

## **CRUISE RESULTS**

### **Cruise 95-1 *Arcturus* Cruise 95-1 *Aldebaran* Eastern Bering Sea Crab and Groundfish Survey June-August 1995**

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 June to August 1995. 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.

Secondary objectives were to:

1. conduct additional sampling in areas of high king crab and Tanner crab abundance to reduce variability in population estimates;
2. collect maturity data from yellowfin sole for spawning studies;
3. evaluate bottom trawl performance and configuration with net mensuration equipment;

4. collect stomach samples for trophic interaction studies;
5. collect and preserve various whole specimens and tissue samples from both fish and invertebrates for special study requests;
6. record observations of pathological anomalies of various fish species to assess prevalence of infestations;
7. evaluate potential bias resulting from current methods of subsampling large trawl catches;
8. determine the effect of reducing tow duration from 30 to 15 minutes on observed catch-per-unit-effort (CPUE) and size distribution; and
9. observe fishing net configuration and fish and invertebrate behavior in relation to the net using a low light video camera.

#### **VESSELS AND GEAR**

Sampling at the standard sites was coordinated using two chartered commercial vessels, the F/V *Arcturus* and F/V *Aldebaran*. Both vessels were 39.6 m (130 ft) in length.

The standard bottom trawl, used at all 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 (6 x 9 ft), steel V-doors and 54.9 m (180.1 ft) 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, previously used since the 1970s.

Seawater temperature profiles were collected at most sampling sites using a micro-bathythermograph attached to the head-rope of the net. Surface seawater temperatures were also collected with a bucket thermometer lowered over the side of the vessels.

Net mensuration systems were used aboard both vessels to provide sampling net configuration and performance data to be used in area-swept and CPUE calculations.

### ITINERARY

The *Arcturus* and *Aldebaran* began the survey in Dutch Harbor, Alaska on June 1. Both vessels returned to Dutch Harbor on August 2 upon the completion of the 1995 eastern Bering Sea crab-groundfish survey. Intervening port calls were made by both vessels in Akutan on June 15 and Dutch Harbor on June 22 and July 14 to obtain supplies and/or exchange scientific personnel.

### 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 snow crab (*Chionoecetes opilio*) in that area. Additional time was allocated to intensify sampling efforts near the standard station locations where large concentrations of king (*Paralithodes* spp.) or Tanner crab (*Chionoecetes* spp.) were encountered.

The *Arcturus* and *Aldebaran* sampled alternate north/south columns 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, distance fished as well as catch information, were 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.

Large catches (i.e. catches exceeding the holding capacity of the sorting tables, 1,400 kg - 2,100 kg) were completely processed as time permitted. In cases where time did not permit complete processing of large catches, subsampling of the catch was conducted. Because of concern that the subsampling of the catch may result in a biased estimate of catch rates due to species and size stratification in the research trawl, the remaining portion

of the large catches was then processed, as time allowed, to provide a comparative data set.

Upon completion of the standard survey, the *Aldebaran* and *Arcturus* conducted a bottom trawl experiment to evaluate the effect of reducing the standard tow duration from 30 minutes to 15 minutes. The data collected during this 10 day study will be used to compare differences between CPUE and length distributions relative to time and distance trawled. A low light video camera was mounted behind the headrope of net on the *Arcturus* to record fish behavior and escapement in relation to the standard research bottom trawl.

## RESULTS

The *Arcturus* and *Aldebaran* successfully conducted a total of 394 bottom trawls during the survey including 379 successfully completed trawls, 4 opportunistic hauls to collect additional information on crab, and 11 unsuccessful hauls. Nine large catches were completely processed to provide information to evaluate the current subsampling method.

Biological data collected from fish species during the standard survey are summarized in Table 1. The field parties on the two vessels recorded 126,069 length measurements from the major fish species and collected and preserved nearly 4,000 age structures. Individual length-weight data were also recorded for yellowfin sole. Over 9,500 stomachs were preserved from various fish taxa for food habits analysis. Whole specimens and tissue samples of various fish and invertebrate species were preserved for identification, training, and other purposes.

Upon completion of the standard survey, an additional 143 bottom trawls were completed during the tow duration experiment. The low light camera was used on 42 of these experimental tows. Approximately 143,000 length measurements from 7 fish species were recorded during the tow duration experiment (Table 2).

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 3. Walleye pollock (*Theragra chalcogramma*) was the most abundant fish species and had an overall CPUE of 116.7 kg/ha trawled. They were encountered at nearly all sampling sites, with largest mean catches (161.2 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 (26.4 kg/ha).

Rock sole (*Pleuronectes bilineata*) and yellowfin sole (*P. aspera*) were the most abundant flatfish species, with overall CPUE values of 49.1 kg/ha and 43.9 kg/ha, respectively. Yellowfin sole were primarily found in 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 107.1 kg/ha in waters less than 50 m to less than 0.1 kg/ha in waters greater than 100 m. A similar depth-related decrease in rock sole abundance was also observed.

