



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
Seattle, Washington 98112

October 23, 1981

CRUISE RESULTS

Eastern Bering Sea Crab/Groundfish Survey

Cruise No. CH-81-03 NOAA R/V CHAPMAN

Cruise No. AL-81-01 R/V ALASKA

May-August 1981

Cruise Period

NOAA R/V CHAPMAN -- May 11-August 6

Chartered R/V ALASKA -- May 19-July 23

Itinerary

The NOAA R/V CHAPMAN departed Seattle May 11 and returned to Kodiak on August 6 upon completion of the 1981 eastern Bering Sea crab/groundfish survey. Intervening port calls were made in Kodiak on May 17 and Dutch Harbor on May 5, June 6, June 21, and June 27 to load equipment and exchange scientific personnel. One additional port call was made at Dutch Harbor on August 1 for vessel repairs. A total of 1 1/2 sea days were lost due to vessel repairs aboard the R/V CHAPMAN and an additional 1/2 day was lost due to a helicopter medivac of an injured crew member. One fishing day was lost due to bad weather.

The R/V ALASKA began its charter on May 19 in Kodiak, and returned to Kodiak on July 23 upon completion of her scheduled portion of the survey. Port calls were made at Dutch Harbor on June 7 and July 5 to exchange scientific personnel. One fishing day was lost due to vessel repairs and four and one-half fishing days aboard the R/V ALASKA were lost due to bad weather.

Area Surveyed

The area surveyed extended south from approximately 61°40' N. latitude to Unimak Pass and east from 179°03 E. longitude along the 100 fm line to the mainland (Figure 1).

Primary Objectives

The primary objectives of this survey were to:

1. continue the annual series of demersal trawl assessment surveys of crab and groundfish in the eastern Bering Sea;



