



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

Alaska Fisheries Science Center
Resource Assessment and Conservation
Engineering Division
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CRUISE RESULTS
Cruise 89-1 Alaska
Cruise 89-1 Ocean Hope 3
1989 Eastern Bering Sea Crab and Groundfish Survey
June-August 1989

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) completed the annual crab and groundfish survey of the eastern Bering Sea during June-August 1989. This was a continuation of the annual series of eastern Bering Sea crab-groundfish assessment surveys which began in 1971.

ITINERARY

The Alaska and Ocean Hope 3 departed Dutch Harbor, Alaska, on June 3 and returned to Dutch Harbor on August 17 upon the completion of the 1989 eastern Bering Sea crab-groundfish survey. Intervening port calls were made by both vessels in Dutch Harbor on June 27 and July 23 to obtain supplies and exchange scientific personnel. The Ocean Hope 3 also made port calls to Egegik, Alaska, on June 7 to disembark a member of the field party and St. Paul on July 6 to pick up supplies. A total of 20 vessel days were lost to unfishable weather conditions.

OBJECTIVES

The primary objectives of this survey were to continue the annual series of assessment surveys of crab and groundfish in the eastern Bering Sea to provide information for:

1. the North Pacific Fishery Management Council on the abundance and condition of the resources for management purposes,



2. the U.S. fishing industry, and
3. scientific studies of the resources.

Secondary objectives were to:

1. examine crab and halibut by-catch in inshore trawling areas;
2. assess yellowfin sole abundance in spawning areas in Togiak Bay and Kuskokwim Bay;
3. conduct comparative trawl experiments to evaluate sampling net performance between survey vessels;
4. evaluate trawl performance and configuration with mensuration equipment;
5. tag Pacific cod;
6. collect stomach samples for food habit studies;
7. collect and preserve specimens and tissue samples for special studies requests and;
8. recover, examine, and reset two specially modified crab pots set in shallow waters near the Alaska Peninsula in 1988 to investigate settling of juvenile king crab.

VESSELS AND GEAR

Survey activities were coordinated between two U.S. vessels, the 30.5 m University of Washington research vessel Alaska and the 31.4 m commercial fishing vessel Ocean Hope 3. A Soviet vessel, the Mys Babushkina, also surveyed the area between May 19 and July 5 but at about half the sampling density as the U.S. vessels. Data and samples collected aboard the Mys Babushkina will be used to supplement those collected aboard the U.S. vessels but results from the Soviet vessel are not reported here.

The standard bottom trawl used by the U.S. vessels at all standard continental shelf stations was an 83-112 eastern trawl. These nets have a 25.3 m (83 ft) headrope and a 34.1 m (112 ft) footrope (Figure 1). They were towed behind 1,000 kg, 1.8 X 2.7 m, steel V-doors and 54.9 m paired dandyline. Each lower dandyline had a 0.61 m chain extension connected to the lower wing edge to improve bottom tending characteristics. The 83-112 eastern trawl has been the standard sampling net used during annual eastern Bering Sea surveys since 1982 when it replaced the 400 mesh eastern trawl.

Net mensuration systems aboard both vessels were used during most tows to provide gear configuration and performance data to be used in area swept calculations.

SURVEY DESIGN AND METHODS

The standard survey area, sampled annually since 1979, is shown in Figure 2. Sampling sites were established on the basis of a 20 x 20 nmi grid pattern used during previous surveys, although more intensive sampling was carried out in the Pribilof Islands and St. Matthew Island regions to collect additional data on crab populations. Stations were also established in the Togiak Bay and Kuskokwim Bay areas to investigate abundance of yellowfin sole in these areas where commercial fisheries have operated in recent years. The area between 160° W and 162° W was also sampled in response to a request from the North Pacific Fishery Management Council to investigate incidence of crab and halibut in trawl catches relative to the possible expansion of the inshore trawl fishery from 25 to 30 fm. Additional stations northwest of the standard survey area were also established to estimate the abundance of Tanner crab (*Chionoecetes opilio*) in an area that has produced high commercial landings in recent years.

