Ontogenetic Habitat Use and Specificity in Stingrays (Dasyatidae) in South Eleuthera, The Bahamas

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Introduction

With human induced coastal habitat degradation increasing in a wider tropical context, further attention needs to focus on data deficient species that occupy these environments such as, stingrays (Dasyatidae). Stingrays make up a significant portion of nearshore fish biomass and play a significant role in the function and health of these ecosystems, yet virtually nothing is known of their most basic biology and ecology. In order to understand their role in these habitats, it is critical to elucidate information regarding their population abundances, competition, habitat use and specificity. Furthermore, stingrays segregate themselves among various habitats according to life history phase (ontogeny), and this will provide much needed information to develop conservation frameworks for not only these species, but habitats critical to their life-history. If these stingrays aren't protected and habitat degradation continues it is possible that populations would decline, yet no data are available on any associated impacts on ray removal from these ecosystems.

Objectives

1. Identify habitat occupation based on ontogeny.
2. Assess the extent of sexual segregation.
3. Determine how spatial resources are partitioned between two sympatric species *Dasyatis americana* and *Himantura schmardae* (Figure 1a and b).

Fig 1a. Southern stingray *Dasyatis americana*

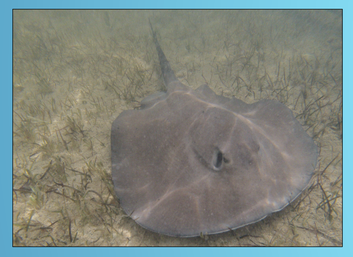

Fig 1b. Chupare whiptail stingray *Himantura schmardae*

Materials and Methods

Stingrays were sampled from both offshore and inshore locations, collected using hand nets and seine nets (Figure 2a), and worked up in shallow water to ensure the safety of the team and the stingray (Figure 2b). Several morphometric measurements were recorded (mm) (Figure 2c and 3), and rays were tagged with both an internal and external tag (Figure 2d), and weighed (kg).

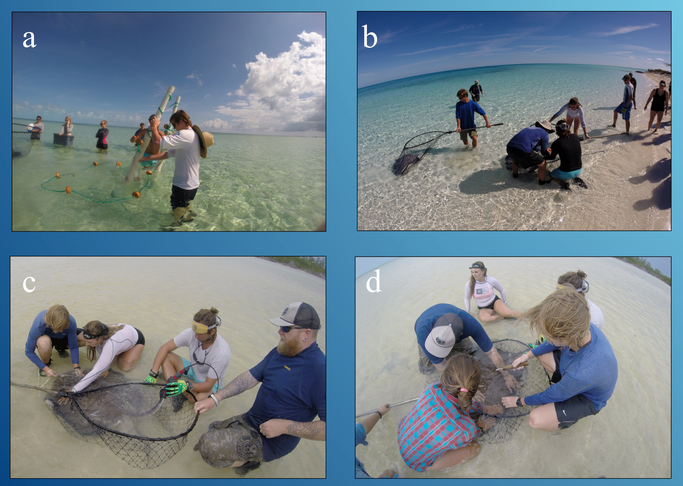

Fig 2. Catching and sampling Southern Stingrays at the Schooner Cays. A) herding rays, B) bringing rays to shallow water, C) measuring inter-orbital space(the space between the eyes), and D) inserting an external tag.

Analytical Methods

- Data were tested for normality and subsequently transformed to meet assumptions of parametric testing.
- Size data (disc widths W_D) tested using paired t-tests assuming unequal variance.
- Significance was calculated at $p<0.05$ using size frequency distributions for all rays, location, and species.

Results

- In total, 24 female and 10 male stingrays were captured.
- Stingrays captured at offshore locations proved to be significantly larger (W_D mm) than the rays sampled from inshore locations ($p<0.01$).
- Females were found to be significantly larger than males (W_D mm) for both species of stingrays captured ($p<0.01$) (Figure 5C).
- Thirteen stingrays were captured at inshore locations while 21 stingrays were captured at offshore locations. The range of sizes of all rays encompassed most size classes (Figures 5A and B).
- Female stingrays sampled had a mean disc width of 830.0 mm (± 47.0 SE) while males had a mean of 605.2 mm (± 69.8 SE) making females 37% larger than males.
- Rays sampled >700mm W_D were significantly more abundant at offshore locations, while stingrays of <700mm W_D were found among inshore locations.

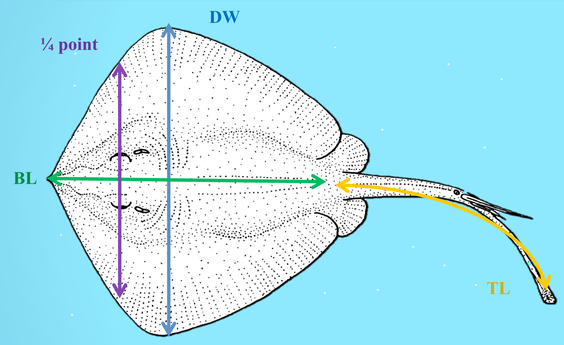

Fig 3. In blue is disc width which measures the widest point of the animal, in purple is quarter point which measures over the eyes, in green is the body length which extends to the crease of the pectoral fin and in yellow is tail length which can be combined with body length to form total length.

