

## Background

### Life History of Sea Cucumbers:

Sea cucumbers (Holothuroidea) are small benthic organisms that are in the phylum Echinodermata. Most possess tube feet called podia and move by crawling up to 4m per day [Fig. 1]. Sea cucumbers may be susceptible to exploitation because they grow relatively slowly, have restricted home ranges, and reproduction is dependent on the densities of individuals in a given area.



Fig.1 Sea cucumber's podia

### Ecological Value:

Sea cucumbers play an important role in filtering sediments and recycling nutrients back into the food web. Over the span of a year, this creature can vacuum up to 200 pounds of sand. Likewise, the eggs of sea cucumbers provide nutrients for many marine species. When burrowing in the sand these organisms also allow for microorganisms to receive oxygen.

### Sea Cucumber's Around the World:

Sea cucumbers have been a dietary delicacy and medicinal cure for Asians over many centuries. Sea cucumbers have attracted much interest in export-oriented fisheries in at least 70 countries, specifically China. Yet as sea cucumber fisheries have been exhausted throughout Asian waters, export companies are searching for new, harvestable populations.

### Bahamian Sea Cucumber Fisheries:

Currently, The Government of China has budgeted thirty-five billion USD for infrastructural development projects in The Caribbean and in Latin America. The Bahamas aims to qualify for funding under this program by developing a commercial fishery for sea cucumbers. Currently, there is no sea cucumber fishery however in 2010 The Bahamas opened a pilot fishery in North Andros, which was depleted in 11 months. In addition, the government has tons of dried sea cucumbers waiting to be exported.

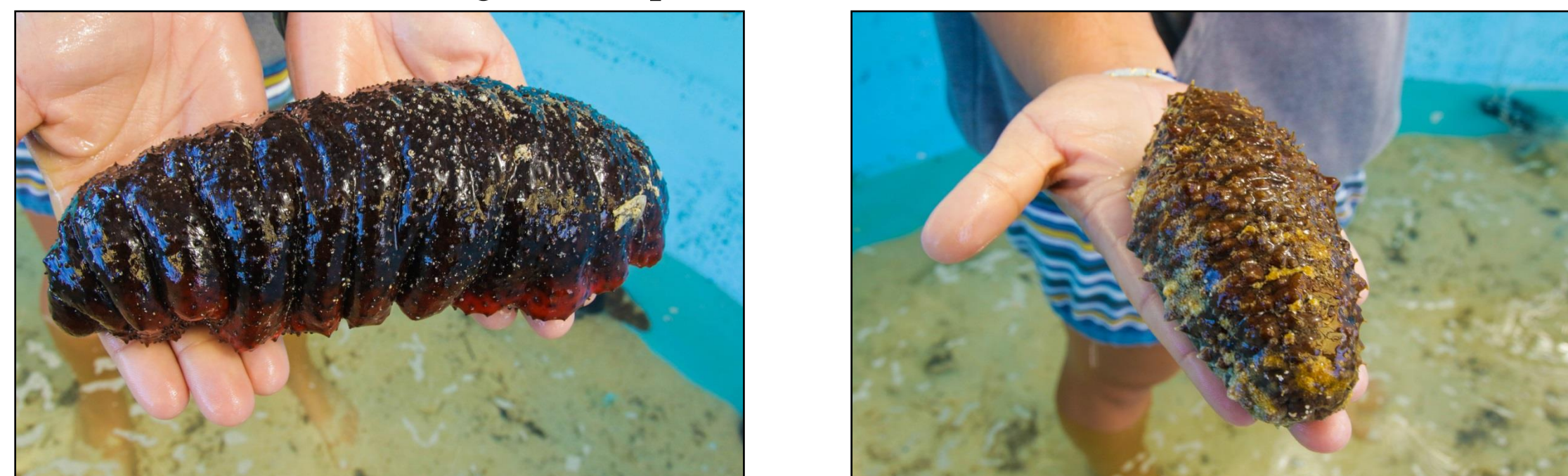


Fig. 2 Commercially viable sea cucumbers in The Bahamas [from left to right: Donkey Dung *Holothuria mexicana*, and the Furry *Astichopus multifidus*]

We are studying the Furry and Donkey Dung sea cucumbers which are the commercially viable species in The Bahamas [Fig 2].