The Alaska and Ocean Hope 3 sampled alternate north/south rows of stations proceeding from Bristol Bay westward to the shelf edge. A tow 30 minutes in duration was made at most sampling sites. All catches were sorted to the lowest possible taxon, weighed, and enumerated. Station data, including time, position, trawl performance, and distance fished, as well as catch information, were entered onto diskettes with shipboard computer systems. Size composition and age samples by sex-centimeter category and other biological data were collected from the major fish species encountered. Length-width measurements, shell condition, clutch size, and tissues and organs for various studies were collected from the major crab species. Special study collections were stored in appropriate fixatives or frozen. Sea water temperature profiles were collected at each station using expendable bathythermograph (XBT) probes.

Upon completion of the standard survey the Alaska and Ocean Hope 3 conducted a side-by-side trawling experiment near Amak Island. The primary purpose of this experiment was to evaluate fishing effectiveness between vessels and sampling gear using the 83-112 eastern bottom trawl and the 400 mesh eastern trawl. The 400 mesh eastern trawl was the standard sampling net used during the eastern Bering Sea surveys until 1982 when it was replaced by the 83-112 eastern trawl. However, these experiments could not be undertaken because one of the 400 mesh eastern trawls was lost overboard. Instead, a series of side-by-side tows were conducted using the 83-112 trawl to compare the relative fishing

powers of the two survey vessels from this method with those derived from the alternate row method.

RESULTS

The Alaska and Ocean Hope 3 successfully completed 426 bottom hauls, including a total of 36 side-by-side comparative trawls (Figure 2). The Ocean Hope 3 completed an additional 12 trawl hauls in the Port Moller region to collect information for crab and Pacific halibut by-catch between 160° W and 162° W at depths of 16-30 fathoms. The Alaska also conducted five tows to examine the effect of otter door size on effective net width.

Biological data collected from fish species are summarized in Table 1. The two U.S. vessels recorded approximately 155,000 length measurements by sex-centimeter category from the major fish species and about 4,400 age structures were collected and preserved. Biological data collected from fish species on the Alaska and Ocean Hope 3 are summarized in Table 1. About 7,500 stomachs were preserved from various taxa for feeding habit analysis. Nearly 300 Pacific cod were tagged and released to provide information on stock movements. Very few viable Greenland turbot were encountered and, subsequently, no specimens were tagged. Red king crab were tagged and released to provide information for growth and movement studies. Numerous whole specimens of various species were preserved for identification, training, and other purposes. Sea water temperature profiles were collected at each station using expendable bathythermograph (XBT) probes.

Several monitor sites along the Alaska Peninsula were identified for assessment of juvenile crab too small to be adequately sampled with survey trawls. Standard crab pots filled with trawl webbing served as artificial habitats to attract small crab during the 1988 survey. A long-term digital recording thermograph was included at each site to provide a continuous year-round record of bottom water temperatures. Although an extensive search was conducted by the Alaska, neither of the two special crab pots were found.

The total standard survey area region encompassed approximately 136,000 nmi² and overall catches averaged nearly 384 kg/ha trawled. Fish comprised about 77% (297 kg/ha) of the total catch, while invertebrates accounted for the remaining 23% or 87 kg/ha trawled.

Walleye pollock was the most abundant species encountered, with an overall CPUE of about 165 kg/ha trawled (Table 2). They were taken at nearly all sampling sites occupied, with largest mean catches (291.0 kg/ha) observed in outer shelf waters at depths

of 100-200 m (Figure 3). Mean catches were greatly reduced at depths less than 50 m (10.0 kg/ha).

Yellowfin sole and rock sole were the most abundant flatfish species, with overall CPUE values of 36.0 kg/ha and 27.3 kg/ha, respectively. Yellowfin sole were primarily restricted to central and inner shelf waters, while rock sole had major concentrations in Bristol Bay and near the Pribilof Islands (Figures 4 and 5). Yellowfin sole catches decreased sharply with increased depth, from 117.8 kg/ha in waters less than 50 m to <0.1 kg/ha in waters greater than 100 m. A similar, although less marked, depth-related decrease in rock sole abundance was also observed.