156 00M 64 00N

64 00N 180 00W

54 00N 156 00W

54 00N 180 00W

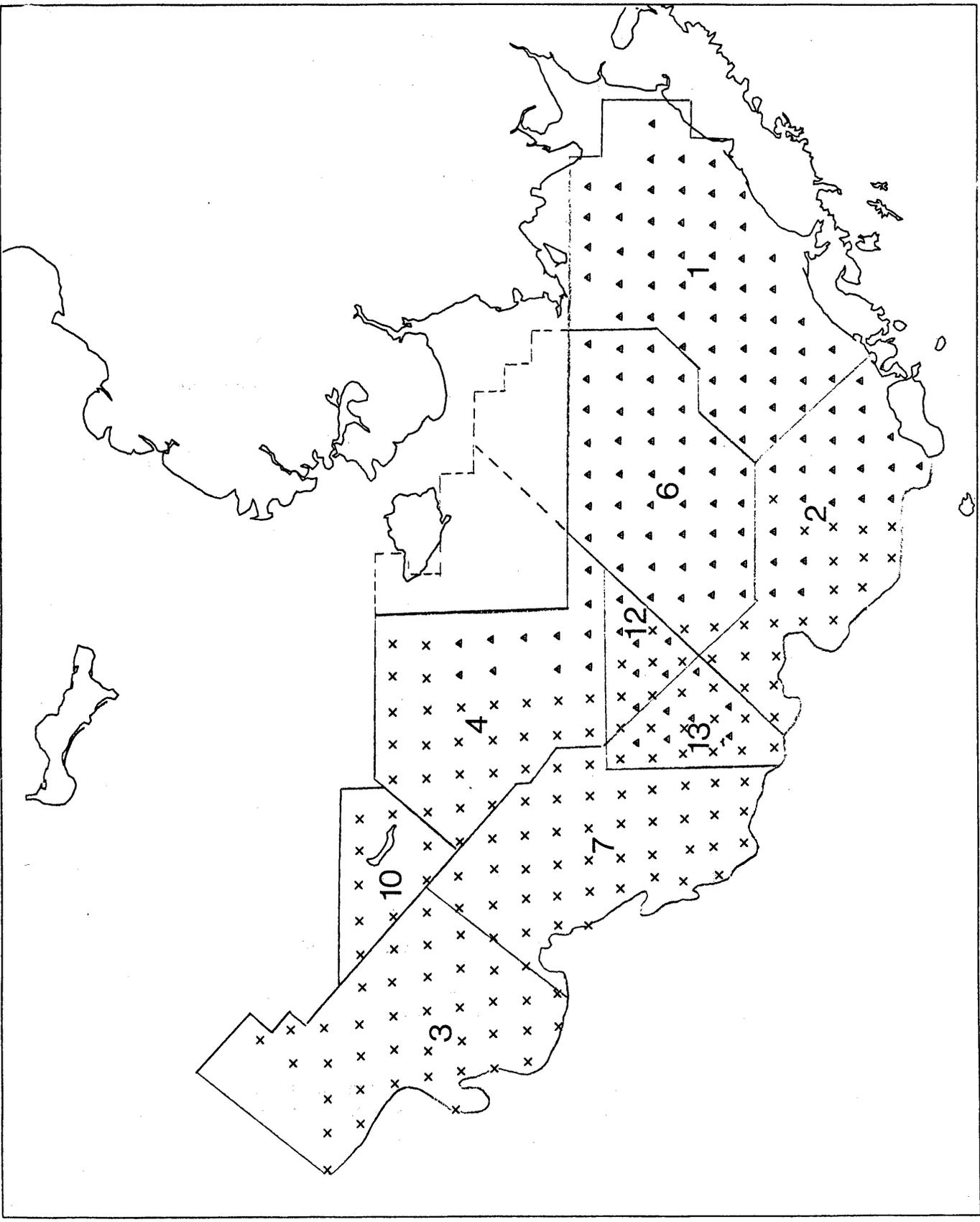


Figure 1. -- Successfully trawled survey stations during the 1981 eastern Bering Sea crab/groundfish survey. (X indicates positions of R/V Chapman hauls and \blacktriangle indicates positions of R/V Alaska hauls).

2. collect biological data on crab and groundfish species in the survey region;
3. collect water temperature information using XBT's and bucket thermometers;
4. conduct side-by-side comparative fishing experiments between the R/V ALASKA and the R/V CHAPMAN, and
5. conduct side-by-side comparative fishing experiments between the R/V CHAPMAN and the Japanese Fisheries Agency R/V RYOAN MARU No. 31.

Secondary Objectives

Secondary objectives were to:

1. examine stomach contents of yellowfin sole, Pacific cod and pollock;
2. collect and preserve stomach contents of Pacific cod and pollock for food habits studies.
3. collect samples of fishes and invertebrates for the University of Washington and other institutions;
4. collect ichthyoplankton samples for the University of Washington;
5. take photographs of fishes and invertebrates; and
6. collect trawl gear performance information with hydroacoustic net mensuration instruments.

Gear

The 83-112 otter trawl was used for all stations trawled by the R/V CHAPMAN. It had a 112' footrope and 83' headrope with 4" mesh in the wings and body and 3-1/2" mesh in the intermediate and codend with 1-1/4" mesh codend liner (Figure 2). There were 41 floats on the headrope. The mean effective path width was 62.3 ft with a mean vertical opening of 7.5 ft. Six-foot by 9 foot steel V-doors and 45 fm dandyines (30 fm single and 15 fm double) were used.

The ALASKA used the 400-mesh eastern trawl (Figure 3) at all stations with: 94' footrope and 71' headrope, 4" mesh in wings and body, 3-1/2" mesh in intermediate and codend with 1-1/4" mesh codend liner, and 15 floats on the headrope. Five-foot by 7-foot steel V-doors and 25-fathom dandyines (15-fathom single and 10-fathom double) were used. A 505 μ m bongo net was used for sampling ichthyoplankton.

XBT probes were used to measure the water column temperatures at each station. Calibrated bucket thermometers were used to measure surface temperature.

