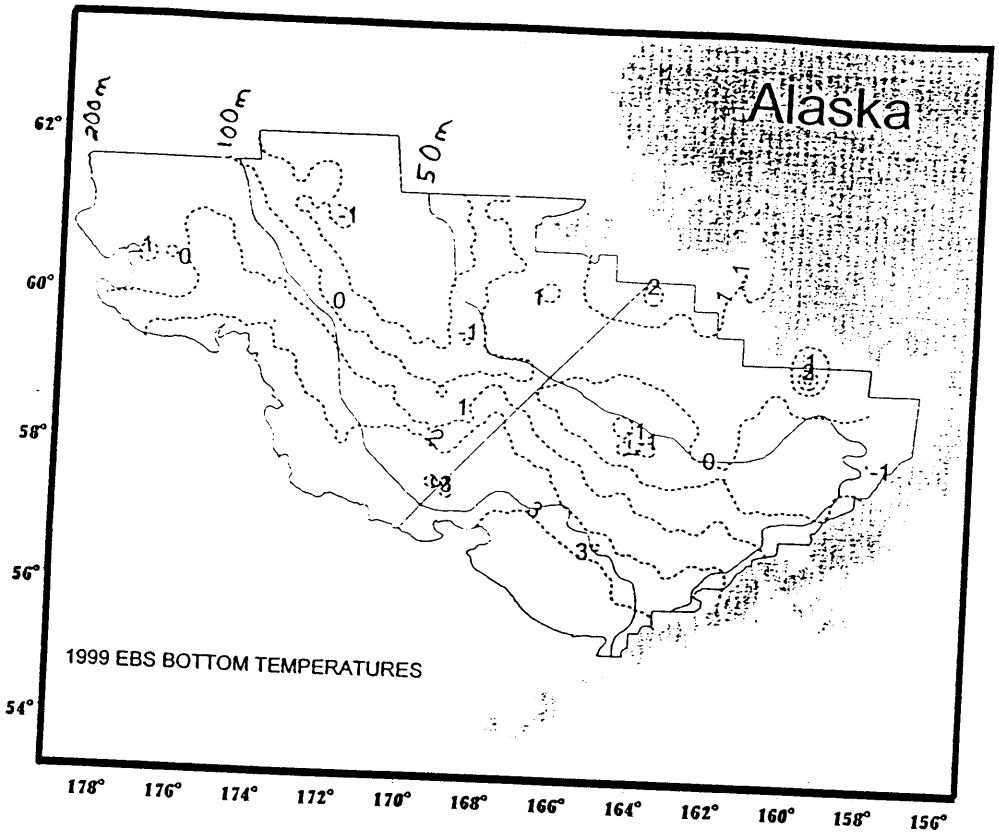


Figure 6 1999 EASTERN BERING SEA BOTTOM TEMPERATURES

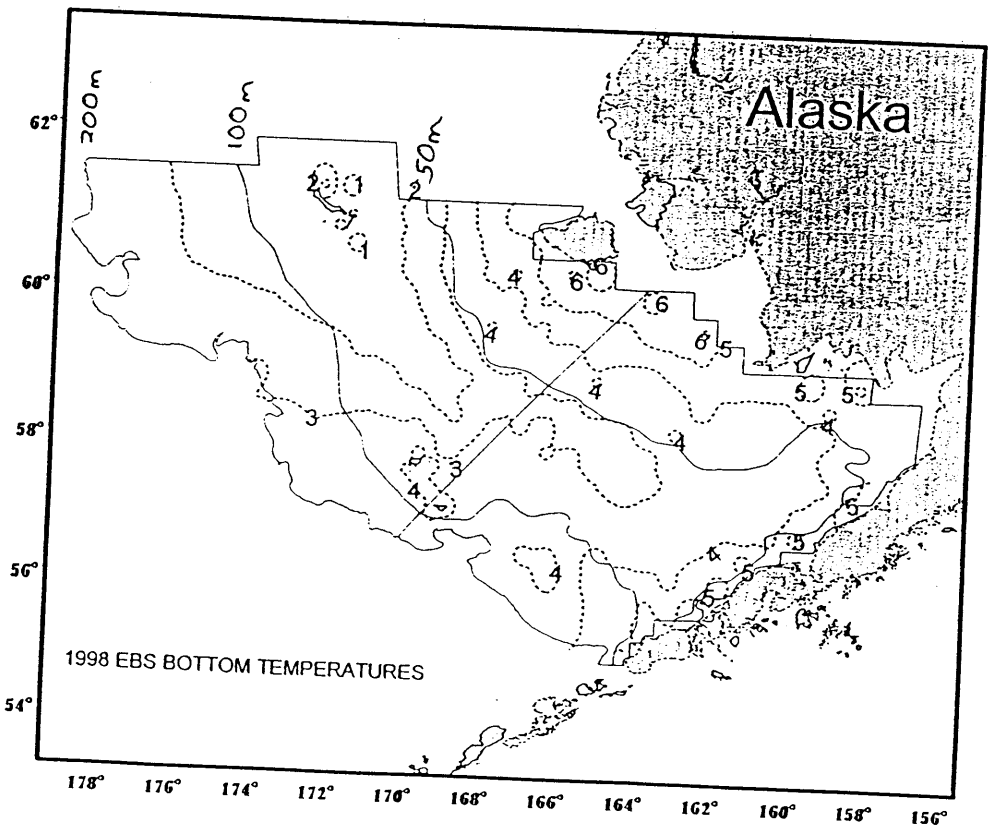


Figure 7

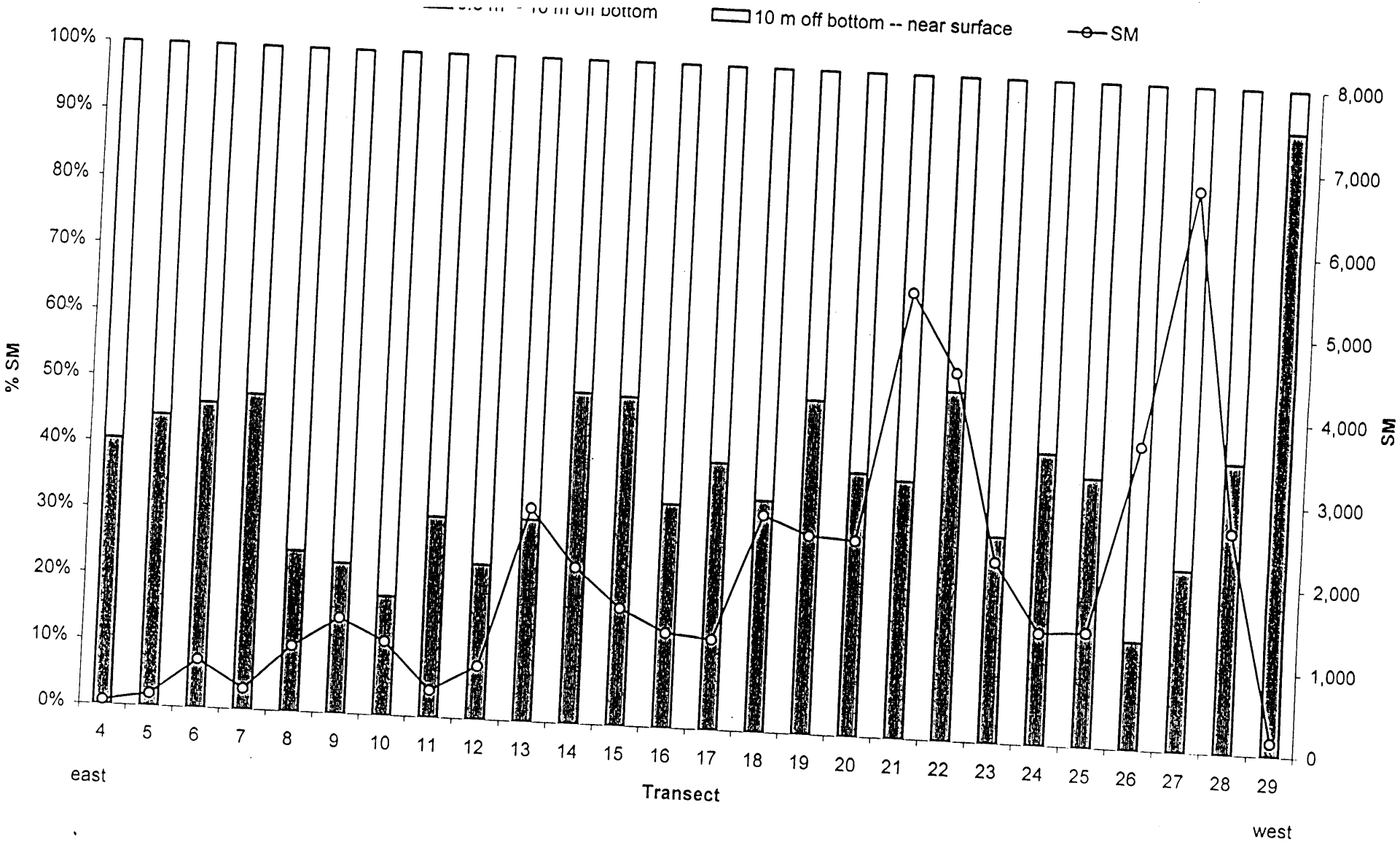


Figure 8. Vertical distribution of pollock acoustic return (% SM) and total pollock acoustic return (SM) by transect during the summer 1999 acoustic-trawl survey of the eastern Bering Sea shelf. No pollock acoustic return was detected in transects 1-3.

