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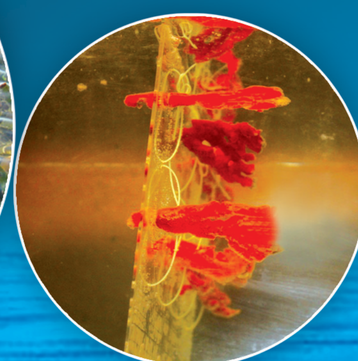

Technical and Extension Series

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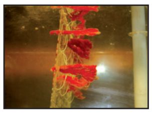
Deepsea shrimp trawler at Kollam


A view of *Spirastrella inconstans in Palk Bay*


Explants of *Echinodictyum gorgonoides* fixed to perspex panel

CONTENTS

The Marine Fisheries Information Service : Technical and Extension Series envisages dissemination of information on marine fishery resources based on research results to the planners, industry and fish farmers, and transfer of technology from laboratory to field.

Lanternfishes (Myctophids): by-catch of deepsea shrimp trawlers operated off Kollam, south-west coast of India

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Introduction

By-catch and discards have received a great deal of scientific attention, their minimisation being a goal of marine fisheries management (Powers, 2006). The Nordic workshop (Nordic Council of Ministers, 2003) defined by-catch as "the proportion of the catch which is taken on the board, or brought to the surface by the vessel and which is subsequently thrown back to sea, dead or dying or likely to die". Most of the earlier studies deal with optimisation of fishing efficiency and minimisation of fishing impact, but by-catch and discards data have rarely been used to learn about the distribution, abundance and biology of the incidental species being caught, although several recent studies have indicated the informative value of by-catch concerning food habits (Koen Alonso *et al.,* 2001), feeding ecology (Rheeder and Sauer, 1998) and recruitment indices (Payne *et al.,* 2005).

According to FAO discard database, during 1992 - 2001, yearly average discards were estimated as 7.3 million t of which Indian Ocean accounted for about 9%. Mesopelagic fishes are common by-catch in many of the world's fisheries targeting deepsea shrimp species. Shrimp trawl fisheries generate a higher proportion of discards than any other fishery type (Alverson *et al.,* 1994) and account for more than one third of the estimated total global discards from fisheries (Pascoe, 1997). In most cases, the weight of the by-catch exceeds that of the shrimp catch and is comprised of tens or hundreds of species of fish and invertebrates (Stobutzki *et al.,* 2001; Steele *et al.,* 2002). In the past, most of the mesopelagic fish catches were discarded without being properly recorded.

The mesopelagic zone has been defined in different ways based on depth, temperature and light regimes. Depth seems to be the best criterion and mesopelagic fish can be defined as fishes that live in the mesopelagic zone *i.e.*, between 200 and 1000 m depth. Beebe (1935) was the first fishery biologist to observe myctophid fishes in the mesopelagic zone of the ocean. Many fish families fall within this definition, but generally the Myctophidae, Neoscopilidae and Gonostomatidae are dominant. Sternoptychidae, Bathylagidae, Chiasmodontidae, Trichiuridae, Nomeidae and others seem to be fairly important in some areas. In the present paper, the main emphasis has been given to the family Myctophidae.

Myctophids are the most species-rich family of mesopelagic communities in the world's oceans (Gjøsaeter and Kawaguchi, 1980), with an estimated biomass of about 70–200 million t (Lubimova *et al.,* 1987). Family Myctophidae comprises 32 genera with at least 240 species (Nelson, 2006), found in all oceans from near surface to deep waters. They are thought to migrate to the productive epipelagic zone, which contributes to their abundance in the open sea (Watanabe *et al*., 2002). About 55 species of myctophids are known from the Arabian Sea including its southern part of the Indian Ocean (Kornilova and Tsarin, 1993; Tsarin, 1993), with an estimated biomass of 100 million t of *Benthosema pterotum* (US GLOBEC, 1993). Karuppasamy *et al.* (2006) reported 27 species of myctophids from Indian EEZ. Somvanshi *et al.* (2009) reported five species of myctophids from south-west coast of India. Gopakumar *et al*. (1983) studied the fatty acid composition of *B. pterotum* and Lekshmi Nair *et al.* (1983) carried out nutritional evaluation of the fish meal and fish hydrolysates of *B. pterotum* from Gulf of Oman and found them to be of good quality, which could be used as a protein supplement in animal feeds.

The present report describes the myctophid by-catch along with other mesopelagic fish catch by deepsea shrimp trawlers operating in the

Quilon bank (8^0 N -11^0 N and 74^0 E -76^0 E), Kerala coast. Regular observations were made in the two major fish landing centres, Sakthikulangara, Kollam and Cochin Fisheries Harbour from December, 2008 to May, 2009 and subsamples of by-catch were collected to identify the myctophid species in the deepsea trawl fisheries. The trawlers operating from Neendakara and Cochin Fisheries Harbours have an OAL of 13-16 m with an engine power of 100 to 120 HP and fitted with echosounders, GPS *etc.* (Fig. 1). The shrimp trawls have mesh sizes ranging from 40 mm (in the front part) to 28 mm (in the codend). Based on the usual catches of bottom trawl operation, it was found that shrimps mostly inhabited the uneven bottom surface. The trawlers specifically targeted *Aristeus alcockii, Heterocarpus woodmasoni, Heterocarpus gibbosus, Plesionika spinipes* and *Metapenaeopsis andamanensis*. These trawlers stay back at sea for 9 to 15 days and operate at a depth range of 350 to 450 m. Trawling operations are mainly carried out during early morning as well as late evening and the catches were dominated by deepsea shrimps. The trawling operations extend from 4 to 6 h at a towing speed of 2 knots. Normally in each operation, by-catch contributes about 20 to 40% along with targeted species. Sometimes the by-catch exceeded more than 80% and was discarded without being taken onboard the vessel. So far there is no mechanism to make a reasonable estimate of these discards. Identification of fish species was carried out following Smith and Heemstra (1986) and Fischer and Bianchi (1984).

The major components in the by-catch belonged to the families Rhinochimaeridae, Echinorhinidae, Centrophoridae, Squalidae, Stomiidae, Sternoptychidae, Gonostomatidae, Ateleopodidae, Chlorophthalmidae, Ipnopidae, Evermannellidae, Neoscopelidae and Myctophidae. The identified species are listed in the Table 1.

By-catch comprised considerable quantity of small shrimps and non-conventional deepsea fishes of marketable size (Fig. 2). After onboard sorting, they were brought to the landing centres and sold for nominal price, to be mainly used in fishmeal production (Fig. 3). Of late, due to heavy demand for fish and high cost, some of the species are being used for human consumption, fetching about Rs. 30-45/- per kg. All large sized chondrichthyans belonging to families like Rhinochimaeridae, Echinorhinidae, Centrophoridae and Squalidae are getting high values in the landing centres.

Fig. 1. Deepsea shrimp trawler at Kollam

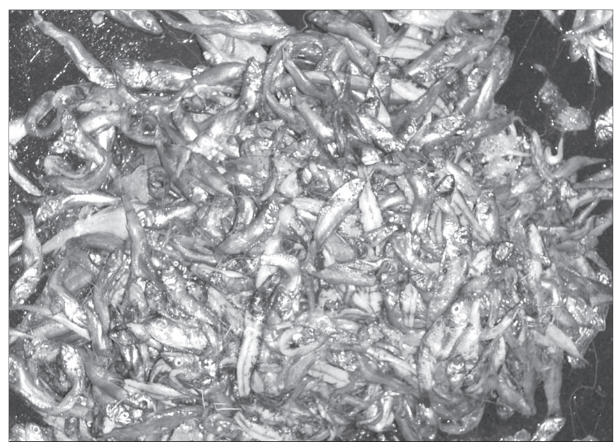

Fig. 2. By-catch and discards

Fig. 3. Low value by-catch landed at Cochin

Among the lanternfishes, benthopelagic myctophids dominated followed by Neoscopilids. *Diaphus* was the most abundant genus followed by

