# SHRIMP RESEARCH ABOARD SOVIET SHIP IN GULF OF ALASKA

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One result of the 1970 meeting of U.S. and Soviet fishery scientists in Moscow was a joint research program to investigate the shrimp resources in the Gulf of Alaska. The Soviet research vessel 'Krill' surveyed offshore areas south of the Alaska Peninsula and near Kodiak Island from January through March 1971. U.S. scientists were permitted to go aboard and participate in the Soviet part of the research.

Fishery scientists from the United States and the Soviet Union have met annually since 1966 to discuss resources of mutual interest and the results of their research. During the Moscow meeting in December 1970, they discussed the shrimp species from south of the Alaska Peninsula near Kodiak Island. In 1970, this area yielded a combined U.S.-Soviet catch of over 92 million pounds of shrimp.

Both countries presented program outlines that had similar objectives: (1) to assess the standing stock of shrimp offshore along the southeast coast of Kodiak Island and the Alaska Peninsula from Portlock Bank to Unimak Pass; and (2) to collect biological data to determine if catches taken both offshore and inshore are from one large homogeneous shrimp population or from distinct stocks. Pink shrimp (Pandalus borealis) was the primary species of interest.

## The Research Vessels

Vessels assigned to the research effort were the 'Krill' of the USSR Pacific Scientific Research Institute of Marine Fisheries and Oceanography (TINRO), and the NMFS 'Oregon'. The Krill was to sample offshore areas during January through March, the Oregon adjacent areas during April and May.

On March 11, Soviet and U.S. scientists met aboard the Krill in Chiniak Bay near Kodiak, Alaska, to discuss plans for the remainder of the cruise. The Krill had been and would continue to operate outside the 12-mile contiguous zone bordering the Alaska coastline. Because the data gathered during the Soviet research cruise contained information of considerable interest to U.S. scientists and fishing industry, two biologists from the NMFS Kodiak Laboratory--Perry A. Thompson Jr. and I--were invited to accompany the Krill during the remainder of the Soviet research operation. The following photos and text describe our observations (Figures 1-12).

## VESSEL, CREW, AND OPERATIONS

The Krill was built in the USSR in 1968. It is a typical Mayak-class side trawler. Overall length is 178 ft, beam 30 ft, and draft 10 ft; gross displacement is 929 metric tons. Propulsion is provided by low-speed diesel engine driving a single variable pitch propeller. Cruising speed is approximately 12 knots. Minor modifications for scientific work included a hydrographic winch for oceanographic casts, and a wet lab area in the forepeak where samples were processed.

Electronic gear on the bridge included two medium range radars; magnetic and gyro compasses; radio direction finder; automatic pilot; and two multirange, dry paper fathometers with maximum depth ranges to 600 fathoms.

## The Crew

The Krill's crew numbered 27, including four women: vessel captain, 3 mates, about 8 engineers, 6 fishermen, an electronics

