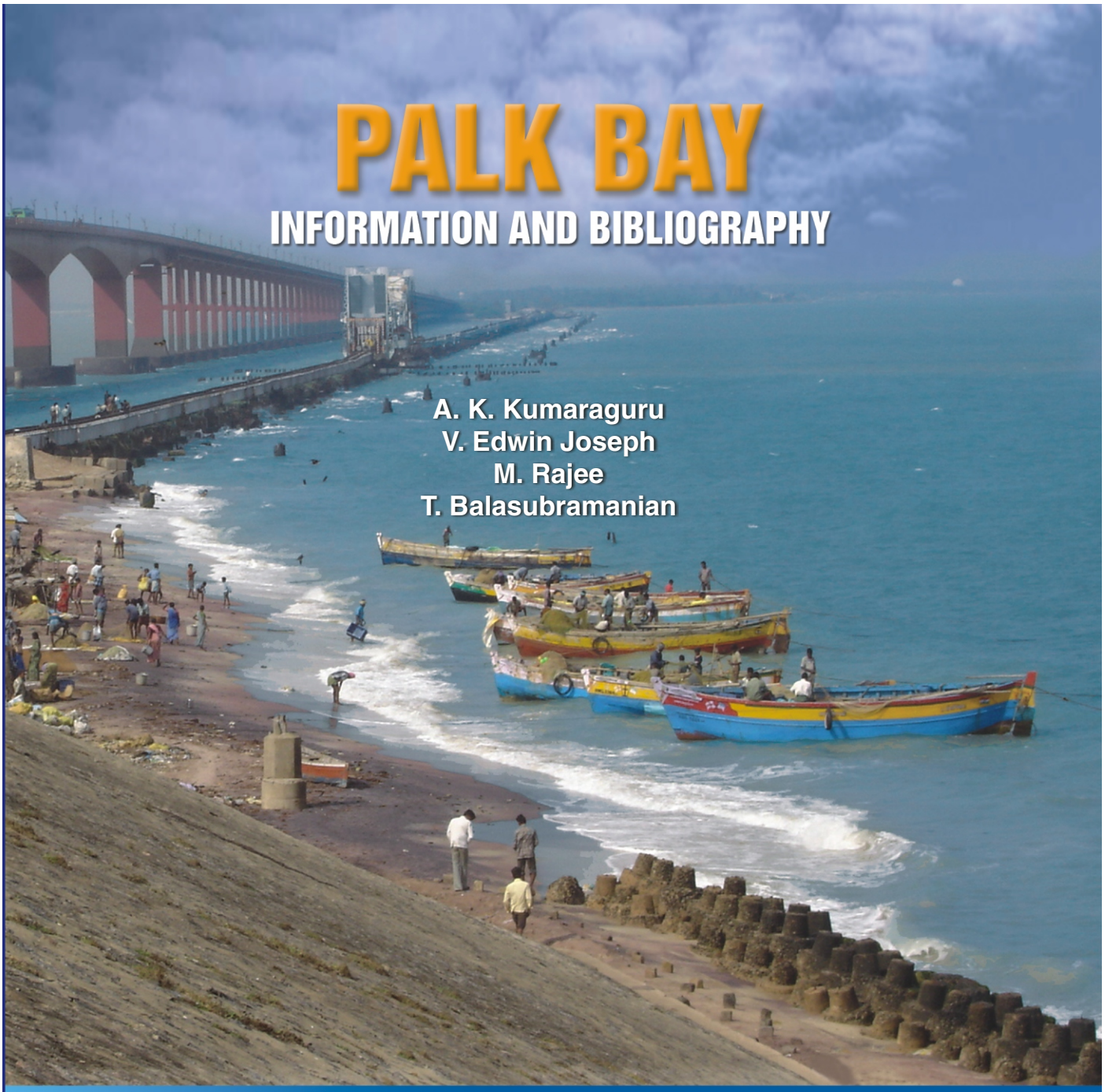
PALK BAY

INFORMATION AND BIBLIOGRAPHY



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March 2008

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Citation : Kumaraguru, A.K., V. Edwin Joseph, M. Rajee and T. Blasubramanian. 2008. Palk Bay - Information and Bibliography, CAS in Marine Biology, Annamalai University, Parangipettai and Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai. 227 pp.

This publication has no commercial value

Compiled by

Centre for Marine and Coastal Studies, Madurai Kamaraj University

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Photos Courtesy	:	J. Jerald Wilson and N. Marimuthu
Front Cover	:	Pamban fish landing centre in the backdrop of Rail and Road Bridges across Pamban viaduct
Back Cover	:	Chinnapalam fish landing centre in the backdrop of Pamban Road Bridge

Typeset & Printed at Rehana Offset Printers, Srivilliputtur - 626 125. Phone : 04563 - 260383

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Environmental Information System (ENVIS)
Centre of Advanced Study in Marine Biology
Annamalai University
Parangipettai - 608 502
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Sponsored by

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FOREWORD

Palk Bay is an important marine zone of high productivity lying between India and Sri Lanka. The marine waters of Palk Bay are as important as those of the Gulf of Mannar, both in the southeast coast of our country. They are of great significance to us because they lie within the territory of our State of Tamilnadu. Palk Bay has been in the limelight in recent times especially in the context of Sethu Samudram Ship Channel Project. A number of scientific workers have published their findings on various aspects of the Palk Bay environment. This includes the physical and chemical nature of water and sediments, the organisms and their biology and ecology. All such information is found scattered in a wide variety of journals, bulletins, magazines, newsletters, news papers etc. In the present age of information explosion, it is indeed a time consuming affair for any researcher to sift through the scientific literature to obtain information on any particular aspect of any particular region. The authors of this book on "Palk Bay - Information and bibliography" have made that job easier for the researchers by compiling all the available literature on Palk Bay in one compendium. I am sure this compilation will be of great use to our scholars in pursuing their researches in the field of Marine Sciences.

(Dr. M. RAMANATHAN)

Contents

Palk Bay

1. Introduction

Palk Bay, named after Sir Robert Palk (1717-1798) the then Governor of Madras Presidency (1755-1763), is situated in the southeast coast of India encompassing the sea between Point Calimere (Kodikkarai) near Vedaranyam in the north and the northern shores of Mandapam to Dhanushkodi in the south. It is situated between Latitude 9º 55' - 10º 45' N and Longitude 78º 58' - 79º 55' E. The Palk Bay itself is about 110 km long and is surrounded on the northern and western sides by the coastline of the State of Tamilndau in the mainland of India. Palk Bay and Gulf of Mannar to its south are connected by a narrow passage called Pamban Strait which is about 1.2 km wide and 3 to 5 m deep that separates the Island of Rameswaram from the mainland. The Palk Bay waters merge with those of the Bay of Bengal in the northeast and the Gulf of Mannar waters in the south. The Palk Strait is just 35 km of water that is narrower than the English channel and separates the northern coast of Sri Lanka from the southeast coast of India. Therefore the international boundary line is close to the shores of both the countries. The boundary is only 6.9 km away from Dhanushkodi, 11.5 km away from Rameswaram, 15.9 km away from Point Calimere, 23 km away from Vedaranyam and 24.5 km away from Thondi. Palk strait lies northeast of Palk Bay between the State of Tamilnadu in India and the island nation of Sri Lanka and the width of Palk Bay ranges from 64 to 137 km (Cathcart, 2003).

Palk Bay at its southern end is studded with a chain of submerged islands or shoals which appear to connect Dhanushkodi on Rameswaram island in Tamilnadu and Thalaimannar on the Mannar island of Sri Lanka. This apparent bridge is also known as Ramasethu by the pious religious Hindus and has gained significance in recent days because of the Sethusamudram Ship Channel Project and the wide publicity created by the news media. This chain of shoals is known as Adam's bridge the name of which comes from the story that Sri Lanka was the site of the biblical earthly paradise and that it was created when Adam was expelled (Wikipedia, 2006). This bridge is approximately a 30 km long shallow ridge, with 9 km of islands and shallows and 21 km of open water, and is of Holocene conglomerate and sandstone mantled with islands and shoals of shifting sand all of which rest upon Miocene limestone (Cathcart, 2004).

The average water temperature in the Palk Bay varies from 24.6°C to 29.1°C with the lowest and the highest occurring in January and April respectively. The Palk Bay remains practically calm during most of the months. Turbulent conditions prevail during northeast monsoon period and fresh water streams dilute the sea near Mandapam. The coastline of Palk Bay has coral reefs, mangroves, lagoons, and sea grass ecosystems. The fishing season starts in October and lasts till February. Peak fishing season is during December to January. The annual average fish production is around 85,000 tonnes. The saline water and the muddy substratum coupled with seasonal rains

and discharge from Vaigai and Cauvery rivers has created a good breeding ground for pelagic and demersal fishes. It can be considered as internal waters because it is in most parts land locked and is not suitable for navigation of big ships because of shoals, currents and coral reefs. The marine environment and geographical features of the region show wide variations. The areas are rich in biological diversity and have a long history of human settlement, use and exploitation. They contain diversified and productive ecosystems such as estuaries, salt marshes, sea grass beds and mangroves that are sensitive to human activities.

2. Hydrographic features of Palk Bay waters

Palk Bay is a shallow and flat basin, nowhere exceeding 15 meters depth. On an average the depth hardly exceeds 9 meters. The whole Palk Bay area is under the spell of both southwest and northeast monsoons. However, the southwest monsoon contributes only very little towards the annual rainfall of this area. Rainfall is moderate to heavy during October to mid-December with occasional gales. The mean annual rainfall varies from 762 mm to 1,270 mm. The monthly average atmospheric temperature varies from 25°C to 31°C with the maximum and minimum occurring in May and January respectively.

2.1. Surface Water Temperature

The surface waters are subjected to diurnal variations of temperature due to solar heating by day and cooling by night. The variations are much more appreciable in the case of shallow basins due to the low thermal capacity of the basin waters. It is possible to compare the temperatures over different regions. Only when the diurnal variations of temperature are minimal, they can be neglected.

2.2. Surface Water Salinity

The distribution of surface salinity values depends not only on the origin of the water mass but also on the evaporation from the surface. Unless the factors of evaporation such as the winds and humidity gradients in the micro layers of air over the surface are known, the effect of evaporation on local salinity values cannot be discerned. The salinity variations are further complicated by mixing of water masses brought into the region by currents causing turbulent exchange. The 32ppt isohaline boundary serves as a line of demarcation between the low saline coastal waters to its left and high saline Bay of Bengal waters to its right. Along an axis in the direction of southwest from the Strait, the salinity at first decreases gradually and then more rapidly towards the further end of this axis, disregarding the shallow dip at the middle. The gradient is very strong in the southwest as in the case of temperature.

2.3. Surface Water Density

The density distribution of surface waters of the Palk Bay has been studied.

The isopycnal of the surface density value 20 in the north may be treated as forward boundary of the Bay of Bengal waters. Similarly, the isopycnal 19 may be the limiting contour for coastal waters. As in the case of salinity, it is clear from the orientation of the isopycnal 19 that the coastal water is limited to a narrow region in the northwest and to a wider area in the southwest. The sharp gradients of density of the southwestern region indicate that mixing of the coastal waters with the sea is not prominent in this region. The density decreases along an axis in the southwestern direction from the Strait, the waters being more of sea origin at the beginning and more of coastal origin at its further end.

2.4. Dissolved Oxygen

The distribution of dissolved oxygen (ml/l) in the surface waters of Palk Bay is substantial as it is a shallow body of water. The effect of wind mixing, apart from the biochemical factors, in the horizontal and vertical directions determines the distribution of oxygen. Therefore, it is observed that the waters everywhere in the Palk Bay are almost saturated with dissolved oxygen. They sometimes even exceed the saturation limit by a small percentage, especially in the northern region.

2.5. Minerals

Chemical composition of lagoon muds and geological aspects of surface sediments of Palk bay have been reported. Palk Bay is shallow and reaches a maximum depth of 13 m and covers an area of about 600 km^2 . Pambar on the northwestern side, Kottakkarai on the west and Vaigai on the southwestern side are the 3 streams/rivers flowing into the bay. The land adjacent to the bay consists of alluvium, charnockite, khondalite, garnetsillimanite gneiss, pink and grey granites, amphibolite and pyroxenite and biotite schists lie on the northwest and southern parts of the alluvium. The presence of montmorillonite, kaolinite and illite have been indicated. Montmorillonite is dominant in the nearshore and deep bay sediments. The other two have been found to be the next major clay minerals in the order of their abundance.

2.6. Nutrients

2.6.1. Phosphate

The mean monthly values for Phophate in Palk Bay waters is between 0.12 and 0.25 µg.at $P.l^{-1}$ (3.7 to 7.7 mg $P.m^3$). It is to be noted here that the level of phosphates in these waters is far below that observed in the waters of higher latitudes. Such low values combined with the absence of marked seasonal cycles may point to a low level of organic production in these waters. However, from low phosphate values alone it cannot be emphatically stated that the area is very poor. It is quite probable that much more rapid metabolism in the tropical seas show accumulation of nutrient substances as they occur in most Northern waters during the winter.

2.6.2. Nitrate

In the Palk Bay, unlike the phosphate, the nitrate shows much greater seasonal fluctuations. On some occasions, nitrates are either totally absent or present only in negligible quantities. There are two facts, viz., marked seasonal variations and occasional depletion of nitrates which show that besides the usual channel of utilization of nitrates by the phytoplankton, there are equally significant factors which control their concentration in these waters. It is possible that denitrifying bacteria present in the shallow Palk Bay environment are utilizing the inorganic nitrates for their energy requirements and the nitrates in their turn are progressively reduced to nitrogen. This has been demonstrated under laboratory conditions also. The denitrifiers occur in more or less restricted areas subject to the influence of land drainage.

2.6.3. Silicate

The annual range of silicates in Palk Bay is 15 µg. at $Si.l^{-1}$. (900 mg. $SiO_2.m^3$) the highest and lowest being 20.0 and 5.0 µg. at $Si.l^{-1}$ (1,200 and 300 mg. $SiO_2.m^3$). It is seen that the total annual turnover of silicates is very high in the Palk Bay.

2.7. Sediments

Palk Bay is one of the five major permanent sediment sinks of India. Marine and river sources contribute to these sediments. Small rivers draining in to Palk Bay off the Sri Lankan and Indian coasts bring in sediments. Long-shore currents from Bay of Bengal in the north and Gulf of Mannar in the south transport these sediments in to the Bay. The Palk Bay is very shallow with water depths ranging from 5 to 10 meters along the coastal areas and less than 20 meters in most other places. The sea becomes turbid during southwest and northeast monsoon periods, due to re-suspension of bottom sediments. However, in general, the Palk Bay is very calm during most of the time because of the protection offered by the Palk Strait on the north and Pamban pass and Adam's bridge on the south and hence powerful currents and waves do not enter the Palk Bay.

The sediments are primarily silted clay close to the coast and sandy mud little away from the coast. The sediment contains high organic matter due to decay of Sea grass. An average yearly deposition of sediments to a thickness of 0.6 cm is observed. The depositional features are identified as occurrence of spits, shoals and progradation of coastline. The depositional features are also observed to agree with the formation of very shallow areas in the Palk Bay. The enlargement of Manamelkudi sand spit and the emergence of sand banks between point calimere and Point Pedro (Sri Lanka) across the entrance of the Palk bay, are the evidences of the depositional features occurring in this region.

The accretion pattern has been observed in the Palk Bay of Ammapattinam,

Mandapam and Rameswaram. Large amounts of sediments from the pediments are removed constantly by rainfall and carried by minor rivers and dumped in to the Palk Bay.

3. Bio-resources and Biodiversity

Palk Bay and Gulf of Mannar are interconnected with each other not only physically but also oceanographically by way of flow of currents especially under the influence of the northeast and southwest monsoons. Therefore a vast majority of the organisms found in the Gulf of Mannar are also seen in the Palk Bay particularly those free living/moving/floating animals/plants. However, the Palk Bay lacks the habitats such as the islands found in the Gulf of Mannar which support a wide variety of corals. Otherwise, Palk Bay is as resourceful and productive as the Gulf of Mannar. Palk Bay environment is unique in the sense that it is almost an enclosed bay with input from several small rivers along its coast from Point Calimere (Kodikkarai near Vedaranyam) in the north to Mandapam in the south. The branches of the grand river Cauvery which drain through the districts of Thanjavur, Thiruvarur and Nagapattinam form a large backwater system between Muthupet and Point Calimere. The marshlands of this backwater system support lush growth of Mangrove forests which harbour a wide variety of birds both native and seasonally migratory. The backwaters act as breeding and feeding grounds for a wide variety of fin-fish and shell-fish. The enclosed nature of the bay provides protected waters that dolphins, porpoises and turtles frequent the region. Although the scientific literature available on the Palk Bay are relatively limited compared to that of the Gulf of Mannar, existing information also suggests the presence of endangered dugongs.

3.1. Biodiversity

Palk Bay is rich in biodiversity having all the important groups of flora and fauna in its environment. The total number of species and their endemic form given in parentheses are Foraminifera 51 (2), Tintinnids 12, Flora 143 (1), Sponges 275 (31), Coelentrates other than corals 123 (49), Stony corals 128 (43), Polyzoa 100 (15), Polychaeta 75 (22), Insecta 1 (1), Crustacea 651 (159), Mollusca 733 (26), Echinodermata 274 (2), Prochordata 66 (41), Fishes 580, Turtles 5, Birds 61, and Mammals 11. Among all the molluscs, though no live animals have been found, shells of *Nautilus pompilius* and *Spirula spirula* are washed ashore along the Palk Bay coast.

3.2. Phytoplankton

Generally 2 to 3 phytoplankton blooms have been recorded in the Palk Bay annually. Phytoplankton blooming, particularly that of *Trichodesmium*, a blue green alga, which used to form clumpy aggregates has been observed in Palk Bay. The maximum number of occurrence of this alga was 240 lakhs per litre. The numbers from

7 to 8 lakhs per litre indicate blooming and occurrs in the northern part of Palk Bay and extends south from here. The phytoplankton peaks do not seem to follow the monsoons strictly as do zooplankton. The bloom occurs mostly in January which is prominent and also during April to May. Blooming of unicellular biota observed here are those of *Trichodesmium theibauti, T. erythraeum, Noctiluca ceratum, Gymodinium* and rarely *Gonyaulax*. Considerable variation in abundance, composition and succession in phytoplankton has been observed from year to year.

3.3. Algae

Plants of *Gacilaria edulis, G. foliifera* and *G. gracilariopsis* are collected at a station near Rameswaram (Lat. 9º 17' N; Long. 79º 19' E), which is situated on the Palk Bay side at about 20 km east of Mandapam. Populations of these three agar yielding red algae have been found throughout the year with two half yearly growth cycles, one from October/November to April and the other from May/ June to September.

3.4. Seaweed Resources

Palk Bay is rich in seaweed resources of economic importance. The fringing coral reefs extending from Pamban eastwards to Devil's Point and then southward to Ohlaikuda and Rameswaram have, in abundance, *Gelidium micropterum* and various species of *Gracilaria*, which are among the chief Indian agar-yielding seaweeds. The lagoons between the reefs and the shore exhibit rich growth of *Gracilaria lichenoides* (locally known as "kanji paasi'). The reef also has, in abundance, *Sargassum* and *Turbinaria* which are good sources of algin. Further, seaweed and sea grasses are found along the shores of the Island.

3.5. Primary Production

Palk Bay waters are one of the highly productive ocean waters of the world. Primary production is the direct indicator of photosynthesis and production of algal biomass. Poductivity ranges between 100 and 868 mg $C.m^2.d^{-1}$. The average annual production has been reported as 205 mg $C.m^2.d^{-1}$. The euphotic zone of the nearshore waters is less than 6 m and owing to turbidity the production is only 1.2 to 1.5 g $C.m^2.d^{-1}$ which is equivalent to an annual production of 450 g $C.m^2$. In offshore waters where the euphotic zone may extend between 15 and 40 m the production would be 3 to 5 g $C.m^2$. Since primary production is the base of the energy pyramid any interference on this may reflect on the other organisms in the food chain and thus on the fisheries ultimately.

3.6. Zooplankton

The maximum zooplankton biomass values have been recorded during October-December and the minimum has been noticed during January – March. In

Palk Bay, high species diversity index of meroplankton has been observed during January and August. Various groups of zooplankton are present. Of these, copepods are the most prominent, the diversity index of which ranges between 2.67 and 4.24. In the northern part of Palk Bay, the zooplankton show bimodal cycle, with a primary peak during September-October period and a minor peak between January and March which is related to the prevailing monsoon conditions.

3.7. Meio fauna

In terms of Meio fauna count the number varies between 0 -132 and in biomass 0 -19.4 mg per kilogram of sediment. Meio fauna is comprised of larval *Polychaetes, Nematodes* and other Worms and shrunken jelly like masses of juvenile *Tunicates* or *Ascidians.*

4. Macrobenthos

4.1. Corals

Coral reefs in Palk Bay are only limited and extend to a length of seven kilometers along the northern side of the Mandapam peninsula. The eastern end of this reef terminates at the Pamban pass. The reefs are fringing type and are situated about 200 to 500 meters away from the shore. They are not continuous and are broken here and there. Palk Bay reefs are known to have 63 species of corals which belong to 22 genera. The reefs have a variety of associated flora and fauna. The coral colonies which form large reefs in the sea not only give refuge to a variety of organisms, including food and oranamental fishes, but also act as feeding and breeding grounds for them. Using isotopic C-14 method a sample from massive Porites of gorgonite from the raised reef at Pamban has been found to be of age 4,020 ± 160 years.

4.2. Sponges and Gorgonids

There are 275 species of sponges living in the Palk Bay and Gulf of Mannar area. They live in the island biosphere and in the open seaward areas. They are abundant in about 30 metres depth. Gorgonids have also been dredged form deeper waters beyond 50 meters. sponges, soft corals and gorgonids are the sources of rare bioactive compounds, having pharmacological properties in the cure of acute diseases. Gorgonid is one animal group that is rich in bioactive compounds, like prostaglandin, which is oxytocic and vasodilater and is used in ductus arteriosis and as abortifacient.

4.3. Chanks and Sacred chank

Fishing for chanks is done during March to June in the Palk Bay off the coasts of Thangachimadam and Rameswaram. The dominant variety present in the Palk Bay is *Obtusa*. The environs of Rameswaram island have proved to be an excellent reserve for the establishment of chank fishery. Fishermen from Periapattinam, Keelakarai,

Vedhalai, Pamban, Rameswaram and Thangachimadam are engaged for this purpose. There are a number of shops where a variety of fancy shells are sold. Although chanks were fished regularly every month their populations have dwindled in recent times. Usually chanks prefer fine sandy areas with rocky beds wherein nereids are plenty. Although dextral whorled chanks are common the rare and freak sinistral (Valampuri) chank is also available in this area.

The sacred chank, *Xancus pyrum*, is a gregarious, large, marine gastropod and it's dwelling places form distinct chank beds. The shell is milky white. In addition to ornamental purpose, the recent demand for chank shells, flesh and operculam has led to the increased exploitation of chanks. Chank flesh is rich in protein and minerals and compares favorably with fish meat. In living condition, the shell of the chank is covered by a thick periostracum, which is brown in colour, soft and velvety and easily peels off after the animal dies. Exploitation of chank by modified trawl nets along Rameswaram coast in Tamilnadu has been reported.

4.4. Echinoderms

Palk Bay has good resource potential of seacucumbers due to *beche-de-mer* export from India. Nearly 60% of the demand is met from Palk Bay. The processed seacucumber is known as *beche-de-mer*. Sea cucumbers are collected by skin divers including women in shallow waters from 2-10m depth. Presently, operation of a modified trawl net called chanku madi valai is yielding good catches of seacucumbers along with chanks (*Xancus pyrum*). At Pamban, the fishing lasts only for a period of 4 to 6 weeks in March - April period. At Rameswaram they are fished for nearly three months in May – August period. On an average 100,000 seacucumbers are harvested in a season. They are exported mostly to Penang and Hong Kong. Holothurians, to which the seacucumbers belong, are detritus feeders and hence are found in seaweed habitats.

4.5. Marine flora

Marine flora in Palk Bay include 32 species of green algae, 35 species of brown algae, 59 species of red algae, 3 species of blue green algae and 13 species of sea grasses.

4.6. Tunicates

Palk Bay has good source of tunicates. These jelly like organisms are mostly sedentary and contain a variety of bioactive compounds useful in making drugs.

4.7. Turtles

Turtle fishery in Palk Bay, Tamil Nadu, is an age old one and is of importance for the non-Hindu fishermen. It has been estimated that an average of about 3,000 to 4,000 turtles were landed every year between Pamban and Cape Comorin. In the Palk

Bay region the fishery was of a much lower level and about 1,000 turtles were landed annually between Rameswaram and Mimisal. The main turtle fishing centers in Palk Bay were Rameswaram, Thondi, Thirupalaikudi and Devipattinam. The green turtle constituted about 75% of the total catch. Olive ridley and loggerhead turtles formed about 20% of the catch. The catch was mainly sent to Tuticorin from different assembling centers where special pens were constructed in the sea close to shore for keeping the turtles alive. Turtles were caught by special type of nets made of fibres of *Acacia planiforons* or of catton yarn. Two types of nets were used. One was pachu valai (net) and the other was kattu valai requiring 5 to 8 men each for operation. The pachu valai was usually cast out during night at the entrance of two parallel coral reefs and hauled after a lapse of 12 to 18 hours. The other kattu valai fishing was also conducted between two coral reefs but in much shallower water and six fishermen usually operated the net. The net was usually laid on full moon nights and fishing was generally conducted for two hours. Turtle fishing is now prohibited under Wildlife Protection Act.

4.8. Mammals

Occasionally marine mammals and turtles have been observed to get washed ashore. Carcass examination has indicated that death was often due to propeller cuts or due to consumption of flotsam.

4.8.1. Dolphins

These animals are oceanic and roam about in Palk Bay area. It is likely that only the fragile and the infirm move towards Palk Bay here as they are known from their strandings. So far no mass stranding has been observed in the area of Palk Bay. *Stenella longirostris* and *Tursios truncates* are caught in various nets and the ones thus caught and injured (porobably) are clandestinely butchered for meat since capture or harming them is prohibited by law.

4.8.2. Dugong

The endangered Dugong, *Dugong dugon* lives within 10 m depth not far from the shore, usually in groups limited to 5-7 individuals among the sea grass beds. The sea grass, *Cymodocea*, is their chief diet. They have been found near Adirampattinam area in the Palk Bay. Dugongs are harmless and sluggish in nature. They can grow to a size of over 300 kg measuring 1.0 – 1.5 m in length. They give birth to a single calf at a time and the gestation period lasts 13-14 months. Though young male adults compete for female partners, once they have paired they remain paired for life. They have no natural enemies except man. The exact number of individuals living in the Palk Bay region is not known. Due to uncontrolled fishing carried out till recently and also due to reduction in their grazing area viz., the sea grass *Cymodocea*, their numbers

have come down drastically. However, they are now protected by the Wildlife Protection Act of 1972 and are listed in the endangered category.

5. Fisheries

The coastline in Tamil Nadu can be broadly divided into three fishing zones. They are (1) Pulicat Lake to Point calimere that lies in the Coromandal coast; (2) Point calimere to Dhanushkodi that covers the Palk Bay and the Palk Strait; and (3) Dhanushkodi to Kanyakumari which covers the Gulf of Mannar.

Fishing in Palk Bay is based on multi-gear, multi-species and is carried out throughout the coast of mainland and the northern side of Pamban/ Rameswarm Island. There are 87 fish landing centers located along the Palk Bay coast south of point calimere. Fishing is done in the Bay throughout the day. Fishermen of Mandapam and Pamban island may stay put for fishing lasting even for five to seven days at a stretch. Catamarans, dug-out canoes, plank built Tuticorin type Thoni or vallam, and stretched masula boats are the traditional crafts in use. The bottom conditions in Palk Bay are favorable for bottom trawling and hence good catches are obtained.

5.1. Elasmobranchs

Elasmobranchs are the largest group of fishes and are well represended in the fishery wealth of Ramewaram Island on the Palk Bay side**.** The common fishes found in this area include *Scoliodon sp., Rays, Skates, Tiger-sharks, Saw-fish and Hammer-head sharks.*

5.2. Squid fishery

The squid is the most common edible mollusc of Rameswaram Island. The squids appear in shoals in shallow waters off the coast of Rameswaram during April and the peak season is during the month of June when they come to the shore to deposit egg capsules among the sea-weeds. Two methods are employed in catching them. They are mostly caught by shore-seines and during the peak season they may range up to 5,000 per haul. About 20 to 30 fishermen are engaged in this fishing during the season.

5.3. Lobsters and crabs

Lobsters, crabs and cephalopods are important foreign exchange earners of Palk Bay canal zone fishery. In Mandapam *Panulirus ornatus* is the main species, *P.pencillatus and P. longiceps a*re also caught. *Scylla tranquibarica* and *Neptunus (Portunus) pelagicus* are important among the crabs caught. The former is a foreign exchange earner and is exported alive.

5.4. Cephalopods

In Palk Bay more than 70% of cephalopods are caught in trawls and the

Table 1. List of Fishing Centres within Palk Bay Region

1. Point Calimere	30. Ammapattinam	59. Pazhanivalasai
2. Muthupet	31. Pudukudi - North	60. Puduvalasai
3. Adirampatinam	32. Pudukudi - South	61. Panaikulam
4. Karayur Street	33. Kottaipattinam	62. Algankulam
5. Sunambukkarar Street	34. Jegathapattinam	63. Athankarai
6. Eripurakarai	35. Embavayal	64. Thoppuvalasai
7. Kollakadu	36. Palakudi	65. Dhargavalasai
8. Pudupattinam	37. Kumarappan Vayal	66. Alaigathanvalasai
9. Mallipattinam	38. Gopalpattinam	67. Irumeni
10. Chinnamunai	39. Pudur	68. Pirrappanvalasi
11. Manova Colony	40. Arasantalai	69. Pillaimadam
12. Pillaiyar Thittu	41. Pudukuda	70. Munaikkadu
13. Sethubavachatram	42. Sundarapandianpattinam	71. Mandapam - Palk Bay
14. Kalimankuda	43. Theerthanatham	72. Pamban light house
15. Othaiveedu	44. Pasipattinam	73. Akkalmadam
16. Karankuda	45. Damodarapattinam	74. Naalupanai
17. Sambaipattinam	46. Narayanendal	75. Thangachimadam
18. Adamcathevan	47. Valasapattinam	76. Villundy Theertham
19. Senthalaipattinam	48. Purakkudi	77. Pillaikulam
20. Mandhaipattinam	49. Tondi	78. Vadakadu
21. Puthur	50. Nambuthalai	79. Narikkuzhi
22. Somanathapattinam	51. Soliyakudi	80. Ohlaiyadipallam
23. Vallabanpattinam	52. Pudupattinam	81. Ohlaikuda
24. Vadakur	53. Mullimunai	82. Changumaal
25. Kattumavadi	54. Karankadu	83. Kariyur
26. Pattadabiramanpattinam	55. Morepannai	84. Cherankottai
27. Krishnarajanpattinam	56. Thiruppalaikudi	85. Kothandaramarkovil
28. Thulasipattinam	57. Devipattinam	86. Moondrayarchatram
29. Thulasipattinam - South	58. Mudiveeranpattinam	87. Dhanushkodi

remaining in shore seines. The squids *Loligo duvaucelii, L. investigatoris, Dorytruthid sibogae* and *Sepioteuthis lessoniana* are pelagic. The last one which lays eggs on algae, seaweeds, rocks, corals and the others release eggs in the water column. Cuttlefishes in the Palk Bay area are *Sepia pharaonis, S. secleats, and S. inermis* which are demersal in habitat and lay eggs on the benthic algae and hard bottom. *Sapiella inermis* is an inshore species and is caught by shore-seines.

5.5. Pearl Oyster culture

The pearl oyster culture in Palk Bay region is done in very shallow and calm waters during May to October. The sea bottom in the culture site is sandy and has abundant seagrass growth in places. It also has a natural bed of pearl oyster *Pinctada sugillata* and rock oyster *Saccostrea cuculata*. *Pinctada fucata* population in this bed is very sparse. The sea water temperature ranges from 25.7° to 33.0°C; salinity is from 26.9 to 35.6 ppt; pH is 8.0 to 8.8 and dissolved oxygen is 2.8 to 6.0 ml/l. The average depth of the sea in the area is 1.5 to 2 meters. Although the Physico-chemical characteristics of both the Gulf of Mannar and Palk Bay are almost same, Palk Bay has indicated better growth rate of pearl oyster in culture. Predatation was negligible and fouling on the oyster was less in Palk Bay.

5.6. Breeding grounds

There is no specific locality identifiable as breeding ground for fishes. The fishes breed throughout the Palk Bay and throughout the year. However, maximum number of eggs are collected during March. The eggs are identified as those of clupeoids, carangids, cyanoglossids and muraenids. There exists a minor fishery for juvenile fishes in Pamban Island and theedai areas during January-March in which mostly baby sardines are caught by torch (koondu) fishing during night hours.

5.7. Changing trend in fisheries

Conventionally in Palk Bay, during the early 1950s the crafts employed by the fishers were catamarans, Tuticorin type boats and dug out canoes. The major gears used then were boat seines, drift nets, gill nets and shore seines. More than 55% of the catch was obtained by boat seines operated from catamarans. Gill nets operated from Tuticorin type boats got about 34% of catch. The remaining 11% catch came from drift nets and shore seines.

5.7.1. Nylon nets

Nylon nets were introduced in the late 1950s and the fish catch increased by almost 30%. In the 1960s the catch increased almost by 200% with lesser sardines constituting the bulk of the catch.

5.7.2. Trawlers

A marked revolution occurred in the 1970s in fishing with the introduction of mechanized trawlers and the emergence of prawn fishery leading to an increase of over 400% in the total fish catch.

5.7.3. Impact of modernization

In the Palk Bay, trawling has made the once important shore seine fishing obsolete. However, now the indigenous fishing crafts are reviving as the Tuticorin type boats, dug out canoes and even catamarans are using outboard engines for propulsion. The FAO sponsored Bay of Bengal programme introduced pair trawls using high opening bottom trawls in the Palk Bay to catch large sized rock cods, snappers, seer fishes, lethrinids, pomfrets, horse mackeral and carangids. This diversification of gears for exploitation of different varieties of resources has made the indigenous fishery more efficient.

5.7.4. Newer trends

The oil sardine, *Sardinella longiceps*, fishery in the canal zone is a new event. A few years before even stray number is a rarity. During 1996 their catch was 1,419 tonnes. Further in the adjoining area of Pamban Island even their eggs and larvae have been observed. Another important change is the unusual increase in mackeral *Rastraliger kanagurta*. Earlier the mackeral fishery yield was only 213 tonnes but in 1996 it reached 3,711 tonnes in the Palk Bay region.