Table 1. Major species observed in the by-catch

Family	Species
Rhinochimaeridae	*Neoharriotta pinnata* (Schnakenbeck, 1931)
Echinorhinidae	*Echinorhinus brucus* (Bonnaterre, 1788)
Centrophoridae	*Centrophorus* sp.
Squalidae	*Squalus* spp.
Rajidae	*Dipturus* sp.
Notacanthidae	*Notacanthus* sp.
Congridae	*Bathyuroconger vicinus* (Vaillant, 1888)
Nemichthyidae	*Nemichthys scolopaceus* Richardson, 1848
Alepocephalidae	*Alepocephalus* spp.
Stomiidae	*Astronesthes indicus* Brauer, 1902
	Chauliodus sloani Bloch & Schneider, 1801
Sternoptychidae	*Polyipnus indicus* Schultz, 1961
	Polyipnus sp.
Phosichthyidae	*Vinciguerria* sp.
Ateleopodidae	*Ateleopus indicus* Alcock, 1891
	Ijimaia loppei Roule, 1922
Chlorophthalmidae	*Chlorophthalmus bicornis* Norman, 1939
	Chlorophthalmus agassizi Bonaparte, 1840
Ipnopidae	*Bathypterois atricolor* Alcock, 1896
Evermannellidae	*Evermannella indica* Brauer, 1906
Neoscopelidae	*Neoscopelus microchir* (Matsubara, 1943)
Myctophidae	*Myctophum obtusirostre* Tåning, 1928
	Diaphus thiollierei Fowler, 1934
	Diaphus watasei Jordan & Starks, 1904
	Myctophum fissunovi Becker & Borodulina, 1971
	Diaphus garmani Gilbert, 1906
Macrouridae	*Malacocephalus laevis* (Lowe, 1843)
	Nezumia propinqua (Gilbert & Cramer, 1897)
	Gadomus spp.
Moridae	*Physiculus roseus* Alcock, 1891
Ophidiidae	*Dicrolene multifilis* (Alcock, 1889)
	Glyptophidium argenteum Alcock, 1889
	Glyptophidium sp.
Acropomatidae	*Synagrops* spp.
Lophiidae	*Lophiomus setigerus* (Vahl, 1797)
Trachichthyidae	*Gephyroberyx darwinii* (Johnson, 1866)
Berycidae	*Beryx splendens* Lowe, 1834
	Beryx sp.
Zeidae	*Zenopsis conchifer* (Lowe, 1852)
Setarchidae	*Setarches guentheri* Johnson, 1862
Scorpaenidae	*Pontinus nigerimum* Eschmeyer, 1983
Triglidae	*Pterygotrigla hemisticta* (Temminck & Schlegel, 1843)
Priacanthidae	*Priacanthus hamrur* (Forsskål, 1775)
	Heteropriacanthus sp.
Centrolophidae	*Psenopsis cyanea* (Alcock, 1890)
Trichiuridae	*Trichiurus auriga* Klunzinger, 1884
Bathyclupeidae	*Bathyclupea* sp.
Gempylidae	*Neoepinnula orientalis* (Gilchrist & von Bonde, 1924)
Polymixiidae	*Polymixia japonica* Günther, 1877
Ariommatidae	*Ariomma indica* (Day, 1871)
Nomeidae	*Cubiceps whiteleggii* (Waite, 1894)
	Cubiceps sp.
Percophidae	*Bembrops caudimacula* Steindachner, 1876
Peristediidae	*Peristedion miniatum* Goode, 1880
Bothidae	*Chascanopsetta lugubris* Alcock, 1894
Samaridae	*Samaris cristatus* Gray, 1831
Cynoglossidae	*Cynoglossus arel* (Bloch & Schneider, 1801)

Myctophum in the family Myctophidae. Among the myctophids, *Diaphus watasei* was the most dominant species. *Diaphus garmani* was recorded for the first time from the Indian waters (Fig. 4). The identified species of the family Myctophidae includes *D. watasei, D. thiollierei, D. garmani, Myctophum obtusirostre* and *M. fissunovi.* Length frequency studies of *D. watasei* was carried out. A total of 90 samples of *D. watasei* were examined and the S_L ranged from 7 to 13 cm with a prominent mode at 10 cm. Gut content analysis of *D. watasei* (n = 86) revealed that stomach of most of the fishes were empty.

Fig. 4. *Diaphus garmani*, 54 mm LS

In the present study, information on landings of myctophids as a major component in the by-catch of deepsea shrimp trawlers was confirmed. Most of the species obtained were benthopelagic and are available significantly during early morning and late evening which provide information on biology and species compositions. *D. watasei* was the most dominant species observed during the study. Based on the observations of the present study, it is suggested that bottom trawling survey along with midwater trawling should be carried out in order to estimate the actual biomass of myctophids in the Arabian Sea.

Preliminary studies on the growth in captivity of *Spirastrella inconstans* (Dendy) collected from the intertidal region of Palk Bay, south-east coast of India

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Marine sponges are rich sources of bioactive metabolites that can be used as lead compounds to treat various diseases. Although concerted efforts resulted in the development of many new bioactive compounds from marine sponges, only very few compounds have reached the clinical trial stage. One of the reasons for this, as cited by many workers is that many of the sponge bioactive metabolites are highly toxic, thus leading to a low therapeutic index. However, the second major reason is the ‘supply problem’. Collection of large quantities of sponge biomass from the wild becomes a pre-requisite for obtaining sufficient amounts of metabolites from natural populations. Consequently, the natural populations may not be able to sustain such heavy exploitation.

Although chemical synthesis of the target compounds is a more direct method to overcome the issue of over-exploitation of wild population, many natural products are not amenable to chemical synthesis due to the complexity of their chemical structure. Therefore, the second option is to produce large quantities of the target species through suitable aquaculture techniques which would ensure a steady supply of material. This would also ensure the protection of depleting natural stocks.

In India, studies on sponge aquaculture is still at infancy. Preliminary studies on the growth of selected species would provide baseline information for future strategic research planning to develop innovative culture techniques for potential marine sponges.

In this backdrop, an attempt was made to understand the growth behaviour of one of the potential sponge species, *Spirastrella inconstans* which is found distributed in the Gulf of Mannar and Palk Bay, south-east coast of India. Studies by earlier workers have proved that *S. inconstans* from Krusadi Island exhibited diuretic activity. They have also shown that *S. inconstans* var. *digitata* from Rameswaram exhibited antiviral activity against *Encephalomyocarditis* virus.

Systematic position of the candidate species

Phylum	: Porifera
Class	: Demospongiae
Order	: Hadromerida
Family	: Spirastrellidae
Genus and Species	: *Spirastrella inconstans* (Dendy)

Salient characteristic features of *Spirastrella inconstans* selected for study

Spirastrella inconstans is found commonly distributed in the intertidal region of Palk Bay and Gulf of Mannar. The colonies of the same species look morphologically different. Some are massive, while others are digitate forms having finger-like projections. The basal portion is found partly buried in sand and during extreme low tides, the upper portion of the animal often lie exposed (Fig. 1). The colouration is pale yellow internally and brown externally, when alive. In massive forms, the oscules are found scattered, while in digitate forms, the oscules are found mainly in the terminal portion. The diameter of the oscules range from 1.5 to 3.0 mm.

Fig. 1. A view of *Spirastrella inconstans* lying partially exposed during low tide in Palk Bay

Collection and identification

The specimens of *S. inconstans* were collected from Palk Bay (Mandapam region) in July 2007 and transported live to Cochin. The spicule characteristics from different regions of sponge body were studied in detail for confirming the species identity. The analysis revealed the presence of two types of spicules *viz.*, i) Tylostyles : 150.01–567.86 µm x 2.04–21.92 µm and ii) Spirasters : 6.86–24.81 µm x 0.81–3.36 µm (Fig. 2).