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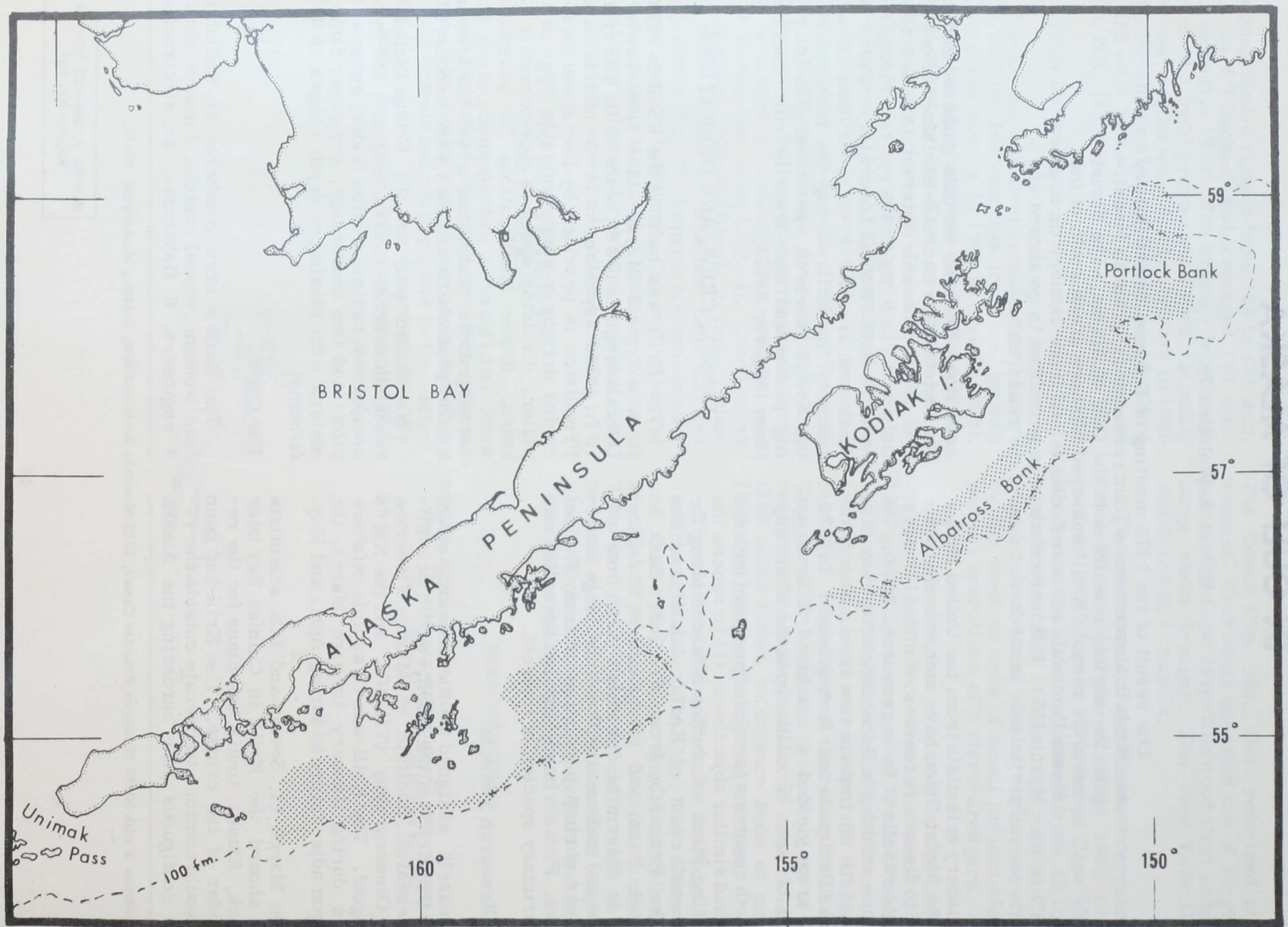


Fig. 1 - Shaded portion of the chart indicates the area surveyed by the Soviet research vessel Krill during the joint U.S.-USSR shrimp surveys in the Gulf of Alaska, January-March 1971.

