



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest and Alaska
Fisheries Center
Resource Assessment & Conservation Engineering
2725 Montlake Boulevard East
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CRUISE RESULTS

Charter Vessel U.S. DOMINATOR and NOAA RV CHAPMAN

Cruise Nos. DO 82-1 and CH 82-4

Eastern Bering Sea Walleye Pollock
Echo integrator-Midwater Trawl Survey

CRUISE PERIOD, AREA, AND ITINERARY

U.S. DOMINATOR

The U.S. Dominator returned to Seattle on August 10, 1982, after completing a two month echo integrator-midwater trawl survey of the eastern Bering Sea pollock resource. During the cruise, the outer continental shelf and upper slope (50-250 fm) region was surveyed between Unimak Pass and St. Lawrence Island (Figs. 1 and 2, transects 1-50, 55, 56). In addition, the inner shelf area (20-50 fm) was surveyed between approximately 60°N and 63°N (Fig. 2, transects 51-54, 57-75). Data on the acoustic target strength of pollock were collected at selected locations in the outer shelf survey area and in the Aleutian Basin. The cruise itinerary was as follows:

May 27-28	Acoustic system calibration and testing in Puget Sound.
June 1-June 9	Transit to Dutch Harbor, embark scientists.
June 9-July 7	Leg I - Survey of outer shelf/upper slope area from Unimak Pass to northwest of Pribilofs; arrived Dutch Harbor on July 7.
July 7-August 4	Leg II - Survey of remainder of outer shelf/slope area and part of inner shelf area; conducted target strength data collection in Aleutian Basin; arrived Kodiak on August 4.
August 4-11	Transit to Seattle; conducted acoustic system calibration.



RV CHAPMAN

From August 4 to September 2, the Chapman conducted an echo integrator-midwater trawl survey in the inner shelf area (20-50 fm) of the Bering Sea between Nunivak Island and the Alaska Peninsula (Fig. 3). The vessel's itinerary was as follows:

August 4-7	Equipment installation in Kodiak and transit to survey area.
August 8-17	Leg I - Acoustic-trawl survey (transects 1-81, transit to Dutch Harbor.
August 18-21	In port; transit to survey area.
August 22-31	Leg II - Acoustic-trawl survey (transects 9-21).
September 1-2	Return to Dutch Harbor

OBJECTIVES

The U.S. Dominator and Chapman cruises were conducted as part of a comprehensive multi-vessel survey of the demersal fishery resources of the eastern Bering Sea. Their primary objectives were to: (1) collect echo integrator and midwater trawl data necessary to determine the distribution, biomass, and biological composition of the off-bottom component of the pollock resource in the shelf-upper slope region, (2) collect measurements of pollock target strength used to scale echo integrator outputs, (3) collect data on the distribution and abundance of age 0 pollock within the survey area, and (4) collect data for research on pollock feeding habits.

ACOUSTIC EQUIPMENT AND TRAWL GEAR

U.S. DOMINATOR

Acoustic data were collected aboard the U.S. Dominator using a new van-contained computerized echo integration and target strength measurement system. The system's transducer was mounted in a deadweight body towed off to the side and behind the vessel. The system uses a 38 kHz echo sounder with three receivers and a dual beam transducer. One receiver is used for echo integration analysis. The other two receivers are used to collect dual beam target strength data from single fish targets. Echo integration and target strength data collection and preliminary data processing were completed using a new Hewlett Packard computer system and software package.

Trawl sampling for adult and juvenile fish was done with a #9A Gourcock¹ rope wing midwater trawl fished with 6 m Suberkrub doors and a cable netsounder system. The trawl had a headrope and footrope length of 335 feet and breastline lengths of 245 feet. The wing ropes were 5/8 inch diameter rope and varied in length from 207.5 feet to 67.2 feet.

¹/ Reference to trade names of commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

The average vertical mouth opening of the trawl was 15-18 fathoms. Body mesh size ranged from 64 inches to 4-3/4 inches. The cod end was equipped with a 1-1/4 inch liner. The cod end cover mesh size was 3-1/2 inches. All mesh sizes referred to here and in the sections below were stretched measure.

Bottom trawl hauls were made with a modified 83-112 trawl with a 112-foot footrope, an 33-foot headrope, 4 inch mesh in the wings and body, and 3-1/2 inch mesh in the intermediate and cod end. The cod end was equipped with a 1-1/2 inch mesh liner. The trawl was fished with 5 x 7 foot steel V-doors.

Age 0 pollock and other small fish were sampled using a Marinovich midwater trawl with 5 x 7 foot steel V-doors. The trawl is square, with headrope, footrope and breastline lengths of 30 feet and mesh sizes ranging from 3 inches forward to 1-1/4 inches in the cod end. The cod end was equipped with a 3/8-inch knotless web liner. The average vertical mouth opening of the trawl was 2-3 fathoms.

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Acoustic data were collected and processed with a Biosonics, Inc. Model 101 echo sounder (38 kHz) and a Model 120 digital echo integrator. The integrator was interfaced to a TRS 80 Model III minicomputer with floppy disks used to store the integrator output. The system's transducer was mounted in a 2-ft V fin towed behind the vessel. In addition to the real-time processing, the acoustic data were simultaneously recorded in analog form on cassette tape. Echograms were obtained with an EPC Model 1600 chart recorder.

The Marinovich trawl (described above) and a Diamond 1000 trawl were used for midwater sampling. The Diamond 1000 trawl is a square midwater trawl with headrope, footrope and breastline lengths of 177 feet and with mesh sizes ranging from 32 inches forward to 3-1/2 inches in the cod end. A 1-1/4 inch mesh liner was installed in the cod end. The Diamond 1000 trawl was fished with 5 x 7 foot steel V doors and 30 fathom dandy-lines. The average vertical mouth opening of the trawl was 9-10 fathoms. Both trawls were fished with a cable netsounder system.

SURVEY METHODS

U.S. DOMINATOR

The survey was conducted 24 hours per day along a systematic zig-zag trackline between approximately the 50 and 250 fm isobaths. The average distance between adjacent transects was 15 n.m. Vessel speed averaged about 9 knots and the transducer was towed at depths ranging from 10-20 m. Density estimates from the echo integration system were output at one-minute intervals for up to 400 one-meter depth intervals from the transducer to the bottom and in each of 40 one-meter, bottom-referenced intervals.

Trawl hauls using the rope trawl were made on selected aggregations of echo sign for species identification and, especially,

to obtain pollock biological data and samples. For each trawl haul, the total weight was determined for each species, and the total number was estimated for each species of finfish. A haul's entire catch was sorted and weighed by species unless it exceeded approximately 2,500 lb. Larger catches were sampled and the total catch per species was obtained by extrapolation. Sex and length composition data were collected for each catch of pollock. Individual pollock otolith samples were obtained for most trawl stations. Data on the individual weight and maturity of pollock were collected from selected hauls. Biological data were collected on species other than pollock, but the total amount was small because pollock was the dominant species in all trawl hauls. Trawl hauls with the Marinovich midwater trawl were made regularly to sample small fish not captured by the rope trawl. Samples of age 0 pollock and cod were collected when sufficient numbers were taken. Samples were separated by species and frozen and/or preserved in formalin.

Pollock target strength measurements were collected with the dual beam system from low density aggregations of fish in the Aleutian Basin. During both day and night periods, pollock were located in situations amenable to the use of in-situ techniques, i.e. they occurred in essentially monospecific aggregations and there was a high percentage of single fish echoes. Additional measurements were obtained at night several times during the shelf-slope survey. At all sites where target strength data were collected, midwater trawl hauls were made with the rope trawl to obtain species and size composition data.

Pollock stomach samples were obtained from the majority of trawl hauls which contained adult pollock. Ten acceptable stomachs (i.e., not empty and no regurgitation apparent) per haul were preserved in formalin for laboratory analysis. An additional ten acceptable stomachs were visually scanned, and prey composition and volume were estimated. During each haul, an attempt was made to obtain stomach samples from the entire length range of pollock observed.