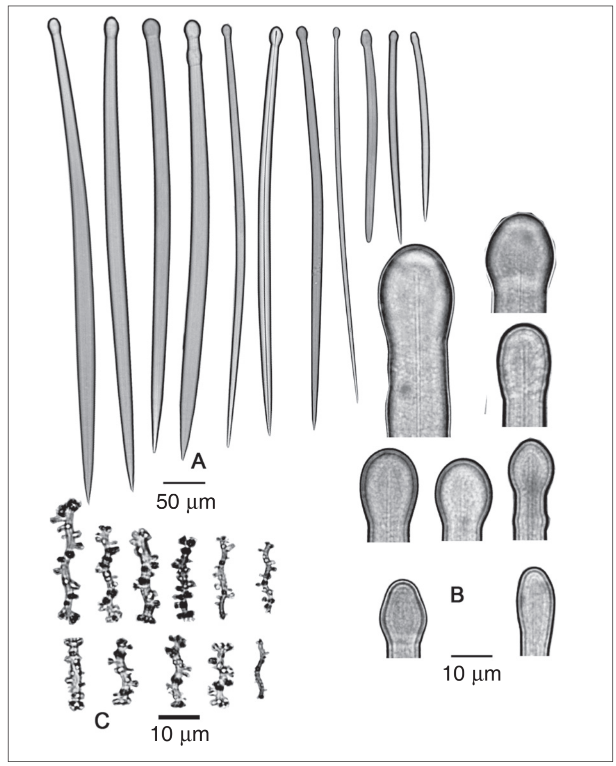

Fig. 2. Spicule characteristics of *Spirastrella inconstans*

Growth in captivity

Three live specimens of *S. inconstans* (designated here as A, B and C) were maintained live in 2 t capacity FRP tanks. Filtered seawater having a salinity of 33-35 ppt was used. Water temperature ranged from 26.0–29.7 °C while pH ranged from 7.78 to 7.96. Microalgae was provided once a day in the morning hours. All the three specimens were found to survive well in captivity and showed good growth. The growth increment for a period of one month from 15th September to 15th October, 2007 is presented in this paper. The growth in terms of increment in height is mentioned. Specimen A showed an increase in growth from 149 mm to 175 mm in a span of one month (Fig. 3), while specimen B showed a growth increment of 12 mm (104 to 116 mm) (Fig. 4) during the same period. Specimen C showed an increase in growth from 121 to 132 mm in one month period (Fig. 5).

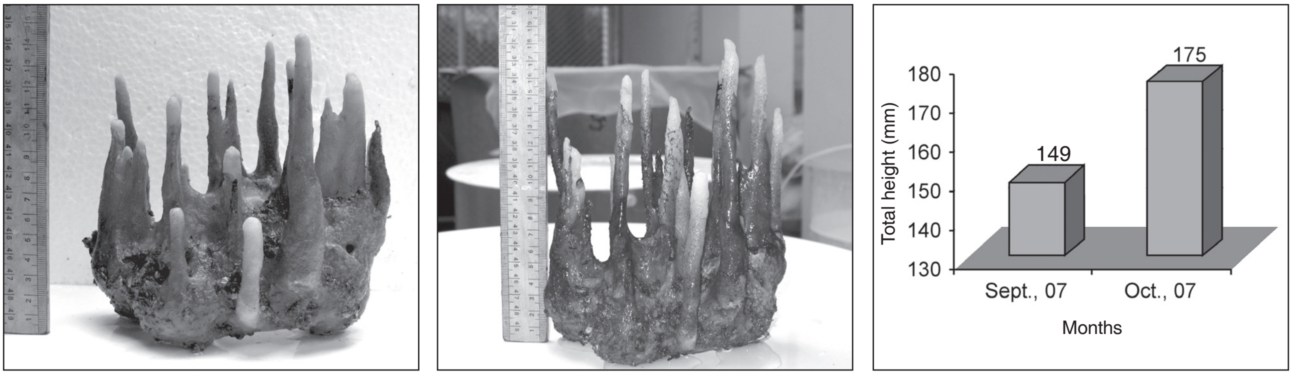

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Fig. 3. Growth of *Spirastrella inconstans* (Specimen A)

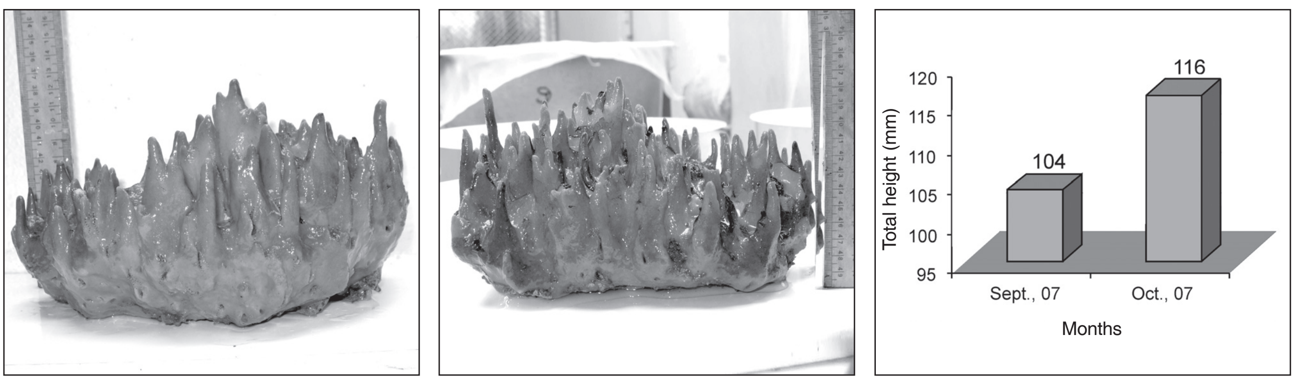

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Fig. 4. Growth of *Spirastrella inconstans* (Specimen B)

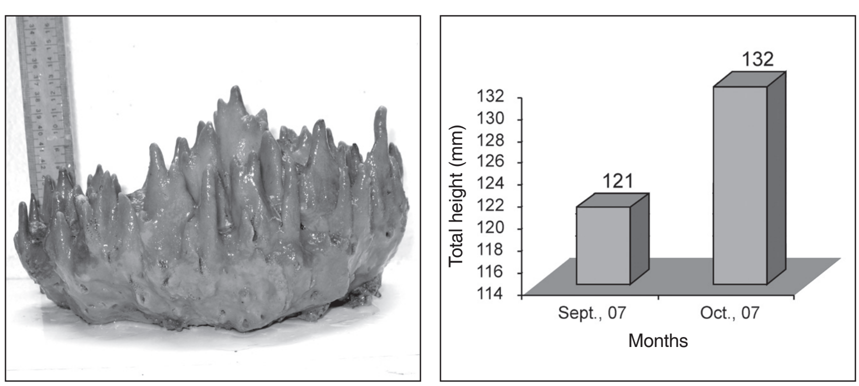

Fig. 5. Growth of *Spirastrella inconstans* (Specimen C)

The present study demonstrated that some of the sponges can thrive well in culture systems, which is a pre-requisite for any propagation programme. There is a need to develop suitable cost-effective culture techniques for large biomass production of potential sponge species which would enable a steady supply of materials required for pharmaceutical industries. Farming of potential species would also minimise the pressure of over-harvest from the wild.

Mariculture of marine sponges for drug development : bioactivity potentials of cultured sponges, *Callyspongia subarmigera* (Ridley) and *Echinodictyum gorgonoides* (Dendy)

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Among all metazoan phyla, marine sponges are considered as the richest source of biologically and pharmacologically active chemicals. More than 5,300 different products are recorded from sponges and their associated microorganisms. Every year, about 200 new metabolites are reported from sponges. Considering the emerging diseases and the rapid development of disease resistance among microbes, the detection of novel metabolites from sponges gains importance and also provides scope for developing new drugs against disease causing bacteria, virus, fungi and parasites. In nature, the chemical interactions in the marine habitat of sponges suggest that products from them function as defense tools to protect them against predators including fish. Sponge product ara-A (vidarabine), the anti-viral drug used against the *Herpes simplex encephalitis* virus has advanced to the late stages of clinical trials. Others such as manzamine A (activity against malaria, tuberculosis, HIV and others), lasonolides (antifungal activity) and psammaplin A (antibacterial activity) are considered as promising leads. However, most sponges contain only trace quantity of the bioactive molecules. The increasing demand for initial experimental trials, possible success and subsequent industrial use for scaling up will lead to severe pressure on the wild population and hence the possible overexploitation and extinction of the target species as such. In view of the limited availability of larger quantities of defined source material (the so-called 'supply problem'), and to cater to the requirements without loss of bioactive potential, mariculture could be considered as one of the best options. Hence, mariculture of two species *viz.*, *Callyspongia subarmigera* (Ridley) and *Echinodictyum gorgonoides* (Dendy) was attempted at Vizhinjam Research Centre of CMFRI. The salient findings of the experimental culture of these two species of sponge by two methods *viz.*, culture in re-circulatory semi-enclosed aquaria and culture in open sea together with their bioactivity potential during culture conditions are presented.