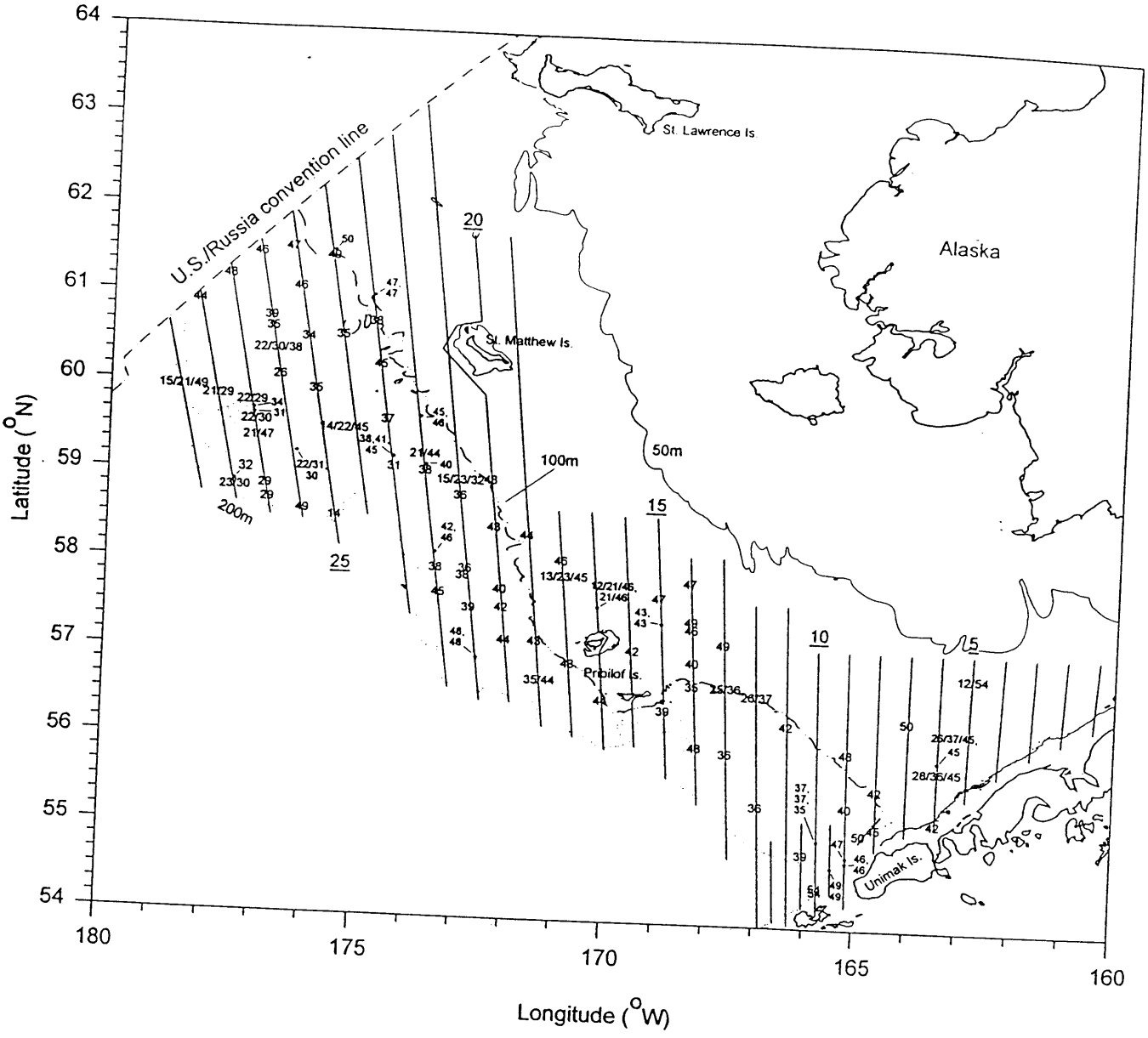


Figure 9. Transect lines with trawl haul average lengths (single value) or length modes (e.g., 14/22/45) during the summer 1999 pollock echo integration-trawl survey of the eastern Bering Sea shelf and slope, MF99-09. Haul locations where pollock numbered < 50 were excluded.