Pacific cod were encountered at nearly all sites sampled except in the more nearshore waters along the Alaska mainland (Figure 6). Catch rates varied by depth zone from 3.8 kg/ha trawled at depths less than 50 m to 34.2 kg/ha at depths of 100-200 m, with an overall average of 20.6 kg/ha trawled.

Alaska plaice, flathead sole, arrowtooth flounder, and Pacific halibut had a combined catch rate of 28.0 kg/ha. Alaska plaice was the most abundant species of this group, with highest catch rates (12.5 kg/ha) in central shelf waters 50-100 m. Highest catch rates of arrowtooth flounder (17.5 kg/ha) and flathead sole (15.2 kg/ha) were located in waters 100-200 m.

Tanner crab (*C. opilio*) was the most abundant commercially important crab species encountered, with a total average catch rate of 15.2 kg/ha. Red king crab, blue king crab, and Tanner crab (*C. bairdi*) had overall catch rates of 2.7 kg/ha or less.

SCIENTIFIC PERSONNEL^a**Alaska****Leg 1**

A. Shimada^b
 (M) Wilson
 M. Yang
 P. Cummiskey^c
 F. Hartsock^c

Leg 2

P. Anderson^{bc}
 (C) Rose
 C. Armistead
 C. Chumbley
 B. Dew^c

Leg 3

(B) Otto^{bc}
 D. Fisk
 (M) Wilson
 M. Yang
 K. Cunningham^d

Ocean Hope 3**Leg 1**

(T) Sample^b
 D. Molenaar
 (D) Roetcisoender
 R. Macintosh^c
 T. Armetta

Leg 2

(G) Walters^b
 D. Molenaar
 L. Haaga
 L. Cherepow
 B. Stevens^c

Leg 3

(T) Sample^b
 M. Bailey
 E. Munk^c
 F. Hartsock^c
 B. Raschi^e

- a Personnel from AFSC, Seattle, unless otherwise noted
 b Field Party Chief
 c Personnel from AFSC, Kodiak Laboratory
 d Personnel from Yale University
 e Personnel from Texas A & M

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Table 1.--Biological data collected by the Alaska and Ocean Hope 3 during the 1989 eastern Bering Sea crab-groundfish survey.

Species	Length measurements	Age structures ^a	Stomach samples	Number tagged
Walleye pollock	38,926	1,262	2,379	--
Pacific cod	4,936	765	1,806	291
Yellowfin sole	35,019	748	1,005	--
Rock sole	30,676	688	334	--
Flathead sole/ Bering flounder	21,562	463 ^b	770	--
Pacific halibut	1,827	--	287	--
Alaska plaice	8,647	465 ^c	258	--
Arrowtooth flounder/ Kamchatka flounder	11,264	--	458	--
Greenland turbot	432	--	173	--
Rex sole	398	--	--	--
Pacific herring	467	--	--	--
Pacific ocean perch	5	--	--	--
Northern rockfish	15	--	--	--
Saffron cod	250	--	--	--
Longhead dab	160	--	--	--
Misc. species	98	--	--	--
Total	<u>154,682</u>	<u>4,391</u>	<u>7,470</u>	<u>291</u>

^a Scale scrape samples, in addition to otoliths, were collected from Pacific cod. Only otoliths were taken from all other species.

^b Otoliths and individual weights collected aboard the Mys Babushkina.

^c Otoliths collected aboard the Mys Babushkina.

Table 2.--Catch rates (kg/ha) by depth zone of commercially important fish and crab species taken in the standard area during the 1989 eastern Bering Sea crab-groundfish survey.