Sponge culture in the offshore laboratory conditions

All-glass aquarium tanks of 60x45x30 cm fitted with filtration unit and perforated perspex panels served as bioreactors for sponge culture in the laboratory. Compressed air with air–water lift was provided for re-circulating seawater and for development of ammonia oxidising bacteria in the bioreactor.

Explant preparation and culture

Freshly collected sponge *Echinodictyum gorgonoides* from Kanyakumari were washed and explants of about 5 ± 1 g size were prepared by cutting with a sharp surface-sterilised knife. Individual explant was weighed and kept in seawater without allowing them to dry. The explants were fixed to the perspex panel as could be seen from Fig. 1.

Fig. 1. Explants of *Echinodictyum gorgonoides* fixed to perspex panel

Feeding of sponge explants in the laboratory culture system

The sponge explants fixed in perspex sheet in the aquarium were fed with microalga *Nanochloropsis* sp. at the rate of 3.5×10^6 cells initially. The cell density was increased gradually and the algal feed was provided twice per day. The wastes remaining in the culture system were removed every day and water was exchanged on alternate days. At different intervals of time, sponge tissues from the bioreactor were aseptically removed for evaluating the bioactivity using standard microbiological and other bioassay methods.

Sponge culture in the open sea

Experiments were conducted to evaluate the growth and bioactivity performance of sponges cultured in open sea conditions. For this set of experiments, sponges *C. subarmigera, E. gorgonoides* and *C. diffusa* collected off Kanyakumari and Vizhinjam were used. The sponge masses were cleaned with fresh seawater, placed in plastic circular fruit baskets (closed) and held at varying depths of seawater at Vizhinjam Bay, Trivandrum coast. They were tied one above the other at 1 m depth intervals and suspended in the vertical plane and hung in the vicinity of the open sea cage farming site of the Central Marine Fisheries Research Institute, Vizhinjam Bay with proper anchoring. Fouling organisms attached to the baskets were periodically removed. The average pH of the water in the Vizhinjam Bay varied between 7.60 and 8.10. The dissolved oxygen content ranged from 3.6 to 4.17 mg/l; while the salinity was between 29.5 and 35 ppt. Fig. 2 and 3 depict the sponge culture method and growth of *C. subarmigera*.

Harvesting of sponges cultured in the open sea and testing bioactivity

The initial results indicated that in the open sea culture conditions, among three species, only *C. subarmigera* survived. Portions from the sponge were aseptically removed for bioactivity tests. The excised sponge tissues were macerated with methanol and after requisite period of incubation, the methanol was evaporated and extracts were prepared for different assays. The bioactivity was tested as per the standard microbiological and other bioassay methods. The bioactivity of harvested sponge biomass at each harvested date was evaluated to compare and determine whether repeated harvesting affected the bioactivity of sponge tissue.

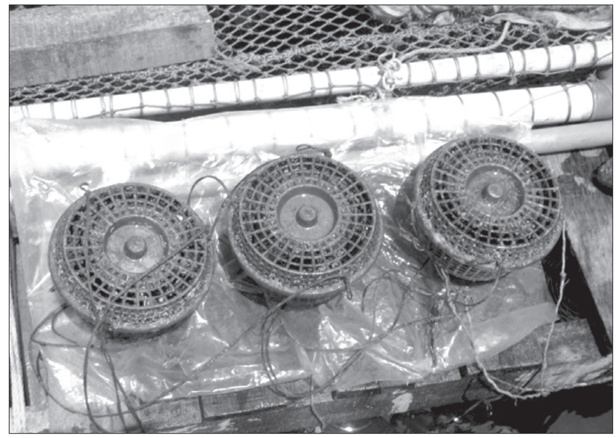

Fig. 2. Baskets containing sponges

Fig. 3. *Callyspongia subarmigera* cultured in Vizhinjam Bay

In laboratory conditions in the aquaria, *E. gorgonoides* survived the experimentation period of 80 days. Though the growth was low, bioactivities such as antibiotic activity as well as the cytotoxicity were retained. The experimental results are furnished in Table 1 and 2.

In the open sea culture conditions, *C. subarmigera* grew at an average rate of 88.94 mg per day. The overall growth was 93.37% compared to the initially stocked sponge tissue. Retention of bioactivity was noticed through the repeated harvests, though there was reduction in the bioactivity. The details of bioactivity of extract before and after culture are presented in Table 3 and 4.

Table 1. Antibacterial activity of fresh and laboratory cultured *Echinodictyum gorgonoides* extract

Test Bacteria (fish pathogenic bacteria)	*Callyspongia* extract (%)	Zone of Inhibition (mm)		
		Fresh extract	Activity after 40 d culture	Activity after 75 d culture
Pseudomonas aeruginosa	0.1	7	7	10
	1.0	8	8	12
Vibrio harveyi	0.1	8	7	7
	1.0	10	8	8
Vibrio alginolyticus	0.1	7	-	9
	1.0	8	0	10
Vibrio pelagius	0.1	-	8	8
	1.0	8	11	9

Table 2. Brine shrimp cytotoxicity of cultured *Echinodictyum gorgonoides*

Extract (%)	Lethality (%) in the extract of sponge before introduction for culture (Fresh)	Lethality (%) in sponge extract after 40 d culture	Lethality (%) in sponge extract after 75 d culture
Control	-	-	-
0.1	-	15	5
1	10	30	20
10	25	40	40

Table 3. Antibacterial activity of extract of *Callyspongia subarmigera* cultured in the open sea

Test bacteria (fish pathogenic bacteria)	*Callyspongia* extract (%)	Zone of Inhibition (mm)		
		Fresh extract	Activity after 40 d culture	Activity after 75 d culture
Pseudomonas aeruginosa	0.1	8	7	-
	1.0	9	-	-
Vibrio harveyi	0.1	7	-	7
	1.0	7	7	7
Vibrio alginolyticus	0.1	7	-	7
	1.0	8	9	8
Vibrio pelagius	0.1	11	8	7
	1.0	19	14	8

Table 4. Brine shrimp cytotoxicity of *Callyspongia subarmigera* cultured in the open sea conditions

Extract (%)	Lethality (%) in sponge extract before introduction for culture (Fresh)	Lethality (%) in sponge extract after 40 d culture	Lethality (%) in sponge extract after 75 d culture
Control	-	-	-
0.1	30	20	20
1	50	35	20
10	70	50	35

The results of sponge culture experiments and the data regarding bioactivity suggest that sponge species that produce bioactive compounds can be cultivated in the laboratory with seawater re-circulatory system as well as in open sea mariculture conditions. In both the systems, the sponges retained their health state to a large extent and also their potency to produce bioactive compounds. This is the first experimental results based report of culture of sponges for bioactivity in tropical conditions prevailing in the Indian subcontinent.

It could be inferred that the bioactivity potential of the sponge in culture conditions is determined by the survival and growth, which are influenced by the farming environment. This view is supported by the fact that only *C. subarmigera* could survive and produce bioactive metabolites, as the species was collected from the Vizhinjam coast as well as cultured in the nearby vicinity. The other two species could not survive for long as they were collected and transported from elsewhere. Thus the marine environment influences the biosynthesis and yield of target metabolite. However, it may be too early to conclude about the survival of different species of sponges in culture conditions based on the results of present set of experiments as repeated seasonal trials are yet to be made. Hence, further elaborate culture trials in the open sea conditions are essential along with repeated harvests and their impact on bioactivity pattern. For these, sponges having different bioactivity patterns are to be collected from different locations and cultured in different depths of a select marine habitat. The preliminary studies also made it clear that in order to achieve the maximum production of specific metabolites or molecules from marine sponges or any other organism with bioactivity potentials, it is essential to devise and develop novel culture methods with considerable flexibility. It is also important to develop efficient economic farming technologies before sponge metabolites are needed in commercial qualities and quantities for drug production, thereby ensuring sustained supply.