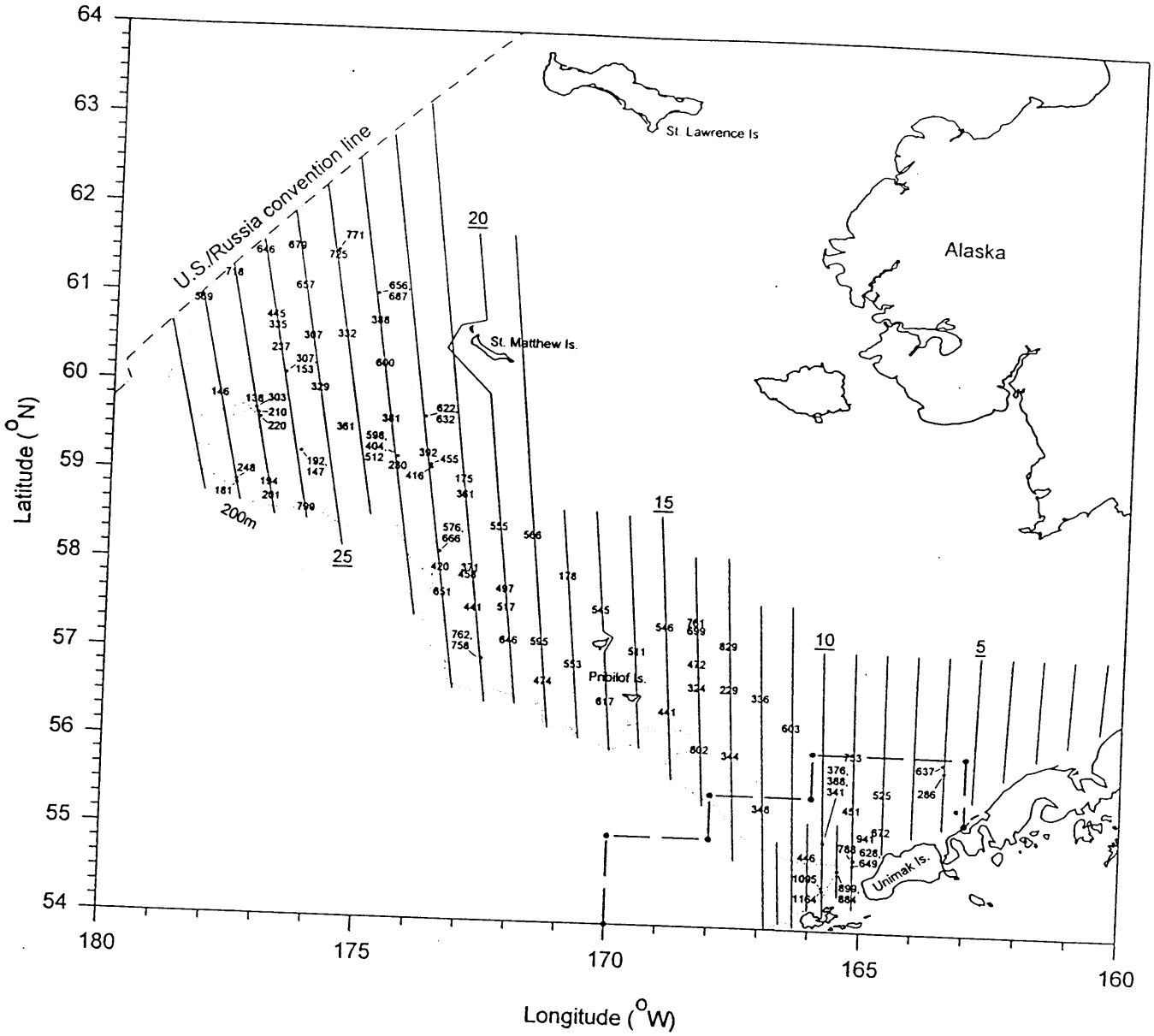
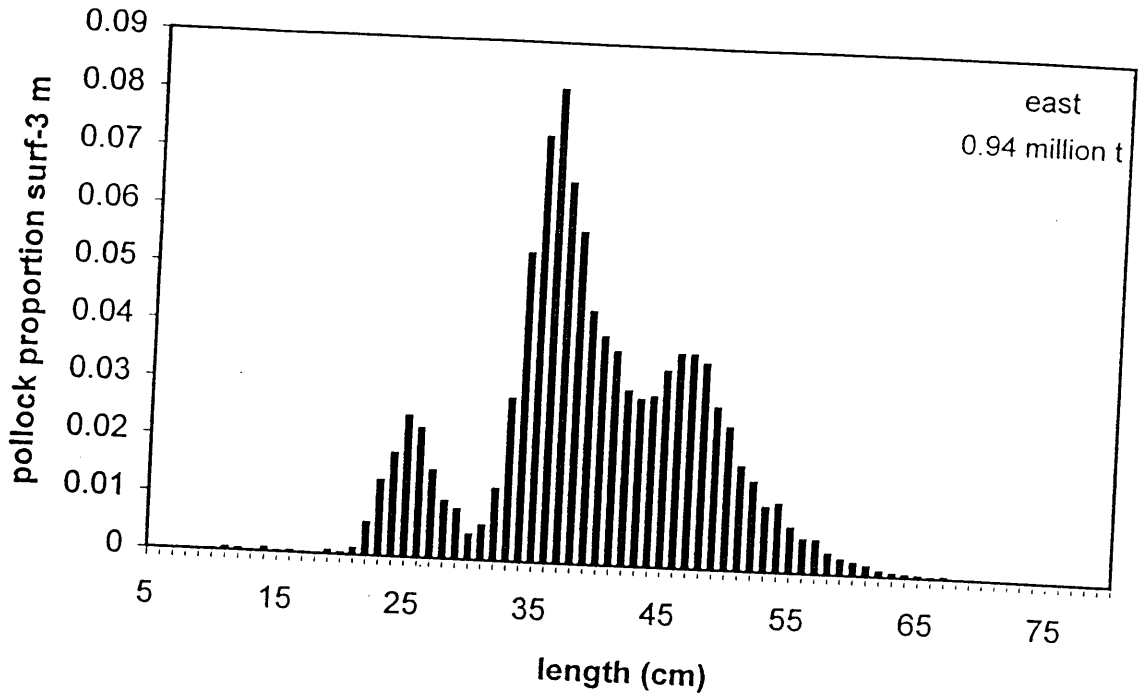


Figure 10. Average pollock weight (g) caught at midwater trawl haul locations during the summer 1999 acoustic-trawl survey of the eastern Bering Sea shelf. Haul locations where pollock numbered less than 50 were excluded. Transect numbers are underlined, and the Critical Habitat area is outlined.