Fig 4. Rays were sampled from seven sites across two locations: inshore and offshore.

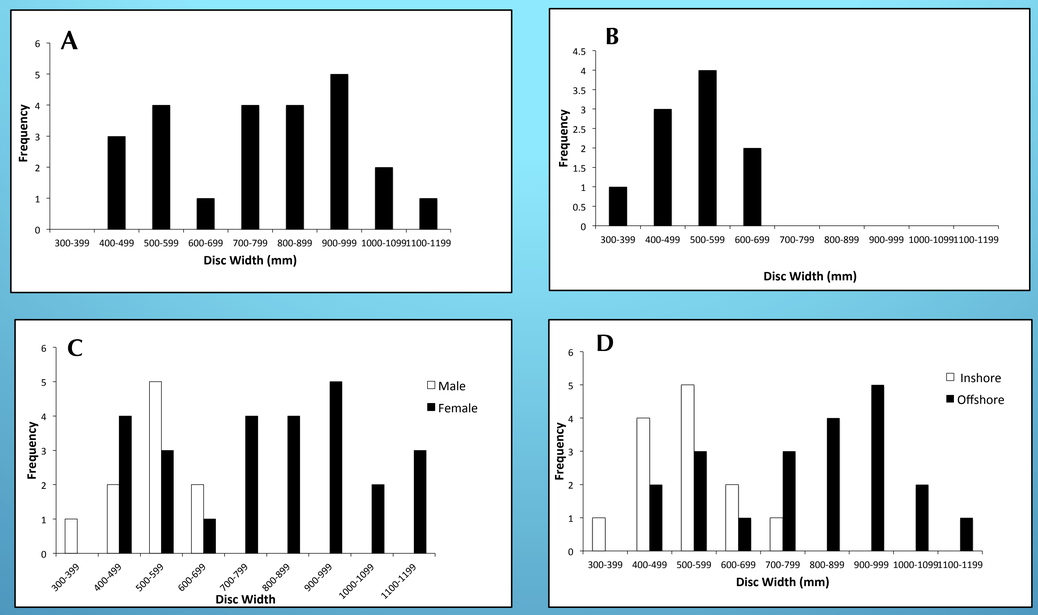

Fig 5. Size frequency distribution of **A)** *D. americana*, and **B)** *H. schmardae* **C)** males versus females of both species, and **D)** both species by location.

Discussion

Stingrays sampled from offshore locations were significantly larger than rays sampled at inshore locations, confirming our hypothesis that rays spatially segregate based on ontogeny. This might suggest that inshore habitats occupied by juvenile stingrays are used as locations safe from predators. *Dasyatis americana* occupied both in-shore and off-shore sites, with distinct patterns in ontogeny between locations; whereas *H. schmardae* sampled exclusively at inshore sites, specifically creeks systems. This demonstrates a definitive example of spatial resource partitioning between these sympatric species and no two species were recorded at the same site. *D. americana* were also sexually segregated with females occupying offshore locations and smaller males inshore whereas *H. schmardae* were recorded in mixed sex aggregations. Throughout the study, data were recorded that provide a baseline for future efforts in stingray research.

Conclusions

This research has determined clear patterns of spatial resource partitioning between two sympatric species of batoid. Furthermore these segregations also relate to sex and ontogenetic stage for *D. americana* as well as life stage for juvenile *H. schmardae* in creek systems. These data will provide foundations for assessing habitat use and specificity of important species in these environments, and further conservation arguments for ecosystem driven approaches to management of sensitive habitats.

Future Directions

- Expand sampling among creeks to form arguments for *H. schmardae* nursery habitats.
- Telemetry studies should be conducted to obtain fine-scale resolution data on habitat use.
- Sample further locations around Eleuthera to add to the robustness of these data.
- In order to determine the importance of inshore creek systems and tidal zones, further data should be collected on whether these habitats are nurseries.

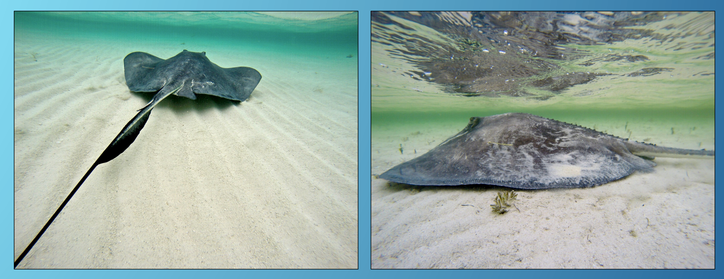

Fig 6. On the left, previously caught and tagged ray swimming away after release . On the right is the heaviest ray caught weighing over 50 kg

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