Methods

The survey area was delineated, as in previous years, to comprehensively assess the crab and groundfish resources of the eastern Bering Sea. This study

83/112 EASTERN

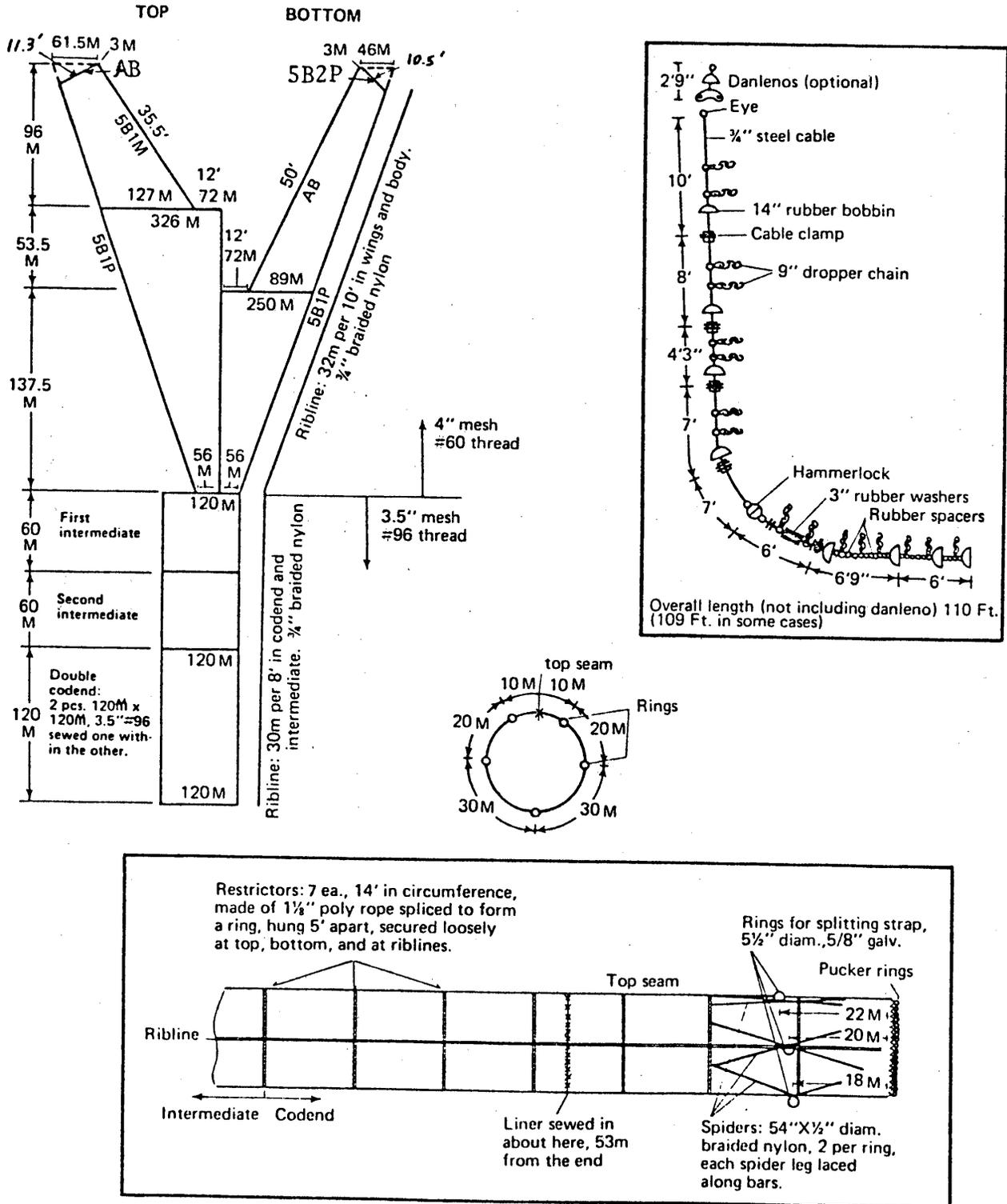
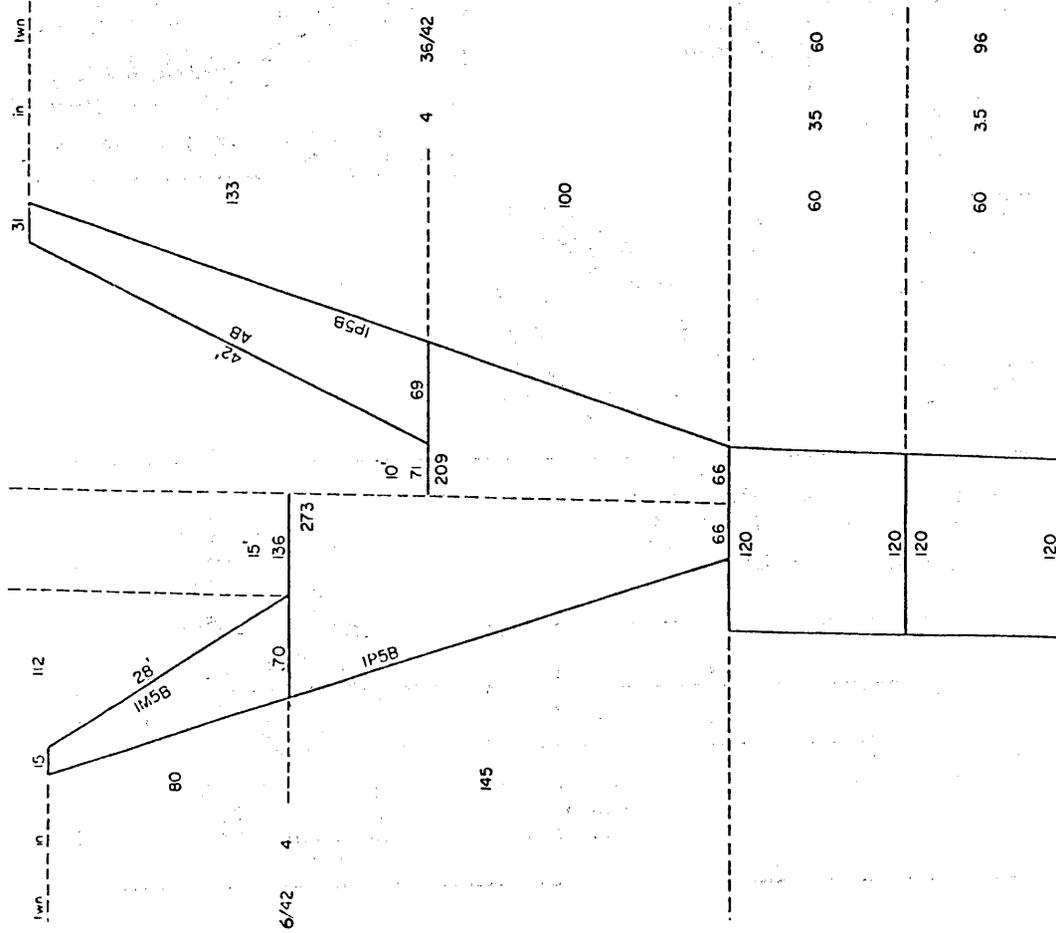