Three deep midwater trawl hauls (~350 fm) were made during the cruise to provide material for taxonomic studies of mesopelagic fishes. These hauls included two in the Aleutian Basin and one south of Unimak Pass.

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The survey was conducted 24 hours a day along a zig-zag trackline run between the 20 and 50 fathom isobaths. The V-fin was towed at an average depth of 10 m and an average speed of 8 knots. Echo integrator density estimates were output at 5-minute intervals for each 10 m depth stratum from the transducer to a depth approximately 4 m above the bottom. Midwater trawl hauls were made to identify echo sign and collect biological data. Trawl catches were processed for species composition and biological data in the same manner as described above for the U.S. Dominator survey.

RESULTS

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The outer shelf/upper slope survey and the northern portion of the inner shelf survey were completed on a 6074 n.m. trackline (Figs. 1 and 2). Seventy-five trawl hauls were completed including 59 with the rope trawl, 12 using the Marinovich trawl, and 4 with the bottom trawl (Fig. 4). A list of species caught, by trawl type, is shown in Table 1. Pollock was the dominant species in the catches (Table 2). Pollock (>age 0) represented 99% (by weight) of the total catch of all species taken in rope trawl hauls made on the shelf and upper slope. In most of the Marinovich trawl hauls, jellyfish was the principal species caught (by weight) and age 0 pollock was the most abundant fish (by number).

The relative abundance of pollock (>age 0), as determined from an analysis of echograms, is shown in Fig. 5. A comparable map of the distribution of pollock during the summer of 1979, which is based on a survey conducted by the NOAA research vessel Miller Freeman (Cruise 79-3), is shown in Fig. 6. Pollock aggregations were observed from Unimak Pass to north of St. Matthew Island, primarily between the 100 and 200 m bottom depth contours. The average length of pollock tended to decrease with increasing latitude (Fig. 7 and Fig. 8). The majority of fish observed were between 30 and 45 cm in length. Only a small number of trawl hauls contained fish shorter than 30 cm. It is anticipated that population estimates for 1 and 2 year-old fish will be substantially lower than in 1979; whereas estimates for older fish will be substantially higher (Fig. 9). For the shelf-slope part of the survey, sex ratios estimated from midwater trawl hauls did not differ significantly from 1 to 1. However, in the Aleutian Basin, the proportion of females in the catch was 0.30, a value close to that (.37) observed in the Basin during the 1979 survey.

RV CHAPMAN

The inner shelf survey was completed on a 2654 n.m. trackline (Fig. 3). Ten midwater trawl hauls were made with the Marinovich trawl and five with the Diamond 1000 trawl (Fig. 10). Table 3 is a list by trawl type of species caught.

The principal result of the inner shelf survey was the occurrence of a large scattering layer covering most of the area between the 20 and 50 fm isobaths and averaging 20 fathoms in thickness. The layer extended over 55,400 n.m.². Catches within the layer using the Marinovich trawl were composed primarily of jellyfish and age 0 fish (Table 4). These age 0 fish were pollock with trace amounts (<5% by numbers) of Pacific cod and flatfish. The age 0 pollock ranged in size from 25 to 85 mm. In the southern part of the survey area, they were slightly larger than those in the north (Fig. 11). Age 0 pollock were encountered throughout the inner shelf survey region (Fig. 12). Although jellyfish were the dominant organisms (by weight) in the Marinovich trawl catch, it is reasonable to assume that age 0 pollock were the primary scatterers in the depth regions analyzed. The scattering layer was extremely dense and somewhat patchy (i.e., contained higher density areas within the continuous scattering layer). These scattering characteristics are

usually associated with free-swimming organisms (such as fish) which are capable of aggregating. Also, since the jellyfish are relatively poor sound scatterers, jellyfish densities producing echo returns as high as those observed during the survey would almost certainly have resulted in extremely large catches. Echo sign ranged from a 10 m thick, near surface layer to a scattering extending from near surface to bottom (Fig. 13). The depth and vertical extent of the layer was strongly influenced by water temperature. When a thermocline was present, the layer was observed near that depth (Fig. 13A); when no distinct thermocline existed, the fish were distributed from surface to bottom (Fig. 13B). Age 0 pollock appeared to avoid depths where the water temperature was less than about 2.5-3.0°C.

A very rough estimate of the number of age 0 pollock in the survey area was made using the catch rates in the Marinovich trawl. Areal density, ρ , assuming 100% trawl efficiency and that the entire layer was within the vertical path of the trawl, was calculated for each trawl haul as:

$$\rho = N/wD, \text{ where}$$

N is the number of age 0 pollock captured, w is the width of the trawl (6.1 m) and D is the distance fished. The average areal density estimated from the 10 Marinovich trawl hauls was 1.94 million fish/nm². The total area over which the layer occurred was 55,400 nm², resulting in an abundance estimate of 107 billion age 0 pollock. Assuming age 0 pollock were distributed throughout the layer, the estimate would tend to be conservative since the vertical extent of the layer was usually several times larger than the vertical mouth opening of the trawl. Trawl efficiency of less than 100%, which was almost certainly the case, would also cause the estimate to be conservative. An opposite bias may have resulted from a tendency during the survey to make trawl hauls in higher density areas.

Except for age 0 fish, few schools of pollock were located in the inner shelf area. Only one Diamond trawl catch yielded significant quantities of adult fish (Haul 12; Table 4).

SCIENTIFIC PERSONNEL

U.S. DOMINATOR

Leg I

Edmund Nunnallee	Chief Scientist, NWAFC
Daniel Twohig	Electronics Technician, NWAFC
Michael Macaulay	Oceanographer/Programmer, NWAFC
John Garrison	Electronics Technician, NWAFC
Jan McCrory	Biological Technician, NWAFC
Thomas Wilderbuer	Fishery Biologist, NWAFC
Ronald Payne	Biological Technician, NWAFC

Leg II

Jimmie Traynor	Chief Scientist, NWAFC
Daniel Twohig	Electronics Technician, NWAFC
Neal Williamson	Statistician, NWAFC
Gary Smith	Oceanographer, NWAFC
Eric Stirrup	NOAA Corps Officer, NWAFC
Roger Mercer	NOAA Corps Officer, NWAFC

CHAPMAN

Leg I

Jimmie Traynor	Chief Scientist, NWAFC
Neal Williamson	Statistician, NWAFC
Charles Knechtel	Operations Research Analyst, NWAFC
Nancie Cummings	Fishery Biologist, NWAFC

Leg II

Edmund Nunnallee	Chief Scientist, NWAFC
John Garrison	Electronics Technician, NWAFC
Charles Knechtel	Operations Research Analyst, NWAFC
Nancie Cummings	Fishery Biologist, NWAFC

Table 1 List of species encountered in trawl hauls during U.S. Dominator Cruise 82-1.

<u>Taxa</u>	<u>Common name</u>	<u>Scientific name</u>	Gourock (midwater)	Marinovich (midwater)	Bottom Deepwater ^{1/}
Gadidae	Walleye pollock	<u>Theragra chalcogramma</u>	x	x	x
	Pacific cod	<u>Gadus macrocephalus</u>	x		x
	Saffron cod	<u>Eleginus gracilis</u>			x
	Arctic cod	<u>Boreogadus saida</u>			x
Salmonidae	Chinook salmon	<u>Oncorhynchus tshawytscha</u>	x		
	Chum salmon	<u>Oncorhynchus keta</u>	x		
	Coho salmon	<u>Oncorhynchus kisutch</u>	x		
Cottidae	Great sculpin	<u>Myoxocephalus polyacanthocephalus</u>	x		
	Yellow Irish lord	<u>Hemilepidotus jordani</u>	x		
	Butterfly sculpin	<u>Hemilepidotus papilio</u>	x		x
	Bigmouth sculpin	<u>Hemitripterus bolini</u>			x
	Red Irish lord	<u>Hemilepidotus hemilepidotus</u>			x
	Plain sculpin	<u>Myoxocephalus jaok</u>			x
		<u>Myoxocephalus sp.</u>			x
Pleuronectidae	Greenland turbot	<u>Reinhardtius hippoglossoides</u>	x		x
	Rock sole	<u>Lepidopsetta bilineata</u>	x		x
	Yellowfin sole	<u>Lemanda aspera</u>			x
	Pacific halibut	<u>Hippoglossus stenolepis</u>			x
	Arrowtooth flounder	<u>Atherestes stomias</u>			x
	Flathead sole	<u>Hippoglossoides elassodon</u>			x
	Alaska plaice	<u>Pleuronectes quadrituberculatus</u>			x
Cyclopteridae	Smooth lump sucker	<u>Aptocyclus ventricosus</u>	x	x	x
	Marbled snailfish	<u>Liparis dennyi</u>			x
Zoarcidae	Wattled eelpout	<u>Lycodes palearis</u>	x		x
	Marbled eelpout	<u>Lycodes concolor</u>			x
Clupeidae	Pacific herring	<u>Clupea harengus pallas</u>	x		x

^{1/} One deepwater tow was made with the Marinovich trawl and the other two were made with the Gourock rope trawl.

