

**INTERNATIONAL NORTH PACIFIC FISHERIES COMMISSION**

**Established by Convention between Canada, Japan  
and the United States for the Conservation of the  
Fisheries Resources of the North Pacific Ocean**

**ANNUAL REPORT**

**FOR THE YEAR**

**1955**

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Somewhat similar work was undertaken on the *Mitkof* and *Paragon* with limited facilities and equipment by personnel of the U. S. Fish and Wildlife Service, following procedures recommended by the Department of Oceanography. Work done on the *Cobb*, *Mitkof*, and *Paragon* is described in the report from the Department of Oceanography (Gast, Amidon, Hebard and Selinger, 1956).

Oceanographic observations were limited to bathythermograph measurements at each fishing station and at intermediate points, a few water samples at depths down to 500 or 1000 meters and to vertical tows with half-meter plankton nets. Dissolved oxygen and phosphate determinations were made on the *John N. Cobb*.

A data report based on the above programs is being assembled.

contents of sockeye salmon caught in the Japanese fishery. Similar studies will be made of the stomachs of salmon caught by the U. S. Fish and Wildlife Service. Preliminary results indicated that the organisms common in the stomachs of the plankton-feeding salmon were not well represented in the plankton samples.

Japanese reports indicate that the bulk of the salmon caught in their high seas fisheries are taken when surface temperatures are between 4° and 9°C. with practically none caught when the temperatures are below 1°C. or above 13°C. Operations of the U. S. exploratory vessels in 1955 were conducted fairly late in the season and in areas where the temperatures were towards the upper portion of the range reported by the Japanese, and south of the Aleutian Islands no salmon were caught at locations where the temperatures exceeded 11°C.

TABLE 12. Summary of Observations—1955.

	John N. Cobb	Mitkof	Paragon	Total
Oceanographic Stations .....	43	18	26	87
Salinity Analyses .....	463	168	174	805
O <sub>2</sub> and PO <sub>4</sub> Analyses .....	340 each	—	—	340 each
Zooplankton Samples .....	28	17	48	93
Phytoplankton Samples .....	—	68	52	120
Bathythermograph Obs. ....	127	50	95	272

A fortunate coincidence in 1955 was the international co-operative study of the Pacific Ocean north of 20° conducted during the period July - September and known as Operation NORPAC. Although none of the field work was supported under the Fish and Wildlife contract the information collected by certain Japanese, Canadian and U. S. vessels provided a comprehensive and synoptic picture of the oceanography of the area of interest to the Commission. Data collected by the *Brown Bear* have been analyzed and compiled by personnel employed on the contract. The data report of the *Brown Bear* was issued as a joint report of the Office of Naval Research, U. S. Fish and Wildlife Service, and the Fish Commission of Oregon, all of whom provided financial support (Fleming, et al, 1956).

Investigations of the food organisms (plankton) are being actively pursued, as well as studies of the stomach contents of the salmon. One report (Allen, 1956) has been issued on the stomach

Preliminary results indicate that the water conditions on the two sides of the Northern Pacific are markedly different. The Asiatic side is one of contrasts, being colder in winter than in corresponding latitudes on the American side, particularly in the Gulf of Alaska. The range in temperature at any time of the year is also greater on the Asiatic side because of the warm water introduced by the Kuroshio and the cold water carried south by the Oyashio. The waters of the Gulf of Alaska are relatively warm through the year. These differences may be expected to have direct effects on the growth and behavior of the salmon and indirectly through their effects on the nature and abundance of food organisms.

#### KING CRAB

The United States has increased its research effort on king crabs in the eastern Bering Sea, continuing the research program begun with Japan over a year ago. While in the area, biologists of the two countries communicated almost daily by radio-

phone to exchange ideas. Mr. Seiwa Kawasaki of the Japan Fishery Agency was aboard the U. S. Fish and Wildlife Service charter vessel *Torden-skjold*, for a total of ten days; Mr. T. Miyahara of the Fish and Wildlife Service made three brief visits aboard the *Tokei Maru*, the Japanese king crab mothership.