5.8. Non conventional fishery

The pearl oysters settle and grow on hard rocky substrata called paars. Paars are found abundantly from Pamban in the north to Manapad in the south for a stretch of 160 km where 83 well known paars exist. Non-conventional fishers collect seaweeds, algae, ornamental shells, gargonids and holothurians.

5.9. Present fishing limits

Usually mechanized trawl fishing is done up to 50 meters (about 30 fathoms) depth during November to February. For deep sea prawns up to 180 meters (about 100 fathoms) are reached. In the case of gargonid fishery, trawl nets are operated beyond 50 meters depth. Otherwise non mechanized boats operate within the depth of 36 meters (20 fathoms). Depth-wise analysis reveals that silverbellies are dominant in 11-20 m depth zone and catfish, rays, prawns and miscellaneous fishes in 4-10 m depth zone in the Palk Bay.

5.10. Conflicts over fisheries in the Palk Bay

5.10.1. Kachchatheevu

Kachchatheevu, a small island in the Palk Bay, is registered as a territory under

the Ramanathapuram sub-registrar's office in Tamilnadu. This island was part of the Zamindari of the Rajah of Ramnad who exercised control and ownership of the island. The Government of India in 1902 gave the island to him and the *peshkush* payable by him for the zamindari was calculated on the basis that the island formed part of the estate. The Rajah had leased out the island for fishing and other rights including grazing and has been collecting taxes till 1947. This island that belongs to Tamilnadu was handed over to Sri Lanka by the 1974 agreement to get the goodwill of Sri Lanka. At present, the fishermen of Tamilnadu who go to kachchatheevu are ill-treated. The Tamils claim that the land was given away to Sri Lanka without the concurrence of the people of Tamilnadu. In order to protect the Tamil fishermen, and to safeguard the interests of Tamils there are vociferous public figures who argue for retaking Kachchatheevu.

5.10.2. Conflict over Kachchatheevu

The tiny uninhabited island is situated in the Palk Bay at a distance of 12.8 km and 16 km from the nearest points of SriLanka and India respectively. It is located 16.8 km south of Delft island in Sri Lanka and 19.2 km from Rameswaram. The island is about 1.8 km long and 274 meters broad in its widest point. The area of the island is about 285.2 acres. Traditionally Tamilnadu fishermen have used this island as a staging post to dry their fishing nets and fish catch. There is a catholic church of St.Antony where pilgrims mostly from Tamilnadu and some from Sri Lanka gather every year at the end of March for a week long religious festival. St.Antony is revered as the guardian of fishermen, protecting them from turbulent seas and inclement weather which is prevalent during northeast monsoon time. It is believed that the church was built in the early part of the 20th Century by one Seenikuppan Padayachi, a fisherman of Ramanathapuram, to fulfill his offering. It is known from the 1972 Gazetteer of Ramanathapuram that a catholic priest from Thangachimadam near Pamban on the Rameswaram island would visit the church during the festival to conduct the mass.

The island itself is barren, but the sea surrounding it is rich in prawns and hence it has become a source of dispute. Most of the violations of international boundary line take place near this island because of the availability of prawns here. Historically chank shells, pearl oysters, and corals collected from the sea around this island were important sources of income for the fishermen. The British used the island as a ground for bombing practice during the Second World War.

The maritime boundary in the Palk Strait was demarcated by the 1974 agreement between the two countries by which Kachchatheevu was ceded to Sri Lanka. Similarly, the 1976 Agreement was made to demarcate the boundary in the Gulf of Mannar and Bay of Bengal which barred the fishermen from fishing in each other's waters. However, Indian fishermen and pilgrims were allowed to enjoy access to visit

Kachchatheevu as before and were not required to attain travel documents of visas for these purposes. The Kachchatheevu settlement was largely a goodwill agreement to boost the morale of the Bandaranaika regime in Sri Lanka at that time.

The establishment of the Exclusive Economic Zones by the two countries, India and Sri Lanka, was to exercise sovereign rights over the living and non-living resources of their respective zones. Thus, the fishing vessels and fishermen of India should not engage fishing in the historic waters, the territorial sea and the Exclusive Economic Zone of Sri Lanka, nor should the fishing vessels and fishermen of Sri Lanka engage in fishing in the historic waters, the territorial sea and the Exclusive Economic Zone of India, without the express permission of either Sri Lanka or India as the case may be.

In times of heightened internal conflict Sri Lanka promulgates emergency regulations which convert their territorial waters into a prohibited zone. Owing to security concerns, Sri Lankan fishermen living in Jaffna and Mannar face restrictions on the type of boats they can own, the areas where they can fish and the duration they can be at sea. Similarly, for the Indian territorial waters, the Indian Government applies strict measures to prevent infiltration and movement of militants. In such situations there is no opportunity to distinguish between militants and fishermen.

5.10.3. Conflict over fishing

The massive growth of fishing activity and income sharing in the region is also a cause for concern. As per available information, the number of trawling boats operating from Rameswaram is about 1,000. There are about 1,500 traditional crafts also. Ramanathapuram district ranks first in the total Marine fish landings of Tamil Nadu. The growth rate of Marine fish landings of this district is also much higher than that of the State as a whole. For instance, it was 44.9 % during 1987-90, 10.6 % during 1990-93 and 20.7 % during 1993-96, while it was 9.0 %, 8.3 % and 9.2 % respectively for the whole state. Similarly, for the period 1992-96, the Palk Bay with only 27 % of the coastline accounted for 36.7 % of the State's fish landing, while the other two major coasts viz., Coramandal and Gulf of Mannar with 35 % and 32 % of coastline respectively, accounted for only 28.6 % and 25.9 % respectively.

The ocean currents and sedimentation on the Sri Lankan side of the Palk Bay have made it a rich ground of Tiger Prawns that fetch high price and hence fishermen from Tamil Nadu venture into Sri Lanka waters beyond Kachchatheevu, up to Delft Island off the Jaffna coast, even at the risk of being killed. Unlike other places in the state of Tamilnadu, the system that is in vogue in Rameswaram in sharing the fish catch also puts pressure on the fishers to go to fishing grounds much closer to Sri Lanka, where the availability of prawns is high. In other places of Tamilnadu the net income is shared between the boat owner and crew in the ratio 60:40. On the other hand in

Rameswaram the boat owners pay only daily wages.

It appears from the above facts that if we don't decongest Rameswaram and other affected areas, there will be no solution to the problem of fishermen from India and Sri Lanka crossing into each other's territorial waters.

6. Corals and coral reefs

Corals are the marine invertebrates of the Phylum Cnidaria and class Anthazoa which live in association with the algae called Zooxanthellae. They form colonies and build structures of sheer beauty of form, colour and design. In India, corals are found in the Gulf of Kutch, around Lakshadweep Islands, off Ratnagiri, Malvan and Mangalore in the Gulf of Mannar, Palk Strait and around Andaman and Nicobar Islands.

Coral colonies thrive in shallow and warm tropical marine waters. They are highly productive. In fact, among the biological organisms, man's ability to alter the surface of the earth is rivaled only by colonies of these tiny coral polyps. They also have the potential of yielding a variety of bioactive substances including drugs for curing diseases.

Corals live in and build colonies to form massive underwater structures similar to and often much larger than, those built by honey bees or termites. However, they are not as advanced as these insects. Hence they neither have the ability to move away from their living structures, e.g., to run away from dangers or disasters such as unusual temperature raise in the ambience, nor do they have the division of labour in their colonies to effectively manage crisis situations. As a result, they succumb to even minor changes in the ambient environmental conditions, resulting in disasters. Such disasters struck in the years 1998 and 2002 killing a large section of the corals in the Palk Bay, which may have far- reaching consequences on the fisheries of this region.

6.1. Importance of Corals

1. Food resources: Massive structures of coral colonies form large reefs in the sea which not only provide refuge to a variety of organisms, including food and ornamental fishes, but also act as feeding and breeding grounds for them. The Gulf of Mannar and Palk Bay reefs with an area of 100 km^2 can yield 1,000-15,000 tonnes of fish per year.
2. Genetic resources: They support a wide variety of other animals which perhaps has the greatest diversity of the innumerous ecological niches available. Therefore even a slight disturbance can cause widespread damage to the species structure and ecological balance.
3. Industrial Chemicals: There is a vast potential for industrial exploitation of reef organisms for bioactive substances of medicinal value. Prostaglandins and

antibiotics and even substances with anti-tumor activity have been extracted from some corals and associated fauna.

4. Aesthetic Qualities: Coral reefs play an important role in maintaining aesthetic qualities of certain places. This is particularly true for tourist resort Islands. Enjoying the sheer beauty, colours and forms will greatly help psychologically in relieving tension in the lives of a lot of our people.

5. Educational and Scientific Values: There is a complex food web and trophic organization in coral reef ecosystems, and its biodiversity of fauna and flora, thus supporting a tremendous variety of life forms. Therefore they are of great educational and scientific value especially for the students of our schools, colleges, universities and public.

6. Protection against Natural calamities: Corals protect land borders against waves and storm surges. They act as baffles and bear the brunt of nature's fury. The tsunami destruction of 26th December 2004 was less because of the coral reefs which acted as barriers to dissipate the energy of the waves.

7. Recreational benefits: Coral reef ecosystems are places of recreation for people who like swimming, snorkeling and diving for hobby. Since the waters in which the corals live are normally clear and clean, swimmers and divers can enjoy seeing a variety of corals and associated fauna and flora.

8. Use in construction: Coral mining in the past has been done for large boulders of corals. Usually the high percentage of lime is needed by sugarcane industries, chemical factories making calcium carbide and cement factories. Low percentage lime goes towards making mortar in local constructions.

9. There is a great potential for commercial aquarium fishes from coral reefs. No organized effort has been made to exploit these resources on a sustainable yield basis. Neither do we know the number of species of aquarium fishes nor anything about their biology and potential yield.

6.2. Coral reef ecosystem

The coral reef in the Palk Bay runs parallel to the land in an east-west direction between Lat.9°17' N and Long.79°17' E - 79°8' E. The Bay is a shallow flat basin and its depth hardly exceeds 9 meters. The coral reef in the Palk Bay starts from Munaikadu, as a wall like formation with a width of 1-2 meters, and runs east up to Thonithurai to a distance of about 5.5 km where the width reaches more than 300m. East of Pamban Pass, the reef again starts near Thangachimadam and runs, although not continuously, up to Agnitheertham in Rameswaram covering a distance of nearly 18 km.

6.3. Physico-chemical Environment

Palk Bay is largely influenced by both southwest and northeast monsoons. However, southwest monsoon contributes only little towards the total annual rainfall in this region. The mean annual rainfall varies from 820 to 1,650 mm. The monthly average temperature of the waters ranges between 24.6° and 29.1°C. The tidal elevation in Palk Bay is about 1m. The salinity of Palk Bay waters decreases gradually along an axis in the southwest direction running from the strait. High saline water is found in the southwest corner of the Bay. The density of water decreases along an axis of the southwestern direction from the Strait. Temperature, salinity, density and dissolved oxygen values of the surface waters of Palk Bay indicate that the Bay of Bengal waters entering the Palk Strait influence the hydrographic conditions. On the other hand the influence of Gulf of Mannar waters from the south on the hydrological parameters of Palk Bay is only minor.

6.4. Distribution of Corals

Twenty species of corals were reported in the Palk Bay region in the late 1960s. This number increased to 25 by the late 1990s. However, a thorough survey of the coral reef areas in the Gulf of Mannar brought the number of species occurring in the region to 50 by the year 2004. They belong to 27 genera of 11 families. The reef area of the Palk Bay has been divided in to five zones viz., shore, lagoon, shoreward slope, reef crest and seaward slope.

6.4.1. Shore

The shore region of the reef is mostly sandy with dead pieces of corals except at the extreme eastern side and near the Pamban bridge where one can see traces of sand stones. The vegetation on the shore is comprised of *Cocos nucifera, Borassus flabellifer, Casuarina equisetifolia, Azadirachta indica* and a few thorny shrubs.

6.4.2. Lagoon

The width of the lagoon varies from 200-600m at different places with a depth of 1-2m. The bottom is sandy with molluscan shells and pieces of disintegrating corals. Living corals are absent in the lagoon probably due to absence of any hard substratum on which coral larvae can settle. Sponges such as *Hercina fusca, Dysidea fragilis, Spirastrella inconstans* and *Calispongia diffusa* are found in this region.

6.4.3. Reef Crest

The reef crest often gets exposed at low tide times. Corals are rare at the reef crest, perhaps due to over-exposure to sun which is deleterious to the corals.

6.4.4. Seaward Slope

On the seaward side of the slope, coral growth is comparatively better in terms

of distribution and diversity than on the shoreward side. Majority of corals belong to *Pocillopora sp., Acropora sp., and Montipora sp.*

6.4.5. Diversity

A total of 61 species of marine macroalgae have been recorded in Palk Bay and they belong to three major groups viz., green algae (14 genera with 28 species), brown algae (8 genera with 13 species) and red algae (17 genera with 20 species). The occurrence of different species in the quadrate samples showed *Halimeda opuntia* to be the dominant one in the reef. Species of *Caulerpa* and *Sargassum* were the next most common algal species found in the reef. The physical conditions such as the nature of substratum and water above the substratum have been found to influence the floral diversity of the coral reef area in Palk Bay.

The common inhabitants of the sandy lagoon floor are *Cymodocea sp., Ulva reticulata, Turbinaria sp., Padina sp., Hailmeda sp., and Amphiora sp.* Animals such as *Holothuria scabra, H. atra* and *Pentaceraster australis* are found in this area. In the seaward slope of the reef, few encrusting calcareous algae are found.

Bivalves have been found to cause considerable damage to the coral reefs as they act as biological agents in the erosion of hard coral stones. More than 73 species of molluscs have been observed as associates of corals in the Palk Bay. The branching corals *Acropora corymbosa and Pocillopora damicornis* showed large number of molluscan associates compared to other branched living corals.

An estimated 300 to 400 kg of sea horses have been exported from the Palk Bay coast fetching an average revenue of about Rs: 80,000 for the local fishermen. During the 1970s fishermen of Palk Bay region complained about the disappearance of large beds of algae owing to the 1964 cyclone effects. Therefore, there was near total absence of turtles and dugongs in this area at that time. However, the situation turned around and the algal beds have sprung up once again in the area and the conditions have come back to normal. The lean period for prawn fishery in the Palk Bay is during September – October, and January – April.

6.5. Current Status

The coral reef ecosystem has now completely changed in the pattern of distribution of corals and associates. The lagoon area is having large number of boulders occupied by various species of scleractnian corals. Six scleractinian coral species have been recorded in the lagoon area of Vellaperukkumunai reef. The findings also indicate that species of boring sponges are more in number than that of the macro-sponges.

Inshore waters of Palk Bay during the monsoon becomes muddy due to suspended sand and silt stirred up from the sandy shore by wave action. The large

degree of silt settlement has a remarkable effect especially during the northeast monsoon. Cyclonic winds, during the monsoon season, cause mechanical damage to the corals of this area. Huge quantities of silt settlement during northeast monsoon has a definite impact on the distribution and diversity of coral reef associated plants and animals. Enrichment of nutrients in the coral reef ecosystem increases the phytoplankton population and reduces sunlight penetration into the water column thus paving the way for ecosystem changes. The seafood processing industries and nearby households discharge hot/cold, and dirty sewage water directly into the sea. Wherever industries are located changes in coral reef ecosystem have become visible. *Perna virides* which is not a common bivalve in the coral reef ecosystem has been found occasionally in good numbers and in large sizes in the Palk Bay.

6.6. Coral Destruction

Natural causes of coral destruction include strong monsoon winds and cyclones which turn some areas of coral reefs into rubble banks. Extensive dilution of salinity due to heavy rains can kill corals but fortunately tidal influence offsets the extent of damage. Silting due to land erosion is a serious cause for concern especially in the land where extensive removal of trees for timber results in soil erosion. Perhaps maximum damage to Indian coral reefs has been done by widespread mining for road and building construction, and lime making for cement manufacture.

Pollution is becoming a major cause of coral destruction in recent years. This is because of increased population settlements in coastal towns, which dump their untreated domestic and industrial wastes into the oceans. This is true in the Palk Bay region also. In Rameswaram island, increased tourist activity has resulted in establishment of residences and commercial places which contribute to pollution load by way of sewage effluents.

Many of the coral grounds have been destroyed also because of unscrupulous fishing, using trawl nets in shallow depths of 2 to 3 fathoms, and by use of shore seine fishing nets around coral reef areas.

6.7. Coral mining

Coral mining is done for large boulders of corals. Usually high percentage coral lime is needed by sugarcane industries and cement factories whereas low percentage lime goes towards making mortar in local constructions. Several years ago, the fisherfolk were removing both live and dead corals, even breaking branches of live stag-horn corals thinking that they would grow new branches fast. Huge blocks of honey comb and brain corals were removed leaving the small live ones. As almost all fisherfolk involved in coral mining are illiterate and know nothing about the biology and ecology of corals, they can’t visualize the implications of coral destruction. They don’t realize

that the dead corals themselves play a vital role in the expansion of coral colonies by allowing settlement of new larvae to form new coral colonies. Under completely undisturbed conditions such growth can lead to the build up of even large landmass.

6.8. Coral Bleaching

The coral-bleaching phenomenon that occurred extensively during 1998 was due to unusual rise in surface sea-water temperature, which reached above 32°C in the peak of summer. This confounded with the failure of the southwest monsoon winds during this period exerted great stress on the corals leading to expulsion of zooxanthellae from their bodies causing the bleaching phenomenon.

Coral reefs form one of the most dynamic and productive of all marine ecosystems in the world. Reefs provide the feeding and breeding grounds for thousands of food and ornamental fishes. There are millions of people in the tropics whose livelihood depends on coral reefs. It has been estimated that a part of the protein consumed in their diet is being obtained from the coral reefs. A variety of seaweeds are also collected from coral reefs which are used for food, medicine, fertilizer etc. Therefore, it is a cause for concern that coral reefs and associated organisms are threatened by the *El-Niño* Southern Oscillation which affects the global climate. The *El- Niño* phenomenon is known to cause fluctuations in rainfall, resulting in drought in some areas and heavy rainfall in other places. A reduction in distribution of coral associated fishes due to bleaching in the reefs of Palk Bay region has been reported which may be also due to an apparent movement of small pelagic fishes from the shallows to the deep waters.

6.9. Corals and Impact of tsunami

The live coral cover of 26.7% in the Palk Bay was reduced to 19.2% after the tsunami. The coral cover under stress was 2.8%, which included those showing partial bleaching and those with infestation of pink line disease. Silt smothered coral cover was 10.5%. Damaged corals due to tsunami included recently killed corals, upturned corals and broken corals. In Palk Bay region there was no change in landscape structure. Temporary inundation of sea water was noticed in some places only. There was substantial increase in sedimentation rate after the tsunami in the coral reef environment of Palk Bay. Thus the rate of sedimentation observed before the tsunami as 12 $mg.cm^2.d^{-1}$ during November 2004 increased substantially to 54 $mg.cm^2.d^{-1}$ at the end of December 2004. However, it decreased back to the normal level of 13 $mg.cm^2.d^{-1}$ during January 2005.

7. Sethusamudram Ship Channel Project

The Rs.2,427 crore Sethusamudram Ship Channel Project (SSCP) under construction between India and Sri Lanka, is expected to be operational by the year

2008. India doesn't have a continuous navigable route here due to the presence of a shallow ridge in between at depths of 1.5 to 3.5 meters. This ridge is known as Adam's Bridge. The Palk Bay itself is also too shallow for navigation. Therefore the SSCP was conceived to create a continuous ship channel by dredging across the Adam's Bridge and in the shallow parts of Palk Bay. Of this, about 90 km needs dredging, which will be done for 35 km length in the southern leg from Adam's Bridge and for a length of 54 km in the northern leg at Palk Strait. Some hard strata have been reported beneath the soft sand during surveys by the National Hydrographic Office of Dehradun. The area adjoining Adam's Bridge near Dhanushkodi Peninsula, on the North and the South, was reported to be sandy by the National Ship Design Research Centre (NSDRC) of Visakhapatnam during their survey in connection with this project.

Intervening stretches of Palk Bay which require no dredging is 78 km long. Dredging is to be done to achieve a depth of 12 meters for ships with a draft of 10 meters i.e., those which reach 10 meters down under water. In terms of weight, a fully loaded 30,000 deadweight tonnage ship will be able to sail through. Deadweight tonnage is the maximum weight that a ship can safely carry when fully loaded, including the crew, passengers, cargo, fuel, water, and stores. The breadth of the channel at the sea bottom will be 300 meters. The Project authorities claim that the channel will save up to 780 km of circumnavigating distance going round Sri Lanka and 24-30 hours of voyage time on the sea.

7.1. Environmental Regulations

The environmental rules and regulations in force, land use on the coastal areas will be as per the Coastal Regulations Zone (CRZ) Notification issued by the Ministry of Environment and Forests (MoEF), Government of India in 1991 and Subsequent amendments under the Environmental Protection Act. The Notification is administered by the State Department of Environment and Forests. During the operational phase of the project, the most important instrument to be complied with relates to the international Convention for the Prevention of Pollution from Ships of 1973 as modified by the Protocol of 1978 (MARPOL 73/78) for which India is a signatory.

7.2. Environmental Status

Sediment samples collected along the proposed channel alignment showed the presence of organic carbon, total nitrogen, total phosphorous and sulphate in concentrations adequate for biological growth. Almost all the sediment samples showed the presence of oil and grease. The concentrations of heavy metals are high in some of the sediments in the Palk Bay as compared to other locations.

7.2.1. Biological Resources

The gross primary productivity along the proposed channel alignment varied

from 142 to 472 mgC.m^3.d^{-1} indicating that the region is biologically productive. Copepods are the dominant zooplankton. Macrobenthos are represented by 78 varieties exhibiting fairly good diversity. The meiofauna are comprised of larval polychaetes, nematodes and other worms.

Corals are not found along the proposed channel alignment in Adam's Bridge although other groups of biological resources like sea fans, sponges, pearl oysters, chanks, and holothuroids at various sampling points have been recorded. In general, according to the EIA report, the density of economically/ecologically important species along the proposed alignment is not significant. There are 87 fish landing stations between the south of Point Calimere and Pamban in the Palk Bay.

7.2.2. Biodiversity

Non-conventional fishing in the region is represented by pearl oysters, chanks, sea weeds, ornamental shells and holothurians. There has been a declining trend in the production of these organisms as evidenced by the revenues received by Marine Products Export Development Authority (MPEDA). Point calimere wild life sanctuary has over 17.26 km^2 area comprising tidal swamps, dry evergreen forests and mangroves located in coastal areas of Palk Strait in Nagapattinam District. The sanctuary is bestowed with populations of varied wildlife such as Chital, Wild Bear, Bonnet Macaque, Black Buck, Flamingoes, Teals, Gulls, Terns, Plovers and Stilts. Dolphins and Turtles are seen close to shore areas.

7.3. Land Environment

Based on an analysis and interpretation of IRS IC LISS-III satellite data, merged with PAN data, degraded area in Pamban (Rameswaram) Island has been delineated for anticipated disposal of dredged material to the extent possible with prior approval under CRZ regulations. A large stretch of about 753 hectares of such land between Rameswaram and Dhanushkodi is available.

7.4. Controversies

The Sethusamudram project is faced with issues such as environmental, economic and livelihood issues. Any adverse impact on fisherfolk and biodiversity and Post-tsunami status are also issues. Another issue concerning the EIA is that the assessment has mostly used secondary data and that too as far back as 1976. One of the questions raised was, How can a project which will pass through a biological hotspot and one which is likely to have so many impacts be assessed on the basis of secondary data?

A supporter of the project on the other hand opines that the proposed channel will bring benefits like surge in the development of coastal trade and development of

industries. However, the opponents claim that there is no data supporting this statement and that it is clear that the project proponents, in this case, have sought to provide only a makeshift document to primarily overcome the hurdle of environmental clearance.

The Indian Meterologoical Department considers the coastal stretch between Nagapattinam and Pamban as high risk zone of tropical cyclones. A retired naval commander has reported that hydrological studies on the impact of the deep channel over the prevailing swift and seasonal ocean currents have been carried out including the siltation pattern of the channel and hence the amount of periodical dredging required. The report has shown that the current velocity is as mild as 0.2 - 0.4 $m.s^{-1}$ (0.75 to 1.5 $km.h^{-1}$), which appears to be too optimistic.

Ecologists fear that locating such a huge project, which requires large amounts of dredging, so close to a biodiversity hotspot might lead to irreparable damage to its biodiversity. They claim that the turbid waters caused by the dredging may kill sea grasses such as *Halophyla ovata* and *Cymodocea serrulata* on which dugongs, also known as sea cows, depend for feeding. The dugong is an endangered species. Dugongs cannot live without the sea grass, and the latter needs sunlight to thrive. The turbid waters may not allow sunlight to penetrate in to the sea grass beds. Further, the sea grass beds are required for prawns to settle and grow in their post-larva stage. Thus, by damaging the sea grass the ecological balance will be destroyed is another claim against the project.

8. Conclusion

This would minimize environmental impacts as well cost of dredging and disposal. It would be ideal to explore the possibility of dredging the channel to 10 m depth in first phase to cater to vessels of 9.15 m draught and monitor environmental status during construction and operation phases. The proposal of 12.0 m depth can be subsequently taken up in the second phase provided adverse impacts on the environment are not observed.

Hydrodynamic modeling studies using Depth integrated Velocity and Solute Transport (DIVAST) model have shown that, even for the highest spring tidal water conditions, there will be no significant change in the magnitude and direction of current velocities along the proposed alignment due to the construction of the channel in Adam's bridge area.

During the construction and operation phases of the channel, the potential sources of marine pollution are spillage of oil and grease, marine litter, jetsam and floatsam including plastic bags, discarded articles of human use from the sea borne vessels which will have to be controlled.

The channel may facilitate the movement of fishes and other biota from the

Bay of Bengal to the Indian Ocean and *vice-versa*. By this way, the entry of Oceanic and alien species into the Palk Bay and Gulf of Mannar, as also the dispersal of endemic species outside the Palk Bay could occur.

9. Research Gap Areas Identified

1. Information on existence of various species of corals is available. However, the extent of their distribution needs to be assessed as done in the case of forests. Special emphasis should be given to soft corals. Long term monitoring of corals is essential. Protection/ Conservation measures are to be taken.
2. Although present in limited areas, research on coral reef ecology particularly the interaction of other animal species with the corals should be studied in order to understand their contribution to fishery in this region.
3. Coral biology with particular reference to population density, reproduction, spawning seasons and patterns of distribution should be studied.
4. Rehabilitation of corals in reef denuded areas, especially around Mandapam and Rameswaram must be done.
5. As done in its construction phase, the impact of Sethu Samudram Ship Channel Project (SSCP) on the coral reef ecosystem during its operation phase also needs to be studied especially in relation to the monsoons i.e., both the southwest and north-east monsoons, as well as the cyclones, influencing the underwater current patterns.
6. The concern raised by a few publications on bio-invasion due to the SSCP and the operation of foreign vessels in future in the region needs to be addressed. This should include bio-monitoring of invasive and introduced species.
7. Although the endangered dugong has been reported to be present in the Palk Bay there is no information about the region where they live and nothing is known about its habitat ecology and hence needs attention.
8. Exclusive surveys should be conducted to assess the status of endangered and threatened species such as marine turtles, seahorses, dolphins, dugongs, molluscs, corals, etc.
9. Importance should be given to study the Seagrass ecosystem which is necessary for the survival of the endangered dugongs. The availability, extent of distribution, diversity and biomass potential of seagrass in Palk Bay needs to be assessed. Long term monitoring of seagrass ecosystem will be helpful.
10. Dolphins are known to frequent the waters of Palk Bay. However, the available information is only about their morphometry and that too based on stranded carcasses only. Efforts should be made to study their biology, ecology and behavior in nature.

11. Extensive research on sea turtles, especially about their seasonal migration, nesting grounds and breeding populations, should be carried out.
12. Although distribution of mangroves in the Palk Bay is limited to Vedaranyam coast in the northern shores of Palk Bay, their ecology in terms of their support to fisheries, land protection and significance as feeding and breeding grounds for sea birds, sea snakes and other organisms needs to be understood.
13. A GIS based Resource Information System should be developed to provide baseline information for which current underwater surveys should be carried out to locate pearl oyster beds, chank beds, seaweed grounds, sea grass beds and coral reef distribution. A resource map should be prepared based on such surveys.
14. The majority of information available is based on studies carried out either in the northern portion of the Palk Bay or on the southern region of the Bay. Hence attempts must be made to cover the rest of the Palk Bay region also to identify any new grounds of living resources.
15. Pollution is a cause for concern, although not to a large extent, a thorough understanding of the situation in the Palk Bay is lacking. Hence it is necessary to conduct research to find out the impact of pollution and the polluting sources, including domestic, municipal and industrial discharges, on the marine living resources of the Bay. A thorough coastal survey between Vedaranyam and Dhanushkodi should be conducted to identify and map the pollution sources.
16. An assessment of destructive fishing practices and the number of fisherfolk involved should be done and measures to rectify should be adopted.
17. A clear understanding and estimate of fishery resources harvested by various fishing sectors, such as mechanized and non-mechanized vessels, and the number of fishermen involved are required.
18. Fishery dynamics and stock assessment are to be done for the Palk Bay region.
19. Information on Socio-economic status of Palk Bay dependent human population is lacking. This should be studied to understand the problems and prospects of using the human resource to protect and conserve the marine resources.
20. In order to relieve human pressure on the marine living resources in this region, alternate livelihood options should be explored. Entrepreneurship Training programmes may be conducted and extension activities carried out periodically by scientific institutions in order to disseminate information and spread environment friendly aquaculture technology such as pearl culture, seaweed culture, seacucumber culture etc. Commercially viable short term programmes such as crab fattening, lobster fattening, and marine ornamental fish rearing may be introduced as alternate livelihood options.

21. Research on the impact of climate change and sea level alterations in the Palk Bay may be initiated.
22. A complete list of fauna and flora of the Palk Bay may be prepared.
23. Information on traditional knowledge in the region may be compiled.
24. Remote sensing should be used, including aerial surveys and photography, to assess the current status of the topography, geomorphology, forest cover and land use patterns of the coastal area of the Palk Bay. Towards this a thorough coastal survey between Vedaranyam and Dhanushkodi should be conducted to identify and map the various activities and sources of impacts using GIS tools.

Fig. 1. Map showing Palk Bay

A

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Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India..

Abstract: This paper deals with various aspects of the biology of the green turtle *C.mydas* of Mandapam region caught during 1971-1976. The major food items observed in the stomachs are sea grasses and seaweeds. The relationship or morphometric measurements with plastron width, which is used here as standard measurement, showed linear regression with best correlation. The relationship of carapace length (straight) with other body measurements were also examined. The plastron width-weight relationship for 316 turtles were worked out. The regression coefficients of the same for the sub adults (weighing less than 71 kg), males and females were found to differ significantly. Females greatly outnumber males in all the years. Plastron length and weight frequencies for females and males were analyzed. Using annual weight frequencies for 6 yrs from 1971 to 1976, the modals were traced. The highest weight increment, 18.64 kg is in the 7th year of age and highest plastron width, 15.2 cm in the 2nd year.

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Abstract : The east coast as a whole, however, has 1% probability of 7 or more cyclones crossing in a year. In fact 1943 is the only year during the above said 104 years in which 7 cyclones crossed the east coast, 3 in Orissa and 2 each in Andhra Pradesh and Tamil Nadu. Orissa has the highest probability (56%) of at least one cyclone. Andhra Pradesh, West Bengal and Tamil Nadu have respectively 46%, 36% and 27.5% probabilities of atleast one cyclone making landfall per year. There is 98% probability that atleast one cyclone will cross the east coast of India. It may be mentioned that 1920, 1965 and 1975 were the three years during which not a single cyclone crossed the east coast of India.

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Abstract : India, faced with the problem of food shortages as it is, has, since two decades, been systematically investigating and harvesting the resources of the around her with a view to augmenting her food produtier. But the emphasis laid has been mostly on fishes, and the molluscan shellfish, in generically, have not been given due attention. Besides forming food, the mollusks are a useful source in making lime, mortar and cement for the

house building industry and as ornaments and curies. This is a source where relatively little investment can bring in high returns. Among the edible mollusks, clams and oysters abound our coasts. Though the biology of species like *Crassostrea madrasensis, C. gryphoids, Meretrix meretrix, M. casta, Katelysia opima, K. marmorata, Solen kempi, Donax cuneatus, D, faba, Gafrarium tumidum, Anadara goanosa* and a few others has been studied from different areas data on the exploited and potential resources have not been adequately obtained.

In the present paper the distribution of calm, cockle and oyster resources of the Indian coasts, including the estuaries and backwaters, based on a survey conducted along the east and west coasts and the published data has been dealt with. The present level of harvesting is given and the scope for future exploitation is indicated. The need for starting systematic culture of these species as well as simple transplantation to bring new areas into production is stressed. The need for educating the public on the food value of the mollusca is also pointed out. The article cannot be said to cover all the above aspects in great detail but it attempts to highlight the importance of the edible bivalve resources in the present situation.

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Abstrat : Pearl fisheries of India are of ancient origin. The pearl oyster resources are located mainly in the Gulf of Kutch and Gulf of Mannar. They are subjected to wide fluctuations from year to year, particularly when they are exploited for natural pearls. In 1972, Veppalodai, near Tuticorin, was selected as a site for conducting experiments on pearl oyster farming and on the development of cultural pearls. Modern method of raft culture was adopted for raising mother oysters. This method proved successful despite the trying sea conditions prevailing during the monsoon months. The survival rate of the pearl oysters in the farm was about 789% during the first year. The oysters grew fast in the farm in certain seasons and remained healthy throughout the experiments. Fouling by different of organisms was a serious problem and, if checked properly, led to mortality of oysters. Settlement of the spats of pearl oyster occurred at the farm from May to July.

At Veppalodai, the techniques of producing cultured pearls from the Indian pearl oyster, *Pinctada fucata,* were developed and for the first time free, spherical cultured pearl were produced. The potential and implications of pearl culture in India have been discussed in relation to the situations prevailing in the pearl culture industry of other parts of the world.

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Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The five volumes of Herdman (1903-1906) on the "Report to the Government of Ceylon on the pearl oyster fisheries of the Gulf of Mannar" and the treatise of Hornell (1922) on "The Indian pearl fisheries of the Gulf of Mannar and Palk Bay" are the works of scientists who had mastery over the subject of pearl fisheries of the Gulf of Mannar on both the Indian and Sri Lankan sides. Subsequent to 1922 the only major contributions,

aside the routine survey, have been the use of dredge for fishing of pearl oysters on the Sri Lankan side (Sivalingam 1958) and the survey and charting of "Pearl and chank beds of Gulf of Mannar" on the Indian side by Baschiere-Salvadori and his Indian associates introducing SCUBA-diving for the first time as reported in First through Third Report to the Government of India.