Table 1 (continued).

<u>Taxa</u>	<u>Common name</u>	<u>Scientific name</u>	Gourock (midwater)	Marinovich (midwater)	Bottom	Deepwater ^{1/}
Hexagrammidae	Atka mackerel	<u>Pleurogrammus monopterygius</u>	X			
Icosteidae	Ragfish	<u>Icosteus Aenigmaticus</u>	X			
Alopiidae	Salmon shark	<u>Lamna ditropis</u>				
Osmeridae	Capelin	<u>Mallotus villosus</u>			X	
Scopelarchidae	Northern pearleye	<u>Benthalbella dentata</u>	X	X		X
Chauliodontidae	Pacific viperfish	<u>Chauliodus macouni</u>	X	X		X
Lithodidae	Blue king crab	<u>Paralithodes platypus</u>			X	
Pterasteridae		<u>Pteraster tessellatus</u>			X	
Melamphaeidae	Highsnout melamphid	<u>Melamphaes lugubris</u>	X			X
Ascidiacea		<u>Halocynthia aurantium</u>			X	
Porcellanasteridae	Purple-orange seastar	<u>Asterias amurensis</u>			X	
Cragonidae	Rounded-spine Hyas crab	<u>Hyas coarctatus aluticus</u>			X	
Gorgonocephalidae	Basket Star	<u>Gorgonocephalus caryi</u>			X	
Soft coral		<u>Eunephthya (gersenia) rubiformis</u>			X	
Melanostomiatidae		<u>Poromitra crassiceps</u>	X	X		X
Majidae	Tanner crab (opilio) Tanner crab (unident.)	<u>Chionoecotes opilio</u>			X X	
Oneirodidae	Dreamer (unident.)					

Table 1 (continued).

<u>Taxa</u>	<u>Common name</u>	<u>Scientific name</u>	Gourock (midwater)	Marinovich (midwater)	Bottom	Deepwater ^{1/}
Metridium	Sea anemones	<u>Tealia</u> sp.			x	
Cephalopoda		<u>Gonatus</u> sp.	x			
		<u>Gonatopsis</u> sp.	x			x
Decapoda	Squid (unident.) Shrimp (unident.)		x			
			x	x		x
Bathylagidae	Blacksmelt (unident.)	<u>Bathylagus</u> sp.	x	x		x
Myctophidae	Lanternfish (unident.)		x	x		x
Argentinidae	Argentine (unident.)		x	x		x
Cragonidae		<u>Argis</u> sp.				x
		<u>Leptasterias</u> sp.				x
Tellinidae		<u>Macoma</u> sp.				x
Scyphozoa	Jellyfish (unident.)		x	x	x	x
Amphipoda	Amphipod (unident.)				x	
Rajidae	Skate (unident.)					x
Paguridae	Hermit crab (unident.)					x
Prosobranchiata	Snail (unident.)					x
Macrouridae	Grenadier (unident.)		x	x		x
Brotulidae	Brotula (unident.)				x	x

Table 1 (continued).

<u>Taxa</u>	<u>Common name</u>	<u>Scientific name</u>	Gourock (midwater)	Marinovich (midwater)	Bottom	Deepwater ^{1/}
Euphausiacea	Euphausiid (unident.)		x			
Gastropoda	Snail eggs		x		x	
	Roundfish (unident.)		x			

2. ---Trawl haul station and catch data, U. S. Dominator Cruise 82-1.

Date (1982)	Start Pos.		Time of day (GMT + 9)	Depth (fm) Gear/bottom	Temp (°C) Surface/surf	Durar tion (hr)	Dist. fished (n.m.)	Catch (lbs)		
	Lat (N)	Long (W)						Pollock (> Age 0)	Others	
Gourock rope trawl										
1	6/11	55° 34'	164° 46'	1325	30/54	5.4/3.3	0.3	1.0	603	209
2	6/11	54° 55'	165° 38'	2123	53/69	4.9/4.8	1.0	0.8	6289	200
3	6/12	55° 32'	165° 25'	0920	45/59	5.2/4.0	0.9	2.8	1809	200
4	6/12	55° 30'	165° 54'	2040	44/64	5.5/4.3	0.6	1.8	1485	272
5	6/13	55° 56'	166° 05'	1342	35/63	5.6/3.9	0.6	2.8	7040	200
6	6/14	55° 20'	167° 22'	0810	55/78	5.5/4.0	1.0	3.0	3400	1
7	6/14	56° 15'	166° 42'	1718	37/59	5.9/2.6	0.8	2.7	3987	17
8	6/15	55° 40'	167° 56'	0925	49/73	5.7/4.1	0.5	1.6	4516	0
9	6/15	56° 12'	168° 06'	2140	56/79	6.4/4.1	1.0	3.5	357	33
10	6/16	56° 29'	168° 23'	0947	45/64	6.3/6.5	1.2	4.4	754	0
12	6/16	56° 22'	168° 40'	2115	40/70	6.4/4.0	0.4	1.1	4125	6
13	6/17	56° 04'	170° 29'	1440	18/260	5.6/4.6	1.3	5.4	378	6
14	6/17	56° 10'	170° 33'	1655	46/70	5.6/3.9	0.4	1.1	1487	41
15	6/18	56° 19'	171° 15'	1100	57/78	5.0/4.3	0.5	2.2	1564	11
16	6/18	56° 44'	171° 44'	2145	46/65	5.6/3.8	0.3	0.7	3069	6
17	6/19	56° 54'	172° 37'	1745	47/66	5.4/ -	1.2	2.7	60	0
19	6/20	57° 03'	173° 15'	1515	50/72	5.5/3.6	1.3	4.1	803	27
20	6/21	57° 41'	173° 16'	1605	63/73	5.0/3.5	1.2	3.8	4927	52
22	6/22	58° 09'	173° 15'	1624	32/60	5.2/3.9	0.5	1.6	3494	0
24	6/23	58° 23'	173° 46'	1153	40/63	- / -	1.2	4.6	5500	42
25	6/23	58° 39'	172° 30'	2000	34/55	4.5/2.0	1.0	3.1	322	6
26	6/24	58° 40'	173° 55'	1418	41/70	4.7/3.0	0.6	2.2	7500	2

Table --- (Continued)