Pacific cod (*Gadus macrocephalus*) were encountered at nearly all sites sampled (Fig. 6) and had an overall average catch rate of 22.4 kg/ha. Catch rates were smallest at inner shelf stations less than 50 m.

Alaska plaice (*P. 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 37.2 kg/ha. Alaska plaice and flathead sole/Bering flounder were the most abundant species of this group, with an overall catch rate of 12.1 kg/ha and 12.4 kg/ha, respectively.

Snow crab (*Chionocetes opilio*) was the most abundant commercially important crab species encountered, with a total average catch rate of 11.0 kg/ha. Red king crab (*Paralithoides camtschatica*), blue king crab (*P. platypus*), and Tanner crab (*C. bairdi*) each had overall catch rates ranging from 0.6 kg/ha to 1.5 kg/ha.

#### SCIENTIFIC PERSONNEL<sup>a</sup>

##### F/V *Arcturus*

###### Leg 1

C. Armistead<sup>b</sup>  
D. Roetcisonder  
D. Smith  
J. Hagga<sup>c</sup>  
B. Dew<sup>c</sup>  
F. Morado

###### Leg 2

P. Cummiskey<sup>bc</sup>  
C. Armistead  
P. Goddard  
C. Derrah  
J. Hagga<sup>c</sup>  
L. Mooney

###### Leg 3

P. Goddard<sup>b</sup>  
P. Munro  
M. Yang  
R. MacIntosh<sup>c</sup>  
B. Otto<sup>c</sup>  
L. Mooney

##### F/V *Aldebaran*

###### Leg 1

###### Leg 2

###### Leg 3

T. Sample <sup>b</sup>	G. Walters <sup>b</sup>	P. Anderson <sup>b</sup>
D. Nichol	B. McConnaughey	T. Sample
B. Page	R. Wiggins	D. Nichol
K. Smith	A. Beier <sup>d</sup>	G. Mundel
F. Hartsock <sup>c</sup>	E. Munk <sup>c</sup>	B. Page
S. Payne <sup>c</sup>	N. Terrell <sup>c</sup>	N. Terrell <sup>c</sup>

<sup>a</sup> Personnel from the AFSC, Seattle, unless otherwise noted

<sup>b</sup> Field Party Chief

<sup>c</sup> Personnel from the AFSC, Kodiak Laboratory

<sup>d</sup> Volunteer, Southampton College, Long Island, N.Y.

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Table 1.--Biological data collected on the *Arcturus* and *Aldebaran* during the standard 1995 eastern Bering Sea crab-groundfish survey.

Species	Length measurements	Age structures <sup>1/</sup>	Stomach samples
Walleye pollock	31,552	1,275	3,304
Pacific cod	10,009	654	2,605
Yellowfin sole <sup>2/</sup>	22,127	654	1,080
Rock sole	27,248	434	555
Flathead sole/ Bering flounder	18,137	396 <sup>3/</sup>	519
Pacific halibut	1,241	--	231
Alaska plaice	9,999	287	316
Arrowtooth flounder/ Kamchatka flounder	6,669	74 <sup>4/</sup>	478
Greenland turbot	353	--	80
Rex sole	352	--	--
Starry flounder	86	--	--
Pacific herring	851	--	--
Skate species	385	--	385
Misc. species	60	--	--
Total	<u>126,069</u>	<u>3,774</u>	<u>9,553</u>

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

<sup>2/</sup> Maturity data were also collected from yellowfin sole.

<sup>3/</sup> Age structures were collected from flathead sole only.

<sup>4/</sup> Age structures were collected from each species separately.



Table 2.--Size composition data collected on the *Arcturus* and *Aldebaran* during the tow duration experiment.

Species	Length measurements
Walleye pollock	17,829
Pacific cod	9,071
Yellowfin sole	46,156
Rock sole	41,137
Flathead sole	11,835
Alaska Plaice	15,050
Arrowtooth flounder	<u>1,960</u>
Total	143,038

Table 3.--Catch rates (kg/ha) by depth zone of commercially important fish and crab species taken aboard the *Arcturus* and *Aldebaran* during the 1995 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	26.4	139.3	161.2	116.7
Yellowfin sole	107.1	34.7	<0.1	43.9
Rock sole	118.7	35.5	7.5	49.1
Pacific cod	22.5	20.3	26.7	22.4
Alaska plaice	12.7	17.5	1.4	12.1
Flathead sole/ Bering flounder	2.4	14.9	17.2	12.4
Arrowtooth flounder/ Kamchatka flounder	0.2	6.8	23.3	9.4
Pacific halibut	4.0	2.6	3.9	3.3
Opilio Tanner crab	3.0	13.2	14.5	11.0
Red king crab	0.9	2.6	0.0	1.5
Bairdi Tanner crab	0.1	1.5	1.1	1.1
Blue king crab	<0.1	1.2	0.2	0.6