### Aim:

Assess sea cucumber abundance and populations on different bottom types in South Eleuthera.

### Objectives:

1. Assess abundance of sea cucumbers on different habitats in South Eleuthera
2. Assess the population of Furry and Donkey Dung sea cucumbers in South Eleuthera
3. Disseminate results to the Department of Marine Resources

## Study Site

South Eleuthera, located in Bahamas, is found on the bank between the Caribbean Sea and the Exuma Sound [Fig. 3].

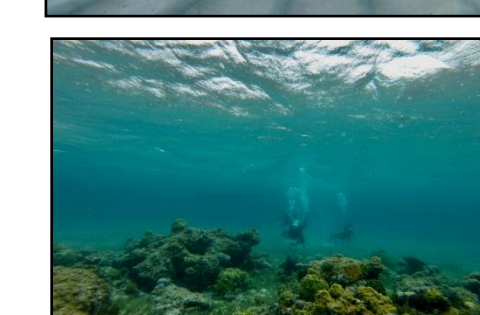
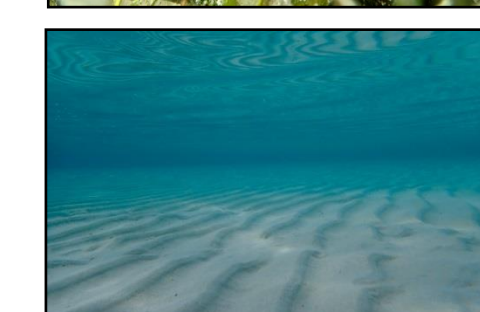