Haul	Date (1982)	Start Pos		Time of day (GMT + 9)	Depth (fm) Gear/bottom	Temp (°C) Surface/gear	Dura- tion (hr)	Dist. fished (n.m.)	Catch (lbs)	
		Lat (N)	Long (W)						Pollock (> Age 0)	Others
28	6/25	58°49'	174°50'	0952	52/74	4.8/3.0	1.3	4.2	2461	14
29	6/27	59°01'	175°39'	0820	48/71	5.1/2.5	1.0	3.4	12553	10
30	6/27	58°58'	177°38'	1708	48/71	5.5/2.8	0.9	2.8	2985	50
31	6/28	59°17'	174°16'	1027	40/62	4.6/2.3	1.0	3.4	800	8
33	6/29	59°30'	176°35'	1606	50/74	4.8/2.5	1.0	3.1	1117	13
34	6/30	59°40'	174°28'	1016	28/61	4.9/3.8	1.6	6.1	896	11
35	6/30	59°48'	176°30'	2007	37/74	4.3/2.3	1.0	3.6	10670	0
36	7/01	59°55'	178°28'	0821	45/75	5.0/3.7	1.2	3.6	11360	0
37	7/11	61°02'	177°51'	1227	53/78	5.4/1.8	1.0	3.1	6517	2
38	7/12	61°13'	178°01'	0036	37/82	5.3/2.2	0.2	0.6	4905	0
39	7/12	61°30'	176°07'	1327	29/54	4.7/1.1	0.4	1.7	3997	0
42	7/15	61°12'	176°11'	0859	37/56	6.0/3.5	0.5	2.0	15107	0
45	7/17	59°10'	171°11'	0050	15/40	5.7/4.6	1.0	4.0	284	108
46	7/18	58°49'	171°48'	0024	24/49	7.4/2.2	1.0	3.1	596	19
47	7/18	58°29'	171°23'	1223	24/46	7.5/2.5	0.7	2.5	4893	117
49	7/19	58°08'	171°24'	0100	25/50	7.5/4.0	0.5	1.6	--	-- 1/2
50	7/19	57°27'	171°25'	1418	35/51	7.5/4.0	1.1	3.0	1500	21
51	7/19	57°26'	171°24'	1718	12/52	7.5/6.7	1.0	4.2	5	200
53	7/20	57°25'	171°23'	0040	25/52	7.5/4.5	0.9	2.1	0	20
54	7/20	58°37'	172°06'	2125	28/52	7.3/3.5	0.5	1.6	11970	1
56	7/22	59°41'	172°37'	0055	19/45	6.8/1.3	0.5	1.8	17956	0
57	7/23	60°26'	176°27'	1003	38/68 ✓	7.2/4.0	0.3	1.1	6022	0
60	7/24	60°23'	179°54'	0047	15/1000	7.4/7.0	1.0	3.8	1634	119
61	7/24	59°07'	179°57'	1255	22/1600	8.0/5.8	1.0	3.8	315	91

Table 2. --- (Continued)

Haul	Date (1982)	Start Pos.		Time of day (GMT + 9)	Depth (fm) Gear/bottom	Temp (°C) Surface/gear	Dura- tion (hr)	Dist. fished (n.m.)	Catch (lbs)	
		Lat (N)	Long (W)						Pollock (> Age 0)	Others
62	7/24	58°14'	179°24'	2020	12/1970	7.6/6.1	1.0	4.5	391	69
64	7/25	58°04'	179°34'	0045	355/1970	7.5/3.6	2.1	8.0	--	-- 2/
65	7/25	57°01'	176°49'	1522	14/1800	7.5/6.2	1.1	4.3	427	77
66	7/26	55°43'	176°39'	0037	15/2000	7.7/6.5	1.0	4.0	522	7
67	7/26	53°39'	176°41'	1708	15/2000	7.8/5.7	1.1	4.5	197	59
70	7/27	52°57'	176°01'	1235	16/2000	8.2/6.5	1.1	4.4	490	2
71	7/28	52°55'	176°06'	0002	15/2000	8.2/6.5	1.0	4.2	2180	256
72	7/28	52°49'	176°07'	1224	28/2000	8.2/4.4	1.0	4.0	160	12
73	7/28	52°51'	176°05'	1820	18/2000	8.2/5.7	1.0	3.4	264	0
74	7/29	52°50'	176°01'	0619	15/2000	8.2/6.6	1.1	3.8	649	28
75	8/01	53°14'	163°50'	0031	372/2300	10.2/3.6	2.0	4.0	--	-- 2/

Marinovich trawl

	Date	Lat (N)	Long (W)	Time of day (GMT + 9)	Depth (fm) Gear/bottom	Temp (°C) Surface/gear	Dura- tion (hr)	Dist. fished (n.m.)	Catch (lbs)				
									Age 0 Pollock	Age 0 Roundfish (unident.)	Pollock (> Age 0)	Jelly- fish	Other species
11	6/16	56°25'	168°29'	1212	13/66	6.3/6.3	0.5	2.0	--	--	5.0	--	0.1
18	6/20	57°10'	172°47'	1037	12/60	5.3/4.9	0.8	3.3	--	< 0.1	--	2.0	--
21	6/21	57°37'	173°23'	1907	7/74	5.0/4.9	0.8	3.3	--	< 0.1	--	25.0	--
27	6/24	58°39'	174°01'	1548	25/71	4.7/3.0	0.5	1.8	--	< 0.1	1.0	25.0	--
32	6/29	59°30'	176°41'	1432	14/79	4.8/4.7	0.8	2.5	--	--	--	25.0	0.1
14	7/16	59°08'	171°16'	2243	15/40	5.7/4.6	1.0	3.4	3.6	--	--	100.0	--
23	6/22	58°08'	173°18'	1742	12/58	5.2/5.0	0.5	1.7	--	0.1	0.8	25.0	--

Table 2.--- (Continued)

Haul	Date (1982)	Start Pos.		Time of day (GMT + 9)	Depth (fm) Gear/bottom	Temp (°C) Surface/gear	Dura- tion (hr)	Dist. fished (n.m.)	Catch (lbs)				
		Lat (N)	Long (W)						Age 0 Pollock	Age 0 Roundfish (unident.)	Pollock (>Age 0)	Jelly- fish	Other species
52	7/19	57° 28'	171° 30'	2130	10/52	7.5/7.0	1.1	4.7	0.1	--	--	80.0	--
55	7/21	59° 41'	172° 40'	2220	10/46	6.8/6.5	1.2	4.7	0.1	--	--	120.0	--
58	7/23	60° 23'	176° 26'	1110	10/68	7.2/7.5	1.0	3.2	0.1	--	8.5	40.0	--
59	7/23	60° 24'	179° 48'	2312	10/1000	7.4/7.1	1.0	3.4	< 0.1	--	7.7	44.0	--
63	7/24	58° 09'	179° 25'	2202	10/1970	7.6/7.1	1.0	3.7	0.2	--	7.1	31.0	1.5
68	7/27	53° 25'	176° 40'	0013	350/2000	7.8/3.8	1.6	3.7	--	--	--	--	-- 2/
69	7/27	53° 19'	176° 43'	0230	10/2000	7.8/6.3	1.0	4.0	--	--	4.7	11.8	0.2

83/112 Bottom trawl

	Date	Lat (N)	Long (W)	Time of day	Depth (fm)	Temp (°C)	Dura- tion (hr)	Dist. fished (n.m.)	Catch (lbs)			
									(>Age 0) Pollock	Pacific cod	Yellowfin, sole	Others
40	7/13	62° 18'	173° 16'	1808	31/31	6.0/-1.3	0.5	2.2	--	--	--	10.3
41	7/14	61° 48'	169° 53'	1019	23/23	7.2/-1.6	0.5	1.7	3.6	--	4.8	132.4
43	7/16	60° 15'	169° 23'	1053	23/23	5.2/2.8	0.5	1.8	108.5	159.0	230.0	164.5
48	7/18	58° 29'	171° 18'	1400	45/45	7.5/2.5	0.5	1.6	361.8	95.3	51.2	143.6

1/ Gear fouled

2/ Deep water trawl catches included a variety of mesopelagic species.

Table 2 List of species encountered in midwater trawl hauls during Chapman Cruise 82-4.