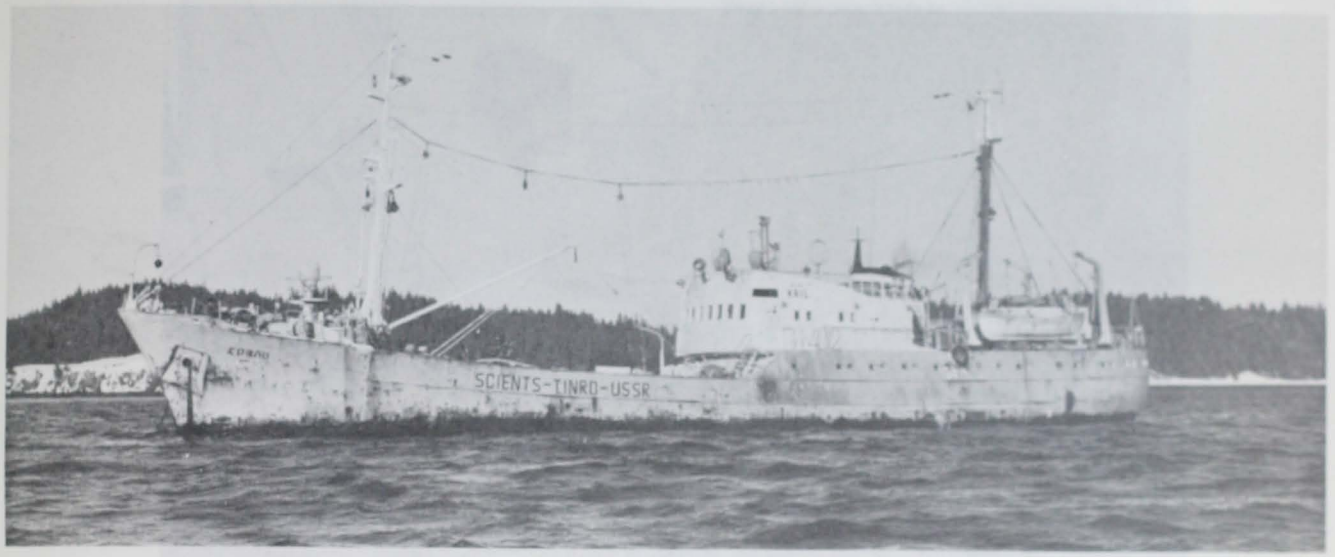


Fig. 2 - Soviet research vessel Krill in Chiniak Bay waiting to rendezvous with U.S. scientists. Lettering "SCIENTS-TINRO-USSR" signifies a scientific vessel for the Soviet Union's Pacific Scientific Institute of Fisheries and Oceanography.

Fig. 3 - Captain Anatoly Maslenikov, 35-year-old skipper of USSR RV Krill.

Fig. 4 - A 2,000-lb catch of pink shrimp being dumped on deck. The $\frac{3}{4}$-inch mesh liner inside the cod end can be seen extending past the puckering rings.

Fig. 5 - After a catch is brought aboard, fish and invertebrates are separated by species, and weight estimates are determined.

Fig. 6 - In the vessel laboratory, Chief Scientist Yuri Skilarof and a technician gather biological data from a shrimp sample.

Fig. 7 - Soviet fishermen prepare the net for the next sampling station. The large metal ball in foreground is attached to the center of the headrope. Approximately 40 smaller floats were fastened to the headrope on each side of the large float.

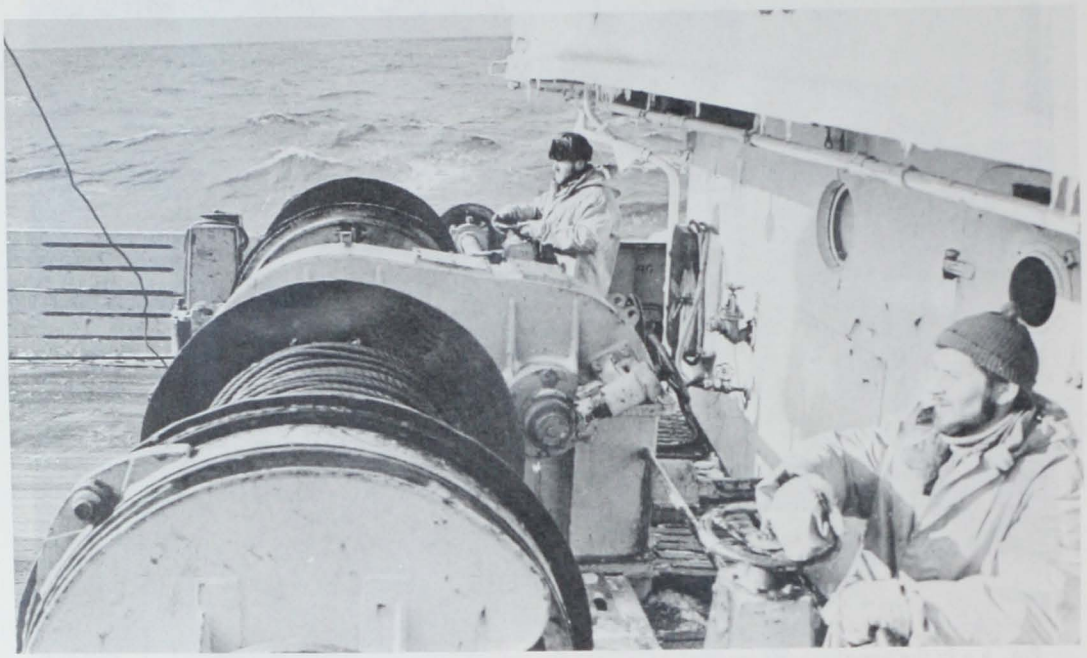

Fig. 8 - Large electric winches are used to pay out and retrieve the trawl cables.