#### Records of the Commercial Catch.

Although the United States was unable to place biologists aboard commercial fishing boats in 1955, operators of the *Deep Sea* and *Nordic Maid*, fishing in the Bering Sea area, have made their log books available to the Service. These log books provide records as to time, duration, course, depth and position for each trawl effort as well as wind direction and force, barometric pressures and total number of legal† size male king crabs. Some information on other species is also noted.

Catch data from the Japanese mothership operations have also been received. The data include dates, position of the mothership, number

of trawl efforts, number of tangle net units lifted, catch of legal sized male crabs by gear, and sometimes the number of cases of canned crabs produced.

An examination of the available log books of the *MV Deep Sea* and the catch data from the Japanese fishery has been made. The log book records of the *Deep Sea* date back to 1950. The catch data of the Japanese efforts are available for 1931 and from 1933 through 1939, and also from 1953 through 1955. Because of some discrepancies in some of the Japanese pre-war data, the analysis was confined to only the post-war activities.‡

The data from these sources show that, based on the catch-per-unit-effort values for the *Deep Sea*, the relative abundance of king crabs in the eastern Bering Sea was about the same in 1951 as in 1950, about twenty percent less in 1952, about ten percent less in 1953, about five percent less in 1954, and in 1955, about ten percent greater than

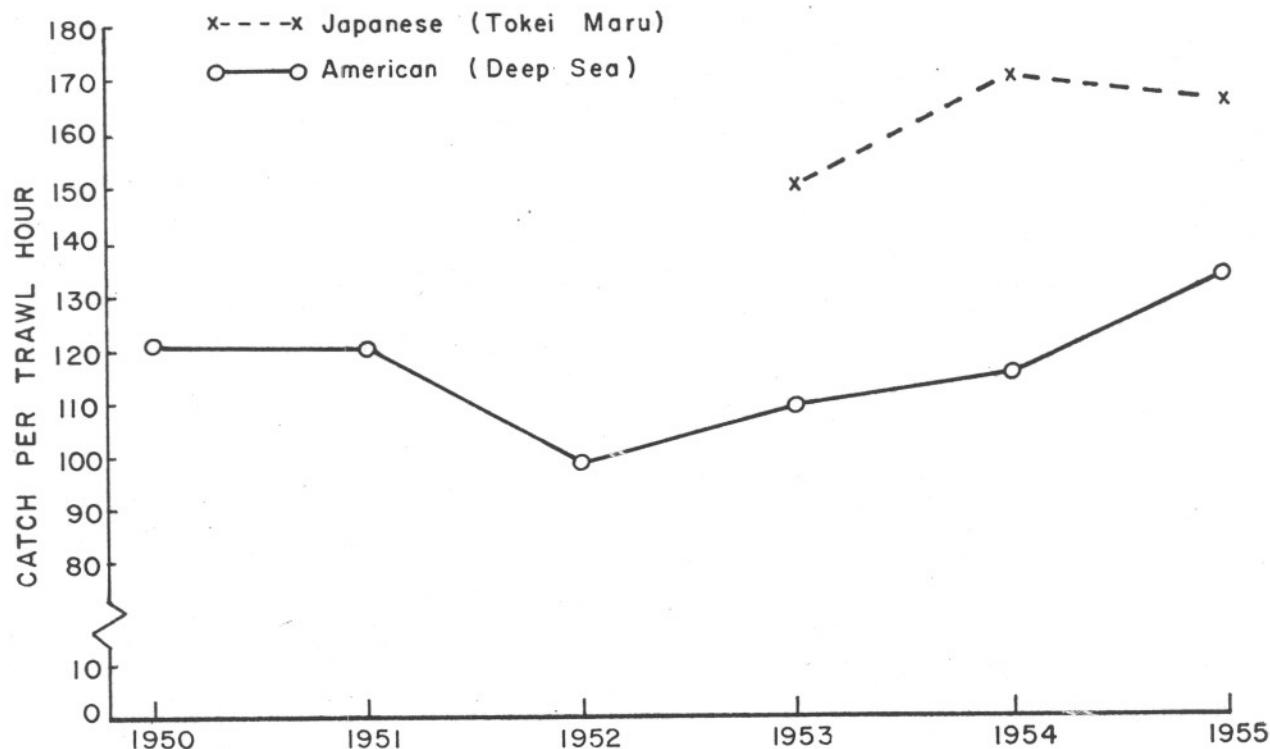


Fig. 4. King Crab Catch-per-Effort — 1950 - 1955.