<u>Taxa</u>	<u>Common name</u>	<u>Scientific name</u>	Diamond	Marinovich
Gadidae	Walleye pollock	<u>Theragra chalcogramma</u>	X	X
	Pacific cod	<u>Gadus macrocephalus</u>	X	X
Osmeridae	Capelin	<u>Mallotus villosus</u>		X
Cottidae	Great sculpin	<u>Myoxocephalus</u>	X	
	Sculpin (unident.)	<u>polyacanthocephalus</u>		X
Pleuronectidae	Flatfish larvae (unident.)			X
	Yellowfin sole	<u>Limanda aspera</u>	X	X
	Alaska plaice	<u>Pleuronectes quadrituberculatus</u>	X	
	Flathead sole	<u>Hippoglossoides elassodon</u>	X	
	Rock sole	<u>Lepidopsetta bilineata</u>	X	
Agonidae	Sturgeon poacher	<u>Podothecus acipenserinus</u>	X	X
Stichaeidae	Snake prickleback	<u>Lumpenus sagitta</u>		X
	Prickleback (unident.)			X
Rajidae	Starry skate	<u>Raja stellulata</u>	X	
Majidae	Tanner crab (opilio)	<u>Chionoecetes opilio</u>	X	
Paralithodes	Red king crab	<u>Paralithodes camtschatica</u>	X	
Decapod shrimps	Shrimp (unident.)			X
Euphausiacea	Euphausius (unident.)			X
Amphipoda	Amphipods (unident.)			X
Gorgonocephalidae	Basket starfish (unident.)		X	
Scyphozoa	Jellyfish (unident.)		X	X
Ctenophora	Ctenophore			X

4.--Midwater trawl haul station and catch data, Chapman Cruise 82-4.

Date (1982)	Start Pos.		Time of day (GMT-19)	Depth (fm) Gear/Bottom	Temp (°C) Surface/gear	Durat- ion (hr)	Dist. fished (n.m.)	C a t c h (lbs)						
	Lat (N)	Long (W)						Age 0 Pollock	Age 0 Pac. cod	Age 0 Flat- fish	Jelly- fish	Yellow- fin sole	Other Species	
Marinovich Trawl														
1	8/8	58°31'	171°06'	1244	15/49	8.5/6.0	0.9	2.4	9.2	--	--	99.8	--	< 0.1
3	8/10	58°42'	168°40'	1412	16/31	8.1/3.1	0.5	1.6	0.4	--	0.1	13.1	--	0.6
4	8/10	58°55'	167°38'	2318	16/22	6.7/6.5	0.5	1.5	5.4	--	0.1	0.1	--	1.2
5	8/11	58°11'	168°32'	0821	8/36	7.7/7.7	1.0	3.0	166.1	2.3	--	17.5	0.7	--
6	8/11	57°58'	168°49'	1248	18/38	8.7/2.9	1.0	2.7	3.9	--	0.2	22.5	--	0.6
8	8/15	57°04'	168°33'	0229	13/43	7.3/7.3	1.0	3.9	3.9	1.4	0.2	35.4	1.7	0.2
10	8/16	56°58'	167°38'	2102	15/42	7.9/7.6	0.3	0.9	53.1	0.9	--	174.0	--	--
11	8/23	58°13'	164°51'	1026	17/24	7.1/7.0	0.5	1.4	16.3	--	0.1	0.1	1.5	--
13	8/27	56°16'	163°47'	1440	35/47	10.1/2.5	1.0	2.0	4.0	1.3	--	220.0	--	--
14	8/31	56°40'	161°45'	1004	12/38	9.6/9.4	0.5	1.5	6.3	1.1	--	55.8	--	--
Diamond Trawl														
2	8/9	59°31'	168°47'	1020	10/22	6.5/6.4	0.6	1.5	----- No Catch -----					
7	8/11	58°00'	168°48'	1422	17/38	8.7/2.9	0.9	3.5	--	--	--	51.0	--	1.3
9	8/15	58°25'	166°01'	1839	15/24	7.5/6.2	0.5	1.5	< 0.1	--	--	--	20.6	--
15	8/31	56°29'	161°28'	1326	25/37	9.3/8.3	1.0	2.1	4.0	--	--	172.2	11.2	--
12	8/25	57°08'	164°10'	1308		7.2/1.9	2.1		3027.0	58.0	10.7	20.0	53.8	20.7

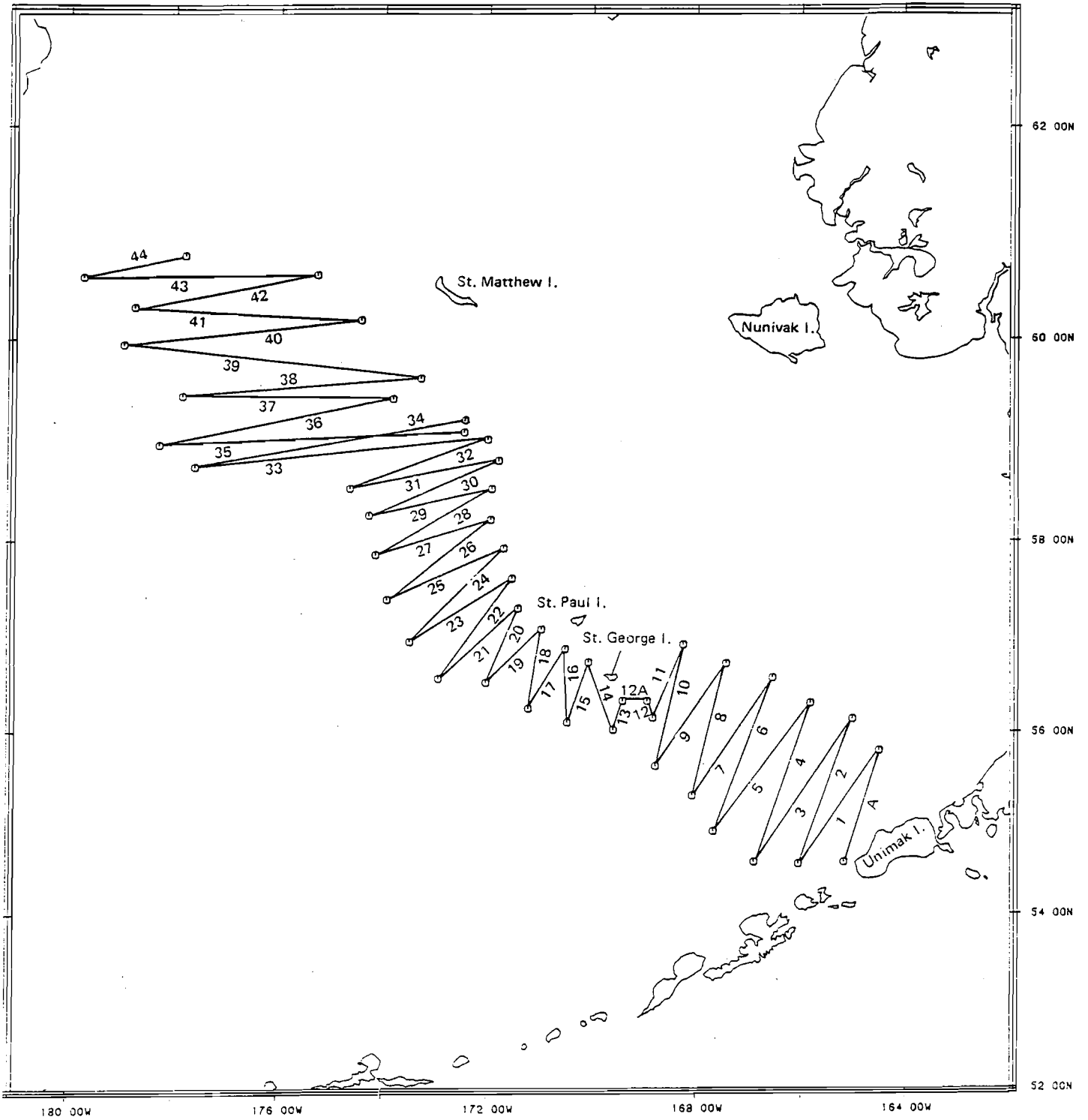


Fig. 1. Acoustic survey trackline, U.S. Dominator Cruise 82-1, Leg I.