Fig. 4 Habitat types

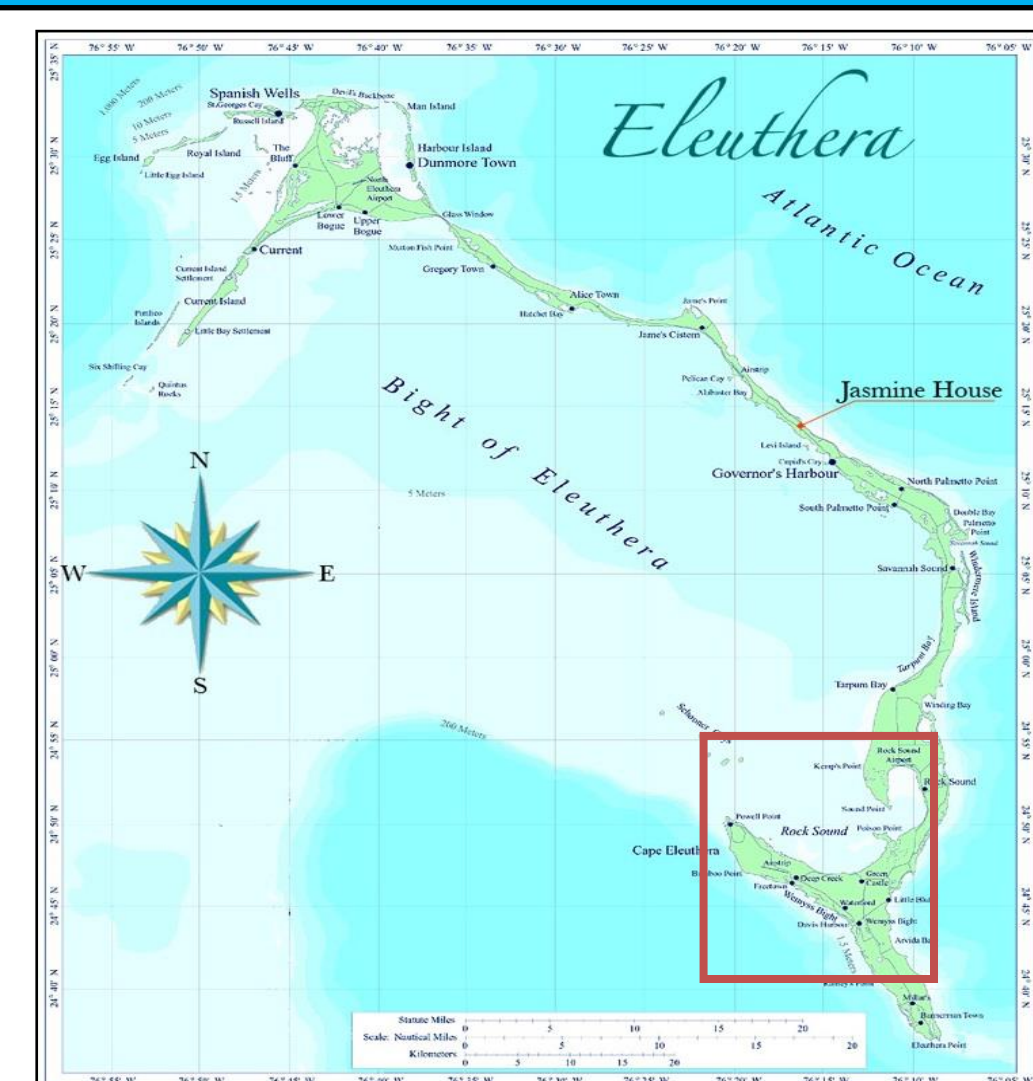


Fig.3 Map of Eleuthera. Red box indicates study site

Study site details:  
• Maximum depth 5m

## Methodology

### Abundance Assessment of Sea Cucumbers Using Manta Tow:

1. Visually inspect sea cucumber population across three different habitats [Fig. 5] for 100m intervals
2. Two manta tow boards behind 10m Panga visually inspecting 2m to each side
3. Use GPS to take waypoints at the start and end of each 100m interval