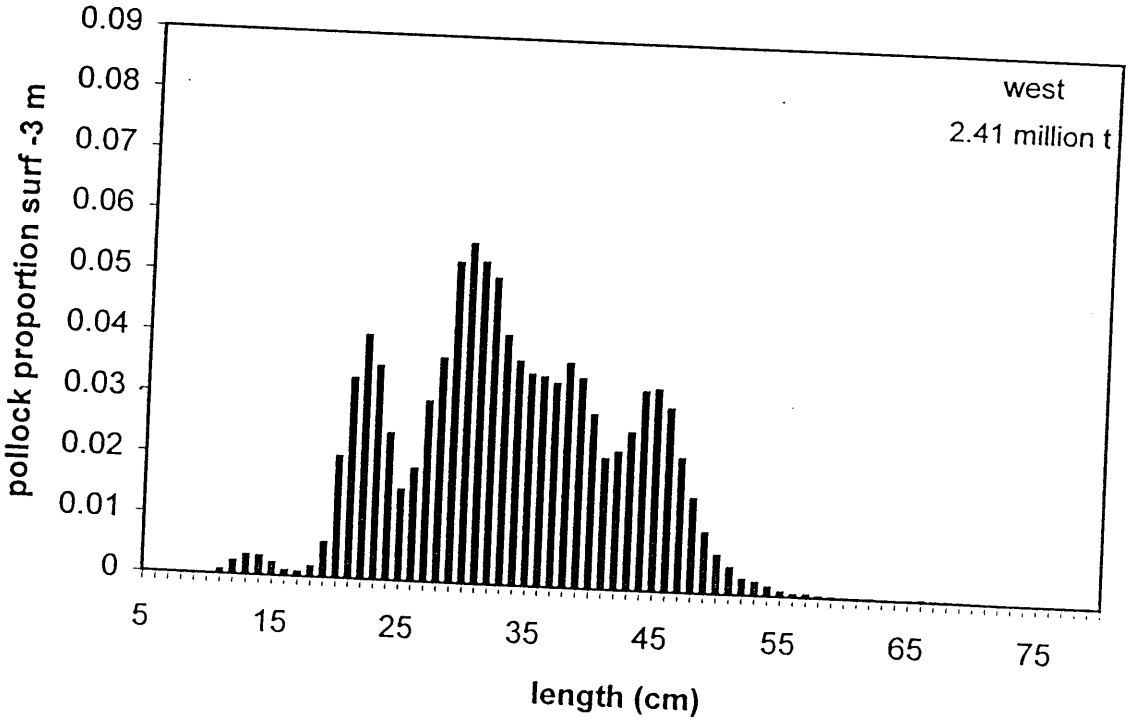


Figure 11. Proportion of pollock east (top) and west (bottom) of 170 W between the surface and 3 m off-bottom from the summer 1999 acoustic-trawl survey of the Bering Sea shelf.