† King crabs measuring more than 6½" in greatest width of carapace.

‡ Details of the pre-war data have been requested from Japanese sources.

in 1950 and 1951 (see Fig. 4). Although the catch-per-unit-effort value for 1955 may not be comparable, due to an alteration of the *Deep Sea's* net, the Japanese catch-per-unit-effort value for 1955 remains at a high level. These values indicate that the abundance of king crabs in the eastern Bering Sea does not show signs of decline.

#### Distribution.

From May 10 to July 27, 1955, the vessel *Tordenskjold*, investigated the distribution and abundance of king crabs independent of the commercial fishing operations. As shown in Fig. 5,

were made, each of one-half hour duration, and distributed over the twenty-six stations. Of great interest is that crabs were found throughout the areas explored as evidenced by the catch of king crabs in every one of the 104 trawl efforts. Indications of abundance during the period of June and July of 1955, were found only in two well separated areas.

#### Relation of Currents to Distribution of Young Crabs.

At each of the twenty-six fishing stations we obtained surface and bottom water temperatures,

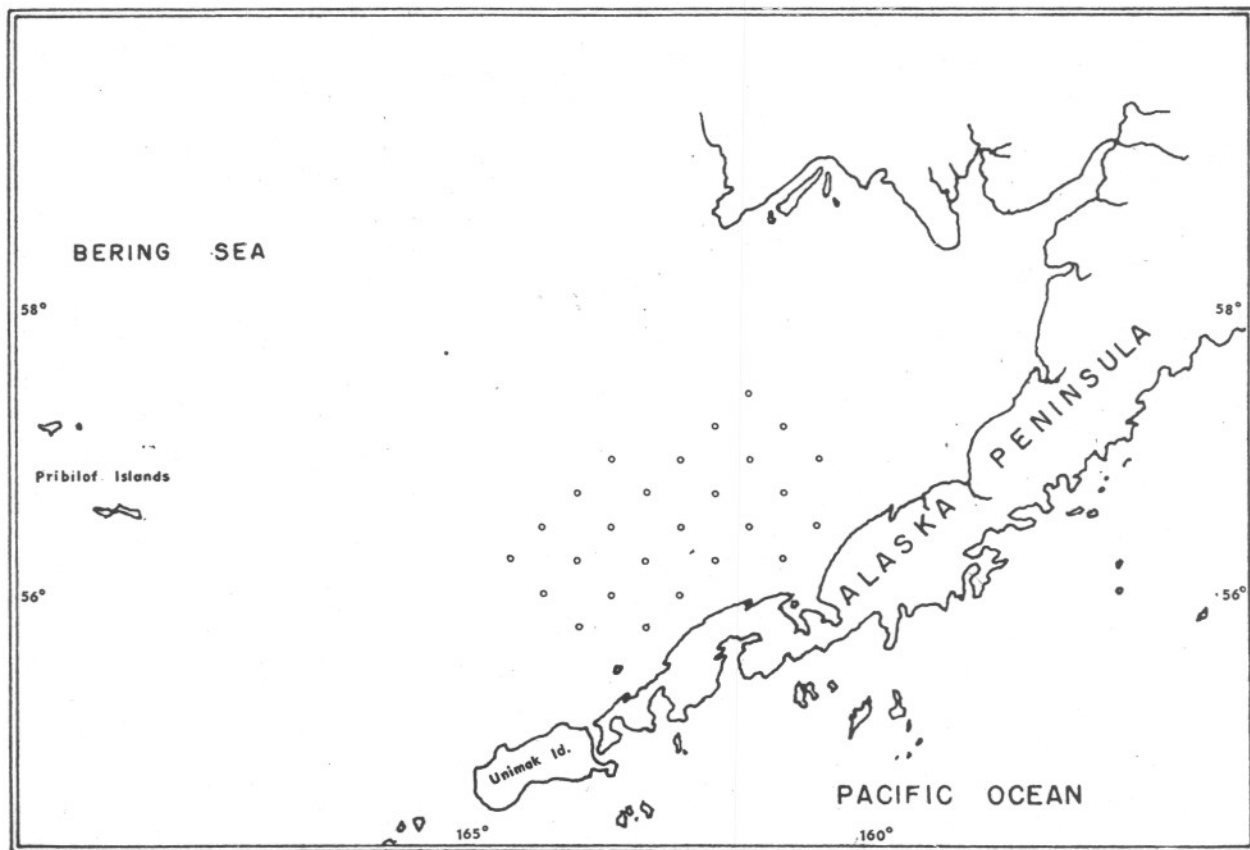


Fig. 5. King Crab Sampling Stations — 1955.

there were twenty-six trap and trawl stations distributed throughout the fishing area.

Traps were not satisfactory for these studies; they selectively took male crabs, were difficult to locate in the high seas and, because of the strong tides and winds, often drifted away from their stations and were lost.

