Assessing Relative Abundance and Biodiversity of Deep-Sea Fauna in the Exuma Sound, Eleuthera, The Bahamas

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Introduction

The deep-sea is a foreign world of which there is very limited knowledge. It is dark, has very high pressure, low temperatures (from 4°C-10°C), little oxygen, high salinity, and very dense waters (Norse et al. 2011). Because of these conditions it is extremely difficult to study the deep-sea. As coastal and shallow water ecosystems are being depleted, fisheries have been transitioning to the deep-sea. As a result, overfishing in the deep-sea has become an increasingly large problem. Deep-sea fish have different characteristics and qualities than shallow water fish. For example, they have significantly longer life spans, low fecundity rates, and low metabolisms (Norse et al. 2011). As a result of these characteristics, deep-sea species are highly vulnerable to fishing.

There is not much previous research on the deep-sea in the Bahamas. Through this research, baseline data on a relatively healthy deep-sea ecosystem can be collected because the Bahamian deep-sea has minimal anthropogenic and natural influences compared to the ones from other areas with similar geographical systems. One example is the Gulf of Mexico, a relatively similar ecosystem with heavy deep-sea fishing.

This research could potentially benefit the greater scientific community as well as the Department of Marine Resources in the Bahamas. It could provide concrete baseline evidence that could help create regulations to help their depth, economic, and environmental issues.

Objectives

1. Gather data on species relative abundance and distribution in the Exuma Sound.

Study Site

This study was conducted in the Exuma Sound (a relatively unimpacted deep-sea ecosystem) off the coast of Cape Eleuthera.

Methods

Baited remote underwater video surveys (BRUVs) are effective and non-invasive ways to study the deep-sea (Brooks et al. 2011). The Medusa (BRUV), a specialized camera for depths of 3-6000 meters, was used in this study. Throughout this study The Medusa was deployed six times between 700-1400m.

Deployment

Once The Medusa was ready to be deployed, it was attached to a steel crane and dropped into the water. The Medusa recorded 12 hours of footage during its time underwater and was retrieved the next day.

Retrieval

Through the deck box, a way to communicate with The Medusa’s Port, a signal was sent to release the sandbags that weigh it down. Once the sandbags were released, the flotation device made The Medusa float to the surface. Once it was surfaced, The Medusa was attached to the steel crane and brought back onto the boat. It was then returned to the lab at Cape Eleuthera Institute and video footage was downloaded and analyzed.

Discussion

Depth-related trends were observed for four specific species: Bathymodus giganteus, Heterocarpus adami, Centrophorus sp, and Squalus cubensis. The opposite trends of the relative abundances of Bathymodus giganteus (Figure 3) and Heterocarpus sp. (Figure 2) could be explained by the fact that both of these species are scavengers and compete for the same resources for food. To limit this competition, they potentially avoid each other living at different depths. Squalus cubensis were found at shallower depths (maximum 801 m) than Centrophorus sp. (maximum 928 m). This could be because Centrophorus sp. is more resilient than Squalus cubensis in harsh living conditions of the deep-sea (Bailey et al. 2007). It is also interesting to note that Squalus cubensis were thought not to live deeper than 380 meters (Monzini 2006). However, we found some at 801 meters. We assume that this is because the thermocline in the Bahamas is at much deeper than in most parts of the world, so Squalus cubensis were able to live in deeper water.

However, final conclusions cannot be made from this data due to lack of replicate drops. In the future, additional replicate drops need to be conducted at the same depths to confirm our speculations. Also, different bait could be used to attract different species.

This data is extremely important because this study was performed in the Exuma Sound, where commercial deep-sea fishing has not yet been established. The abundances found here can be assumed to be the representative of normal, healthy environment. This data can be an important future regulation for deep-sea fishing to help minimize shifting baselines of these species’ abundances.

Akknowledgements

Synaphobranchidae
Pholidoteuthidae
Gempylidae

Squalidae

Pandalidae

Centrophoridae

Species

Figure 6. The Medusa on a research vessel.

Figure 9. EventMaster.

Figure 7. Radiolucation with the Medusa.

Figure 8. Data Box and Transducer.

The analysis was done through EventMaster, a computer software. This software allows the user to pause the footage whenever a species appears on the screen and tag the species along with other details and information. EventMaster calculates MaxN, which is a conservative estimate of relative abundance. Figure 8 is an example of MaxN. In this case, the MaxN of Bathymodus giganteus is 7.

Literature Cited

Exuma L.E., diversity, distribution and abundance of sharks in the Bahamas. Endangered Species Research. 13:
Sumaila, Squalus cubensis giganteus (Table 1), changes in species composition between each drop were observed Figure 12. The Medusa on a research vessel (Ekeland et al. 2011). The Medusa (BRUV) is a specialized camera for depths
in shallower depths. Contrasting to the six species we observed at 724m, only Squalus cubensis was observed at 801m and none were observed at 928m.

Figure 13. The MaxN of Squalus cubensis from drop depths of 724m, 727m, 801m, and 928m.

Figure 14. Maximum depths where each species was observed.