

## **CRUISE RESULTS**

### **Cruise 2000-01 (F/V Arcturus) Cruise 2000-01 (F/V Aldebaran) 2000 Eastern Bering Sea Crab and Groundfish Survey**

**May-July 2000**

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) conducted the annual crab and groundfish bottom trawl survey of the eastern Bering Sea shelf from May to July 2000. This was a continuation of the annual series of eastern Bering Sea crab-groundfish assessment surveys which began in 1971.

#### **OBJECTIVES**

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

1. the North Pacific Fishery Management Council on the distribution, abundance, and biological condition of important groundfish and crab species;
2. the U.S. fishing industry on catch per unit effort and size composition; and
3. the support of ongoing studies on the biology, behavior, and dynamics of key ecosystem components.
4. Secondary objectives were to:
5. conduct additional sampling in areas of high king crab and Tanner crab abundance to reduce variability in population estimates;
6. evaluate bottom trawl performance and configuration with net mensuration equipment;
7. sample nearshore sites near Togiak Bay, Kuskowim Bay, and Port Moller to investigate distribution of yellowfin sole and other species in areas immediately adjacent to the standard survey area;
8. collect fish egg masses to help determine critical spawning habitats;
9. collect length-girth relationships for yellowfin sole, rock sole, and flathead sole for data to determine harvest effects and selectivity of modifying the mesh size of commercial fisheries trawls;
10. collect small walleye pollock and Arctic cod to evaluate difference in the ratio of otolith length and fish length by species;
11. collect fin clip samples from walleye pollock to determine genetic DNA markers in population structure;
12. collect and preserve specimens of fish and invertebrates for a voucher data base;
13. collect stomach samples for trophic interaction studies;
14. collect specimens of bigmouth sculpin (*Hemitripterus bolini*), egg masses, ovaries, and sponge to describe bigmouth sculpin development and life history; and
15. collect and preserve various whole specimens and tissue samples from both fish and invertebrates for special study requests.

#### **VESSELS AND GEAR**

Sampling at the standard sites was coordinated between two chartered commercial vessels, the F/V Arcturus and F/V Aldebaran. Both vessels were 39.6 m (130 ft) in length. The bottom trawl used at all standard sampling 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 (Fig. 1). They were towed behind 1,000 kg, 1.8 X 2.7 m, steel V-doors and 54.9 m (180.1 ft) paired dandyines. Each lower dandyine 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, previously used since the 1970s. Seawater temperature profiles were collected at most sampling sites using a micro-bathythermograph attached to the headrope of the net. Surface seawater temperatures were also collected with a bucket thermometer. Net mensuration systems and bottom contact sensors aboard both vessels were used to provide sampling net configuration and performance data to be used in area-swept and catch-per-unit-effort (CPUE) calculations.

## **ITINERARY**

The Arcturus and Aldebaran began the bottom trawl survey in Dutch Harbor, Alaska on May 19. The Arcturus completed its portion of the standard survey on July 13 and proceeded to conduct a special study experiment evaluating the effects of towing speed and fish escapement under the footrope of a bottom trawl. The Aldebaran completed the standard survey on July 20, resampled red king crab in Bristol Bay, then proceeded to Pavlov Bay to continue the annual shrimp survey. The Aldebaran ended the charter in Dutch Harbor on July 27 while the Arcturus finished on July 30. Intervening port calls were made by both vessels in Dutch Harbor on June 5 because of mechanical problems aboard the Aldebaran and July 1 to obtain supplies and exchange scientific personnel. Vessel time lost due to the mechanical breakdown aboard the Aldebaran resulted in a charter extension added to the third leg. Both vessels also made a port call to St. Paul on June 21 for personnel exchange. The Aldebaran made an additional call to St. Paul on June 27 to disembark a scientist.

## **SURVEY DESIGN AND METHODS**

The standard survey area is shown in Figure 2. Sampling sites were established on the basis of a 20 x 20 nm 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. Additional stations northwest of the standard survey area were established to estimate the abundance of Tanner crab (*Chionoecetes opilio*) in that area.

The Arcturus and Aldebaran then sampled alternate north/south columns of stations proceeding from Bristol Bay westward to the shelf edge. Tows of 30 minutes in duration were made at most sampling sites. All catches were sorted to the lowest possible taxon, weighed, and enumerated. Station data including time, position, trawl performance, distance fished as well as catch information was entered onto diskettes with shipboard computer systems.