Trawling proved to be the more effective method of fishing, and a total of 104 trawl efforts

as well as a water sample from the bottom for analysis by the Department of Oceanography of the University of Washington. Although we made numerous plankton hauls in the commercial fishing area between March 13 and June 1, 1954 and between July 13 and December 2, 1954, no larval king crabs were observed. This suggests that the young inhabit areas other than those occupied by the commercial fleet.

### Identification of Stocks.

The standardized measurements agreed upon by biologists of Japan and the United States in March of 1954 are shown in Figure 6. The United States has now measured a total of 8,466 king crabs (Table 13) and is coding the data on punched cards in preparation for statistical study and analysis.

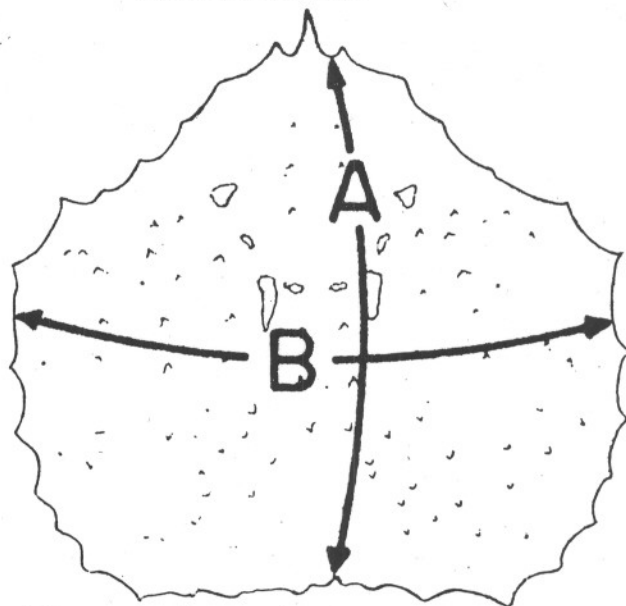
TABLE 13. King Crab Measurements.

Year	Vessel	Number Measured
1953	Tokei Maru	3,840
1954	Deep Sea	2,712
1955	Tordenskjold	1,914
Total .....		8,466

### Growth and Age Determination.

Evidence from two independent experiments indicates that mature male king crabs may not molt regularly every year as previously believed. First, observations made on crabs brought from

Fig. 6. Diagram showing Standardized King Crab Carapace Dimensions.



Distance A: Carapace length measured from the hind margin of the right orbit to the mid point of the posterior margin.

Distance B: Carapace width is the greatest distance across the carapace. This measurement is made between spines.

