SETTLEMENT PATTERNS OF POST-LARVAL REEF FISH IN ELEUTHERA, BAHAMAS

LYNDELL GIFFENIG, SOPHIE OCHS, MAX THOMPSON, ELSA DAVIS, CHASE HAYLON AND ANITA WRAY

ADVISOR: SKYLAR MILLER

Introduction

The post larval stage of Caribbean reef fish is extremely vital to their life cycle (Leis, 1991). In this stage, the fish settle into a habitat to mature into juveniles. The location that the fish settle will vary depending on species from coral reefs to mangroves to sea grass beds (Pollux et al., 2007), however, our study focuses on coral reef habitats. When fish settle into these locations, they are small (generally between 1-2 centimeters). At this point, they are very susceptible to predation, leading to 56% of reef fish death occurring within one to two days of settlement (Almany and Webster, 2006). The settlement stage is also very important to adult population dynamics (Jones, 1990). Various methods (light traps, under water visual surveys and plankton tows (Leis, 1991)) have been used to study the early life stages of coral reef fish, but don't give an accurate representation of where post-larval fish are settling (Valles et al., 2006). Due to this difficulty, no previous studies have been conducted in Eleuthera, Bahamas.

Purpose and Objectives

- To document spatial and temporal settlement patterns of coral reef fishes in Eleuthera, The Bahamas.
- To find if there is a variation in settlement abundance with in reef types.

Abiotic

- Ocean currents
- Tides
- Lunar cycles
- Temperature

Biotic

- Competition
- Predation
- Resource availability
- Behavior

Abiotic factors like ocean currents and tides affect settlement because fish use them to travel. Lunar cycles affect when fish settle and studies have shown that fish prefer the new moon due to the lack of light which offers protection from predators (Thorrold et al, 1993). Abiotic factors such as competition and resource availability can decide if a reef is an ideal habitat. Predation also affects where fish settle and how many survive past settlement (Almany and Webster, 2006). Finally, fish have behavioral characteristics that they use to settle, such as olfactory and auditory senses (Thorrold et al, 1993).

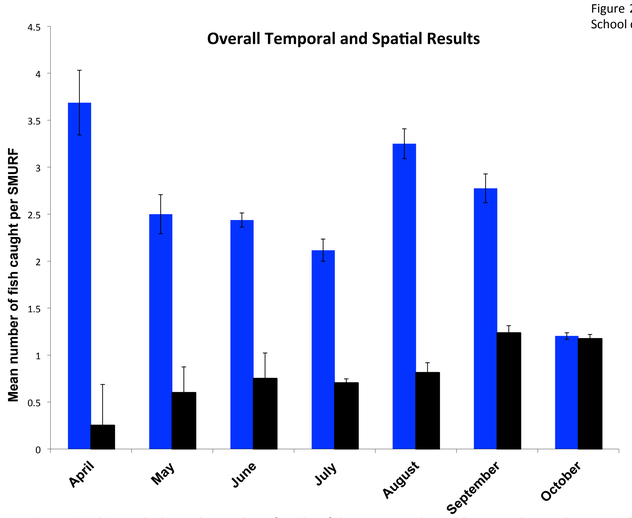

Figure 10: This graph shows the number of settling fish across months and between the two locations. The continuous reef has a significantly higher abundance of settling fish than the patch reef (p<.0001). This is because there are more available resources at the continuous reef and the patch reef is harder to get to due to the islands hydro-geography. When patch and continuous reef data is combined, August and September show significantly more abundance in collection (p=.0187).

The Biphasic Life Cycle of Coral Reef Fishes

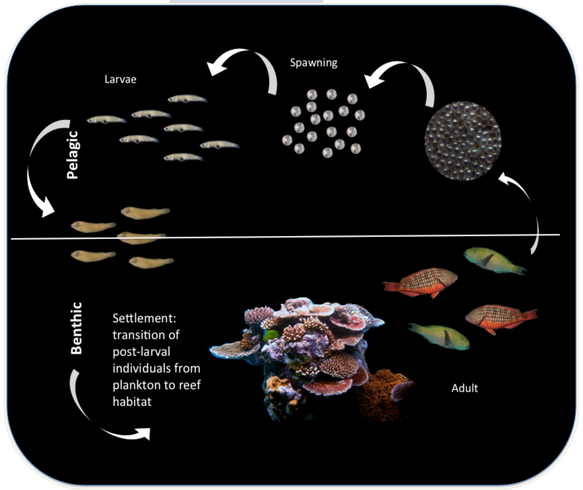

Figure 1: The life cycle of biphasic reef fish begins at spawning when eggs are released into the open water. The eggs then are fertilized, undergo settlement to benthic environments as post larvae before maturing into juvenile and reef associated adults. (image credit, Skylar Miller)

Location

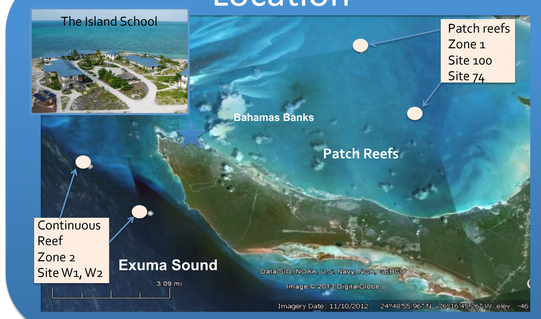

Figure 2: SMURFs were placed into 2 zones. Zone oneis in the Bahamas Banks, north of the Island School campus. Zone two is south of Island School, just next to the wall of the Exuma sound.