Age samples (by sex-centimeter category), size composition, 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 were frozen.

## **RESULTS**

The Arcturus and Aldebaran conducted 400 bottom trawls during the standard survey including 371 successfully completed trawls at scheduled sampling sites, 19 special study near shore stations, and 10 unsuccessful hauls. As the standard survey neared completion, the Arcturus did a special experiment to assess the effect of towing speed on fishing efficiency of the 83/112 and Nor'eastern bottom sampling trawls. A total of 53 tows were completed. This study was conducted in the outer shelf waters south of the Pribilof Islands. While the Arcturus conducted this study, the Aldebaran completed the standard survey and re-sampled 23 stations in Bristol bay to collect additional information on red king crab. The Aldebaran then proceeded to Pavlov Bay to conduct the annual forage species/shrimp survey. Biological data collected from fish species are summarized in Table 1. The two vessels recorded 157,257 length measurements from the major fish species and 6,079 age structures were collected and preserved. Individual length-weight data were also recorded during the otolith collection process. A total of 7,744 stomachs were preserved from various fish taxa for feeding habit analysis. Whole specimens and tissue samples of various fish and invertebrate species were preserved for identification, training, and other

purposes. The total standard survey area encompassed approximately 463,400 km<sup>2</sup>. Catch rates of important fish and crab species, by depth zone, are shown in Table 2.

Walleye pollock (*Theragra chalcogramma*) was the most abundant round-fish species and had an overall CPUE of 111.1 kg/ha trawled. They were encountered at nearly all sampling sites, with largest mean catches (155.8 kg/ha) observed in outer shelf waters at depths of 100-200 m (Fig. 3). Mean catches were much lower at depths less than 50 m (27.6 kg/ha).

Northern rock sole (*Lepidopsetta polyxystra*) and yellowfin sole (*Limanda aspera*) were the most abundant flatfish species, with overall CPUE values of 45.1 kg/ha and 33.5 kg/ha, respectively. Yellowfin sole were primarily restricted to the central and inner shelf waters, while rock sole were more broadly distributed with concentrations in Bristol Bay, around the Pribilof Islands, and the outer shelf (Figs. 4 and 5). Yellowfin sole catches decreased sharply with increased depth, from 80.1 kg/ha in waters less than 50 m to less than 0.1 kg/ha in waters greater than 100 m (Table 2). A similar depth-related decrease in rock sole abundance was also observed.

Pacific cod (*Gadus macrocephalus*) were encountered at most of the sites sampled (Fig. 6). Mean catch rates were smallest at inner shelf stations less than 50 m (6.8 kg/ha) and greatest in the central shelf region (14.8 kg/ha).

Alaska plaice (*Pleuronectes quadrituberculatus*), flathead sole/Bering flounder (*Hippoglossoides elassodon* and *H. robustus*), arrowtooth/Kamchatka flounder (*Atherestes stomias* and *A. evermanni*), and Pacific halibut (*Hippoglossus stenolepis*) had a combined catch rate of 27.2 kg/ha. Alaska plaice and flathead sole/Bering flounder were the most abundant species of this group, with an overall catch rate of 9.5 kg/ha and 8.3 kg/ha respectively.

Opilio Tanner crab was the most abundant commercially important crab species encountered, with a total average catch rate of 4.2 kg/ha. Red king crab (*Paralithoides camtschatica*) had an overall mean CPUE of 1.3 kg/ha while blue king crab (*P. platypus*) and Bairdi Tanner crab (*C. bairdi*) had overall catch rates of 0.2 kg/ha and 0.6 kg/ha trawled respectively.

## SCIENTIFIC PERSONNEL

### F/V Arcturus

<u>Leg 1</u>	<u>Leg 2</u>	<u>Leg 3</u>
D. Nichol b	P. Cummiskey bd	P. Munro b
J. Hoff	D. Nichol	K. Weinberg
T. Buckley	G. Mundell	M. Yang
J. Forsberg c	M. Nelson	R. Barrick c
R. MacIntosh d	R. Barrick c	B. Otto d
B. McKenna d	S. Persselin d	K. Swiney d