Species	Inner shelf < 50 m	Central shelf 50-100 m	Outer shelf 100-200 m	Total area
Walleye pollock	10.0	172.3	291.0	164.9
Yellowfin sole	117.8	25.0	<0.1	36.0
Rock sole	45.7	34.8	2.4	27.3
Pacific cod	3.8	19.3	34.2	20.6
Alaska plaice	9.9	12.5	4.2	9.5
Flathead sole	0.6	7.8	15.2	8.6
Arrowtooth flounder	0.1	6.1	17.5	8.3
Pacific halibut	1.6	1.6	1.6	1.6
Opilio Tanner crab	1.2	22.0	13.3	15.2
Red king crab	1.0	1.2	0.0	0.8
Bairdi Tanner crab	1.4	4.0	1.5	2.7
Blue king crab	<0.1	1.1	0.1	0.6
Total effort (hectares)	382.5	751.2	403.9	1537.6

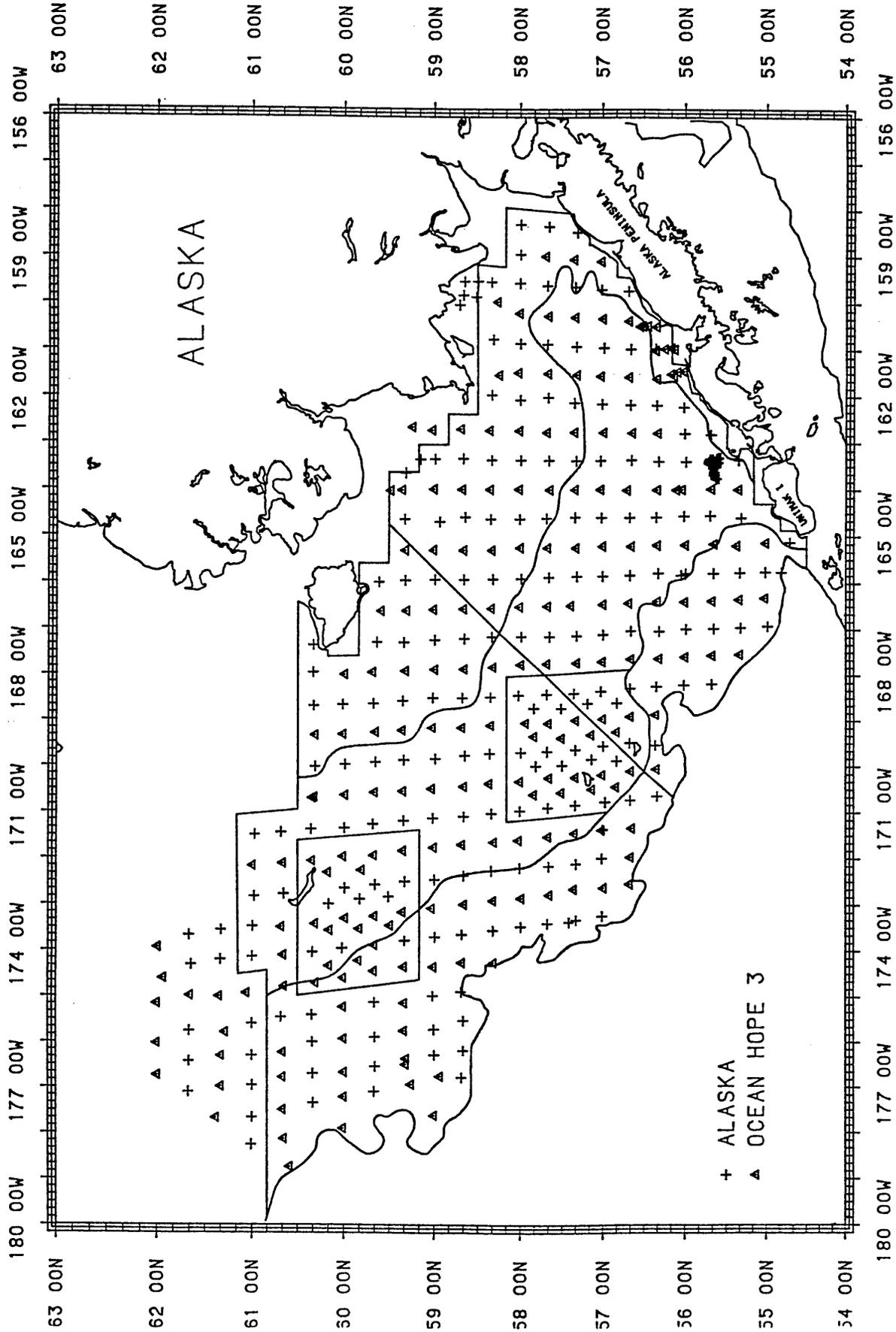


Figure 2.--Sampling sites occupied by the Alaska and Ocean Hope 3 during the 1989 eastern Bering survey. The solid lines indicate the standard survey area boundaries and subareas. The dense concentration of stations around 163° W and 55° 30' N shows the locations of side-by-side trawling to compare fishing efficiencies between vessels.

