Geological and geo-morphological influences on some Sea-cucumber species in Northwest coast of Sri Lanka

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Abstract

The Continental shelf of Sri Lanka is having highly productive ecosystems mainly sea grass beds, marshy lands and coral reefs. These ecosystems are valuable resource for the coastal communities and the marine scientists. Also coastal ecosystems have been utilized as a food source and income generator to each coastal nations.

The current study is focused on bottom geology and relative abundance of sea cucumber species *Holoturia atra* and *Holothuria edulis* which are commercially exploited in north western coast of Sri Lanka. This was the first effort in Sri Lanka to study abundance of sea cucumbers with bottom sedimentological status. However, the study is given encouraging results for further studies on other bottom species such as sea urchins, gastropods and cephalopods.

The study revealed that the sea cucumbers associated with loosely bounded coarse grained sediments. The preferred grain sizes for *H.atra* and *H.edulis* are -0.77• to 0.75• and -0.77• to 0.55• respectively. Also, results indicates that they are concentrated at the 10 meter water depths.

Integrated further studies on bottom oceanic status, side scan imagery and under water video graphs are required to establish a better relationship among the geology, geo-morphology and abundance of bottom animals.

Introduction

Sri Lanka is an small Island which lies at Southern tip of India between 5º to 10º N and 79º to 82º E. Since it is an Island with large sea territory having plenty of marine habitats around the country but never explore systematically. Advanced technologies and integrated geological, geophysical and oceanographic methodologies provide an integrated systems approach for mapping seafloor features that will facilitate the understanding of marine habitats with associated bottom animals. This approach provides an efficient and economic way to image the shallow seafloor and produces data that can be used to address multiple problems in fisheries habitat management. The current study was conducted in northwestern coastal area in Sri Lanka (Fig 1) mainly focused on bottom characteristics and the abundance of sea cucumber. The total number of 230 sediment samples were randomly collected and sieve analysis were done for gradational analysis of the sediments. In addition to sediment analysis abundance of sea cucumber species, *Holothuria atra (H.atra)* and *Holothuria edulis (H.edulis)* were estimated by diving operations.

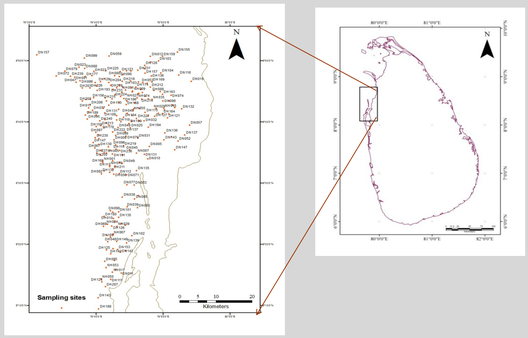

Fig 1 Map of the sampling locations of the study area

Objectives

Major Objectives

The overall objectives of the research is development of a relationship between bottom sediment distribution geomorphology and sea-cucumber abundance in northwest coast of Sri Lanka.

Minor Objectives

(a) Collection of high relief hard bottom data and Digital Elevation Model (DEM) of the area

(b) Identification of gravel, sand, silt beds and comparison with abundance of Sea Cucumber.

Methodology

This study was conducted as part of a resources survey which was carried out in Northwestern coastal area in Sri Lanka year 2009. The purpose of the study was to define the bottom habitats and identification of prospective areas of sea cucumbers.

More than two hundred thirty (230) bottom sediment samples were collected during the survey. In addition to that bottom relief were established using available bathymetric data and the field measurements during the survey. Also, sea cucumber abundance of *H.atra* and *H.edulis* were estimated by diving operations.

Sediments were graded due grain size by sieve analysis and statistical parameters were calculated using Matlab programme. Finally, maps of abundance with gravel, sand, silt, depth, mean and sorting were generated by ArcGIS mapping software.

Also, integrated side scan imaging, bathymetric survey, sea bed video graph and bottom oceanographic status should be included to current study in future.

Results and Discussion

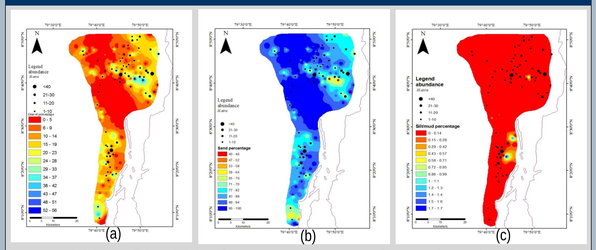

Fig. 2(a), 2(b), 2(c) illustrate the gravel, sand and silt/ mud distribution with abundance of Sea cucumber species *H.atra*

Gravel sand and silt distributions maps were generated in ArcGIS and the abundances of *H.atra* and *H.edulis* were plotted on the maps, (Fig 2 & 3). According to the maps *H. atra* is concentrated into two specific areas in Southern and Northern parts of the study area where sand concentration is about 60 – 80 percent. Also, maps indicated that *H.atra* is associated with least amount of silt/ mud and considerable amount of gravel which represent less than 1 percent and between 10 to 25 percent respectively.