### F/V Aldebaran

<u>Leg 1</u>	<u>Leg 2</u>	<u>Leg 3</u>
T. Sample b	D. Benjamin b	P. Anderson bd
E. Acuna	D. Nebenzahl	D. Benjamin
F. Morado	L. Appesland	E. Acuna
M. Yang	T. Price	D. Nebenzahl
K. Smith	E. Munk d	K. Smith
C. Armistead d	B. O'Gorman d	G. Lang

- a Personnel from the AFSC, Seattle, unless otherwise noted
- b Field Party Chief
- c Personnel from the International Pacific Halibut Commission
- d Personnel from the AFSC, Kodiak Laboratory

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 For further information contact Dr. Gary Stauffer, Director, Resource Assessment and Conservation Engineering Division, Alaska Fisheries Science Center, National Marine Fisheries Service, 7600 Sand Point Way NE, Building 4, BIN C15700, Seattle, WA 98115-0070 -- Telephone (206) 526-4170  
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Table 1. Biological data collected during the 2000 eastern Bering Sea crab-groundfish survey.

<u>Species</u>	<u>Length Measurements</u>	<u>Age Structures<sup>1/2/</sup></u>	<u>Stomach Samples</u>
Walleye pollock	44,165	1,593	3,056
Pacific cod	12,564	889	2,484
Yellowfin sole	28,199	908	153
Rock sole	33,691	410	143
Flathead sole <sup>3/</sup>			
Bering flounder	18,440	455	132
Pacific halibut	1,350	661	39
Alaska plaice	10,147	368	103
Arrowtooth flounder/			
Kamchatka flounder	9,287	--	404
Greenland turbot	248	188	21
Rex sole	1,503	187	15
Longhead dab	1,837	245	31
Plain sculpin	1,496	--	24
Misc. sculpins	659	174	62
Starry flounder	838	--	31
Alaska skate	2,140	--	633
Misc. skates	193	--	91
Misc. species	647	1	322
<b>Total</b>	<b>157,257</b>	<b>6,079</b>	<b>7,744</b>

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

2/ Individual length-weight data were also collected.

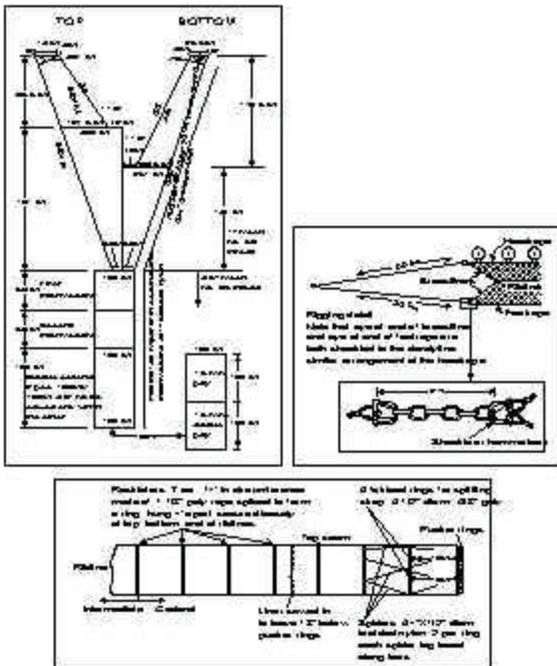
3/ Age structures were collected from flathead sole only.

Table 2. Catch rates (kg/ha) by depth zone of commercially important fish and crab species taken aboard the Arcturus and Aldebaran during the 2000 eastern Bering Sea crab-groundfish survey.

<u>Species</u>	<u>Inner shelf &lt; 50 m</u>	<u>Central shelf 50-100 m</u>	<u>Outer shelf 100-200 m</u>	<u>Total Area</u>
Walleye pollock	27.6	129.7	155.8	111.1
Yellowfin sole	80.1	27.5	<0.1	33.5
Rock sole	127.4	26.4	5.5	45.1
Pacific cod	6.8	14.8	11.5	11.9
Alaska plaice	9.5	13.6	1.6	9.5
Flathead sole/ Bering flounder	0.9	9.3	13.0	8.3
Arrowtooth flounder/ Kamchatka flounder	<0.1	3.7	19.1	6.8
Pacific halibut	2.6	2.1	3.5	2.6
Opilio Tanner crab	1.0	3.6	8.5	4.2
Red king crab	1.7	1.7	0.0	1.3
Bairdi Tanner crab	0.2	0.8	0.6	0.6
Blue king crab	<0.01	0.4	<0.1	0.2

