Returns From 1956 Tagging

It has been expected that there would be some return in 1958 from immatures tagged two years earlier in the 1956 experiments. A total of seven were returned. Details are shown in Table 25.

All of the above were from among the larger immatures which had spent two years at sea when tagged.

Russia recently sent three more chum salmon tags which were affixed in 1956 and recovered in 1957. Table 26 shows the details.

KING CRAB INVESTIGATIONS

King crab investigators are continuing research designed to provide the International North Pacific Fisheries Commission with the facts necessary to determine need for joint conservation measures of the eastern Bering Sea king crab stock. Simply stated, our goal is to determine the most productive rate of fishing and to compare this with the existing fisheries which in recent years have been stabilized at about one and one-half million male crabs per year.

Catch statistics for the 1958 season are not yet available but it is expected that the total catch was approximately the same number of crabs as it has been since 1953. Although a United States mothership and three fishing vessels operated in the Bering Sea in 1958, the fleet fished only a limited time; and the United States catch from this area will show a decline from 1957. The general magnitude of the total should not change appreciably in view of the relative size of the Japanese and United States catches.

Data needed to determine the amount of fishing that this stock can support on a maximum yield basis were collected as in previous years. Basically chartered vessels trawled at a series of evenly spaced stations to provide us with data needed to determine abundance and growth. The crabs caught were tagged and released throughout the area.

In spite of the extremely adverse weather conditions encountered during the 1958 field season, the chartered vessel MV *Tordenskjold* was able to fish at 68 stations in late April and May and at 63 stations during June and the first half of July. (See Figure 29 for station patterns). In addition to fishing, approximately 160 hydrographic stations were occupied. In the 1958 station pattern 9,851 crabs were tagged and released for growth, migration and mortality studies. Table 27 summarizes, by years, the tagging with numbers released and recovered.

Table 25. Return data for 7 salmon tagged in 1956 and recovered in 1958

Species	Date tagged (1956)	Date recovered (1958)	Location tagged	Location recovered	
Red	8/2	6/6	12 mi. S. Adak Is.	49°15′ N	169°44′ E
Chum	7/14	6/14	3 mi. S. Adak Is.	48 34	165 20
Chum	7/7	6/19	4 mi. S. Adak Is.	51 24	154 02
Chum	7/14	7/28	3 mi. S. Adak Is.	51 40	154 05
Chum	7/8	7/17	6 mi. S. Adak Is.	50 00	153 00
Chum	8/3	8/10	10 mi. S. Adak Is.	Okhota R. (Okhotsk Sea coast)	
Chum	7/21	11/14	3 mi.S. Adak Is.	Shibetsu R. (Hokkaido)	

Table 26. Return data for 3 salmon tagged in 1956 and recovered in 1957

Species	Date tagged (1956)	Date recovered (1957)	Location tagged	Location recovered
Chum	7/8	8/15-31	6 mi. S. Adak Is.	Okhota River, Okhotsk coast
Chum	6/25	Early Sept.	10 mi. S.E. Atka Pass	Inja River, Okhotsk coast
Chum	8/5	Early Sept.	10 mi. S. Adak Is.	Kukhtui River, Okhotsk coast

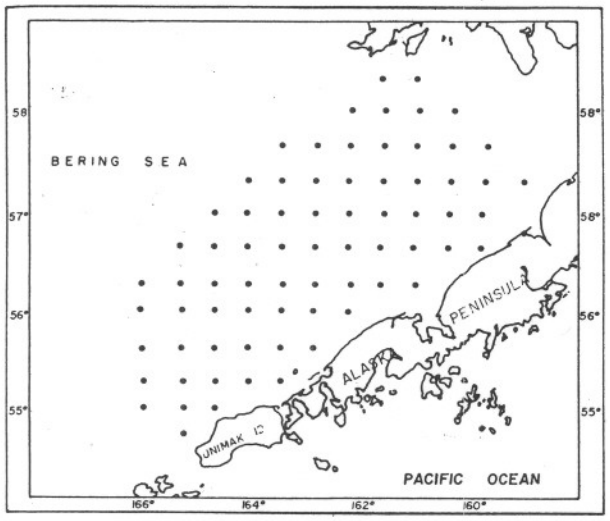

Figure 29. 1958 king crab station pattern.

crab caught in order to determine if the crab had moulted within the year. Growth rates calculated from the three years data and tag recoveries are plotted in Figure 30. Beginning with the smallest crab for which growth has been observed, increments adjusted by the percentage of non-moulting crabs of each size have been added in order to construct the growth curves. For comparison, a rate of "average maximum growth" is included which would be the calculated growth if all crabs moulted annually.

That the incidence of non-moulting crabs was higher in 1957 than for 1956 or 1958 is quite evident; the reason for this difference is not known, although there is no basis to expect that the frequency of moulting should remain the same every year.