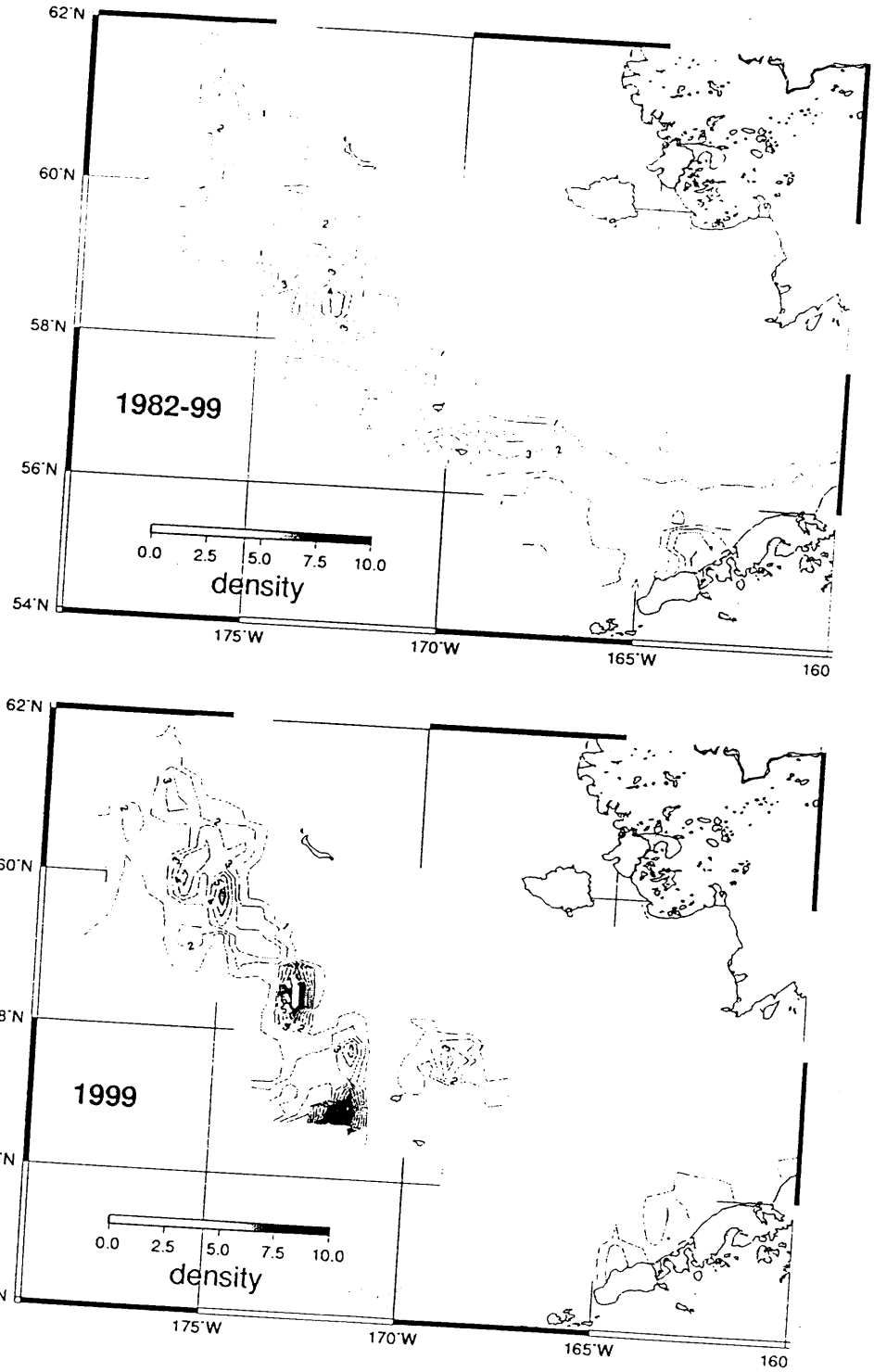


Figure 1.9. Map showing the average walleye pollock catch-per-unit effort (1982-1999) compared to that observed during the 1999 NMFS EBS shelf bottom-trawl survey (bottom).

	biomass (million t)
1998	2.21
1999	3.57

Table 1.5. Biomass (age 1+) of eastern Bering Sea walleye pollock as estimated by surveys 1979-1999 (millions of tons).

Year	Bottom trawl survey (t)	EIT Survey (t)	EIT Percent age 3+	Total[1] (t)	Near bottom biomass
1979	3.20	7.46	(22%)	10.66	30%
1980	1.00				
1981	2.30				
1982	2.86	4.90	(95%)	7.76	46%
1983	6.24				
1984	4.89				
1985	4.63	4.80	(97%)	9.43	54%
1986	4.90				
1987	5.11				
1988	7.11	4.68	(97%)	11.79	63%
1989	5.93				
1990	7.13				
1991	5.11	1.45	N/A	6.56	79%
1992	4.37				
1993	5.52				
1994	4.98	2.89	(85%)	7.87	64%
1995	5.41				
1996	3.20	2.31	(97%)	5.51	60%
1997	3.03	2.59	(70%)	5.62	54%
1998	2.21				
1999	3.57	3.29[2]		6.86	52%

[1] Although the two survey estimates are added in this table, the stock assessment model treats them as separate indices (survey "q's" are estimated).

[2] This figure excludes the zone near the "horseshoe" area of the EBS (southeast) not usually surveyed, the value including this area was 3.35 million tons.