



## DEVASTATION EFFECT OF TRADITIONAL BOTTOM-SET-GILL NET FISHERY ON *CLATHRIA FRONDIFERA* (BOWERBANK, 1875) IN NORTHERN GULF OF MANNAR, INDIA

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### ABSTRACT

Even though the quantification and qualification of Trawl bycatch of Indian fishery are documented well, the detailed documentation on sponge by-catch is lacking in all the types of fishing practices. Sponges are the most common by-catch in traditional fishery like bottom-set-gill nets than the bottom trawlers in the Indian scenario. Gill net seems to be ecosystem friendly when compared to other fishing gears but it is equally problematic as a large-scale fishery to the marine ecosystem. Indian sponges, especially *Clathria frondifera* known for their unique and essential biochemical content. Bottom-set-gill nets ("nandu valai"), which are common in the northern Gulf of Mannar region, are the widely used artisanal gears in crab fishery. Among the three selected study sites, Vedhalai (15.760 kg) recorded more amount of *Clathria frondifera* than Ervadi (12.030kg) and Pamban (7.000 kg). The ANOVA single factor analysis clearly indicates that the abundance of *Clathria frondifera* is significantly varied between the study sites ( $P < 0.05$ ) than between the fishing seasons ( $P < 0.5$ ). Consequently, this study proves the lack of research in marine sponge distribution studies in Gulf of Mannar marine biosphere reserve.

**KEYWORDS:** bycatch, red sponge, demospongiae, porifera, crab net.

### INTRODUCTION

Protecting marine biodiversity is a major component of conservation practices and fishing is the ultimate pressure on the similar such as decline in species diversity, shift in the target species availability and diversity and abundance of reef fishes (Russ and Alcala, 1989, Roberts, 1995, Ohman *et al.*, 1997; Gonc *et al.*, 2008). Discarding the organisms is a familiar practice in most of the fishing gears of the worldwide fishery and this activity has unanimously criticized by researchers and policy makers worldwide (Hall *et al.*, 2000, Kelleher 2005; Soykan *et al.*, 2008). Among all fishing gears, bottom-set-gill nets are the passive and size selective fishing gears responsible for 20% of world fish catch (FAO, 2014). Compared to other fishing gears gill net seems to be ecosystem friendly but it is equally problematic as a large-scale fishery to the marine ecosystem (Shester and Micheli, 2011; FAO, 2014).

Marine sponges belong to the Phylum Porifera are omnipresent in the world ocean (Ramkumar *et al.*, 2013) and the major key factor in marine habitat-forming (NRC, 2002). Consequently, the increasing occurrence of sponges in by-catch of various fishing practices leads to biodiversity depletion (Van Dolah *et al.*, 1987, Roberts, 2002; Shester and Micheli, 2011). Unfortunately, the quantitative information about by-catch of sponges in various fishing practices is scarcely documented all over the world. Even though, the quantification and qualification of Trawl bycatch of Indian fishery is documented well (Sujatha, 1995, Menon, 1996, Simon *et*

*al.*, 2005, Kumar and Deepthi, 2006, Dineshababu *et al.*, 2012; Dineshababu *et al.*, 2013), the detailed documentation on sponge by-catch is lacking in all the type of fishing practices. Sponges are most common by-catch in traditional fishery like a bottom-set-gill net than the bottom trawlers in Indian fisheries scenario (Sujatha, 1995, Kurup *et al.*, 2003 and 2004, Kellehar, 2005, Murugan and Durgekar, 2008; Vinod *et al.*, 2014). Indian sponges, especially *Clathria spp.* known for their unique and essential biochemical content (Saravanakumar *et al.*, 2016). The first report on the isolation and structural characterization of N-methyl pyrrolidone from a marine source was from the sponge *Clathria frondifera* (Radhika *et al.*, 2007). Saravanakumar *et al.* (2016) investigated well on the chemical constituent of *Clathria frondifera* and screened 26, 26-Dimethyl-5, 24(28)-ergostadien-3 $\alpha$ -ol, 2-tert-Butyl-4-isopropyl-5-methylphenol and E-15-Heptadecenal compounds. Mohankumar and Tamilselvi (2012) reported that *Clathria sp.* showed more antimicrobial activity than the other sponges against *Staphylococcus sp.*

Bottom-set-gill nets, which are common in northern Gulf of Mannar region, are widely used in artisanal fishing gears for crab fishery (Murugan and Durgekar, 2008). The red sponge, *Clathria frondifera* found to be one of the common by-catches in crab net fishery of Gulf of Mannar (Radhika *et al.*, 2007). A detailed account of bycatch of *Clathria frondifera* from all the types of fishing gear operated in Gulf of Mannar is also not available, though widely reported for its biochemical content by the

researchers (Selvin and Lipton, 2004). Accordingly, documentation of by-catch status of *Clathria frondifera* is very much important for the future conservation and sustainable utilization of the species. Therefore the present study is aimed to investigate the bycatch status of *Clathria frondifera* of northern Gulf of Mannar coast for the first time in India.