**Figure 1. 83/112 Eastern**

83/112 EASTERN



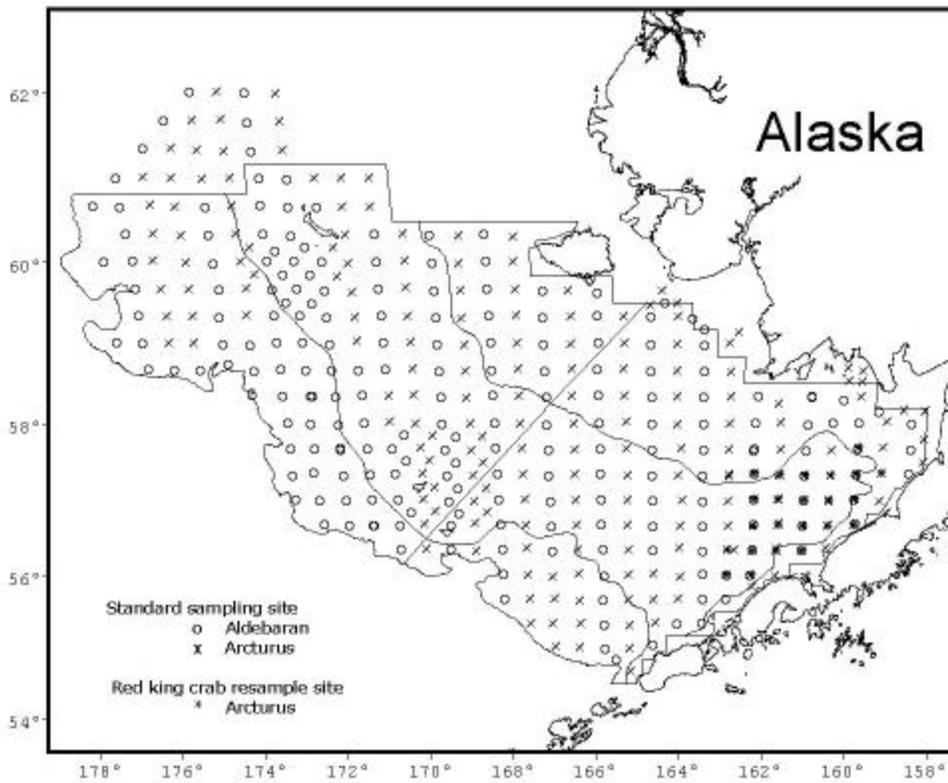


Figure 2.--Distribution of total sampling effort by the Aldebaran and Arcturus during the 2000 eastern Bering Sea bottom trawl survey.