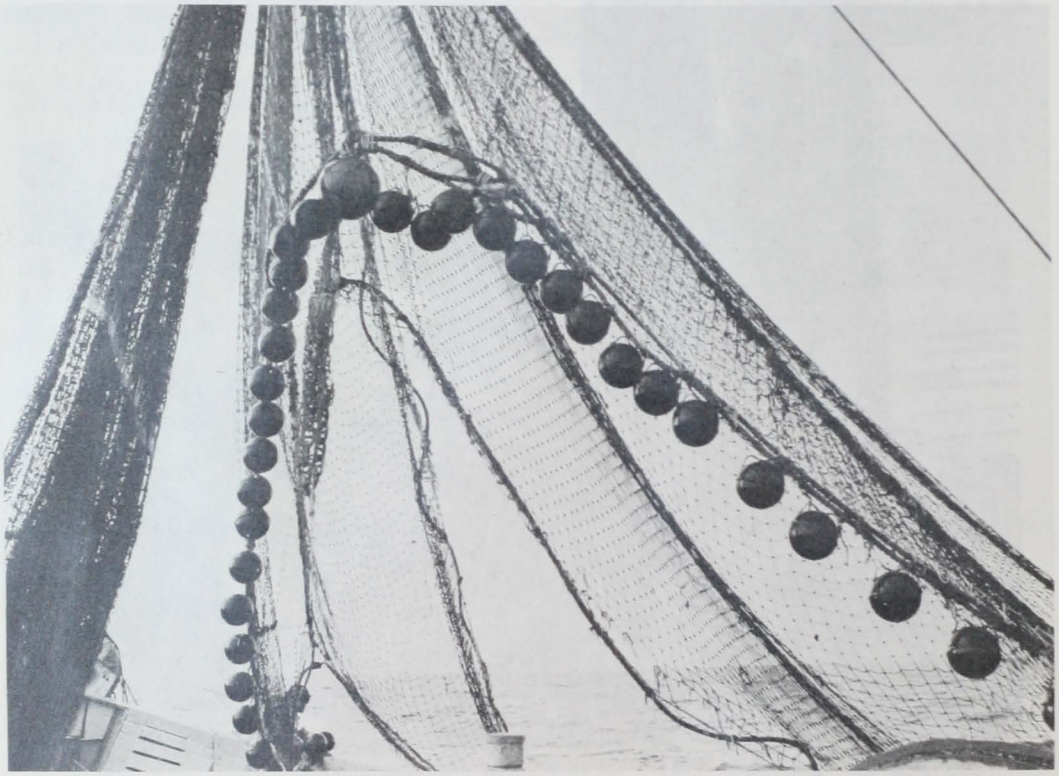

Fig. 9 - Forward portion of the shrimp trawl being brought aboard the RV Krill. Relative size of the net can be determined by noting the crewman partially obscured by floats at the lower margin of the photograph.

