THE EFFECTS OF TRAWLING ON BLUE CRAB (*CALLINECTES SAPIDUS*) PREDATION

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http://laterallineco.com/blog/wp-content/uploads/2009/01/bluecrab.jpg

Introduction

- Trawls and Dredges cause an impact on the ecosystem by damaging sediment, scarring the seabed, killing submerged aquatic vegetation, and causing harm to or even killing non-target marine species.
- Scavenger levels are known to increase in recently trawled areas like the Irish Sea (Ramsay et al 1998).
- In Anglesey North whales, scavengers have been known to increase their prey consumption in an area post trawling (Kaiser et al 1994).
- The attraction to highly damaged prey can increase when compared to lower and undamaged prey (Moore et al 1996).

- Blue crabs are known to be the keystone species in the Chesapeake Bay food-web.
- More than 1/3 of the nations' commercial blue crabs are caught from the Chesapeake Bay.
- Trawling and dredging in the Chesapeake Bay is common, however, the direct impact of trawling and dredging in the Bay has not been researched enough and is not yet known.

Hypotheses

- H_0: There will be no correlation between the level of blue crab predation and the degree of damage to the bivalves.
- H_1: The higher the level of damage to the bivalve the more the consumption by blue crabs.

http://www.erdc.usace.army.mil/pls/erdcpub

Methods

- 10 gallon tanks (bubbler, 5cm of sand, saltwater at 10ppt) were used.
- Each crab had food withheld from it for 60 hours prior to the start of the experiment.
- 6 crabs were randomly placed in one of 4 treatment groups with 4 mussels and 4 clams.
- The 4 treatment groups were:
  - <u>Control</u> - no damage and were buried all the way below sand (5 cm).
  - <u>Low Impact</u> - placed in a Ziplock container with sand, small stones, and water and were agitated for 45 mins and then buried 2.5 cm below sand.
  - <u>Medium Impact</u> - dropped at 3 ft of elevation until small cracks were present and buried about 1-1.5 cm below sand.
  - <u>High Impact</u> - smashed once with a mallet and were not buried.
- Crabs were checked every 24 hours for 72 hours and the number of clams and mussels consumed after 72 hours were recorded for data.

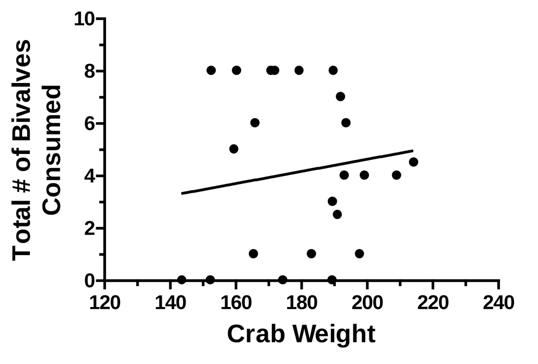


Figure 1: Comparison between number of bivalves consumed and Blue Crab initial weight using a Linear Regression Analysis. Pvalue < 0.05 showing significant difference in correlation between weight of Blue Crabs and the number of total Bivalves consumed.

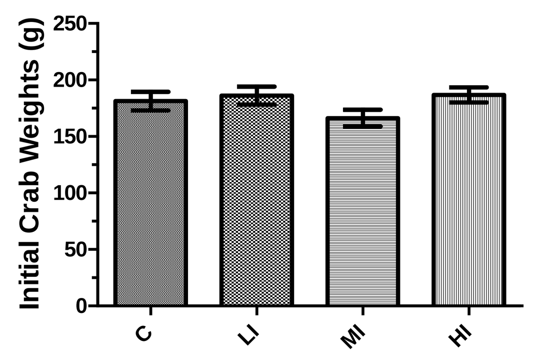
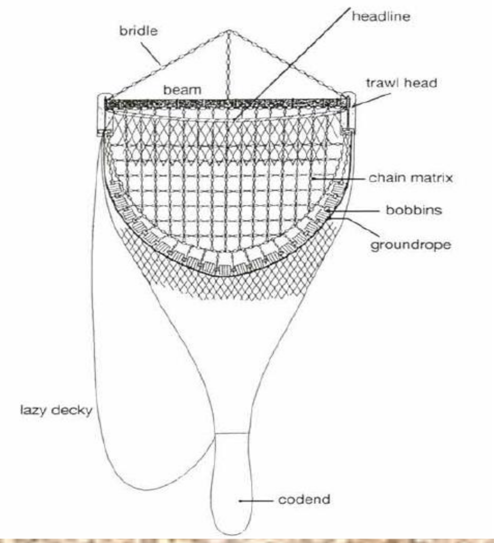