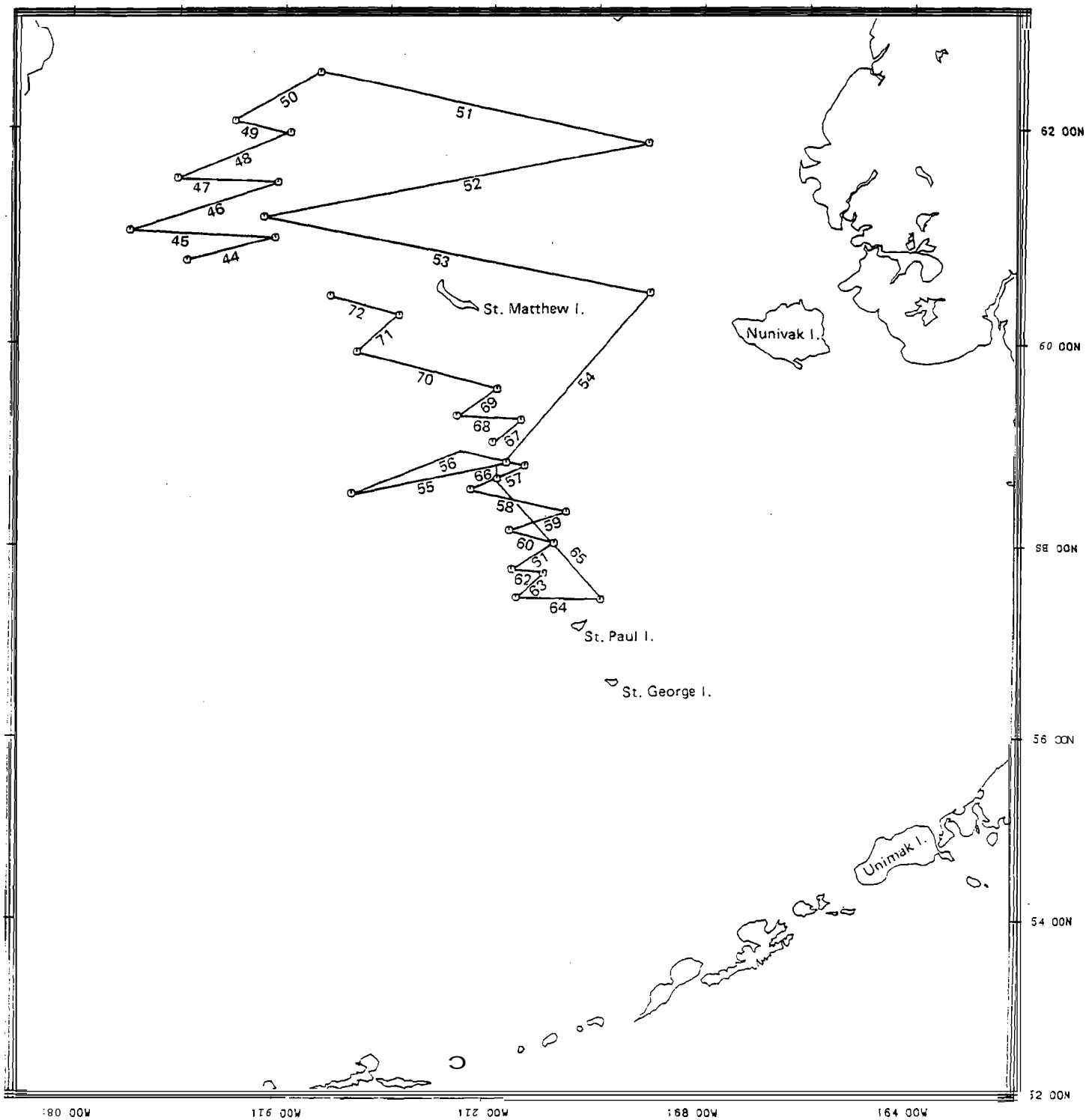


Fig. 2. Acoustic survey trackline, U.S. Dominator Cruise 82-1, Leg II.

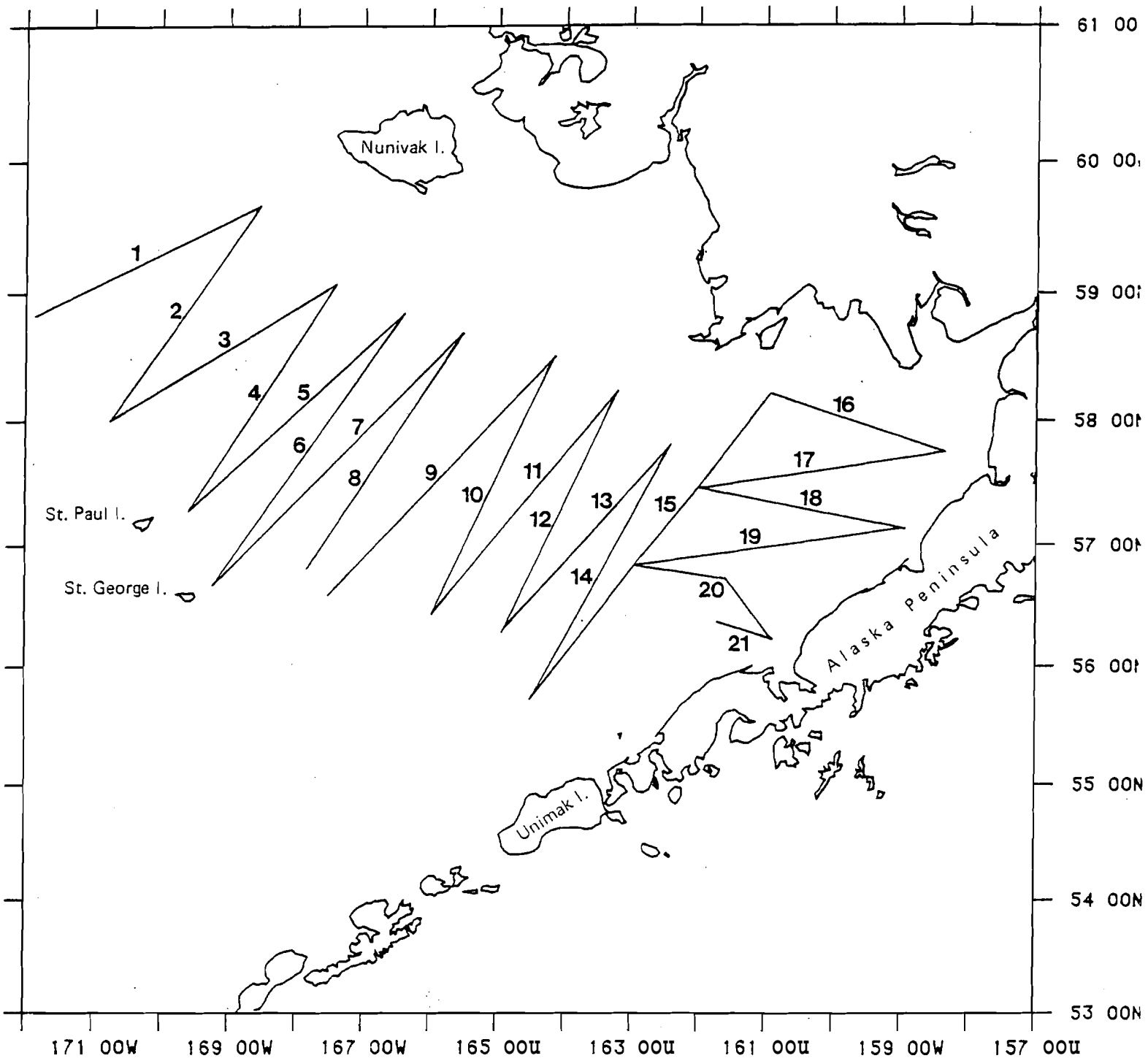


Fig. 3 Acoustic survey trackline, Chayman Cruise 82-4.