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Abstract: In the Gulf of Mannar area, near the Cape comorin region, boat Kattumarams are in use. The Palk Bay and the Gulf of Mannar are sheltered areas from where the fishermen operate their indigenous canoes or vallams. Two distinct types of Kattumarams are used in Tamil Nadu. They are raft and boat kattumarams.

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Address : Central Marine Fisheries Research Institute, Cochin – 682 018.

Abstract : Four species of Foraminifera, namly *Fissurina ventricosa* (Wiesner*), Nonion grateloupi* (d' Orbigny), *Nonionella auricular Heron- Allen,* and *Earland* and *Bolivina variabilis* were found in the stomach contents of the prawn, *Penaeus semisulcatus*. There appear to be new records from the Palk Bay. All the four species have been described and figured**.**

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Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu India.

Abstract: In this study of Foraminifera, 12 spp have been described and illustrated along with a list of 34 spp, reported from the beach sands of Palk Bay and Gulf of Mannar. This includes 6 new records from the Indian region. Details regarding the morphology of the test and the world-wide distribution of the different spp have been given. Of the 34 spp, the diagnostic characters of 12 spp, which are of special interest, have been included along with illustrations. Of the 12 spp described, 6 spp in the following list are recorded for the first time from the Indian coasts: *(Marginulina cf. crepidula, Elphidium frigidum, Rosalina concinna, Asterorotalia pulchelia, Pararotalia armata, and Amphistegina gibbosa).*

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Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu India.

Abstract: Fishery of *P. pelagicus* along the Palk Bay and Gulf of Mannar is by a type of gill

net locally known as Nandu valai . They are also caught in large numbers in trawls operated by mechanised boats. The monthly catch per unit effort at the 3 major crab fishing centres Devipattanam, Vedalai and Mandapam is estimated for 3 yrs and Vedalai is found to be the most productive centre for crabs. Some information regarding the marketing, disposal, longevity of life outside seawater and sound production are also given.

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Abstract : In January 1980 BOBP initiated a project in four fishing villages of Thanjavur district in Tamil Nadu. The men needed credit for buying nets; the women for fish marketing. Consequently the project organized loans from a nationalized bank in Adirampattinam for both fisherwomen Extension Service of the Tamil Nadu Department of fisheries, through a cooperative society. The credit programme for fisherwomen was meant to increase the profitability of petty marketing operations, generate investment capital for them through their own savings, and step up the volume of marketing. The study showed that the levels of credit provided to the target groups of fisherwomen were appropriate and that all borrowers found the loans advantageous since they did not have to pay exorbitant rates of interest.

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Abstract: The union government of India has approved the construction of the Sethusamudram Ship Canal Project (SSCP), a massive channel designed to liberate the country's shipping industry. This project involves the establishment of a route, which will link the Palk Bay to the Gulf of Mannar, by dredging through the 29km Adams Bridge chain of shoals that link India with Sri Lanka. The Tuticorin Port Trust is the nodal agency responsible for the implementation of SSCP and it has set up a special project vehicle (SPV) to raise the capital. The 20km, 300m-wide stretch between Tuticorin and Adams Bridge will be constructed by dredging a shallow area of the Bridge to 12m. A report by National Environmental Engineering Research Institute (NEERI), Nagpur, India, predicts that dredging activities will permanently destroy flora and fauna in Adams Bridge and Palk Bay. Several organizations led by Greenspace and Colombo-based Environmental Foundation Ltd. (EFL) have raised questions regarding environmental issues concerning the project. Despite posing the environmental dangers, SSCP provides several economic advantages also, such as enabling easy sail of ships from India's west to east coast. SSCP thus signals a major boost for India's shipping industry and the rapid development of its ports.

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Address : National Institute of Oceanography, Dona Paula, Goa 403 004, India. E-mail: antmas@darya.nio.org

Abstract : Relentless hydrometeorological events are the major natural hazards that have afflicted the inhabitants of the east coast. Storm surges have attained a height of 12 m, and provoked seawater invasion 35 km inland. Loss of life (10,000 people in 1977) and

destruction of property (12 lakh houses in 1999) are devastating. Monetary loss of a single event touched 2248 crore rupees. Flattening of sand dunes, removal of coastal forests, reclamation of wetlands, inappropriate layout of buildings and roads reduce the inherent functional potential of ecosystems and correspondingly enhance the degree of risk. Abandoning vulnerable coasts, managed retreat, or safer setback with intervening forested landforms are feasible long-term options. The Coastal Regulation Zone does not protect lowlands prone to inundations due to storm surges; hence adaptation rather than mitigation should be the key of hazard management. A public policy that identifies coastal geological processes, recognizes the protective value of coastal landforms, acknowledges mandatory buffer zones and considers options for adaptation, is the sustainable alternative to attenuate the ravages of hydrometeorological events.

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Abstract: Popularized in India by the Bay of Bengal Programme, high-opening bottom trawls have attracted wide notice. Early this year BOBP conducted an-impact study on the biological effects of this technology. The article on these pages reports the study's findings - that there is no immediate need for management measures.

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Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Among coral boring animals the bivalves are the most destructive. The present account deals with the coral-boring bivalves of the Gulf of Mannar and Palk Bay with observations on their effect on the reef.

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Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *P. subsinuata,* an erycinacean bivalve, is reported as a commensal of *S. nepa* and *S. raphidea* from Palk Bay and Gulf of Mannar. This is the first report of an erycinacean bivalve commensal to a stomatopod from Indian waters. In the present note a brief description of the species with taxonomic details are given.

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Abstract : In the present note 22 species of boring bivalves belonging to 11 genera have been recorded from Indian Coast. This information is mainly based on the collections from Mandapam southeast coast of India, Quilon, Minicoy and Andaman Islands. The list of species with their distribution in Indian Coast is also briefly discussed.

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Address: USDA Land Grant, Cooperative Research and Extension, College of the Marshall Islands, PB-1258, Majuro, MH 96960, Republic of the Marshall Islands; E-mail: manojnair999@yahoo.com

Abstract: India is well known for the production of beautiful natural pearls. India has a wealth of pearl producing oysters. The main ones among these are the Akoya oyster *Pinctada fucata* distributed from the famous Gulf of Mannar, Palk Bay, and Gulf of Kutch (mistakenly identified and wrongly reported by many even now as *Pinctada radiata*) and the Black lip pearl oyster *Pinctada margaritifera* in the Andaman and Nicobar Islands. Pearl culture in India was first conducted on an experimental scale in the early 1970s by the Central Marine Fisheries Research Institute (CMFRI) at its Tuticorin research center on the southeastern Coast of India. The institute had initiated experimental pearl production in 1972 and the first Indian cultured pearl produced the following year. Hatchery technology was developed by CMFRI for *P. fucata* and *P. margaritifera* in the early (1982) and late eighties (1987) respectively. With the technology, being standardized after repeated experimentation, sea farming of pearl oysters, cultured pearl production, hatchery production, etc was taken by private entrepreneurs and coastal community groups on both coasts of India. This paper, in addition to giving an overview of evolution of the Indian marine pearl farming, also discusses the recent innovations like onshore pearl culture.

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Address : Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

Abstract : A hatchery technology for the species sea cucumber Holothuria (Theelothuria*) spinifera* Theel has already been developed in 1988. In addition to this, another species *Holothuria spinifera* ("chenna attai", or "raja attai") is also being fished in large quantities and widely processed along the coast of Gulf of Mannar and Palk Bay. *H. spinifera* was once rated high in the marker and are in good demand in China. Considering the commercial value, attempts were initiated for hatchery production of seed of *H. spinifera*. About 8 numbers of *H.spinifera* (length ranging from 150 – 340 mm and weight ranging from 200 – 350 gm) were collected and reared in a one tonne FRP tank with 10 cm thickness of coral sand at the bottom. For the first time, the hatchery at TRC of CMFRI, Tuticorin, spawning could be achieved in *H. spinifera*, and the larvae were successfully reared up to the settlement stage. The eggs were spherical, visible to the naked eyes. After fertilization, the eggs were carefully washed thoroughly to remove the excess sperms and maintained in a 100 l tank with filtered sea water. Motile gastrula with a ciliated and oval shaped body is observed after 24 hours and the size ranged in length from 265 –282 µm and diameter 166 – 199 µm. During the larval rearing, environmental parameters were regularly monitored. The water temperature ranged between 29-31ºC, salinity 34 – 35 ppt, pH 8.01 – 8.2 and the

dissolved Oxygen varied from 2 – 4.15 ml/l. The water was changed completely on alternate days and the larvae were taken out to find the survival rate.

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Address: Marine Biological Station, Zoological Survey of India, 130, Santhome High Road, Chennai - 600 028, India.

Abstract: Sponges are one of the dominant groups in the Gulf of Mannar Biosphere Reserve when compared to other major reef fauna. Thomas (1987) recorded 275 species in GoMBR and Palk Bay; 82, 25 and 95 species from Lakshadweep, Gulf of Kachchh and Andaman and Nicobar islands respectively. In Gulf of Mannar sponges occur in different life form categories such as massive, digitate, encrusting, globular, lobate, arborescent and plate. Digitate forms are predominant in Poomarichan, Shingle, Krusadai and Manouli islands. Massive forms are common in Nallathanni, Puzhuvinichalli, Mulli, Appa and Anaipar islands. Globular forms are seen in Anaipar and Nallathanni islands. Lobate forms are present only in Hare Island. Quadrat survey shows 72 % of sponges in the intertidal regions of Poomarichan and Manouli Islands. In the present study brittle stars, crabs, barnacle and bivalves were recorded as associated fauna of sponges.

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Address : Environmental Information System, Centre for Advanced study in Marine Biology, Parangipettai - 608 502, Tamilnadu, India.

Abstract : The quality of environment is important for the health of the coral biota. The coral reefs in the Gulf of Mannar face many ecological stresses. They impair the healthy growth of the coral reefs. The sick status of coral reef environment is mainly due to the environmental changes. In this area most of those changes are caused by the anthropogenic effects directly or indirectly. The coral bleaching is the immediate indicator of the deleterious fluctuations of environmental factors and stresses upon the coral reef. The coral bleaching is the physiological expression of stresses resulting in the loss of symbiotic algae by reef corals in the physical and chemical response to environmental influences like light, excess temperature, turbidity and salinity in the seawater variations. In this article the stress of due to siltation and nutrients upon the healthy of coral reefs of the Gulf of Mannar and Palk Bay is described and discussed.

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Address : Environmental Information System, Centre for Advanced study in Marine Biology, Parangipettai - 608 502, Tamilnadu, India.

Abstract : Reef building corals of the families *Pocilloporidae, Acroporidae, Poritidae*, and *Faviidae* were collected at low tide. A total of 73 species of molluscs were associated with corals in Palk Bay, viz., 46 species of gastropods belonging to 17 families, and 27 species of bivalves belonging to 13 families. Molluscs were rarely associated with young corals. The present study shows that the structure and size (weight) of corals influence the molluscan diversity. The number of molluscan individuals increases coral weight. With a single exception, no molluscs were associated with the massive coral *Favia pallida*. Very few boring bivalves were recorded from branching corals.

25. **Asir Ramesh, D. and T. Kannupandi.** 1997. Recent Changes in the Coral Reef Ecosystem of Palk Bay: A Comparative Status of Previous Reports and Researches. (ed) Vineeta Hoon (1997), *Proceedings of the Regional Workshop on the Conservation and Sustainable Management of Coral Reefs*. No.22, CRSARD, Madras.

Address : Environmental Information System, Centre for Advanced study in Marine Biology, Parangipettai - 608 502, Tamilnadu, India.

Abstract : Comparing old data with present data is the only way to analyse the ecosystem and assess changes caused by nature and anthrophogeic influences. Coral reef constitute a sensitive and fragile ecosystem little researched in India. The coral reef of Palk bay has been thoroughly studied by Gopinadhapillai (1969), Thomas (1969), Appukuttan (1969), Mallik (1983), Silas and Fernando (1985), Umamaheswara Rao (1989), Marichamy (1983). This paper aims to analyze the present status of the coral reef of Palk Bay by comparing it with previous studies. The conclusion is that the Palk Bay coral reef ecosystem is in good health but certain areas need attention.

26. **Athiyaman, N and P. Jayakumar.** 2004. Ancient anchors off Tamil Nadu coast and ship tonnage analysis. *Curr. Sci.,* 86(9): 1261-1267.

Address : Centre for Underwater Archaeology, Tamil University, Thanjavur, 613 005, India.

Abstract : The coastal region of Tamil Nadu played a major role in maritime activities even before the Christian era. In the course of such activities some of the ships which visited this coastal region, lost their anchors made of stone or metal. This paper presents the details of a few of such anchors recovered by the Centre for Underwater Archaeology of Tamil University, Thanjavur. An attempt is made to find the possible dates of these anchors and to calculate the approximate tonnage of ships served by these anchors. Information on a few stone anchors found in the west coast region is also used in this analysis. Our study suggests the need of further analysis of the anchors that are found in the Indian coastal waters. This can provide interesting results regarding the characteristics of ships that floated in Indian waters.

B

27. **Badrudeen, M., A. Bastin Fernando, C. Kasinathan, N. Kaliaperumal, S. Krishna Pillai, V.Kunjukrishnapillai, G. Pandian, M. Sivadas and P. Vedavyasa Rao.** 1987. An instance of mass fish mortality at Mandapam, southeast coast of India. *Mar. Fish Inf. Serv. T & E. Ser.,* 75: 1-5.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Mass mortality fishes was found washed ashore along the beaches of Mandapam on the Palk Bay side in the early hours of 13th May, 1987. The dead fishes washed ashore and other organisms were found as far as about 12 km stretch of the coast from the Mandapam fish landing center towards west up to Theedai fishing village. It was estimated that about 2 –3 tonnes of fishes might have been killed by the phenomenon. About 20 species of important fishes including some of the commercial species, two species of crabs, mollusks such as *Sepia spp., Loligo spp., Aplysia spp*., and *Donax sp., and alphied* shrimps were found affected. Among the dead fishes, *Epinephelus spp., Lethrinus spp., Siganus spp., Platycephalus spp., Psammoperca wasigensis, Therapon sp., Apogon., Plotosus sp., Muraena spp., and Gobius spp*., were abundant and among crustaceans the blue swimming crab *Portunus pelagicus* was the principal species. The inshore sea of Mandapam during the reported period of mortality was calm. There was also no strong wind normally prevalent in the area but the water in the affected area appeared turbid and murky. The bottom soil at patches was found to be black. It was possible that the phytoplankton blooms reported just before the phenomenon and its isolated occurrence immediately after the incidence, and associated changes in the water quality, the mixing up of the polluted water drained from the Mandapam fish landing center and its subsequent spread within the reef area due to the prevailing water current would have triggered off an anoxic condition in the water column causing stress in the environment and consequent mortality of the fishes.

28. **Badrudeen, M. and P.K. Mahadevan Pillai.** 1997. Food and feeding habits of the big-eyed majarra, *Gerres macracanthus* Bleeker of the Palk Bay and the Gulf of Mannar. *J. Mar. Biol. Assoc. India,* 38: 58-62.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Gut contents of *Gerres macracanthus* from the Palk Bay and the Gulf of Mannar landed by trawl net at Rameswaram and Mandapam were analysed. A total of 1,602 fishes from the Palk Bay and 102 fishes from the Gulf of Mannar were examined for stomach content analyses. The points method was followed in the present study. The frequency of various components in the food has been estimated by occurrence method and expressed in percentages. Polychaetes were the most common food item followed by *Penaeus semisulcatus, Parapenaeopsis tennella* and *Metapenaeus affinis,* in the order of abundance. Much difference could not be noted in the food components of the fishes occurring in the Gulf of Mannar and the Palk Bay.

29. **Badrudeen, M. and A.D. Diwan.** 1997. Note on seasonal fishery of Holothuria (Metriatyla) scabra Jaeger from Pamban Island. *Mar. Fish. Infor. Ser., T & E. Ser.,* 149 : 14.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 530, Tamilnadu, India.

Abstract : Sea cucumber are reported from the shallow waters of the Indian coast, is 75 species, of these about 12 species are commercially important. *Holothuria scabra* locally called as ' Vella attai' is the dominant species exploited by fishermen by skin diving in the Palk Bay. This species is landed almost throughout the year, in places like Thiruppalaikudi, Devipattinam, Mandapam and Rameshwaram in the Palk Bay and Vedalai, Periapattinam and Killakarai in the Gulf of Mannar. During July – October 1995, *H. scabra* was landed at Sangumal fish landing center in the Pamban Island in fair quantities. The collection of sea cucumber is mostly done by skin diving using masks when the sea waters is very clear without turbidity. The catch declined in the first week of September. The fishing ground in the Palk Bay side of Pamban island is muddy and sandy with extensive growth of sea grasses, which is considered to be a productive fishing ground for holothurians which yielded 6.5 tonnes of dried products were landed at Sangumal landing center. This note gives the details of a seasonal fishery from the Pamban island.

30. **Badrudeen, M., P. Nammalwar and K. Dorairaj.** 2004. Status of sea-cow *Dugong dugon* (Müller) along the southeast coast of India. *J. Bombay Nat. Hist. Soc.,* 101 (3) : 381-387.

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp 623 520, Tamil Nadu, India. Email: drnam@hotmail.com

Abstract : Observations on the stranding and incidental catch of Sea-cow *Dugong dugon* (Müller) along the southeast coast of India are reviewed here. The number of incidental catch and stranded Dugongs were greater in the Gulf of Mannar than in the Palk Bay region during 1994-2000. The need for protection and conservation of Dugongs from indiscriminate exploitation are stressed upon to evolve suitable management strategies.

31. **Balachandran, S., S.A. Hussein and L.G. Underhill.** 2000. Primary moult, biometrics, mass and age composition of Grey Plovers Pluvialis squatarola in southeastern India. *Bird Study,* 47: 82–90.

Address : Bombay Natural History Society, Hornbill House, S.B. Singh Road, Bombay 23, India, Avian Demography Unit, Department of Statistical Sciences, University of Cape Town, Rondebosch, 7701 South Africa.

Abstract : Little is known about the biology of waders wintering in southern Asia; this paper deals with the Grey Plover *Pluvialis squatarola*, a species extensively studied only in western Europe. Adult Grey Plovers wintering in southeastern India underwent primary moult in autumn; the duration was estimated to be 127 days, with mean starting date 1 September and mean completion date 5 January. Some first-year Grey Plovers initiated primary moult in late winter and spring, and completed this moult the following spring. The average mass of adults on arrival in September was 200 g, fluctuated close to 220 g

from October to February, and increased to 280 g near the end of May. The mass variation did not show the January peak observed in western Europe. Breeding productivity, measured as the percentage of first-year birds in winter catches, varied between 5% and 70% over six years, and showed a positive correlation with that of Dark-bellied Brent Geese Branta b. bernicla in western Europe and Curlew Sandpipers Calidris ferruginea in South Africa.

32. **Balakrishnan Nair, N and K. Dharmaraj.** 1980. Wood boring molluscs of the Palk Bay and the Gulf of Mannar. *Mahasagar,* 13(3): 249-260.

Address: Department of Aquatic Biology and Fisheries, University of Kerala, Trivandrum-695 007, India.

Abstract: The incidence and activity of eleven species of shipworms (Bivalvia: Teredinidae) and two species of piddocks (Bivalvia: Pholadidae) in several localities along the coasts of the Gulf of Mannar and the Palk Bay, are reported. The borer activity and nature of timber destruction are noted in aquafarms where *Teredo furcifera* von Martens, *T. fulleri* Clapp. *T. bartschi* Clapp and *Lyrodus pedicellatus* (Quatrefages) are active. In floating timbers from the open sea *Bankia campanellata* Moll & Roch, *B. carinata* (Gray) and *Martesia fragilis* Verrill & Bush are found to be common. Less important forms include such species as *Teredo triangularis* Edmondson, *Teredora princesae* (Sivickis), *Uperotus clavus* (Gmelin), *U. rehderi* (Nair), *Teredothyra excavata* (Jeffreys) and *Martesia flrialll* (Linnaeus). The incidence of these pests and the relative destruction of timber structures in different mariculture farms varied with locality. The possible causes for the severe attack, nature of vertical distribution, factors affecting the spatial variations and the possibilities of prolonging the service life of indigenous timbers in coastal waters are discussed briefly.

33. **Balasubramanian, T and M.V.M. Wafar.** 1974. Primary productivity of some Fringing Reefs of southeast India. *Mahasagar,* 7: 157.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Primary productivity of two fringing reefs in southeast India was studied from the diurnal curve method. The rate of production in the waters around the reef was determined by 14C uptake and chlorophyll-a estimation. The rates of production and consumption in individual sea-grasses were determined by the light and dark bottle oxygen method. Gross production of the Palk Bay reef ranged from 4.86 gC/m^2/day in March to 9.5 gC/m^2/day in May. In the Krusadai Island reef the rate of gross production was 2.39 gC/m^2/day in November. Phytoplankton production in the Palk Bay reef area ranged from 0.51 gC/m^2/day to 1.62 gC/m^2/day and chlorophyll-a values from 0.177 µg/l to 0.695 µg/l. In the Krusadai reef the phytoplankton production was 0.17gC/m^2/day and the chlorophyll-a was 0.163 µg/l. Oxygen production and consumption in individual corals and seagrasses indicate that the individual species is autotrophic with P/R ratios exceeding 1.

34. **Bapat, S.V.** 1955. A preliminary study of the pelagic fish eggs and larvae of Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 2(1): 231-255.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Mandapam, India.

Abstract: The present paper reports on the occurrence, distribution and fluctuation of pelagic fish eggs in the Gulf of Mannar and the Palk Bay near Mandapam. The results are based on an examination of 43,352 fish eggs from 238 samples of plankton collected from the Gulf of Mannar and the Palk Bay. Experiments conducted in rearing the larvre to a stage when they can be identified did not yield satisfactory results. Artificial fertilisation proved helpful in deciding the identity in one species. Fourteen types of fish eggs and larvae have been described in detail, of which six belong to the suborder Clupeoidei, two to the genus Caranx, one to Cynoglossus and one to the family Muramidae. Eight types have been tentatively identified up to the genus or species, namely, *Anchoviella* sp., *Thrissocles* sp., *Kowala coval, Dussumieria* sp., *Sardinella fimbriata, Caranx leptolepis, Caranx* sp. and *Cynoglossus* sp. Spawning appears to take place in types B, D, H, C and I late in the evening or early in the night and in E in the early hours of the day. It has been observed that fish eggs occur in both of the areas studied almost throughout the year, the maximum number being taken in the month of March when the surface salinity-temperature in the Gulf of Mannar and the surface temperature in the Palk Bay were fairly low. There was greater concentration of fish eggs in the Gulf of Mannar than in the Palk Bay, although the general trend of their occurrence was similar in the two areas.

35. **Bastian Fernando, A. and P.V.R. Nair.** 1960. Observations on the distribution and occurrence of diatoms in the inshore waters of the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 7(1): 49-68.

Address : Central Marine Fisheries Research Institute, Cochin - 682 031, India.

Abstract : An attempt was made to study the nature and composition of the diatom community that occur in the plankton of Mandapam area, the abundance of species and the recurrent pattern in the annual distribution of the various species. The results are based on regular tow – net samples of Palk Bay during May 1951 to June 1953. Palk Bay being a more or less enclosed area, several of the tropical and south temperate species which occur there exhibit regular periodicities. The relatively more regular seasonal variations and succession exhibited by these species may be an indication of a larger autochthonous breeding stock of diatoms in this area. Which are mostly neritic.

36. **Bastian Fernando, A. and S. Jones.** 1973. The present status of the turtle fishery in the Gulf of Mannar and Palk Bay. *Proc. Living Resources Seas around India,* pp. 641-647.

37. **Batcha, H and M. Badrudeen** 1992. Length-weight relationship and relative condition of *Leiognathus brevirostris* (Valenciennes) from the Palk Bay. *J. Mar. Biol. Assoc. India,* 34(1&2): 269-270.

Address: Central Marine Fisheries Research Institute, Cochin - 682 031, India.

Abstract: The length-weight relationship of *Leiognathus brevirostris* which supports a commercial fishery in the Palk Bay at Mandapam is found to be logarithmic, expressed

by the formula: Log W = -4.8512 + 3.004 Log L indicating an isometric growth pattern of the fish in its natural habitat. The mean relative condition of the species is 0.996 which denotes the normal well being of the fish in this region.

38. **Bensam, P.** 1972. Sciaenid fishery resources of the Gulf of Mannar and Palk Bay. *Proc.Sym. Living Resaurces of the Seas around India.* pp. 461-469**.**

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The Gulf of Mannar – Palk Bay area, forming the southern sector of the east coast of India, harbours many species of *Sciaenids,* including some commercially valuable forms like *Pseudosciaena diacanthus, P. aneus, Otolithes argenteus, Johnius maculates,* etc. until a decade ago, this resource remained poorly tapped due to lack of fishing facilities proper for its capture. Since the establishment of the Government of India Offshore Fishing Station at tuticorin and Indo – Norwegian Project at Mandapam, trawling grounds for scisenids off the Pinnakayal esturine region in the Gulf of Mannar and Vaigai reverine area in the Palk Bay have been charted. Catch trends by indigenous and mechanized crafts in centres like Sippikulam – Vaipar, Vembar and thakarai indicate the presence of good fishing grounds for the *sciaenids.* Further work of charting these grounds in the Gulf of Mannar – Palk Bay area, particularly off river mouths and esturies, remains to be carried out in order to have an adequate knowledge on the distribution and abundance of this resource. The indication is that the present levels of exploitation can be increased further without fear of depletion.

39. **Bensam, P.** 1972. A preliminery review of our knowledge on the early life histories of Clupeiformes from Indian waters with provisional keys for identifiying the eggs and early larvae. *La mer.,* 9 (3) : 158-167.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

40. **Bensam, P.** 1987. Eggs and early larvae of the grey mullet Valamugil seheli, Forsskal). *Indian J. Fish.,* 34(2): 171-177.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Planktonic eggs collected from Palk Bay and Gulf of Mannar and identified circumstantially as of Valamugil seheli were reared in the laboratory up to the 72-h postlarvae. Newly hatched larvae measured 2.179 mm. In the 24-h larva, most of the black pigment spots had migrated to the ventral side of the body. The 48-h-old larva had its mouth formed, eyes pigmented, yolk utilized and pectoral fins developed, and so was in the early postlarval stage. In the 72-h larva there was increase in pigmentation along both dorsal and ventral aspects of body. The eggs could be distinguished from those of the allied species by their size and/or the size of oil globules. By the location of the oil globule as well as by the nature of pigmentation the early larvae could be distinguished from those of *Mugil cephalus.*

41. **Bensam, P and T.R. Udhayashankar.** 1990. Colonisation and Growth of the Seagrasses, *Halodule uninervis* (Forskal) Ascherson and *Halophila ovalis* (R. Brown) Hooker f. in marine culture ponds at Mandapam. *Proc. 2nd Indian Fish. Forum,* 27th to 31st May'90. pp. 51-53.

Address: Central Marine Fisheries Research Institute, Cochin - 682 031, India.

Abstract: Observations carried out at Mandapam from 1983 to 1986 on the colonisation and growth of *Halodule uninervis* and *Halophila ovalis* are presented. Dislodged bits of the sea grasses were brought into three ponds of 60 x 30 x lm from Palk Bay due to cyclonic and tidal conditions of the sea at the end of 1983. In pond I, *H. uninervis* alone had established and grown from about 90 plants/m^2 in January 1984 to 800/m^2 in October, reaching the peak abundance of 8100/m^2 during February, 1986. In the other two ponds. both the species got established. *H. ovalis* was the principal species in the order of about 6:1 in pond II, while *H. uninervis* was dominant in pond III, in the order of about 3.4:1. The peak levels of abundance for *H. ovalis* and *H. uninervis* in the former pond were about 7700/m^2 and 1200/m^2 in March and January 1986 respectively.

42. **Bindu Sulochanan and K. Muniyandi.** 2005. Hydrographic parameters off Gulf of Mannar and Palk Bay during an year of abnormal rainfall. *J.Mar.Biol.Assoc.India,* 47(2):198-200.

Address: Regional Centre of Central Marine Fisheries Research Institute, Marine Fisheries PO., Mandapam Camp - 623520, Tamilnadu, India.

Abstract: The results of monthly observations on the hydrographic parameters in the Gulf of Mannar and Palk Bay during the period 2002-03 are reported. The meteorological parameters for the period have also been compiled. The area received 1120 mm rainfall during the period as against a normal of 760 mm. Maximum wind velocity of 16.2 km/hr was in June and humidity of 78% in December. A comparison of the parameters of temperature, salinity, pH, dissolved oxygen, primary productivity and biomass of both the ecosystems is presented.

43. **Blase, F.W.** 1982. Coastal village development in four fishing communities of Adirampattinam, Tamil Nadu, India. *Work. Pap. Bay Bengal Programme,* 19 : 21.

Abstract : The BOBP plans and executes village – level extension pilot projects in member countries that test new methodologies for raising the incomes and living standards of fisher folk. The strategy was to pinpoint the major stumbling blocks or problems if possible. To ensure explicability of the project, efforts were made to tap resources – personnel and financial – that were available or accessible to the villagers. Apart from these stated needs of the fisher folk, the paper examinations whether existing technology in fisheries can be improved to help target groups.

44. **BOBP.** 1981. BOBP tries out high-opening bottom trawls: Good results. *BOBP News,* Jan'81, 12 pp.

Address: Bay of Bengal Programme, Madras, India.

Abstract: The BOBP conducted experiments with high-opening bottom trawls at Palk Bay, off Mandapam and in the Gulf of Mannar off Tuticorin.

45. **Boby Ignatius., G. Rathore, I. Jagadis, D. Kandasami and A.C.C. Victor.** 1999. Observations on captive spawning and rearing of sea horse *Hippocampus kuda. Mar. Fish. Infor. Serv. T & E Ser.,* 163: 1-2.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Syngnathids*, comprising seahorses and pipe fishes from an important group among the non – food fishes. The seahorse *Hippocampus kuda* is one of the species of tropical seahorses which occurs sparsely in the Gulf of Mannar and Palk Bay of Tamil Nadu coast. These fishes are exploited mainly as a source of aphrodisiac such as asthma, arteriosclerosis, goiter and lymph node diseases. The low fecundity, high competition for the juvenile survival, sparse distribution, mate fidelity and irrational exploitation to meet the ever increasing international demand make the resource unsustainable. So it would not only enhance the export trade and foreign exchange inflow but also rebuild and conserve the wild population from its destruction. In India successful complete rearing of seahorse was accomplished at the Regional Centre of CMFRI, Mandapam Camp. About 50 nos. of adult seahorse ranging 9.5 to 11.7 cm weight 3.0 to 3.8 g were collected from the inshore waters of Palk Bay and stocked in one tonne glass aquarium tanks. Biofilters were fitted in the tanks for maintaining ranged from 28 – 32 ° C and salinity 33 – 35 ppt in the brood stock tank. Brood stock maintained continued for 1 – 2 weeks.

Three different live feeds were cultured and used for the rearing of the baby seahorses. After one week of incubation, from 17.07.1999 onwards the brooding seahorses started releasing fully developed babies measuring 9.0mm in size. Newly released young ones of a seahorse was collected and stocked in one tonne capacity FRP tanks containing filtered sea water for the rearing experiments. Baby seahorses were pale green in colour, later turned to brown / black within 12 – 24 hours. An adult male with fully developed brood pouch released approximately 250 – 300 babies in one release.

46. **Bose, M. and A. Palanichamy.** 2003. On the landing propoise *Neophocaena phocanoides* at Rameswaram, Tamil Nadu. *Mar. fish. Infor. Serv., T&E Ser.,* 175: 12.

Address : Mandapam Regional Centre of CMFRI. Mandapam Camp.

Abstact : A female finless black porpoise *Neophocaena phocaenoides* measuring 113 cm in total length was landed at Rameshwaram Palk Bay coast around Mandapam region on 16.9.2002. The porpoise was caught by gill net locally called as valivalai, operated off Rameshwaram at a depth of 16 meters. The morphometric characters are , length from tip of upper jaw to the origin of flipper and the length from tip of upper jaw to the center of eye , length from tip of upper jaw to the center of blow hole are given, 23, 10.2, and 11 respectively. The length of upper jaw, length of lower jaw and the length of blow hole are given 6.5, 6,2 respectively. Then the length of flipper (outer margin), the length of flipper (inner margin) and length of caudal fluke (outer margin) are given 20.5, 12.5, 20.5 respectively. The length of flipper (inner margin), length of caudal fluke (outer margin), then the length of caudal fluke (inner margin) and the length of snout to the of genital opening are given respectively.

C

47. **Central Chronicle.** 2006. Sethusamudram project: Nitty-gritty not adequately thought. In: http://www.centralchronicle.com/20060315/1503301.htm

Abstract : The Rs. 2,427-crore Sethusamudram Shipping Canal Project (SSCP) between India and Sri Lanka is expected to be operational by 2008: it will allow ships sailing between the east and west coasts of India a straight passage through India's territorial waters, instead of circumnavigating Sri Lanka. India doesn't have a continuous navigable route here due to the presence of a shallow ridge (1.5 metre to 3.5 metre deep) called 'Adam's Bridge'. The Palk Bay is also too shallow for navigation. SSCP will create a continuous ship channel by dredging Adam's Bridge and the shallow parts of Palk Bay. The channel's total length will be 167.5 km. Of this, about 90 km needs dredging, which will be done for 35 km length in the southern leg at Adam's Bridge and for a length of 54 km in the northern leg at Palk Straits.

48. **Central Chronicle.** 2006. Sethusamudram project-II. In: http://www.centralchronicle.com/20060317/1703301.htm

Abstract : About 34 mcm of dredged materials from Palk Bay will be dumped off-shore in the Bay of Bengal. Both the dumping locations had been identified by NEERI. The total quantity of spoils that would come from capital dredging is supposed to be 81.5 to 88.5 x 106 cubic metres (cu m). The quantum of dredged spoil that would come from maintenance dredging is supposed to be 0.1 x 106 cu m/year. Specific dumpsites have been identified only for 8.5 to 9.5 per cent of the total dredged spoil. But the authorities are quick to counter that this is incorrect and they have identified dumping spots for all the dredged material. Besides the initial dredging, annual maintenance dredging would also be required to maintain the proper depth of the channel. Authorities say for the first two years, 2 mcm per year of maintenance dredging would be required. That will go down to 1.7 mcm/year in the next two years, before stabilizing at 1.4 mcm/year from then on. This raises the issue of continuous sedimentation. Palk Bay is one of the five major permanent sediment sinks of India. Marine and riverine sources contribute to these sediments. Small rivers draining into Palk Bay off the Sri Lankan and Indian coasts, longshore currents from Bay of Bengal in the north and Gulf of Mannar transport these sediments into the bay.