Figure 2: The average weight of crabs for each group; Control, Low Impact (LI), Medium Impact (MI), and High Impact (HI). Error bars represent one standard error from the mean using a One-Way ANOVA test (p<0.05) with a Tukey post-test to compare the averages. The results show no significant difference between the average weight of crabs when comparing each group.



Beam Trawl from Fish Scavenging Behaviour in Recently Trawled Areas Experiment by: M.J. Kaiser and B.E. Spencer.

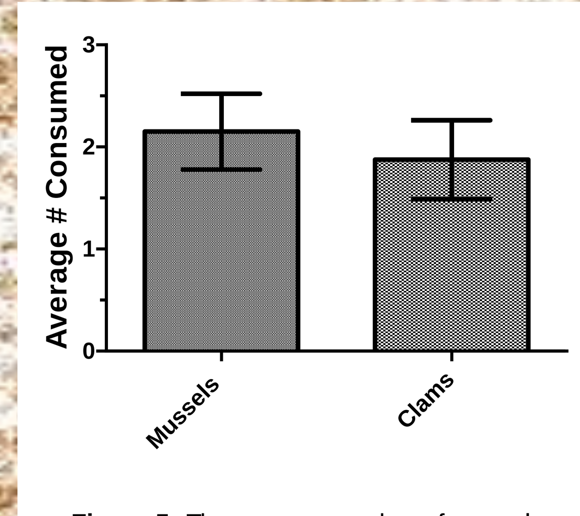


Figure 5: The average number of mussels versus clams consumed by Blue Crabs was compared in the above figure. Error bars represent one standard error from the mean using a regular unpaired t-test with the P value > 0.05 (P= 0.8631). Results show no significant difference between the average number of mussels consumed by the Blue crabs when compared to the average number of clams being consumed.

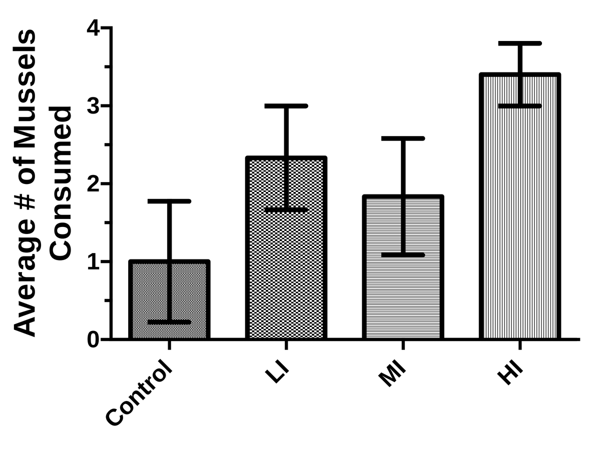


Figure 3: The average number of mussels consumed were compared for each group; Control, Low Impact (LI), Medium Impact (MI), and High Impact (HI). Error bars represent one standard error from the mean from the One-Way ANOVA test (p<0.05) with a Tukey post-test. The results show no significant difference between the average number of mussels consumed when comparing each group.