Figure 2. -- Diagram of the 83-112 demersal trawl.

400 MESH EASTERN



Headrope:
71 ft of 3/8", 6 x 19 galvanized wire rope wrapped with 3/8" polypropylene rope.

Footrope:
94 ft, 1/2", 6 x 19 galvanized wire rope wrapped with 9/16" polypropylene rope.

Breastlines:
6 ft, 1/4" proof coil galvanized chain.

Footrope weight:
1/4", proof coil galvanized chain, 112.5 ft long (9 links per 7-1/2" hanging).

Flotation:
15 pieces, 8" diameter floats (5.5 lbs buoyancy = 82.5 lbs) evenly spaced.

Codend liner:
1-1/4" mesh, No. 18 nylon; 340 meshes around, 240 meshes deep, secured 15 meshes up from bottom of intermediate (leave about 2 ft of liner extending from end of bag).

Otterboards:
5 x 7 ft V-doors - 820-850 lbs each.

Figure 3. -- Diagram of the 400-mesh eastern demersal trawl.

region encompasses the major distributional area of commercially important demersal fish and shellfish stocks. Trawling stations were uniformly established on the basis of the standard 20 x 20 mile grid (1 station per 400 nm²) that has been used in earlier Bering Sea surveys. Two age structure collection areas (southeast and northwest) were defined to examine differences in year-class and growth rates of selected fish species by region.

A 30-minute demersal trawl haul was conducted at each scheduled station, and an attempt was made to maintain a constant towing speed of 3 knots. Catches weighing less than approximately 2400 lb were entirely sorted and processed. Catches weighing more than the 2500 lb capacity of the sorting table were subsampled. Commercially important crab species were completely removed from every catch. After the catch or subsampled portion of the catch was sorted into baskets, all species or species groups were weighed, enumerated, and either discarded overboard or saved for further processing.

Additional biological data collected on fish species of interest included size frequencies by sex and the collection of age structures. These species included:

Pollock (Theragra chalcogramma)
 Yellowfin sole (Limanda aspera)
 Rock sole (Lepidopsetta bilineata)
 Pacific halibut (Hippoglossus stenolepis)
 Pacific cod (Gadus macrocephalus)
 Sablefish (Anaplopoma fimbria)
 Pacific ocean perch (Sebastes alutus)
 Arrowtooth flounder (Ateresthes stomias)
 Alaska plaice (Pleuronectes quadrituberculatus)
 Greenland turbot (Reinhardtius hippoglossoides)
 Flathead sole (Hippoglossoides stenolepis)

Total weights and numbers were determined for king and tanner crab. All individuals were measured when the crab catch was small. A representative subsample, or approximately 300 crabs, were processed from very large crab catches. In addition to carapace measurements, shell condition, clutch size, and egg condition were also recorded. Tanner crabs were examined for the presence of "blackmat" disease.

The R/V CHAPMAN and the R/V ALASKA conducted 10 days of side-by-side comparative trawling experiments to study relative fishing powers between vessels. The catches were processed as per normal sampling procedures. Preliminary results of this experiment are given in Table 1.

The R/V CHAPMAN and the Japanese Fisheries Agency R/V RYOAN MARU No. 31 conducted 7 days of side-by-side comparative trawling experiments similar to those used by the R/V CHAPMAN and R/V ALASKA. Data from these latter experiments have not been analyzed.

Table 1.--Preliminary fishing power correction factors for R/V CHAPMAN and R/V ALASKA.

Species ^{1/}	Fishing power correction factor	
	CHAPMAN	ALASKA
Skates	0.522	1.00
Greenland turbot	1.00	0.395
Yellowfin sole	0.737	1.00
Rock sole	0.618	1.00
Alaska plaice	0.628	1.00
Sculpins	0.385	1.00

^{1/} For all other species or species groups the fishing power correction factor for both vessels is assumed to equal 1.00.

Results

A total of 409 demersal trawls were attempted, with 382 successful hauls including 76 comparative trawls between the R/V ALASKA and R/V CHAPMAN, 22 comparative hauls between the R/V CHAPMAN and R/V RYOAN MARU No. 31 and 36 opportunistic hauls. Figure 1 shows the distribution of scheduled stations that were successfully trawled.

A total of 163,992 length measurements were taken by sex/cm category for the major fish species encountered (Table 2). Otolith or scale samples for aging were collected from 5,993 individual fish in two subareas (Table 3).