We are attempting to obtain growth rates by a second method, that of observing the progression

Table 27. Summary of tag releases and recoveries

Tagging year	Number released	Recoveries during: 1954	1955	1956	1957	1958	Total
1954	1,107	44	60	1	2	1	108
1955	1,351		32	53	35	18	138
1956	4,063			53	197	114	364
1957	13,795				42	192	234
1958	9,851					40	40
Total	30,167	44	92	107	276	365	884

We are very grateful to the Japan Fisheries Agency for their part in arranging for the recovery and for supplying us with measurements, shell conditions and catch information regarding the tagged crabs caught by the Japanese operations.

Growth

The tag recoveries summarized above include 88 crabs which show growth and thus provide a basis for estimating growth rates. Growth per moult as indicated by these recoveries is about 15 millimeters for crabs of about 110 millimeters in carapace length, decreasing slightly as size increases. However, as 76 of these are crabs ranging in length from 110 to 155 millimeters, it is evident that we need more recoveries showing growth, particularly of the smaller sizes.

During the 1956, 1957 and 1958 field seasons, biologists recorded the shell appearance of every

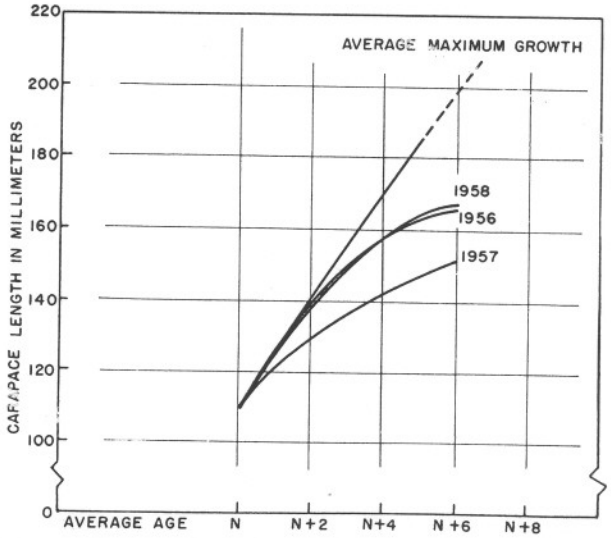

Figure 30. Growth of Bering Sea king crabs from tags.

of modes through size frequencies. Using skin diving equipment, we caught 879 small crabs near Unalaska Island during late April and May. An additional 26 were caught by other means for a total of 905 crabs. During September we caught 413 crabs. The sizes of crabs from the two sampling periods are graphically presented in Figure 31.

Carapace lengths for crabs caught by the United States research vessel and by Japanese vessels are being exchanged for further studies of the size frequencies.

In general the methods appear useable. Although additional information is necessary it is hoped that in a year or two these studies will have progressed sufficiently to provide a reliable estimate of growth throughout the size range.

Abundance

In order to determine the abundance of crabs, the area fished by the trawl at each station was calculated; distance was measured with a specially designed meter towed behind the net, and the width of the net was calculated by measuring the distance and the angle between two balls fastened to the otter boards and trailing on the surface. The wings of the experimental net were attached directly to the otter boards so that the distance between the boards was equivalent to net spread. At each station the catch was recorded and an average density of crabs per unit area calculated. The estimate of abundance is based on the average density from all units in the station pattern. As mentioned in previous reports, the estimates are of a minimal nature, since they are based on the assumption that all crabs in the path of the trawl are caught. The greater the degree to which crabs escape, the lower our estimate is with respect to the actual abundance. Although the estimates for 1957 and 1958 are probably of the right magnitude, the 1958 estimate differs from that derived by tag recovery and further study is necessary.

The abundance of male king crabs larger than 135 millimeters in carapace length (6¼ inches in carapace width) was calculated to be 22 million in the 27,200 square miles covered by the cruise of the 1958 survey and 18 million in the 25,200 square miles in the second cruise. This compares with our estimate of 19 million in the 30,000 square miles sampled during the 1957 field season.

Meat Content

In evaluating maximum yield we must consider the condition of the crab at the time caught and the actual meat yield. Samples of crabs ranging in carapace length from 160 to 180 (average 166.8 mm.) were weighed, boiled and the meat extracted. The difference in recoverable meat varied from 19 percent of the live weight of crabs with newly formed shells to 30 percent of the live weight of crabs with old shells. The actual average weight of meat recovered from these samples was 26 and 45 ounces respectively.