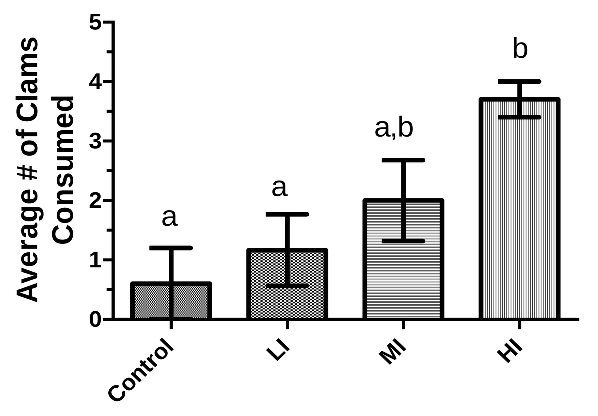
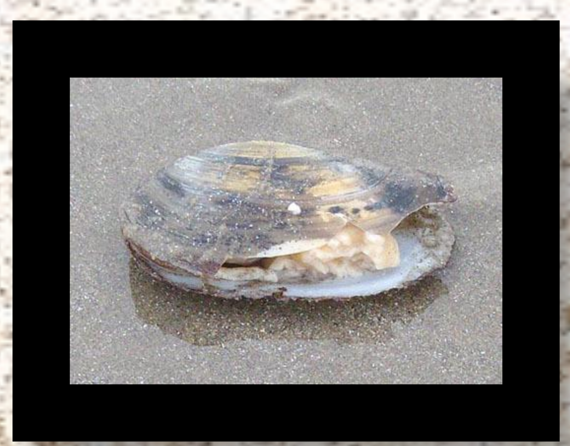


Figure 4: The average number of clams consumed were compared for each group; Control, Low Impact (LI), Medium Impact (MI), and High Impact (HI). Error bars represent one standard error from the mean from the One-Way ANOVA test (p<0.05) with a Tukey post-test.Means not significantly different in value have the same symbols. The letters (a and b) indicate the values that were significantly different from one another.



http://bellissimanh.wordpress.com/2009/09/03/smashing-seagulls/

Results

- There was a correlation that indicated that larger crabs ate more bivalves during the experiment (Fig. 1). However, the crab weights in each treatment group showed no significant difference (Fig. 2) indicating this variability should not impact the experiment.
- No significant difference was shown between the average number of clams eaten compared to the average number of mussels eaten by Blue Crabs (Fig. 5)
- No significant difference existed between treatment groups and the average number of mussels consumed. However, the trend suggests that an increase in damage shows an increase in mussel consumption (Fig. 3).
- The average number of clams consumed resulted in significant difference between the treatment groups. The higher the damage level the more clams the crabs ate (Fig. 4).

Overall Conclusions

- The data supported the alternate hypothesis that as damage on the mussels and clams increase, predation increased.
  - Bivalve damage levels, when amplified, might have caused an increase in the level of blue crab consumption of bivalves when compared to the lower damage level groups possibly due to additional exposed and available tissue (Hughes et al 1995).
  - Finding prey could have been more difficult for the crabs in the lower level damage groups due to the increase in burying depth (Eggleston et al 1992).
  - Scent concentrations being too low could have caused a decrease in finding prey in low damage level groups (Levinton 2001).
- In the field, decreased prey encounter rates occurring in the low and undamaged treatment groups could cause emigration of the predator (Blue Crab) (Eggleston et al 1992).
- Dredging, trawling, and other damaging fishing gear are causing more damage on an already heavily impacted system.

Works Cited

Eggleston, David B., Romuald N. Lipcius, and Anson H. Hines. 1992. Density-Dependent Predation by Blue Crabs Upon Infaunal Clam Species with Contrasting Distribution and Abdundance Patterns. Journal of Marine Ecology Progress Series 85: 55-68.

Hughes, Roger N., and Raymond Seed. 1995. Behavioural Mechanisms of Prey Selection in Crabs. Journal of Experimental Marine Biology and Ecology 193: 225-38.

Jenkins, S. R., C. Mullens, and A. R. Brand. 2004. Predator and Scavenger Aggregation to Discarded By-Catch From dredge Fisheries: Importance of Damage Level. Journal of Sea Research 51: 69-76.

Kaiser, M. J., and B. E. Spencer. 1994. Fish Scavenging Behavior in Recently Trawled Areas. <u>Marine Ecology Progress series</u> 112: 41-49.

Levinton, Jeffrey. 2001. Marine Biology: Function, Biodiversity, Ecology. 2nd ed. Oxford University Press, New York, NY.

Moore, P. G., and J. Howarth. 1996. Foraging by Marine Scavengers: Effects of Relatedness, Bait Damage and Hunger. Journal of Sea Research 36: 267-73.

Ramsey, Kirsten, Michel J. Kaiser, and Roger N. Hughes. 1998. Responses of Benthic Scavengers to Fishing Disturbance by Towed Gears in Different Habitats. Journal of Experimental Marine Biology and Ecology 224: 73-89.

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