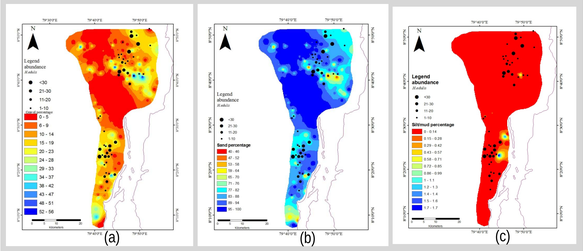

Fig. 3(a), 3(b), 3(c) illustrate the gravel, sand and silt/ mud distribution with abundance of Sea cucumber species *H.edulis*

The study revealed that the *H.edulis* also mainly concentrated in similar areas to *H.atra*. However, field investigations revealed that the available abundance of *H. atra* is relatively greater than the abundance of the *H.edulis*. The results suggest that the area having more favourable bottom condition to *H. atra* than the *H.edulis*

Abundance with Geomorphology

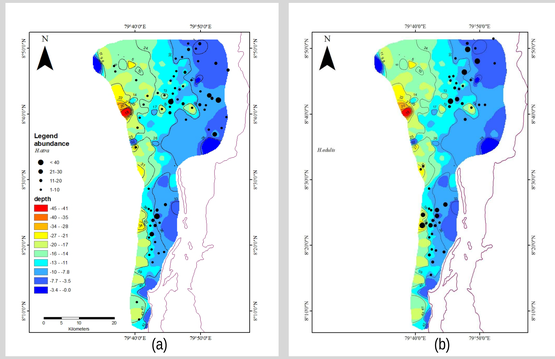

Fig 4 (a) and (b) illustrate the *H.atra* and *H.edulis* distribution in the study area

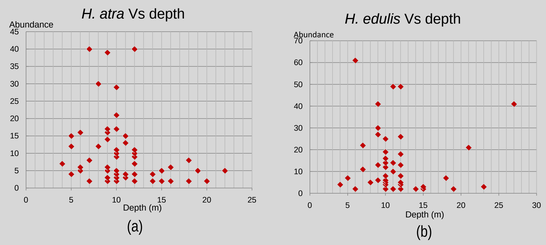

Fig 5 (a) and (b) illustrates the *H.atra* and *H.edulis* distribution in the study area

Fig 4(a) and (b) illustrates the distribution of *H.atra* and *H.edulis* with the geomorphology of the area. The maps shows that both *H.atra* and *H.edulis* area associated with the water depths between 5 to 15 meters in the study area. Also, results indicates that highest concentration of both species are closely associated with the water depth of 10 meters.

Abundance and Mean

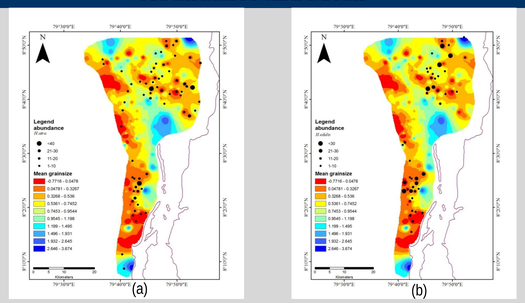

Fig 6(a) and (b) shows the behaviour of *H.atra* and *H. edulis* with mean grain size of the sediments

The Fig 6(a) and (b) illustrate the distribution of *H.atra* and *H.edulis* with the grain sizes. The preferred grain sizes for *H.atra* and *H.edulis* are -0.77• to 0.75• and -0.77• to 0.55• values. The results indicate that the *H.edulis* is more prefer to stay in coarser grained environment than H.atra

Conclusions

H.atra and *H.edulis* are mainly associated with sandy and gravelly bottom in the study area. Since gravel and sand beds having enough porosities that provides media to Dissolved Oxygen (DO) to infiltrate into bottom sediments. Also, loosely bounded gravel and sand beds make facilities to both species to easy access into the bottom. Since silt/ mud are hardly bounded, *H.atra* and *H.edulis* having lesser access capacity to hard bottom. This may be the main reason to those species are associated with loosely bounded soft sediments. The behaviour of *H.atra* and *H.edulis* with grain sizes are bit different. The results indicate that H.edulis is preferred to stay in coarse grain environment than *H. atra*.

Also, the study revealed that the higher abundance of both species are associated with the water depth of 10 meters. In addition to the bottom conditions, the influence of bottom oceanic status are vital factor to study abundance of bottom animal however to be investigated in future.

The current study mainly focused on bottom characteristics, morphology and the abundance of two sea cucumber species. However, further studies are necessary to identify bottom features using side scan sonar imageries and bottom video graphs. The integrated results make access to build up better relationship of regional geomorphology, geology and bottom animal abundance

Acknowledgements

Authors wish to thanks all the team members involved in data collection and sediment sampling during the field. Also, authors wishes to extend their gratitude to professor Dave Monahan and GEBCO guiding committee to accept this as a publication in Fifth annual GEBCO science day. In addition to that financial assistance received by FAO/IFAD project in field sampling would be highly appreciated.

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