A total of 2,021 Pacific cod stomachs were collected from 133 stations. Initial examination of the stomach contents indicates that a wide variety of food items were taken by cod including pollock, yellowfin sole, eelpouts, king and tanner crabs, and molluscs. Approximately 200 pollock stomachs were collected for analysis in a REFM Division study on pollock cannibalism. Pacific cod and pollock stomachs were also collected from 7 hauls over a 24 hour period at a single station for a daily ration study. Additionally, 250 yellowfin sole stomachs were examined for food habit analysis.

Approximately 800 specimens of fish and invertebrates were collected for special studies at various universities and research centers, including 130 tanner (Chionocetes bairdi) crab for a mating mark study and 100 tanner (C. bairdi) for fecundity studies. A quillfish (Ptilichthys goodei), an uncommon Bering Sea fish, was collected and preserved for the University of Washington fish collection. Approximately 30 bonqo net tows were completed by the R/V ALASKA for an ichthyoplankton study being conducted at the University of Washington. Thirty specimens of searchers (Bathymaster signatus) were collected for taxonomical examinations to be conducted at NWAFC.

Pollock were the most abundant species encountered on the survey with an overall CPUE of 59.8 kg/ha (Table 4). The greatest pollock abundance was found in subarea 12 (86.2 kg/ha) and subarea 13 (106.6 kg/ha) near the Pribilof Islands (Figure 4). Pollock were the most abundant species in every subarea except subareas 1, 4, and 6 (Table 5).

Yellowfin sole were the second most abundant species observed with an overall CPUE of 48.0 kg/ha. Yellowfin sole were the most abundant species in subarea 6 (137.9 kg/ha) and subarea 1 (98.6 kg/ha) in inner Bristol Bay (Figure 5). Low catches of yellowfin sole, less than 1 kg/ha were observed in subareas 3 and 7 and generally along the outer shelf area. Several ripe and running yellowfin sole males were caught at two shallow inshore northern Bristol Bay stations near Cape Pierce.

Pacific cod were the third most abundant species estimated in the survey area with a CPUE of 19.8 kg/ha. They were present at all but one of the successfully trawled stations. Pacific cod were the most abundant species, 27.7 kg/ha, in subarea 4 (Figure 6).

Table 2.--Groundfish length measurements taken during the 1981 eastern Bering Sea crab/groundfish survey.

Species	Number of fish measured
Pollock	52,628
Pacific cod	13,400
Sablefish	111
Arrowtooth and Asiatic flounders	3,622
Greenland turbot	6,098
Pacific halibut	1,250
Flathead sole	13,725
Yellowfin sole	48,167
Starry flounder	26
Rock sole	14,608
Alaska plaice	<u>10,357</u>
Total frequencies	163,992

Table 3.--Age structures^{1/} collected by subarea during the 1981 eastern Bering Sea crab/groundfish survey.

Species	<u>Age structures collected by subarea</u>		
	NW area	SE area	Total
Pollock	739	874	1,613
Pacific cod	1,242	1,053	2,295
Sablefish	19	52	71
Greenland turbot	281	121	402
Yellowfin sole	334	474	808
Rock sole	147	310	457
Alaska plaice	<u>132</u>	<u>215</u>	<u>347</u>
Total	2,894	3,099	5,993

^{1/} Scales were collected from Pacific cod and otoliths from other species.

Table 4.--Rank order of abundance of the 20 most abundant fish and invertebrate taxa taken during the crab-groundfish survey, May-August, 1981.

Rank	Taxon	CPUE (kg/ha) ^{1/}
1	walleye pollock	59.8
2	yellowfin sole	48.0
3	Pacific cod	19.8
4	Alaska plaice	10.3
5	tanner crab (<u>C. opilio</u>)	7.1
6	rock sole	6.8
7	hermit crab unident.	5.7
8	purple-orange seastar	5.2
9	starfish unident.	4.3
10	flathead sole	3.7
11	red king crab	3.0
12	starry skate	2.9
13	tanner crab (<u>C. bairdi</u>)	2.5
14	sculpins (<u>Myoxocephalus</u>)	2.3
15	common mud star	1.8
16	Greenland turbot	1.7
17	sponge unident.	1.4
18	yellow Irish lord	1.4
19	longhead dab	1.3
20	basket starfish	1.3

^{1/} Total effort was 1,390 ha.

