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DIADEMA AND ECHINOMETRA VIRIDIS
INTERFERENCE OF DUSKY DAMSELFISH TERRITORY
IN GREATER LAMESHUR BAY, ST. JOHN USVI

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ABSTRACT

The interactions herein involved the insertion of additional species that impeded or prevented predation. Examined was the role of damselfishes in defending their algal mats from attack by adult and juvenile diadema, and echinometra viridis. Five damselfish territories were observed, two adult homes and three juvenile homes were experimented with on the transect. . Results showed that the adult damselfishes had less inhibitions toward the corallivore interferences than the juveniles. The adult damselfishes picked up and moved the echinometras and the juvenile diademas, but only poked at the adult diademas. They would drag these corallivores anywhere from 91 centimeters to 143 centimeters. The juvenile damselfishes just aggressively charged the echinometras, and broke off the spines of the juvenile diadema; however they just circled but did not approach the adult diademas. Thus we can assume that ejection response is an adaptation related to the defense and maintenance of an important resource.

INTRODUCTION

Dusky damselfish, Eupomacentrus dorsopuncicans, are one of the most abundant in shore reef fishes of the Caribbean (Randall 1983). They feed on more algae and detritus than live animal material. Adult damselfish are usually dark grey to blackish, and juveniles are considerably smaller and lighter in color. These characteristics were important in determining what territories I would use to conduct my research.

The damselfish defend their algal mats from herbivorous competitors for a variety of reasons. It now seems evident that intraspecific and interspecific competition for food are common among herbivorous fishes that live on the reef. Literature that has emphasized how the E. dorsopuncicans show territorial aggression, and attempt to exclude herbivores from their feeding

areas are contained in (Low 1971, Myberg and Thresher 1974, Robertson et al. 1976, Glynn and Wellington 1983). My experiment involves the placing of diadema and *Echinometra viridis* in the center of the territory of which these fish are defending. Behavioral observations are then recorded after repetitive experimentation. These herbivorous organisms threaten the food supply and spatial relations of the damselfish.

MATERIALS AND METHODS

All observations were recorded while I was on SCUBA. Besides SCUBA gear, mylar sheets and clip boards were used in mapping and recording data. Chains were used in estimating the sizes of the fish and their territories. Each link on the chain was 1.3 centimeters long so calculations were figured out and rounded off. The only other material used was thick gloves to carry the diadema and echinometra.

First I swam over the transect lines looking for the presence of damselfish. I found two adult fish and three juveniles to experiment with. I made careful observations on the size and colorations of the fish so I could make sure that each time I went back to the transect I was experimenting and observing the same fish. I also carefully mapped out the damselfish territories and added topographical descriptions in order to make sure I was also observing the same space each time.

In order to determine the size of each of the damselfish territories I used my hand as the threatening element. I would place my hand in a circular pattern on the algal mats and if the fish I was watching attacked my hand I considered this part of their territory. If a bordering fish attacked my hand, or if the fish ignored my hand, I assumed this was not part of their protected area. Then I measured the area where my hand had been with a chain creating a circle. Links on the chain were 1.3 centimeters long, thus I multiplied the number of chains by 1.3 to get the exact number of centimeters in the circumference. The fish were estimated in length by trying to get as close to the fish as possible with the chain.

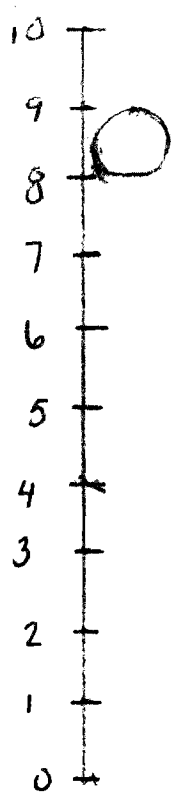
The diadema and *E. viridis* were found off of the transect by swimming on SCUBA. Clipboards were used to wedge the organisms off of their territory. A clipboard was placed at the basal part of the diademas, where the tube feet are found, and the board would gently push the diademas out of their territory and I could then hold them with gloves on. I would then swim to the prearranged site with the organism and place it in the territory. Observations were then recorded after each time the experiment was done. The same process was used for the *E. viridis* capturing and experimenting.