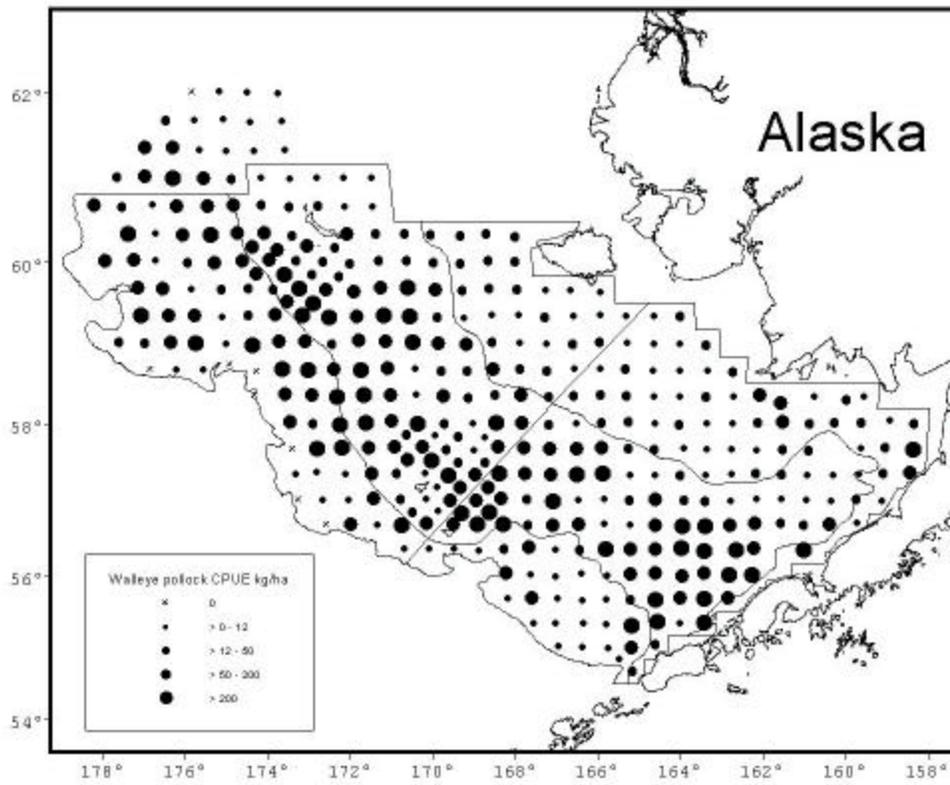


Figure 3.--Distribution of and relative abundance of walleye pollock during the 2000 eastern Bering Sea bottom trawl survey.

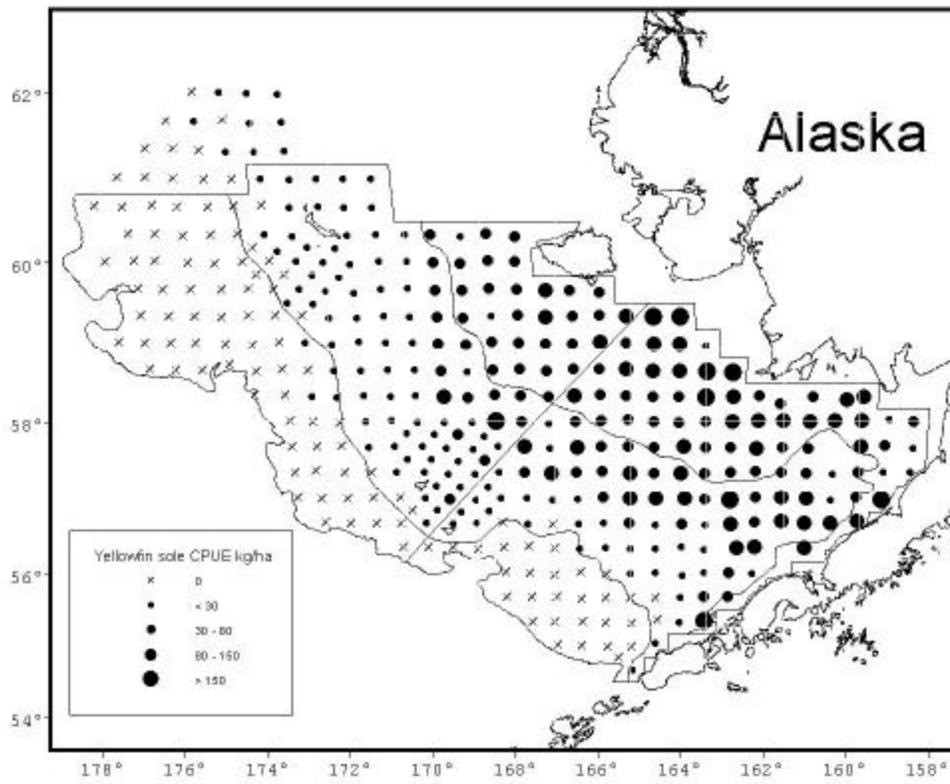


Figure 4.--Distribution of and relative abundance of yellowfin sole during the 2000 eastern Bering Sea bottom trawl survey.