49. **Chacko, P.I.** 1944. On the bionomics of the big jawed jumper, *Lactarius lactarius* (Cuv.&Val.). *Curr. Sci.,* 13: 108.

Address: Fisheries Bureau, Madras, India.

Abstract: The Big-jawed Jumper, Lactarius (Cuv. & Val.) is a shoaling fish contributing to an important fishery in the Gulf of Mannar and Palk Bay, from the month of January. The peak occurs in September and October.

50. **Chacko, P.I and A. Rahim.** 1968. Survey of fishing ground in the Palk-Bay and Northern sector of the Gulf of Mannar off Rameswaram, Pamban and Mandapam. *Madras J. Fish.,* 4: 47-55.

Address: Krusadai Biological Station, Krusadai Island, Gulf of Mannar, India.

Abstract: With the introduction of mechanized fishing boats by the Madras State Fisheries Department, a Survey Station was located in Rameswaram to survey the fishing grounds in the Palk Bay and northern sector of the Gulf of Mannar to demonstrate to the fishermen the method of exploitation of these new areas, a total area of 1,250 square miles, extending from Valinokkam Point to Dhanushkodi in the Gulf of Mannar side.

51. **Chandramohan, P., B.K. Jena and V. Sanil Kumar.** 2001. Littoral drift sources and sinks along the Indian coast. *Curr. Sci.,* 81(3): 292-297.

Address : National Institute of Oceanography, Dona Paula, Goa 403 004 India; E-mail: sanil@darya.nio.org

Abstract : Numerous theoretical and field studies have been carried out to quantify the volume and direction of littoral sediment transport along the Indian coast. Nevertheless, very little effort has been made to identify the sources for the littoral transport, which feed to the nearshore transport mechanism and on sinks, wherein the continuous movement of the littoral sediment breaks and deposits over a considerable period of time. Rivers are the major source for the littoral drift and the annual discharge of sediments to sea along the Indian coast is about 1.2 x 1012 kg. The construction of inland dams, irrigation barrages, have considerably reduced the sediment load brought to the sea. Due to the fall in the influx of sediments and concentration of wave energy, many coastal segments experience erosion. In order to identify the extent of the significance of the major sinks for the sediment deposition along the Indian coast, a study was undertaken to evaluate the long-term sediment deposition in Gulf of Kachch, Gulf of Khambhat, Gulf of Mannar, Palk Bay and Sandheads. The study shows an average yearly deposition of sediments to a thickness of 0.025 m at Gulf of Kachchh, 0.03 m at Gulf of Khambhat, 0.01 m at Gulf of Mannar, 0.006 m at Palk Bay and 0.003 m at Sandheads. The depositional features identified in the present study have been noticed as occurrences of spits, shoals and the progradation of coastline.

52. **Chari, S.T and M.M. Unney.** 1947. The food value of two common molluscs found near Pamban and the chemical composition of their shells. *Curr. Sci.* 16: 294.

Address : National Institute of Water and Atmospheric Research Limited, P.O. Box 14901, Kilbirine, Wellington, Newzealand. e-mail : c.woods@niwa.cri.nz

Abstract : The food value of two common edible molluscs found near Pamban from the shores of the Krusadai Island, were analyzed According to A.O.A.C, methods. Phosphorus Ammonium Molybdate, (Volumetric method), Calcium (MeCrudden's Permaganate method),and Iron (Elvehjem-Kennedy method), were also estimated. The result were those molluscs compare in food value very favorably with fish, and also richer in Ca and Fe, where somewhat poorer in P. The shells of molluscs are sometimes used for making quicklime. The high $CaCo_3$ content provides the main sources of a high quality lime.

53. **Chidambaram, K and M.M. Unney.** 1944. Notes on the swarming of planktonic algae, *Trichodesmium erythraeum* in the Pamban area and its effect on the fauna. *Curr. Sci.,* 13 : 263.

Address : National Institute of Water and Atmospheric Research Limited, P.O. Box 14901, Kilbirine, Wellington, Newzealand. e-mail : c.woods@niwa.cri.nz

Abstract : The Swarming of the planktonic algae *Trichodesmium erythraeum* in the southern coast of Pamban area when the following fishes and crabs were washed ashore dead condition , 1. *Gerres filamentosus,* 2. *G.abbreviatus,* 3. *Chanos chanos,* 4. *Mugil spp.*, 5. *Saurus indicus,* 6. *Platycephalus insidiator*, 7. *Therapon jarbua*, 8. *Sphyraena obtusata,* 9. *Lutjanus lioglossus,* 10. *Neptunus spp*., 11. *Gelasimus spp.* The recent observation showed that the mortalitywas also due to the purification and pollution caused by the dead algae. On 22.5.1944 onwards there was bright sun shine which was responsible for the swarming of the algae in large patches by the acceleration of the photo-synthetic activity. The absence of sunlight, the thick layer of floating algae and increase in temperature the water has caused the death of the algae and polluted the waters causing the liberation of the offensive smell. And then the dead algae had settled down to the bottom and the "balance" in the water restored. The clogging of the gills with the consequent asphyxiation and related hydrological disturbances should have been supplemental factors for the heavy mortality of fishes had reported.

54. **Chris M.C. Woods.** 2002. Natural diet of the seahorse *Hippocampus abdominalis.* New Zealand Journal of Marine and Freshwater Research, 36: 655–660.

Address : National Institute of Water and Atmospheric, Research Limited, P.O. Box 14 901, Kilbirnie, Wellington, New Zealand, email: c.woods@niwa.cri.nz

Abstract : This investigation examined the diet of adult wild seahorses, *Hippocampus abdominalis* Leeson 1827, from Wellington Harbour, New Zealand. Diet of seahorses (n = 59) collected from shallow subtidal macroalgal stands consisted largely of crustaceans, in particular amphipods (e.g., *caprellid and ischyrocerid amphipods*), caridean shrimp (i.e., *Hippolyte bifidirostris*), and peracarids (i.e., *the mysid Tenagomysis similis*). There were no differences in diet between male and female seahorses. Smaller seahorses consumed a greater amount of crustaceans than larger seahorses, as a result of the greater proportion of amphipods in their gut contents. There were some seasonal differences in diet, with amphipod consumption peaking in spring and summer, and decapod consumption lowest in autumn.

55. **CMFRI.** 1978. Culture of other marine organisms. *CMFRI Spec. Publ.,* 2: 21-22.

Address : Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract : The Institute is also studying the possibilities of culture of other marine organisms such as sponges, holothurians, marine turtles and perches. The sponge, *Spongia officianalis* var. *ceylonensis* has a wide distribution in the shallow waters of the Gulf of Mannar, Palk Bay and the Arabian Sea. It grows to 30 cm in diameter. Culture experiments on this species have indicated great prospects of its large-scale culture.

56. **CMFRI.** 2002. Central Marine Fisheries Research Institute Annual Report 2001-2002. 160p.

Address : Central Marine Fisheries Research Institute, Post Box Number 1603, Tatapuram Post, Cochin - 682 014, India.

Abstract : During the year, 59 in-house projects, 33 sponsored projects, 11 consultancy projects and 12 projects of NATP were implemented at the Institute. The marine fish production in India, which was estimated at 2.33 million t, showed a decline of 13% over the previous year. This was caused by a decline of 27% in oil sardine landings, 24% in croakers, 34% in mackerel, 15% in penaeid prawns, 9% in cephalopods though there was an increase in the landing of scads. Fourteen species of sharks, 7 of skates and 10 of rays were landed at different centres. Gujarat and Maharastra accounted for the bulk of shark landings whereas Tamilnadu contributed to the major landings of rays. Bulk of the silverbelly landings were obtained along southeast coast of India where *L. dussumieri* was most abundant in the Gulf of Mannar and *L. brevirostris* and *L. jonesi* were abundant in the Palk Bay. The number of species that contributed to the fishery was much greater in the east coast. Croakers were exploited by trawlers and to a lesser extent by gill nets. The species composition of the landings and the dominant species varied in different regions. In lizardfish, two species contributed to the fishery, of which *S. tumbil* was dominant along the northwest coast whereas *S. undosquamis* along the east coast. Monitoring of the environmental characteristics of coastal waters continued. The zooplankton biomass showed the peak during post monsoon period. The total value of marine fish landing in India was estimated as Rs.10,341 crores at the first sale price level. The direct and indirect role of women in the fish-processing sector was studied.

57. **CMFRI.** 2004. Production of agar and sodium alginate from the Seaweeds of Gulf of Mannar and Palk Bay. *EPR/REV*/01.

58. **CMFRI.** 2004. Production of agar from the seaweeds of Gulf of Mannar and Palk Bay. *CMFRI Ann. Rep.* (2003-2004) ICAR Revolving Fund. pp. 82-83.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: During April to October, 2003, a total of 664 kg of food grade agar was produced from the red seaweed *Gracilaria edulis* in sheet, bit and powder forms. An income of Rs.l, 24,329/- was generated by sale of 594 kg agar.

59. **CMFRI.** 2005. Characteristics of exploited stocks of threadfin breams and silverbellies. *CMFRI Ann. Rep.* (2004-2005) DEM/CAP/03. pp. 29-30.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Off Mandapam, the fishery was contributed by 8 species from Palk Bay dominated by *L. brevirostris* and by 10 species of Gulf of Mannar dominated by *L. dussumieri.*

60. **CMFRI.** 2005. Culture of seaweeds. *CMFRI Ann. Rep.* (2004-2005) FEM/03. pp. 56-57.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : Total landings of seaweeds in Tamil Nadu were 1,668 t (dry weight) compared to 2,749 t (dry weight) during 2004 constituting 995 t of *Sargassum* spp, 34 t of *Turbinaria* spp, 170 t of *Gelidiella acerosa*, 58 t of *Hypnea* spp, 76 t of *Gracilaria edulis,* 35 t of *G.. crassa* and 300 t of *Gracilaria* spp. Pilot scale field cultivation of carrageenan yielding

red seaweed *Kappaphycus alvarezii* carried out in the nearshore area of Palk Bay and Gulf of Mannar showed maximum increase in yield of 4.3 fold after 30-32 days in Palk Bay and 5.7 fold after 22-34 days in Gulf of Mannar. A total quantity of 12.5 t (wet wt) of crop was harvested during July 2004 to March 2005.

D

61. **Dan Wilhelmsson, D., J.K. Patterson Edward, Arjan Rajasuriya, Jerker Tamelander and Nishanthi Perera.** 2005. Coral Reef Degradation in the Indian Ocean (CORDIO) – *Status Report.* pp. 66-82.

Address : CORDIO South Asia 1999-2004, Colombo, Sri Lanka; Suganthi Devadason Marine Research Institute, Tuticorin, Tamil Nadu, India; National Aquatic Research and resources Agency, Colombo, Sri Lanka; CORDIO/IUCN, Regional Marine Program; South Asia Cooperative Environment Programme, Colombo, Sri Lanka.

Abstract : Close to half of the world's poor people live in South Asia (UNICEF, 2001; Samarakoon, 2004). Ramachandran (2002) identified population growth, insufficient food production, and underdevelopment as the major problems in the region. Open access to the sea, poverty, and an increasing demand for fishery products has escalated pressure on coastal resources (e.g. James, 1994; Devaraj & Vivekanandan, 1999; Bhattacharya & Sarkar, 2003; Perera et al., this volume). For example, in India, the number of fishermen in coastal villages increased from two million to six million between 1980 and 1997 (Meenakumari, 2002). Moreover, growing commercial fleets operating in near-shore waters to supply expanding export markets cause habitat destruction and deprive local communities of fish products and a cheap source of nutrition (Jayashree & Arunachalam, 2000; Bavinck, 2003; Bhattacharya & Sarkar, 2003). About 10% and 15% of the total fish catches in India and Sri Lanka respectively are derived from coral reefs by small-scale fishermen (Wafar, 1986; Rajasuriya et al., 1995). Although this is a considerable proportion of the national fish catches, these statistics do not adequately illustrate the actual situation in many areas in the region where hundreds of thousands of poor people depend solely on the products of coral reefs for food and livelihood (e.g. Berg et al., 1998, Kannan et al., 2001; Shanthini et al., 2002; Hoon, 2003; Singh & Andrews, 2003; Whittingham, 2003; Patterson et al., this volume).

62. **Desa, M., M.V. Ramana, T. Ramprasad.** 2006. Seafloor spreading magnetic anomalies south off Sri Lanka. *Marine Geology,* 229(3&4): 227-240.

Abstract : Results obtained from compilation and reinterpretation of about 21,200 line km of bathymetry, magnetic and satellite gravity data between 10°S to 10°N latitudes and 75° to 90°E longitudes south off Sri Lanka are presented here. Magnetic data and the synthetic seafloor spreading model reveal the presence of Mesozoic anomaly sequence M11 through M0 south of Sri Lanka. The oldest magnetic anomaly M11 (134Ma) occurs between 110 and 140 km away from the Sri Lankan coast. The seafloor created during the Early Cretaceous is estimated to have evolved with variable half-spreading rates ranging from 5.5 to 1.53 cm/yr. The trends of the fracture zones inferred from the offsets in the magnetic anomalies have been constrained using the satellite gravity mosaic. The Cretaceous Magnetic Quiet Zone (CMQZ, 121-84 Ma) crust between the isochrons M0 and A34 has an unequal width and widens from about 170 km in the west (80°E longitude) to about 500 km towards east (85°E longitude). Plate reconstruction models for 160 Ma (Fit), 134 Ma (M11), 121 Ma (M0) and 84 Ma (A34) are generated under the constraints

of newly identified magnetic anomaly isochrons and fracture zones. The mismatch in the A34 reconstruction is attributed to the emplacement of the Ob, Lena and Marion Dufresne seamounts at the spreading ridge axis and/or the frequent ridge jumps in the Middle Cretaceous during the major plate reorganization.

63. **Devaraj, M.** 1976. Discovery of the scombrid *Scomberomorus koreanus* (Kishinouye) in India, with taxonomic discussion on the species. *Jap. J. Ichthyol.,* 23(2) : 79-87.

Address : Central Institute of Fisheries Education, Versova, Mumbai - 400 061, India.

Abstract: The discovery of *Scomberomorus koreanus* (Kishinouye, 1915) in Palk Bay extends its distribution to the Indian Ocean. Day's (1878) *Cybium kuhlii* is considered a misidentification of *S. koreanus. S. koreanus* differs significantly from *S. semifasciatus* in many features.

64. **Devaraj, M.** 1983. Maturity, spawning and fecundity of the King Seer, *Scomberomorus commerson* (Lacepede), in the seas around the India Peninsula. *Indian J. Fish.,* 30(2): 203-230.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Based on the modes of ova, 12 progressive stages are identified in the maturation of ovaries of king seer. A line, 3 standard errors above the regression of Gonad index on total length of fish in resting or immature stages, L (G.I. = - 0.195 + 0.002046 L), is found useful in the separation of spawning fish from nonspawning fish. Estimation of maturity on the basis of the regression of maximum ova diameter (m.o.d.) on G.I. holds only up to a G.I of 7.2, beyond which m.o.d, is in the range of 34 to 47 m.d. (1 m.d. = 0.0167 mm) irrespective of G.I. The length at first maturity (701-800 mm of the median 750 mm) shows considerable agreement with the values reported for the Papua New Guinea and East African regions. Spawning season extends from January to September, during which a weak brood results in January – February, a strong brood during the peak spawning in April – May and another weak brood in July – august. The three batches of ova in the spawn – ripe ovaries (stage L) are spawned successively at an interval of a month or even less. The number of ova in the first, second and third batches are in the of 1 : 1 0.27, spawning grounds are located along strictly inshore and protected coves, as those close to Panaikulam on Palk Bay and Pudumadam on Gulf of Mannar . Males, females and inderminates are in the ratio 52.3 : 43.2 : 4.5. Males, are dominant up to a length of 1300 mm, and females, beyond this length. There is no significant maturity stages (F to L) or between estimates by different formulae. The relation between absolute fecundity, defined as the total number of ova spawned in one season over the three spawning acts (y in thousands), and total length of fish (x in mm) is found to be, y = - 2273 + 3.5793 x.. Fecundity – fish weight relation reveals that , for every ton of spawning females, 291.9 million eggs are produced. For most of the maturity stages, egg size – fish length relation exhibits negative correlation.

65. **Devaraj, M.** 1986. Maturity, spawning and fecundity of the streaked seer, *Scomberomorus lineolatus* (Cuvier and Valenciennes), in the Gulf of Mannar and Palk Bay. *Indian J.*

Fish., 33(3): 293-319.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The ovary of streaked seer passes through 12 finer maturity stages. Gonad index values separating the spawning from the nonspawning females range from 3 at the 441-480 mm length group to 5 at the 961-1000 mm group. The fish attain first maturity when about 700 mm total length when they are about 2 years old. Each year class is composed of one weak brood produced in the period January to early March, a dominant brood during mid-March to end of May and another weak brood in late June to late July. Spawning takes place in inshore waters up to a distance where the depth is about 25 m. There is no lunar periodicity in spawning. Males and females occur in the ratio of 40.5:59.5. The increase in fecundity per 10 mm body length is 65,998, whereas the fecundity per ton of spawning females is 570 million.

66. **Devaraj, M.** 1987. Maturity, spawning and fecundity of the spotted seer, *Scomberomorus guttatus,* in the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 34(1): 48-77.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The ovary of spotted seer passes through 10 finer maturity stages. First maturity is attained when the fish is about 400 mm in total length, i.e., when the age is about 20 months. Spawning extends from January to August, releasing a weak brood in January-February, a strong brood in March-July (peak in April-May) and another weak brood in August. Spawning takes place in areas between 20 m and 60 m depth in the northern Gulf of Mannar. The spent adults migrate to the central Gulf of Mannar coast by November-December. Spawning takes place around the full-moon period. Females far outnumber (60.2%) males (39.5%). Although the males are predominant in size groups between 361 mm and 481 mm, they are scarce or absent in size groups larger than 481 mm suggesting early senility and death.

67. **Devaraj, M and V. Ravichandran.** 1988. Dynamics of Indian chank fisheries. *CMFRI Bulletin,* 42(1): 100-105.

Address: Central Institute of Fisheries Education, Versova, Bombay-400061.

Abstract: The demand for chanks from the bangle industry in West Bengal had persisted at about 2.5 million chanks per year from the early part of this century to the present. The present supplies which meet only about 40% of the demand come mainly from the Gulf of Mannar. The average annual stock in the Gulf of Mannar is 2.0 million adult chanks of which 44.83% are exploited. The initial stock size however varies from year to year and hence there exists different levels of optimum yields for different initial stock sizes than fisheries in Palk Bay and the Coramandal coasts yield annually an average of 49,000 chanks and 24,500 chanks respectively while in Kerala the average annual yield is 20,100 chanks. The average annual stock of chanks in the intertidal Gulf of Kutch is 25,000 of which only 30.6% is exploited but additional catch is possible only for the 60.8 mm diameter size chanks as the 81 mm diameter size groups are already well exploited.

There is prospect for increasing the present supplies by introducing SCUBA diving in 20-30 m deep grounds in the Gulf of Mannar and by exploiting the Gulf of Kutch beyond the intertidal zone.

68. **Devaraj, M.** 1997. A brief on the contribution of the Central Marine Fisheries Research Institute on research and knowledge of coral reefs of India. *Regional workshop on the conservation and sustainable management of coral reefs,* Chennai, 15-17. pp. C21-C25.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The coral reefs found in different parts of the coasts of the Indian mainland and Lakshadweep and Andaman Islands have always been a subject of Scientific interest and fascination. They include the sensitive fringing reef ecosystems in the Gulf of Mannar, Palk bay, Gulf of Kutch and the atolls of the Lakshadweep Islands and the continental Island reefs of Andaman and Nicobar, all covering an estimated area of about 1,217 sq. km.

69. **Devaraj, M.** 1998. Food and feeding habits of the streaked seer, *Scomberomorus lineolatus* (Cuvier and Valenciennes), in the Gulf of Mannar and Palk Bay. *J. Mar. Biol. Assoc. India,* 40(1&2): 91-104.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Adult streaked seer feeds almost exclusively on smaller pelagics of which sardines are the most important, while the juveniles of < 200 mm length feed predominantly on the whitebaits and sometimes on the Sciaenids and Saurida. The total food spectrum is limited to only about five food items. This species is intermediate between the King Seer and the Spotted Seer in its predatory habits, but like the latter, does not chase baits fast enough to be caught in trolls. The stock of streaked seer however is much less than that of either of the other two species in the study areas. Feeding is active around 7 p.m. and between about 5 and 9 a.m. Competition between fish < 800 mm length and fish> 800 mm length was obvious in 1968-69 when there was a shortfall in forage abundance. Food intake and utilisation do not show definite evidence of the prevalence of spawning stress. The K-line shows that food intake maintains the streaked seer within the normal biokinetic range as the spotted seer and the king seer, but the T-line suggests low levels of metabolic expenditure per unit time and also conditions of stress.

70. **Dey, S. and Ramesh P. Singh.** 2003. Comparison of chlorophyll distributions in the northeastern Arabian Sea and southern Bay of Bengal using IRS-P4 Ocean Color Monitor data. *Remote sensing of environment ,* 85(4): 424-428.

Address : Department of Civil Engineering, Indian Institute of Technology, Kanpur 208 016, India.

Abstract : Water masses of different temperature and salinity partially govern the distributions of chlorophyll concentration. In the present paper, chlorophyll concentration has been deduced over the northeastern Arabian Sea and the southern Bay of Bengal using Ocean Color Monitor (OCM) data onboard Indian Remote Sensing Series Polar satellite (IRS-P4). The chlorophyll concentration is found to be higher in the northeastern Arabian

Sea compared to those in the southern Bay of Bengal. The higher chlorophyll concentration is found during the northeast monsoon compared to those during the pre- and post-monsoon period and also in the coastal water compared to the open ocean. Higher spatial and seasonal chlorophyll distributions in the northeastern Arabian Sea compared to the southern Bay of Bengal is attributed to the shallow depth of the shelf in the Arabian Sea.

71. **Dhanya, S., S. Rajagopal, S. Ajmal Khan and T. Balasubramanian.** 2005. Embryonic development in alligator pipefish, *Syngnathoides biaculeatus* (bloch, 1785). *Curr. Sci.,* 88(1): 178-181.

Abstract: The alligator pipefish, *Syngnathoides biaculeatus* (Bloch, 1785) is a common inhabitant of seagrass beds along Palk Bay, southeast coast of India. This primitive pipefish broods the embryos along the undersurface of its trunk. Eleven embryonic stages were sequenced based on morphological differences. The newborn resembles adults in form except for a slightly cylindrical body, shorter snout and brown colour. The gestation period was 25 k 5 days at a temperature range of 28-32°C.

72. **Dhargalkar, V.K and N. Pereira.** 2005. Seaweed: Promising plant of the millennium. *Sci. Cult.,* 71(3&4): 60-66.

Abstract : Seaweeds, one of the important marine living resources could be termed as the futuristically promising plants. These plants have been a source of food, feed and medicine in the orient as well as in the west, since ancient times. Although, seaweeds in India are used for industrial production of agar and alginate and as a fertilizer, it is yet to be utilized on a large scale for various purposes, which is not being done, due to lack of its awareness among the Indian populace. In order to harness the rich potential of seaweeds in India, the present limited use needs to be diversified into other contemporary areas of application. Being a plant of unique structure and biochemical composition, seaweed could be exploited for its multi-functional properties in the form of food, energy, medicine and cosmetics. In addition to the comprehensive view on its uses, the article also calls for the need to implement biotechnological tools for sustainable management of seaweed resources. All in all, an attempt has been made to highlight the prospects of seaweed in India in the modern context.

73. **DOD. 2001.** *Resources Information System for Gulf of Mannar,* India. Department of Ocean Development, Government of India. 87 pp.

Address : Department of Ocean Development, Integrated Coastal and Marine Area Management Project Directorate, Chennai - 601 302, Tamilnadu, India.

Abstract : The information system can be used as a baseline to conduct monitoring of biodiversity in future. Mapping of corals, seagrass and mangroves using remote sensing and GIS has demonstrated that these tools can be excellently used for monitoring and management of the Gulf of Mannar. The overlay facility of GIS clearly indicated distribution of corals and seagrass with reference to depth. This can be used for demarcation of areas of conservation and protection. Earlier report indicated that the coral reef area of Palk Bay and Gulf of Mannar to be 94.3 sq.km. based on 1989-90 IRS 1A satellite data (SAC,

1994). In the present study, the coral reef and seagrass areas around the islands of Gulf of Mannar alone are estimated to be 100 and 85.5 sq.km respectively based on 1998 IRS 1D satellite data. The difference may be due to better satellite resolution and extensive field verification conducted using SCUBA diving and ROV. Eventhough 46 species of corals have been recorded with less percentage of live coral coverage, extensive areas of dead corals were observed. However, new coral colonies are regenerating around most of the islands. Therefore, if adequate protection measures are taken with the involvement of local community, there is a possibility of improving the coral reef distribution area.

74. **Dorairaj, K.** 1973. Hermaphroditism in the threadfin fish, *Polynemus microstoma* Bleeker *Indian J. Fish.,* 20(1): 256-259.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The occurrence of hermaphroditism in the small-mouthed threadfin fish, *Polynemus microstoma* Bleeker, collected from the Palk Bay and the Gulf of Mannar is reported for the first time. Hermaphroditism is found in both the lobes of the gonad. The two sex portions in the ovotestis, which are easily distinguishable by their colour, adhere along the entire length of the gonad in antero-posterior direction. The testicular portion is on the inner' lateral side of the gonad. The relative size of the male and female portions of the ovotestis varies in different specimens. It is seen from the microsections that the two sex portions are separated by a thin connective tissue.

75. **Dorairaj, S.** 2004. Sethu project will not create geological imbalance. *The Hindu* dated 27th Sep. 04.

Abstract : Tracing the geological history of the Palk Bay and GoM, he says that the two basins are part of the Cauvery Basin, formed during the separation of India and Antarctica in the Gondwana period. They were united till the emplacement of the magmatic plume from mantle and formed as a ridge. The development of this ridge below the sea has enhanced the coral growth in the form of a coral atoll around the intrusive body and acted as a "sand trapper" forming the Rameswaram Island.

76. **Down to Earth.** 2005. PMO exposes system slip-up: Blocks Tamil Nadu's mega Sethusamudram project, cleared by other agencies. *Down to Earth,* dated 15th April '05, p 15.

Abstract : The Prime Minister's office (PMO) has raised serious concerns about the Sethusamudram Shipping Canal Project (SSCP) in Tamil Nadu. The SSCP aims to provide a route linking India's eastern and western shores, doing away with the current need to circumnavigate Sri Lanka. In a note issued in the first week of March 2005, the PMO raised many questions about the environmental impact assessment (EIA) study on the project carried out by the National Environmental Engineering Research Institute (NEERI), Nagpur. It has sought many clarifications before according a final approval to the project. The note directs that the clearances issued by the Union ministry of environment and forests (MoEF) and the Tamil Nadu Pollution Control Board to SSCP be put on hold till a

proper evaluation of specific issues is made. The over Rs 2,000 crore project will be implemented by the Tuticorin Port Trust (TPT) . The 152 kilometres (km) long canal will originate from the Tuticorin harbour in the south and run through the Gulf of Mannar, the Palk Bay and the Palk Strait in the north and northeast directions before joining the Bay of Bengal.

77. **Durairaj, S., M.M. Nainar, M.K. Laine, R. Sudhakaran and S. Inbaraj.** 1984. Study on the quality of Beche-de-mer in trade and shrinkage of specimens during processing. *Fish. Technol.,* 21(1): 19-24.

Address: Fisheries College and Research Institute, Tuticorin - 628 008, Tamilnadu, India.

Abstract: The Beche-de-mer industry in India is a cent percent export oriented industry being confined to south east coast in Palk Bay and Gulf of Mannar in Tamilnadu. Chemical quality of 180 trade samples of Beche-de-mer of four sizes collected from the Beche-de-mer curing centres of Ramanathapuram district was studied. Moisture ranged from 6.2 to 24.4% and sand content from 0.11 to 20.42% for all grades. Mean values of sand content are for grade I = 3.47%, grade 2 = 4.50%, grade 3 = 3.68%, grade 4 = 6.87%. Sodium chloride was almost constant for all grades at 5.7%. TVBN values ranged from 10 to 78.4 mg%. 44 laboratory samples of different grades were prepared following trade practice and examined for chemical quality. Mean moisture values are for grade 1 = 13.4%, grade 2 = 12.44%, grade 3 = 12.62% grade 4 = 12.08% and mean values of sand are for grade 1 = 0.70%, grade 2 = 0.90%, grade 3 = 1.16%, grade 4 = 2.15%. The percentage of shrinkage of the animals ranged from 56% to 60% for dried beche-de-mer of 7.5 cm size and above.

78. **Durve, V.S and K. Alagarswami.** 1964. An incidenc of fish mortality in Athankarai estyary near Mandapam. *J. Mar. Biol. Assoc. India.* 6(1): 147-149.

Abstract : Occurrence of fish mortality in Athankarai estuary near Mandapam was reported on 20 th July, 1963. Athankarai estuary is formed by the river Vaigai which takes its origin in the Western Ghats and meets the Palk Bay near the village Athankarai about 15 km. West of Mandapam. The river is not perennial due to the diversion of its water for irrigation purposes and thus, during summer, the river flow more or less ceases even much upstream of Vaigai Causeway. At this place the width of the river is about 180 m, and remains more or less the same for a distance of 2 km, downstream, after which this lessens a little. The tidal amplitude in the Palk Bay is very low. The highest tides in the year range from 0.5 to 0.8 m. The tidal effect is more pronounced during North East winds. The soil in this region is very clayey and there are salt pans on the southern side of estuary. The sun – soil water which is highly saline (sal. 106.48 ppt) is used for the manufacture of salt in these pans. There was no freshwater flow in the estuary from the river during the period when the present mortality was reported.

E

79. **Eashwar, M., P. Chandrasekaran, G. Subramanian and S.V. Iyer.** 1987. Effects on variations in biofouling assemblage and exposure conditions on the corrosion of mild steel. *Key Eng Mat.* 20-28 (pt 1-4), pp. pt 4, pp. 3265-3274.

Address: Central Electro Chemical Research Institute, Karaikudi, Tamilnadu, India.

Abstract: Results of a year's studies on biofouling and corrosion of mild steel in three different marine environments at Mandapam, India are presented. The locations showed great variations in assemblage of biofouling communities and seawater characteristics. Corrosion of mild steel was considerably influenced by both biofouling and environmental conditions. Data presented are the monthly, quarterly and cumulative rates of corrosion of mild steel at the three locations. Results indicate that algae accelerated corrosion considerably whereas barnacles were generally protective. The effects of tunicates were not evident. However, the severest corrosion was associated with the creation of favourable conditions for sulphate-reducing bacteria. In the waters of Palk Bay, these bacteria accounted for a corrosion value of 134. 5 mdd during one particular month and a quarterly corrosion value of 90.9 mdd.

80. **EFL.** 2006. Sethusamudram Ship Canal Project: EFL position. In: http://www.efl.lk/positiononGMOs.html

Abstract : The Government of India has decided to go ahead with the Sethusamudram Ship Canal Project (SSCP) and has passed the funds necessary for its implementation. This project, which has been almost a century-and-a-half in the making, envisages linking the Arabian Sea with the Bay of Bengal by dredging the shallow waters to the North of Sri Lanka, thereby creating a navigable canal across the Gulf of Mannar, Palk Bay and the Palk Straits. These waters have hitherto not been navigable by cargo shipping, and the justification for the project is that it will save about 400 kms of sailing distance between the East and West coasts of India. An Environmental Impact Assessment (EIA) report was prepared by the National Environment Engineering Research Institute (NEERI) of Nagpur, although it has reportedly had no previous experience with marine projects of this nature. According to the executive summary of this report, the waterway is envisaged to be 260 km in length and 300 metres in breadth. The canal has been assessed at various depths, but is likely to be 14.5 metres deep, allowing the passage of ships with a draught of up to 12.8 metres, including bulk carriers of 65,000 DWT, 240m length overall and 33m beam and container vessels of 56,000 DWT, 290m length overall and 32.2m beam. Map: Trace of SSCP (Courtesy Manitham). In order to create this passage, two channels would have to be dredged, one across Adam's Bridge (the chain of islets and shallows linking India with Sri Lanka) just South-East of Pamban Island and another through the shallows of Palk Bank, deepening the Palk Straits. The total length of these two channels would be 56 kms. The initial excavations would produce in excess of 80 million m^3 of dredged silt and sand and subsequent maintenance dredging to keep the passage open is estimated by NEERI to require 100,000 m^3 silt/sand per year to be removed. (EFL : Environmental Foundation Ltd)

G

81. **Ganapathy, A.** 1991. Unusually heavy Landings of Cow – Nose Ray, *Rhinoptera javanica* along the Palk Bay coast, near Thondi. *Mar. Fish. Infor. Ser. T & E. Ser.,* No. 117 : 20.

Address : CMFRI, Mandapam Camp - 623 520.

Abstract : In the present report, observations made on the large – scale landings of *R. javanica* by mechanized trawlers along the Palk Bay coast are presented. The net operated in the present case was trawl net mesh ranging from 15 to 20 mm. More than 10 tonnes of *R. Javanica* were landed near Thondi on 26.12.1991. The local fishermen informed that about 5 tonnes and 0.5 tonnes of the same species were landed respectively on 2.1.1992 and 7.1.1992. In all case boat were operated in S.E direction at a depth from 13 to 14 m.

82. **Ganapathy, A.** 1992. On a porpoise *(Neophocaena phocaenoides*) stranded along Palk Bay coast, near Thondi, Tamil Nadu. *Mar. Fish. Infor. Serv., T & E Ser.,* 117: 17.

Address : Mandapam Regeional Centre of CMFRI, Mandapam Camp – 623 520.

Abstact : A male propoise *Neophocaena phocaenoides* locally called , ' Minikutty' was found washed ashore afresh at Mullimunai, a landing center near Thondi along the Palk Bay coast north of Ramanathapuram District, on 21.1.1992. Local fishermen told that another ' Minikutty' was seen on that beach a week back. It was found that there was no trace of any wounds on the body. There was information about yet another mammal of this species found stranded in the same week at M.V. Patinum (Soliakudi) a fish landing center which is about 5 km from this observation center. Altogether there was stranding of 3 mammals of the same species in a week's duration and that too along the 5 km stretch of beach.

The following were the measurements (in cm) of *N. phocaenoides* , Tip of upper jaw to deepest part of caudal fluke notch was 12, tip of upper jaw to anus is 100 ,and the upper jaw to center of umbilicus measured 83, then the tip of upper jaw to blow hole was 15 and the center of eye to the tip of upper jaw ranged 12. The lower jaw projection beyond the upper portion was 2, the eye length,1 .2. Flipper length was 25 and the Girth at eye was 28. Teeth counts contains , right upper and right lower was 17 and 15, and then the left upper and left lower counts 12 respectively.