An overview of marine fish landings in India during 2005 - 2006

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The estimated all India total marine fish landings during the year 2006 was 2.71 million t compared to 2.30 million t in 2005 which showed 18.1% increase The sector-wise contributions in 2005 were, 69.5%, 25.9% and 4.6% by the mechanised, motorised and non-motorised sectors respectively and in 2006 it was 71.1%, 24.1% and 4.8% respectively (Table 1). Trawl nets, gillnets, dol/bagnets and seine nets are the important gears operating along the Indian coasts.

During 2005, south-west region comprising of Kerala, Karnataka and Goa contributed 36% of the total landings, north-west region comprising Maharashtra and Gujarat 31%, south-east region comprising of Andhra Pradesh, Tamil Nadu and Puducherry (Pondicherry) 20% and north-east region comprising of West Bengal and Orissa contributed 13%. During 2006, the contributions from the above regions were 35%, 33%, 22% and 10% respectively (Fig. 1).

Table 1. All India marine fish landings during 2005 and 2006

Sector	Catch / Effort	2005	2006
Mechanised	Landings ('000 t)	1595	1928
	Units (x 000)	2389	2664
Motorised	Landings ('000 t)	594	652
	Units (x 000)	4650	5547
Traditional	Landings ('000 t)	106	130
	Units (x 000)	3161	3025
Total	Landings ('000 t)	2295	2711
	Units (x 000)	10199	11236

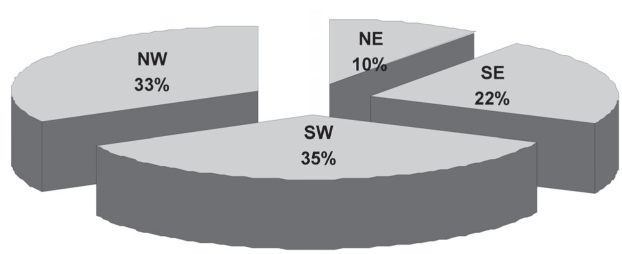

Fig. 1. Region-wise fish production in India during 2006

Oilsardine contributed 14.6% each, ribbonfish 8.7% and 5%, Indian mackerel 5.2% and 5.5%, penaeid prawns 6.4% and 7.5%, non-penaeid prawns 6.3% and 5.3%, Bombayduck 4.4% and 5.3%, croakers 4.4% and 5%, threadfin breams 4.1% and 3.9%, cephalopods 5% and 4.2% respectively towards the total marine fish landings of the years 2006 and 2005 (Table 2; Fig. 2). Trawl landings from north-west, south-west, south-east and north-east regions were 18%, 13%, 9% and 4% respectively during 2005 while the same during 2006 were 19%, 13%, 9% and 3% of the total landings. Ring seine and purse seine are the two important gears operating in the south-west region in addition to trawl net and gillnet. Ring seine landings in this region were nearly 14% in 2005 and 10.4% in 2006 and purse-seine landings 4.8% and 5.7% in 2005 and 2006 respectively. Dolnet is an important gear operating in the north-west region in addition to trawl nets. The contribution of dolnet was 8.5% during 2005 and 9.7% during 2006. Fourth quarter was the most productive period with contribution of 40% and 36% of the all India landings during 2005 and 2006, respectively.

Region-wise landings

North-east

North-east region with a coastal length of about 638 km has 101 landing centres, 987 fishing villages, 1.40 lakh fishermen families and 7.20 lakh fisherfolk population (Marine Fisheries Census, 2005). The estimated marine fish landings of this region was 2.99 lakh t during 2005. In 2006, the estimated marine fish landings was 2.73 lakh t registering 8.5% decrease compared to 2005 (Table 3). The most productive season was fourth quarter with a landings of 1.72 lakh t during 2005 whereas the first quarter with 1.04 lakh t was the most productive season during 2006. Second quarter landings showed a decrease of about 122 thousand t and third quarter showed an increase of about 59.7 thousand t during 2006 as compared to 2005. Bombayduck, catfishes, other clupeids such as *Hilsa* spp., croakers, prawns, carangids, ribbonfishes, pomfrets and anchovies were the important resources. Except catfishes and hilsa shads, other resources showed a decrease in the landings during the year 2006 (Fig. 3). Seventy two percentage of the landings was by mechanised sector, 24% by motorised sector and 4% by traditional sector during the year 2005 and it was 70%, 26 % and 4% respectively during 2006. Gillnet landings in this region dominated with 44%, followed by trawl net with 43.5% of the mechanised landings during 2005. It was 43.3% and 38.6% respectively during the year 2006 (Table 4). Catch per unit effort (CPUE) for mechanised trawl net (MTN) was 2377 (kg/unit) with

Table 2. Landings of the major resources (in tonnes) in India during 2005 and 2006

Group	2005					2006				
	1 QR	2 QR	3 QR	4 QR	Total	1 QR	2 QR	3 QR	4 QR	Total
Oilsardine	80477	51492	75819	127074	334862	96219	83976	72862	141541	394598
Penaeid prawns	45402	29664	44999	52034	172099	52168	36503	27016	56773	172460
Indian mackerel	19717	24494	38884	42329	125424	32140	27488	33940	48350	141918
Bombayduck	25691	9992	12569	74101	122353	39016	10121	23314	46056	118507
Non-penaeid prawns	33888	23432	5428	58359	121107	50953	45415	10186	64233	170787
Croakers	31424	15434	18021	50658	115537	32946	19699	17973	48787	119405
Ribbonfishes	20821	8427	8247	76620	114115	35341	17919	55845	125940	235045
Cephalopods	18742	20978	20116	37233	97069	28252	23062	39435	45292	136041
Threadfin breams	23767	33094	14373	17133	88367	29924	23452	30569	27372	111317
Silverbellies	8570	12034	22443	15799	58846	16729	10450	17559	19888	64626
Carangids	17304	33489	44333	47830	142956	24953	28974	32550	35459	121936
Others	184765	136153	158940	322897	802755	282657	148040	186982	306669	924348
Total	510568	398683	464172	922067	2295490	721298	475099	548231	966360	2710988

QR: Quarter

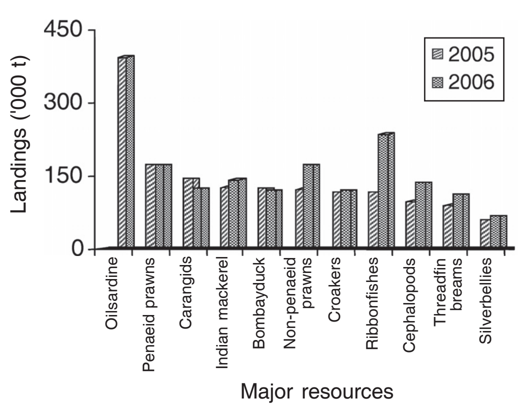

Fig. 2. Landings of major fishery resources in India during 2005 and 2006

Table 3. Landings of the major resources (in tonnes) in the north-east region during 2005 and 2006

Group	2005					2006				
	1 QR	2 QR	3 QR	4 QR	Total	1 QR	2 QR	3 QR	4 QR	Total
Bombayduck	11126	1014	7044	18734	37918	15240	913	6781	13875	36809
Hilsa shad	723	4645	7363	18513	31244	4955	341	29316	2110	36722
Other clupeids	6024	1212	3439	19861	30536	10548	1157	3979	10052	25736
Croakers	5706	1259	5753	16571	29289	7831	1439	3323	11668	24261
Non-penaeid prawns	8930	33	600	13162	22725	14442	410	136	7470	22458
Pomfrets	2727	561	4033	14428	21749	8576	577	1926	5085	16164
Penaeid prawns	4433	875	5610	9511	20429	4279	1174	1747	8493	15693
Ribbonfishes	3328	277	1265	11760	16630	5677	416	1150	8968	16211
Catfishes	3367	705	3432	8200	15704	6460	799	3772	5177	16208
Carangids	2423	519	4250	7611	14803	4184	859	1133	4069	10245
Anchovies	3101	1240	1322	8288	13951	4485	1379	501	5124	11489
Others	9180	1534	7988	25244	43946	17234	2769	5893	15511	41407
Total	61068	13874	52099	171883	298924	103911	12233	59657	97602	273403

