INTERNATIONAL JOURNAL OF APPLIED BIOLOGY AND PHARMACEUTICAL TECHNOLOGY

www.ijabpt.com Volume-3, Issue-3, July-Sept-2012 Coden : IJABPT Copyrights@2012 ISSN : 0976-4550

Received: 19th June-2012 *Revised: 23nd June-2012* *Accepted: 26th June-2012*

Research article

FOULING COMMUNITIES ON SHIP WRECK SITE IN THE GULF OF MANNAR, INDIA

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ABSTRACT : The Gulf of Mannar is one of the world's richest marine biospheres and occupies an area of 10,500 sq.km. Twenty one coral reef islands and small patchy reefs are present between Lat. 80^0 47'N and Long. 78^0 12' E to Lat. 90^0 15' N and Long. 79^0 14' E. from Pamban to Thoothukudi as an arc. These islands possess a very interesting heterogeneous group of fauna and flora. The study was conducted on a twenty year old ship wreck in the Gulf of Mannar, India. During low tides, remnants of the ship are exposed to about 1.5 meters above the water surface. The entire ship wreck is regarded as an artificial reef that harbors corals, fishes and other fauna. Artificial reefs are beneficial in reef conservation and rehabilitation efforts. Successions of artificial reef communities were preliminarily studied using the Line and Belt transect method to assess the composition of benthic organisms like soft corals (25.6 %) and live corals (23.1 %). The abundance of several common reef fishes is also reported.

Key words: Shipwreck, Artificial Reef, Fish Community, Gulf of Mannar.

INTRODUCTION

Coral reef ecosystems are not only important for biological diversity and productivity but also for coastal protection, tourism development, and subsistence economies. They serve as focal points for socio-economic and cultural activities in many areas (Wafar 1990). The conservation of coral reefs is a big problem for sustainable development because it is a long term process and requires the support of local stake holders. The destruction of marine environments by both human and natural causes has substantially reduced the fish catch. Therefore, many countries have started developing artificial reefs to increase fish production (Burgess et al. 2003). Historical and modern shipwrecks have become ideal sites for artificial reef development if they are preserved properly on the sea floor. The hard surface of a wrecked ship acts as a habitat for flora and fauna settlement. The accumulation of settled marine organisms in turn creates intricate artificial reef structures and food for the assemblage of fish (Seaman 2005).

The Gulf of Mannar is the biggest Marine Biosphere Reserve in India where twenty one coral reef islands are located between Tuticorin in the South to Pamban in the North. About 3600 species of flora and fauna (Venkatraman et al.2003), more than 90 species of sponges (Burton 1937), 119 species of annelid fauna, a good number of Polychaetes (Fauvel 1930), 450 species of mollusks (Sathyamurthy 1952) and 32 species of corals (Edward and Ramesh 1996) near Pulli Island in the Gulf of Mannar have been reported. Several lobsters, sea fans, sea horses, echinoderms, ornamental shells and crabs (Kumaraguru and Jayakumar 1998), a variety of reef associated fishes Reddiah (1970), two common species of Dolphins (Krishna Pillai et al.1986) and the endangered species of Dugong off the Tuticorin coast (Silas and Fernando 1985) have also been reported in the Gulf of Mannar.

Due to illegal mining and unregulated fishing activities, the coral reef ecosystem got slowly degraded and fish resources gradually declined around the islands (Edward et al. 2004). The main objective of the present study carried out from June 2008 to December 2008, was to take a census of the benthic communities in the sunken ship that served as an artificial reef, and was regarded by local fisher folk as a major fishing site.

MATERIAL AND METHODS

The study area is the site of the twenty year old ship wreck located about 8 km south of Vembar coast in the Gulf of Mannar (N 9°02'08.20, E 78°24'03.02) (Figure-1). The length, width and height are 51 m, 11 m and 9 m respectively (Figure-2).

