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

Chartered vessel F/V *Sea Wolf* (Cruise 2004-01)

2004 AFSC-BSFRF Cooperative Opilio Crab Bottom Trawl Survey

July 6-26, 2004

The Resource Assessment and Conservation Engineering (RACE) Division of the Alaska Fisheries Science Center (AFSC) and the industry-sponsored, Bering Sea Fisheries Research Foundation (BSFRF), recently completed a cooperative bottom trawl survey for snow crab *Chionoecetes opilio*. This report documents the activities accomplished on the survey.

ITINERARY

The survey was conducted aboard the BSFRF chartered vessel F/V *Sea Wolf* from July 6-26, 2004. Loading took place in Dutch Harbor, Alaska on July 6, before the vessel proceeded north to the survey area. Stations were sampled from July 10-24. The vessel was offloaded on July 26 in Dutch Harbor, Alaska.

OBJECTIVES

The primary objectives of this survey were:

1. to sample additional stations within the standard AFSC annual Bering Sea shelf bottom trawl survey area, where high densities of mature males and mature females have typically been encountered, for the purpose of determining the shape of the snow crab density variogram and to determine the level of improvement in the estimation of snow crab abundance provided by additional sampling stations; and
2. to sample additional stations outside of the standard AFSC annual Bering Sea shelf bottom trawl survey area for the purpose of assessing the distribution and abundance of mature male and female opilio crab in these areas.

Secondary survey objectives were:

1. to compare catches of the standard survey net to catches from the same net rigged with a tickler chain; and
2. to collect length/weight data, otoliths, and stomach contents from marbled eelpout *Lycodes raridens*, and butterfly sculpin *Hemilepidotus papilio* for special study requests.

VESSELS AND GEAR

The F/V *Sea Wolf* is a 43.5-m long (143 ft) stern trawler powered by a single Caterpillar[1] main engine (1710 horsepower at 1275 rpm) and equipped with twin Rapp Hydema TWS-2022 trawl winches carrying approximately 1500 m of 25.4 mm (1 inch) diameter dyform trawl wire. The F/V *Sea Wolf* was chartered by the BSFRF and staffed with an experienced fishing captain and a 4-member fishing crew. The charter vessel fuel, sampling gear, scientific supplies, and four scientists were provided by the AFSC (Table 1).

The survey used RACE Division's standardized 83-112 Eastern survey trawls and rigging, the same trawl used in the annual Bering Sea shelf surveys since 1982. The 83-112 Eastern, is a low-rise, 2-seam flatfish trawl fished with a pair of 1.8 x 2.7-m (6 x 9 ft) steel V-doors weighing approximately 816 kg each. The doors are attached to the net by a pair of 3-m long, 15.9 mm long-link chain door legs, a 12.2 m-long, 19.1-mm diameter stranded wire door leg extension, and a pair of 55-m long, 15.9-mm diameter bare stranded wire bridles on each side. The 34.1-m long (112 ft), 54.0-mm diameter footrope is designed for use on soft bottom and is constructed of 15.9-mm diameter stranded wire rope protected with a single wrap of 12.7-mm diameter polypropylene line and split rubber hose. The footrope is evenly weighted along its length by 41.3 kg of 7.9-mm diameter proof coil chain from which the webbing is hung. An additional 0.6 m-long, 12.7-mm diameter long-link chain extension connects each lower bridle to the trawl wingtips to help keep the footrope close to the bottom. The 25.5-m long (83 ft) headrope is constructed of 12.7-mm diameter stranded wire rope wrapped with 9.5-mm diameter polypropylene line and utilizes 41 evenly spaced 20.3-cm diameter floats that provide approximately 116.4 kg of buoyancy. The wings and body of the survey net are constructed of 101.6 mm stretch-mesh, 3-strand braided nylon (#60). The intermediate and double walled codend are constructed of 88.9 mm stretch-mesh, 3-strand braided nylon (#96). Inside the codend is a 31.8 mm stretch-mesh nylon (#18) liner used to retain small fauna.

During one tow a 32.8-m long tickler chain was deployed ahead of the survey trawl footrope to compare catches with a standard survey tow. The tickler chain was made of 12.7-mm diameter proof coil chain and consisted of 4 sections: two 14.8-m long sections (one per side), that attached to the wing tip aft of the chain wing extension with a 15.9-mm diameter hammerlock, and two 1.6-m long center sections connected in the middle with a 9.5-mm diameter shackle. Each side section was connected to each center section using a 15.9-mm diameter hammerlock, and to the footrope by a 71-cm long, 12.7-mm diameter proof coil dropper chain that extended out from each corner at the wing seams.

