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Fighting for shelter: Are aggressive Caribbean spiny lobsters the best den competitors?

Katherine Heldt

Michael Childress

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Katherine Heldt and Michael Childress

Department of Biological Sciences, Clemson University

Introduction

Juvenile spiny lobsters are highly gregarious and use shelters for protection from predators. Variation in numbers of individuals sharing dens suggests that sharing a den may not always be beneficial. In recent years, sponge loss events in Florida Bay have decreased the amount of natural shelters available in some regions, resulting in enriched (sponge abundant) and impoverished (sponge depleted) habitats. However, lobster abundance has remained relatively constant suggesting that spiny lobsters may be able to mitigate habitat loss.

In the wild, aggression is often exhibited, but its impacts on den sharing is not well known. Since shelter loss may result in increased aggression and den competition, some individuals may be excluded from dens resulting in increased predation risks. This study examined the relationship between social and denning behaviors and how these relationships change after shelter loss.

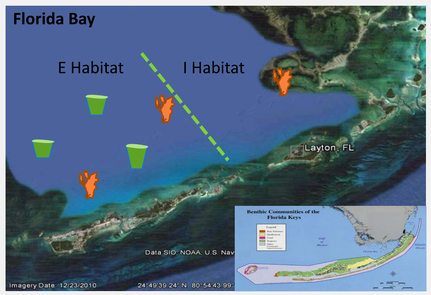
We determined levels of social behavior by direct observation and estimated the role of habitat loss on denning behavior by measuring the frequency of den use, den sharing and den fidelity before and after a shelter loss event. We used best fit forward step-wise regression models with minAIC scores to determine variables that best explained denning behaviors. Since the spiny lobster fishery is one of the most important fisheries in Florida, it is important for us to understand the impacts of shelter loss events on this commercially and culturally important species.

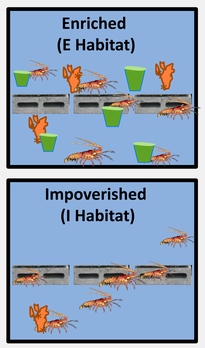
We predict that:

- Larger individuals will be more aggressive and less gregarious than smaller individuals
- Habitat type (enriched/impoverished) and size will influence den use, den sharing and den fidelity
- After shelter loss, larger individuals will decrease den sharing and increase den use and den fidelity

Collection

Wild-caught juvenile spiny lobsters (n=320) from Florida Bay (Long Key, FL) were collected from 8 enriched (E) and 8 impoverished (I) habitats to evaluate the influence of prior habitat experience on social and denning behaviors. As shown below, enriched sites were abundant in natural coral and sponge shelters, while impoverished sites were not. During collection, all sites contained artificial shelter.





For all individuals:

1) Sex determined

2) Body size measured

3) Marked with ID tags

4) Housed in similar sized pairs

Social Behavior

To determine levels of aggression, the frequency of antennae flicks and pushes were recorded for one week. Lobsters were observed at night under red light for ten minutes. To determine levels of gregariousness, twice a day for one week, individuals were recorded as either outside, inside or sharing the den.

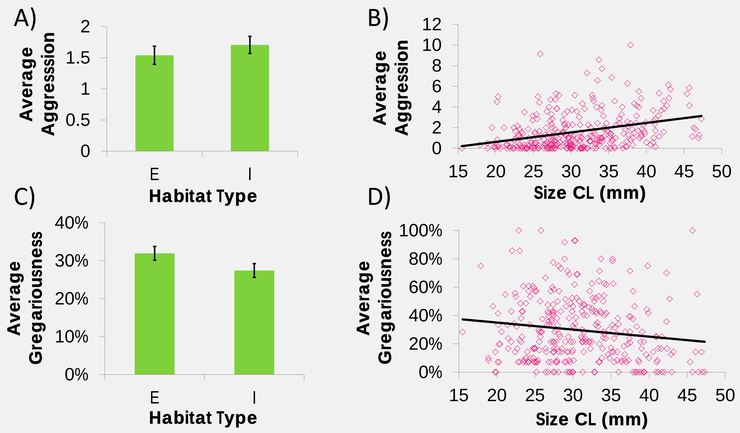


Figure 1. The average level of aggression (A & B) and gregariousness (C & D) examined by habitat type and size.

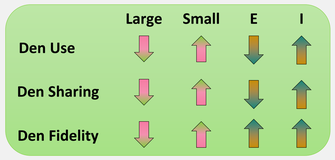
	Aggression			Gregariousness		
Source	df	F-value	P-value	df	F-value	P-value
Habitat Type (E/I)	1	-	-	1	-	-
Size (CL mm)	1	35.494	<0.001**	1	6.208	0.013*
Sex (M/F)	1	2.425	0.120	1	-	-
Injury (Y/N)	1	13.137	<0.001**	1	-	-
Molting (Y/N)	1	13.876	0.025*	1	-	-

Table 1. Best fit forward step-wise models with minAIC scores. Sources with p-values less than 0.05 express variables that best explain aggression and gregariousness.