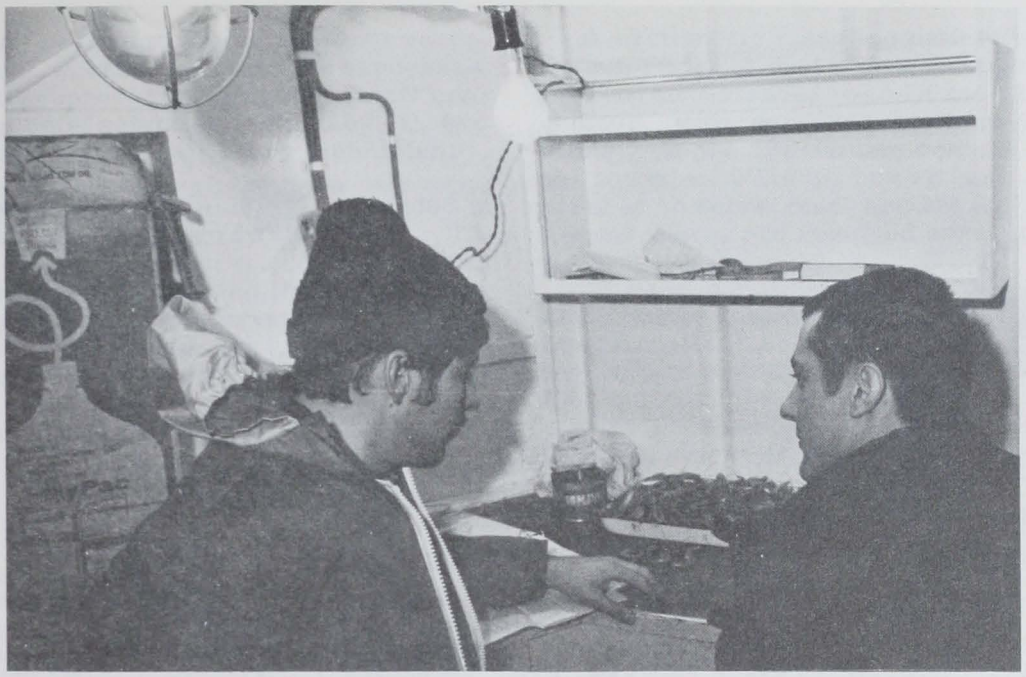

Fig. 10 - Perry Thompson (left) of the NMFS Kodiak Laboratory discusses sexual characteristics of Pandalid shrimp with Soviet chief scientist aboard the USSR RV Krill.

Fig. 11 - Soviet master fisherman repairing the net. Damage to the fishing gear was commonplace while exploring the offshore areas.

Fig. 12 - The RV Krill underway and heading for another sampling station.

technician, radioman, cook, and 2 stewards. The women worked as cook, stewardesses, and oceanographer. The scientific staff consisted of a chief scientist (ichthyologist), two oceanographers, and a fishery technician.

Workdays began at 6:00 AM and ended at 10:00 PM Alaska Standard Time. The crew operated in two watches; captain and scientific crew worked the entire 16-hr day. Although the area surveyed was several time zones from home port, clocks aboard the vessel always were set to Kamchatka Time, the nearest Soviet time zone across the International Date Line.

## GEAR

Standard fishing gear was a trawl with a liner in the cod end. The trawl had an 89-ft headrope and an overall length (center of headrope to tip of cod end) of 130 ft. An 89-ft mudline of cable wrapped with rope (overall diameter about 5 inches) was attached to the footrope and hung about 12 to 18 inches below it. Vertical height at tips of the wings was 16 ft, and 20 to 23 ft at the center of the mouth. Eighty floats, approximately 8 inches in diameter, were attached to the headrope.

Mesh sizes (stretched measure) in the net were:

Wings and mouth--5½-inch mesh.

Bosom--4-inch mesh.

Intermediate and cod end--2 inch mesh.

Liner in posterior 33 ft of net--¾-inch mesh.

The trawl was equipped with 137-ft dandylines and 6 x 9-ft oval doors.

Oceanographic data, including salinity and temperature measurements, were obtained by a surface thermometer, reversing thermometers, and Nansen bottles.

## METHODS

The sampling techniques were those developed during previous Soviet shrimp work.

A systematic sampling pattern started at the outer edge of the 12-mile contiguous fishing zone and extended to about the 120-fathom contour, with sampling stations every 12 miles. At the 120-fathom contour, the vessel made a 90° turn, traveled 12 miles parallel to shore, made another 90° turn back toward shore, and resumed sampling.

At each sampling station, sounding transects were used to locate trawlable bottom. Occasionally 2 to 3 hours were spent searching before bottom suitable for a 30-min tow was located. When the net was alongside vessel at completion of a tow, reversing thermometer-Nansen bottle casts were made. Temperature and water samples were taken at the surface, and at 25-fathom depth intervals to the ocean floor.

### Samples Taken

After the catch was taken aboard and dumped on deck, a sample of approximately 250 shrimp was taken from the center of the pile. Then the remainder of the catch was examined and a weight estimate made for each species. If there were few roundfish, each individual was counted.

A subsample of 100 pink shrimp was taken from the original sample of 250. Each shrimp was weighed to 0.1 g on a small balance and measured for total length to the nearest millimeter. Carapace length was measured to the nearest 0.1 mm, and grouped in 1-mm increments for length-frequency analysis. Sex was determined by examination of the endopodite of the first pair of pleopods, a method employed by Rasmussen (1953). Sex determinations were classed into five categories: juvenile, male, transitional, gravid females, and nongravid females.

After all samples were taken, the remainder of the catch of shrimp and edible fish was frozen. Fish were eviserated before freezing.