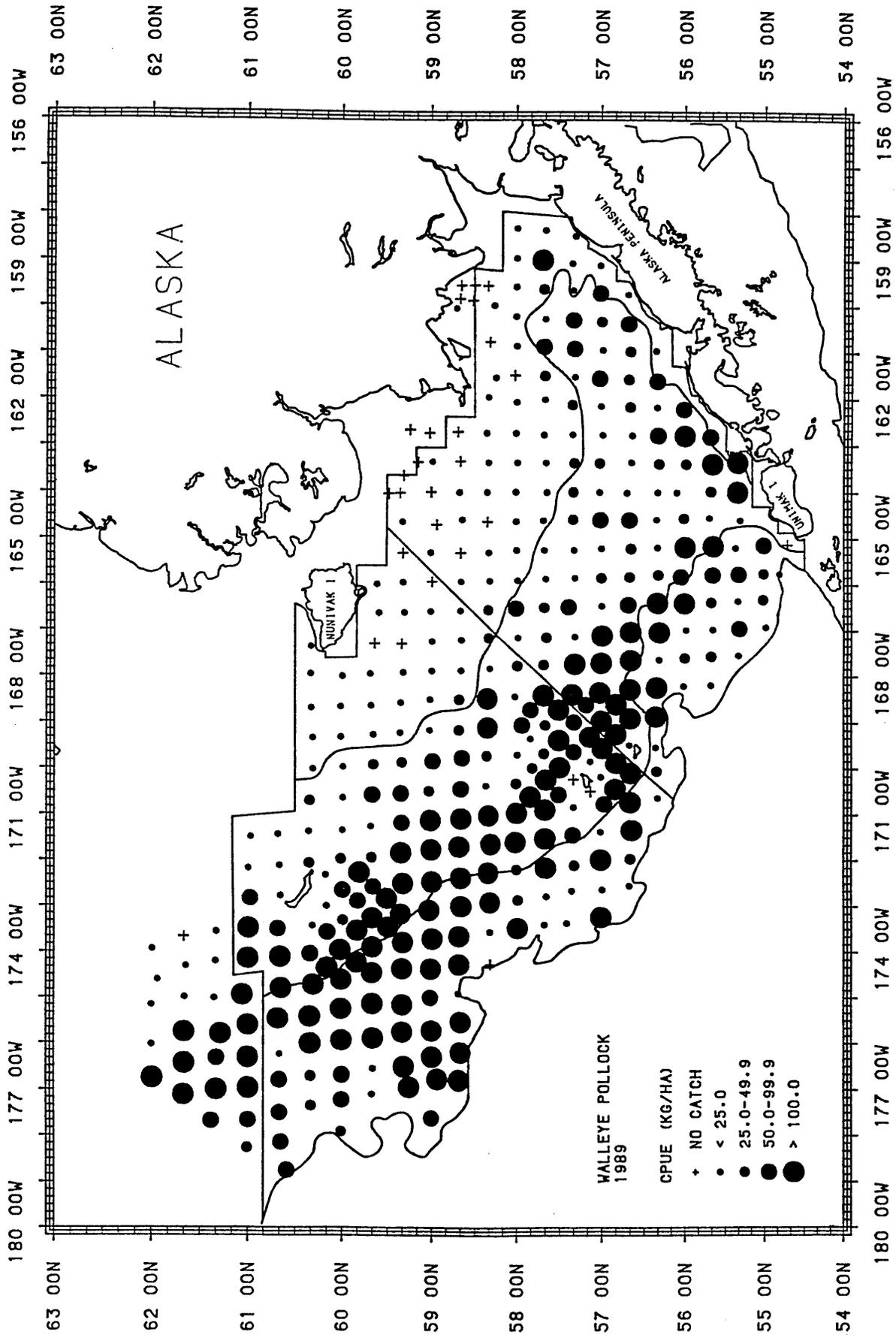


Figure 3.--Distribution of catch rates of walleye pollock during the 1989 eastern Bering Sea crab-groundfish survey.