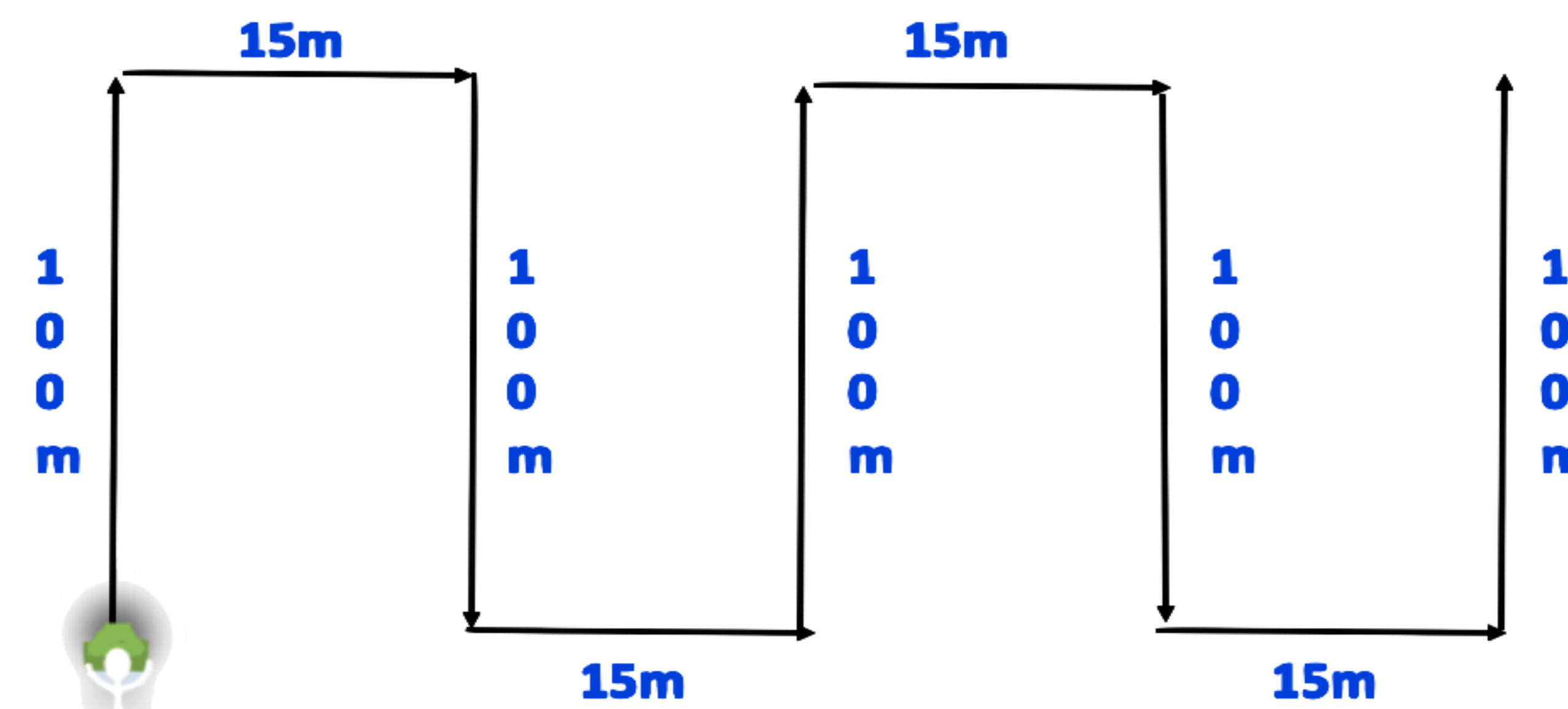


Fig. 5 Manta Tow Method

### Sea Cucumber Population Assessment Using SCUBA:

1. Using highest abundance results (>20 sea cucumbers) from manta tow to complete population assessments
2. Lay seven belt transects with total area of 480m<sup>2</sup>
3. Within belt transects identifying species [Fig. 6]
4. Measure sea cucumber sizes (contracted length / width) following the methods described by Yingst [1982]