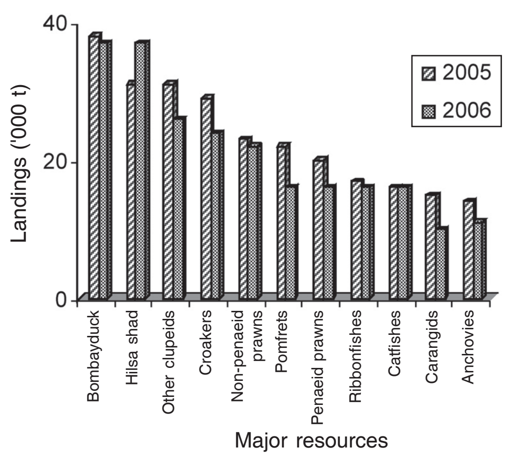

Fig. 3. Landings of major resources in the north-east region during 2005 and 2006

catch per hour (CPH) 39 kg/h during 2005 and the same was 2496 kg/unit and 48 kg/h respectively during 2006. CPH was more with 46 kg/h and 57 kg/h in the landings of mechanised bag net (MBN) during 2005 and 2006 respectively.

South-east region

This region spreads over a coastal length of 2050 km and has 649 landing centres, 1107 fishing villages, 3.33 lakh fishermen families and 13.43 lakh fisher folk population. The estimated marine fish landings of this region was 4.50 lakh t during 2005. The landings during 2006 showed an increase of 31.7% with 5.93 lakh t. Except the second quarter, the landings of the other three quarters recorded an increase in the fish landings during the year 2006 when compared to 2005, with more productive seasons in first and fourth quarters. Oilsardine, other sardines, silverbellies, ribbonfishes, croakers, carangids, mackerels and penaeid prawns were the major exploited resources in this region (Table 5; Fig. 4). Oilsardine and other sardines landings showed an increase of about 37,000 t during 2006 compared to 2005. Silverbellies landings was about 51,000 t which showed an increase of about 9,000 t during 2006. Other resources also showed reasonable

Table 4. Marine fish landings of major gears of different sectors with catch rates in the north-east region during 2005 and 2006

Sector	Gear	2005					2006				
		Total	Effort (x000)		CPUE	CPH	Total	Effort (x000)		CPUE	CPH
		(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)	(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)
Mechanised	MTN	93	39	2410	2377	39	74	30	1538	2496	48
	MGN	95	125	5671	762	17	83	91	4229	916	20
	MBN	25	60	532	410	46	34	61	589	548	57
Motorised	OBGN	38	350	1279	108	29	37	324	1363	115	27
	OBBN	31	105	555	295	55	23	117	605	199	39
Traditional	NM	12	292	972	42	13	12	266	954	43	12

MTN: Mechanised trawlnet; MGN: Mechanised gillnet; MBN: Mechanised bagnet; OBGN: Outboard gillnet;
OBBN: Outboard bagnet; NM: Non-mechanised, AFH: Actual fishing hours

increase in the landings during 2006. The mechanised sector contributed 48% and motorised sector 35% to the total landings of the year 2005. In 2006, the contributions were 44% and 40% respectively (Table 6). The major gears operating in this region were trawl nets, gillnets and hooks and line. Trawl net contributed 94.5% and 92% of the total landings in the mechanised sector during 2005 and 2006 respectively. Motorised sector in this region contributed 35% and 41 % during the years 2005 and 2006 respectively. The maximum contribution of 77% by the motorised sector landings was from outboard driftnet/gillnets. Traditional sector contributed 17% and 15% respectively during the year 2005 and 2006.

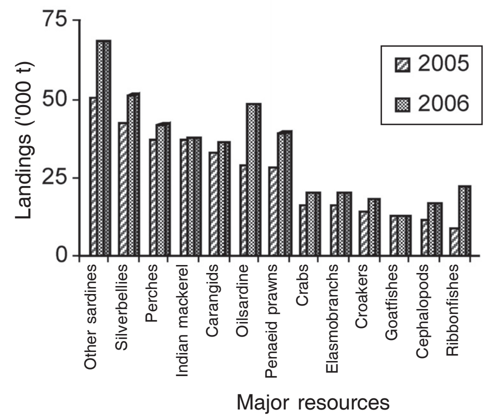

Fig. 4. Landings of major resources in the south-east region during 2005 and 2006

Table 5. Landings of the major resources (in tonnes) in the south-east region during 2005 and 2006

Group	2005					2006				
	1 QR	2 QR	3 QR	4 QR	Total	1 QR	2 QR	3 QR	4 QR	Total
Other sardines	9392	10191	9834	20787	50204	27713	10509	9132	21072	68426
Silverbellies	6241	9810	14486	11875	42412	13092	6932	16305	14930	51259
Perches	5491	10679	9985	10711	36866	10582	7488	12390	11456	41916
Indian mackerel	9039	12700	8718	6105	36562	12105	9461	9410	6780	37756
Carangids	5599	8809	9320	8801	32529	9063	5693	12642	8652	36050
Oilsardine	1587	5427	8134	13706	28854	6296	13204	15266	13354	48120
Penaeid prawns	5399	6022	7825	8744	27990	9808	7364	10462	11565	39199
Crabs	2860	3689	4567	4708	15824	4502	4931	4951	5787	20171
Elasmobranchs	3553	3591	4023	4553	15720	6733	2694	5389	5047	19863
Croakers	2363	2363	3698	5807	14231	5646	2863	3464	5817	17790
Goatfishes	1612	4440	3407	2981	12440	3734	1971	3435	3448	12588
Cephalopods	1190	2432	5425	2004	11051	2393	3007	7065	4463	16928
Ribbonfishes	851	476	1598	5670	8595	6190	1033	3703	10997	21923
Others	24113	24034	32292	36744	117183	50332	23441	42848	44736	161357
Total	79290	104663	123312	143196	450461	168189	100591	156462	168104	593346

Table 6. Marine fish landings of major gears of different sectors with catch rates during 2005 and 2006 in the south-east region

Sector	Gear	2005					2006				
		Total	Effort (x000)		CPUE	CPH	Total	Effort (x000)		CPUE	CPH
		(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)	(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)
Mechanised	MTN	205	416	6890	494	30	241	432	8224	558	29
	MGN	9	104	620	84	14	16	210	1213	75	13
Motorised	OBGN	121	1989	8743	61	14	184	2685	13048	68	14
	OBHL	15	252	1146	60	13	21	326	1950	63	11
Traditional	NM	77	2077	10380	37	7	92	1922	9347	48	10

MTN: Mechanised trawlnet; MGN: Mechanised gillnet; OBGN: Outboard gillnet, OBHL: Outboard hook and line, NM: Non-mechanised

South-west region

South-west region has a coastal length of 994 km, 300 landing centres, 417 fishing villages, 1.53 lakh fishermen families and 7.84 lakh fisherfolk population. This region ranks first in the fish production with 9.38 lakh t and its contribution was 35% of the total fish production of India during the year 2006. The region recorded 11.5% increase in the landings during 2006 as compared to 2005, the estimated landings being 8.42 lakh t. Oilsardine formed major portion of the fish landings in this region with 3.03 and 3.43 lakh t during 2005 and 2006 respectively. Oilsardine catch recorded an increase of 13% during 2006 compared to 2005. Fourth quarter was the most productive period in both the years. The major resources *viz*., mackerel, ribbonfishes, threadfinbreams, cephalopods and stomatopods showed increase in the landings while the commercially important resources like penaeid prawns and carangids showed decrease in the landings during 2006 compared to 2005 (Table 7; Fig. 5).