83. **Ganapathy, A.** 1994. On a Hawksbill turtle washed ashore near Thondi along Palk Bay coast of Tamil Nadu. *Mar. Fish. Infor. Serv. T & E. Ser.,*133: 19.

Address : Regional Centre of CMFRI, Mandapam Camp – 623 520.

Abstract : Narendal, a small fishing village along Palk Bay coast near Thondi in Tamil Nadu was reported, an adult Hawksbill turtle washed ashore , the animal was found in a dead condition on the shore on 20.4.1994. The morphometric measurements in cm are , the total length of animal 50cm, then the carapace length was 45, and lateral scutes consist of 4 pairs, then the central scutes 5 nos, marginal and precentral scutes found 11and 2 pairs. A number of barnacles were attached to all the scutes of the carapace and dorsal and ventral sides of the flippers of the turtle.

84. **Ganapathy, A.** 1994. On the unusual occurrence of *Acetes spp* in the inshore waters of Palk Bay. *Mar. Fish. Infor. Serv. T & E. Ser.,* 135: 12.

Address : Regional Centre of C.M.F.R.I., Mandapam camp – 623 520**.**

Abstract : An unusual occurrence of *Acetes spp.,* was noticed on 21.6.1994, at M.V. Pattinam (Solai Kudi) a mechanized landing center near Thondi along Palk Bay region. The fishing for the species locally called as "Chella kooni" was conducted in the Knee-deep water depth. Employed the gears were mosquito nets and common saris. The catches were estimated at about 500 kg. Sun dried *Acetes spp*, were sold Rs.10/ per Madras measure in the market of Nambuthalai, a near by fishing village. Length measurements were taken for a sample of 25 specimens. The size of *Acetes spp*, ranged from 15 to 25 mm.

85. **Ganapathy, A.** 1998. Major and minor fisheries of India. 5 fisheries harboures along the Palk Bay coast. *Mar. Fish. Infor. Serv. T & E. Ser.,* 153: 16 -17**.**

Address : Mandapam regional Centre of CMFRI, Mandapm Camp – 623 520. India.

Abstract : Along the Palk Bay coast of Tamil Nadu Thondi is one important fisheries Harbour,and the fishing activity in and around practiced thought the year. The major group of fishes caught are prawns (*Penaeus semisulcatus*), crabs (*Portunus pelagicus),* perches *(Lethrinus spp., & Psammoperca waigiensis), Belone (Hemiramphus spp*.,) and rays. The major operation of gear are thalluvalai, nanduvalai and nylon valai (gillnet) at this locality. Apart from country craft fishing, a minimum of 100 trawlers are operated around this area for which the estimated annual landing amounts to 0.2 million tones. The minor fisheries Harbour was constructed for the use of small mechanized crafts, such units do not land the catch in the jetty at present. In the fisheries Harbour, there is one ice plant and one cold – storage. The ice plant with a capacity of 6 t is leased to a private company now. One ice- plant of 30 t capacity owned by a private company exists at Thondi.

86. **Gandhi**, **A.** 2005. On a Humpback dolphin, *Sousa chinensis* washed ashore at Rameswaram landing centre along Palk Bay. *Mar. Fish. Infor. Serv. T & E. Ser.,* 183: 20.

Address : Mandapam Regional Centre of CMFRI, Mandapam camp.

Abstract : A dead dolphin was washed ashore at Rameswaram landing center along Palk Bay on 18-1-2005. From the external characters, mainly the number of teeth, it was identified as Humpback dolphin, *Sousa chinensis*. The specimen was a female of 150 cm in total length and weighed 50 kg.

87. **Gandhi, S., G.V. Rajamanickam and R. Nigam.** 2002. Taxonomy and distribution of benthic foraminifera from the sediments of Palk Strait, Tamil Nadu, east coast of India. *J. Palaeontol. Soc. India,* 47 : 47-64.

Abstract : A systematic study of benthic foraminifera has been made on 42 sediment samples collected between Mandapam and Kodiyakkarai, off Palk Strait, Tamil Nadu, India. A total of 102 benthic foraminiferal species belonging to 52 genera, 38 families,

23superfamilies and 5 suborders are identified. The above species were compared to inventories given by earlier workers on east and west coast faunas. The result shows the presence of 38 species for the first time in this Strait. All these 38 species are illustrated here and their taxonomical details are provided. The foraminiferal distribution shows the number of species to be higher in the south of Manalmelkudi as compared to the north.

88. **Gandhi, S. and G. V. Rajamanickam.** 2004. Benthic foraminifera in recognising siltation: A case study from the Palk Strait, East coast of India. *J. Geol. Soc. India,* 64 (3) : 293-304.

Address: Department of Earth Sciences, Tamil University, Thanjavur - 613 005, India; Department of Disaster Management, SASTRA Deemed University, Thanjavur - 613 402, India.

Abstract: In order to use foraminifera as a tool for siltation studies, benthic foraminiferal studies of both living and dead have been undertaken in the Palk Strait, East coast of India. Forty Two offshore sediment samples upto 10 m water depth in eight transects have been collected using Lafond-Dietz snapper. The study has yielded a total of 102 benthic foraminiferal species. It has been observed that benthic foraminifera are abundant at Mandapam and Devipattinam transects with high diversity in living species while the Manalmelkudi transect has displayed less abundance with the low diversity. The living/ dead ratio is 6.6 % in Manalmelkudi and 24. 57 % in Devipattinam. Based on the living/ dead ratio, the rate of sedimentation has been estimated to be more in the south of Manalmelkudi than in the north. Unlike in the adjacent Gulf of Mannar and Bay, of Bengal, an abrupt reduction in the diversity of benthic foraminifera, abnormality in the shape and size of the tests of species of *Lagena, Asterorotalia, Quinqueloculina, Spiroloculina, Pararotalia,* etc., and the presence of agglutinated foraminifera in the Palk Strait, in fact, suggests the prevailing high turbidity and in turn siltation, leading to an unfavourable environment in the present study area.

89. **Gandhi, V.** 1998. *Studies on the Ecology and Biology of Butterfish, Scatophagus argus in Mandapam Coastal Region.* Ph.D Thesis. Madurai Kamaraj University, Madurai. 200 pp.

Address: Centre for Marine and Coastal Studies, School of Energy, Environment and Natural Resources, Madurai Kamaraj University, Madurai – 625 021, Tamil Nadu, India.

Abstract: The biology and ecology of the spotted scat, *Scatophagus argus* was studied as it has economic and ornamental value. Detailed studies on biometry, length weight relationship, food and feeding habits, reproduction and population growth parameters were carried out. Variations in body structure, number of dorsal spines, anal spines, dorsal rays and anal rays were observed. The scat had 11 dorsal spines, 15-17 dorsal rays, 4 anal spines and 14-15 anal rays. The body was solid, angular and deeply compressed and the fins were yellowish with light brown markings between the rays. The length weight relationship indicated that the value of the exponent 'n' was considerably below 3. There was a sudden increase in weight of the fish on attainment of first maturity which occurred for the males in the size group 120-129 mm and for the females in the size group 140-149 mm. Analysis of covariance to test the equality of length and weight relationship in males and females revealed significant difference between the sexes. Studies on food and

feeding habits clearly indicated that scats are omnivorous and generally prefer phytoplankton, filamentous algae, *Ulva* spp., coral polyps, sea anemones, bivalves, lepas, prawns and other crustaceans and alphids. Variations in moisture content in muscles, liver, and gonad between male and female fishes were observed. It was found out that the moisture content in muscles, liver and gonad was dependent on the content of carbohydrate and lipids in these organs. It was also observed that the moisture content greatly decreased during the development of gonad and spawning. The size of ova varied according to the stages of development of ova. It was also observed that the spawning of scat fish occurs twice a year; one during northeast monsoon and the other during southwest monsoon. In the present study maturity of gonad, both in male and female fishes, was observed. The study clearly indicated that the development and percentage of occurrence of gonad are related to the size of the fishes. The mean gonado-somatic indices of male and female fishes were greater than the grand mean (1.00 in male and 5.31 in female) during the southwest and northeast monsoon months coinciding with spawning season of the scat. Physico-chemical parameters of surface and bottom waters of the locations in Gulf of Mannar and Palk Bay, where from the fishes were collected, were studied. The study concludes that the Scat fish is suitable for aquarium, because of its attractive appearance, friendly behavior with other organisms, slow growth, and hardiness to withstand stress. Boiled lettuce, spinach, steeped oatmeal, aquarium plants like *Nitella* spp., and *Riccia* spp., were the favorable feed items for the scat fish in aquarium. The time taken for rearing of fry in aquarium was calculated and it took 18 days to attain a length of 20mm. The study concludes that these findings would help the fishermen to know the proper harvest time to catch the Scat fish from the Gulf of Mannar and Palk Bay.

90. **Gandhi, V and C. Kasinathan.** 2002. On a Sei whale *Balaenoptera borealis* washed ashore at Pirappan valasai (Palk Bay) near Mandapam. *Mar. Fish. Infor. Serv. T & E. Ser.,* 173: 4.

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : On 26-7-2001 , a male *sei whale Balaenoptera borealis* lesson was washed ashore in dead condition at Pirappanvalasi (Palk Bay) near Mandapam. The whale might have died in the mid sea due to an injury caused by collision with fishing boat in the portion of the notch of the caudal flukes. The total length of the whale was 9 meters with an approximate weight of 8 tonnes. It had 52 throat grooves which terminated half way between tip of flipper and umbilicus. The other morphometric measurements of the sei whale were the length from snout to notch of caudal flukes-900, the length from tip of snout to blow hole is 180, and the length from tip of snout to anterior insertion of flipper 235, then the length from tip of snout to center of anus is 650, length from notch of fluke to posterior end of dorsal fin is 300, where as the length of fluke on outer curvature is 200 respectively.

And then the length of fluke on inner curvature of the animal is measured is 215, the length of dorsal fin base 625, vertical height of dorsal fin is 27, length of flipper from anterior insertion to tip ranged 100, then the length of flipper along the curve on lower border is 70, and greatest width of flipper 25, depth of body at anal region is 250. The

depth of body at origin in region of eye is 270, then the length of upper jaw and length of lower jaw is 135, 175 respectively,then the diameter of eye is measured 25.

91. **Geographer.** 1975. Limits in the seas. No. 66. Historic water boundary : India-Srilanka,

Address : The Geographer, Bureau of intelligence and research, U.S. Department of State.

Abstract : This paper is one of a series issued by The Geographer, Bureau of Intelligence and Research of the Department of State. The aim of the series is to set forth the basis for national arrangements for the measurement of the territorial sea or the division of the continental shelf of maritime nations. The governments of the republic of India and the republic of Srilanka agreed on June 26-28, 1974, to delimitation of a boundary through the "historic water" of Palk Bay. The agreement, which came into force on July 8, 1974, has been printed in the Government of India's Notice to Mariners, Edition No. 9, Notices 133 to 156, April 15, 1975.

92. **George Alexander, C.A. George and R. Jambunathan.** 1974. Cyclones and depressions of 1973 – Bay of Bengal and Arabian Sea. *Indian J. Meteorol. Geophy.,* 25 (3 & 4) : 357-358.

Abstract : A low pressure area formed over extreme south east Bay on 10th and became well marked on the 11th and 12th. It concentrated into a depression at 1200 GMT of 13th near 7°N, 88.5°E. Moving west-north-west, it became deep on the morning of 14th with its centre near 8°N, 85°E. Continuing to move west-north-west, it crossed south Tamil Nadu coast near Pamban on 15th night and emerged into Lakshadweep – Maldive area on 16th as a low.

93. **Gopakumar, G and H.M. Kasim.** 2005. *Seminar on "Palk Strait and opportunities for livelihood support of coastal communities".* Organized by national Biodiversity Authority, Government of India, Chennai and Aquaculture foundation of India, Chennai at Ramanathapuram. (11th-12th December,2005).

94. **Gopalakrishna Pillai, N and R. Sathiadas.** 1972. Pair trawling strikes good grounds for pomfret in the Palk Bay, Tamil Nadu, *Mar. Fish. Inf. Serv. T & E Ser.,* 39: 1-6.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India

Abstract : Pomfrets being in demand as quality table fishes and the landings, as was witnessed during these operations, quite unusual in this region, attention was paid togather the details and the results of the operations during February to April 1982 are presented. The areas where the pair trawling was conducted , fishing was restricted to within 79º 10' - 79º 30' E longitude and 9º 40' N latitude in the Palk Bay north of Mandapam in Tamil Nadu. The sea bottom in this area is mostly muddy and the depth of operation ranged between 10 to 12m. The design of the two – boat, high opening bottom trawl introduced by the FAO is in the form of a conical bag consisting of wings 15.4 m, over hand 3m, belly 23m, throat 5m and cod end 7.5 m with an overall head-rope length of 33 m. Pair trawling conducted off Rameswaram and Mandapam during February to April 1982 are furnished, The total estimated landings of fishes during these three months was 1,166, 7 tonnes and

the catch per unit effort 1,093,4 kg. The percentage composition of the dominant groups of fishes shows that pomfrets and rainbow sardines were landed more or less in equal proportions. Sciaenids and cat fishes formed 17.55% and 9.32% respectively. Other important groups landed were silver bellies (5.75%), rays (4.79%) and miscellaneous fishes, manly *Pellona spp., Hilsa spp., llisha spp.,* Carangids and lesser sardines other than rainbow sardines (2.98%).

The change in fishing pattern during this period was mainly due to comparatively lesser returns in trawl fishing and high profitability of pair trawling. Detailed information regarding the operational coast such as diesel and lubricating oil expenditure, wages to the crew members and shore costs such were collected. The average operational expenditure per trip of pair trawlers, following the fixed wages system is given in table 3 and it works out to about Rs. 1,200/- excluding the interest for investment, depreciation, insurance and repairing and maintenance charges. Trawl fishing in recent years are also known to bring in stray catches of pomfrets. Therefore such huge landings of pomfrets as observed during February to April by pair trawling conducted off Rameswaram, Pamban and Mandapam are quite a significant feature and this is the first time that such heavy landings have been reported here.

95. **Gopalakrishna Pillai, N and K. Dorairaj.** 1985. Results of the trawling survey by an institutional boat Cadalmin II in the Palk Bay and Gulf of Mannar, Mandapam, during 1977-80. *Indian J. Fish.,* 32(1): 123-132.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : During the course of the trawling survey conducted in 1977-80 R.V. Cadalmin II (13.3 m, 100 BHP) landed from the Palk Bay and Gulf of Mannar a total of 46.366 kg of all fish at an annual average catch rate of 57.5 kg as a result of a total fishing effort of 806.3 h. Silverbellies formed 80% of the catch. The sub-areas 9-78/1F, 9-79/2B, 2C, 3B, 3C, 3D, 4A, 4B and 4C were found to be most productive. April-June in the Palk Bay and October-December in the Gulf of Mannar were the best seasons for trawling. Over 70% of the catch came from 4-10 m depth. When compared with earlier studies, a change was noticed in the composition of fish species in this region. The estimated potential yield for all the eight sub-areas surveyed in the Palk Bay and seven sub-areas in the Gulf of Mannar was 874.6 t and 473.7 t, respectively.

96. **Gopinadha Pillai, C.S. 1967.** *Studies on Corals.* Ph.D., Thesis submitted to University of Kerala. 338 pp.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : The present work entitle " Studies on Corals" systematic and ecological studies on the stony corals of the seas around India was carried out at the suggestion and guidance of Dr. S. Jones, Director, Central Marine Fisheries Research Station, Mandapam Camp during the period April 1964 to April 1967. Corals from the Laccadives, Tuticorin, Palk Bay and Gulf of Mannar around Mandapam and Andaman Islands were studied and total of 125 species belonging to 34 genera and 1 subgenus were described in detail.

Photographic illustration is given for all the forms described herein except for a few species that are well known. Three species are described as new to science, while names are suggested for one Goniopore and two Porites already described but not named according to binomial system. A brief account of the horizontal distribution of corals and the factors that probably control their zoning on the fringing reefs of Palk Bay (Mandapam) are described. The composition of the coral fauna around Mandapam is also discussed.

97. **Gopinadha Pillai, C.S.** 1969. Studies on Indian corals I. Report on a new species of *Montipora (Scleractinia, Acroporidae). J. Mar. Biol. Assoc. India,* 9(2) : 399-401.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The coral fauna of Gulf of Mannar and Palk Bay around Mandapam in South India, is one which has received very little attention of the biologists. The author made an intensive collection of shallow-water Scleractinians from this area during 1964-1966, comprising about species. One may naturally expect several new species in a large biological collection from an area which is little investigated. But curiously enough, the coral fauna of this area yield only a few new species, one of which is described in the present paper. The rest of the new species in the collection will be reported subsequent occasions. The present species is named after the name of the place from where the holotype is collected. The specimen will be deposited in the reference collection museum of the Central Marine Fisheries Institute, Mandapam Camp.

98. **Gopinadha Pillai, C.S.** 1969. The distribution of corals on a reef at Mandapam (Palk Bay) S. India. *J. Mar. Biol. Assoc. India,* 11(1&2): 62-72.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Small coral reefs of fringing type are found in the Palk Bay and Gulf of Mannar at the southeastern coast of India. They are located chiefly around the various Islands lying between Tuticorin and Rameswaram in the Gulf of Mannar, and in Palk Bay at Mandapam and along the eastern side of Rameswaram Island. Early references to some of these reefs are made by Foote (1880) Thurston (1895) and Sewell (1932,1935) who referred largely to the raised up reefs of the Rameswaram Island. In this account an attempt is made to describe the structure of a shallow-water reef at Mandapam (Palk Bay). The horizontal distribution of the various corals on the reef is discussed in relation to a few possible factors that might influence the distribution. This account is based on a study of the reef which was visited as and when conditions permitted, for over a period of three years.

99. **Gopinadha Pillai, C.S.** 1971. Composition of the coral fauna of the Southeastern coast of India and the Laccadives. In : *Regional variations in Indian Ocean coral reefs.* (eds) D.R.Stoddart and Sir E.M. Yong, Zoological society of London, Acad. Press, London.28:301-327.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Coral reefs of fringing nature are found both in the Gulf of Mannar and Palk Bay on the southeastern coast of India. In the Gulf of Mannar, they are scattered mostly around the various islands lying between Tuticorin and Rameswaram. The reefs of Palk Bay are confined to the northern and eastern coasts of Rameswaram Island and the northern side of Mandapam. Investigations on the corals of this area, between Long. 79° 4'E and 79° 15'E and Lat. 9° 10'N and 9° 18'N, have revealed the occurrence of 117 spp divided among 33 genera. Of these, 110 spp of 26 genera are hermatypic and the rest ahermatypic. The most conspicuous components of the coral fauna of this area are the members of the families Acroporidae, Poritidae and Faviidae. It is feared that the coral reefs of southeast India are fast deteriorating due to natural as well as artificial causes some of which are also discussed in this paper. The Scleractinia of the Laccadive Archipelago are still poorly known except for some information from Minicoy and Chetland Island. To the present a total of 69 spp belonging to 26 genera are known from the archipelago, all of which are known to occur at Minicoy Atoll. A comparison of the coral fauna of southeastern India and the Laccadives is also presented.

100. **Gopinadha Pillai, C.S.** 1972. Stony corals of the seas around India. I *Proc. Symp. Corals and Coral reefs,* MBAI. pp. 191-216.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Three hundred and forty species of scleractinian corals of seventy six genera have been hitherto recorded from the seas around India, including the Maldives, the Laccadives, Ceylon, Palk Bay and Gulf of Mannar along the Indian coast, the Andaman and Nicobar Islands and the Mergul Archipelago. Out of these, 253 species divided among 49 genera are hermatypic and the rest ahermatypic. The Maldivian coral fauna, as it is known, includes 166 species of 66 genera and that of the Laccadives, 73 species divided among 29 genera. A total of 90 species assignable to 39 genera is known to occur in Ceylon. The Palk Bay and Gulf of Mannar around Mandapam are known to harbour a total of 117 species belonging to 32 genera. The coral fauna of Tuticorin in the Gulf of Mannar has not been fully investigated and only 21 species of 19 genera have been hitherto recorded. The Andaman Islands are known to have 68 species divided among 31 genera and the Mergui Archipelago (west of 98° 30'E) has 65 species of 31 genera. The deeper waters of Bay of Bengal and the Arabian Sea, between the longitudes 60'E and 98° 30'E and north of latitude 1° S, around the Indian subcontinent, other than the various localities already mentioned, are known to have 25 species belonging to 15 genera. These are mostly ahermatypic. A good many genera and species are common to the various localities mentioned but a few are peculiar to one or the other area.

101. **Gopinadha Pillai, C.S and P.V. Ramachandran Nair.** 1972. Productivity studies on some hermatypic corals by means of both oxygen measurements and 14C method. *Proc. Symp. Corals and Coral Reefs, MBAI.* pp.43-58.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The hermatypic corals harbour boring filamentous algae in their skeleton as well as symbiotic zooxanthellae in their soft tissue. These imprisoned algae produce much more quantity of oxygen by photosynthesis than the respiratory needs of the coral. Various attempts have been made in the past to estimate the oxygen production of corals and there was apparently disagreement among authors on the role of boring algae in the total production. In this work an attempt is made to evaluate the percentage of oxygen production contributed by the boring algae and the symbionts of a few species of reef building stony corals. From Palk Bay and Gulf of Mannar around Mandapam (S.India). The gross production was estimated by dark and light bottles by Winkler technique, converting the oxygen values into carbon equivalents. The share of zooxanthellae was then determined by incubating the isolated symbionts with $NaH14CO^3$. A marked difference was observed in the two sets of values thus obtained. In the light of the present results the role of the boring algae in the productivity of reef corals is discussed.

102. **Gopinadha Pillai, C.S.** 1973. Coral resource of India with special reference to Palk Bay and Gulf of Mannar. *Proc. Symp. Living Resources of Seas Around India.* pp. 700-705.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Coral formations are found within the seas around India, in tht Gulf of Kutch, in Andaman and Nicobar Islands, in Palk Bay and Gulf of Mannar on the eastern coast and in the Laccadive Archipelago. In the former areas we have fringing reefs whereas the whole of Laccadives are atolls. These reefs harbour a rich and varied coral fauna of appreciable economic importance. The black coral of commerce Antipatharia is found to occur in the Gulf of Mannar and in the Laccadives at a depth of about 5 to 200 metres. But the feasibility of their commercial exploitation sti1l remains to be ascertained. The blue coral (*Heliopora*) is available in large scale in Laccadives at moderate depths. The most important commercially valuable corals of the Indian coasts are the scleractinias. They form a major source of calcium carbonate and are used in the preparation of calcium carbide, lime and cement, besides as building blocks and in the construction of roads. The corals from Palk Bay and Gulf of Mannar around Mandapam are brought ashore in large quantities for the above purposes affording livelihood for about 500 people. A quantitative estimation of the potential exploitable stock is yet to be made. In the present paper a qualitative analysis of the commercially important corals of this area, based on field studies and survey of the exploited stock, is given. A few problems on conservation are also suggested.

103. **Gopinadha Pillai, C.S.** 1975. An assessment of the effects of environment and human interference on the coral reefs of Palk Bay and Gulf of Mannar along the Indian Coast. *Seafood Export J.,* 7(12): 1-13.

104. **Gopinadha Pillai, C.S.** 1977. The structure, formation and species diversity of South Indian reefs. *Proc. 3rd Internatl. Symp. Coral reefs,* Miami, 1: 47-53.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: A well developed reef, the 'Mannar Barrier' stretches along the southeast coast of India, from Rameswaram Island to Tuticorin in a northeast, southwest direction, to a distance of nearly 140 km. This formation is bridged by a shallow ridge, 'Adam's Bridge' to the reefs of Ceylon. On the leeward side of the reef flat, there are 20 small Islands, which are more or less 5 sq. km in size and mostly of the same elevation as the mainland coast. Since sediment supply was considered inadequate on the flat for the formation of these Islands, it is suggested that they are parts of the mainland, which got separated by a wide subsidence in sub-Recent time during which Ceylon also finally severed its connection from the mainland of India. This subsidence caused a wide lagoon-like portion of the sea resulting in the 'Mannar Barrier'. The fringing or patch-reefs found on the leeward side of the sand cays, as well as in the Palk Bay are Secondary Formation on shallow waters where granite or laterite substratum was exposed by erosion. While the southern part of the barrier has very few species dominated by *Pocillopora damicornis., Acropora* spp., *Montipora* spp., and *Turbinaria* spp., the northern portion has a rich diversity of genera and species dominated by *Poritids* and *Faviids*, along with *Pocilloporidae* and *Acroporidae*. The encrusting calcareous algae are very significant as a reef builder at the south, while insignificant down north.

105. **Gopinadha Pillai, C.S and K.K. Appukkuttan.** 1978. Distribution of molluscs in and around the coral reefs of the southeastern coast in India. *J. Bomb.Nat.Hist.Soc.,* 77:26-47.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : The report presents the results of a synecological analysis of the molluscan fauna associated with the different hard and soft substrates in and around the fringing coral reefs of Palk Bay and Gulf of Mannar around Mandapam between the longitudes 79°8' and 79° 14' E, and latitudes 9° 12' and 9° 18' N. This study forms part of a programme of survey of the reef-associated living resources of the seas around India. An attempt has been made to identify and to assess the comparative dominance of the molluscan communities in the different habitats as also to delineate the physical and biological factors that influence their selection of habitats. The molluscs of this area are fairly well known, thanks to the works of Hornell (1915, 1917, 1922, 1951), Gravely (1927), Satyamurthi (1952, 1956), Rao (1970), Jones (1970). Silas (1968) and many others whose contributions are listed by Nair and Rao (1974). Though about 450 species are known from this area, there appears to be little attempt in the past to discuss the synecological aspects of molluscan distribution but for the work of Rao and Sundaram (1972). Satyamurthi (1952, 1956) has mentioned the natural habitat of many species he has described. The present collection includes only 112 species roughly one fourth of the known species, partly because we have not accounted the many dead shells found except from the raised reefs. In the recent past, there has been considerable destruction to reefs due to indiscriminate quarrying of corals and this has directly caused a dwindling of the molluscs associated with the reefs.

106. **Gopinadha Pillai, C.S.** 1983. Structure and generic diversity of recent Scleractinia of India. *J. Mar. Biol. Assoc. India,* 25(1&2): 78-90.

Address : Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract : An updated check-list indicates that the Recent Scleractinian fauna of India, including Lakshadweep, Gulf of Kutch, Southeast coast of India and the Andaman and Nicobar Islands, has a total of 199 species divided among 71 genera. Out of these, 50 genera and 155 species are herma types and the rest 44 species of 21 genera are ahermatypes. Lakshadweep is known to have a total of 31 genera with 78 species. A comprehensive list of coral from Gulf of Kutch is provided for the first time in this paper which includes 24 genera and 37 species. A total of 94 species divided among 37 genera is hitherto known from the southeast coast including Palk Bay and Gulf of Mannar. The scleractinians of Andaman and Nicobar Islands include 59 genera and 135 species of which 47 genera with 100 species are hermatypes and the rest ahermatypes. The occurrence of the various species in the four major coral growing areas are indicated in the check-list. None of the genus is endemic. The Andaman and Nicobar Islands fauna is perhaps the richest both in number and diversity of elements, and includes a few genera and species which are less common in the Indo-Pacific, but recorded from the eastern Indian Ocean. The regional variations of the coral fauna of India is briefly discussed.

107. **Gopinadha Pillai, C.S.** 1986. Recent corals from the southeast coast of India. pp. 107-201. In : *Recent advances in Marine Biology,* (ed.) P.S.B.R. James, Today and Tomorrow's Prin. & Pub., New Delhi, 1986: 591 pp.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The recent stony corals of the southeast cost of India collected by the author from the small islands extending from Tuticorin to Rameswaram in Gulf of Mannar and the shallow waters of Mandapam in Palk Bay are described and illustrated providing a comprehensive account of the coral fauna of this region. The present account deals with 92 species divided among 36 genera of which 10 genera are ahermatypes and the rest reef builders. Yet another genus viz., Madracis of the family pocilloidae was once obtained from the deep waters of Gulf of Mannar. But is not considered in this work due to taxonomic difficulties. Among the species of *Montipora* described *M. jonesi* is new to science. A synopsis of the various species is provided under each genus discussed and detailed descriptions are provided based on material collected. A major attempt was made to solve many problems of synonyms that have resulted in a remarkable reduction of the species recognised by earlier authors. As far as possible ecological notes under each species is provided with specific location of their occurrence to facilitate future collection and determination.

108. **Gopinatha Menon, N.** 2003. Catfishes. *In. Status of Exploited Marine Fishery Resources of India,* CMFRI, Cochin, India. pp. 110-119.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Among a wide variety of coastal demersal fish species, the marine catfishes assume prime dominance, by virtue of their abundance in the coastal grounds, vulnerability, migration and behavior. Compared to many other demersal fishes, catfishes are within the affordable range of poor/middle, class fish eaters. They have a wide distributional range

in the Indo-Pacific region, all along the Indian coastal waters upto the middle shelf with preferential concentration on muddy grounds of 30-70 m depths. They migrate both vertically (diurnal migration) and horizontally (seasonal) in small schools to large shoals in response to seasonal climatic/hydrographic variations, drift pattern, biology and reproductive behaviour of the species. Although the young ones live at the bottom, the adults frequently visit column/surface water and move in shoals along the prevailing drifts of the southwest and southeast monsoon, and become amenable to a variety of fishing gears. Marine catfishes belonging to the family Tachysuridae are grouped under three genera Tachysurus (= Arius), Osteogeneiosus and Batrachocephalus in Indian waters with 21 species under the former genus and one species each in the latter two genera. Of the 23 species recorded from the Indian waters, 11 appear in the commercial fisheries with characteristic species abundance and seasonal variation in different regions. The genus Batrachocephalus, represented by a single species *B. mino*, has only rare occurrence in the Gulf of Mannar and Palk Bay. The species diversity in the commercial fisheries has dwindled since the nineties to 4-6 species along the southeast coast and 2-4 species in southwest region of India. A drastic decline in their production in the above regions was also noteworthy.

109. **Gurusamy, K and V. Ramadoss.** 2000. Effect of sewage and oil pollution on biochemical constituents of a few economic Sea weeds in the lagoon of the Palk Bay reefs at mandapam South east coast of India. *Ecotoxicology Enviromental Monitoring.* 10(3-4): 265-271.

Address : Dept. of Zoology, Sri S.R.N.M.College Sattur 626 203, Tamil Nadu. Centre for Marine and Coastal Studies Dept. of Environment, School of Energy Environemt, and Natural Resources, Madurai Kamaraj University, Madurai – 625 021.

Abstract : Effect of sewage and oil pollution on the seasonal variation on biological constituents (proteins, carbohydrates and lipids) in seaweeds such as *Padina gymnospora (Kuetz*) *Vickers (Family : Dictyotaceae), Gracilaria corticata* J. Ag, (Family : *Gracilariaceae), and Sargassam wightii Greville* (Family : *Sargassaceae)* collected from two stations of the Palk Bay were studied for one year from May 1998 to April 1999.The protein, carbohydrates and lipids varied from 0.08. to 28.10 mg g^{-1}, 0.06 to 1.53 mg g^{-1} and 0.05% to 14.59% station I, and 0.08 to 26.00 mg g^{-1}, 1.50 to 1.50 mg g^{-1}, and 0.04% to 14.00% in station II respectively. Brown algae showed higher protein, carbohydrates and lipids content than red algae. Biochemical constituents were generally more during monsoon and post- monsoon seasons.

H

110. **Hameed Batcha.** 1989. Report on a shoal of *Javanese cow*- nose ray from Palk Bay. *Mar. Fish. Infor. Ser. T & E Ser.,* No. 104 : 10.

Address : Madras Research centre of C.M.F.R.I, Madras.

Abstract : One such shoal was sighted in the Palk Bay on 16 – 12 – 1989 by the shrimp trawlers operated at a depth of 10 m and netted the fish at an average rate of 350 kg per boat. The occurrence of violated shoals of Javanese cow-nose ray (*Rhinoptera javanica)* has been reported on a few occasions from the south east coast of India. The width of the ray ranging from 100-165 cm and the weight ranged from 16-57 kg. Nearly eighty percent of the fish were female. To analysis the gut content of the ray, the crushed pieces of gastropods shells, partly digested fishes such as *scienids* and *gobids*, and crustaceans like crabs, Squilla, *Penaeus semisulcatus* and *Alpheus spp.,* The rays landed were processed by pit curing method. And the cured products were sent to the markets in Kerala where there is good demand.

111. **Hameed Batcha and M. Badrudeen.** 1992. Length-weight relationship and relative condition of *Leiognathus brevirostris (Velenciennes*) from the Palk Bay. *J. Mar. Biol. Assoc. India.* 34(1&2): 269-270.

Abstract : The length-weight relationship of *Leiognathus brevirostris* which supports a commercial fishery in the Palk Bay at Mandapam is found to be expressed by the formula : Log W =- 4.8512 + 3.004 Log L indicating an isometric growth pattern of the fish in its natural habitat. The mean relative condition of the species is 0.996 which denote the normal well being of the fish in this region.

112. **Hoon, V.** 1997. Coral reef of India: Review of their extent, condition, research and management status. *Regional workshop on the conservation and sustainable management of coral reefs, Proceedings* No.22, CRASARD. B1-B22.

Address: Bay of Bengal Programme, FAO, Chennai, Tamilnadu, India.

Abstract: The major reef formations in India are restricted to the Gulf of Mannar, Palk bay, Gulf of Kutch, Andaman and Nicobar Islands and the Lakshadweep Islands. While the Lakshadweep reefs are atolls, the others are all fringing reefs. Patchy coral is present in the inter-tidal areas of the central west coast of the country. Coral reefs in India are being damaged and destroyed at an increasing rate. They face serious problems of stress from anthropogenic pressures and interference. However we cannot be precise about how much and where, because of special difficulties of monitoring underwater. The Reef condition is generally poor and declining in near shore waters and areas of high population density. Relatively pristine reefs are located around uninhabited Islands or ban-ier type reefs located away from population centers. Sedimentation, dredging and coral mining are damaging near shore reefs, while the use of explosives and bottom nets in fishing are damaging off shore reefs in specific sites. Although institutions and laws are sufficient in theory to manage and protect the reefs in India, authorities in the field have taken little effective action in implementing these laws.

113. **Hornell, J.** 1915. The recent pearl fishery in Palk bay with biological notes upon pearl oyster. *J. Asian Soc. Beng. New. Ser.,* 11: 153-164.

114. **Hornell, J.** 1922. The Indian pearl fisheries of the Gulf of Mannar and Palk Bay. *Madras Fish. Bull.,* 16: 1-188.

115. **Hornell, J. 1924.** Report on the inspection of pearl banks in the Gulf of Mannar and Palk Bay in March and April 1923. *Madras. Fish. Bull.,* 17: 199-214.