Gear Selectivity

In order to determine the size selectivity of twenty-inch mesh tangle nets, ten shackles borrowed from the Japanese mothership were set in an area where crabs ranging in carapace length from 70 to 185 millimeters were abundant. The nets were fished for eight days and the catch compared with

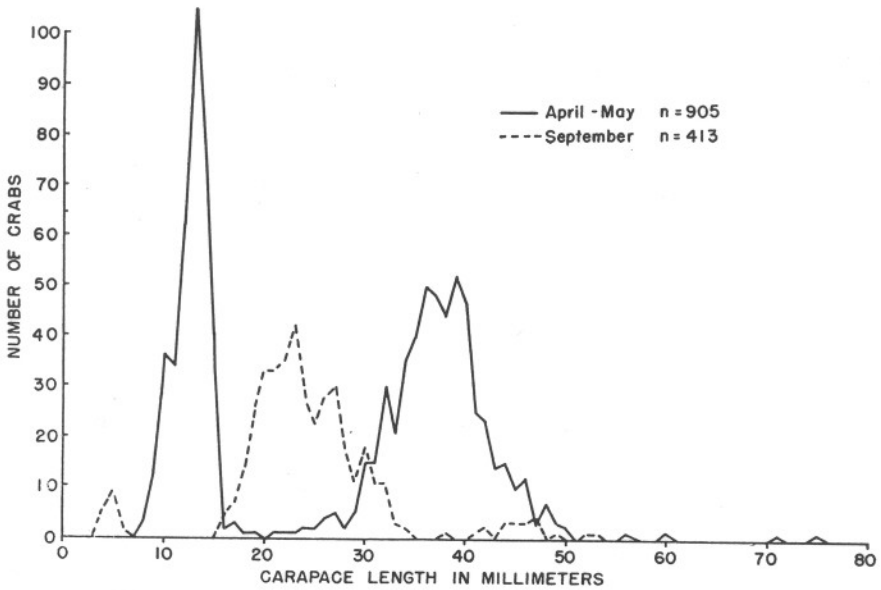

Figure 31. Size frequency of Unalaska king crabs, 1958.

the catch from trawl sets made immediately before and immediately after the tangle net set.

If we assume that the largest mode of the size frequencies indicates the point from which all crabs are caught in proportion to their actual abundance, we find that the experimental trawl, lined in the cod-end with 1½" mesh, retains all sizes greater than 95 millimeters and that the twenty-inch mesh tangle net retains all crabs larger

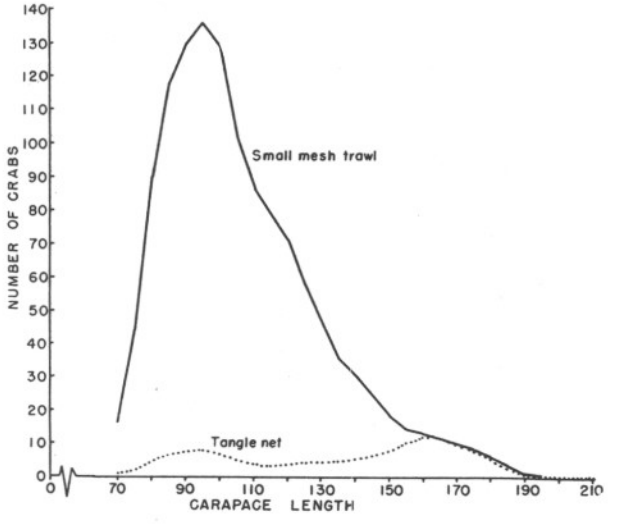

Figure 32. Adjusted size frequencies of catches by experimental small mesh trawl and tangle nets.

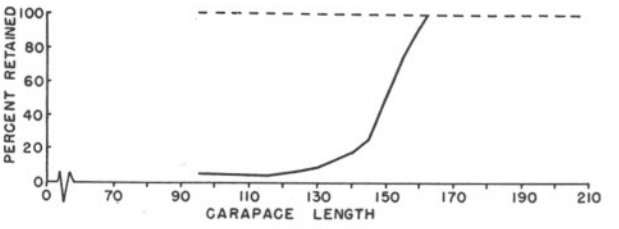

Figure 33. Tangle net selectivity.

than 165 millimeters. In order to compare the two size frequencies, we determined the ratio between tangle net and trawl catches of crabs larger than 165 mm. and used the ratio to adjust the remainder of the tangle net catch. A size frequency of this adjusted data is plotted in Figure 32. The difference between the two size frequency curves illustrates the difference in selectivity; Figure 33 shows the size difference in terms of percent retained by the tangle net. It also shows a relatively stable rate of retention of sizes from 95 to 120 mm. The rate then increases gradually to 145 mm. and then rises rapidly. At 165 mm., according to our assumption, there is no selectivity.

We are sincerely grateful to Nippon Suisan Co., Ltd., for the use of the tangle nets and for their advice and instruction in their use.

CORRECTION

In figure 15, page 85 of the 1957 Annual Report, the numbers of crabs released in 1957 should be changed from 13,747 to 13,795.