Conclusions

We found that aggression was positively correlated with size with larger individuals being more aggressive. Gregariousness was negatively correlated with size with larger individuals being less gregarious.

Both habitat type (E/I) and size play a large role in den use, den sharing and den fidelity. Surprisingly, larger individuals showed decreased den use and den fidelity after shelter loss, which was the opposite of our predictions.



These data suggest that prior experience and vulnerability, rather than aggression, predicts which individuals will remain in a den after sudden shelter loss. It is likely that juvenile spiny lobsters can mitigate shelter loss through changes in behavior and potentially prevent increased predation during habitat loss events.

Denning Behavior

Ten pairs of juvenile spiny lobsters were placed into a mesocosm that contained a few natural predators (grey snapper). Every morning, for one week, the location of each individual was recorded. After four days, half of the shelter blocks were removed to simulate a sudden shelter loss event.

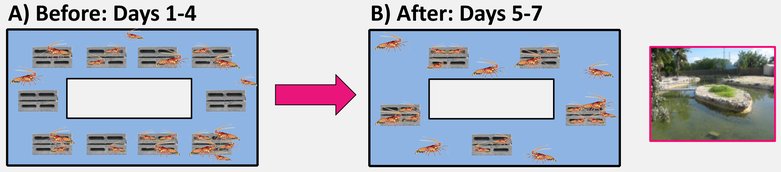


Figure 2. A diagram of the mesocosm A) before shelter loss and B) after shelter loss.

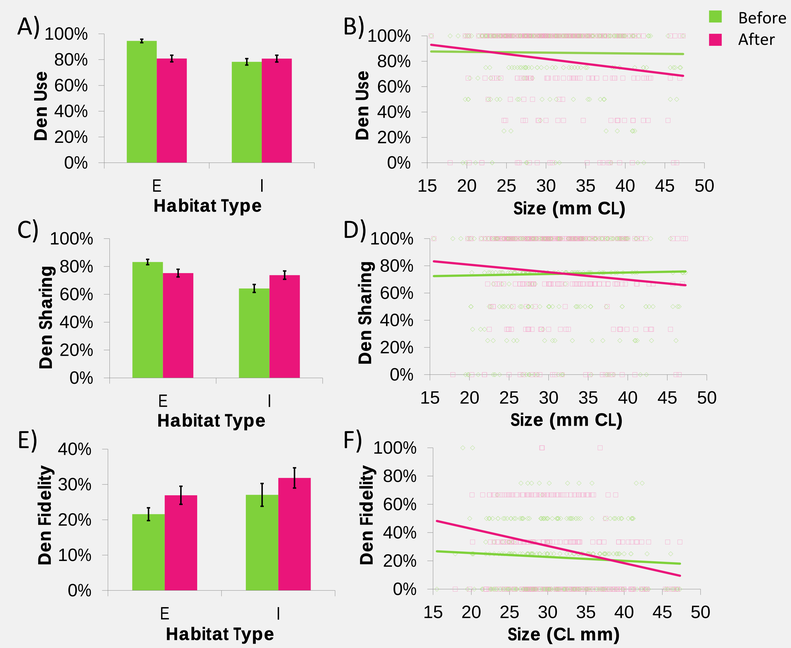


Figure 3. The percent of den use (A & B), den sharing (C & D) and den fidelity (E & F) before and after shelter loss examined by habitat type and size. Green represents data taken before the shelter loss, and pink represents data taken after the shelter loss.

	Den Use			Den Sharing			Den Fidelity		
Source	df	F-value	P-value	df	F-value	P-value	df	F-value	P-value
Habitat Type (E/I)	1	11.987	<0.001**	1	17.122	<0.001**	1	4.833	0.028*
Size (CL mm)	1	1.068	0.302	1	0.021	0.886	1	20.257	<0.001**
Treatment (B/A)	1	5.648	0.018*	1	0.0778	0.780	1	-	-
Habitat x Treat	1	16.661	<0.001**	1	13.91	<0.001**	1	-	-
Size x Treat	1	4.472	0.035*	1	5.489	0.020*	1	7.399	0.007*
Injury (Y/N)	1	3.665	0.056	1	5.932	0.015*	1	4.347	0.038*
Sex (M/F)	1	3.306	0.070	1	3.604	0.058	1	4.833	0.028*

Table 2. Best fit forward step-wise models with minAIC scores. Sources with p-values less than 0.05 express variables that best explain den use, den sharing and den fidelity.

Acknowledgements

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