116. **Hornell, J.** 1942. The Indian Chank in Folklore and Religion. *Folklore*, 53(2) :113-125.

Abstract : It is noteworthy that the living chank is limited in distribution to the coasts of India. From 2 ½ to 3 millions are obtained annually in the Gulf of Mannar, Palk Bay and north of Ceylone; a relatively small number is taken in nets by the fishermen of the Coramandal Coast and some thousands are collected on the Kathiawar. The Indian Chank (Xancus [Turbinella] pyrum, L.,), the sangu of the Tamils who fish for it in the south of India, and the sankha of the people of the North, is the most massively built gastropod shell of the Indian Ocean. The texture and in colour it resembles the purest of white porcelain and it is susceptible of a high polish; these atributres attracted attention at an extremely early period for in the sites of Chanhu- daro in the Indus vally and of Ur and Lagash in Mesopotamia, all dating from the third millennium B.C., the presence of libation vessels and engraved pendants made from chank shells demonstrated how valued these shells were in religious ritual and for personal adornment probably amuletic in the latter case – by the ancient peoples who lived in these cradles of civilization.

117. **Hylleberg, J and R.N. Kilburn.** 2002. Annotated inventory of molluscs from the Gulf of Mannar and vicinity. *Spec. Publ. Phuket Mar. Biol. Centre,* 26: 19-79.

Address: Institute of Biological Sciences, Aarhus University, Aarhus Denmark; E-mail: hylleberg@biology.aau.dk

Abstract: Some 866 valid species in 116 families of molluscs from the eastern coast of India stretching from Chennai (formerly Madras) to west of Cape Comorin (India) were recorded. The following number of species were counted: Polyplacophora (8), Gastropoda (584), Bivalvia (266), Scaphopoda (7), and Cephalopoda (1). Records of synonyms and obvious misidentifications are listed and indexed together with diverging classification adopted by different authors. Most species have been obtained from Palk Bay and the Indian side of the Gulf of Mannar. Selected literature records, photographs of species of *Littorinidae, Oliva, Conidae,* and material identified by resource persons of the Tropical Marine Mollusc Programme (TMMP) are included in the inventory. We have recorded 866 valid species in 116 families of molluscs from the eastern coast of India stretching from Chennai (formerly Madras) to west of Cape Comorin.

I

118. **Irulandy, S.M. and Daniel Sudhandra Dev** 1999. Commercial exploitation of seaweeds by fisherfolk in Gulf of Mannar. Their socioeconomic status and problems. *Seaweed Res. Utiln.,* 21(1&2): 125-127.

Address: Krusadai Marine biological Station, Department of Fisheries, Mandapam-623 518, Tamilnadu, India.

Abstract: Sample survey was undertaken to study the status of commercial exploitation of seaweeds in six places viz., Pamban, Thonithurai, Vedalai, Seeniyappa Dargah, Periyapattanam and Keelakkarai along the Gulf of Mannar Coast. Data were collected on the number of country crafts engaged for the collection of seaweeds and daily income per head. The problems faced by the fisherfolk in the seaweed collection during peak season is discussed. The need for considering relaxation of the existing acts in connection with seaweed collection from Gulf of Mannar area is also discussed. Cultivation of commercially important agarophyte Gracilaria edulis in the shallow waters of Gulf of Mannar and Palk Bay is recommended based on the pilot scale experiment conducted at Kurusadai Island to ensure continuous supply of seaweeds to the industries and provide additional income to the fisherfolk.

119. **Issac Rajendran, A.D and Kanaga Raj David.** 1969. A preliminary underwater survey of the extent of the coral reefs in and around of the islands in the Gulf of Mannar. *Proceedings of the symposium on Coral and Coral reefs.* pp. 231-238.

Address : Department of Fisheries, Tamil Nadu, India.

Abstract : A survey using aqualung was made to observe the extent of the corals around the islands along the southeast coast of India. Nineteen islands were covered in the survey and the eastern side of the islands apperars to have a greater expanse of living coral reefs since the exploitation of coral on commercial lines is done mostly on the western and northern sides, allowing the estern side to remain unexploited.

120. **Iyer, K.M and V.K. Pillai.** 1976. Microbiological investigations in Indian coastal waters and the Indian Ocean. *J. Mar. Biol. Assoc. India,* 18(2): 266-271.

Address: Central Institute of Fisheries Technology, Matsyapuri, Cochin - 682 029, India.

Abstract: The past two decades have witnessed several marine microbiological investigations being carried out by different workers on the east and west coasts of India. The enumeration of the heterotrophic bacteria of the surface and bottom waters, muds and plankton tows and of certain physiological groups had been carried out off the coast of Madras, in the Palk Bay and the Gulf of Mannar. The nature of the bacterial flora associated with seawater and fishes off Malabar Coast had also been worked out though less exhaustively. The quantitative as well as the generic distribution of bacteria in seawater off Cochin and in fresh fishes caught therein has recently been studied. Marine bacteria producing B12 and certain antibiotics had been isolated from the seawater and marine muds off Bombay Coast. Investigation on marine yeasts was first done in Bombay waters

and subsequently studies were made in Vellar Estuary and the near-shore waters of Porto Novo. The distribution of yeasts in the Indian Ocean has been studied recently during the International Indian Ocean Expedition. The occurrence of marine bacteriophages had been reported earlier at Bombay and the recent International Indian Ocean Expedition has met with bacteriophages in the bottom and off East African Coast. Valuable information on the geographical distribution, movement and the biochemical activities of bacteria inhabiting the Indian ocean has been provided by some of the earlier Soviet Oceanic Expeditions.

J

121. **Jagadis, I., N. Gopinatha Menon and A. Shanmugavel.** 2004. Observations on the effect of bottom trawling on dislocation of non-edible biota in the Palk Bay and Gulf of Mannar, south east coast of India. In : Large Marine Ecosystems, Fishery Survey of India. pp.607-624.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu India.

Abstract: Observations on the dislocated non-edible biota by bottom trawlers in the Palk Bay and Gulf of Mannar were made during 1995-1998. Data were collected at trawl landing centers, Rameswaram (Palk Bay) and Pamban (Gulf of Mannar). The average composition of non-edible biota of the total trawl discard was 38.1% and 33.9% at Rameswaram and Pamban respectively. The dislocated non-edible biota were classified into three groups i.e., (1) major invertebrates, (2) minor invertebrates (including seaweeds) and (3) non-living forms and their rates of dislocation are presented for both the centers. The annual average rate of dislocation increased gradually from 44.7 to 71.5 kg/unit at Rameswaram whereas at Pamban it varied between 49.5 and 61.5 kg/unit during the observation period. Though the number of boats operated varied greatly between these two centers, the average rate of dislocation for both the centers during the whole period was more or less equal. Among the different groups of organisms dislocated, non-edible crab was dominant at both the centers followed by echinoderms, stomatopods and molluscs at Rameswaram and stomatopods, molluscs and echinoderms at Pamban. Among the minor invertebrates sea weeds and sea pens were represented in higher magnitude compared with other components at Rameswaram; whereas at Pamban, sponges and seaweeds were dominating.

122. **Jagtap, T.G., D.S. Komarpant and R.S. Rodrigues.** 2003. Status of a seagrass ecosystem: An ecologically sensitive wetland habitat from India. The Society of Wetland Scientists; Wetlands.Wilmington NC., 23(1):161-170.

Address: National Institute of Oceanography (CSIR), Donapaula, Goa-403004, India; E-mail: tanaji@csnio.ren.nic.in

Abstract: Seagrasses in shallow sheltered regions of estuarine, brackish, and marine environments are of productive and ecological importance. The major seagrass meadows in India exist along the southeast coast (Gulf of Mannar and Palk Bay) and in the lagoons of Islands from Lakshadweep (Arabian sea) and Andaman and Nicobar (Bay of Bengal). The flora comprises 15 species and is dominated by *Cymodocea rotundata, C. serrulata, Thalassia hemprichii, Halodule uninervis, H. pinifolia, Halophila beccarii, H. ovata,* and *H. ovalis*. Distribution occurs from the intertidal zone to a maximum depth of similar to 15 m. Maximum growth and biomass are restricted from the lower littoral zone to the depth of 2-2.5 m. A significant correlation ($r = -0.63$ and -0.71, respectively, $p < 0.05$) was observed between depth and biomass from major seagrass meadows. Greatest species richness and biomass of seagrass occur mainly in open marine sandy habitats. Associated and epiphytic flora mainly consist of marine algae and are dominated by members of the rhodophyceae group. Various fishes, molluscs, crustaceans and echinoderms form the predominant associated fauna. Macrofauna mainly comprised of Oligochaetes (40.17%),

Polychaetes (18.96%), Crustaceans (11.36%), and Nematods (18.71%), while meiofaunal groups mainly consisted of Turbellaria (34.17%), Nematoda (37.3%), and Harpacticoida (10.11%). In India, seagrass habitat, although categorized under ecologically sensitive coastal areas, is largely ignored from the educational, research, and management points of views. In spite of being one of the predominant marine macrophytic flora, surprisingly, seagrasses have not been introduced in plant science studies, even at the university level. Unawareness regarding the functions of seagrasses at an educational level and among the common people and coastal zone managers has resulted in enormous damage to them in the recent past. Seagrass habitat is under constantly increasing threat from various anthropogenic activities. Strict implementation of Coastal Zone Regulation (CRZ) act is imperative to check further deterioration of seagrass beds.

123. **Jaishankar, C.** 2005. Mandapam "records" 510 mm of rain in a single day. *The Hindu* dated 5th April 2005.

Abstract : The Mandapam rain gauge station run by the revenue department has recorded 510 mm in a day. Though the rainfall figure is unbelievable, various records available with the Collector's office have recorded the same figure. The rain, which started on Sunday morning, continued without any break till this morning. People could not come out of their houses, as heavy rain lashed the area. According to the data available with the Collector's Office, the rain gauge station situated near the railway station recorded 510 mm during the last 24 hours that ended 8 a.m. today. Rameswaram recorded 111 mm of rainfall. Similarly, Ramanathapuram has received 120 mm rain.

124. **James, D.B.** 1973. *Beche-de-mer* resources of India. *Proc. Symp. Living Resources Seas around India, CMFRI,* pp.706-711.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Beche-de-mer* or the cured holothurian is considered a delicacy in some of the South-East Asian countries. The entire quantity of about 30,000 kg produced annually at present in the country is exported since it is not consumed locally. *Holothuria scabra* is the species almost exclusively used in this country for this purpose. It is comparatively large growing to about 300 mm in length and weighing over half a kilogram in fresh condition. The holothurians are collected by divers in 2 to 6 fathoms depth of waters from February to September, the peak season being in June to August. They are also brought in appreciable numbers in trawls. Along the Indian coasts holothurians occur in large numbers in the Gulf of Kutch and along the southeast coast. The holothurians are more abundant in the Palk Bay than in the Gulf of Mannar. In the Laccadive Islands and the Andaman group of Islands which have coral reefs and lagoons the large sized species of holothurians like *Thelenota ananas, Holothuria marmorata* and *Actinopyga mauritiana* are well suited for this purpose. With proper exploitation of the totally unexploited grounds, the annual production of *Beche-de-mer* can be increased substantially.

125. **James, D.B.** 1982. Ecology of intertidal echinoderms of the Indian seas. *J. Mar. Biol. Assoc. India,* 24(1&2): 124-129.

Address: Central Marine Fisheries Research Institute, Madras - 600 105, Tamilnadu, India.

Abstract: Echinoderms are common and conspicuous organisms of the intertidal region. Their body structure is modified to live on different substrata such as rocky shores, sandy beaches, muddy flats, algal beds and coral reefs. Their concentration in the coral reefs is maximum. The author during the past twenty years has collected and studied echinoderms from various places along the Indian Coast and also from the coral reefs of the Gulf of Mannar and Palk Bay, Andaman and Nicobar Islands and the Lakshadweep Islands. More than one hundred species belonging to all the five classes have been collected from the intertidal region of India. In this paper their adaptations, habits and their distribution in the intertidal region are discussed.

126. **James, D.B.** 1986. Zoogeography of shallow water echinoderms of Indian seas. ***In***: *Recent Advances in Marine Biology.* (*Ed*.) P.S.B.R. James, Today & Tommorrow Prints & Publishers, New Delhi, pp. 569-591.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The study of zoogeography of echinoderms is important to know the changes in shoreline or relation of landmasses to each other. Very little is known about the zoogeography of echinoderms of Indian Seas. In the present paper the zoogeography of echinoderms from Lakshadweep and Maldives, Gulf of Mannar and Palk Bay along the southeast coast of India, Sri Lanka and Andaman and Nicobar Islands is discussed. Of particular interest is the distribution of echinoderms of Gulf of Mannar and Palk Bay along the southeast coast of India and Sri Lanka. Despite the geographical proximity between the two regions the faunal composition is different. Reasons for this anomaly are indicated. At the end of the paper distributional Tables for all regions are given.

127. **James, D.B.** 1988. Research, conservation and management of edible holothurians and their impact on the *Beche-de-mer* industry. *CMFRI Spec. Publ.,* 40: 97-98.

Address: Central Marine Fisheries Research Institute, Madras, Tamilnadu, India.

Abstract: Very little research has been done on the edible holothurians from India. Although more than 70 species of holothurians are known from the shallow waters of India only about 10 species are found to be economically important. At present one species, *Holothuria* (Metriatyla) *scabra*, is almost exclusively used in the Gulf of Mannar and Palk Bay and also Andamans for the preparation of *Beche-de-mer*. There are already indications of fishing pressure affecting the stocks.

128. **James, D.B.** 1994. Holothurian resources from India and their exploitation. *CMFRI Bulletin,* 46: 27-31.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: In the seas around India nearly 200 species of holothurians are known, of which about 75 species are from the shallow waters within 20 m depth. Of these, about 15 species are of commercial value. At present processing is restricted only to the Gulf of Mannar and Palk Bay on the mainland. Here *Holothuria* (*Metriatyla*) *scabra* is mainly used. The other species exploited are *Holothuria* (*Thelothuria*) *spinifera* and *Bohadschia marmorata. Holothuria* (*Halodeima*) *atra* which occurs in large numbers can also be tried. At present there is no exploitation in the Lakshadweep. In Lakshadweep, *Holothuria* (*Microthele*) *nobilis* which yields first grade *beche-de-mer* occurs in abundance followed by *Bohadschia argus* and *Stichopus choloronotus.* Exploitation is stopped in Andaman and Nicobar Islands. *Holothuria* (*Metriatyla*) *scabra* and species of *Actinopyga* are important from the Andaman and Nicobar Islands.

129. **James, D.B.** 1994. Systematics, Biology, Ecology and zoogeography of Holothurians; Zoogeography and systematics of holothurians used for *Beche-de-mer* in India. *CMFRI Bulletin,* 46: 34-36.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Although holothurians have wide range of distribution in general, they are restricted to certain regions and also- have localised distribution in some cases. *Holothuria (Metriatyla) scabra* is distributed in the Gulf of Mannar and Palk Bay and also at Andaman and Nicobar Islands, but not represented in the Lakshadweep. *Holothuria (Theelothuria) spinifera* has a localised distribution in the Gulf of Mannar and Palk Bay. *Holothuria (Microthele) nobilis* is abundant in the Lakshadweep, but absent in the Gulf of Mannar and Palk Bay. Species of *Actinopyga* occur in the Lakshadweep and the Andaman and Nicobar Islands, but not on the Indian side of the Gulf of Mannar and Palk Bay. Brief notes on the taxonomy of commercially important holothurians are given.

130. **James, D.B and B.K. Baskar.** 1994. Present status of the *Beche-de-mer* industry in the Palk Bay and the Gulf of Mannar. *CMFRI Bulletin,* 46: 85-90.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: A survey was conducted to study the present status of the *beche-de-mer* from Adirampatnam to Cape Comorin. At present processing of holothurians is carried out from Rameswaram to Sethubhavachatram in Palk Bay and from Pamban to Tuticorin in the Gulf of Mannar. In the Palk Bay, Rameswaram and Thirupalakudi are the most important centres and in the Gulf of Mannar, Kilakarai, Periapatnam and Tuticorin are important centres. Mostly *Holothuria (Metriatyla) scabra* is processed. Very small quantities of *Holothuria (Theelothuria) spinifera* and *Bohadschia marmorata* are also processed. The exploitation is more on the Palk Bay than in the Gulf of Mannar. In most of the places there are indications of overfishing. At present the resource remains untapped from a vast stretch in the Gulf of Mannar from Kilakarai to Tuticorin. The present day catch and effort from various processing centres are presented.

131. **James, D.B.** 1996. Conservation of sea cucumbers. pp.80-88. ***In***: *Marine biodiversity : Conservation and management,* (eds) N.G. Menon and C.S.G. Pillai, CMFRI. 205 pp.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : Over the years there is a fall in the landings of the seacucumbers all over the Gulf of Mannar and Palk Bay along with fall in the size of the specimens collected. The catch per unit of effort has also significantly fallen in the recent years. All these factors point to over exploitation of the sea cucumbers and need for their conservation.

132. **James, D.B and M. Badrudeen.** 1997. Observations on the landings of the sea cucumber *Holothuria spinifera* at Rameswaram by Chanku Madi. *Mar. Fish. Infor. Ser. T & E Ser.,* 149 : 6-8.

Abstract : More than 650 species of sea cucumber are known from the various parts of the world and in India, nearly 200 species occur of which about a dozen species are of commercial importance. In India Sea cucumber industry was chiefly depending on one species *Holothuria scabra* locally known as "Vella attai". In addition to this another species *H. spinifera* locally known as "Raja attai" or Cheena attai occurs in large quantities in some areas and are processed for export. Trawlers operating from Rameswaram fish landing centre occasionally land Sea cucumbers but recently a few boats have made some modifications in the trawl nets to collect chanks which bring higher prices. Sea cucumbers trawled by Chanku madi command lesser price when compared to those collected by skin diving due to spoilage in the sea itself. *H. spiniferra* varies in length from 160 to 350 mm. Major catch of the sea cucumber landed at Rameswaram is processed there itself and a small portion at Mandapam. The major portion of the processed material is sent to Kilakarai and some to Madras for export.

133. **James, D.B.** 1999. Abnormal Asteroids from the Seas Around India. *Mar. Fish. Infor. Ser. T & E. Ser.,* 159 : 21-22.

Abstract : Echinoderms as a rule are *pentamerous* and therefore most of the asteroids have only five arms. Some other asteroids like *Luidia maculata*, *Acanthaster planci* and other always have more than five arms. The number of arms may be less than five or more than five due to freak formation at the time of development. In members belong in to the families *Ophidiasteridae, Echinasteridae* and some others, the arms are long and slender and are brittle. Abnormal asteroids break either due to injury or by autotomy, especially when they are disturbed. Echinoderms are highly evolved among invertebrates, they show primitive characters like autotomy, regeneration, radial symmetry and asexual reproduction.

In the Gulf of Mannar and Palk Bay at Mandapam , the most common and conspicuous asteroid is *Pentaceraster regulus.* More than hundred of *Pentaceraster regulus* specimens belonging to this species are caught in the crab nets during certain seasons and thrown on the beach. At that time those specimen with three arms, fore arms ,six arms and even some time seven arms were collected. In the case of small star fish *Linckia multifora* which live under coral stones in the Intertidal region are more vulnerable for breaking. A six armed *Asterina lorioli* was collected from the Intertidal region under coral stones at Mandapam. *Astropecten indicus* usually has five arms, but those with four arms and

six arms were also collected from Mandapam.

134. **James, D.B.** 2000. Seacucumber. ***In***: *Marine Fisheries Research and management,* (eds) V.N. Pillai and N.G. Menon, CMFRI, Kochi, pp.124-151.

Address : Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

Abstract : Sea cucumbers are a group of economically important echinoderms with a wide range of distribution in coral to mangrove habitats. Out of 200 species known from Indian seas, 75 are from shallow seas; while only a dozen of them belonging to Holothuridae and Stichopodia are large with thick body wall and hence commercially important. They occur in exploitable concentration in the Gulf of Mannar, Palk Bay, Lakshadweep and Andaman & Nicobar Islands. The paper presents family, genera and species key to identification along with the description and distribution of important species. The paper also reviews their ecology, animal association, parasites, biotoxicity, collection, handling and processing for *Beche-de-mer*, conservation and management and hatchery and culture in Indian situation.

135. **James, D.B.** 2001. Twenty sea cucumbers from seas around India. *Naga.* 24(1&2): 4-8.

Address : Central Marine Fisheries Research Institute, Cochin, India.

Abstract : Twenty species of sea cucumbers from India are described briefly, with photographs which will enable research workers and farmers to identify them.

136. **James, D.B., A. Chellam and P.S. Asha.** 2001. The early development of the starfish *Pentaceraster regulus* (Muller and Troschel) from Tuticorin. *Mar. Infor. Serv., T&E Ser.,* 167: 12-13.

Address: Central Marine Fisheries Research Institute, Tuticorin-628 001, Tamilnadu, India.

Abstract: The star fish *Pentaceraster regulus* (Muller and Troschel) is a widely distributed and common species in the Gulf of Mannar and Palk Bay in shallow waters. Though this species was maintained for a number of years in an aquarium at Mandapam (Gulf of Mannar), no spawning could be observed as they were reared in running sea water. This species was first noticed to spawn in November 98 in FRP tanks in the hatchery of TRC of CMFRI, Tuticorin. The males and females were found to spawn simultaneously in the tanks. The sperms were released in thick streams at an interval of two to three minutes. The star fish bent the arms ventrally to exert pressure to release the sperms and eggs. The eggs where spherical, bluish green in colour and measured 120 µm in diameter on an average. After 24 hours blastula was formed. Next 48 hours single ciliated band with the length of 279 µm and the length of 115 µm was noticed. The late *bipinnaria larva* resembled an *auricularia* have the sacciform of stomach and sac like digestive tract was formed. After 15 days, *bipinnaria* transformed in *tibrachiolaria.* The larvae were fed with the micro algae *Isochrysis galbana (*1 million cells / ml) daily.

The culture medium was infested with copepods and ciliates rendering further development impossible and therefore the experiment was terminated.

137. **James, D.B.** 2004. Culture possibilities of seacucumbers in India. *Proc. National Seminar on New Frontiers in Marine Bioscience Research, January 22-23, 2004.* pp. 97-104.

Address: 37 Sadasiva Metha Street, Metha Nagar, Chennai- 600 029, Tamilnadu, India.

Abstract: In the world there are about 1400 species of sea cucumbers and of these about 30 species are consumed in various ways. In the seas around India about 200 species are distributed and of these about a dozen species are of commerical importance. The Chinese introduced the sea cucumber industry to India more than 1000 years back. Seacucumbers are defenseless animals and get quickly over-exploited from any place. The sea cucumber population in the Gulf of Mannar and Palk Bay dwindled alarmingly due to continuous exploitation over the years. The only way to make use of this valuable product and earn foreign exchange for the country is to produce the seed and farm them to marketable size. India produced the seed of the most valuable species *Holothuria scabra* in 1988 at Tuticorin by thermal stimulation. Following the same techniques other countries like Australia, Indonesia, New Caledonia, Maldives, Solomon Islands and Vietnam have produced the seed of this species and are farming them. In China the techniques for farming are perfected for the temperate species *Apostichopus japonicus*. The same methods can be applied with suitable modifications. The seed of *Holothuria scabra* is found to grow well in the prawn farms subsisting on the excess feed settling at the bottom of the farm without affecting the prawn farming operations. The results obtained so far are very encouraging and the seed is expected to reach marketable size at the end of one year.

138. **James, D.B.** 2005. Seacucumber resources of India and their potential for culture. *Proc. Ocean life food and Med. Expo.,* Aquaculture Foundation of India, Chennai. p. 90.

Address: Principal Scientist (Retd.), 37, Sadasiva Metha Street, Metha Nagar, Chennai-600 029, Tamilnadu, India.

Abstract: In the world there are about 1400 species of seacucumber and in the seas around India about 200 species are known, most of them from deep waters. About 30 species are of commercial importance in the world and in India 15 species are processed. They are consumed in fresh, chilled, frozen, dried or processed form. In India species beloging to the genera *Holothuria. Thelenota, Actinopyga, Stichopus* and *Bohadschia* are used in the processing. *Holothuria scabra* is the most valuble species in India. It is distributed in the Gulf of Mannar and Palk Bay and also in the Andaman and Nicobar Islands. The seed of *Holothuria scabra* was produced *for* the first time in 1988 at the Tuticorin Research Centre of the Central Marine Fisheries Research Institute. The seeds so produced on a number of occasions were grown under different conditions at different places. When they were grown in prawn farm the growth rate was found to be three times faster. It is expected to reach marketable size at the end of one year. In China due to disease problem many prawn farms were closed and later converted into seacucumber farms. We too can do the same thing in India with advantage.

139. **James, P.S.B.R.** 1959. *Eupleurogrammus intermedius* (Gray) (Trichiuridae: Pisces), a new record from Indian waters. *J. Mar. Biol. Assoc. India,* 1 (2) : 139-142.

Abstract : Day recorded three species of *Trichiurids viz., Trichiurus haumela* (forskal*). Trichiurus savala Cuvier, and Trichiurus muticus* Gray from the Indian Seas and indicated their occurrence in the Indo- Pacific. The course of his work on the biology and fishery of Indian' *Trichiuruds*, the author obtained representative collections of the different species from various parts of the Indian coast, and is now in a position to say that a fourth species. *E. intermedius* (Gray) (*T. intermedius* Gray) definitely occurs in our waters. Day has not mentioned the occurrence of this species in our coastal waters. It appears that this species is most common and dominant in the Gulf of Mannar and Palk Bay, while it occurs along with *E. muticus* further north (Andhra Coast). The occurrence of the other two Indian species *T. lepturus and L. savala* is more wide spread along our coast and they are often fished along with *E. intermedius* in the Gulf of Mannar and Palk Bay, while all four along the Andhra Coast.

140. **James, P.S.B.R.** 1964. Some observation on the fishery of *Chorinemus lysan* Forskal of the Rameswaram Island with notes on its biology. *Indian J. Fish*., 11(1): 268- 276.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Several species of carangids are known to occur in the Palk Bay and Gulf of Mannar in the vicinity of Mandapam of which *Selaroids leptolepis, Selaro kalla, Caranx sexfaseiatus, C. carangus, C. ignobilis, Carangoids armatus, Atropus atropus, Megalaspis cordyla* and *Chorinemus lysan* are the most common species and important from the fishery point of view.

141. **James, P.S.B.R and C. Adolph.** 1965. Observations on trawl Fishing in the Palk Bay and Gulf of Mannar in the vicinity of Mandapam. *Indian J. Fish*., 12(1&2): 530-545.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The fishing methods along the southeast coast of India with special reference to the Palk Bay and Gulf of Mannar in the vicinity of Mandapam include the operation of drift gill nets and bottom-set gill nets from plank-built boats, boat seines or bag nets from catamarans, shore seines, hooks and lines and traps, depending on the type of fish available at a particular locality. Operation of trawl nets from mechanized vessels in this area on a commercial scale is comparatively recent. Though a few small mechanized boats have been conducting trawling operations especially off Rameswaram for the past few years, no systematic survey of the fishing grounds has been carried out nor are the biological data for the commercially important fishes that could be caught in these net available. During the course of their work on the biology of silver-bellies and prawns of this area, the authors had opportunity to make some general observations on the catches landed by the Indo-Norwegian Project medium boats and since such observations are lacking for this area till date, the information gathered during the year 1964 is given in this paper. Although quantitative data are also presented in this account to indicate the general trend, special attention has been paid to the qualitative analyses of the catches through an year since the chief aim of the paper is to provide information on the availability

of various species of fish and prawns that could be commercially exploited.

142. **James, P.S.B.R.** 1965. On a giant moray eel, *Thysoidea macrura* (Bleeker) from the Palk Bay with notes on some aspects of its anatomy. *J. Mar. Biol. Assoc. India.* 7 (2): 401-405.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : During the course of field observations at Mandapam on 14 th October 1965, the author came across a large male specimen of the moray eel, *Thyrsoidea macrura* measuring 3031 mm total length and weighing 7.26 kg, which was caught in a trawl net at 6 fathoms depth in the Palk Bay off Mandapam. The first record of a giant specimen from the Indian region in recent times and also for the anatomical details given in this note which have not been studied so far. The stuffed specimen has been kept in the Museum of the Central Fisheries Research Institute, Mandapam Camp (Reg. No. CMFRI – F 38/ 96.

143. **James, P.S.B.R.** 1966. Notes on the biology and fishery of the butterfly Ray, *Gymnura poecilura* from the Palk Bay and Gulf of Mannar, *Indian J. Fish.,* 13(1&2): 150-157.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Observation on the biology and fishery of the butterfly ray, *Gymnura poecilura* (Shaw) from the Palk Bay and Gulf of Mannar including details of description, size, proportional measurements, developmental stages, habits, colour and numerical abundance are given.

144. **James, P.S.B.R and M. Badrudeen.** 1968. On certain anomalies in the fishes of the family Leiognathidae. *J. Mar. Biol. Assoc. India,* 10(1): 107-113.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Instances of anomalies are quite common in fishes and were reported by earlier authors in a number of families of fishes, involving different parts of the body. Dawson (1964) gave a valuable bibliography on the subject. Some recent accounts on anomalies in fishes from India are those of Kapoor and Sarkar (1955), Sarkar and Kapoor (1956), Sarkar and Kaushik (1958), Tandon (1959), James (1960), Kaushik (1960), Luther (1962), Chhapgar (1964), Bensam (1965), Bapat and Radhakrishnan (1967) and Rangarajan (1967). During the course of study of the biology and fishery of the fishes of the family Leiognathidae from the Palk Bay and Gulf of Mannar, the authors came across seventeen specimens of seven different species of this family showing certain anomalies. These pertain to the body profile, fins, eye and colour. A brief description of these anomalies is given in this paper. The specimens were deposited in the Reference Collection Museum at Central Marine Fisheries Research Institute (Five specimens of *Leiognathus dussumieri-Reg.* No. F. 98/594A; Three specimens *ofL.brevirostris-Reg.* No. F. 98/283 B; *Two* specimens of *L. bindus-Reg.* No. F. 98/280 B; Four specimens of *Leiognathus-Reg.* No. F.

98/593 A; one specimen of *L.fasciatus-Reg.* No. F. 98/279 B; One specimen of *L. leuciscus-Reg.* No. F. 98/569 A; and one specimen of *L. lincoalus-Reg.* No. F. 98/595 A).

145. **James, P.S.B.R.** 1968. A note on the torch (Soonthu) fishing for white-bait off Rameswaram in the Palk Bay. *J. Bomb. Nat. Hist. Soc.,* 64(1): 123-125.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Earlier records do not indicate a substantial catch of white-bait from this area, although they from a greater part of the catch in certain seasons elsewhere along the east and west coasts of India, and are highly esteemed as food fishes both in the fresh and cured condition. Fishing at night using lights of various types and power to attract fishes is extensively carried out in Japan, Thailand and Philippines and certain studies have been conducted on the effect of light on fish shoals, their behavior, magnitude of the catches, etc. The use of torches in fishing at night in various parts of India was mentioned by Hornell (1938,1950). According to him, torches are used in conjunction with rafts, ordinary sickle and spears, where two species of White-Bait (genus *Anchoviella*) namely, *A. indica* and *A. commersonii* frequently occur in the fish catches from Palk Bay. While adults are caught in limited quantities almost round the year in shore seines, bag nets and trawl nets, young ones of these species are caught in large numbers especially in shore seines, during March-April and September to November.

146. **James, P.S.B.R.** 1969. Comments on the four new species of ribbon-fishes (Family Trichiuridae) recently reported from India. *J. Mar. Biol. Assoc. India,* 9 (2) : 327-338.

Address : Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : GUPTA (1966) described briefly two species of ribbon – fishes of the genus *Trichiurus Linnaeus, Viz*., *T . gangeticus* and from the Hoogly esturine system, strongly enough, without citing earlier literature on the group. Subsequent to this report, Dutt and Thankam (1966)described two more new species *Trichiurid* fish from Waltair, namely *Trichiurus russelli* and *Lepturacanthus serratus,* Later, Gupta (1967) gave further details on the two species he reported. As one with some experience with the fishes of the family *Trichiuridae* from India, I felt the need to comment in detail on these new species based on examination of holotypes, paratypes, other material in my possession and the published details, the particulars of which are given in this paper. These are dealt with in detail in the memoir on the ribbon – fishes of family *Trichiuridae* of Indian, (James 1967). Where brief comments on the four new species are also given in the Addendum.

147. **James, P.S.B.R.** 1971. On the occurrence of a blue-green alga on fishes of the family Leiognathidae. *J. Mar. Biol. Assoc. India,* 13(1): 133-135.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: This note records the occurrence and association of the blue-green alga, chroococcaceae on the fishes of the family Leiognathidae, especially on *Leiognathus*

dussumieri, L. brevirostris, L. splendens, L. lineolatus and *L. berbis* from the Palk Bay and the Gulf of Mannar.

148. **James, P.S.B.R.** 1974. An osteological study of the dugong, *Dugong dugon* (Sirenia) from India. *Mar. Biol.,* 27(2): 173-184.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : An osteological study of the dugong (sea cow) *Dugong dugon* (Müller) from India, based on complete skeletons of an adult male and a juvenile female indicated certain morphological variations with age. It has also revealed a close osteological similarity between the dugongs from India and the Red Sea. Based on a statistical analysis, regression equations for certain typical skull measurements have been calculated; these equations, characteristic of the dugong from India, could be used for comparing dugongs of different regions.

149. **James, P.S.B.R. and M. Badrudeen.** 1975. Biology and fishery of *Leiognathus brevirostris* (Valenciennes) from the Palk Bay and the Gulf of Mannar. *Indian J. Mar. Sci.,* 4(1):50-59.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Age and growth, reproduction, food and feeding habits, and fishery of *L.brevirostris* from the Palk Bay and the Gulf of Mannar are described, based on material collected from commercial catches landed by different fishing gear during 1969. Life span of the species is (approx) 2 yr, attaining a size of (approx) 60 and 120 mm at the end of 1st and 2nd yr respectively. Female fish mature at (approx) 63 mm and the male at 68 mm when they are just about 1 yr old. Females produce a maximum number of 16,243 eggs. The species spawns throughout the year with intense spawning in may/June and Oct/ Nov. Individual fish appear to spawn twice in a year. Diatoms, copepods, lucifer, nematodes and polychaetes form important food of the species. The commercial fishery is based on 1 and < 2 yr old fish, the dominant size range being 62 to 105 mm. Fishing grounds are confined up to 12 m in the Palk Bay and 25 m in the Gulf of Mannar. Females appear to be caught in greater numbers than males. Since the species is short lived and breeds at the end of 1st yr, the present methods of exploitation appear to leave enough brood for replenishment of the stock and ensure maximum utilization of the resource.