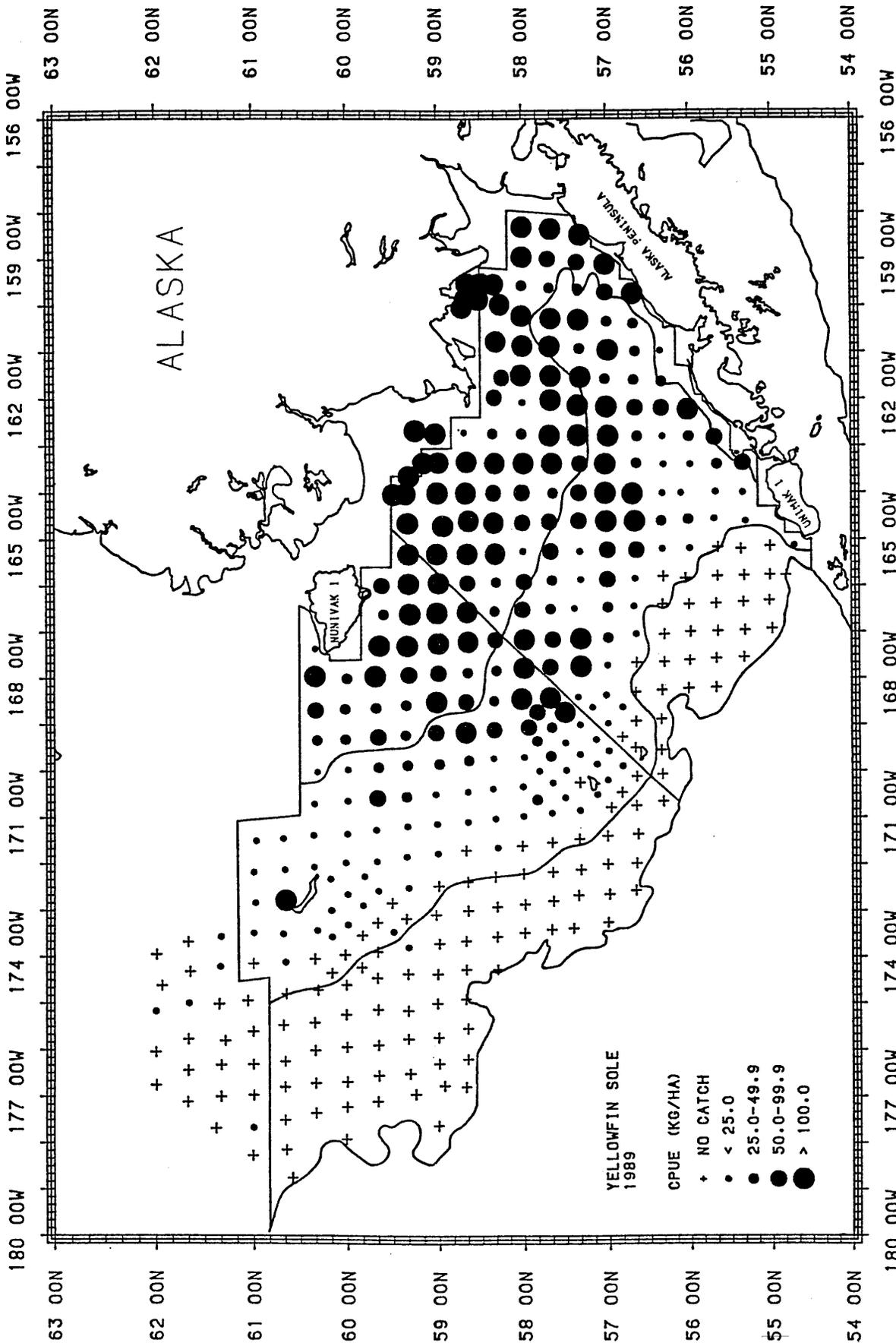


Figure 4.--Distribution of catch rates of yellowfin sole during the 1989 eastern Bering Sea crab-groundfish survey.