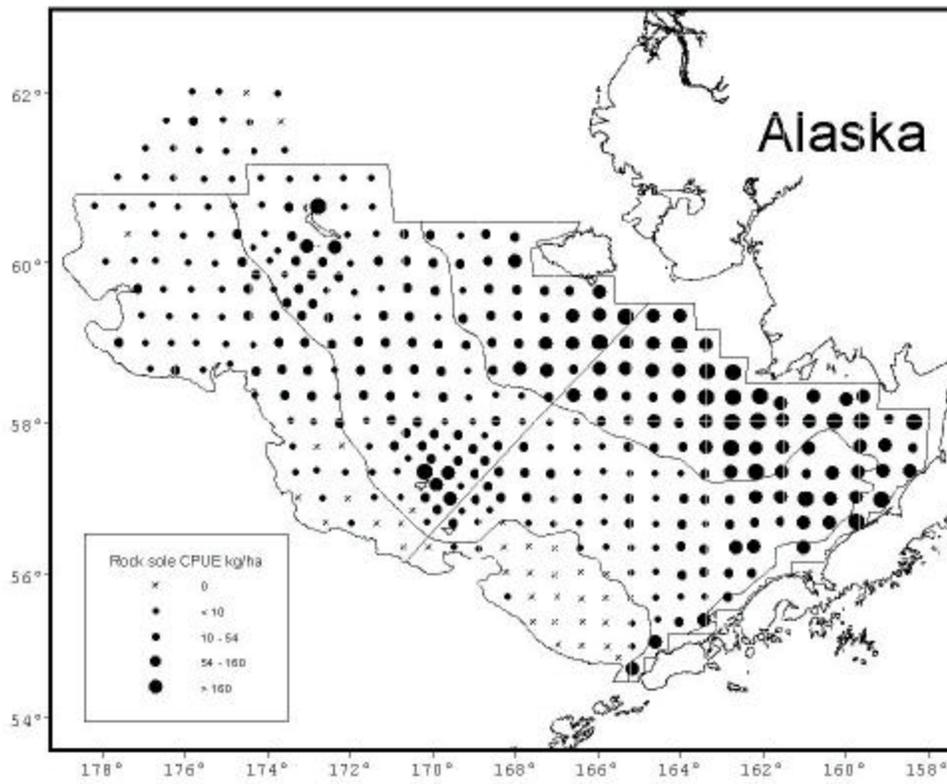


Figure 5.--Distribution of and relative abundance of northern rock sole during the 2000 eastern Bering Sea bottom trawl survey.

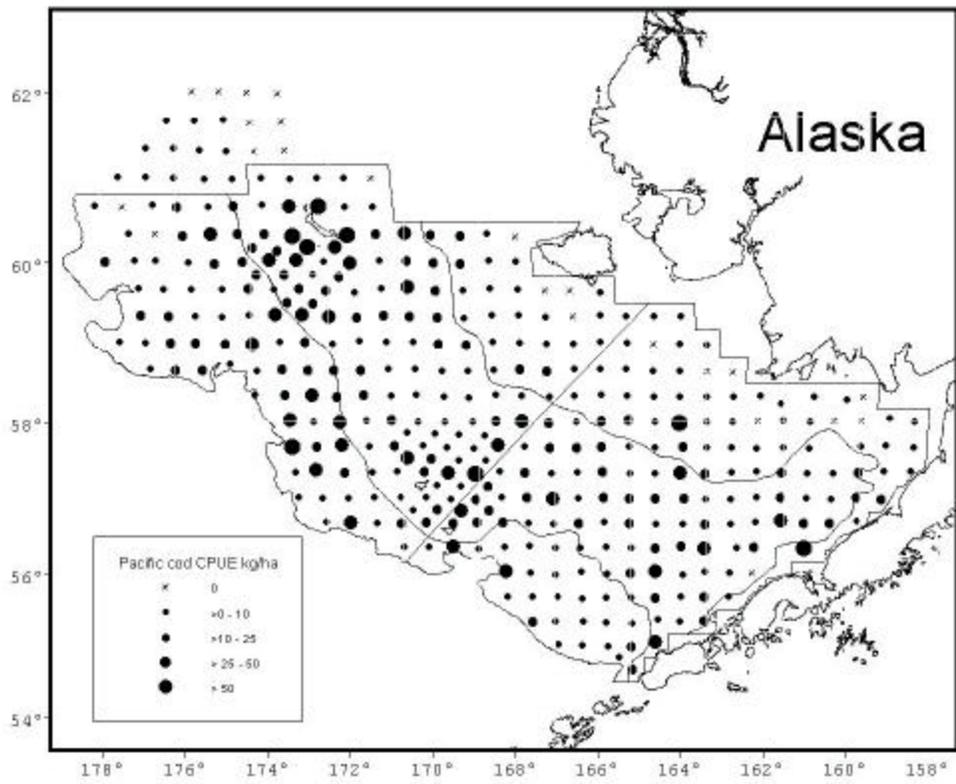


Figure 6.--Distribution of and relative abundance of Pacific cod during the 2000 eastern Bering Sea bottom trawl survey.