OBSERVATIONS OF MOLTING FEMALE KING CRABS, *PARALITHODES CAMTSCHATICA* (TILESIUS)

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ABSTRACT

This report describes observations of nine molting mature female king crabs, *Paralithodes camtschatica* (Tilesius), caught in Pavlof Bay on the Alaska Peninsula between May 1 and May 18, 1957. Observations show that molting soft-shelled crabs emerge through an opening between the posterior margin of the carapace and anterior margin of the abdominal segments. The female king crab specimens all cast their shells without males being present. Most cast shells were intact, without breaks in the shell parts. Maximum increment in carapace length of newly molted female king crabs was attained two days after molting and ranged from 2 to 6 mm.

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INTRODUCTION

The King Crab Investigation of the United States Bureau of Commercial Fisheries is conducting studies to determine the need for conservation measures of eastern Bering Sea king crab, *Paralithodes camtschatica* (Tilesius), as part of the research program of the International North Pacific Fisheries Commission. In this respect, knowledge of the biology of king crab is essential.

Molting, an important phase in the life history of king crab as well as in other crustaceans, is a phenomenon whereby the exoskeleton is periodically discarded. Generally, all outer cuticular layers of the shell, eyes, antennae, gills, tendons, mouth parts, esophagus, and stomach with its chitinous teeth are replaced. In mature female king crabs, molting is associated with reproduction and growth. It is generally accepted by researchers that molting occurs annually, followed immediately by mating. The fertilized eggs are carried for approximately 10 to 11 months, after which hatching takes place and molting and mating are again repeated. Marukawa (1933) reports that female molting is aided by the male crabs who hold the chelipeds of females during molting and mating. He also reports that molting can take place in the absence of males.

This report describes 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 M. V. *Deep Sea*, a king crab factory ship.

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

PREMOLTING OBSERVATIONS

Nine female king crabs captured with an otter trawl 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, taken from the hind margin of the orbital socket to the median indentation of the posterior margin of the carapace, were made daily from time of capture until release.

All specimens exhibited premolting characteristics. 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 white found in crabs of nonmolting condition, was detected under the thin membranes at joints of each leg and between plates of the abdomen. On one specimen the suture along the anterior margin of the first abdominal seg-

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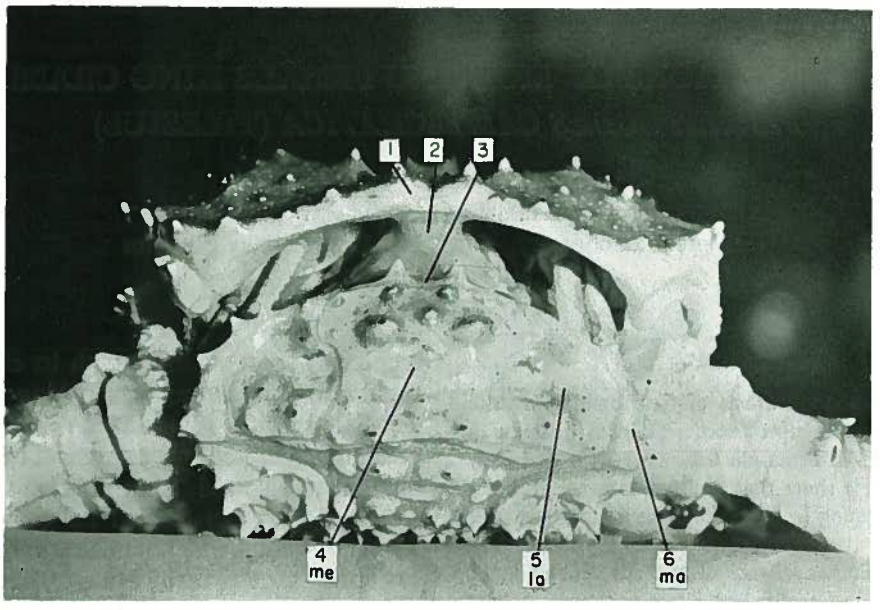

FIGURE 1. Posterior view of king crab showing arrangement of carapace and abdominal segments (After Marukawa, 1933).
1—posterior margin of carapace ;
2—isthmus between carapace and body ;
3—first abdominal segment ;
4–6—second abdominal segments.
me—median plate ; la—lateral plate ; ma—marginal plate.

ment was split and the pink soft shell exposed. (See Figure 1 for arrangement of abdominal segments.) The eyes of specimens were bright red in contrast to brown colored eyes of nonmolting crabs.

Prior to molting, female crabs were observed with their bodies lifted off the bottom of the live boxes. Their abdomens, extended away from their bodies, moved rhythmically back and forth exposing 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 new shell from the old, making extraction easier during molting.

MOLTING OBSERVATIONS

The first step observed in molting was a separation in the thin membrane anterior to the first abdominal segment. 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 nine cast shells remained intact (Figure 2). In the other two, thin membranes in other calcareous parts were torn.