Table 7. Landings of major resources (in tonnes) during 2005 and 2006 in the south-west region

Group	2005					2006				
	1 QR	2 QR	3 QR	4 QR	Total	1 QR	2 QR	3 QR	4 QR	Total
Oilsardine	77928	45267	67647	112808	303650	87503	70501	57396	127389	342789
Indian mackerel	7608	11062	29345	29036	77051	15715	16473	23408	26539	82135
Carangids	4313	20464	27697	18997	71471	5931	16293	15665	11497	49386
Perches	12726	25781	17554	6498	62559	18771	19147	18089	16584	72591
Penaeid prawns	15181	11267	20783	7333	54564	17556	17493	5629	11606	52284
Other clupeids	10512	7054	24203	12773	54542	12422	11073	4079	10177	37751
Cephalopods	5383	12228	12977	7882	38470	6194	10530	16398	14674	47796
Ribbonfishes	2918	1757	2089	24593	31357	6280	6135	35772	24822	73009
Soles	10857	4395	2986	8406	26644	8121	4275	3070	11260	26726
Tunnies	2420	2650	8277	9646	22993	4898	8691	9786	10126	33501
Others	22910	24666	20840	30140	98556	39954	26695	14520	39192	120361
Total	172756	166591	234398	268112	841857	223345	207306	203812	303866	938329

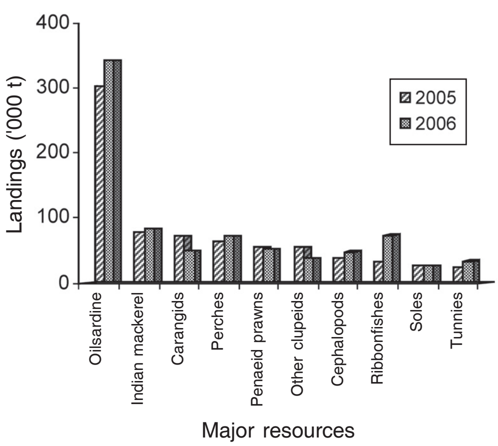

Fig. 5. Landings of major resources in the south-west region during 2005 and 2006

Mechanised sector contributed 60% and motorised sector 38% of the total landings in 2005 while their contribution was 68% and 30% respectively in 2006 (Table 8). Trawl nets contributed 57% and 53% of the landings of the mechanised sector during 2005 and 2006 respectively. Outboard ringseines (OBRS) contributed more, with 67% and 54% of the landings of the motorised sector during 2005 and 2006 respectively. Mechanised ringseines (MRS) showed higher CPUE of 2,646 kg/ unit, CPH being 1,322 kg/h during 2005 while the CPUE of purseseines (MPS) was higher with 2,696 kg/unit and CPH with 1,204 kg/h during 2006. In the motorised sector the CPUE and CPH of ringseines were higher

Table 8. Marine fish landings of major gears of different sectors with catch rates in the south-west region during 2005 and 2006

Sector	Gear	2005					2006				
		Total	Effort (x000)		CPUE	CPH	Total	Effort (x000)		CPUE	CPH
		(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)	(landings '000 t)	Units	AFH	(kg/unit)	(kg/h)
Mechanised	MTN	291	468	6647	622	44	344	515	7977	667	43
	MPS	109	68	323	1602	336	129	48	107	2696	1204
	MRS	102	39	77	2646	1322	155	75	326	2079	477
Motorised	OBGN	74	685	3292	108	22	73	755	3798	97	19
	OBRS	215	196	363	1096	592	153	150	255	1017	600
Traditional	NM	13	613	1231	22	11	16	698	1298	24	13

MTN: Mechanised trawl net; MPS: Mechanised purseseine; MRS: Mechanised ringseine; OBGN: Outboard gillnet; OBRS: Outboard ringseine; NM: Non-mechanised with 1,096 kg/unit and 592 kg/h during 2005 and 1,017 kg/unit and 600 kg/h during 2006.

North-west region

North-west region has 2320 km coastal length, 282 landing centres, 691 fishing villages, 1.30 lakh fishermen families and 6.72 lakh fisherfolk population. It ranked second in the fish production during 2006 with fish landings of 9.06 lakh t which showed an increase of 28.6% over the landings in 2005. Fourth quarter recorded the highest landings (44%) followed by first quarter (25%) and the least landings of 14% registered in the third quarter during the year 2006. Prawns, ribbonfishes, Bombayduck, cephalopods, croakers, threadfin breams and catfishes were the major exploited resources in this region (Table 9; Fig. 6).

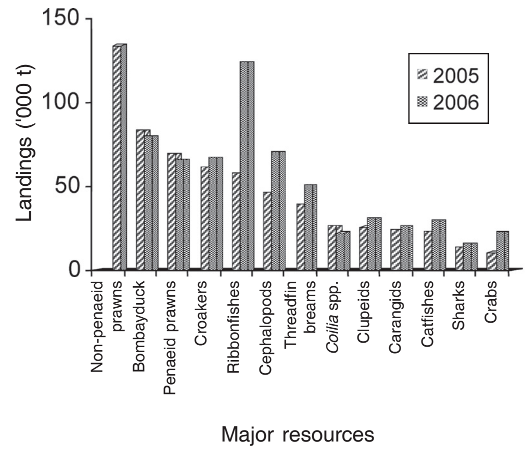

Fig. 6. Landings of major resources in the north-west region during 2005-2006

Table 9. Landings of major resources (in tonnes) in the north-west region during 2005 and 2006

Group	2005					2006				
	1 QR	2 QR	3 QR	4 QR	Total	1 QR	2 QR	3 QR	4 QR	Total
Non-penaeid prawns	23378	22322	2354	39369	87423	30251	44476	7762	51130	133619
Bombayduck	14334	8964	5241	54578	83117	22899	9133	16374	31470	79876
Penaeid prawns	20389	11500	10781	26446	69116	20525	10472	9178	25109	65284
Croakers	21202	9491	4520	26068	61281	17096	13430	8518	28166	67210
Ribbonfishes	13724	5917	3295	34597	57533	17194	10335	15220	81153	123902
Cephalopods	11702	6266	1030	26722	45720	19073	9470	15828	25542	69913
Threadfin breams	12952	11967	942	13509	39370	14157	8127	13134	15297	50715
Coilia spp.	10748	3924	1646	10303	26621	8455	3906	2515	7331	22207
Clupeids	9263	3754	1515	11291	25823	10286	4113	2857	13798	31054
Carangids	4969	3697	3066	12421	24153	5775	6129	3110	11241	26255
Catfishes	6743	4586	3005	8114	22448	7209	6885	2776	12821	29691
Sharks	4029	2751	1988	5067	13835	4992	2251	2545	6373	16161
Crabs	2896	2024	305	5477	10702	6633	7094	3902	5134	22763
Others	41125	16392	14675	64914	137106	41308	19148	24581	82223	167260
Total	197454	113555	54363	338876	704248	225853	154969	128300	396788	905910

The contribution of the mechanised sector were 93% and 92% during 2005 and 2006 respectively (Table 10). Trawlers contributed 63% and 61% in the mechanised sector landings during 2005 and 2006 respectively. Contribution of mechanised dolnet was also significant with 30% and 31% of the mechanised landings during 2005 and 2006 respectively. The contribution in the motorised sector were 6% and 7% of the total landings during 2005 and 2006 respectively. In the motorised sector, the contribution from the outboard driftnet/gillnets was higher with 93% and 97% during 2005 and 2006 respectively. The CPUE of mechanised purseseine was higher with 2,314 kg/unit and CPH was 296 kg/h during 2005 while the CPUE and CPH were 2,396 kg/unit and 214 kg/h respectively during 2006.