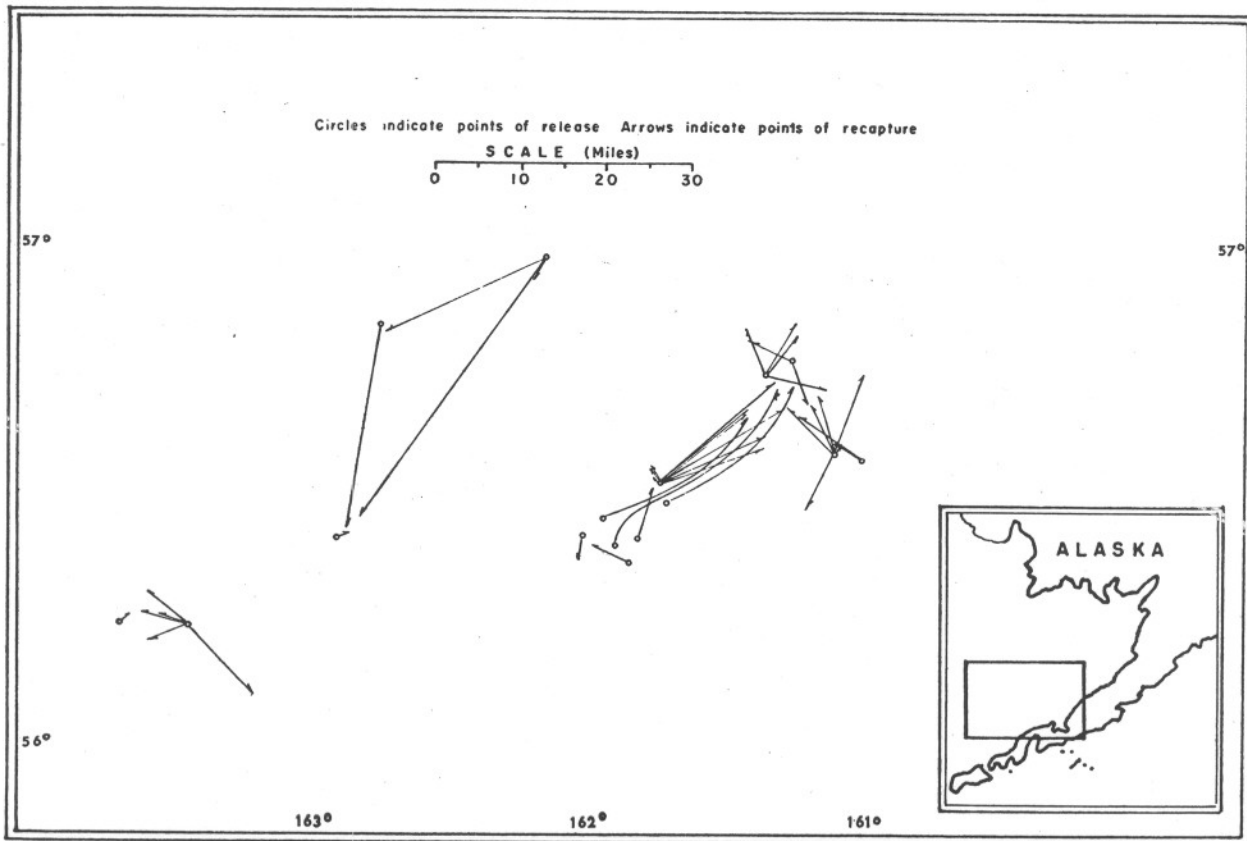


Fig. 7. Tagged King Crab released-recovered positions. Released during 1954 and recovered during 1954.

the Bering Sea to the laboratories at Friday Harbor and Bowman's Bay, Washington showed that some of the male crabs held in captivity failed to molt. Second, plastic discs were attached to the carapace of male king crabs at sea to determine seasonal movement during 1954. Of these tags, 61 have been returned in 1955 of which 28 had been retained on the crabs for more than a year after release.

#### Study of Movements of Crabs by Tagging.

United States biologists conducted tagging experiments in 1954 from the *Deep Sea*, and again in 1955 from the chartered vessel *Tordenskjold*. In 1954 they attached "Peterson disc" tags either to the carapace or to the legs by means of nickel pins. Although the tags were lost at the time of molting, this experiment yielded valuable within-season information. Of the 1,108 tagged crabs released in

1954, we have recaptured 104, 44 of them during 1954 and 60 during the 1955 fishing season. The general areas of release and recoveries during 1954 are illustrated in Fig. 7. Fig. 8 illustrates recoveries in 1955 from 1954 releases.