RESULTS

The results basically showed that the adult dusky damselfish are more aggressive and less intimidated than the juveniles. The adults were bigger and stronger, and used their strength in their ejection behavior. The actual size of the defended algal mats

1. TRANSECT C
METER 3-9
104 cm IN CIRCUMFERENCE
JUVENILE ≈ 3.9 cm.
ENTIRE TERRITORY ALGAL MAT

[1]



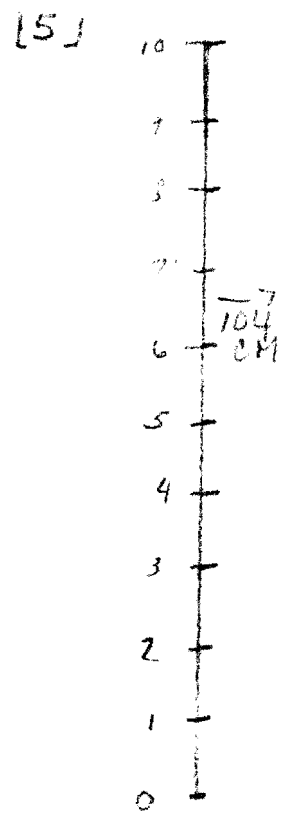
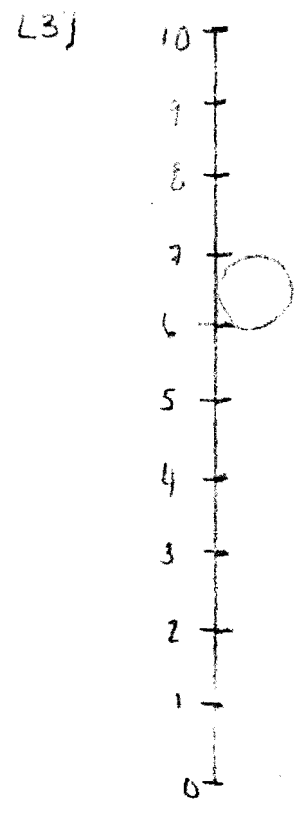
2. TRANSECT C
METER 1-2
117 cm IN CIRCUMFERENCE
JUVENILE ≈ 5.2 cm.
TERRITORY MIXED

[2]



ALGAL MAT (65cm →) SAND (← 52cm)

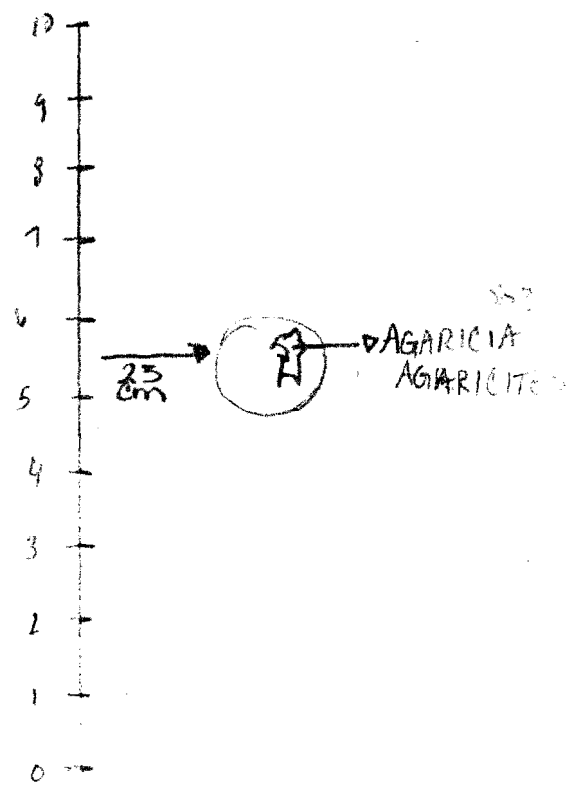
INDIVIDUAL L
 METER 6-7
 113cm IN CIRCUMFERENCE
 ADULT ≈ 7.15 cm
 AGAL MAT [ENTIRE]



5. TRANSECT A
 METER 6-7
 117cm IN CIRCUMFERENCE
 JUVENILE ≈ 5.2 cm
 AGAL MAT [ENTIRE]

4. TRANSECT E
 METER 5-6
 117cm IN CIRCUMFERENCE
 ADULT ≈ 6.5 cm
 AGAL MAT [ENTIRE]

[4]