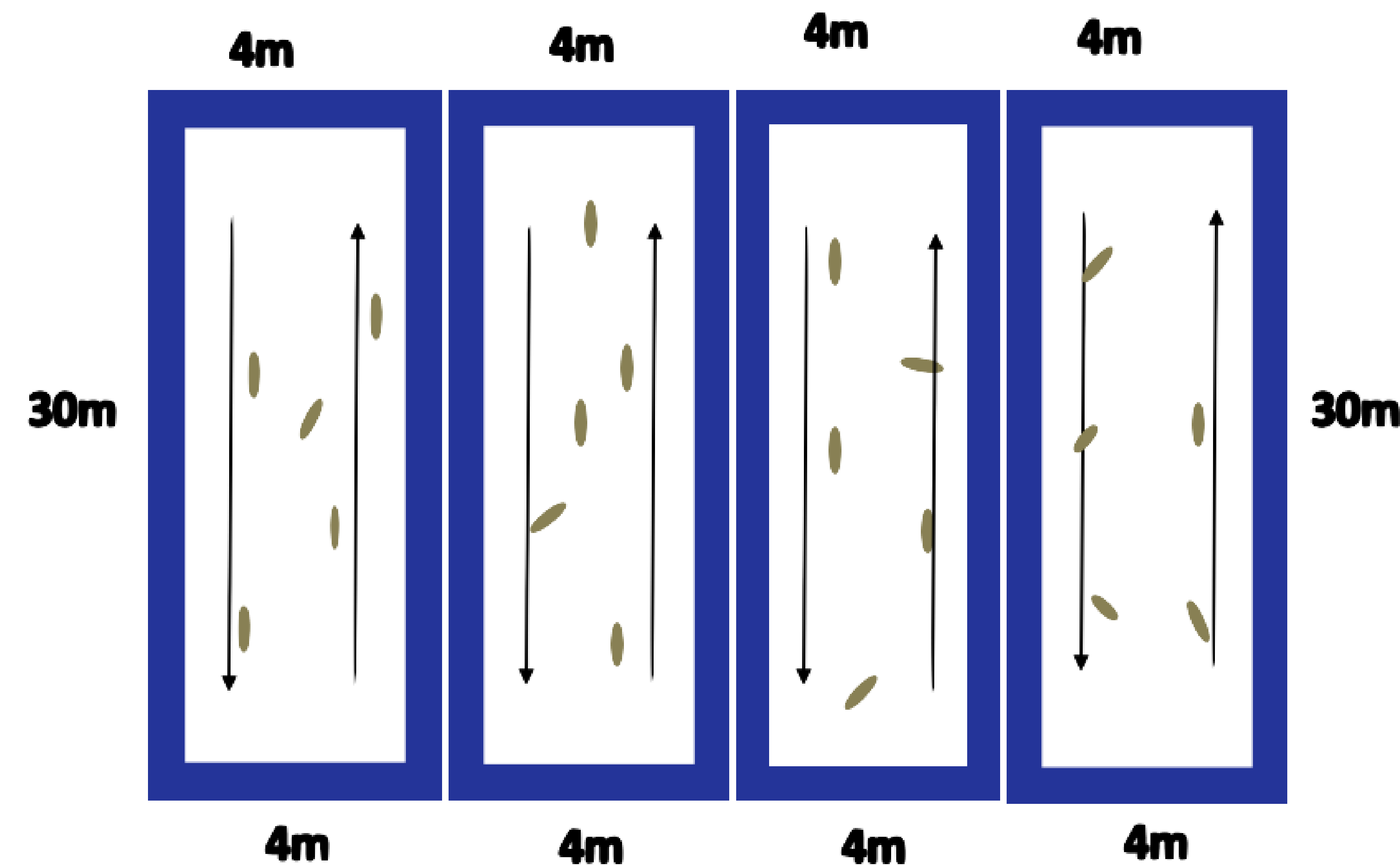


Fig. 6 SCUBA survey method



Fig. 7 Students completing SCUBA survey

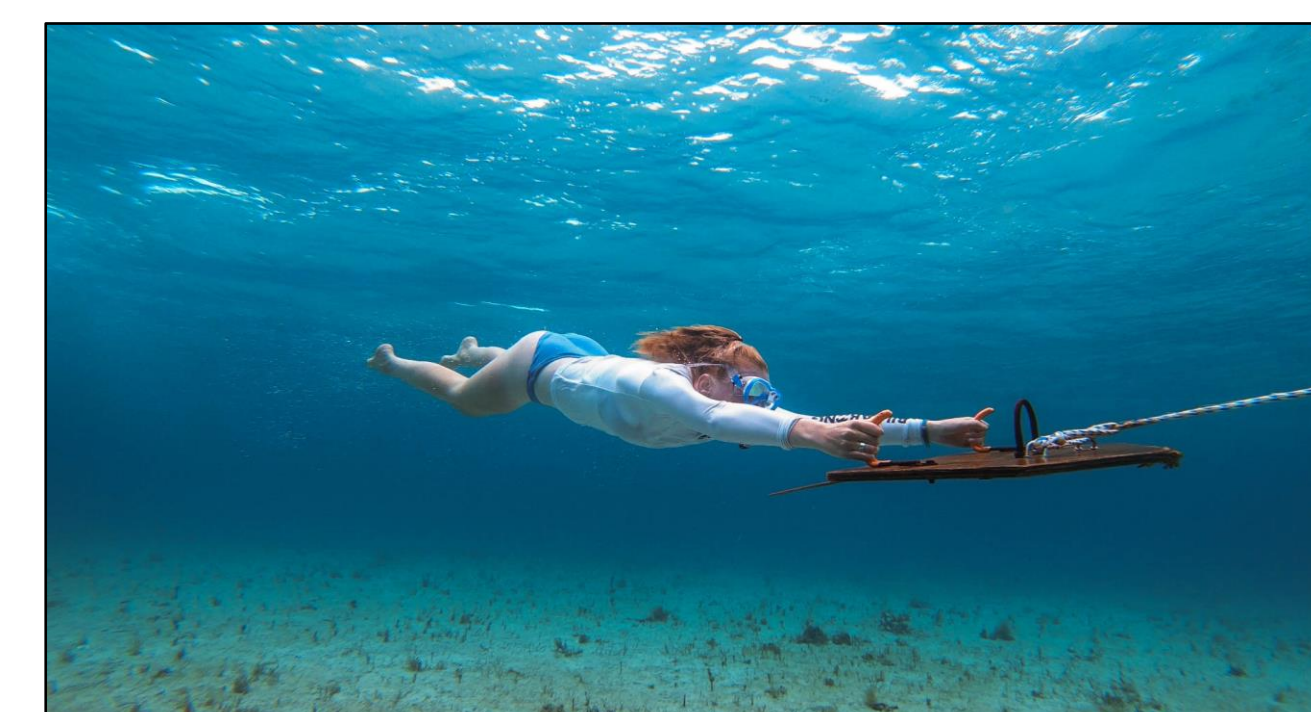


Fig. 8 Eliza Bradford manta towing

## Results

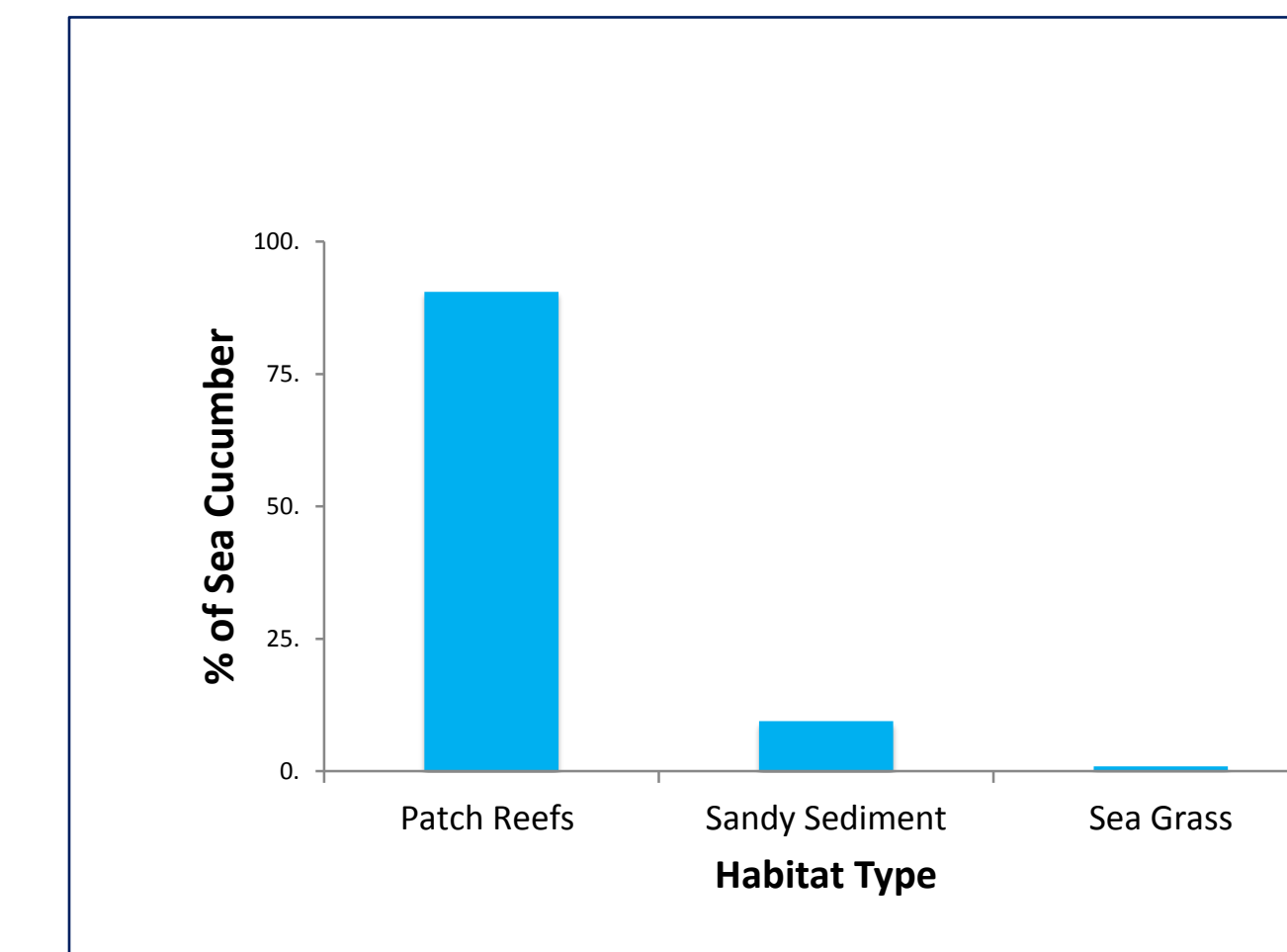