Realizing the deficiencies of a tag that is lost during molting, we adopted a different type of tag in 1955. Biologists placed a "spaghetti tag" made of plastic tubing, through the muscle tissue under the carapace and tied it securely to form a loop (Fig. 9). This type of tag, previously used by the Alaska Department of Fisheries and by the Japanese, should be retained by the crab through molt. We tagged a total of 1,350 male king crabs in this manner during 1955, distributed throughout the 26 fishing stations. The recoveries during the 1955 fishing season totaled 32 crabs. (See Fig. 10 for positions of tagged crab releases and recoveries).

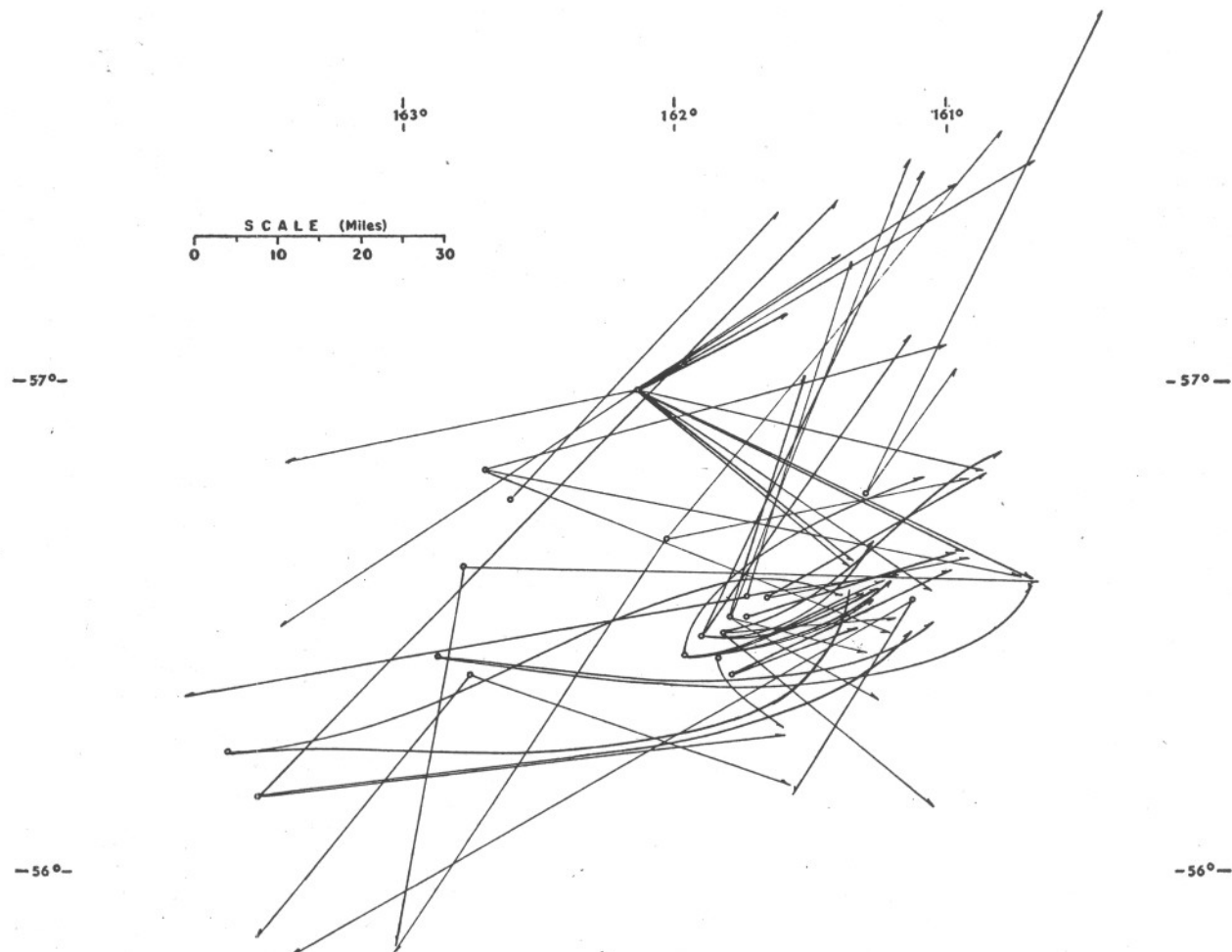


Fig. 8. Tagged King Crab released - recovered positions. Released during 1954 — Recovered during 1955. Circles indicate points of release. Arrows indicate points of recapture.

Figure 9. ILLUSTRATION OF A KING CRAB WITH "SPAGHETTI" TYPE TAG

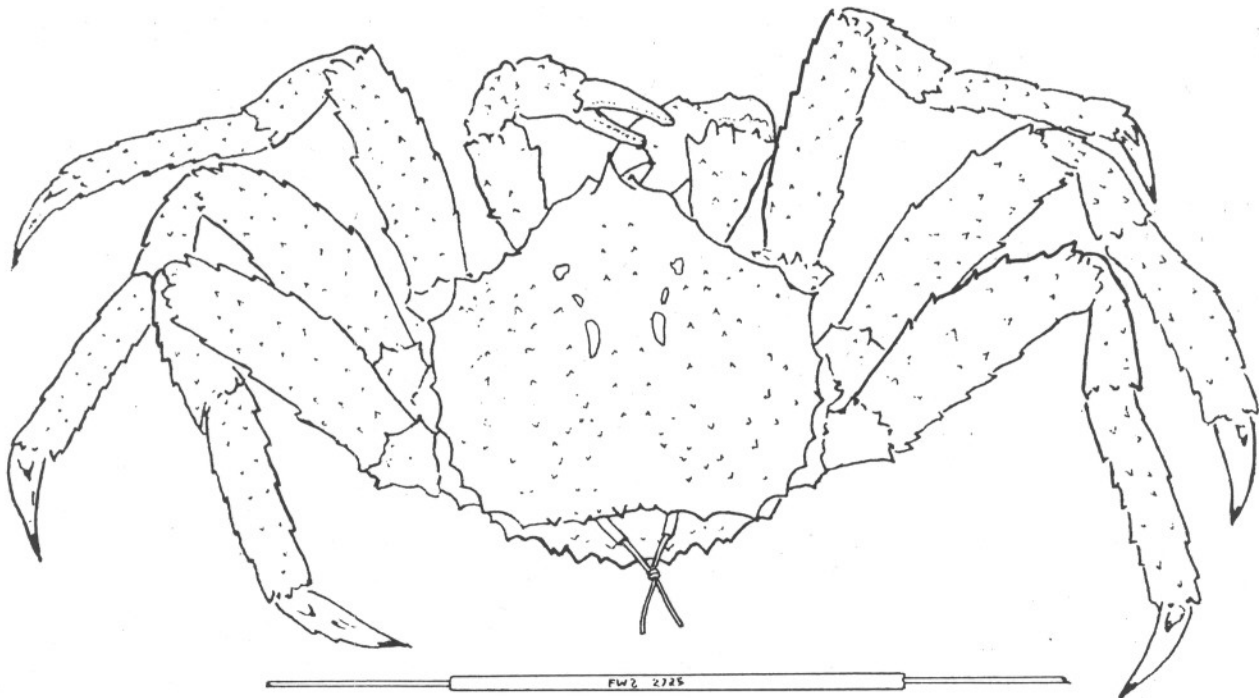
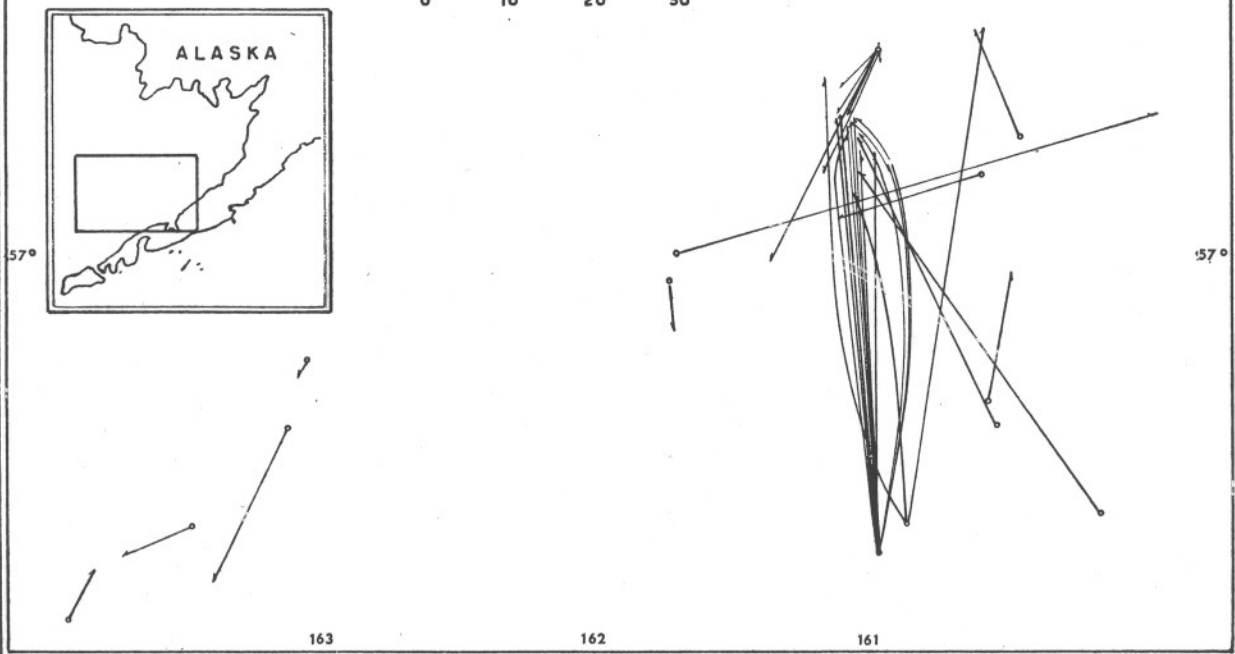