DATA OBSERVATION TABLES

TABLE I - Table I is a series of observations involving 6 experiments with the adult Diademids. SEE MAPS

TERRITORIAL FISH
NUMBERS
AS THEY APPEAR
ON MAPS

	EXP. 1	2	3	4	5	6
1	Darted at organism	Circled organism / Darted	No Reaction	Darted / circled	circled	No reaction
2	circled / Darted	circled / Darted	Circled	No reaction	circled	circled
3	Bit off spines / Charged	Pushed out of territory by nudging it	Charged Diademid / circled it	Snapped spines off / charged it	charged it / pushed D. out of home	Bit off spines until it (D.) left
4	Darted circled / Pushed D. out	snapped spines off	Pushed out / charged	Darted and Snapped spines off	snapped spines off / charged D. off	Charged / pushed out
5	circled	Darted / circled	circled	circled	Darted	Darted / circled

4/17/1983 - 1. TIME 10:00 AM - 11:00 AM
 EXP. 1-6 WITH GAVIN & K. J.

Territory FISH #	1	2	3	4	5	6
1	aggressively charged broke spines off until Diadema left AGALMAT	same as EXP 1	same as EXP 1	same as EXP. 1	same as EXP. 1	same as EXP. 1
2	same results for EXP. 1-6 as FISH #1					
3	Dragged 160cm moved Diadema - picked it up by spines and moved it.	Dragged Diadema 91cm	Dragged 80cm	Dragged 143 cm	Dragged 73cm	Dragged 130 cm
4	Dragged 84cm	Dragged 102 cm	Dragged 97 cm	Dragged 108 cm	Dragged 110 cm	Dragged 70 cm
5	Same results for all EXP. 1-6 as FISH #1					

DATA TABLE III - Table III is to be completed using *E. viridis* as the herbivore infesting your the *Conium maculatum* territory.

Territory

FISH #

	EXP 1	2	3	4	5	6
1	Pushed <i>E. viridis</i> out	Pushed it out	Same as EXP.	Moved <i>E. viridis</i> 104 cm	Same as Exp 1	Same as Exp. 1
2	Picked up <i>E. viridis</i> moved 87 cm	Moved 90 cm	Pushed <i>E. viridis</i> out	Same as EXP 3	Same as EXP 3	Same as EXP 3
3	Moved 100 cm	Moved 92 cm	Moved 123 cm	Moved 70 cm	Moved 110 cm	Moved 130 cm
4	Moved 88 cm	Moved 122 cm	Moved 82 cm	Moved 140 cm	Moved 111 cm	Moved 94 cm
5	Pushed it out	Same as EXP 1	Same as EXP 1	Same as EXP. 1	Same EXP. 1	Same EXP. 1

ranged from 104 centimeters in circumference to 117 centimeters in circumference. The estimated size of the juvenile damselfish ranged from 3.9 centimeters to 5.2 centimeters in length. The adult fish were 7.15 and 6.5 centimeters in length. However one of the adult measured territories was equal in size to one of the juvenile homes.

The adult diademas caused little reaction from the adult damselfish and basically no reaction from the juvenile fish. The juvenile diademas caused a complete ejection response from the adult fish, and an aggressive pushing response from the younger fish. The same observations were made for the *E. viridis*. The adult fish would drag or carry the young diademas and *Echinometras* any where from 70 centimeters to 143 centimeters in one quick carry. Thus my estimation of their territories were sometimes larger or smaller than amount of space they covered during one ejection response with organism in mouth.

DISCUSSION

The experiments helped prove two basic hypotheses about dusky damselfish aggression: they defend their algal mats for space and food. Which one of these hypotheses is the most motivating factor is really not yet known. Also there is question to how the size of the protected area correlates to how far the fish dragged or carried the herbivore. The fish were carrying the organisms much farther than my estimated circumferences. It seems as though once the fish had the organism out of its immediate territory it just kept swimming with it until it dropped out of its mouth. There is also speculation to why the dusky damselfish defend algal mats so large if they only retreat to areas that are located under their algal mats or are crevices in *Montastrea annularis*. Once again we can only speculate that space and food play some sort role in this ejection behavior and retreat behavior. The dusky damselfish are unique aggressors in that they pack an intense territoriality adaptation into what looks to be relatively harmless animal.

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