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

Three to four days were required for the carapace of newly molted crabs to harden. Although specimens were held from 5 to 13 days after hardening, the initial growth measured two days after molting was found to be the total growth. Carapace length increments ranged from 2 to 6 mm., with an average of 4 mm., as shown in Table 1 and Figure 3.

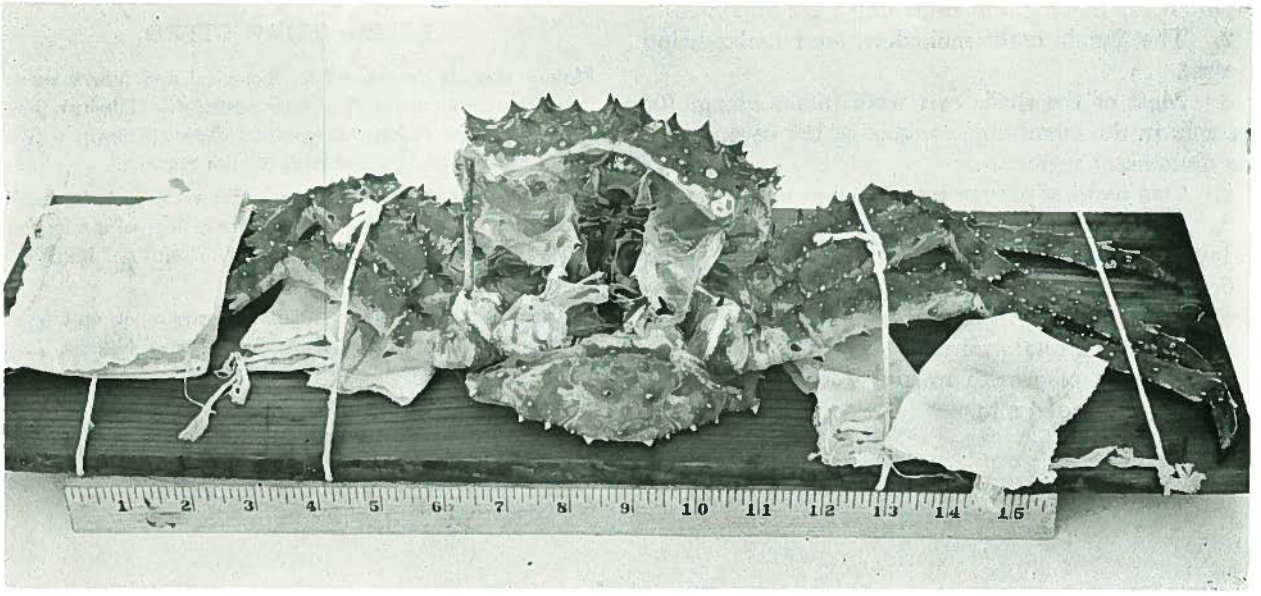

FIGURE 2. Posterior view of intact cast shell of female king crab showing opening through which the crab emerged from the old shell.

TABLE 1. Dimensions of nine molting female king crabs.

No.	Carapace length before molt (mm.)	Carapace length after molt (mm.)	Growth increment (mm.)	Carapace length increase (%)	Days held from molt to release
1	115	120.0	5.0	4.3	10
2	118	121.0	3.0	2.5	13
3	119	122.0	3.0	2.5	10
4	120	122.0	2.0	1.7	13
5	123	127.0	4.0	3.3	11
6	127	132.0	5.0	3.9	7
7	131	136.0	5.0	3.8	13
8	131	137.0	6.0	4.6	5
9	141	144.5	3.5	2.5	12

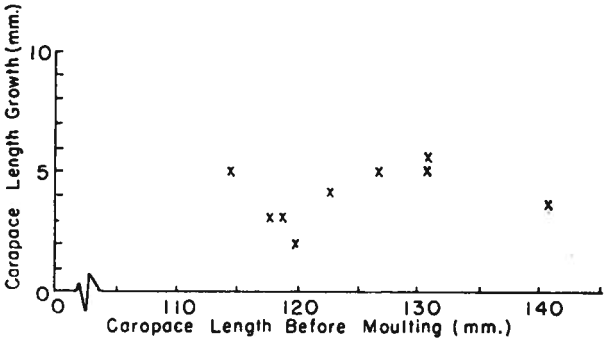

FIGURE 3. Growth increments of nine female king crabs.

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

DISCUSSION

The observations of molting mature female king crabs made in this study were similar to that described by Marukawa (1933).

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 cast shells remained completely intact, except for torn membranes on the posterior ends of the carapaces. In all nine cast shells the carapace and leg shells were not cracked.

Growth increments from this study agree with growth of females described by Marukawa (1933), Wallace *et al.* (1949) and Stevens (1955). The 3 to 4 days taken for shell-hardening also agrees with Marukawa's findings.

Wallace *et al.* (1949) states that female king 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. It is known in other crustaceans that females may extrude unfertilized eggs which later disintegrate.

SUMMARY

1. Before molting female king crabs were observed

rhythmically moving and stretching their abdomens.

2. The female crabs molted without 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 molting process was timed at four minutes.

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

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

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

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