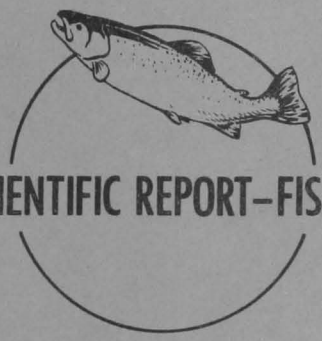
OBSERVATIONS OF MOULTING FEMALE KING CRABS *PARALITHODES CAMTSCHATICA*



SPECIAL SCIENTIFIC REPORT–FISHERIES No. 274

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

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United States Department of the Interior, Fred A. Seaton, Secretary
Fish and Wildlife Service, Arnie J. Suomela, Commissioner

OBSERVATIONS OF MOLTING FEMALE KING CRABS (*Paralithodes camtschatica*)

by

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Contribution No. 4 to research conducted with the approval of the United States Section of the International North Pacific Fisheries Commission. The Commission, established in 1953 by the International Convention for the High Seas Fisheries of the North Pacific Ocean, coordinates the research of the member nations: Japan, Canada, and the United States. The resulting investigations provide data to the Commission for use in carrying out its duties in connection with fishery conservation problems in the North Pacific Ocean. Publication of this scientific report has been approved by the United States Section of the Commission.

Special Scientific Report--Fisheries No. 274

Washington, D. C.

December 1958

The Library of Congress has cataloged this publication as follows:

Sakuda, Henry M

Observations of moulting female king crabs (*Paralithodes camtschatica*) Washington, U. S. Dept. of the Interior, Fish and Wildlife Service, 1958.

5 p. illus. 27 cm. (U. S. Fish and Wildlife Service. Special scientific report: fisheries, no. 274)

Includes bibliography.

1. Paralithodes camtschatica. 1. Title. (Series)

SH11.A335 no. 274 595.3844 59-60427

Library of Congress

The Fish and Wildlife Service series, Special Scientific Report--Fisheries, is cataloged as follows:

U. S. *Fish and Wildlife Service.*

Special scientific report: fisheries. no. 1-

[Washington] 1949-

no. illus., maps, diagrs. 27 cm.

Supersedes in part the Service's Special scientific report.

1. Fisheries—Research.

SH11.A335 639.2072 59-60217

Library of Congress [2]

ABSTRACT

This report describes the observations of 9 molting mature female king crabs (Paralithodes camtschatica) caught in Pavlof Bay on the Alaska Peninsula between May 1 and May 18, 1957. Observations showed that the molting soft-shelled crabs emerge through an opening between the posterior margin of the carapace and anterior margin of the abdominal segments. The female crabs all cast their shells without the males being present. The remaining cast shells were intact, without breaks in the shell parts. The maximum growth of the newly molted crabs was attained 2 days after molting.

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OBSERVATIONS OF MOLTING FEMALE KING CRABS
(Paralithodes camtschatica)

INTRODUCTION

The Pacific Salmon Investigations of the U. S. Fish and Wildlife Service is conducting studies to determine the need for measures for conservation of the eastern Bering Sea king crab (Paralithodes camtschatica), as part of the research program of the International North Pacific Fisheries Commission. In this respect, knowledge of the biology of the king crab is essential.

Molting, an important phase in the life history of king crab as well as other crustacea, is a phenomenon whereby the exoskeleton is periodically discarded. Generally all the outer cuticular layers of the shell, eyes, antennae, gills, tendons, mouth parts, esophagus, and stomach with its chitinous teeth are replaced, leaving no apparent trace of this change. The age of the crab, therefore, is extremely difficult to determine. One of the methods of estimating age is to rear crabs in order to observe the molting frequency and measure the growth attained from molting. These measurements combined with those obtained by sampling the fishery then may give some indications of age.

This report describes the observations of nine molting female king crabs caught in Pavlof Bay on the Alaska Peninsula between May 1 and 18, 1957. Work was done aboard the MV Deep Sea, a king crab factoryship.