Fig. 8 Percentage of Sea Cucumbers in Different Habitats

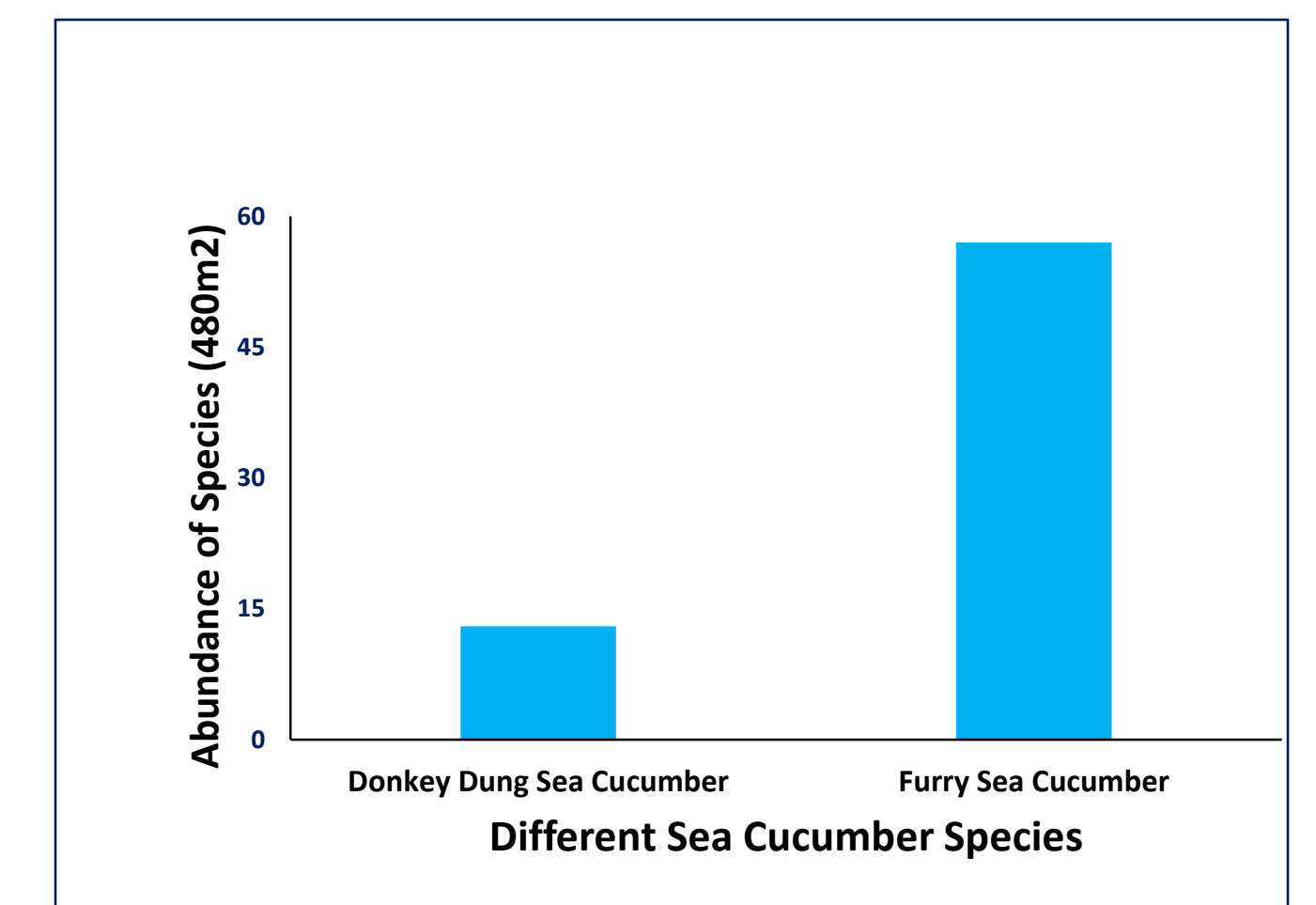


Fig. 9 Abundance of Sea Cucumber Species Variation on Patch Reefs

- Out of the 1085 sea cucumbers we found 90% of them were on patch reefs, 9% on sandy sediment and less than 1% on sea grass [Fig. 8].
- We found 4 times more furry sea cucumbers than donkey dung sea cucumbers on patch reefs [Fig. 9].
- The higher abundance of Furry sea cucumbers in South Eleuthera differed from the results in Andros where there was a higher abundance of Donkey Dung sea cucumbers