Table 5.--Mean CPUE (kg/ha) by subarea of the major fish species and other fish taken during the 1981 eastern Bering Sea demersal trawl survey.

Species	1	2	3	4	6	7	10	12	13	All subareas combined
Pollock	63.4	86.2	65.9	12.4	47.0	69.0	37.3	86.9	106.6	59.8
Yellowfin sole	98.6	18.4	<0.1	26.8	137.9	0.2	0.8	42.0	11.0	48.0
Pacific cod	21.8	12.9	14.5	27.7	21.7	22.7	14.7	10.1	16.0	19.8
Alaska plaice	6.5	2.3	0.2	21.8	32.4	1.2	3.9	12.9	5.4	10.3
Rock sole	21.4	4.9	0.1	0.8	8.1	0.3	0.3	4.7	9.9	6.8
Flathead sole	4.5	9.3	4.8	0.6	1.7	2.5	0.7	0.8	1.8	3.7
Greenland turbot	0.1	0.7	8.2	0.5	0.5	1.9	2.1	0.8	0.7	1.7
Arrowtooth and Asiatic flounders	0.3	4.4	1.4	<0.1	0.2	1.5	0.0	0.5	1.3	1.2
Pacific halibut	2.2	2.4	<0.1	0.3	0.7	0.2	<0.1	1.3	2.9	1.1
Sablefish	0.0	0.9	0.0	0.0	0.0	0.5	0.0	0.0	<0.1	0.2
Pacific ocean perch	0.0	0.0	<0.1	0.0	0.0	0.0	0.0	0.0	0.0	<0.1
Other fish	9.4	20.6	79.9	14.3	15.3	11.6	52.8	18.9	17.4	16.1
Total	228.2	163.0	115.0	105.2	265.5	111.6	112.6	178.9	173.4	168.7

