The Assessment of Deep Sea Distribution and Abundance of Scavenging Fauna in the Exuma Sound

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Introduction:

The ocean is the largest ecosystem on the earth and occupies about 72% of earth. The deep sea is considered anything greater than 200 meters; therefore, approximately 96% of the ocean is deep sea. Less than 5% of the deep sea has been understood and there is a limited understanding of community structure and spatial ecology of organisms that occupy this ecosystem. Deep sea biome abiotic factors include; temperatures, high-pressure, less oxygen, and low light (Davies et al. 2007). Biotic factors consist of; no airspaces, slow metabolisms, low fecundity and longer life spans (Norse et al. 2012). These factors affect the different species in the deep sea such as the different species of scavenging fauna that exist on the bottom floor.

Due to these differences, the deep sea is at larger risk to be affected by anthropogenic impacts such as trawling, overfishing and mining. The deep-sea is becoming more threatened from the enhancement of modern technologies and shallow water fishing stocks being depleted; subsequently, allowing for fisheries to reach deeper waters (Roberts, 2002). It is vital to understand ecosystem dynamics in order to preserve a susceptible to external influences. This research would then help further studies, in these similar climates and environments, be able to track trends of organisms in the deep-sea.

Purpose:

The purpose of this study to gather a baseline measurment of scavenging species to determine variation in species assemlages among different depths and tempatures to observe potential patterns in distribution.

Study Site:

Figure 1: The Bahamas, the circle is South Eleuthera.

Figure 2: The Exuma Sound, the rectangle is where traps are deployed.

Results:

A total of 38 deep-water traps were collected at depths from 550 meters to 1450 meters. 13 different species and 5 species that have not yet been identified were collected. A total of 1298 organisms, including *teleost, crustaceans,* and *elasmobranchs*, were found.The most abundant are 4 species of isopods; *Borralana nov. sp., Booralana tricarinata Bathynomus nov. sp.,*and *Bathynomus giganteus.*

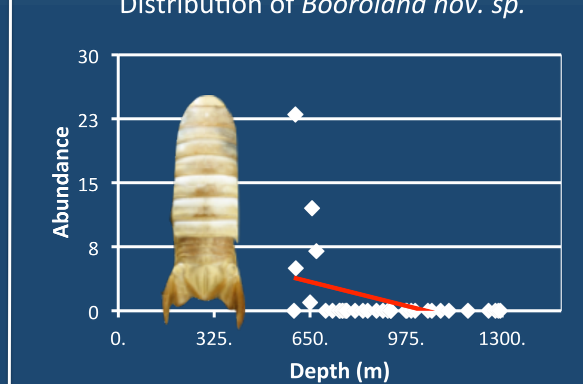

Figure 3: The abundance of *Booralana nov. sp.* was found to significantly decrease in depths ranging between 600 and 1300 meters in the Exuma Sound (p=0.064) (r^2= 0.09183).

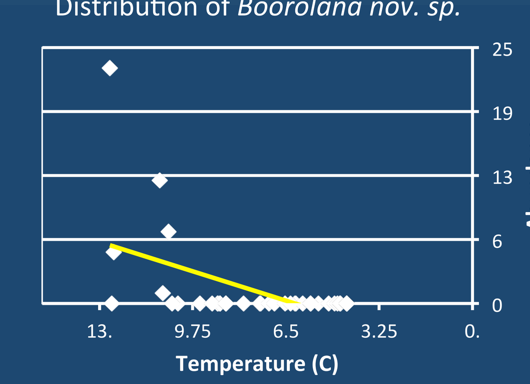

Figure 4 : The abundance of *Booralana nov. sp.* was found to significantly increase as the temperature of the water increased (p=0.0148) (r^2=0.154072).

There was a no significant decrease in the abundance of *Booralana nov. sp.* between approximately 600 -1400 meters and 13 -6.5 Celcius.

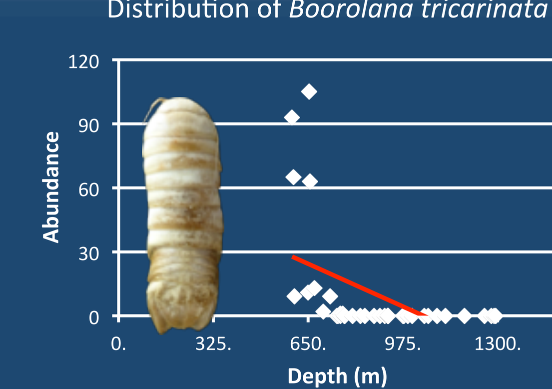

Figure 7: The abundance of *Booralana tricarinata* was found to significantly decrease in depths ranging between 700 and 1300 meters, after a high abundance at around 600 meters (p= 0.0020) (r^2=0.2365).