**MATERIALS & METHODS**

The bottom-set-gillnet locally called as "*nandu valai*" fishing was observed for by-catch of *Clathria frondifera* during 24 continues fishing months from August 2012 to July 2014. Along the northern Gulf of Mannar, Pamban (9°16'21.10" N, 79°12'56.43" E), Vedhalai (9°15'48.31° N, 79°6'10.65" E) and Ervadi (9°12'20.07" N, 78° 44'8.52" E) are the major crab net fishing villages which were selected as the study sites (Fig.1 and 2).



**FIGURE 1.** Map showing the details of three study sites along the northern Gulf of Mannar, southeast coast of India.



**FIGURE 2.** A sample of *Clathria frondifera* (Bowerbank, 1875) collected from the study sites.

Based on the prevailing wind direction, the study period was grouped as four fishing seasons. The first fishing season is from August 2012 to January 2013 and the second, third and fourth fishing seasons were from February 2013 to July 2013, August 2013 to January 2014 and February 2014 to August 2014 respectively. Depends upon the fishing area depth, crab net has 100 to 125cm height and 200 to 300m length. The body of the net made of high-density monofilament nylon rope with a square mesh size of 80 to 100mm. Both the head and foot ropes are of thick multifilament nylon rope, but the head rope made without any floating aids and the foot rope made

with lead weights at a distance of 1 meter. The fishing grounds are on sea grass meadows and nearby reef areas with a distance of 0.5 to 5 km from the shore. Fishing depth is limited up to 10 meters, generally in 3 to 6 meter. In a group of 3 to 6 fishermen go for fishing in a wooden boat locally called as "*vallam*". The overall length of the "*vallam*" is between 20 and 23 feet and based on the number of crews; each craft carries 5 to 25 nets. Among the crews, one person balances the craft and others deploy the nets parallel to the shore. To ensure the position, both the end of the net tied with a bottom weight and a colorful buoy as a marker. Usually, the nets deployed during

evening hours and returned back next day morning. After the retention period of 12 to 14 hours, fishing nets were taken back to the boat and sorting carried out in shore. Samples from each study site were collected from 6 crab nets during every month and weight of the collected samples was recorded. Before the sample collection, length, width and retention time of the nets were selected uniformly from all the study sites. Samples were properly identified with their morphological and spicule characters (Hooper and Van Soest, 2002).

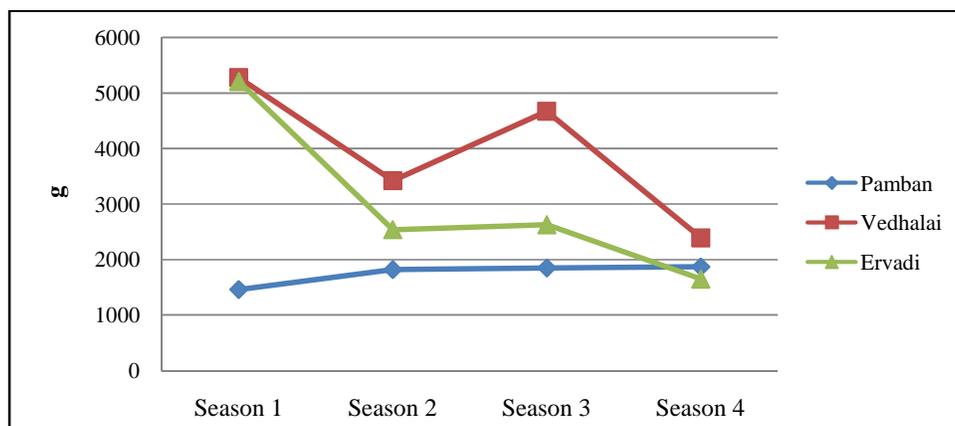
## RESULT

In all the three study sites, by-catch samples of *Clathria frondifera* were collected six times per month from August 2012 to July 2014 from crab nets operated by the traditional *vallam* with similar net sizes. A total of 34,790 g of *Clathria frondifera* were recorded from 150 samples along the three study sites during the study periods. The maximum amount of *Clathria frondifera* were recorded in Vedhalai (15,760 g) followed by Ervadi (12,030 g) and Pamban (7000 g) during the study period (Fig. 3). Crab nets from Vedhalai recorded more amount of *Clathria frondifera* by-catch during all the four seasons during the three-year study periods. In first fishing season, 11,950 g of *Clathria frondifera* were recorded from all the three study sites and it declined nearly 40 % (7,780 g) during the second fishing season (Fig. 3). This amount was slightly increased during the third fishing season i.e., 9,150 g but it was only 5,910 g during the fourth fishing season. Subsequently, the first and fourth fishing season recorded more quantity of sponges whereas this falls during the month of August to January in all three study years. In Pamban, during the first fishing season, 1,460 g of samples were recorded with the highest record on October (730 g) and the lowest record on November (200 g) but there were no samples were recorded during August, September and January during the study period. Samples collected during the second, third and fourth fishing seasons found no much variations and it was 1820 g, 1850 g and 1870 g respectively. During the second fishing season, February recorded 950 g followed by March i.e., 480 g and June i.e., 390 g but no record in