Pink shrimp was the predominant species. Other shrimp and fish species most frequently captured included sidestripe shrimp (Pandalopsis dispar), pollock (Theragra chalcogrammus), Pacific Ocean perch (Sebastes alutus), and Pacific cod (Gadus macrocephalus).

## SHRIMP DATA GATHERED BY U.S. SCIENTISTS

While aboard the Krill, we obtained samples from trawl catches and used a method developed by Allen (1959) to determine the sex of pink shrimp. The method differs somewhat from the single pleopod examination used by Soviet scientists in that sex is determined by examining the secondary sexual characteristics of both the first and second pair of pleopods. Little difference was observed when we compared the two methods (Allen 1959, Rasmussen 1953) for U.S. and Soviet samples obtained at the same stations.

Length-frequency (carapace length) and sex composition data were obtained by us from samples at 11 stations--one at Albatross Bank, 10 from adjacent Portlock Bank--between March 12 and 22. Sex was classified into four categories: male, transitional, gravid females, and nongravid females. Slight differences in percentage frequency by sex were apparent when comparing samples from the two areas (Table 1). Percentage frequency of males in the Portlock samples averaged 12%, and ranged from 0 to 35%, whereas nearly half the specimens in Albatross Bank samples were males. Similarly, female composition for samples from the two areas differed. Percentage of females

Table 1.--Sex composition for Pandalus borealis in samples examined by U.S. scientists aboard USSR RV Krill, March 1971.

| Date sample taken | Individuals in sample No. | Males % | Transitionals % | Females | |
|---|---|---|---|---|---|
| | | | | Nongravid % | Gravid % |
| | | Albatross Bank | | | |
| 3/12/71 | 167 | 47.9 | 31.7 | -- | 20.4 |
| Average | 167* | 47.9 | 31.7 | -- | 20.4 |
| | | Portlock Bank | | | |
| 3/15/71 | 226 | 0.2 | 8.8 | 0.4 | 84.5 |
| 3/15/71 | 167 | 0.6 | 3.0 | 0.6 | 95.8 |
| 3/17/71 | 263 | 27.4 | 59.3 | 0.3 | 13.1 |
| 3/17/71 | 169 | 19.5 | 28.4 | -- | 52.1 |
| 3/18/71 | 194 | 34.5 | 45.9 | 0.5 | 19.1 |
| 3/20/71 | 170 | 2.4 | 77.1 | 2.4 | 8.2 |
| 3/20/71 | 144 | 2.8 | 42.4 | 0.6 | 54.2 |
| 3/20/71 | 152 | -- | 5.3 | -- | 94.7 |
| 3/21/71 | 157 | 7.6 | 56.1 | 0.6 | 35.7 |
| 3/22/71 | 176 | 5.7 | 10.2 | 1.1 | 84.1 |
| Average | 1818* | 11.9 | 34.3 | 0.7 | 54.2 |