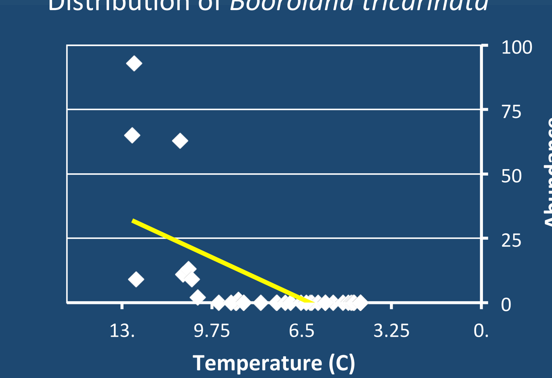

Figure 8: The abundance of *Booralana tricarinata* was found to significantly increase as the temperature of the water increased (p=0.0001) (r^2= 0.381041) (p=00001).

There was a significant decrease in the abundance of *Booralana tricarinata* between approximately 600 - 1400 meters and 13-6.5 Celcius.

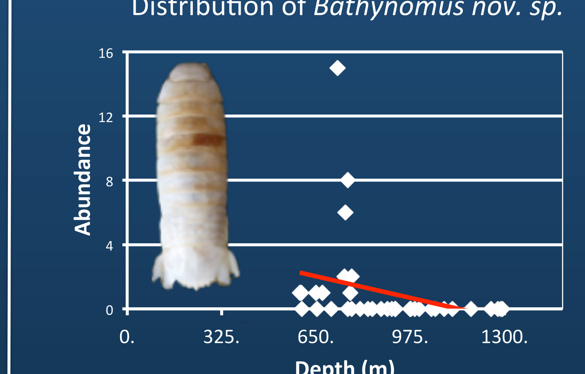

Figure 5: The abundance of *Bathynomus nov. sp.* was found to significantly decrease in depths ranging between 800 and 1300 meters, after a high abundance caught at approximately 700 meters, in the Exuma Sound (p= 0.0367) (r^2=0.115691).

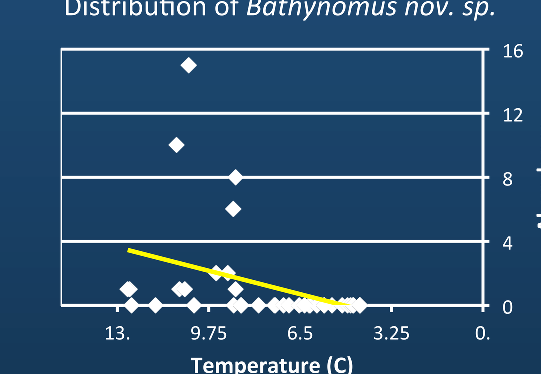

Figure 6: The abundance of *Bathynomus nov. sp.* was found to significantly increase as the temperature of the water increased (p=0.0258) (r^2=0.13063).

There was a significant decrease in the abundance of *Bathynomus nov. sp.* between approximately 600 - 1400 meters 13-6.7 Celcius.

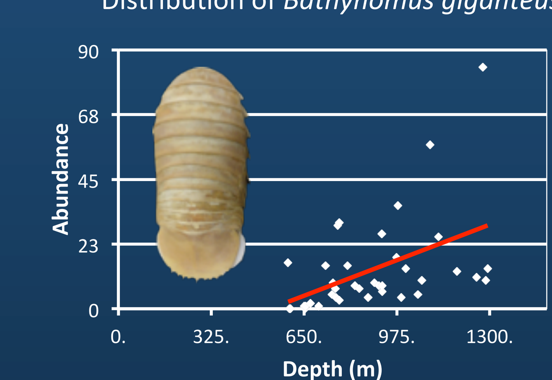

Figure 9: The abundance of Bathynomus giganteus was found to significantly increase in depths ranging between 600 and 1300 meters in the Exuma Sound (p= 0.030) (r^2=0.219027).

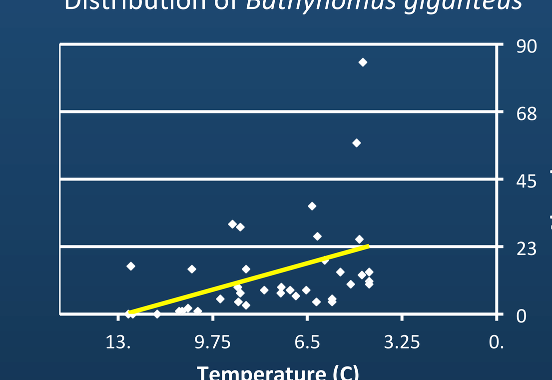

Figure 10: The abundance of *Bathynomus giganteus* wasfound to significantly increase as the temperature of the water increased (p=0.0088) (r^2=0.17563).

There was a significant increase in the abundance of *Bathynomus giganteus* between approximately 600 - 1400 meters and 13-3.25 Celcius.

Table 1: The amount, genus, and species of organisms caught between 550m and 1450m in the Exuma Sound.