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The remnants of the ship are exposed about 1.5m above the surface of water at the time of low tide.
The census of the benthic communities in the shipwreck was assessed by the Line Intercept Transect (LIT) method following Loya (1972). Four 10 meter long transects were laid horizontally at a depth of 9 meters using a flexible fiberglass measuring tape.
To assess the abundance of the fish groups, a 5m wide belt transect was used (English et al. 1997). This involved a waiting period of ten minutes after the tape was laid for the fish to settle, followed by slow swimming using SCUBA equipment along the tape while recording the abundance of fish life. The area surveyed was 2.5 meters on either side of the transect tape. By swimming slow enough, it was possible to reduce the chances of counting an individual twice. Some observations that were outside the belt were also taken into account. The percentage cover of each life form category was then calculated following the method of English et al. (1997).

$$\text{Percentage cover} = \frac{\text{Total number of Category}}{\text{Length of transect}} \times 100$$

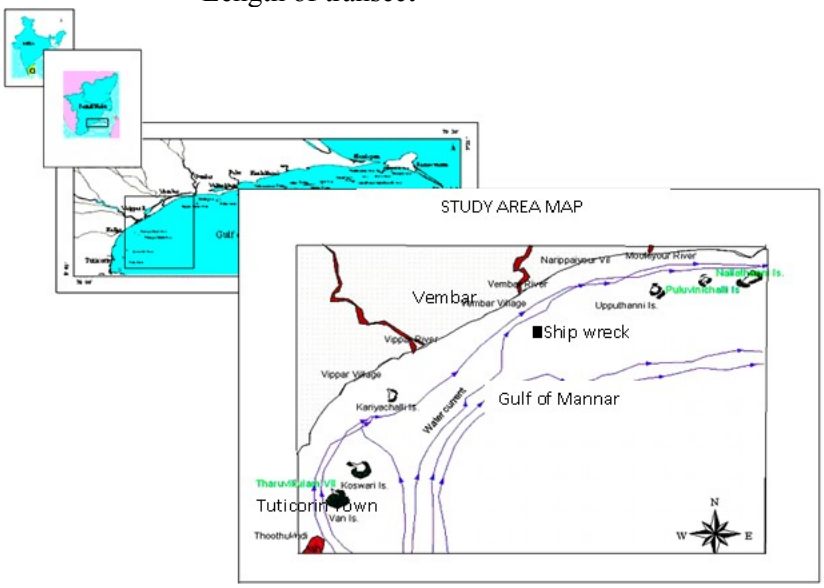
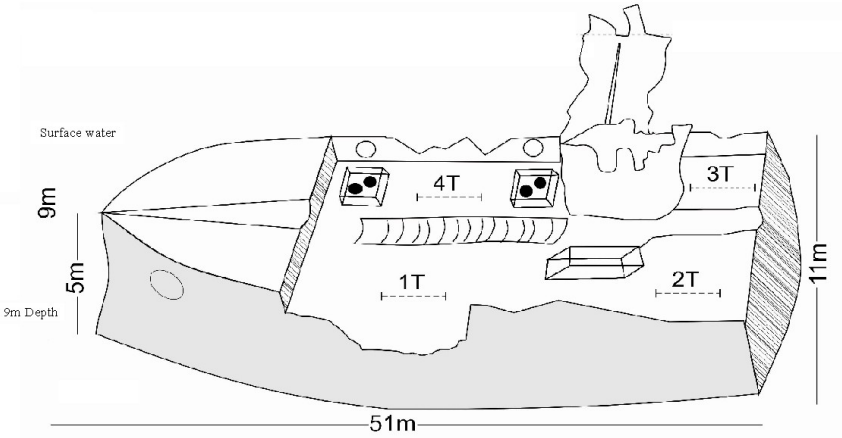


Fig. 1: Location of the study area



T- Transect area (1T-4T), 9m depth, 51m length, 11m width
Fig. 2: A Schematic sketch of the underwater shipwreck

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RESULTS AND DISCUSSION

In the present study, a total of ten categories of benthic organisms were recorded in the wrecked ship. The percentage cover of each category, mean, standard deviation as well as standard error values for benthic communities are shown in table-1. The study revealed that soft corals occupied 25.6 % of the study area and were abundant followed by hard corals that occupied an area of 23.1%. About 18 %, of the surface area of the interior portion of the broken ship was covered with sand and silt. The percentage of area occupied by sponges, tube worms, bivalves, barnacles and algae was 6.3%, 6.3%, 5%, 4.4% and 4.4% respectively and that of other unclassified material was 3.1%.