I am grateful to Wakefield's Deep Sea Trawlers Inc. and the crew of the vessel for their cooperation and the use of their facilities. My thanks also to Mr. Glen Davenport for his assistance, and Mr. T. O. Duncan for photographs.

PREMOLTING OBSERVATIONS

The annual molting and mating period of female king crabs occur in the spring. At this time the male is observed holding the meropodite of the chelipeds of the female with his chela. After the female molts, the male leaves the cast shell and resumes the original "hand shaking" position with the soft-shelled female. The female then lays new eggs which attach to the swimmerets in the abdominal pouch and are fertilized. Shell-casting, however, can take place without the male.

Upon capture, the crabs were placed in live boxes provided with running sea water. For identification each crab was marked with a number on the carapace before and after molting. Carapace length measurements and examinations were made daily from the time of capture until release.

The nine female specimens in a premolting condition had similar external characteristics. The shells of the carapace and appendages were thin and pliable. The membranes connecting the shell parts were also very thin and cellophane-like in texture. A slight pink color, differing from the opaque color found in crabs of nonmolting condition, was detected under the thin membranes at the joints of each leg and between the plates of the abdomen. On one specimen the suture along the anterior border of the first abdominal segment was split and the pink soft shell exposed. (See figure 1 for arrangement of the abdominal segments.) The eyes of the specimens were bright red in contrast to the brown colored eyes of nonmolting crabs.

Prior to molting, the female crabs were observed with their bodies lifted off the bottom of the live box. Their abdomens, extended away from their bodies, moved rhythmically back and forth exposing the swimmerets covered with empty egg cases. This behavior was seen frequently until molting and may be beneficial in releasing zoea larvae as well as loosening the soft shell from the old, making extraction easier during the shell-casting process.

MOLTING OBSERVATIONS

The first step observed in the shell-casting process was a separation in the thin membrane anterior to the first abdominal segment. (See figure 1 for arrangement of the membrane connecting the

