Comparative growth physiology of wild caught and hatchery raised juvenile Alaskan red king crab, *Paralithodes camtschaticus*

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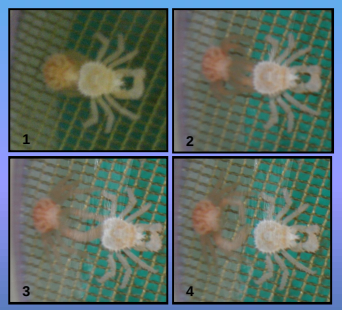
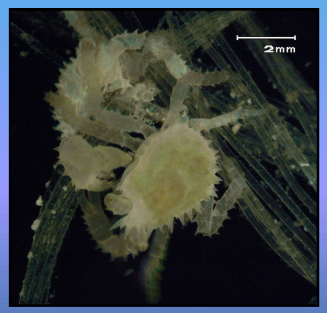
Introduction

Red king crab (RKC), *Paralithodes camtschaticus,* once supported the second most valuable fishery in Alaska. Since the mid-1980's, RKC fisheries have collapsed prompting the closures that, in certain regions of Alaska, are still in effect today. Understanding the early life stages of RKC is important to current restoration and conservation efforts. We have begun exploring the feasibility of crab enhancement, utilizing hatchery raised crabs to restock natural RKC habitats. This project focuses on early juvenile growth, molt timing and the potential differences that might be found between hatchery raised and wild caught RKC.



Juvenile RKC Molt Sequence



Newly molted crab with exuvia

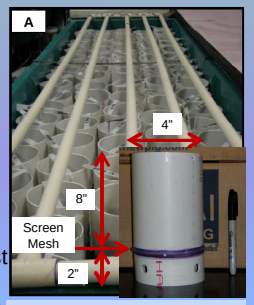
Methods

Molt Interval

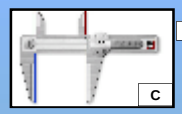
- Hatchery raised and wild caught juvenile RKCs brought to UAS marine laboratory
- Crabs held individually (**A**)
- Ambient (12 m depth) seawater temperature
- Monitored for molts daily

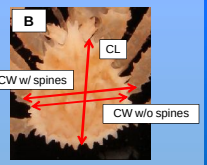
Molt Increment

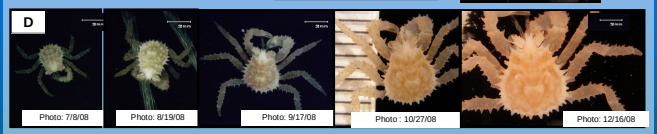
- Photographs of live crabs taken at least five days post-molt (**D**)
- Measured using Screen Calipers © (**C**)
- Carapace length (CL), carapace width without spines (CW w/o spines) and carapace width with spines (CW w/ spines) measured (**B**)



Individual Crab Rearing Containers







Results

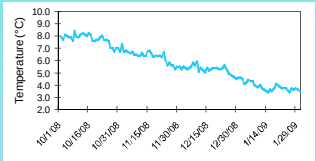


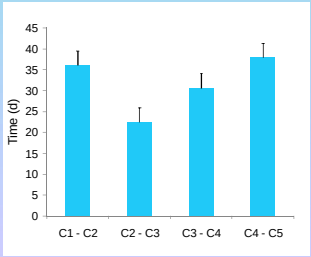
Figure 1

UAS Marine Lab seawater temperature from 10/1/08 to 1/31/09. Seawater kept at ambient to better approximate natural conditions.

Molt Interval

Figure 2

In the summer of 2008, 163 larval and juvenile wild RKC were collected. Of the total glaucothoe (38), 11 molted and survived past C2. The average molt interval for the wild caught RKC through the first four molt cycles increased. Note the molt between C1 and C2 has a longer interval.



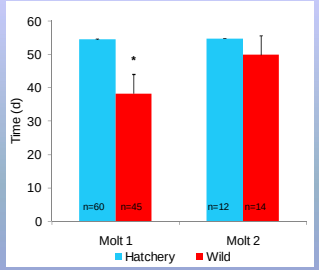


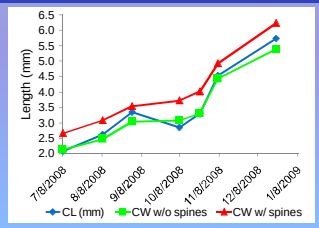
Figure 3

Molt interval (d) over two molt cycles for hatchery raised and wild caught juvenile RKC between October 1, 2008 and January 31, 2009. Wild RKC had significantly shorter molt intervals than hatchery RKC during the first molt cycle (one-way ANOVA; $p < 0.001$). Note: crabs are of comparable age.

Molt Increment

Figure 4

Growth trajectory for a single wild caught juvenile RKC from stage C1 to C7. Molting events are designated by symbols. The growth trajectory is subject to the method (CW or CL; with or w/o spines) used for measurement.



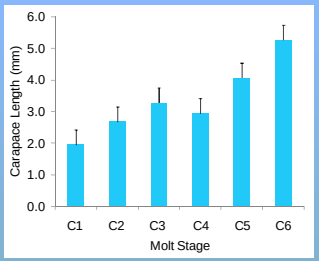


Figure 5

Average carapace length for the first five instars for wild caught RKC.

Instar	Growth Increment (mm)
C1-C2	0.72 ± 0.18
C2-C3	0.60 ± 0.13
C3-C4	-0.33 ± 0.09
C4-C5	1.12 ± 0.29
C5-C6	1.20 ± 0.67

Discussion

Molt Interval

The increased molt interval for the C1-C2 molt in Figure 2 is intriguing. This may be because the first benthic molt is stressful to the juvenile RKC or perhaps placement of the juveniles into the individual rearing containers imposed a handling stress. Next year's studies will explore the potential for the same trend in hatchery raised RKC.

In Figure 3, the significant difference in the duration of the first molt interval between the hatchery and wild RKC is again attributable to the potential handling stress of placing the juvenile crabs into individual rearing containers but will be explored in more detail in next year's study.

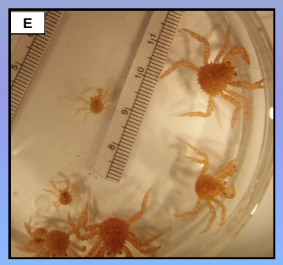
Molt Increment

Since the wild RKC were the only crabs that we obtained as glaucothoe, they were the only crabs that we could be sure of their crab stage (age) and hence, were the only crabs used in the molt increment analysis (Figure 4). Without having this information for the hatchery-reared crabs, which were introduced into the UAS Marine Lab 4 months post-settlement, we could only approximate their molt stage.

The probable explanation for the increment decrease at the C4 stage (Figure 5) is a change in methodology. Prior to this stage photographs were taken under a dissecting scope but beginning at the C4 stage the crabs are too large for the scope camera and a digital camera set up was used.

Future Studies

- Molting hormones
  - Ecdysteriod profile through multiple molt cycles
  - Intermolt and premolt duration
- Molt increment
  - Hatchery RKC glaucothoe
  - Wild RKC glaucothoe
  - Exuvia measurements
- Size disparity (**E**)
  - Interclutch vs year class
  - Density/cannibalism



Size disparity in 2008 year class

Acknowledgements

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