Table: 1 Benthic biodiversity found in the wrecked ship in the offshore of Vembar, Gulf of Mannar.

S.No.	Benthic form	Percentage cover (%)	Mean	Standard Deviation (SD)	Standard Error (SE)
1	Hard corals (HC)	23.1	9.3	3.3	1.7
2	Soft corals (SC)	25.6	10.3	5.1	2.5
3	Sponges (SP)	6.3	2.5	0.6	0.7
4	Algae (AA)	4.4	1.8	2.2	1.1
5	Tubeworm (TW)	6.3	2.5	1.3	0.3
6	Barnacle (BA)	4.4	1.8	0.9	0.5
7	Bivalve and molluscs (BM)	5	2	0.8	0.4
8	Sea urchins (SU)	3.8	1.5	1.3	0.7
9	Sand and silt (SI)	18	7.3	0.9	0.5
10	Others (OT)	3.1	1.3	0.5	0.3
	Total	100 %			

Reef fish diversity was assessed using the visual census method and showed the percentage of different fish groups as Pempheridae (sweeper fishes) 22%, Labridae (wrasse fishes) 21%, Chaetodontidae (butterfly fishes) 12%, lutjanidae (snapper fishes) 11%, Scaridae (parrot fishes) 8%, serranidae (groupers) 7%, Scorpaenidae (scorpion fishes) 7%, Balistidae (trigger fishes) 5%, Diodontidae (porcupine fishes) 5%, and Muraenidae (moray eels) 2% (Table-2).

Table: 2 Associated fish biodiversity found in the wrecked ship

S.No	Type of Fishes	Percentage cover (%)	Mean	Standard Deviation	Standard Error
1	Chaetodontidae	12	6.8	4.9	2.4
2	Diodontidae	5	3	1.8	0.9
3	lutjanidae	11	6	4.9	2.5
4	Pempheridae	22	13	4.4	2.2
5	Serranidae	7	3.8	1.7	0.9
6	Labridae	21	12	3.7	1.9
7	Scaridae	8	4.8	2.5	1.3
8	Scorpaenidae	7	4	1.6	0.8
9	Balistidae	5	2.8	1.7	1.4
10	Muraenidae	2	1	0.8	0.4

Coral reefs worldwide are being continuously disturbed by natural and man-made stresses that severely deteriorate their condition (Wilkinson 2000). Artificial reefs are regarded as a potential tool for reef restoration and rehabilitation (Black 2001; Black and Mead 2001). In the present study, ten kinds of reef forming corals namely *Acoropora, Favia, Galaxea, Goniopora, Leptoria, Montipora, Pavona, Pocilliopora, Porites* and *Turbinaria* covered the wrecked ship. Coral growth in the wrecked ship in turn harbored various types of associated animals**.** The algal composition was lesser than the coral coverage (Table 1). Various invertebrates such as sea urchins, tube worms, barnacles, bivalves, mollusks, algal biomass, as well as soft corals were observed in the study area (Plate-1 and 2).

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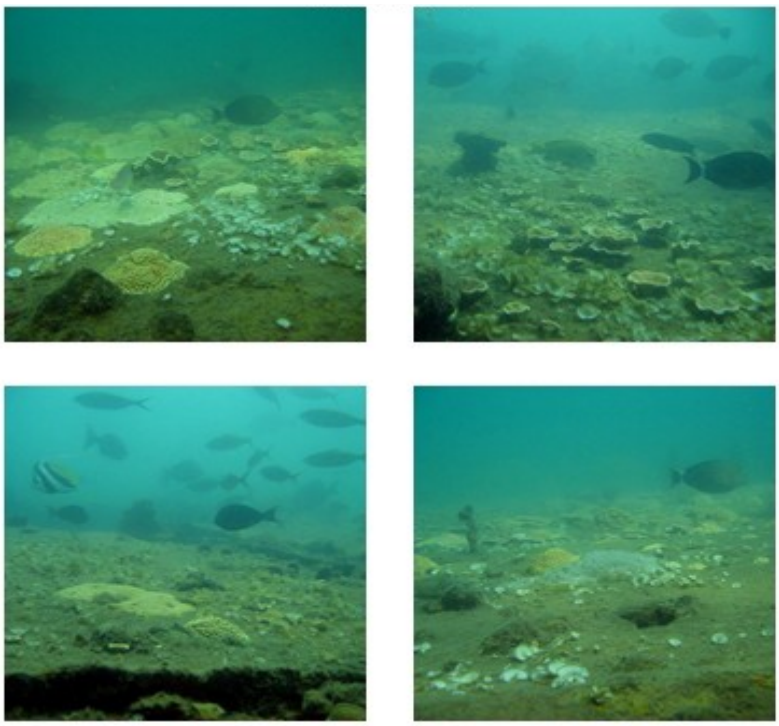