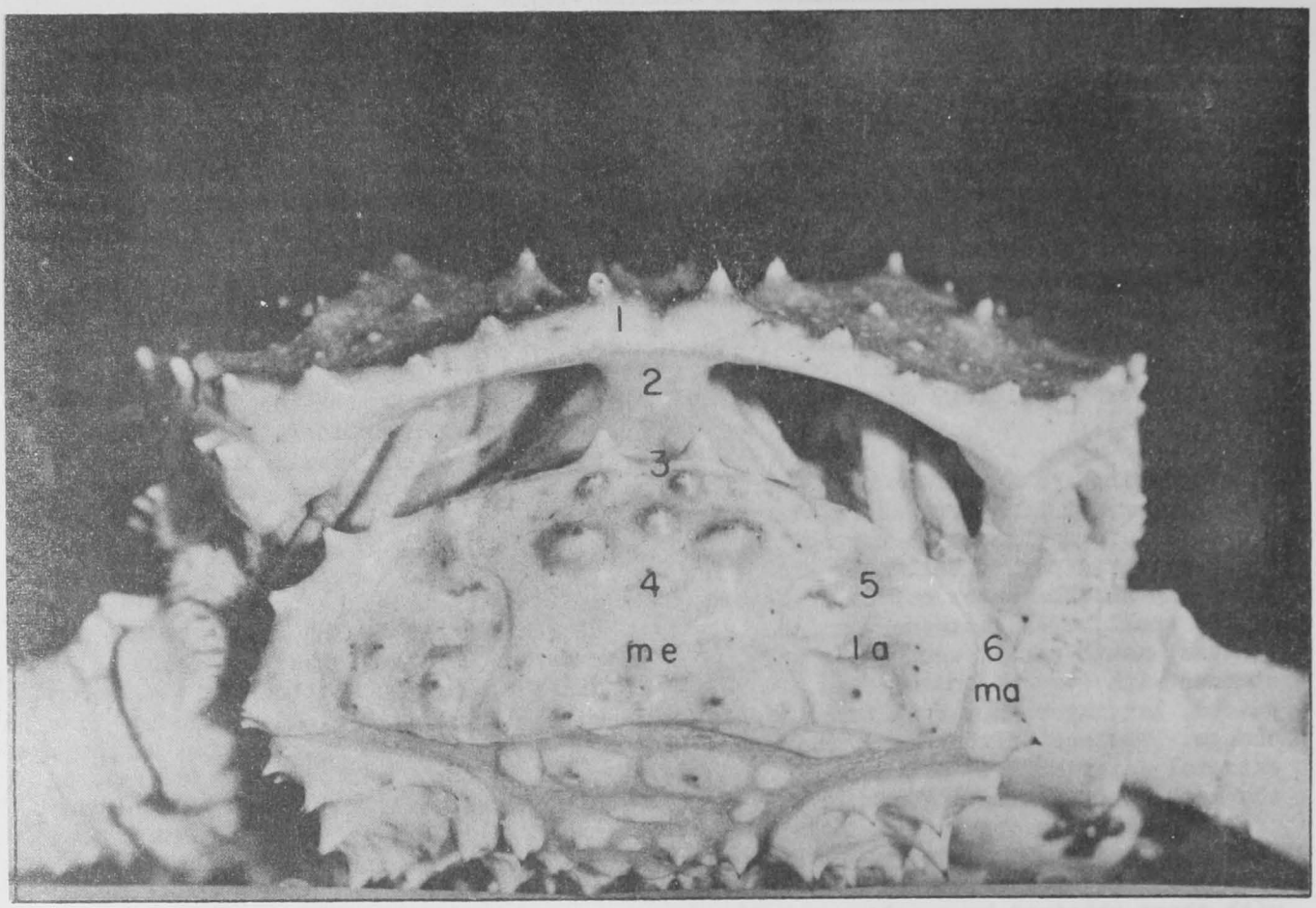

Figure 1.--Posterior view of king crab showing arrangement of carapace and abdominal segments. (After Marukawa, 1933.) 1, posterior border of carapace; 2, isthmus between carapace and body; 3, first abdominal segment; 4-6, second abdominal segments; me- median plate, la- lateral plate, ma- marginal plate.

carapace and abdomen). The carapace and abdominal segments then started to part, thus tearing the membrane further and opening a large gap. The tear in the membrane extended completely along the anterior margin of the abdominal segments, vertically up the isthmus between the carapace and body, and completely across the posterior margin of the carapace. As the membrane continued to tear, the opening grew larger and the soft-shelled crab backed out of the old shell. During the only occasion when a crab was timed casting its shell, four minutes were required to back out of the old shell.

Many females examined during trawling operations were found with the membrane along the first abdominal segment split and this section open.

POSTMOLTING OBSERVATIONS

Seven of the nine cast shells remained intact. The membranes connecting the sides of the carapace to the body shell did not separate (fig. 2), except for the section between the carapace and abdominal segments. In the other two, the thin membranes in other parts of the cast shells were torn and parts lost.

The outer layers of the antennae, eyes, gills, stomach, and mouth parts were entirely left with the old shells; the tendons of the legs were also left in the cast shells. One specimen sloughed off its left fourth leg at the basal segment and left it in the cast shell. This crab would probably regenerate a new leg.