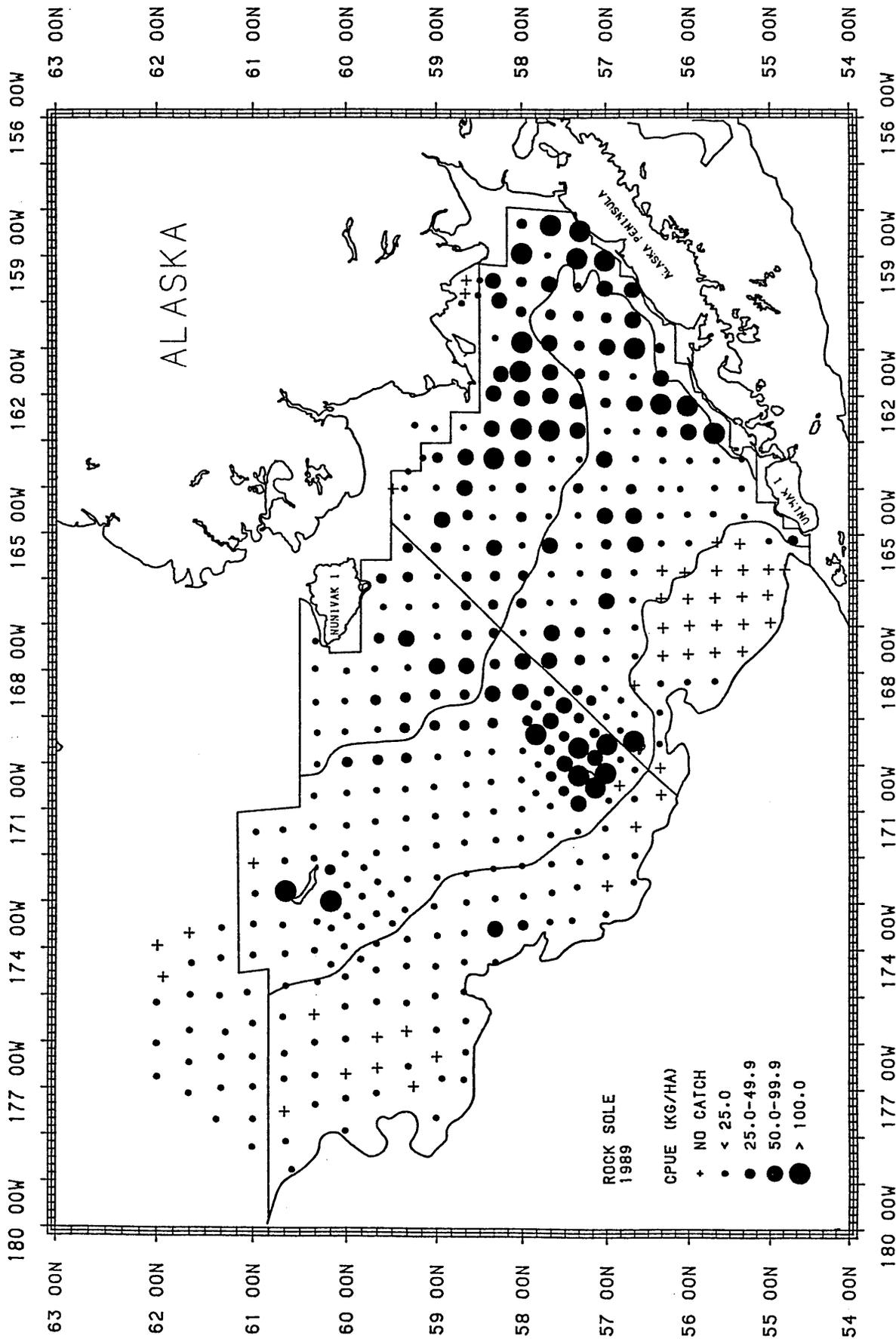


Figure 5.--Distribution of catch rates of rock sole during the 1989 eastern Bering Sea crab-groundfish survey.