* Total number

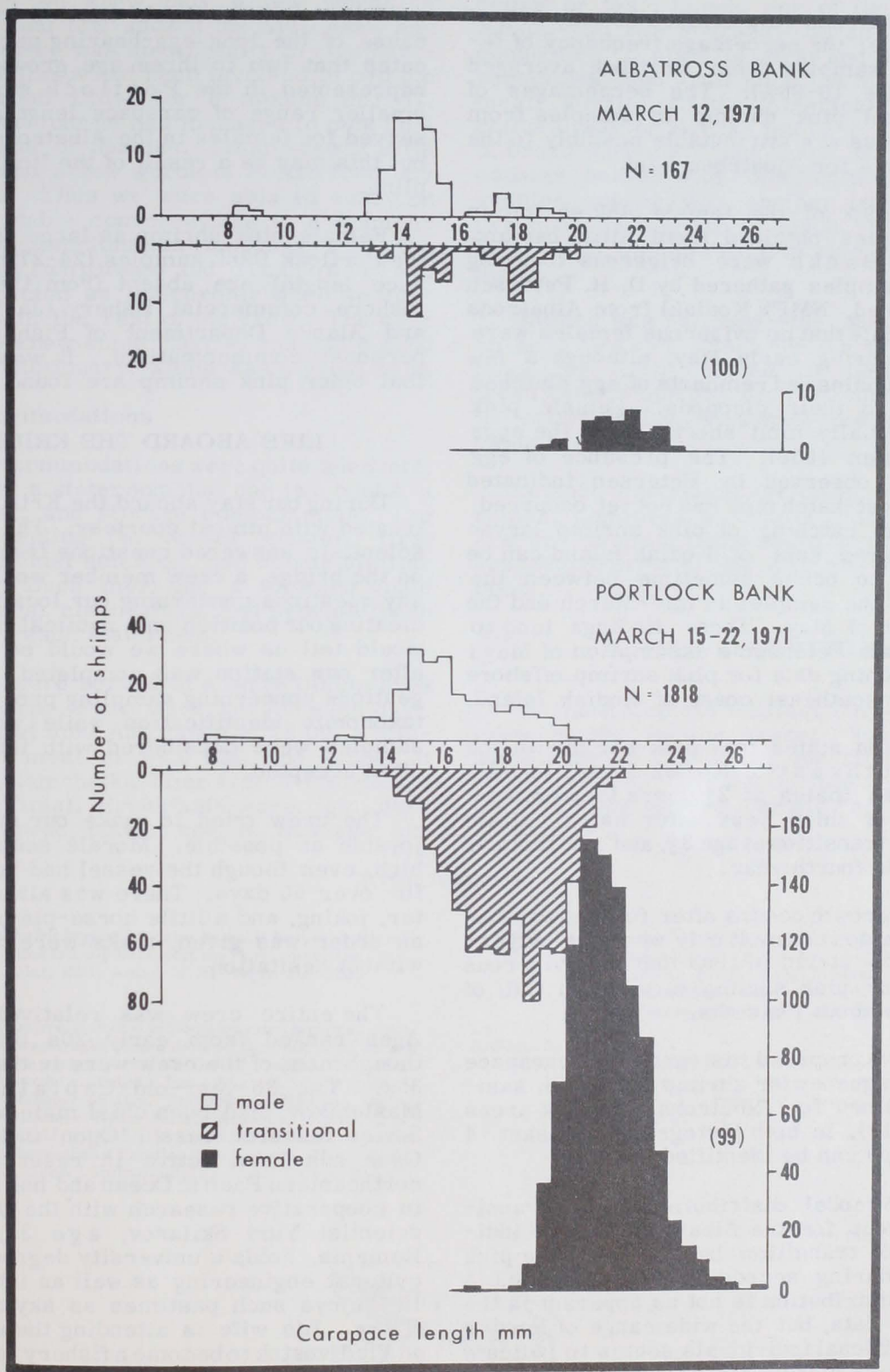


Fig. 13 - Carapace length frequency histogram for Pandalus borealis collected by U.S. scientists aboard the USSR RV Krill, March 1971. Length data are given on 05-mm divisions. Percentage of gravid females is indicated in parentheses.

in the Albatross data comprised only 20% of the sample; the percentage frequency of females in samples from Portlock averaged 55% (range 10-96%). The percentages of transitional pink shrimp in samples from the two areas are attributable possibly to the limited data for Albatross Bank.

Over 99% of the female pink shrimp in U.S. samples obtained from Albatross and Portlock Banks were ovigerous (bearing eggs). Samples gathered by D. H. Petersen (unpublished, NMPS Kodiak) from Albatross area indicate that no ovigerous females were present during early May, although a few sample females had remnants of egg clutches attached to their pleopods. Female pink shrimp usually molt shortly after the eggs hatch (Allen 1959). The presence of egg remnants observed by Petersen indicated that the post-hatch molt had not yet occurred. Therefore, hatching of pink shrimp larvae for the area east of Kodiak Island can be assumed to occur sometime between the taking of the samples in mid-March and the first part of May. These findings tend to corroborate Petersen's assumption of May 1 as the hatching date for pink shrimp offshore from the southeast coast of Kodiak Island.

Peterson states that pink shrimp in the area southeast of Kodiak Island usually mature as males at $2\frac{1}{2}$ years (September-October of third year after hatch), attain complete transition at age $3\frac{1}{2}$, and are mature females in fourth year.

Little growth occurs after fourth year because females can molt only when not ovigerous. Ivanov stated in 1963 that the ovigerous period for pink shrimp in western Gulf of Alaska is about 7 months.

We have prepared histograms of carapace length-frequency for shrimp from U.S. samples obtained for Albatross-Portlock areas (Figure 13). In both histograms, at least 4 age groups can be identified.