Plate 1. Coral recruitment in the wrecked ship

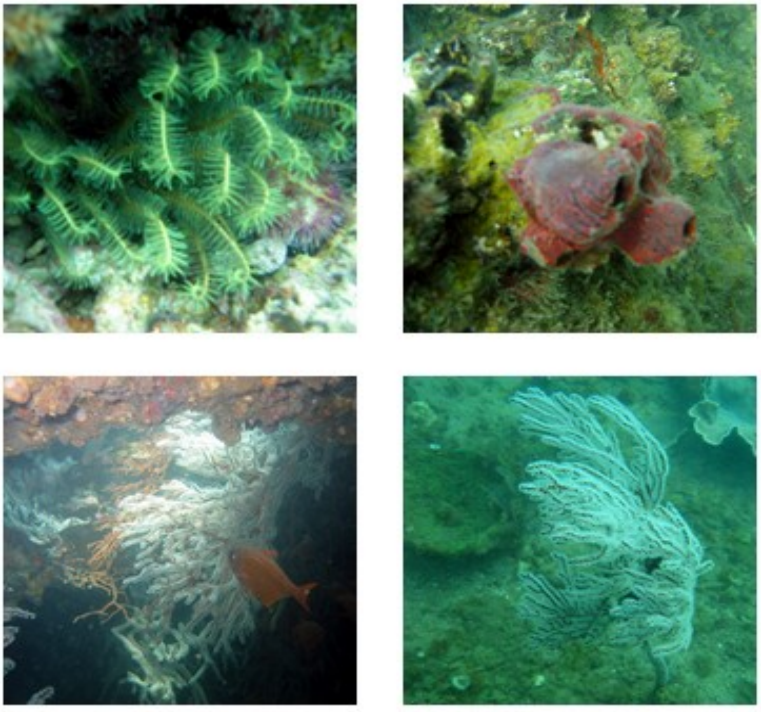

Plate 2. Other associated organisms

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Plate 3 Associated fish

Reef associated fishes (bio-indicators of reef presence) of the families Chaetodontidae, Labridae, Pempheridae, Scorpaenidae were also observed in the wrecked ship (Plate-3). The presence of other commercially important fishes of the family Balistidae, Serranidae, Lutjanidae and Scaridae also indicated that the artificial reef (the wrecked ship) was instrumental for the increase in the diversity of fish and associated fauna (Rao 2004).

The local fisher-folk also actively used the site of the ship-wreck for fishing. Therefore, the creation of artificial reefs in many places on the ocean bottom could create new fertile habitats with higher biodiversity and over-exploitation caused by continuous fishing activities can thus be reduced. If artificial reefs are constructed in many numbers in the near-shore areas, natural coral reefs would be free from the impact of anthropogenic activities. In this way, we can also protect and conserve these fragile ecosystems for the future generation.

ACKNOWLEDGEMENTS

Authors wish to thank Mr. Senbagamoorthy, Department of Forest, Ramnad District for granting permission to survey the Islands. Authors also wish to express their sincere gratitude to the staff of Peoples Action for Development, NGO, Vembar especially to the Executive Director Mr. Rajendraprasad for the help in field surveys. Due gratitude is expressed to my PhD Guide Dr. Sornaraj, associate professor, Kamaraj college, Thoothukudi. I also extend my thanks to Dr. Dr. Christoper Roy, Gust lecturer, JNRM College, Port Blair, Andaman for enriching my knowledge in this study through advice and guidance.

Coden : IJABPT Copyrights@2012 ISSN : 0976-4550

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