

Prediction of Bycatch Mortality Based on Reflex Impairment During the 2009/2010 Commercial Snow Crab Harvest

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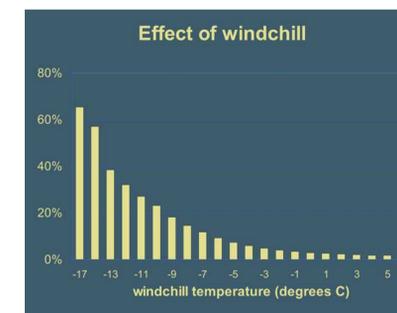
Background

- Calculating total catch for a crab stock must include mortality of sublegal and female crab which are not retained, but, suffer mortality due to exposure and trauma before being returned to the sea.
- Commercial crab vessels vary widely in their handling practices which directly affects discard mortality rates.
- Best available information estimates the crab discard mortality to be 50% in pots but it is widely acknowledged that work is needed to refine that estimate.
- The Reflex Action Mortality Predictor (RAMP) method was used during the 2009 - 2010 commercial snow crab fishery to determine the range of mortality rates which might be expected during the fishery.
- The results will be a first step in improving the bycatch mortality estimate needed to set crab harvest levels in the Bering Sea.
- This project was funded by the North Pacific Research Board and was a cooperative effort between the fishing industry and the National Marine Fisheries Service, Alaska Fisheries Science Center.

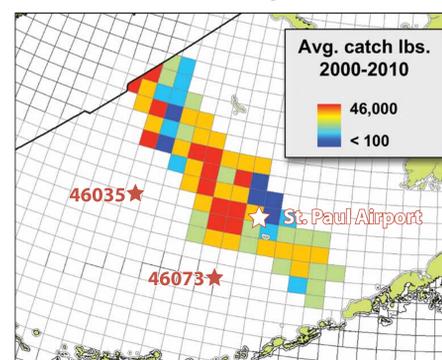


Results

- Over 12,600 snow crab were examined from 22 different vessels from January to April, 2010
- Predicted mortality rates ranged from 1.4% to 27.5% with an overall rate of 5.9%.
- Due to lack of overlapping sampling periods, it was difficult to determine how sorting practices affected reflex impairment.
- The combination of exposure to wind and temperature, as measured at the sorting table, had a direct effect on reflex impairment.
- Wind and temperature data from weather buoys and the St. Paul airport proved to be good predictors of the bycatch mortality observed by different vessels.

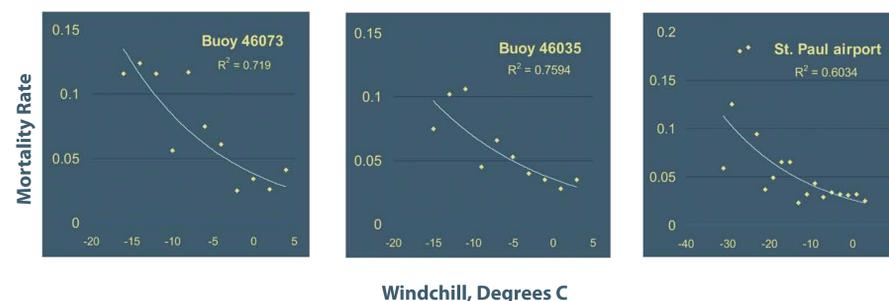


Snow Crab Fishing Grounds



RAMP: Reflex Action Mortality Predictor

- The response to a suite of reflexes can be used to predict mortality caused by stress and trauma.
- The method has been applied to a variety of fish (e.g. Humborstad et al. 2009) and invertebrates including Tanner crab *Chionoecetes bairdi* and snow crab *C. opilio* (Stoner et al. 2008, Stoner 2009).
- This model correctly predicted 91% of snow crab mortalities in an at-sea experiment conducted in 2007.



The Predictor Reflexes



LEG FLARE

Positive: all legs spread high & wide
Negative: legs hang down loosely



EYE RETRACTION

Positive: eye retracts into carapace hood.
Negative: eye does not move back



LEG RETRACTION

Positive: leg retracts back up in posterior direction
Negative: leg does not retract



MOUTH CLOSURE

Positive: 3rd maxilliped retracts
Negative: maxilliped does not return to closed position.



CHELA CLOSURE

Positive: chela open & close
Negative: no movement observed in chela



KICK

Positive: immediate kicking when abdominal flap is lifted.
Negative: no reaction to lifting of flap

Discussion

Although reflex impairment may appear to be a simplistic tool for predicting mortality, it has been demonstrated to be a powerful method which can be applied to snow crab under harsh "deadliest catch" conditions. Care must be taken, however, when applying the method to conditions outside those under which the mortality model was originally developed. Factors not considered in model development such as increased predation and long-term mortality associated with molting could increase predicted mortality rates. Further work is needed to address those issues.

This project did show, however, that short-term mortality associated with the discard process is considerably lower than the 50% estimate that is currently used. Historic weather datasets from weather buoys and airports might be used to calculate historic discard mortality rates based on documented discard numbers and fishery timing. Average discard mortality rates could then be used in the assessment process.

Acknowledgements

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- Stoner, A.W., Rose, C.S., Munk, J.E., Hammond, C.F., and Davis, M.W. 2008. An assessment of discard mortality for two Alaskan crab species, Tanner crab (*Chionoecetes bairdi*) and snow crab (*C. opilio*), based on reflex impairment. Fish. Bull. 106:337-347.