Data was collected by a variety of scientific instruments. Seawater temperature profiles were obtained with a Sea Bird micro-bathythermograph attached to the headrope of the net. Surface water temperatures were also collected using a bucket thermometer. A Netmind

[1] Reference to trade names or commercial firms does not constitute U. S. government endorsement.

acoustic net mensuration system was used to monitor net wing spread and headrope height. A self-contained calibrated bottom contact sensor placed at the center of the footrope provided information on footrope contact with the sea floor. Distance fished was monitored by a global positioning system (Garmin) interfaced with the data from wing spread measurements, bottom contact, headrope depth and bottom temperature following RACE protocols (Stauffer, 2004)[2].

SURVEY DESIGN AND METHODS

The portion of the standard Bering Sea shelf survey area that contains the high-density snow crab population generally lies between latitudes 58E to 63EN and between longitude 170EW and the U.S.-Russia Convention Line (Figure 1). Sampling stations for the AFSC-BSFRF survey were established within this high-density crab region and utilized the standard survey 20 x 20 nm grid framework. Most of the stations were placed within the standard survey area. However, additional sampling effort was allocated to the north and east, outside of the standard survey area to extend our knowledge of snow crab distribution and abundance.

The AFSC-BSFRF survey consisted of 94 stations[3] having varying priorities for completion (Figure 1). There were 72 first priority stations consisting of: 45 randomly located sites (triangles, 1 station per block), including 4 new deep-water stations along the U.S.-Russia Convention Line (note - two of these stations [S-32 and V-29] were placed on the Russia side of the Convention Line by the randomization process and were consequently not sampled); 10 corner stations designed to expand the standard Bering Sea shelf survey high-density area (filled circles); and 15 stations (asterisks, columns 23-26) placed in block centers, designed to resample stations sampled in 2001 for the purpose of delineating the NE edge of the snow crab distribution; and 2 new northern stations (Y-24 and Y-25) also placed in block centers. Second priority stations consisted of 10 stations in columns 20-22 (diamonds) sampled during 2001 and 2 new stations (W-22 and V-22) all of which were placed in block centers. Third priority stations consisted of 10 corner stations (squares) intended to further expand the standard survey high-density snow crab sampling area.

Standard Bering Sea shelf survey towing and catch processing protocols were strictly observed during the AFSC-BSFRF cooperative survey (Stauffer, 2004). Towing procedures included: trawl warp measurement; scope ratios; 30 minute tow duration (measured from when the trawl winches were locked after setting out the trawl wire until the trawl winches were engaged to retrieve the trawl wire); towing during daylight hours; and towing at a 3 knot vessel speed. Station data including time, position, measured trawl dimensions, and distance-fished was entered into shipboard computer systems. Catch processing included the weighing of the total catch before removing all crab. Crab were then sorted by species and sex, weighed, and enumerated (random subsamples taken if crab were too abundant to process in a timely fashion). Crab length-width measurements, shell condition, chela- and clutch-size were collected. In addition to crab sampling, length/weight, otolith, and stomach content data was collected for special studies.

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[2] Stauffer, G. (complier) 2004. NOAA protocols for groundfish bottom trawl surveys of the Nation's fishery resources. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-F/SPO-65, 205 p.
[3] Two stations (W-22 and V-22) were added while the survey was underway.

RESULTS

The F/V *Sea Wolf* successfully completed 73 of the 94 planned survey stations[4], including all of the high priority stations and 3 lower priority stations. In addition to survey sampling, one pair of tows was completed at station ON2423 for the purpose of comparing crab catches using a tickler chain and the standard trawl versus without the tickler chain.

Table 1. List of scientific personnel and their affiliations participating in the 2004 AFSC-BSFRF cooperative snow crab survey.

Participant (title)	**Affiliation**
Ken Weinberg (Field Party Chief)	Alaska Fisheries Science Center
Rich MacIntosh (Crab biologist)	Alaska Fisheries Science Center
Robert Gish (Crab Biologist)	Alaska Department of Fish and Game
Ryan Barr (Student intern)	University of Washington

[4] The F/V Arcturus sampled 10 additional survey stations (W-22, V-22, and the 8 stations in columns 20 and 21 following the completion of the 2004 standard Bering Sea shelf survey).