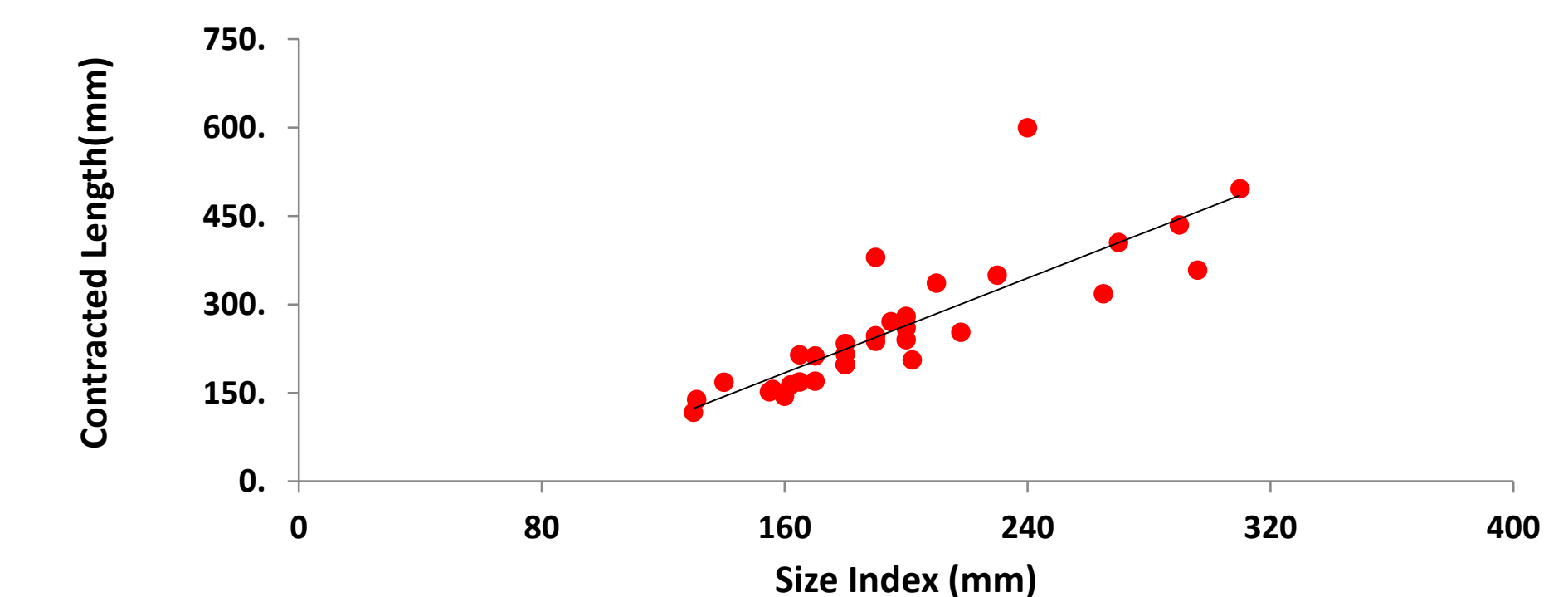


Fig. 10 Size Index -Length Relationship of Sea Cucumbers

- High correlation between sea cucumbers length and size.
- The  $r^2$  value is 0.68, which means that the two variables are highly correlated.

## Discussion

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More information needs to be gathered surrounding the furry and donkey dung sea cucumbers in order to properly inform fisheries management. Little biological data exists to model the population and fishery of either species in the Bahamas. However, previous studies have shown that sea cucumbers are highly vulnerable to over-fishing. Such as Andros where there was slow to no recovery of the species over prolonged periods. This is due to sea cucumbers having delayed maturity of 2-6 years while the life span is 5-10 years. This raises concerns about how quickly the sea cucumber population was depleted in Andros and the opening of a fishery in the Bahamas.

### Future Recommendations

1. Permanent marine reserves
2. Catch quotas



Based off the preliminary results, we would recommend to the Department of Marine Resources that catch quotas and permanent marine reserves be put into place for the sea cucumber fishery if it were to open. From the data collected and how fast a fishery would be depleted, putting a limit on how many sea cucumbers each fisherman can collect and protecting patch reefs will support the sea cucumber populations sustainability in the future.

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Purcell, S., Conand, C., Uthicke, S., Byrne, M. (2016). Ecological roles of exploited sea cucumbers.