150. **James, P.S.B.R and R. Soundrarajan.** 1979. On whales stranded along Indian coast *J. Mar. Biol. Assoc. India,* 21(1&2): 17- 40.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Particulars of whales stranded along the Indian coast including Palk Bay (1748 to 1980) are given.

151. **James, P.S.B.R and M. Najamuddin.** 1980. Recent observation on physicochemical characteristics of the lagoon along the Palk Bay at Mandapam with a note on the possibility of its utilization for large scale fish culture. *Proc. Symp. Coastal Aquaculture, MBAI.* 3:

Abstract 27.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

152. **James, P.S.B.R and R. Soundrarajan.** 1980. On the seed resources of the Indian sand whiting *Sillago silama* (Forskal) from the coastal waters of Palk Bay near Mandapam. *Seminar on Coastal and Inland Fisheries Culture* in Tamilnadu. Fisheries College, Tamilnadu Agricultural University, Tuticorin. 25th April 1980.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

153. **James, P.S.B.R, R. Soundarajan and J. Xavier Rodrigo.** 1984. Preliminary studies on culture of fin fishes in cages in the coastal waters of Palk Bay at Mandapam. *Symp. Coastal Aquaculture*. 3: 910-915.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The present study has been aimed at investigating the possibilities of culturing a few species of economically important marine fishes in suitable low cages suspended in coastal waters. In this paper, the results of preliminary study on culture of rabbit fishes (Siganus *spp.)*, groupers (*Epinephelus spp.*) and whiting *Sillago sihama* (Forsskal) in cages fabricated with different materials and suitability of cages are given. The experiment were conducted from March 1979 to October 1979. Five cages of the dimension 1.5 x 1.0 x 1.0 m and 1.0 x 1.0 x 1.0 m were used. Among the five cages the one fabricated with Palmyra leaf stalks was the cheapest but the two cages fabricated with nylon netting were durable. These cages had been kept tied to casuarina poles and rested on the sea bottom at a depth of about 0.75 m at low tide level in coastal waters of Palk Bay.

Two species of rabbit fishes namely, *Siganus canaliculatus Park* and *S. javus Linnaeus* were reared in cages. *S. canaliculatus* were reared in bamboo spilt cages (1.5 x 1.0 x 1.0 m). The initial sizes of *S. canaliculatus* ranged between 78 and 120 mm (7.5 and 24.0 g) and the stocking density was 60 nos/sq.m. *S. javus* were reared in two nylon net cages (1.0 x 1.0 x 1.0 m). In one cage (stocked in April) the size ranged between 67 mm and 90 mm (5.2 g and 13.0 g) and stocking density was 200 no/sq.m. In the other cage (stocked in May) the sizes ranged between 87 mm and 117 mm (11.5 and 32.3 g) and the stocking density was 160 no/sq.m. Initially for two months both the species were fed with a food prepared out of seaweed, prawn head, fish and rice bran mixed in equal proportions and later on instead of fish and rice bran, fish meal and ground nut oil cake were substituted. For *S. canaliculatus* the average growth increment per month was 8.5 mm and 3.1 g and for *S. javus* average growth per month was 6.2 mm and 2.0 g in one cage and 5.6 and 3.4 g in the other cage.

Two species of groupers, namely, *Epinephelus tauvina* (Forsskal) and *E. hexagonatus* (Forster) were stocked in Palmyra leaf stalk cage (1.5 x 1.0 x 1.0 m) . The stocking density rate was about 13 nos./sq.m and these were fed with chopped fish. The initial

sizes of *E. tauvina* ranged from 173.0 mm to 354.0 mm (80.0 g and 580.0 g) and of *E.hexagonatus* from 224.0 mm to 300.0 mm (190.0 g to 380.0 g). After six months the size of *E.tauvina* ranged from 299.0 to 450.0mm (405. 0 g to 1, 497.0 g) *E. exhagonatus* has not shown any consistent increase in size.

In *Sillago sihama*, stocked in G.I, wire cage (1.5 x 1.0 x 1.0 m), the initial size of fish ranged from 63.0 to 95.0 mm (2.8 g to 6.0 g) and the stocking density was about 70 no/ sq.m. This species was fed with fish meal and groundnut oil cake mixed in equal proportion. The average growth increment per month was 10.0 mm and 1.6 g from July to September.

154. **James, P.S.B.R., A. Raju and V.S. Rengaswamy.** 1984. Further observations on polyculture of finfishes and prawns in saltwater ponds and in a net-pen at Mandapam. *Indian J. Fish.,* 31(1): 31-46.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Polyculture experiments were carried out with milkfish, mullets, Sillago and prawns in salt water ponds and in a netpen in the coastal waters of Palk Bay at Mandapam, during the period 1979-82. The growth of mullet and Sillago was better in the netpen than in the pond, whereas milkfish showed better growth in the pond. Significant differences in production from fertilized and unfertilized ponds have not been noticed, the result of which is attributed to poor soil conditions of the farm. Mullets sharply reacted to low levels of oxygen in ponds.

155. **James, P.S.B.R., R. Soundararajan and J. Xavier Rodrigo.** 1984. A study of the seed resource of the Indian sand whiting *Sillago sihama* (Forskal) in the Palk Bay. *Indian J. Fish.,* 31(3): 313-324.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The fry and fingerlings of the Indian sand whiting, *Sillago sihama* (Forskal), which can serve as seed, have been found to occur in the coastal waters of the Palk Bay throughout the year, with at least three months of peak abundance, January, May and October. From the year-round availability of these it appears that *S. sihama* breeds throughout the year, probably with three peak periods, namely, May-June, August-September and November-December. These were observed to be more during day than in night, and more during the receding and low tides than during the incoming tides. The overall abundance was the highest during full moon period. While a direct relationship of the abundance of the fry and fingerlings could be noticed with the increase in temperature and dissolved-oxygen content, no such relationship was seen with changes in the salinity of seawater.

156. **James, P.S.B.R., V.S. Rengaswamy, A. Raju and G. Mohanraj.** 1985. Studies on diurnal variations in the occurrence of grey mullet seed at Mandapam. *Symp. Ser. Mar. Biol. Assoc. India*, 6: 765-775.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: In order to study the diurnal variations in the occurrence of mullet seed, collections were made during Aug. 1978 to Jul. 1979 and also Aug. 1979 to Oct. 1979 at Theedai near Mandapam along the Palk Bay. The data indicate that the seed of the grey mullet *Liza vaigiensis* dominate the collections with *L. macrolepis* and *Valamugil seheli* occurring in fewer numbers, occasionally. Other species of fishes which occurred along with mullets include *Therapon* sp., *Hemirhamphus* sp., *Chanos chanos*, *Allanetta* sp., *Sillago sihama*, *Tachysurus thalassinus, Nematalosa nasus, Leiognathus brevirostris, Gobids, Belonids, Gerres* sp., *Megalops* sp., and *Plotosus* sp. Prawns were represented by *Penaeus indicus* and *Metapenaeus burkenrodi*.

157. **James, P.S.B.R., G. Mohanraj, V.S. Rengaswamy and A. Raju.** 1985. Preliminary experiments on the culture of grey mullets at Mandapam. *Symp. Ser. Mar. Biol. Assoc. India*, 6: 791-796.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The results of experiments on the culture of grey mullets *Valamugil seheli*, *Liza vaigiensis* and *L. macrolepis* in monoculture and polyculture systems in seawater ponds and a pen erected in coastal waters at Mandapam are detailed. In a monoculture experiment, *L. vaigiensis* was stocked at the rate of 1,125/225 m^2. In polyculture experiments, mullets (*V. seheli*) and *L. macrolepis*, *Chanos chanos* and prawns (*Penaeus indicus*) were stocked at the rate of 100 and 600, 1000 and 300/450 m^2 respectively in one pond and mullets (*V. seheli*) *C. chanos* and *Sillago sihama* at the rate of 750 nos. each in another pond. Mullets (*V. seheli*) and *C. chanos* were also stocked in a pen (81 sq. m) erected in coastal waters of the Palk Bay at the rate of 500 nos. each. The stocks were fed with artificial feed composed of equal proportions of rice bran and groundnut oil cake in the form of paste.

158. **James, P.S.B.R., R. Soundararajan and J. Xavier Rodrigo.** 1985. Preliminary studies on culture of fin-fishes in cages in the coastal waters of Palk Bay at Mandapam. *Symp. Ser. Mar. Biol. Assoc. India*, 6: 910-915.

Address: Indian Council of Agriculture Research, Krishi Bharan, New Delhi-110 001, India.

Abstract: An examination was made of the possibilities of culturing a few species of economically important marine fishes in suitable low cost cages suspended in coastal waters. The results of a preliminary study on culture of rabbit fishes (*Siganus* spp.), groupers (*Epinephelus* spp.) and whiting *Sillago sihama* in cages fabricated with different materials and suitability of cages are given. Among the 5 cages used, the one fabricated with palmyra leaf stalks was the cheapest but the 2 cages fabricated with nylon nettings were durable. Data on growth and stocking density are presented for each cage type.

159. **James, P.S.B.R.** 1986. Biology and Fishery of *Leiognathus jonesi* James from the Palk Bay and Gulf of Mannar. pp. 29-101. In: *Recent Advances in Marine Biology,* (*ed*.) P.S.B.R. James, Today and Tomorrow's New Delhi, 591 pp.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: The paper deals with various aspects of the biology and fishery of the silverbelly, *Leiognathus jonesi* James from Palk Bay and Gulf of Mannar, in the vicinity of Mandapam. The length-weight relationship of indeterminates ($W = 0.0000008276 L^{3.723}$ was found to be significantly different from that of sexed fish ($W = 0.000006279 L^{3.2167}$ indicating that the rate of increase in weight of the former is much higher than that in the latter. The relative condition of females was found to be lower in March and April compared to other months. The species spawns almost throughout the year, the females attaining maturity at 65 mm and males at 70 mm T.L. Females generally dominate in the commercial catches. The counts of mature ova ranged from 686 to 39,806 per female. For the fecundity-length relationship the formula $Y = bX^3$ was found better correlated than other formulae for samples from all places. The most important items of food of the species include *Pleurosigma, Triceratium, Coscinodiscus,* nematodes, copepods and foraminiferans. No significant variations in the food of fish from different places or in different years from the same place have been found. The feeding habits of the fish also do not change with age. The feeding intensity has been found to be more or less uniform in different months. The fish attains a length of about 60, 90,103 and 115 mm T.L at the end of first, second, third and fourth years respectively. The lifespan of the species was found to be more than four years. Maximum length recorded in the present study was 152 mm. The species contributes to the bulk of the catches of silver-bellies from the area, trawl nets accounting for the greatest proportion of the catches at depths varying from 12 to 20 m. Fish 24 to 75 mm length (zero and one year old*)* dominate the commercial catches. Catch per unit of effort during daytime was found to be higher than that at night. The proportion of smaller size groups was greater in the night catches than in the day catches and vice-versa. Operation of pelagic, subsurface and mid water trawls at night can increase the total catch.

160. **James, P.S.B.R.** 1986. On an anomaly in the cheliped of the portunid crab, *Portunus pelagicus*. *J. Mar. Biol. Assoc. India,* 8(1): 218-220.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Portunus pelagicus* is the dominant species and contributes substantially to the crab fishery along the Palk Bay and Gulf of Mannar coasts in the vicinity of Mandapam. On 23rd February 1966, a male specimen of this species with the carapace measuring 59 mm in length and 132 mm. in breadth which had two additional dactyli on the left cheliped was collected from the gill net (Nandu valai) catches from Gulf of Mannar landed near the jetty of the Central Marine Fisheries Research Institute. Such an anomalous condition of the cheliped which appears to be rare has not been reported hitherto in this species and therefore a brief description is given below. The right cheliped of the specimen was unfortunately broken before collection.

161. **James, P.S.B.R., V.S.K. Chennubhotla and J. Xavier Rodrigo.** 1986. Studies on the fauna associated with the cultured seaweed *Gracilaria edulis*. *Proc. Symp. Coastal*

Aquaculture, held at Cochin, from January 12 to 18, 1980. Part 4: Culture of other organisms, environmental studies, training, extension and legal aspects, 6: 1193-1198.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: To study the fauna associated with the cultured seaweed *Gracilaria edulis* in coastal waters of the Palk Bay and the Gulf of Mannar and to assess the damage, if any, caused by any of the organisms, samples of all animals associated with the cultured seaweeds were collected from the seaweed culture sites. Crabs were found to be more numerous than all other groups. Analysis of the stomach contents of the fishes revealed that of the 16 species of fishes encountered, only *Siganus javus* was found to feed voraciously on the seaweed. The crabs represented by *Thalamita crenata* and *T. integra* though not found to feed on the seaweed, could cause extensive damage to growing parts of the seaweed by merely clipping them with their chelipeds as they crawl about amongst the seaweeds. However, greater part of the damage to the cultured seaweed during the period appears to be caused by wind and wave action when the sea becomes rough. Observations indicated damage to growing tips of the seaweed during April to August. This period coincides with the period when the direction of the wind changes from east-west to south-north direction.

162. **James, P.S.B.R.** 1994. Endangered, Vulnerable and Rare Marine Fishes and Animals. *Threatened Fishes of India. Natcon Publ.,* 4: 271-295.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: With intensification of fishing in the inshore regions of the Indian Seas for increasing marine fish production through several innovations, a number of fisheries resources have come to be exploited at optimum levels. The demand for fish and fish products both for internal consumption and for export, has been the main reason for this situation. Among finfishes, the Whale Shark *Rhiniodon typus* of Gujarat, the catfishes of the genus *Tachysurus* off Karnataka and the Whitefish *Lactarius lactarius* along the southwest coast of India have been reduced in abundance. The once existing fisheries for "Dara*" Polynemus indicus, P. heptadactylus, "*Karkara*" Pomadasys hasta, "*Koth*" Otolithoides brunneus, "*Ghol*" Protonibea diacanthus, "*Wam*" Congresox talabanoides, Muraenesox cinereus,* all of the Gujarat - Maharashtra coast and for *Platycephalus maculipinna* along the southeast and southwest coasts have become nonexistant at present. The other marine animals which are causing concern because of habitat damage or declining populations arc the corals in the Gulf of Mannar, Palk Bay, Gulf of Kutch and the Lakshadweep and Andaman-Nicobar Island systems; the gorgonids in the Gulf of Mannar, the molluscan top shells Trochus and Turbo in Andaman-Nicobar Islands; the sacred chank and the pearl oyster *Pinctada fucata* along the south-east coast; the spiny lobsters; *Panulirus* spp., off southeast and southwest coasts and the deep sea lobsters off southeast and southwest coasts; the robber crab *Birqus latro* in Andaman Islands; the Sea cucumber in the Gulf of Mannar, Palk Bay and the two Island systems; the king crab *Tachypleus gigas* of the West Bengal- Orissa coasts; the sea turtles *Chelonia, Eretmochelys,* etc and the Sea Cow *Dugong dugon* in the Gulf of Mannar and Palk Bay. The two marine ecosystems of coral reefs and the mangroves, which harbour a wide variety of finfishes,

crustaceans and molluscs of commercial value along different parts of the coast and the Islands have reached a vulnerable stage. Besides, the ceaseless bottom trawling operations within about 50 m depth from the coast as well as pollution of coastal waters in certain places have been damaging the habitats, thus leading to various ecological problems. Suggestions are offered for the conservation and rational exploitation of marine resources through stricter enforcement of existing laws, setting up of sancturies and preserves, diversification of fishing, declaration of closed seasons for fishing and extension education for coastal human population.

163. **James, P.S.B.R and B.K. Baskar.** 1995. Studies on the biology, Ecology and Fishery of the seacucumber, *Holothuria scabra* from southeast coast of India. *CMFRI Spl. Publ.,* 61: 13-17.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Seacucumbers or Holothurians are the most important groups among the echinoderms which belong to the family Holothuriidae. Among the holothurians, *Holothuria scabra* is commonly available in the Gulf of Mannar, Palk Bay, Andaman and Nicobar Islands and they are used for the preparation of *Beche-de-mer. Beche-de-mer* is the product of the degutted, dried or smoked holothurian rich in protein content. This product is exported to Singapore, Hongkong and other Southeast Asian countries for use as an item of food. Annually India is earning a foreign exchange of about 20 lakhs rupees by exporting this product. Thus there is a good scope to develop the processing industry and to step up the production of *Beche-de-mer* in this country.

164. **James, P.S.B.R.** 1967. The ribbon-fishes of the family Trichiuridae of India. Memoir No.1, MBAI, 228 pp.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

165. **James, P.S.B.R.** 2000. Diatoms to whales: My research and field experiences in the Gulf of Mannar and Palk Bay in the vicinity of Mandapam, along the southeast coast of India. *Golden Jubilee Celebrations Souvenir 2000, Mandapam Regional Centre of CMFRI, Mandapam Camp,* pp. 10-17.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: I am exhilarated and immensely thrilled to narrate my research and field experiences in the Gulf of Mannar and Palk Bay in the 1960s, 1970s and 1980s for publication in the souvenir on the occasion of the Golden Jubilee Celebrations of the Recreation Club, CMFRI, Mandapam Camp which I also served as Secretary and President for some years in the past.

166. **Jayamani, K.** 2002. Status of organic load in coastal waters of chosen sites in the Gulf of Mannar and Palk Bay. *M.Phil., dissertation* submitted to Madurai Kamaraj University. 140 pp.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University,

Madurai-625 021, India.

Abstract: Maintaining the quality of coastal water is the most important one for man since it is directly or indirectly linked to his life. Coastal waters of Gulf of Mannar become polluted due to the activities in ports and harbors, sewage discharge from human settlements along the coast and industrial effluents. Disposal of wastewater and industrial effluents into the oceans will increase the organic pollutant load in the coastal environment. The present investigation monitored the organic pollution load in coastal waters of Rameswaram, Tuticorin and Pudhmadam. Physico-chemical and microbial analyses were done to determine the water quality. Seawater samples were collected from the southeast coast of India from six stations at periodic intervals and analysed. Samples were collected at fortnightly intervals from different areas to assess the coastal water quality in the southeast coast of India. The physico-chemical parameters such as Temperature, pH, Salinity, Dissolved oxygen, Biological oxygen demand, Chemical oxygen demand, Total Organic Carbon and Total kjeldahl nitrogen were estimated. Microbial analysis was done using standard methods. For statistical analysis of the physico-chemical parameters and microbial analysis, ANOVA was done to see variations if any from the control station. Regression analysis was done to see the relationship between physico-chemical parameters and the organic load and microbial population.

167. **Jayaraman, R.** 1954. Seasonal variations in salinity, dissolved oxygen and nutrient salts in the inshore waters of the Gulf of Mannar and Palk Bay near Mandapam (S. India). *Indian J. Fish*., 1(1&2): 345-364.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Data on the seasonal variations is salinity, dissolved oxygen and nutrient salts in the inshore waters of the Gulf of Mannar and Palk Bay between the years 1950-53 have been presented and discussed. Salinity shows a regular seasonal cycle corresponding to the Southwest and Northeast monsoons. Dissolved oxygen content values are steady during most of the year and the surface-bottom differences in the oxygen content are not quite appreciable. The oxygen values are far below the saturation limit. Phosphates are low and do not show much seasonal variation. Nitrates show wider variations due probably to the activity of the denitrifying bacteria. Silicates show the usual inverse relationship with salinity except during the period, June-October in the year 1952. It is suggested that there is a possible association of these conditions with the swarming of Noctiluca observed during the same period.

168. **Jayasankar, P.** 1990. Length-weight relationship and relative condition factor in *Otolithes ruber* (Schneider, 1801) from the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 37(3): 261-263.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The regression coefficients of length-weight relationship in females and males *Otolithes ruber* showed no significant difference and a common regression is

recommended. The regression coefficients depart significantly from 3. Total length-relative condition factor curve showed first major inflexion at 200 mm.

169. **Jayasankar, P.** 1990. On the seasonal hooks and lion fishery at Pamban near Mandapam. *Mar. Fish. Infor. Serv. T&E Ser.* 103: 17.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : A female specimen of *Tachysurus caelatus* measuring 975mm in total length and weighing 8.5kg was landed by a commercial trawlers at Rameswaram landing centre on 8th September, 1988. The fish was caught from a depth about 12m in the Palk Bay. The identity of the specimen was confirmed by the following characteristics features : Tip of dorsal spine produced into a long filament. Teeth on palate villiform, in one small patch on each side, each patch roughly triangular – shaped, with inner edge convex. Head length and length of dorsal spine almost equal. The present record of the fish is the largest size of the species.

170. **Jayasankar, P.** 1991. Sillaginid fishes of Palk Bay and Gulf of Mannar with an account on the maturation and spawning of Indian sand whiting, *Sillago sihama* (Forsskal). *Indian J. Fish*., 38(1): 13-25.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: In the Palk Bay and Gulf of Mannar, 6 species of the family Sillaginidae occurred: *Sillago* (Silaginopodys) *chondropus*, *Sillago* (Sillago) *sihama*, *Sillago* (Sillago) *indica, Sillago* (Parasillago*) vincenti, Sillago* (Parasillago) *argentifasciata* and *Sillago* (Parasillago) *soringa*. A key to the identification of these species is given and their morphometric and meristic characters tabulated. *S. sihama*, the most dominant sillaginid species in this region, was a prolonged breeder. The spawning season of this species extended from July to February, with peak spawning activity during July to November. Lengths at first maturity of females and males were 179 and 159 mm respectively. Fecundity varied from 6,956 to 48,373 and showed high correlation with length, body weight and ovary weight of the fish. Overall sex ratio indicated predominance of females. Length-related sex ratio showed significant dominance of males till 170 mm and that of females above this length.

171. **Jayasankar, P.** 1991. Length-weight relationship and relative condition factor in *Sillago sihama* from Mandapam region. *Indian J. Fish.,* 38(3): 183-186.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Sillago sihama* forms about 60% of all sillaginids commercially exploited in the Gulf of Mannar and Palk Bay landing centres of Ramanathapuram district in Tamil Nadu (Jayasankar, 1991). Only a preliminary study on the length-weight relationship and condition factor of *S. sihama* was made by Radhakrishnan (1957) from Mandapam area. Later work (Jayasankar, 1991) showed a marked difference from Radhakrishnan's results on condition factor. This study re-examins the issue.

172. **Jayasankar, P and M. Bose.** 1992. Observations on Catfish Landings by pair trawlers at Rameswaram, (Palk Bay side). *Mar. Fish. Infor. Serv. T & E. Ser.,* 118: 17-18.

Address : Mandapam Regional Centre of C.M.F.R. I.., Mandapam Camp – 623 520.

Abstract : During 1980 – 81 high opening pair trawl nets commenced in the Palk Bay with Mandapam. Pamban and Rameswaram as bases of operation. They reported the landings of 109 t of catfishes during February – April at Rameswaram. In 1992, the solider catfish, *Osteogreneiosus militaries* (Linnaeus) constituted 61.85% of all catfishes. Such heavy landings of this species have never occurred before in any gear along the Palk Bay and the Gulf of Mannar. January – mid April 1992. The trawling boat operated about 10 – 25 km N.E. off Rameswaram (approx. 9°10'-9°30'N and 79°20'-79°35'E) at 10-16m depths, where the sea bottom is mostly muddy. In April, the catch plummeted to 3.74 t and the fishery disappeared by about middle of April. From the enquiries with local fishermen, it was learnt that best catches of catfishes came from west of Katchativu. During peek landing period (February), up to 35 lorries/day, fully loaded with ice blocks arrived at Rameswaram landing centre. During their introductory operations in the operations in the Palk Bay, the pair trawlers brought enormous quantities of white pomfrets; hence the gear came to be known locally as 'Vaval madi' (In Tamil 'Vaval' means white pomfrets and 'madi' means net). Pair trawl has proved to be the most efficient gear in this region exploiting shoaling fishes moving slightly above the sea bottom. Occurrence of a high percentage of fish in advanced stages of maturation in the catches suggests that this gear exploits catfishes engaged in spawning migration.

173. **Jayasankar, P and K. Alagarswami.** 1993. Studies on the reproduction of Indian sand whiting *Sillago sihama* (Forskal) (Sillaginidae, Percoidei). Mariculture Research under the Postgraduate programme in mariculture. Part-5. (*eds*) K. Rengarajan, A.N. Prathibha, V. Kripa, N. Sridhar and M. Zakhriah. *CMFRI Spec. Publ*., 56 : 77-82.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Some information on the biology notwithstanding, a comprehensive knowledge on maturation and gametogenesis in sillaginids is lacking. Further, their taxonomic status is largely conjuctural. Keeping these lacunae in view, investigations on different aspects of reproduction in *Sillago sihama* along with a systematic study of the family Sillaginidae from the Palk Bay and Gulf of Mannar were taken up for 1) Systematic study of sand whitings from the Palk Bay and Gulf of Mannar, 2) Histological, histochemical and biochemical studies on gonadal maturation, 3) Preliminary studies on the induced maturation and spawning.

174. **Jayasankar, P.** 1997. Population parameters of *Pennahia anea* and *Nibea maculata* in the Palk Bay/Gulf of Mannar area, India. *NAGA.,* 29(2) : 46-48.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

175. **Jayasankar, P.** 2002. Studies on the impact of bottom trawling on the ecology of fishing grounds and living resources of the Palk Bay and Gulf of Mannar. *CMFRI Annual Report,* 2001-2002. pp. 96-98.

Address : Central Marine Fisheries Research Institute, Indian Council of Agricultural Research, Post Box Number 1603, Tatapuram Post, Cochin 682 014, India.

Abstract : In this study, analysis of the data collected on commercial trawl fishing in the Gulf of Mannar and Palk Bay off Mandapam and Rameswaram island regions during the period 1998 – 2000 has been completed. Also the study revealed that with increased fishing effort of both edible and non – edible groups of both Palk Bay and Gulf of Mannar area. Totally 18 trawling voyages were arranged from March 2000 to March 2001. Once the plants are dislocated, their holdfasts can not firmly attach to the substratum and the plants die out subsequently. Declining catches in prawn fishery could be partly due to this dislocation of marine flora by trawling. And then most of the ' in-edible ' biota sustain less injury and survive longer after being captured in trawl gear. Lacerations, loss/damages of appendages/carapace and loss of spines were taken as criteria for assessing injuries. If they are brought to the shore, only a portion of them would find any use in the form of raw material for animal feed and fertilizers. But damage done to the biodiversity of these groups will be of greater magnitude than any economic use for the fishers.

176. **Jayasankar, P.** 2003. Status of mechanized trawling in the Gulf of Mannar and Palk Bay in relation to biodiversity conservation. In: *Proceeding of National Seminar on Biodiversity conservation and management with special emphasis on biosphere reserves* pp. 211-227. (eds.) R.R. Das and R.P. Singh. Environmental Planning and Coordination Organization (EPCO), Bhopal, India.

177. **Jayasankar, P.** 2006. Survival of trawl – caught fish in experimental fishing in the Gulf of Mannar and Palk Bay off Southeast coast of India. *Indian, J. Fish.,* 53(2): 211-217.

Address : Central Marine fisheries research Institute, PB No.1603, Cochin – 682 018, Kerala, India.

Abstact : Survival of injured fish caught in a series of experimental trawl hauls conducted in the Gulf of Mannar and Palk Bay (8 0 55' – 90 20' N; 790 790 40' E) in the southeast coast of India has been examined. Larger, While inedible organism showed shorter duration of survival. Survived longer, while inedible organisms showed shorter duration of survival. Among the target groups, the blue crab, *Portunus pelagicus* had the greatest survival ratio. Among the non-inedible taxa were relatively more resilient to trawling pressures, showing better survival and reduced injury.

178. **Jayasree, V and A.H. Parulekar.** 1977. The ecology and distribution of alcyonaceans at Mandapam (Palk Bay and Gulf of Mannar) South India, *J. Bomb. Nat. Hist. Soc.,* 94(3): 521-524.

Address : National Institute of Oceanography, Dona Paula, Goa - 403 004, India.

179. **Jena, B.K., A.S.N. Murty and P. Chandra Mohan.** 2001. Beach dynamics at Pudhuvalasai in Palk Bay. In. *Proceedings of the International seminar on Quaternary Sea Level Variation,* Shoreline Displacement and Coastal Environment. G.V. Rajamanickam and M.J. Tooley (eds). New Academic Publ. Delhi, pp. 196-203.

180. **Jena, B.K., P. Chandramohan, V. Sanil Kumar.** 2001. Longshore transport based on directional waves along North Tamilnadu Coast, India. *J. Coastal Res.,* 17(2): 322-327.

Address : Ocean Engineering Division, National Institute of Oceanography, Goa - 403 004, India.

Abstract : The accurate assessment of longshore sediment transport pattern along Nagapattinam-Poompuhar coastline bears significance due to the historical erosion and its geographical location adjoining the sheltered Palk Bay. Directional waves were measured off Nagapattinam coastline for one year to estimate the longshore sediment transport rate. It shows that the transport rate is relatively high about $0.1 \times 106m^3$/month in November and December and is low showing less than $0.03 \text{ X } 106m^3$/month in March, April and July. Though the annual gross transport is found to be $0.6 \times 106m^3$/year, the annual net transport is very low showing less than $0.006 \times 106m^3$/year (towards north), indicating the coastline tends to be a nodal drift regime. The temporary rise in wave activities during the cyclonic days often increases the southerly drift, which partly gets deposited in the Palk Bay and causes deficit for the northerly drift.

181. **Jensen, K.R and K. Padmakumar.** 1999. Description of three species of Elysia (Opisthobranchia. sacoglossa) from Southern India, with a discussion of the identity of E. grandifolia Kelaart, 1858. *Phuket Marine Biological Center. Special Publications,* 19(1): 245-246. [Proceedings of the Ninth Workshop of Tropical Marine Mollusc Programme: Abstracts]

182. **Jeyanthi, N.** 2002. Cyclone Disaster Risk in Coastal Region. In: *Cyclone Disaster Management session in National Interactive Workshop held at Tamil Nadu Agricultural University,* February 25-26, 2002. p.54-55.

Abstract : Coastal areas of Bangladesh, North Orissa and West Bengal are the most vulnerable zones to storm surges of height greater than 5 m and so also is the Krishna estuary in Andhra Pradesh. South Orissa, north coastal Andhra Pradesh, South Tamil Nadu are areas where surge height between 3 m to 5 m can be expected. Only Saurashtra Kutch coast is vulnerable to storm surges of height 3 m. Kerala, South Karnataka, Goa coasts are the minimal surge prone zones recording less than 1.5 meters.

183. **Jones, S. and S. Mahadevan.** 1965. Notes on animal associations. 5. The pea crab *Pinnotheres decannensis* inside the respiratory tree of the sea cucumber, *Holothuria scabra*. *J. Mar. Biol. Assoc. India,* 7(2): 377-380.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The sluggish and comparatively defenseless nature of the holothurians make them convenient hosts to many commensals and parasites. A variety of commensals, from protozoans to fish, have been reported from them of which the most interesting and classical example is the pearl fish, Carapus formerly known under Fierasfer. Holothurians collected from the Gulf of Mannar and Palk Bay in the neighborhood of Mandapam were examined especially for the pearl fish but the only internal commensal of interest found was the pea crab, *Pinnotheres decanensis* Chopra from *Holothuria scabra* Jager. The crab was found to remain inside the lower part of the respiratory tree above the cloaca.

184. **Jones, S and A. Bastin Fernando.** 1973. Present status of the turtle fishery in the Gulf of Mannar and the Palk Bay. *Proc. Symp. on Living Resources of seas around India,* pp. 712-715.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Turtles are caught along the entire coastline of India but except in the Gulf of Mannar and Palk Bay it is a fishery of only a causal nature and hardly of any significance. The main commercial species is the green turtle *Chelonia mydas* while other species occur in stray numbers. A fairly regular fishery of some magnitude exists for the green turtle in the Gulf of Mannar and it is estimated that on an average about 3,000 to 4,000 numbers are landed every year between Pamban and Cape Comorin. In the Palk Bay, the fishery is of a much lower level and about 1,000 turtles are estimated to be landed annually between Rameswaram and Mimisal. The possibilities of increasing the catches in the Gulf of Mannar giving due attention to conservation measures are discussed.

185. **Jones, S.** 1976. The present status of the dugong, *Dugong dugon* (Muller) in the Indo-Pacific and problems of its conservation. Rome-Italy *FAO*, 47 pp.

Address: FAO Advisory Committee on Marine Resources Research, Rome (Italy).

Abstract: The dugong, *D. dugon* (Muller) is the only existing sirenian in the Indo-Pacific region, being recorded in coastal areas from southeastern Africa along the southern coast of Asia to the western Pacific Islands. There has been considerable depletion of the stocks of this species throughout its areas of former abundance owing to increasing fishing pressure. This paper concentrates on the state of *D. dugon* on the Indian and Sri Lanka (Ceylon) coasts in the Gulf of Mannar and the Palk Bay where it is reported to have been present in larger numbers than anywhere else in its entire range of distribution. Some areas of former abundance and present remaining local habitat within these 2 bodies of water are given. Fishing for *D. dugon* continues, although catches have diminished considerably in recent years, and specimens are also caught inadvertently in large meshed nets set for other marine species. The meat of the animal is used for human consumption, with demand and price being very high in local areas. While occurring in 'flocks' of many hundreds about a century ago, presently the dugong is rarely seen in this area and it is rare for >1 specimen to be captured at a time. Likewise, the problem appears to be the same in other areas of the dugong's range. Although it has been declared a protected animal by some countries, it is evident that, with the possible exception of Australia, conservation at the

national level has been ineffective; it is only a question of time, therefore, before *D. dugon's* complete or near extermination, unless urgent and effective conservation measures are taken at an international level. Additionally, very little is known of the species' biology and migration in all areas of its range. Systematic investigations on the biology of the species and a general survey of its distribution and abundance in 6 broad zones of the Indo-Pacific region are suggested, with zones established as follows: 1. Red Sea, 2. East Africa and Madagascar, 3. Palk Bay and the Gulf of Mannar, 4. Burma, Andamans and Malaya, 5. Australia and Indonesia, 6. Pacific Islands. Further, the establishment of research centers and sanctuaries in appropriate areas of the Indo-Pacific is suggested, with investigations coordinated by an international agency. In particular, recommendations with regard to the Gulf of Mannar and the Palk Bay are given, calling for joint efforts by the Governments of India and Sri Lanka (Ceylon).

186. **Josileen Jose and N. Gopinatha Menon.** 2004. Larval stages of the Blue swimmer crab, *Portunus pelagicus* (Linnaeus, 1758) (Decapoda, Brachyura). *Crustaceana,* 77(7) : 785-803.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: Larvae of *Portunus pelagicus* (Linnaeus, 1758) were reared in the laboratory on hatching from wild ovigerous females collected from Palk Bay, southeast India. The larval stages included four zoeal stages and one megalopa. The megalopa moulted to the first crab instar. The zoeae and megalopa were very similar to those of other portunids. The duration of each of the first two weak stages was 3-4 days, the following two stages 2-3 days, and the megalopa 3-5 days, reaching the first crab stage in 15-17 days. All zoeal and megalopa stages are described in detail and are documented with illustrations.