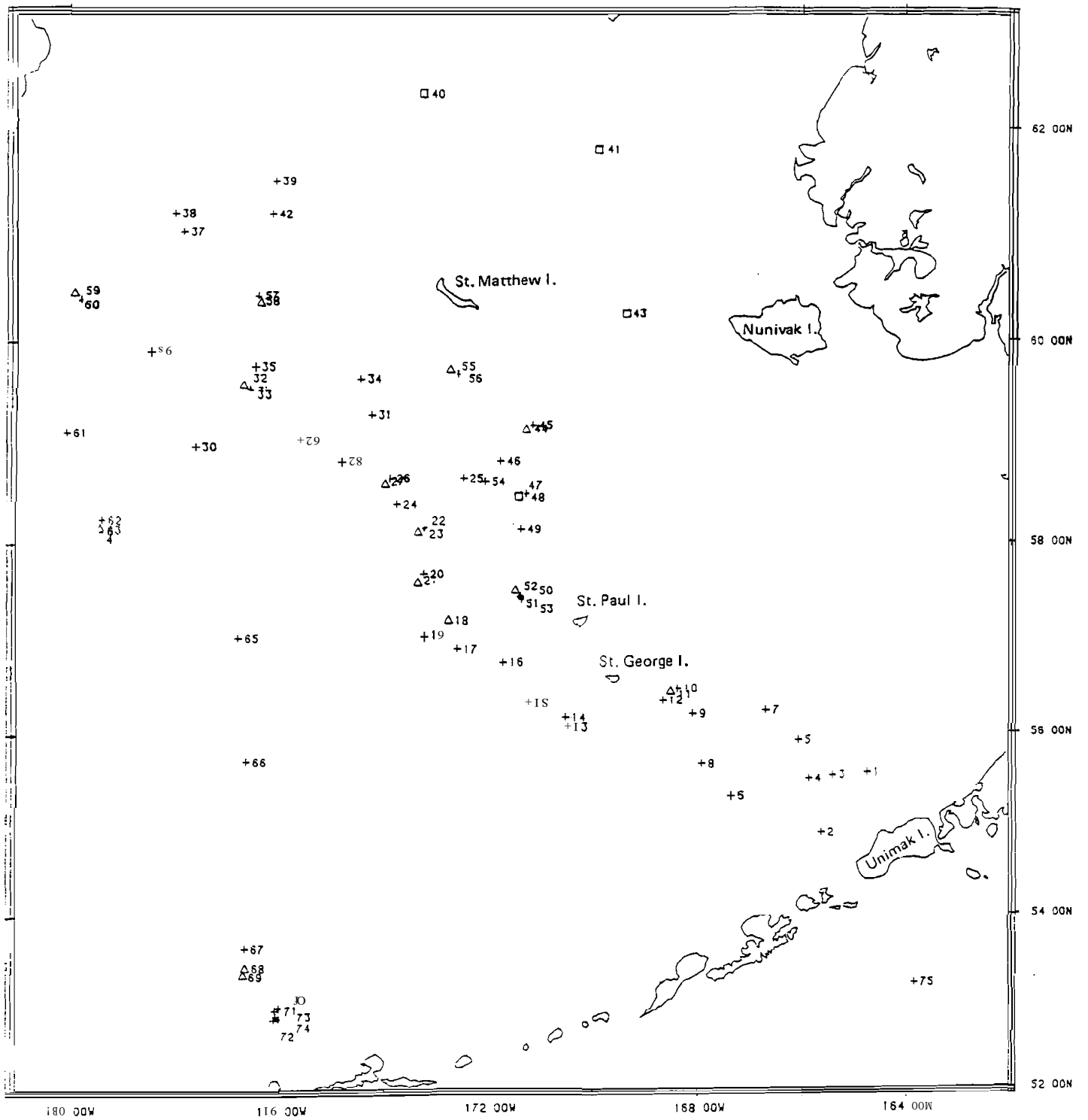


Fig. 4 U.S. Dominator Cruise 82-1 trawl stations - Gonrock rope trawl (+), Marinovich trawl (Δ), and 83/112 bottom trawl (\square).

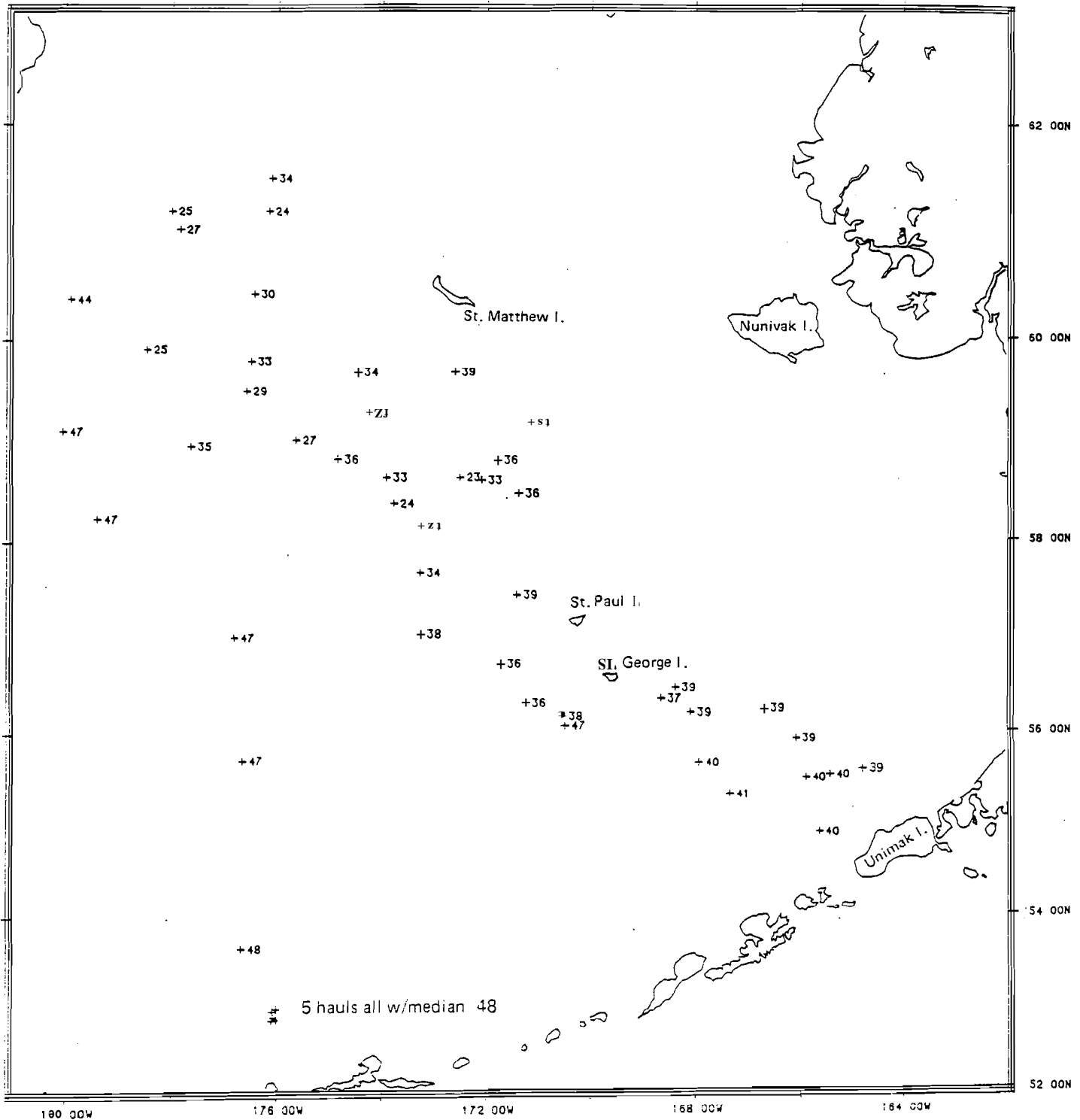


Fig. 7 Median lengths (cm) of pollock (>age 0) at each midwater trawl station where 20 or more fish were caught, U.S. Dominator Cruise 82-1.

