Deep Sea Exploration

Water that is deeper than 200 meters is considered the deep sea. It is the largest ecosystem on the planet; an environment with extremely high pressure, very little light, and low temperature, making it difficult to study.

Unsustainable Fisheries

Recently, fisheries have begun exploiting deep-water resources. Deep-water species are k-selected, meaning they have slow growth rates and low fecundity (Morato et al. 2008). Therefore, deep-sea fishing is unsustainable because deep water species cannot repopulate at the rate in which they are being fished (Norse et al. 2012).

Figure 2A. The Medusa is deployed from the boat. The ball is attached to the wall, which is turned on using a timer, and the CTD (the device that records temperature, depth, and salinity) is turned on using the modem (shown in the picture).

B. The Medusa is attached to a wrench and then is deployed into the water from the boat.

C. The Medusa then sinks to the sea floor due to its negative buoyancy achieved by the biodegradable weights attached underneath the camera.

D. When it is time to retrieve the Medusa, an acoustic signal is sent from the deck box commanding the Medusa to begin rising to the surface.

Previous Deep Sea Studies

The most efficient solution to the exploitation of the deep-sea is to collect holistic data to provide a baseline and factual evidence for why deep-water ecosystems should be managed. Two previous deep-water studies have been conducted at the Cape Eleuthera Institute and The Island School, which have used research long-lining to survey deep water species in the Exuma Sound. In this study, a significant decline in species richness with an increased distance from the wall, increased depth, and lower temperature was observed.

The Medusa

The Medusa is a deep-water bailed remote underwater video survey unit (BRUVS). It is non-invasive because it does not interfere with behavior. It is more holistic because it documents all species that live in deep-water ecosystems, including crustaceans and mollusks that could not be captured with long-lining.

The purpose of this study is to survey the diversity, abundance, and distribution of deep water species within the Northeast Exuma Sound, Bahamas using bailed remote underwater video surveys.

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Figure 3. This satellite map shows South Eleuthera. The star indicates the location of The Island School in relation to the deep sea, which is shown by the dark blue surrounding the capes.

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Figure 4. The Medusa provided data about the environment at the bottom of the Exuma Sound. The environment is sandy, flat, and abundant with plankton. PAR is photosynthetically available light, which is measured by the Medusa at different depths during the descent. Using the CTD, we also studied salinity and temperature in relation to depth (see Figure 5-10).

Figure 5. The average species is compared between Medusa and long line fish. One of the advantages of the Medusa is that it records long line fish and crustaceans as well as shark species. This is shown in the higher species richness seen in Medusa footage as opposed to long-lining.

Figure 6. This shows the relative abundance of sharks, bony fish, and crustaceans. Temperature and depth at the different depths where the Medusa was deployed. Each depth only shows one deployment, so the whole graph shows possible trends. More data would need to be collected to make claims about this data.

Figure 7. The graph shows the relative abundance of the sharks caught on footage using the Medusa using Monkey Island data as opposed to the line data captured through long-lining.

Figure 8. This graph shows the relative abundance of the sharks caught on long lines in the two past years of deep-water studies. This graph shows the number of individuals that were counted and the effort is how long the number of hours deployed for a certain number of hours.

Eye In The Sea

The results of this study are promising because in only 4 Medusa deployments 11 species were recorded, whereas in 72 sets of long-line only 9 species were seen. There were many new discoveries made because of the holistic and noninvasive techniques of the Medusa. The Springer’s sawtail catshark, which has rarely been caught long-lining, was seen on the first deployment. The Sharpnose seven gill shark, which has never been before recorded in The Bahamas, the Medusa allowed a glimpse at 4 crustacean and 3 fish species in the Exuma Sound that were not previously captured by long-lining surveys because they are not susceptible to capture on baited hooks.

Future Deep Water Studies

Though only 4 deployments were conducted, there was valuable information gained about the deep sea ecosystem and biodiversity of the Exuma Sound. In future deep water studies, the Medusa should be deployed more times and for longer periods to allow researchers a better understanding of the relative abundance of species, the depths they typically inhabit, and the deep-sea environment.

Setting Baselines

Studies such as this one provide information about the largest and least studied ecosystem on Earth: the deep sea. Surveying relative abundance sets baselines for deep water species. With these baselines management of deep-water fisheries and conservation of deep-water species is possible.