Nocturnal migration patterns of two Caribbean reef fishes, *Haemulon sciurus* and *Lutjanus apodus*

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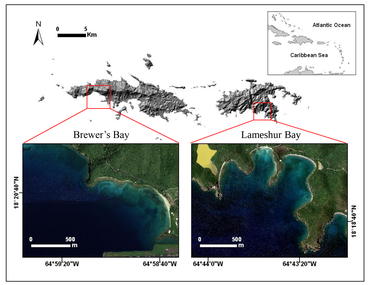
Introduction

In the Caribbean, many coral reef associated fishes have been observed making diel migrations, yet little is known about the detailed movement pathways and space use patterns of individual fish. Often these migrations occur along temporally or spatially consistent corridors that connect preferred resting and foraging habitats. Recent analysis of gut contents from *Haemulids* and *Lutjanids*, has provided evidence that these species forage in seagrass beds and other habitats near their coral reef refuges. Few studies have provided direct and spatially explicit evidence of nocturnal migrations and detailed day and night space use patterns for individual fish.

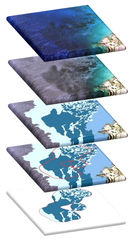
This study integrated manual acoustic telemetry to track two common reef species, the bluestriped grunt (*Haemulon sciurus*) and schoolmaster snapper (*Lutjanus apodus*) throughout their daily home range. Space use patterns of these species were then examined using Geographical Information System (GIS) tools to link movement behavior to seascape structure derived in a benthic habitat map. This study represents a novel integration of spatial technologies to enhance our understanding of the movement ecology of adult *H. sciurus* and *L. apodus*.

Methods



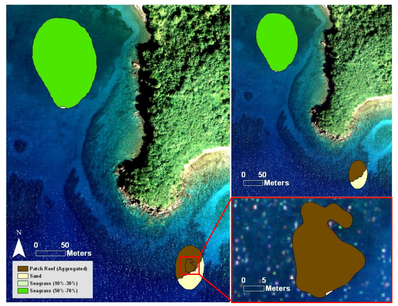
- Two bays chosen for study in the USVI
  - Brewer's Bay, St. Thomas
  - Lameshur Bay, St. John
- Data collected between July 2008 and March 2010
- 3 *H. sciurus* and 3 *L. apodus* were trapped and tagged in Lameshur Bay and 2 *H. sciurus* and 3 *L. apodus* in Brewer's Bay

- Fish were surgically implanted with Vemco© V9-2L acoustic tags
- Continuously tracked each fish for 24hrs



- High resolution (30cm) aerial imagery were acquired
- Image contrast was adjusted using Photoshop to reveal submerged structure
- Habitat maps were digitized with the NOAA habitat digitizer extension
- Fish home ranges were calculated and overlaid on habitat map
- Home ranges were used to clip out activity spaces from habitat map

Day and night activity spaces



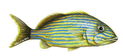


Figure 4: Day and night activity spaces of *H. sciurus* #4 in Brewer's Bay. Night activity space only (top right). Day activity space only (bottom right).

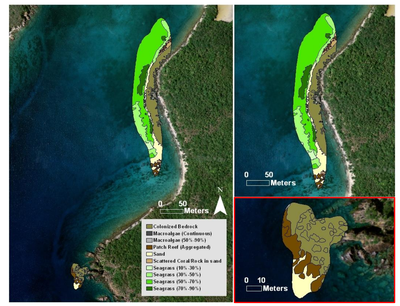


Figure 5: Day and night activity spaces of *L. apodus* #3 in Great Lameshur Bay. Night activity space only (top right). Day activity space only (bottom right).

Major findings

- **Night activity space areas were at least 2x larger than day activity space areas for 10 of the 11 fish tracked (Fig 6)**
- **75% of the night activity spaces that overlapped day activity spaces did so by more than 60% (Fig 7)**

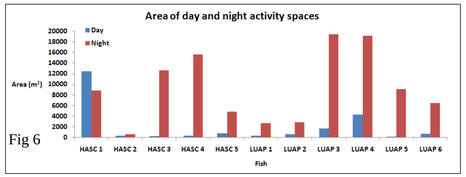


Fig 6

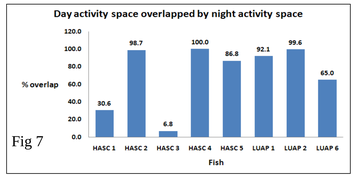
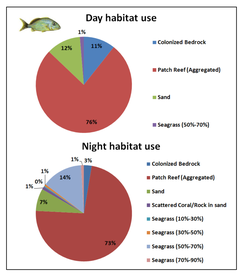
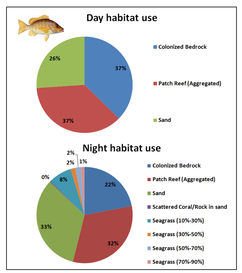


Fig 7

Haemulon sciurus

- A greater diversity of habitats were used at night than during the day
- Aggregated patch reefs used for majority of day and night
- Time spent over seagrass increased between day and night





Lutjanus apodus

- A greater diversity of habitats were used at night than during the day
- Patch reefs, colonized bedrock, and sand were used nearly equally during the day
- Seagrass was used at night and not during the day

Figure 8: Daytime and nighttime habitat use of all *H. sciurus* (n=5) and *L. apodus* (n=6) tracked.

Conclusions

- By tracking and mapping *Haemulon sciurus* and *Lutjanus apodus* migration patterns with quantitative techniques the results of this study demonstrated that these species performed diel migrations, in many cases to discreet nocturnal habitats that were several hundred meters from diurnal habitats, which confirmed qualitative observations from other studies (e.g. Ogden & Zieman 1977)
- These data revealed that nocturnal activity spaces for nearly all of the fish tracked were considerably larger than diurnal activity spaces
- Diurnal and nocturnal activity spaces overlapped for several fishes. In some cases, these overlaps were created as individuals returned to activity spaces (i.e. site fidelity) or ventured farther away from diurnal habitats
- An increase in the number of habitats visited at night, including an increase in the percentage of time spent over seagrass habitat is likely to result from active searching for prey; however, field verification is required
- *H. sciurus* used patch reefs throughout the majority of the day and night, which may indicate a requirement for shelter in structurally complex habitats. Conversely, *L. apodus* used several habitats more evenly, both, during the day and at night
- *H. sciurus* increased their usage of seagrass habitats from 1% during the day to greater than 16% at night. *L. apodus* did not use seagrass during the day and increased their usage of seagrass habitats to approx. 13% at night

Next steps

- Comparison of residence times for specific habitat types among individuals within each species
- In depth characterization of *H. sciurus* and *L. apodus* habitat use and movement ecology
- Examination of interactions and linkages between animal movement and seascape composition and configuration using landscape ecology techniques

Contact information

Please contact *steven.hitt@gmail.com*. More information on this and related projects can be obtained at *http://ccma.nos.noaa.gov/ecosystems/coralreef/acoustic_tracking.html* and *http://ccma.nos.noaa.gov/ecosystems/coralreef/usvi_pr_mapping.html*

Literature Cited

Ogden JC, Zieman JC (1977) Ecological aspects of coral reef seagrass bed contacts in the Caribbean. Proc 3rd Int Coral Reef Symp 1:377–382
Bluestriped grunt photo obtained from http://www.totsntales.com/shop/images/grunt1L.jpg
Schoolmaster snapper photo obtained from http://indian-river.fl.us/fishing/fish/snapscho.jpg

Acknowledgments

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