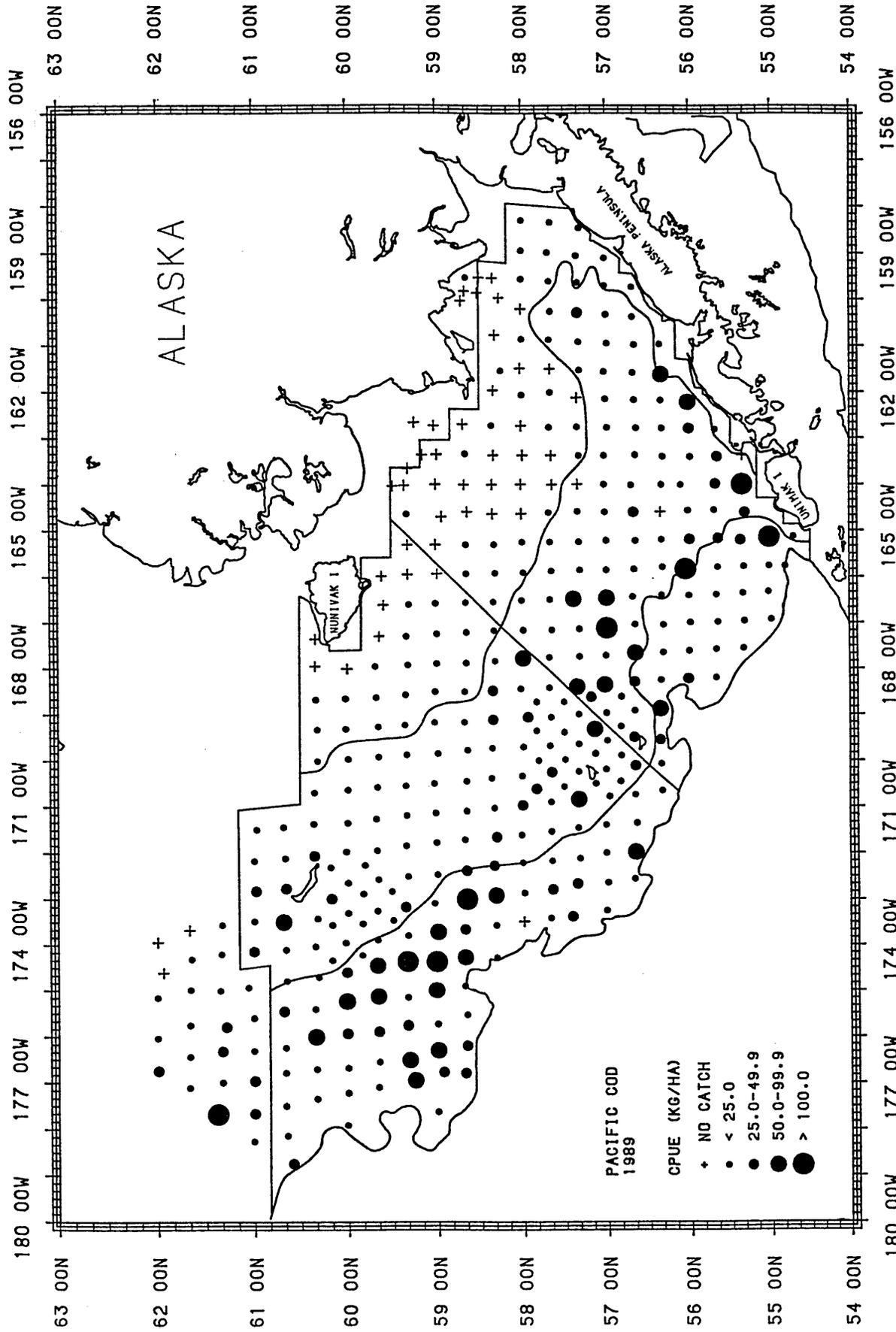


Figure 6.--Distribution of catch rates of Pacific cod during the 1989 eastern Bering Sea crab-groundfish survey.