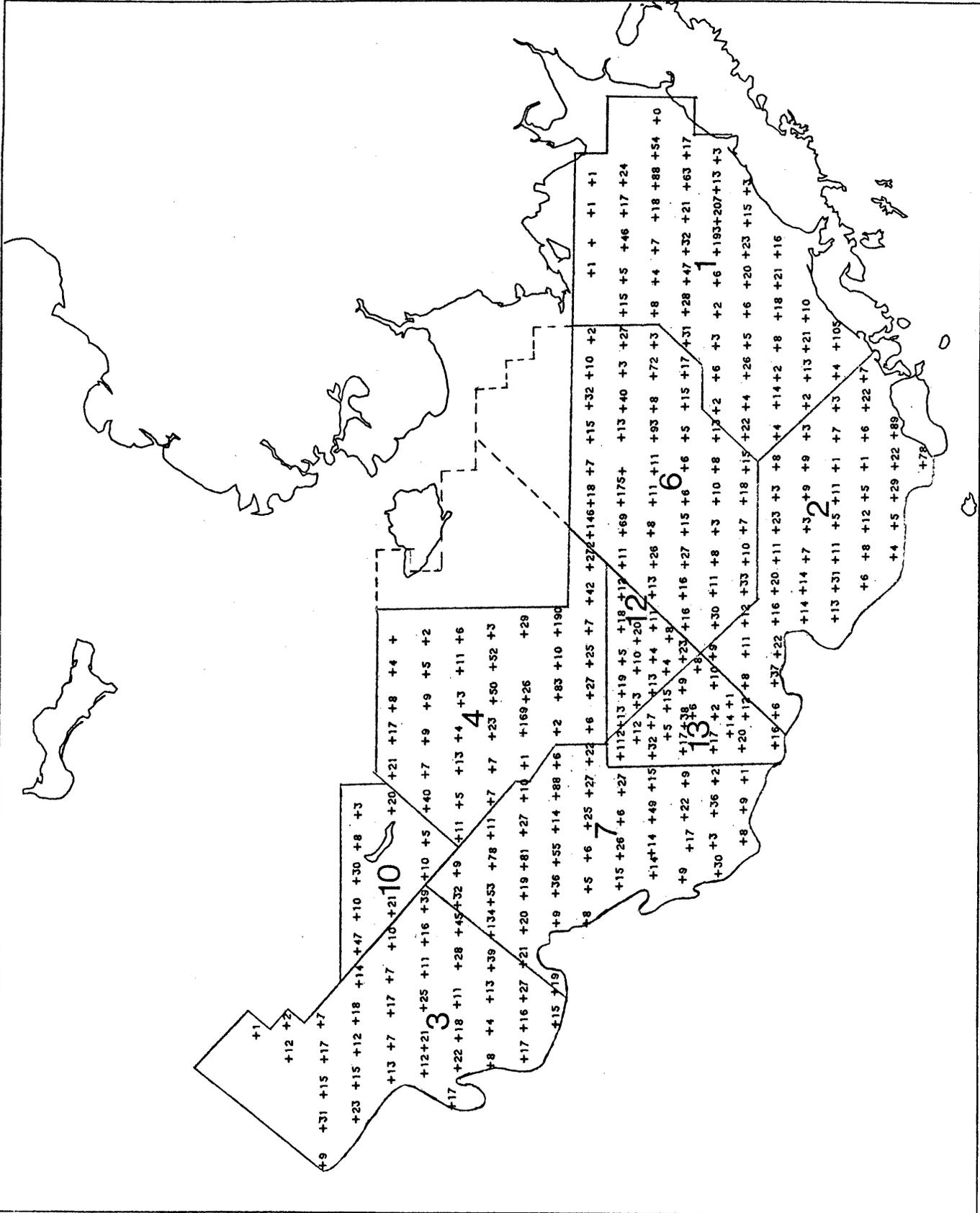


Figure 6.--Distribution and abundance of Pacific cod estimated in the eastern Bering Sea during May-August 1981 (catches in kg/ha).

Personnel

R/V CHAPMAN

Vessel Captain - Warren Taguchi

<u>Leg</u>	<u>Field Party Chief</u>	<u>Other Personnel</u>
1.	Allen Shimada (Seattle)	Kristin Stahl (Kodiak) Doyne Kessler (Kodiak)
2.	Richard MacIntosh (Kodiak)	Allen Shimada (Seattle) Steven Meyers (Kodiak) David Somerton (Seattle)
3.	Doyne Kessler (Kodiak)	Yuko Umeda (Seattle) Franklin Hartsock (Kodiak)
4.	Jeffrey June (Seattle)	Richard MacIntosh (Kodiak) Kristin Stahl (Kodiak) William West (Seattle)

R/V ALASKA

Vessel Captain - Thomas Oswald

1.	Robert Otto (Kodiak)	Chang Ik Zhang (Korea) ^{1/} Yuko Umeda (Seattle) Michael Bohle (Seattle) Steven Wilson (Kodiak)
2.	Jeffrey June (Seattle)	Therese Armetta (Kodiak) Solomon Sears (Seattle) ^{1/} Bob Morrow (Seattle) Sylvia Estrada (Seattle) William West (Seattle)
3.	Michael Bohle (Seattle)	James Hughes (Seattle) Bill Albers (Kodiak) Bill Osborne (Kodiak) Don Fisk (Seattle)

1/ Visiting Scientist

For further information, contact Dr. Murray L. Hayes, Director, Resource Assessment and Conservation Engineering Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, 2725 Montlake Boulevard East, Seattle, Washington 98112. Telephone (206) 442-7719.