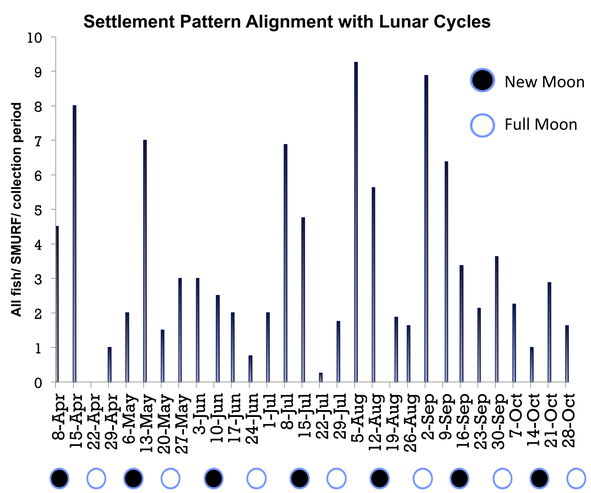

Figure 11: This graph shows the collection abundance of SMURFS during new moons, black circles, and full moons, white circles. On average, abundance in collection was higher during new moons.

What is a SMURF?

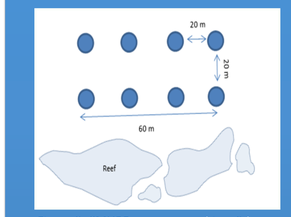

Figure 3: SMURFs are arranged in a 2 by 4 grid at each site.

Figure 4: Arial view of a SMURF unit.

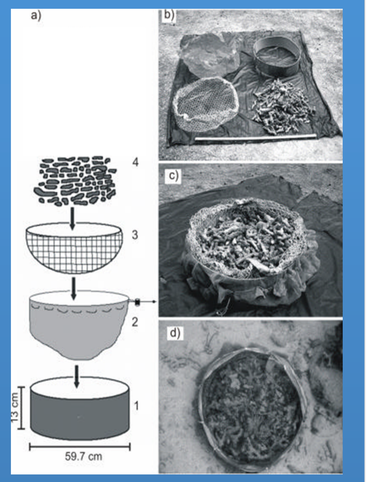

Figure 5: Break down of a SMURF unit (Valles et al, 2006).

The Standard Monitoring Unit for the Recruitment of Fishes (SMURF) is a unit that is placed underwater to monitor settlement patterns of reef fishes (Valles et al, 2006), see Figure 4. It is comprised of four parts that sit inside of each other: coral reef rubble inside of a chicken-wire basket, set inside of a mesh collection bag, set inside of a plastic ring, see Figure 5. The coral reef rubble is considered an ideal habitat for the fish to settle in, so they are potentially attracted to the rubble and then settle inside of the unit for collection. The whole unit is marked with an ID tag and held down to the ocean floor by old conch shells. SMURFs are set up in a 2 by 4 grid at every study site, with 8 units at each site (Figure 3). Collections of all units was done weekly.

Discussion

Results showed that settlement patterns of reef fish in Eleuthera, Bahamas vary over time and space. Total settlement abundance was highest in August and September (Figure 10). Past studies have shown that fish tend to spawn in the summer when the water is warmer due to resource availability (Thorrold et al., 1993). The time between spawning and settlement is approximately 20-30 days which causes the peak months to be in late summer and early fall. Our results also showed that there was a greater abundance of settling fish during the new moon phases (Figure 11). This may be due to the decrease in light during the new moon, causing predation rates to drop overall (Thorrold et al., 1993). Finally, our study showed that more fish settled in the continuous reef than the patch reef (Figure 10). A reason for this variation may be because there are more resources at the continuous reef and more habitats open for settlement. The hydro-geography of this specific location makes it harder for the fish to access the patch reef which might influence settlement in that location. This study will continue until April 2014 in order to complete a full year of results.

Collection Process

Figure 6: The Unit is sprayed with clove oil, a natural anesthetic, to immobilize all of the specimens within it and shaken out into the collection bag.

Figure 7: The collection bag is then quickly sealed to prevent the loss of any specimens and replaced.

Most Abundant Families	Total Count
Goby spp.	451
Cardinalfish spp.	130
Damselfish spp.	118
Parrotfish spp.	108
Soapfish sp.	79

Figure 8: Total count of the most abundant fish species found during all collections.

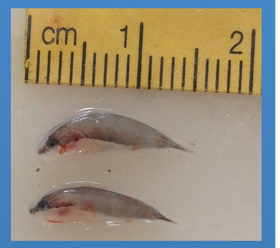

Figure 9: Post-larval soap fish (less than 2 cm.) found during a collection

After a collection is done, see Figures 6 and 7, the filled collection bags are then sorted through to find all of the specimens that were collected. Those specimens are then measured and logged into a data collection sheet. Many different species and organisms of varying sizes are found, see Figure 8, but we are looking primarily for fish that are under 2 cm in length, see Figure 9, indicating that they are in the post-larval phase and not the juvenile phase of life.

Acknowledgements

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