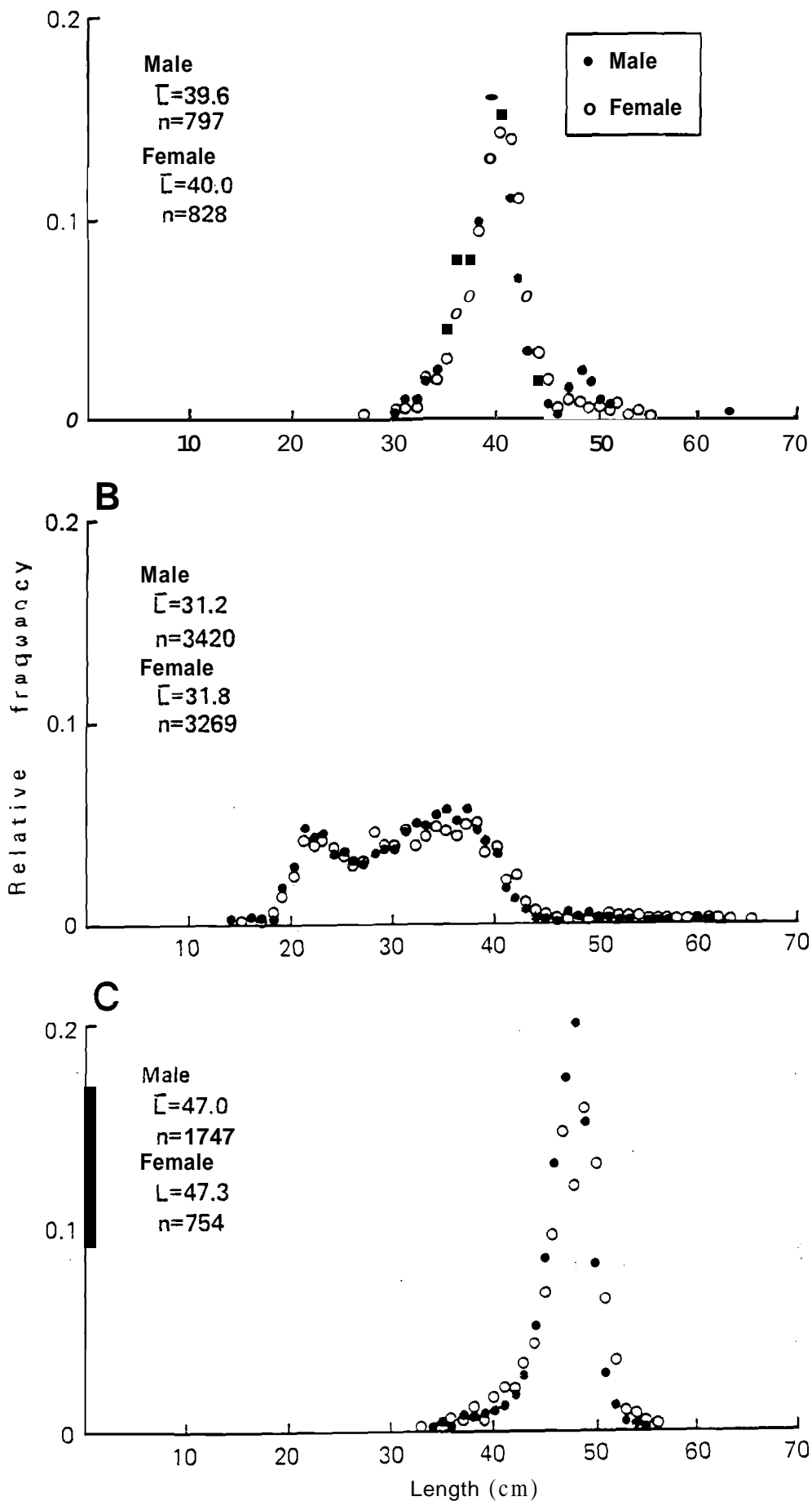


Fig. 8. Length distributions of pollock (>age 0), by sex, taken in midwater rope trawl hauls in three parts of the region surveyed during U.S. Dominator Cruise 82-1. A - area southeast of St. George Island (Hauls 1-13); B - area west and northwest of St. George Island (Hauls 15-57); C - Aleutian Basin area (Hauls 60-74).

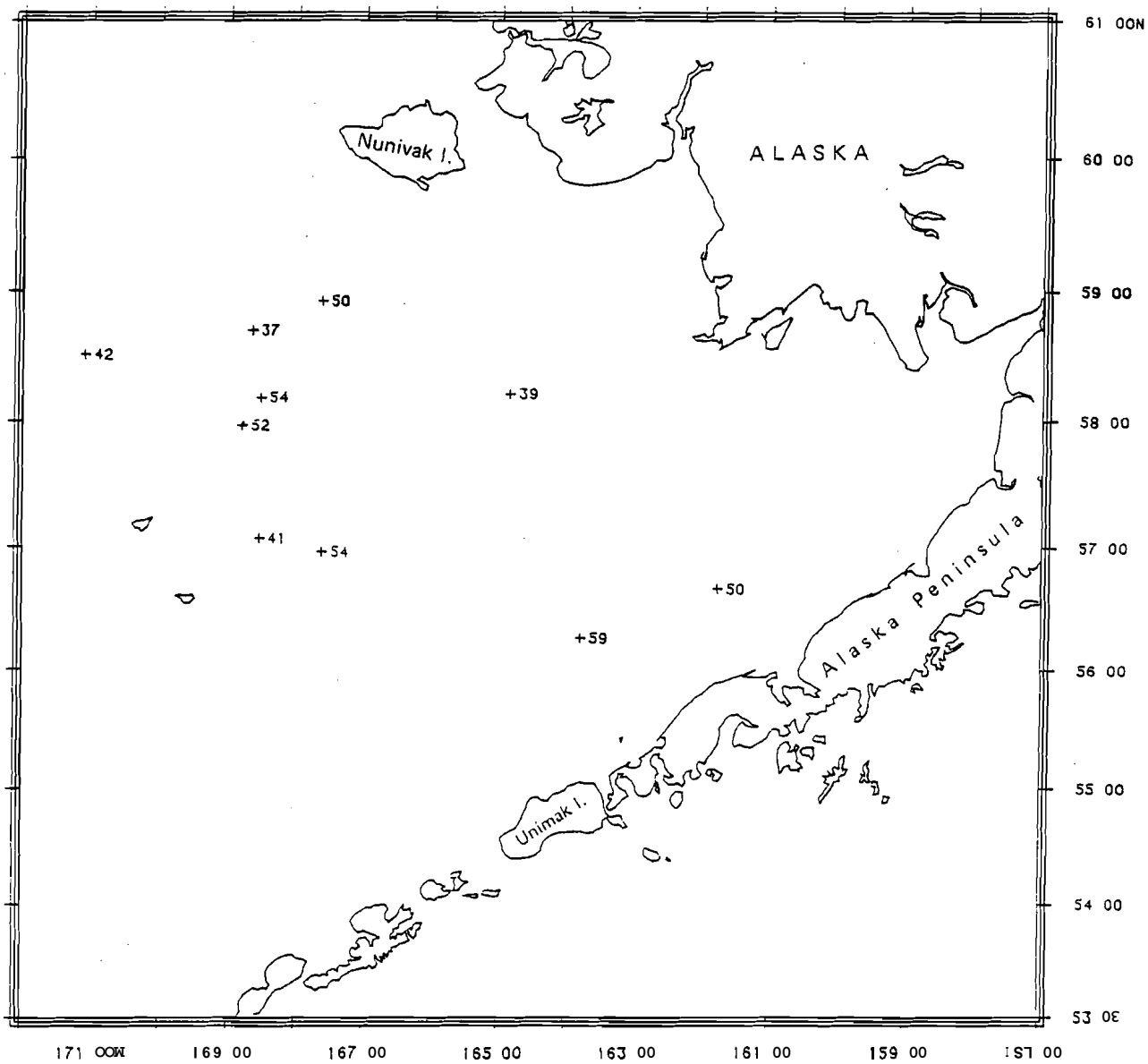


Fig. 11. Median lengths (mm) of age 0 pollock at each midwater trawl station where 20 or more fish were caught, Charman Cruise 82-4.