The bimodal distribution in the transitional group for the Albatross sample indicates sex transition begins for some pink shrimp during second year of growth. A similar distribution is not as apparent in the Portlock data, but the wide range of lengths for transitional individuals seems to indicate that two age groups are present.

The wide range of carapace lengths for female pink shrimp from Portlock Bank, combined with probable limited growth because of the long egg-bearing period, indicates that two to three age groups may be represented in the Portlock samples. A smaller range of carapace lengths was observed for females in the Albatross sample, but this may be a result of the limited sampling.

Female pink shrimp as large as those in the Portlock Bank samples (24-27 mm carapace length) are absent from the adjacent inshore commercial fishery (Jackson 1969 and Alaska Department of Fish and Game personal communication). It would appear that older pink shrimp are found offshore.

## LIFE ABOARD THE KRILL

During our stay aboard the Krill, we were treated with utmost courtesy. The crew and scientists answered questions freely. When on the bridge, a crew member would answer any questions concerning our location by indicating our position on a nautical chart. He would tell us where we would be sampling after our station was completed. Our suggestions concerning sampling procedures or taxonomic identification while working on samples were considered with interest and often accepted.

The crew tried to make our stay as enjoyable as possible. Morale seemed quite high, even though the vessel had been at sea for over 60 days. There was always laughter, joking, and a little horse-play; but when an order was given, tasks were performed without hesitation.

The entire crew was relatively young. Ages ranged from early 20s to mid-40s, though most of the crew were in their 20s or 30s. The 35-year-old captain, Anatoly Maslenikov, had been chief mate aboard the Soviet research vessel 'Ogon' in 1970. The Ogon has been active in research in the northeastern Pacific Ocean and has been used in cooperative research with the U.S. Chief scientist Yuri Skilarov, age 31, born in Rumania, holds a university degree in agricultural engineering as well as ichthyology. He enjoys such pastimes as sky diving and flying. His wife is attending the university in Vladivostok to become a fishery technician. Asked why he had not embarked on a career in agricultural engineering, he said that fishery research was much more interesting to him.

Though we knew only a few words of Russian, and few aboard the Krill knew any English, there was no difficulty in communication. Skilarov had been involved in pelagic research off Chile for 6 months in 1967. During that tour he had managed to pick up a fair amount of Spanish. I also knew a little Spanish and a few words of Polish from my childhood. Thus we were able to carry on understandable conversations in a Spanish-Polish-English-Russian language with the aid of sign language and dictionaries. Skilarov acted as interpreter when we conversed with the rest of the crew. The captain also knew some English and had a good phonetic dictionary, which was a great help.

## The Accommodations

Our accommodations were quite adequate. We shared a stateroom that had two bunks, a sink, desk, and storage compartment. The crew, excepting the vessel master, first mate, and chief scientist, had rooms similar to ours. Each morning, a steward would wash floors, clean sinks, and provide fresh towels for each stateroom.

Meals were served in a large dining area at the stern. Four were served each day: breakfast at 8:00 AM, lunch at 12:00, a mid-afternoon meal at 4:00 PM, and supper at 8:00 PM Kamchatka Time (10:00 PM Alaska Standard Time). Breakfasts were light; dark Russian bread, butter, cheese, sausage, and coffee or tea. Lunch, one of the two large meals, had two courses: borsch or a fish consomme, a plate of meat and potatoes or vegetables, and fruit juice. A midafternoon meal, similar to the American afternoon coffee break or British tea time, consisted of bread and butter, cheese and, occasionally, cookies, served with coffee or tea. The late evening supper was another large meal of two courses similar to lunch. When available, fresh fish and shrimp also were on the menu.

Bathing was rationed--the usual situation on any vessel at sea for lengthy periods. Since the Krill carried 70 metric tons of fresh water which was not replenished during the entire cruise, personnel took freshwater baths every 10 days.

Leisure entertainment consisted of card games, dominoes, a form of Chinese checkers, and listening to the radio through speakers located in the dining area and each stateroom.

## ACKNOWLEDGMENTS

We thank Captain William Torsen and the crew of the fishing vessel 'Voyager' for assistance in delivering and picking us up from the Krill--and the captain and crew of the Krill for making our stay an enjoyable experience.

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