Table 10. Marine fish landings of major gears of different sectors with catch rates in the north-west region during 2005 and 2006

Sector	Gear	2005 Total (landings '000 t)	2005 Effort (x000) Units	2005 Effort (x000) AFH	2005 CPUE (kg/unit)	2005 CPH (kg/h)	2006 Total (landings '000 t)	2006 Effort (x000) Units	2006 Effort (x000) AFH	2006 CPUE (kg/unit)	2006 CPH (kg/h)
Mechanised	MTN	411	270	12025	1520	34	508	292	11786	1740	43
	MPS	9	4	31	2314	296	11	5	52	2396	214
	MDOL	194	542	5016	358	39	264	609	5653	434	47
	MGN	39	205	3717	189	10	50	223	3899	227	13
	MHL	2	8	110	305	21	0	2	64	141	5
Motorised	OBGN	41	562	4364	72	9	56	487	3955	116	14
Traditional	NM	4	179	734	23	6	10	139	562	72	18

MTN: Mechanised trawlnet; MPH: Mechanised purseseine; MDOC: Mechanised dolnet; MGN: Mechanised gillnet
MHL: Mechanised hook and line, OBGN: Outboard gillnet; NM: Non-mechanised

A report on swimbladder disorder in the honeycomb grouper, *Epinephelus merra*

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Swimbladder or airbladder is a thin layered epithelial sac filled with air, lying above the alimentary canal of bony fishes that regulates buoyancy of the fish so that the specific gravity of the fish always matches the depth at which it is swimming. Swimbladder disorder (SBD) is a condition caused by sudden temperature changes impacted stomach resulting from improper feeding or due to bacterial or viral infections of the bladder characterised by inability of the fish to keep a normal upright position in water. Normally gold fishes suffer from SBD due to their globoid body shape. Fish with SBD may float on their side or their back, swim in circles or take head-down posture.

A honeycomb grouper (*Epinephelus merra*) maintained at Marine Aquarium of Vizhinjam Research Centre of CMFRI was found to float with head-down position (Fig. 1). The fish was not feeding for two days. On careful examination, a swelling of about 2 cm diameter was found on the abdomen anterior to vent. Based on the signs, the condition was diagnosed as SBD which could have developed due to impacted stomach pressing on the swimbladder. The fish was relieved of the ailment by inserting a 23 gauge sterile hypodermic needle fitted to a 2 ml syringe into the bladder and aspirating the gas by taking extreme care not to pierce the intestine or the kidneys. The suspected condition was relieved by injecting 1 ml of soap solution into the vent using a sterile tuberculin syringe without the needle. The fish showed normal movements within 30 min and started feeding after 24 h (Fig. 2).

The recommended treatment regime for SBD includes fasting for 2 or 3 days, increasing the tank temperature, avoiding dry floating feeds and deflating the swim bladder. SBD can be prevented by good tank husbandry. The reason for development of SBD in the present case can be attributed to impaction in the alimentary canal probably due to overfeeding. By aspirating the air, the swimbladder was deflated. A lavage with lubricant could break the impaction facilitating the exchange of gases making the fish move normally.

Rare occurrence of the bramble shark *Echinorhinus brucus* (Bonnaterre, 1788) along the Veraval coast

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A spiny shark or bramble shark *Echinorhinus brucus* (Bonnaterre, 1788) was caught in trawl operated near Pakistan border off Veraval coast (Fig. 1). *E. brucus* is exclusively marine, inhabiting deep waters. It is also called sluggish bottom shark, sometimes occurring in shallow waters, especially on the continental and insular shelves and upper slopes upto 900 m depth.

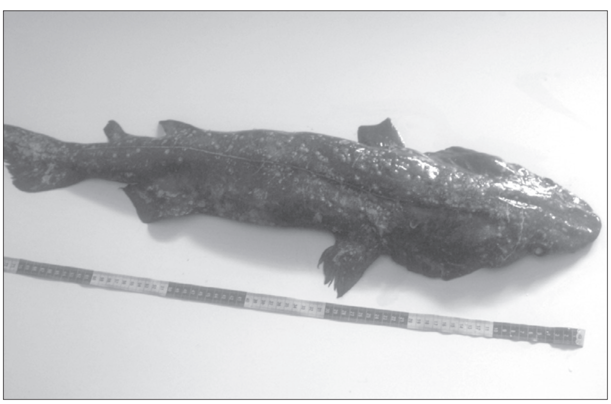

Fig. 1. Spiny shark, *Echinorhinus brucus* caught by trawlers at Veraval

Bramble sharks have dorso-ventrally compressed head (Fig. 2) and the body is long cylindrical, covered with scattered, large protruding thorn-like denticles two small spineless dorsal fins placed far back on the body just before the tail and five pairs of gill slits (Fig. 3). It has no anal fin and has thick caudal peduncle (tail stalk). Teeth are star-cusped and similar in both the jaws. The skin of its back and sides is sparsely strewn in large scales with either one or two sharp points. The colour of the species is dark grey with metallic reflections without darker blotches. They can reach a maximum length of 3.94 m (13 ft) and weigh 500 lbs (227 kg). There are records on the occurrence of this species in the

Fig. 2. Dorso-ventrally compressed head of *Echinorhinus brucus* with denticles

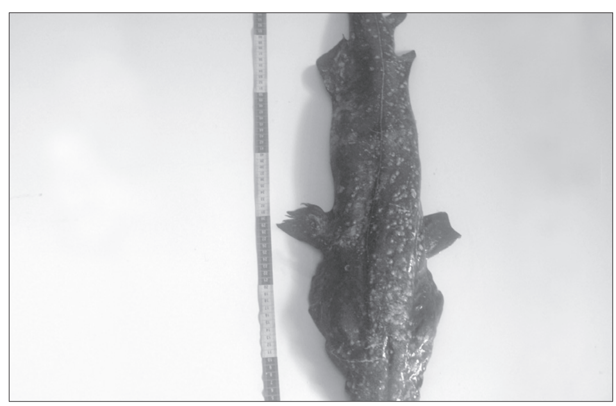

Fig. 3. Body of bramble shark covered with denticles

Western Atlantic, Mediterranean, Pacific Ocean, Australia and New Zealand. The phylogenic position of this species is as follows:

Phylum	:	Chordata
Class	:	Chondrichthys
Subclass	:	Elasmobranchii
Order	:	Squaliformes
Family	:	Echinorhinidae
Genus	:	*Echinorhinus*
Species	:	*E. brucus*

Length measurements of bramble shark landed at Veraval:

Total length	:	87.5 cm
Total weight	:	2.63 kg
Length from snout to Ist dorsal	:	52.5 cm
Snout to pelvic	:	49.5 cm
Snout to orbit	:	7 cm
Ist dorsal to 2nd dorsal	:	4.5 cm
Pelvic to pectoral	:	18.5 cm
Pelvic to Ist dorsal	:	24 cm
Pelvic to tail notch	:	11.5 cm
Pelvic to caudal end	:	31 cm
Eye diameter (dorso-ventral)	:	1.9 cm
Intra-orbital length	:	8.5 cm

Occurrence of a large cornet fish, *Fistularia petimba* in trawl catches of Veraval coast, Gujarat

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A large cornet fish (*Fistularia petimba*) belonging to the family fistulariidae was collected on 3rd February 2009 from the Bidiya Fish Landing Centre, caught by trawler off Veraval coast at a depth of 60 m (Fig. 1). The body of the fish was elongate having depressed mouth at the end of a long tubular snout which was hexagonal in cross section and teeth in jaws with small ridges on snout with antrorse serrations, the upper ridges diverging anteriorly and the inter-orbital space flat. Dorsal and anal fins were short-based and opposite with 15 rays and 15 dorsal segmented rays; pectoral fins with 15 rays; pelvic fins small and abdominal with 6 rays. Lateral line was arched, running anteriorly almost along the middle of back and then bending down to side and continuing posteriorly to an elongate filament produced by the middle of two caudal fin rays. Posterior lateral line was ossified without spines. The colour of the fish was brown, becoming lighter to silvery below. Dorsal and anal fins were with orange cast becoming transparent at base and caudal filament white. The following are the morphometric and mertistic characters:

Fig. 1. *Fistularia petimba* caught by trawlers at Veraval

Total length	:	1480 mm
Total weight	:	2529 g
Length from snout to Ist dorsal	:	1155 mm
Opercular length	:	100 mm
First dorsal to furcal	:	210 mm
Pelvic to pectoral	:	185 mm
Pelvic to anal	:	460 mm
Eye diameter	:	20 mm
Dorsal rays	:	15
Anal rays	:	15
Pelvic rays	:	6
Pectoral rays	:	15
Brancheostegal rays	:	8
Length of prolonged caudal fin ray	:	200 mm