Site Fidelity, Home Range, and Movement of Mutton Snapper (*Lutjanus analis*) in the Lake Worth Lagoon

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Background

- The mutton snapper (*Lutjnaus analis*) is a medium sized snapper distributed in the temperate and tropical waters of the western Atlantic Ocean from New England to Brazil. Considered a coastal species, juveniles and subadults occupy shallow, nearshore waters (<88 ft). With maturity, they move into deeper waters (<282 ft).
- They are bottom associated fish found on an array of habitats such as vegetated sand or mud bottom, hard and coraline bottoms, mangroves, seagrass beds, and other bottom oriented structure.
- Juvenile and subadult habitat requirements are largely unknown, and movement patterns of this species throughout its life stages are not well understood.
- Mutton snapper populations are highly impacted. It is critical we understand their habitat and environmental needs to inform species management.
- The Lake Worth Lagoon is an ideal study location for habitat requirements because it contains many mutton snapper habitats in a relatively small footprint.

Objective

- Examine the coastal habitat use of subadult and juvenile mutton snapper to better understand the needs of these life stages

V9 acoustic tag

Methods

- An array of 12 VEMCO acoustic receivers was deployed in the northern Lake Worth Lagoon in 2021 to gate movement within the area
- Three conductivity/temperature probes were installed adjacent to 3 acoustic receivers
- Between May 2021 and February 2022, mutton snapper were captured using rod and reel in the northern Lake Worth Lagoon (from Peanut Island north)
- Fish between 10 and 16 inches total length (n=25) were implanted with a VEMCO V9 acoustic tag posterior to the pelvic fin and lateral to the midline of the body
- To examine time spent within the lagoon, site fidelity was quantified using a residency index equal to the number of days a fish was detected in the array divided by the time the fish was at large
- To explore habitat preference and movement distance, home ranges were calculated using minimum enclosing circles to reflect acoustic telemetry detection radii
- Environmental influences on movement were modelled with linear mixed effects models

Results

• Site Fidelity

- Mutton snapper (n=25) had been tagged for 20 – 278 days
- Mutton snapper in the Lake Worth Lagoon generally exhibit site fidelity on either end of the extreme
- Fish near Palm Beach Inlet exhibited lower site fidelity than those north of the Blue Heron Bridge

Figure 1. Distribution of site fidelity among tagged snapper. Mutton snapper exhibit both low and high site fidelity

• Home Range and environmental influence on movement

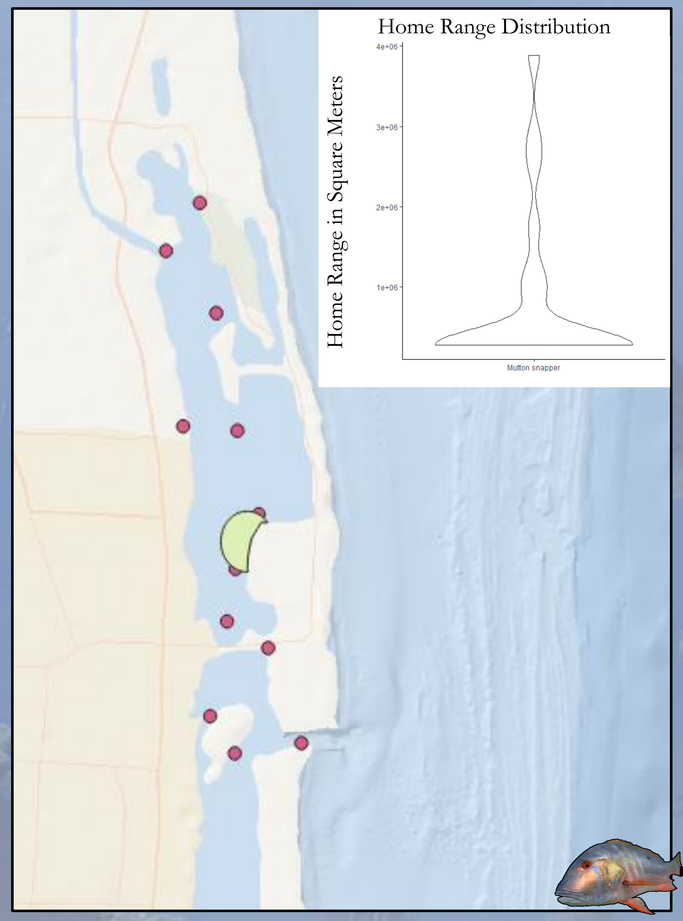

Figure 2. An aerial view of the study site (northern Lake Worth Lagoon). Red dots denote area of the receiver array while the green semicircle shows the most common home range size. Mutton snapper home range distribution shows that mutton snapper home ranges tend to be small and supports the high site fidelity shown in Figure 1.

- Snapper presence was modelled with a linear mixed effect model.
- In areas that experienced relatively large changes in environmental conditions, salinity and temperature together had an adjusted $R^2 = 0.32$
- In areas that exhibit more consistent salinity, however, movement tended to follow fluctuations in temperature (p-value = 0.058)

Discussion

- High site fidelity and small home range size mean that fish are generally staying within the acoustic array and not moving through large areas of the lagoon.
- These areas may be preferred habitat types.
- Fish exhibiting low site fidelity were leaving the array for large amounts of time, but it could not be determined if they were leaving just the array or the lagoon altogether.
- Mutton snapper may be opportunistically staging in Lake Worth Lagoon before moving to their mature habitats.
- Together, salinity and temperature explain 32% of the movement patterns seen in mutton snapper in the Lake Worth Lagoon. Temperature appears to have a greater influence than salinity.
- The small home ranges could be imposed by physiological preferences.

Future Direction

This study provides insight into the coastal habitat use of two mutton snapper life stages and is beginning to highlight the importance of environmental conditions for this species. Indirectly, mutton snapper movement patterns could be used to study the environmental conditions in those areas it chooses to utilize. As this array and its inhabitants continue to provide data, we hope to be able to determine if the mutton snapper can be an indicator species for the coastal habitats throughout its range.

Acknowledgements

- Thank you to the employees of FWC and PBC who have provided their expertise on fish, acoustic tagging, and the Lake Worth Lagoon.
- Thank you to the members of the West Palm Beach Fishing club whose expertise in fishing, enthusiasm for science, and time and effort have made the implementation of this project a reality.

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