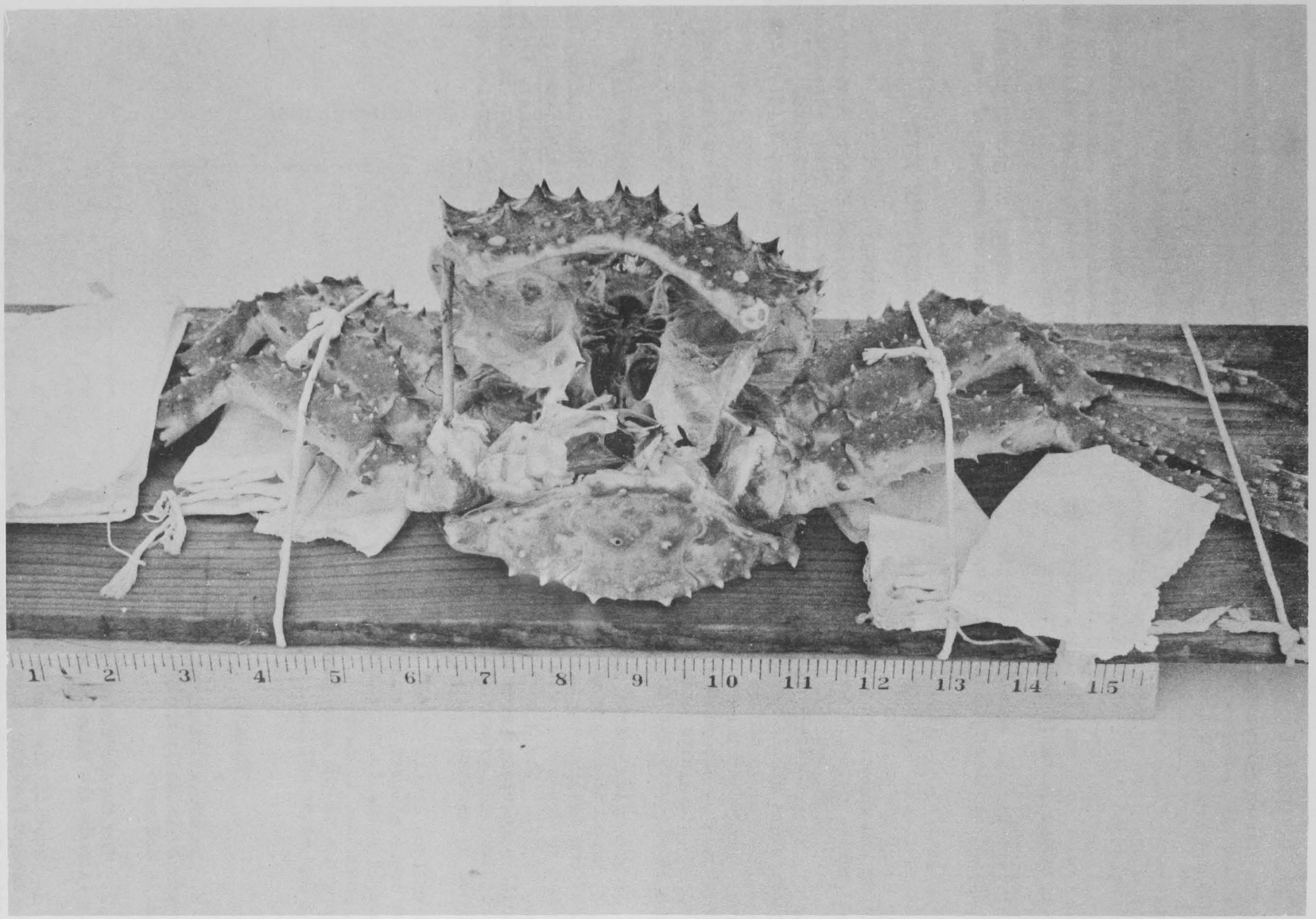

FIGURE 2:--Posterior view of intact cast shell of female king crab showing opening through which the crab emerges from the old shell.

The length measurements of the carapace of the newly molted crabs showed some fluctuations during hardening, which lasted from 3 to 4 days. In all cases, however, the specimens which were held from 5 to 13 days after molting showed the initial growth measured 2 days after molting to be the total growth. Growth from molting ranged from 2 to 6 mm., with an average of 4 mm. as shown in table 1 and figure 3.

