Reproductive Potential of Bristol Bay Red King Crab and Eastern Bering Sea Snow Crab

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Introduction

Commercial Bristol Bay red king crab fishing

Incorporation of reproductive potential in the development of biological reference points is a pressing fishery management need for Bering Sea crab stocks. Currently, assessments of reproductive potential are based upon spawning stock biomass, which does not incorporate variability in egg production from female crabs of differing size/age or other density-dependent or density-independent factors. This project aims to improve assessment of reproductive potential by examining seasonal and interannual variability in the relationship between size and fecundity of Bristol Bay red king crabs (*Paralithodes camtschaticus)* and eastern Bering Sea snow crabs *(Chionoecetes opilio).*

Methods

- Mature female red king crabs and snow crabs were collected in 2007 and 2008 on the NMFS eastern Bering Sea crab and groundfish bottom trawl surveys (summer samples: June through July) and mature female red king crabs were collected by Shellfish Fishery Observers during the Bristol Bay commercial fishery (fall samples: October through November).
- Fecundity was estimated using standard dry weight protocols in which two subsamples of 250 eggs and the remaining egg clutch were dried at 60 C until a constant weight was achieved. Individual egg weights were calculated and extrapolated to estimate the number of eggs in the clutch.
- Red king crabs greater than 104 mm carapace length (CL) were classified as multiparous (brooding second or subsequent egg clutch) based upon 100% size at maturity for Bristol Bay and snow crabs were categorized as multiparous based upon shell condition. It is not possible with our samples to determine if red king crabs smaller than 105 mm carapace length are primiparous (brooding first clutch) or multiparous so these females were grouped together as "small" crabs and may represent primiparous and multiparous females.
- Seasonal data were compared for red king crabs to estimate rates of egg loss from summer to fall based upon the assumption currently being used in Bristol Bay red king crab management that there is one population.
- Data were analyzed using multiple linear regression. *P* values are reported for the terms carapace length or carapace width (CW) and season or year. Confidence intervals are reported when terms season or year are significant.

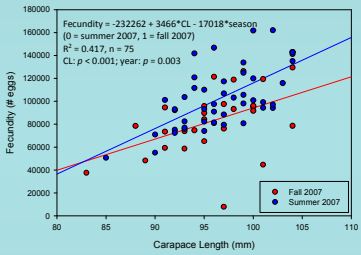
Processed egg clutches in a drying oven

Fecundity samples were collected during the NMFS eastern Bering Sea crab and groundfish bottom trawl survey

Processed red king crab clutch including two subsamples and remaining clutch

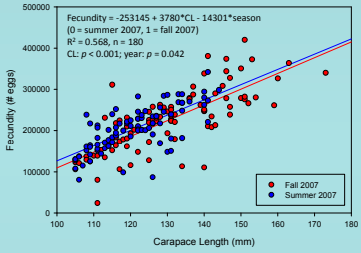
Preliminary Results

Comparison of small red king crab fecundity summer and fall 2007



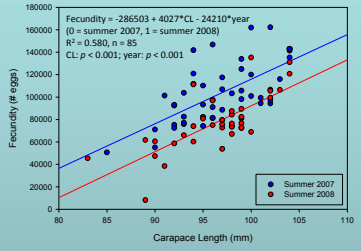
- Small red king crabs were significantly less fecund in fall than summer in 2007, with estimates of egg loss ranging from 5.9% to 27% when size is held constant.

Comparison of multiparous red king crab fecundity summer and fall 2007



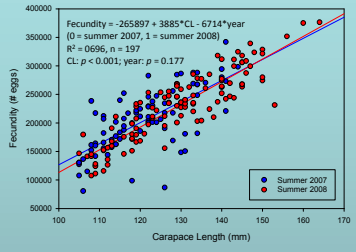
- Multiparous red king crabs were significantly less fecund in fall than summer in 2007, with estimates of egg loss ranging from 0.26% to 13.7% when size is held constant.

Comparison of small red king crab fecundity summers 2007 and 2008



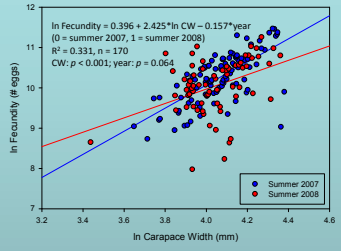
- Small red king crabs were, when size is held constant, 15.4% to 31.4% less fecund in summer 2008 than summer 2007.

Comparison of multiparous red king crab fecundity summers 2007 and 2008



- Interannual differences in fecundity were not observed for multiparous red king crabs between 2007 and 2008.

Comparison of multiparous snow crab fecundity summers 2007 and 2008



- Interannual differences in fecundity were not observed for multiparous snow crabs between 2007 and 2008.

Conclusions

- Red king crabs smaller than 105 mm CL may experience higher rates of egg loss in comparison to larger crabs.
- Interannual variability in fecundity detected among small red king crabs but not multiparous females suggest smaller females may have more variable fecundity than larger females.
- Seasonal and interannual differences in fecundity detected among red king crabs smaller than 105 mm CL may be confounded by combining females of differing reproductive histories (primiparous and multiparous).
- Female size explains more of the variability in fecundity than season or year for both species.
- Fecundity is variable among red king crabs and snow crabs of similar size suggesting that factors in addition to size and year may affect fecundity for these species and further research should consider additional sources of variability.
- Sources of variability in reproductive potential should be explicitly defined in the development of biological reference points associated with reproductive potential.

Future Plans

- Seasonal sampling will continue in 2009.
- Comparisons of 3 years of seasonal and interannual fecundity estimates will provide additional information on variability in reproductive potential and biological significance of finding for these two stocks.

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