April, May and July months. Samples recorded in the third fishing season showed a slight variation from the first fishing season. Like the first fishing season, October (600 g) and November (470 g) months recorded maximum and minimum samples, but the second largest quantity of sample recorded in January. With respect to total samples recorded in a season, fourth and second fishing season were identical.

Vedhalai recorded 5280 g of samples during the first fishing season and showed no identical on total sample recorded between the fishing seasons. Among the four seasons of this study site, the first fishing season recorded most amount of *Clathria frondifera* (5280 g) with January as the highest recorded month. During the second fishing season, a total of 3420 g of sponge samples were recorded during February, March and April only the observed quantities in the respective month were 1720 g, 910 g and 790 g. A total of 4670 g of samples were recorded during the third fishing season (Fig. 3), of which the highest record in December (2240 g) followed by January (840 g), November (740 g), October (600 g) and August (250 g). Among all four fishing seasons in Vedhalai, least amount of samples was recorded in a fourth fishing season. However, during March and February, the collected quantities of samples were 1180 and 930 g respectively, but only 280 g of samples were recorded during March.

In Ervadi, a total of nearly 5210 g of sponge samples were recorded during the first fishing season while this was 2540 g, 2630 g and 1650 g during the second, third and fourth fishing seasons respectively (Fig. 3). During August, September, December 2012 and January 2013 of the first fishing season, the recorded quantity of samples in Ervadi were 1780, 530, 800 and 2100 g respectively. During the second fishing season, the weight of sponge samples recorded was 730 g in February, 960 g in March, 550 g in April and 300 g in July respectively. In November, December and January months of the third season, only minimal quantities of samples were recorded i.e., 540 g, 1300 g, and 790 g respectively. However, the fourth fishing season of this study recorded less quantity i.e., 900, 230 and 520 g in February, April and July respectively.



**FIGURE 3.** The trend line showing the recorded quantity of *Clathria frondifera* from the study sites during the four fishing season.

The ANOVA single factor analysis clearly indicates that the quantity of recorded *Clathria frondifera* samples were

varying more significantly between the study sites ( $P < 0.05$ ) than the fishing seasons ( $P < 0.5$ ) (Table I).

**TABLE I.** ANOVA results of comparative abundance of *Clathria frondifera* between the fishing seasons and study sites.

Source of Variation	SS	df	MS	F	P-value
Between Season	4429625	3	1476542	0.886727	0.48813
Between Sites	1773779	2	886889.3	3.047229	0.053659

## DISCUSSION

During last few decades fishing sector has focused on conservation-oriented practices mainly on charismatic species like dolphins, turtles, sharks and whales (Perrin, 1968; WWF, 2004). But recently researchers broadened their view to addressing the concerns over the discards of non-charismatic species like juveniles of fishes, Invertebrates, and birds (Hall *et al.*, 2000; Eayrs, 2007 and Dineshbabu *et al.*, 2014). Even though, bottom-set-gill nets are rarely investigated for their bycatch related issues, sponge bycatch in these nets were apparent in Gulf of Mannar by several biochemical studies (Selvin and Lipton, 2004, Radhika *et al.*, 2007, Mohankumar and Tamilselvi, 2012; Issac *et al.*, 2012 and Saravanakumar *et al.*, 2016). However, the biochemical property of the common tropical red sponge *Clathria frondifera* was investigated well from the Gulf of Mannar (Radhika *et al.*, 2007; Mohankumar and Tamilselvi, 2012 and Saravanakumar *et al.*, 2016), distribution, abundance and by-catch data of this sponge species in Gulf of Mannar are lacking. Unfortunately, Gill nets used in the traditionally fishing practices and their sponge by-catch are overlooked in Gulf of Mannar.

Since crab net fishery does not have any fishing ban period, fishing carry out all over the year. But the fishing frequency may vary depending upon the wind direction, thus the fishers divided the fishing seasons. Consequently, the month of August to January is the most preferred active fishing season and February to July are less preferred fishing seasons. The ANOVA result and fishermen's opinions coincide in the statement that no particular season for the availability of *Clathria frondifera* in this region.

## CONCLUSION

The main focus of the study reveals that *Clathria frondifera* are the major by-catch composition in the bottom-set-gill net fishery along the northern Gulf of Mannar. The year around the presence of *Clathria frondifera* expose the wider distribution and abundance of this species in northern Gulf of Mannar region.

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