Figure 10. TAGGED KING CRAB RELEASED - RECOVERED POSITIONS  
RELEASED DURING 1955 - RECOVERED DURING 1955

Circles indicate points of release. Arrows indicate points of recapture

SCALE (Miles)  
0 10 20 30



**Determination of Mortalities.**

Because the king crab fishery uses only the adult male crabs, releasing all others, we obtained information aboard the trawler *Deep Sea*, in 1954 on the mortality of the released crabs. A summary

of these observations is given in Table 14. In 39 observations during the spring trip and 53 made during the fall, the greatest mortality of both sexes occurred when the crabs were in a soft-shell condition.

**TABLE 14. Observations on the Mortality of King Crabs Released from a Trawl Fishery.**

Sex	Condition	Time		Total
		Spring Mar. 3 - May 22, 1954	Fall July 22 - Aug. 16, 1954	
	Number of Observations: .....	39	53	92
Females:	Mature—			
	Total caught .....	17,976	1,158	19,134
	Total killed .....	225	93	318
	Percent killed .....	1.25	8.03	1.66
	Immature—			
	Total caught .....	15	2	17
	Total killed .....	0	0	0
	Percent killed .....	0	0	0
	Soft—			
	Total caught .....	9	5	14
	Total killed .....	4	4	8
	Percent killed .....	44.44	80.00	57.14
Males:	Mature—			
	Total caught .....	8,334	13,205	21,539
	Undersized—			
	Total caught .....	892	6,245	7,137
	Total killed .....	5	104	109
	Percent killed .....	0.56	1.67	1.53
	Soft—			
	Total caught .....	597	118	715
	Total killed .....	192	36	228
	Percent killed .....	32.16	30.51	31.89