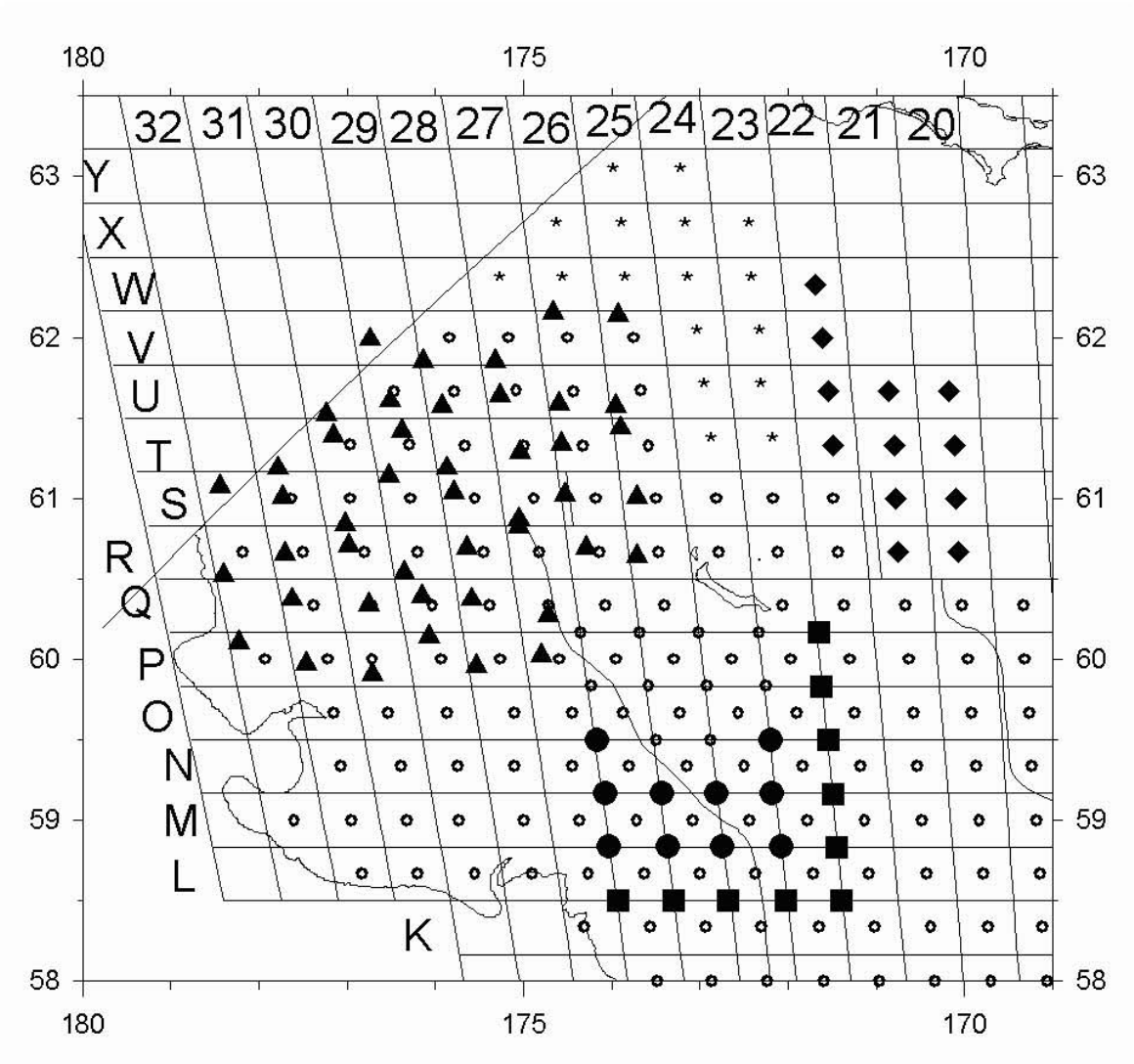

Figure 1. The 2004 AFSC-BSFRF cooperative snow crab survey station plan showing randomly selected stations (triangles) placed within the standard Bering Sea survey grid blocks, additional high density crab corner stations (filled circles), stations extending beyond the standard Bering Sea survey bounds (asterisks and diamonds), and low priority corner stations (squares). Stations occupied during the annual Bering Sea survey are shown as unfilled circles.