Does Maternal Size Affect Red King Crab Reproductive Potential Due to Embryo or Larval Production?

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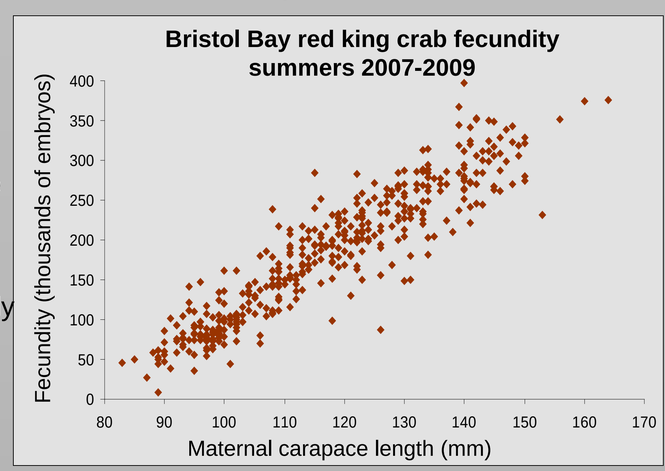
INTRODUCTION

Stock assessment and management of Alaskan red king crab (RKC), *Paralithodes camtschaticus,* do not incorporate reproductive potential based on embryo or larval production. Future incorporation of estimates of fecundity and indices of embryo and larval quality into reproductive potential must address the following effects:

- RKC fecundity increases with maternal size.
- Embryo loss may occur over the ~12 month brooding period so fecundity should be estimated close to hatching.
- In Bristol Bay, RKC fecundity is typically estimated in summer shortly after extrusion.
- Embryo loss may be higher among smaller females (Matsuura and Takeshita, 1985).



- Maternal size affects embryo and larval quality in some crustacean species (i.e. Attard and Hudon, 1987) and has not been examined for RKC.

Objectives:

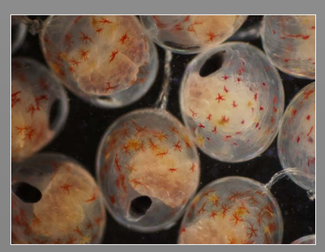
1. To assess seasonal change in Bristol Bay RKC fecundity as a function of maternal size.
2. To examine if embryo quality varies with maternal size.
3. To examine if larval quality varies with maternal size.

METHODS

Seasonal Fecundity

- Mature females 81-173 mm carapace length (CL) were collected in 2007, 2008 and 2009 on the National Marine Fisheries Service (NMFS) summer trawl surveys and by observers during the fall commercial fisheries.
- Fecundity was estimated by dry weight methods (Swiney et al., in press).
- ANCOVA models were used to compare the seasonal size-fecundity relationships for each year. Slopes were homogenous so interaction terms were dropped from the models.

Embryo Quality



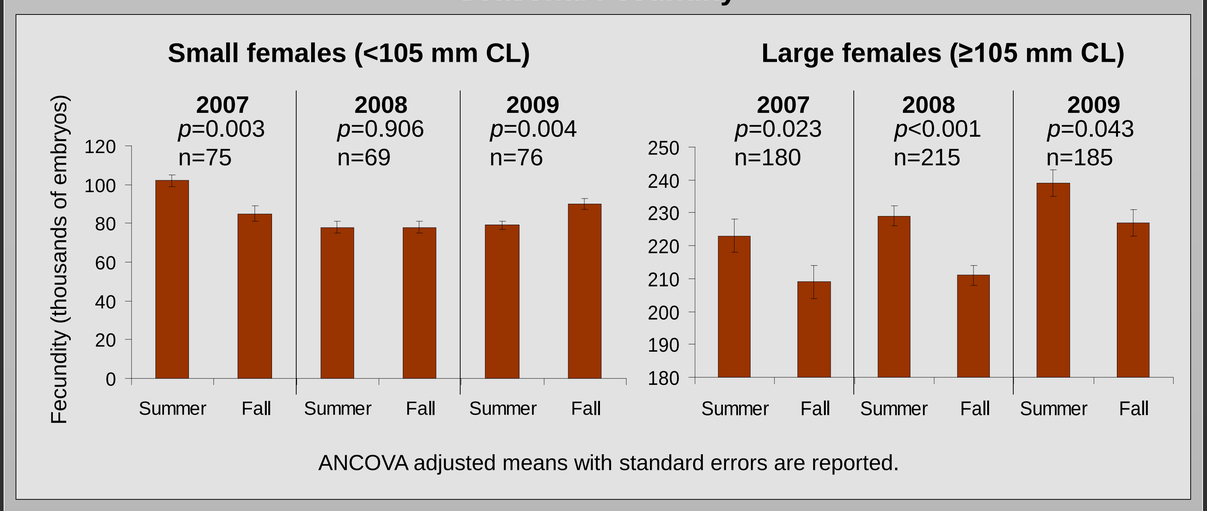
- Mature females 86-145 mm CL were collected in 2009 and 2010 during the NMFS trawl survey.
- Embryo dry masses were derived while determining fecundity.
- Embryos were analyzed for carbon (C) and nitrogen (N) content.
- General linear models were used to examine relationships of embryo mass, C content and N content as a function of maternal size and year. Slopes were homogenous so interaction terms were dropped from the models.