Except for one specimen, all the newly molted females failed to lay eggs.

Wallace et al. (1949) states, "a simultaneous action is exerted by the tissue under the carapace, leading to breaks on the sides, posterior end, and, in some cases, entirely across the carapace. Very often the old shell is left completely intact except for the breaks along the sides of the carapace". In the present study seven of the cast shells remained completely intact, except for the torn membrane on the posterior end of the carapace. In all nine crabs the carapace and leg shells were not cracked.

Growth measurements from this study (fig. 3) agree closely with the growth of females from tagging and molting studies described by Wallace et al. (1949) and Stevens (1955). The 3 to 4 days taken for shell-hardening agrees with the average days required for growth and hardening mentioned by Marukawa (1933).

Wallace et al. (1949) states that female crabs allowed to molt in the absence of males do not extrude their eggs until permitted to mate. In this study, however, one of the nine females extruded eggs a day after molting.

SUMMARY

1. Before molting the females were observed rhythmically moving and stretching their abdomens.

2. The female crabs cast their shells without the males being present.

3. Most of the shells cast were intact except for the split in the membrane connecting the carapace to the abdominal segments.

4. One shell-casting process was timed at 4 minutes.

5. All but one of the newly molted females failed to lay eggs.

6. Size measurements fluctuated during shell-hardening; however, the growth measured 2 days after molting was the total growth.

7. The amount of growth ranged from 2 to 6 mm., with an average of 4 mm.

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Table 1.--Dimensions of nine molting female king crabs

No.	Original carapace length (mm.)	Carapace length at release (mm.)	Growth (mm.)	Days held from molt to release
1.	115	120.0	5.0	10
2.	118	121.0	3.0	13
3.	119	122.0	3.0	10
4.	120	122.0	2.0	13
5.	123	127.0	4.0	11
6.	127	132.0	5.0	7
7.	131	136.0	5.0	13
8.	131	137.0	6.0	5
9.	141	144.5	3.5	12

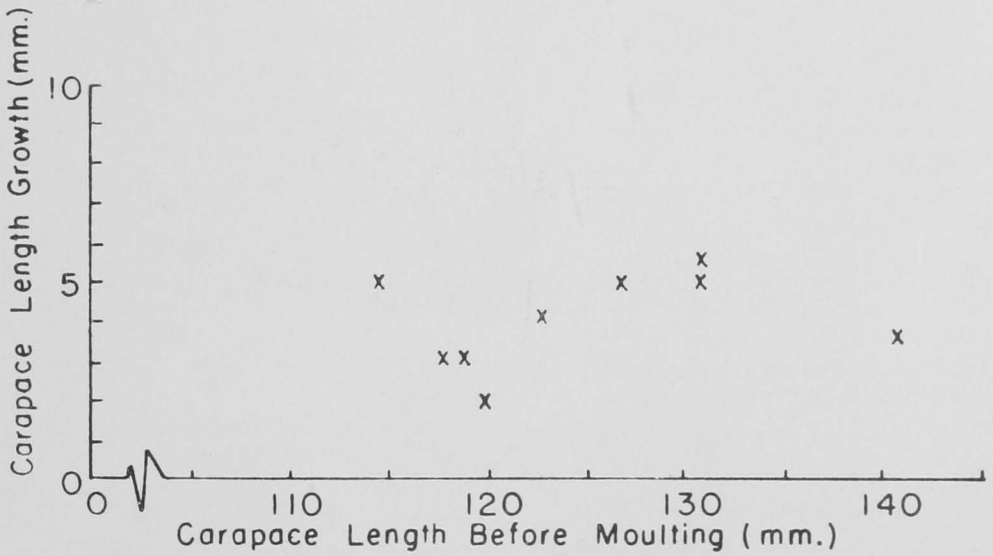

Figure 3.--Growth of nine female king crabs from molting.

INT.-DUP. SEC., WASH., D.C. 48433