Genus	Species	Depth Range	Amount Caught
Bathynomus	*giganteus*	550-1300	469
Bathynomus	*nov. sp.*	550-800	34
Booralana	*tricarinata*	550-800	371
Booralana	*nov. sp.*	600-700	95
Conger	*unknown*	350-750	2
Heretrocapus	*sp.*	550-1300	82
Histiobranchidae	*unknown*	900-950	1
Kiwa	*puravida*	700-750	1
Munida	*coltroi*	600-650	1
Myropsis	*quinquespinosa*	550-600	1
Scyliorhinus	*meadi*	600-650	1
Simenchelys	*parasitica*	1040-1300	23
Synaphobranchus	*affinis*	875-1000	3

Figure 17: *Myropsis quinquespinosa*

Figure 18: *Conger sp.*

Figure 19: *Scyliorhinus meadi*

Discussion:

After examining the data, distinct trends between the correlation of depth and species of isopods was evident. Pervious research suggests that size of an individual increases with depth, the theory of "gigantism"; *Bathynomus giganteus* is the largest of the isopods and occupies that deepest ecosystem agreeing with this theory.

The discrepancy between *Bathynomus* genus could explain interspecies variation and potential geographic variation. In pervious studies abundance of organism decreases with deeper depths due to rigorous living conditions (Levin et al. 2001). This trend could be proven with a larger sample size.

Finally, the lack of knowledge to the deep-sea is an issue for management practices. In order to preserve the ecosystem it is essential to map our study site. Multi-beam mapping would give us an accurate representation of our study site and increase the accuracy of sampling. This would allow for finer deployment distribution and the understanding of the habitat. In order to fully understand the ecosystem dynamics further studies will be needed through different methodologies. One example of this is BRUVs, Baited Remote Underwater Video surveys, which can examine larger and more mobile species.

Methodology:

Figure 11:

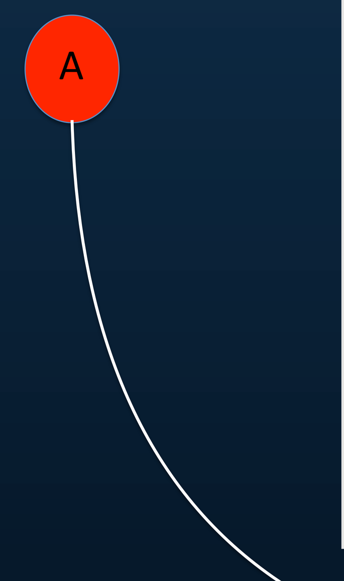

Figure 12: Layout of traps

1. The rigs consists of two traps, one square and one cylindrical. To prepare these traps for deployment they are baited. Half of a bonita is secured into the cylindrical trap and a full Bonita tuna is secured into the square trap with steel wire. There are also TDRs, Temperature Depth Recorders, secured onto the lines.

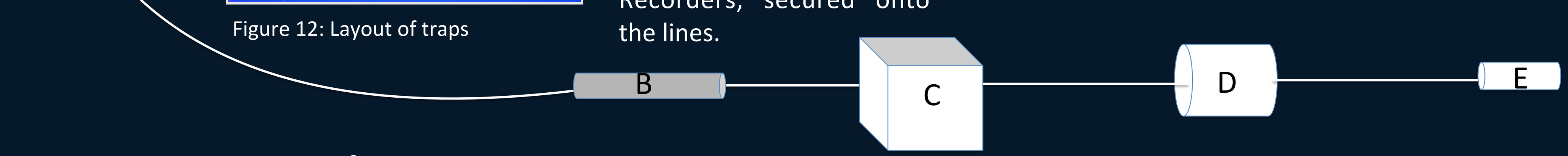

Figure 13: Deploying cylindrical traps

2. The traps are deployed over the side of the boat in depths ranging from 500 meters to 1300 meters. These traps will soak for 24 hours before retrieval. The GPS point of the deployment is also recorded for retrieval.

Figure 11:
A: Buoy for identification
B: TDR or temperature depth recorder
C: Square trap (61 cm by 61 cm by 46 cm)
D: Cylindrical trap (38 cm by 61 cm)
E: 15 Pound weight

Figure 14: Hauler used for retrieving traps

3. In the retrieval of the traps, an Electric Pot Hauler is used to hoist the traps back to the boat. The specimen are collected and sorted by trap for further processing.(picture from vaults) When processing the specimen, weight, lengths and widths are

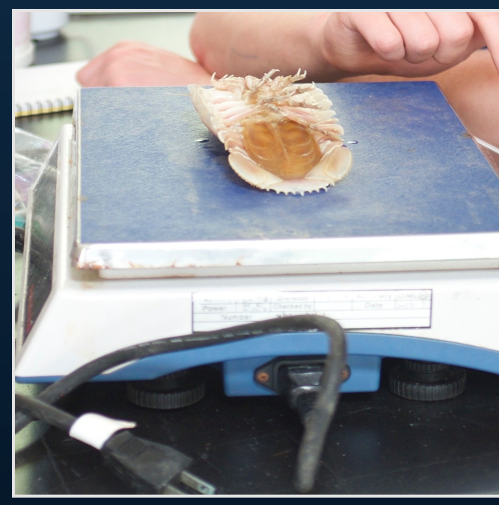

Figure 15 and 16: Processing and taking measurements of isopods

4. When processing the specimen, weight, lengths and widths are measured along with the DNA samples that are collected for further analysis.

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