Larval Quality

- Mature females 93-135 mm CL were collected by onboard observers during the 2007 commercial fishery and shipped live to the Kodiak Laboratory. Larvae hatched in spring 2008.
- Twenty larvae per female were dried and weighed to the nearest thousandths.
- Larvae were analyzed for C and N content.
- Starvation survival experiments were conducted and time to 50% mortality (LT_{50}) estimated.
- Linear regression models were used to determine the relationships of larvae mass, C content, N content and LT_{50} as a function of maternal size.

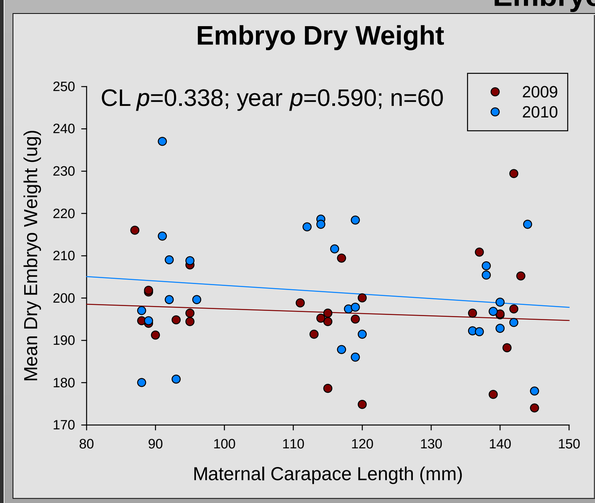
RESULTS

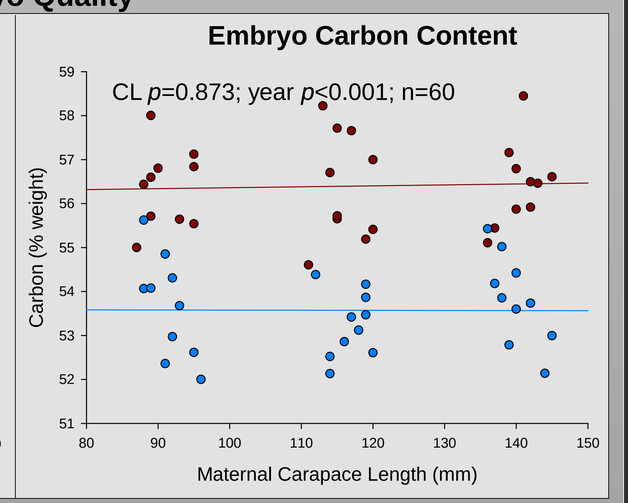
Seasonal Fecundity

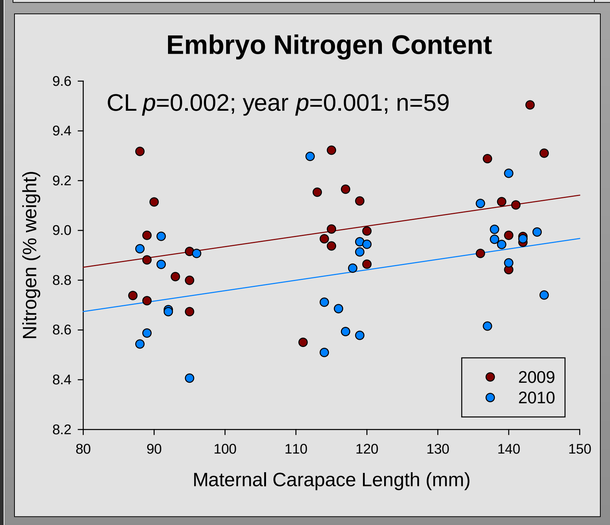


ANCOVA adjusted means with standard errors are reported.

Embryo Quality







Larval Quality

Effect of maternal size on larval quality parameters

	N	R^2	t-stat	p-value
Dry Mass	33	0.003	-0.286	0.777
C Content	35	0.103	1.942	0.061
N Content	35	0.065	1.515	0.139
LT_{50}	35	0.097	-1.887	0.068

CONCLUSIONS

- Seasonal change in fecundity among small females is not consistent.
- Large females were consistently less fecund in the fall than summer, suggesting embryo loss during brooding.
- Minimal inter-annual variability in fecundity was observed. Fecundity did not differ annually except small females in summer 2007 were more fecund than 2008 and 2009 and large females in fall 2009 were more fecund than in 2008.
- Maternal investment in embryo C and N content varied inter-annually, with higher investment in 2009.
- No effect of maternal size on embryo mass or C content was found, however N content increased with maternal size.
- No effect of maternal size on larval mass, C content, N content or LT_{50} was found, suggesting that increasing embryo N content with maternal size does not result in increased larval quality.
- Among the factors considered, maternal size influences on fecundity and embryo loss are the most important to incorporate into reproductive potential estimates for stock assessments.

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The recommendations and general content presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration, or the National Marine Fisheries Service.

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