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187. **Kaliaperumal, N., V.S.K. Chennubhotla, S. Kalimuthu, J.R. Ramalingam and K.Muniyandi.** 1990. Environmental factors influencing the growth of *Gracilaria edulis* in culture. *Mar. Fish. Infor. Serv. T & E. Ser.,* 105: 10-11.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : All these seaweed based industries mostly depend on the seaweed harvested from the south-east coast of Tamil nadu from Mandapam to Kanyakumari. But the availability of *Gelidella acerosa* and *Gracilaria edulis* from natural seaweed beds are inadequate to meet the raw material demanded of agar industries. The cultivation of agar yielding seaweeds at different places in the near shore areas of Gulf of Mannar and Palk Bay, Kanchirangudi estuary, Athankarai estuary, PillaiMadam lagoon and fish farm ponds by vegetative propagation method using long line coir rope nets, coir rope frames, monofilament nylon fishing lines, velon screen bag, coral stones, pen and cages. In the Central Marine Fisheries Research Institute culture experiments with *G. edulis* were conducted in the near shore areas of Gulf of Mannar and Palk Bay during different seasons of the years from 1976 to 1985 continuously. The environmental parameters such as surface water temperature, salinity, dissolved oxygen and nutrients (phosphate, silicate, nitrite and nitrate) during each culture operation were compared in relation to biomass increase and duration of culture period. The Gulf of Mannar and Palk Bay experience contrasting seasonal changes in wind velocity and direction and wave action. These culture experiments were done in the near shore areas at 1m depth in Gulf of Mannar (near CMFRI jetty) from October to March and in Palk Bay (near CMFRI fish farm) from April to September during the calm seasons in both sides. The animals found attached to the nets affecting the growth of *G.edulis* were *Aplysia*, sponges ascidians, bryozoans and molluscan egg mass. The clear water without much sedimentation, optimum light intensity, slightly higher phosphate and nitrate contents in the water and absence of fouling organisms and predators accelerated the growth of *G.edulis.* The shallow water near CMFRI fish farm in Palk Bay are not suitable for *G.edulis* cultivation as the growth of the plant was affected by various environmental factors mentioned above. Hence *G.edulis* could be cultivated in deep waters in Palk Bay side and attempts may also be made to culture *G.edulis* in shallow waters at other areas of Palk Bay in order to select the suitable culture sites and periods of growth.

188. **Kaliaperumal, N., V.S.K. Chennubhotla, S. Kalimuthu, J.R. Ramalingam and K. Muniyandi.** 1993. Growth of *Gracilaria edulis* in relation to environmental factors in field cultivation. *Seaweed Res. Utiln.,*16(1&2):167-176.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Field cultivation of *Gracilaria edulis* was carried out in the near shore areas of Gulf of Mannar and Palk Bay near Mandapam to determine the various environmental

factors which affect the growth of this agar yielding seaweed. The suitable period for field cultivation of *G. edulis* in Gulf of Mannar is from December to March.

189. **Kaliaperumal, N.** 2004. Production of agar from the seaweeds of Gulf of Mannar and Palk Bay. *CMFRI Annual Report,* 2003-2004. pp. 82-83.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

190. **Kaliaperumal, N., S. Kalimuthu and J.R. Ramalingam.** 2004. Present scenario of seaweed exploitation and industry in India. *Seaweed Res. Utiln.,* 26(1&2): 47-53.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Data collected on the commercial exploitation of seaweeds from the natural seaweed beds of Tamilnadu, India during 4 years period from 2000 to 2003 showed that the quantity of agarophytes viz. *Gelidiella acerosa, Gracilaria edulis, G. crassa, G. foliifera* and *G. verrucosa* varied from 965 to 1,518 tons (dry wt) and alginophytes *Sargasssum* spp and *Turbinaria* spp from 1,433 to 2,285 tons (dry wt) per year. The commercial harvest of seaweeds in Gulf of Mannar and Palk Bay is recommended only during the peak growth period of the algae from July/August to January. The harvest of commercially important seaweeds in a rational way from other parts of Indian coast, Lakshadweep and Andaman-Nicobar Islands is suggested. The need for large scale cultivation of agarophytes to augment the resources and uninterrupted supply of raw materials to the seaweed industries is emphasized.

191. **Kanimozhi. G., N. Nadimuthu and A. Pannerselvam.** 2005. Occurrence of filamentous fungi in mangrove substratum along Palk Bay coast. (Abstract only). *Nat. Symp. Marine Plants, their chemistry and utilization*. Seaweed Research and Utilization Association, Mandapam Camp and Suganthi Devadason Marine Research Institute, Tuticorin, dated 23-25 June 2005. p 21.

Address: P.G. and Research Department of Botany and Microbiology, A.V.V.M. Sri Pushpam College, Poondi- 613 503, Tamilnadu, India.

Abstract: Partially decomposed litter samples were collected from 10 stations in Palk Bay during the month of May 2003. Altogether 557 litter samples belong to six different plant origin *(Avicennia* pnematophore, wood, *Suaeda* sp., *Salicornia* sp., *Rhizophora* sp., *Exocaria* sp and *Aegiceros* sp). Totally 20 species of obligate marine fungi belonging to 9 Ascomycetes, one Basidiomycetes and 10 Deutromycetes were identified by direct examination method.

192. **Kannan, L., T. Thangaradjou and P. Anantharaman.** 1999. Status of seagrasses of India. *Seaweed Res. Utiln.,* 21(1&2): 25 - 33.

Abstract : The population parameters of the two most abundant *scienids c*omprising the trawl catch in the Palk Bay/ Gulf of Mannar area are presented. The following parameters

were estimated : 233 mm (L), 1.26 yr"1 (K), - 0.08 yr (to) , 4.24 yr'1 (Z) and 2.24' 1 (M) for *Pennahia anea,* 284 mm (Loo) mm 1.08 yr '1 (K), - 0.05 yr (t0), 4.41 yr'1 (Z) and 1.92 yr' (M) for *Nibea maculata*. Length at first capture was 97 mm for *P.anea* and 124 mm for *N. maculata*. These lengths were noted to be less than the corresponding length at first maturity for both species. The exploitation rates (E) derived indicate that the two species are heavily fished, which may account for the decline in *sciaenid* catches from 1988 to 1992.

193. **Kannan, L.** 2004. Strides of CAS in coral reef research. *Seshaiyana,* 12(1): 13-16.

Address: Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamilnadu India.

Abstract: Coral reefs are tropical shallow water ecosystems, largely restricted to the seas between the latitudes 30° N and 30° S. Reefs protect the coastline against waves, prevent erosion and contribute to the formation of sandy beaches and sheltered harbours. Biodiversity of such coral reef ecosystems is unique in embracing a plethora of flora and fauna. The Centre of Advanced Study in Marine Biology, Annamalai University has carried out studies on many interesting aspects from microbes to pollution in the coral reef environments of the east coast of India in the Gulf of Mannar, Palk Bay and Great Nicobar Island.

194. **Kannan, L.** 2005. Seagrasses of India: Eco-biology and conservation. *Nat. Symp. Marine Plants, their chemistry and utilization*. Seaweed Research and Utilization Association, Mandapam Camp and Suganthi Devadason Marine Research Institute, Tuticorin, dated 23-25 June 2005. p 13.

Address : Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamilnadu India.

Abstract : Seagrasses are marine flowering plants capable of completing their life cycle when they are submerged fully under seawater and are found distributed in almost all the seas of the world except the polar seas. In India, there are 14 species of seagrasses recorded along the east and west coasts. The Gulf of Mannar, Palk Bay, Andaman and Nicobar Islands and Lakshadweep islands are known for seagrass resources. Seagrass species *viz. Enhalus acoroides, Thalassia hemprichii, Cymodocea* spp and *Halodule* spp contribute more biomass in these regions and their photosynthetic productivity is also higher as compared to the other most productive seagrass regions of the world. Environmental (meteorological and physico-chemical) conditions including sediment characteristics play a major role in controlling the distribution, diversity, biomass and productivity of the seagrasses. Among the various ecological parameters, temperature, salinity, turbidity, nutrients and sand-silt composition are the key factors that influence the biomass, distribution and productivity of the seagrasses.

195. **Kannan, L., T. Thangaradjou and R. Sridhar.** 2006. *Reflection of boxing day tsunami on coral reef ecosystem of India.* (eds.) Ramasamy, S.M., C.J. Kumanan, B.R. Sivakumar, and B. Singh. Geomatics in tsunami. pp. 167-177.

Address: CAS in Marine Biology, Annamalai University, Parangipettai 608 502, Tamilnadu, India.

Abstract: Coral reefs, the marine representatives of tropical forests, coupled with the sea grasses contribute considerably to the coastal productivity. Damages to these ecosystems will immediately affect the fishery productivity of the region. Due to this, the long-term ecological impact of the recent tsunami will be a serious set back to the local, national and regional economy than the immediate losses. Andaman and Nicobar reefs represent the second largest coral reef format ion next to the Great Barrier Reef and are also comparable to the coral reefs of Indonesia and Philippines in terms of diversity of species and associated floral and faunal components. The recent mega - subduction of the Indian plate below the Burmese micro -plate in Andaman - Sumatra region has not only deepened the southern and uplifted the northern group of Andaman - Nicobar islands but also created a disastrous tsunami on Dec 26, 2004. While such tectonic changes are expected to cause longterm changes in the coral reefs of Andaman, Nicobar group of islands, the tsunami has damaged the coral reefs instantaneously. However, the coral reefs of the Gulf of Mannar and Palk Bay: are not much affected by the tsunami by virtue of their geographic position in the shadow region of Sri Lanka.

196. **Kannan, R. 1992.** *Marine botanical, hydrographical, and heavy metal studies in the Palk Bay, India.* Ph.D. Thesis, Annamalai University, 93 pp.

197. **Kannan, R and C. Kannan.** 1996. Physicochemical characteristics of Seaweed beds of the Palk Bay, Southeast coast of India. *Indian J. Mar. Sci.* 25: 358-362.

198. **Kannapiran, E and M. Nithyanandan.** 2002. Antibacterial activity of different fractions of extracts from Palk Bay seaweeds. *Seaweed Res. Utiln.,* 24 (1): 177-181.

199. **Karuppanapandian, T.** 2001. *Environmental condition of the coral reef habitat of Palk Bay,* Mandapam. M.Phil Thesis, Madurai Kamaraj University, Madurai – 625 021. 77p**.**

Address : School of Energy, Environment and Natural Resources, Madurai Kamaraj University, Madurai. 625 021.

Abstract : The present study had the main objective to monitor the pollution load in the coral reef area of Palk Bay. Periodical seawater samples were collected and analysed from the reef areas, which were found at a distance between 200 meters and 400 meters from the seashore of the Palk Bay. They were 300 meters away from Pamban over – bridge (station – 1), 275 meters away from Bison House (station – 2), 300 meters away from Discharge point of sea food processing unit (station – 3), and 250 meters away from CMFRI Fish Farm (station – 4). The four sampling stations were compared with a control station, located in the open sea, opposite to the village Vedhalai. Drainage water and other pollutants should be treated properly before released; otherwise, it will lead to distruction of marine organisms particularly coral reefs.

200. **Karuppudurai, T.** 2002. *The coastal Marine Environmental quality of Palk Bay,* Mandapam. M.Phil Thesis, Madurai Kamaraj University, Madurai – 625 021. 96p.

Address : School of Energy, Environment and Natural Resources, Madurai Kamaraj University, Madurai - 625 021**.**

Abstract : The present study dealt with the assessment of water quality of coastal marine environment of Palk Bay, Mandapam. Physico-chemical Parameters were analysed to determine the coastal water quality. This investigation was carried out in 5 different selected stations. All stations were located for a period of 6 months from March 2001 to August 2001 at fortnightly intervals at the surface level from the coastal area. The untreated effluents from these industries caused pollution problems in coastal waters. The problem was noticed in the present study in the Palk Bay region of Mandapam. Continuous monitoring of the coastal water was the need for proper assessment of coasral water quality in the coming days.

201. **Kasinathan, C.** 1988. Bumper catch of 'Kalaru' from Dhanushkodi and Moondrurayar chathiram (Palk Bay), Rameswaram Island. *Mar. Fish. Infor. Serv. T & E. Ser.,* 89: 16-17.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623520, Tamilnadu, India.

Abstract : Five- spotted herring Hilsa kelee locally known as ' Kalaru' in Tamil occurs in small quantities in shore- seines ('Kara valai'), drift net ('Paru valai') and in bottom set gill net ('Disco valai') at Mandapam – Rameswaram region. In the latter region the catch rate ranges from 5 to 30 kg per drift net unit. In the bottom set gill net operated this region, the catch rate of *Hilsa kelee* ranges from the 5 kg per unit. During 1987, April, a bumper catch of *Hilsa kelee* was observed in the shore seines operated at the Palk Bay side at Dhanushkodi and Moondruayarachathiram in the Rameswaram Island. The price of fresh fish ranged from Rs. 1.50 to Rs. 2 per kg, and of the dried fish from Rs. 2.50 to Rs. 3 per kg.

202. **Kasinathan, C and N. Ramamoorthy.** 1995. Observations on a whale shark *Rhinodon typus* smith caught at Athankarai along the Palk Bay coast, Tamil Nadu. *Mar. Fish. Infor. Serv. T & E. Ser.,* 138: 15.

Address : Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp – 623 520, Tamilnadu, India.

Abstract : A large specimen of whale shark *Rhinodon typus* Smith was caught in a shore - seine at Athankarai on 26.10.92 in live condition but died the next day. There was no demand for its flesh, the fish was cut into pieces and buried near the seashore. The morphometric characters and its measurements of the whales shark are the total length of snout to tip of caudal fin is 1,022, the tip of snout to origin of pectoral fin 204 cm, and then the tip of snout to centre ridge ranges 35, when the length of pectoral fin 210. The tip of snout to first gill opening are 148, where the tip of snout to gill opening is 217. The length of upper caudal fluke ranged 225. And then the length of lower caudal fluke, and the head length are 129 and 240 respectively. Where the head width are 224, the tip of the snout to eye is 65. When the length of mouth opening is 145, the measurement of eye diameter and length are 4.5, 6.5 respectively. The tip of snout to spiracle of the specimen is 95, and the length of spiracle 4.5, and Width of spiracle 3.3 and the height of first dorsal fin is 153. When the tip of snout to caudal fluke ranged 822. The height of the gill

opening is 81, and the height of second, third, fourth, and fifth gill opening are of 94, 87, 80, and 60 respectively. The specimen of whale shark is a male and its weight is 5t.

203. **Kasinathan, C.** 2002. On the landing of black porpoise *Neophocaena phocaenoidnoides* at Sangumal (Palk Bay) near Rameswaram. *Mar. Fish. Infor. Serv. T & E. Ser.*,173: 3.

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Black finless porpoises are common in the near shore waters were washed on many occasions along the Palk Bay coast around Mandapam and Rameswaram. On 31.01.2001, a female finless black porpoise, *Neophocaena phocaenoides* ones washed ashore in dead condition was landed at Sangumal (Palk Bay) near Rameswaram. In the neck region the flesh was eaten by stray dogs. The porpoises was caught by gill net locally called as Vali Valai, operated off Rameswaram in the Palk Bay at a depth of 14 to 18 m. The total length and weight were 150 cm and 40 kg respectively. The length from tip of snout to blow hole and the tip of snout to centre of eye and the tip of snout to anterior insertation of flipper were 15 cm, 12cm, and 33 cm respectively. And the length from tip of snout to centre of anus and notch of fluke on outer anus , then the length of fluke on outer curvature and the inner curvature were 110cm, 42cm, 29cm and 20 cm, respectively. The distance between extremities of fluke and the width of flipper were 28cm and 9cm respectively. Where the length of flipper along curve of lower border and the length of flipper from anterior insertation to tip and the greatest width of flipper were 20 cm, 26 cm, 11cm respectively. The depth of body at anal region and the depth of body at origin of eye and the length from tip of lower to centre of anus were 46 cm, 21 cm, and 115 cm respectively. Length of upper jaw and lower jaw were 7 cm and 7 cm respectively. The female specimen were the number of teeth on one side of upper jaw and lower jaw were 15 cm and 15 cm respectively. Those above said measurement were the morphometric characters and its measurements of the black propoise *Neophocaena phocaenoides.*

204. **Kasinathan, C and V. Gandhi.** 2002. On a sperm whale *physeter macrocephalus* washed at Irumeni (Palk Bay) near mandapam. *Mar. Fish. Infor. Serv. T & E. Ser.,* 173: 3-4.

Address : Mandapam Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : On 10.11.2000, a female sperm whale *Physeter macrocephalus* (Linnaeus) measuring 4 m, weighing 1.5t was washed ashore in dead condition at Irumeni (Palk Bay) near Mandapam. The morphometric measurements of the sperm whale is the total length of the animal is 400 cm , the length from the tip of snout to centre of eye is 70 cm, where as the length from tip of snout to anterior insertation of flipper is 100. The Length from tip of snout to centre of anus is 255, and the notch to fluke to posterior end of dorsal fin measure is 160, where the notch to fluke to centre of anus the fluke on outer curvature is 135, 50cm respectively. The length of fluke on inner curvature is 55 and the distance between extremaics of fluke is 110, the width at insertion of fluke and the length of dorsal fin base40 and 30 cm.

The vertical height of dorsal fin of the specimen is 6, where the length of flicker from

anterior insertation to tip ranged 105. Length of flipper along curve of lower border and the greatest width of flipper , 20, 50cm respectively. Depth of body at anal region 67, when the depth of body in region of eye is 30, then the upper and lower jaw is 50,40 and the diameter of eye is 5 cm.

205. **Kasinathan, C.** 2002. On a mink whale *Balaenoptera acutorostrata* caught at Pudupattinam near Thondi along Palk Bay. *Mar. Fish. Infor. Serv. T & E. Ser.,*173: 8.

Address : Mandapam Regional Center of CMFRI, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The present report is on a female minke whale *Balaenoptera acutorostrata* caught in a fishing net at Pudupattinam, near Thondi along Palk Bay coast of Tamil Nadu. The total length from tip to caudal fin is 940 cms, then the tip of snout to notch of caudal flukes 880cms. Where the tip of snout to blowhole is 390. The length from tip of snout to origin of eye 160 and the length from tip of snout to origin of genital opening is 509. Then the length of flipper in the outer curvature ranged 130. The length of inner curvature 75 cm. The animals flippers width are 25 cm. And then the length o dorsal fin in the inner and outer curvature is measured 53 and 27cm respectively.

The width of dorsal fin ranged 26. Depth of body in the flipper region 200, the depth of genital region is 135. Eye measured 172, and then the caudal peduncle region is 50. Length of baleen plate and blowhole is 144, 5.5, and the length of upper and lower jaw, are 157, 182 respectively. And the approximate weight of the above said animal weight is 3 tonnes.

206. **Kasinathan, C., K. Muniyandi, M. Bose and A. Gandhi.** 2002. Observations on whale shark *Rhincodon typus* (Smith) caught at Pamban, Palk Bay and Gulf of Mannar. *Mar. Fish. Infor. Serv. T & E. Ser.,* 174: 12-13.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623520, Tamilnadu, India.

Abstract : There are two whale sharks *Rhincodon typus* (Smith) observed, one was caught at Pamban on,20.10.2001 at light house landing centre. Another one was caught at Pamban Therkuvadi along the Gulf of Mannar coast on 16.01.2002. The morphometric measurements of the 1st one is the total length and the weight of specimen were 688 cm, and 1.5 tonnes respectively. The length from tip of snout to origin of pectoral fin, length from tip of snout to spiracle and the length from tip of snout to first gill opening and last gill opening were estimated 150 cm, 98 cm, and 145 cm respectively. Then the length of caudal upper fluke and the lower caudal fluke were 175 cm and 75 cm respectively. The another one specimen was also estimated where the total length and total weight of the animal was 1068 cm, and 3 tonnes. Then the length from tip to snout to origin of pectoral fin, snout to spiracle, first gill opening. Last gill opening, and the length of caudal fluke, lower caudal fluke, diameter of eye, head length and width of spiracle were ranged 205 cm, 95 cm, 150 cm, 220 cm, 225 cm, 130 cm, 4.5 cm, 240 cm, 5cm, respectively. The first one was sold for Rs 700/- and the second one is sold for Rs. 1200/- for oil extraction.

207. **Kasinathan, C and N. Ramamoorthy.** 2004. On a Sei whale *Balaenoptera borealis* stranded

at Narikuzhi near Rameswaram along the Palk Bay coast, *Mar. Fish. Infor. Serv. T & E. Ser.*, 180: 15.

Address : Mandapam Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu.

Abstract : A sei whale, *Balaenoptera borealis* was stranded at Narikuzhi near Rameswaram along the Palk Bay coast on 1.1.2003. The whale might have died in the mid sea, most probably due to collision with a fishing boat. And there were injuries in the notch of the caudal fluke and flipper region. The total weight and total length of the animal were 12 tonnes and 1500 cm respectively. The origin of flipper tip of snout and tip of snout to centre of anus were 370 cm and 1250 respectively. The length of flipper in the outer curvature and the inner curvature, and greatest width of flipper were 180 cm, 120 cm and 45 cm respectively. The male animal , length from tip of snout to origin of dorsal fin were 1090 cm.

208. **Kasinathan, C., A. Palanichamy, P. Villan and P. Kannan.** 2004. On a hump-back dolphin *Sousa chinensis* washed ashore at Sangumal (Palk Bay) near Rameswaram. *Mar. Fish. Infor. Serv. T & E. Ser.,* 181: 14-15.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : On 9.12.2003, the Carcass of a female dolphin was washed ashore at Sangumal (Palk Bay) near Rameswaram. The number of teeth and from the external characters, it was identified as hump-back dolphin *Sousa chinensis.* The total length and weight of dolphin measured 249 cm and 175 kg having freshly external wounds and blood strains on its body, which suggested the possibility of collition with fishing boat. The other morphometric measurements of the specimen were given. The tip of snout to blow whole and the tip of snout to centre of eye and then the tip of snout to anterior insertation of flipper and the tip of snout to centre of anus were 216 cm, 41 cm, 64 cm, and 179 cm respectively. The tip of lower jaw to centre of anus and the notch of fluke to posterior end of dorsal fin and the notch of fluke to centre of anus, and then the distance between extremities of fluke were ranged, 172 cm, 146 cm, 64 cm, and 63 cm respectively. The length of dorsal fin base and the vertical height of dorsal fin were 51 cm and 20 cm. Where the length of flipper from anterior insertion to tip and the length of flipper along curve of lower border and the greatest width of flipper ranged 32cm , 27 cm, 15 cm respectively. The depth of body at anal region and the depth of body at origin of flipper and then the depth of body at origin of dorsal and the depth of body in region of eye measured were 33 cm, 57 cm, 80 cm, and 45 cm respectively. The length of upper jaw and lower jaw and the diameter of eye were 35 cm, 33 cm, and 2 cm respectively. The female dolphin, where the number of teeth on side of upper jaw and the number of teeth on one side of lower jaw were measured 34 cm and 32 cm respectively.

209. **Kathal, P. K.** 2005. Sethusamudram ship canal project: Oceanographic/geological and ecological impact on marine life in the Gulf of Mannar and Palk bay, southeastern coast of

India. *Curr. Sci.,* 89(7): 1082-1083.

Address: Centre of Advanced Study in Geology, Dr.H.S.G University, Sagar-470 003, India. E-mail: pkkathal@rediffmail.com

Abstract: Sethusamudram Ship Canal (SSC) to be dredged, across a natural chain of shoals of the Adam's Bridge connecting the Gulf of Mannar to Palk Bay along the south-eastern Indian coast of India may trigger ecological imbalance in the region. Environmentally stressed factors like turbidity caused by dredging/displacement of around 9.7 million cubic meter bulk of rock, shoal and sediments during the operation will disturb the O_2-CO_2 ratio, imperative for life and health of phytoplankton. This in turn will retard photoinhibitation and lower the pH of water, amidst a slow pace of photosynthesis besides encouraging an abundant growth of anaerobic organisms that may affect the health of other organisms including marine algae, fish and corals within a very short span of time. A few ecological indicators have been suggested enabling the resource managers to minimise the environmental impact of the canal with affordable procedures in order to safe-guard the earth's second highest marine biodiversity.

210. **Kewalramani, K.M and E.S. Kadri.** 1972. Shell fisheries of India. *Seafood Export J.,* 4(12): 29-39.

Abstract: The authors state that *Oliva gibbosa* are occasionally collected from Palk Bay and Gulf of Mannar for food. Pearl fisheries in Gulf of Mannar is famous since olden days. The pearl fisheries are not regularly operated in GOM. Great fluctuations have also been observed in pearl production; as such the fishery is stopped since 1962. The fishing method of pearl oyster is quite different in GOM than that of Gulf of Kutch. *Pinctada* contributes famous pearl fisheries of the GOM. The authors also state that Ramesary type of chank from Rameswaram is recognized in the commercial field.

211. **Kilburn, R.N.** 2001. Biogeography of Indian marine molluscs. *Phuket Marine Biological Center, Special Publications,* 25(1): 257. [*Proceedings of the 11th Congress and Workshop: Tropical Marine Mollusc Programme (TMMP), Sugnathi Devadason Marine Research Institute, Tuticorin, India, 28th September to 8th October 2000. Edited by J Hylleberg (Part 1: Ecology, Aquaculture & Environment)*]

Abstract: From the marine biogeographical viewpoint, the Indian region is here defined as including Sri Lanka and Bangladesh, but excluding the Andaman Islands, whose fauna is predominantly Malesian. Significant differences in oceanographic conditions between the Bay of Bengal and Arabian Sea are summarized, and attention is drawn to factors that have created potential filter-routes ("barriers"). The Indian molluscan fauna is tropical Indo-Pacific in composition, with perhaps 10-15% endemism, although little data is available for the west coast. There appear to be two centres of endemism, (1) south-eastern India (i.e. the Gulf of Mannar/Palk Bay area) where there is a two-dimensional shelf and (2) the estuaries and backwaters of Orissa, West Bengal and Bangladesh, which serve as refugia for various euryhaline marine taxa that may have evolved under hyposaline conditions in the northern Bay of Bengal.

212. **Kilburn, R.N.** 2002. Biogeography of Indian Marine Molluscs. *Spec. Publ. Phuket Mar. Biol. Cent.,* 26: 5-17.

Address: Natal Museum, P/Bag 9070, Pietermaritzburg, 3201 South Africa; E-mail: dkilburn@nmsa.org.za

Abstract: Analysis of provisional list shows the marine molluscan fauna of the Indian region to be predominantly Indo-Polynesian, with perhaps 4-7% endemism (the exact figure partly depending on whether fresh- and brackish water vicariates of marine groups are included). Significant differences in oceanographic conditions between the Bay of Bengal and Arabian Sea are summarized, and attention is drawn to factors that have created potential barriers or filter-routes. Based on these factors and on the limited faunal inventories available, four subregions are tentatively recognised as the basis for a working hypothesis. There appear to be two centres of endemism: (1) south-eastern India (*i.e* the Gulf of Mannar/Chennai area): it is suggested that the key elements may have vicariated in Palk Bay during periods of emersion of the Mannar shelf, and (2) the estuaries and backwaters of Orissa, West Bengal and Bangladesh, which serve as refugia for various euryhaline marine taxa that may have evolved under hyposaline conditions in the northern Bay of Bengal. Conservation prospects for these two centres are discussed.

213. **Krishna Kartha, K.N.** 1959. A study of the copepoda of the inshore waters of Palk Bay and Gulf of Mannar. *Indian J. Fish.,* 6(1&2): 265-267.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623520, Tamilnadu, India.

Abstract: The paper deals with a detailed study of the composition of the population and behaviour of the dominant species of copepods in the Gulf of Mannar and Palk Bay. It is observed that the species which contributed to the bulk of the copepod stock were same at both the stations and the differences in the modes of fluctuation of the total copepods between them were due to the differences in the occurrence of copepodites and to the diversity of patterns of distribution of the individual species. Details of the distribution patterns of the important species are given. The spawning activity of the copepod populations of the two stations, as indicated by nauplii and copepodites, was also different during the three years. Intensity of spawning appears, in general, to be high at station P, where during May- September the nauplii and copepodites reached numerically high magnitudes.

214. **Krishna Pillai, S and J. Xavier Rodrigo.** 1979. Swarming of *Creseis acicula* Rang (Pteropoda) in the PalkBay off Mandapam. *J. Mar. Biol. Assoc. India,* 21(1&2): 178-180.

Address: Central Marine Fisheries Research Institute, Cochin – 682 018.

Abstract: A dense swarm of *Creseis acicula* in April 1980 was reported in the Palk Bay, Mandapam and its occurrence along the Indian coast was discussed.

215. **Krishna Pillai, S., M. Selvaraj and M. Najmudeen.** 1986. Comparative hydrological study of five ponds near Mandapam and the adjoining inshore water of the Palk Bay. *J.*

Mar. Biol. Assoc. India, 28(1&2): 229-232.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Variation in salinity, temperature and dissolved oxygen of the 5 experimental ponds adjoining the sea near Mandapam, Tamil Nadu, India, were studied from November 1979 to December 1980. The temperature, salinity and pH decreased during the northeast monsoon while dissolved oxygen was high. The low salinity during Nov to Dec (19.02 to 20.94 ppt) was mainly due to rainfall. Higher salinity in July - Augest was due to evaporation and seepage. Salinity values of the ponds were compared with the adjoining sea.

216. **Krishna Pillai, S and C. Kasinathan.** 1988. Report on two dolphins washed ashore near Mandapam. *Mar. Fish. Infor. Serv., T & E Ser.,* 88: 21.

Address : Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp, 623 520, Mandapam, Tamilnadu, India.

Abstract : In Mandapam smaller cetaceans are common , during 1985, two dolphin were washed ashore near Gulf of Mannar and on other one to Palk Bay side. The first specimen observed on 28.1.1985, near Gulf of Mannar was identified as *Tuesiops aduncus* marks of injury in the form of cut was seen on the lateroventral side. The morphometric measurements of those animal are of the total length were 150 kg. And the total length from tip of snout to blowhole, and length from tip of snout to centre of eye and then the length from tip of snout to origin of dorsal fin and the length from tip of snout to anterior insertion of flipper were 27 cm, 25 cm, nil and 38 cm respectively. Then the tip of snout to centre of anus and length from notch of fluke to posterior end of dorsal fin and length from notch of fluke to centre of anus, and the length of fluke on outer curvature and the inner curvature were 84 cm, 60 cm, 59 cm, 24 cm, and 16 cm, respectively. The distance between extremities of fluke and length of dorsal fin base, and the vertical height of dorsal fin, then the length of flipper from anterior insertition to tip, and the length of flipper along curve of lower border and the greatest width of flipper were ranged 16 cm, 22 cm, 17 cm, 16 cm, 24 cm, 15 cm, and 11 cm, respectively. The depth of body at anal region and depth of body at origin of flipper and depth of body at origin of dorsal, where the height of dorsal fin and the length of upper jaw and the lower jaw were 65 cm, 73 cm, 84 cm, nil, 20 cm, and 21 cm, respectively. The diameter and the total number of teeth on one side of upper jaw and total number of teeth on one side of lower jaw were 21 cm, and not fully developed .

The second specimen washed ashore near CMFRI fish farm on the Palk Bay side was observed on 5.2.1985, but the local enquiries revealed that the dolphin was noticed on 25.1. 1985. The specimen was identified a female as *Sousa chinensis* and the caudal region was severely injured which might be the cause for the death. The total length of the animals weighed 225 cm and the length from tip of snout to origin of dorsal fin and length from tip of snout to anterior insertition of flipper and the length from tip of snout to centre of anus were 97 cm, 61 cm, and 121 cm, respectively. And the height of dorsal fin and the total number of teeth on one side of upper jaw and the number of teeth on one side of lower jaw were 54 cm, 31 cm, 31 cm, respectively. As the dolphin was in advanced stage of decomposition. The nature of dolphin have a tendency to follow the boats,

particularly the cod end of the trawls while fishing. The present reports suggests, that the injuries on these dolphin might have been caused by the propeller or the boat.

217. **Krishna Pillai, S.** 1995. Observations on hydrological features of marine fish culture pond waters and the adjacent inshore waters of Palk Bay near Mandapam during 1985-'86. *Sci. Cul.,* 61(10/12): pp.195-197.

218. **Krishna Pillai, S., A.A. Jayaprakash, C. Kasinathan and N. Ramamoorthy.** 1995. On the whale *Balaenoptera borealis* Lesson stranded along Palk Bay coast near Pamban light house. *Mar. Fish. Inform. T&E Ser*. 139: 11.

Address : Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp – 623 520, Tamilnadu, India.

Abstact : The frequency of stranding on the east coast is more than on the west coast. This is the eighth record of stranding of *Sei whale* from the east coast. On 27.1. 1990, a *Sei whale* got entangled in a gill net near Katchativu at a depth of 8.5 m at about 1900 hrs. There are four boats joined together and brought the whale ashore near Pamban light house on the 28th morning in live condition. Attempts were made to push the whale back into the sea but did not succeed. The total length and total weight of the whale consist of 11.4 m and 7000 kg , respectively. The tip of upper jaw to deepest part of fluke and the upper jaw to centre of anus and then the upper jaw to centre of genital slit and upper jaw to end of ventral grooves and the tip of upper jaw to centre of umbilicus ranged , 1140 cm, 975 cm, 870 cm, 680 cm, and 790 cm, respectively. Where the tip of upper jaw top of dorsal fin, and the upper jaw to anterior insertion of flipper and outer curvature of flipper and the inner curvature of flipper , and the flipper width were 670cm, 340 cm, 125 cm, 100 cm and 45 cm, respectively. The height of body at dorsal fin and the height of body at region of anus and body circumference in region from flipper to flipper and then the circumference at caudal fluke and the number of throat grooves were 190 cm, 115 cm, 1020 cm, 160 cm, and 47 cm were respectively. The female whale used to get stranded in all the months of the year, most of the stranding take place during December – January when the sea is very rough during the northeast monsoon.

219. **Krishna Pillai, S and C. Kasinathan.** 1995. Movement of a large shoal of *Hilsa kelee* from Palk Bay to Gulf of Mannar. *Mar. Fish. Infor. Serv. T & E. Ser.,* 140: 8-9.

Address : Regional Centre of Central Marine Fisheries Research Institute, Madapam Camp – 623 520, Tamilnadu, India.

Abstract : A large shoal of *Hilsa kelee* movement from Palk Bay to Gulf of Mannar observed on 2.11.1988. *Hilsa kelee*, local Tamil name called as "Kalaru". This fish occurs in small quantities in trawl nets, shore seines (karavalai), drift net (paruvalai) and bottom gill net (disco valai) operating off Mandapam and Rameswaram islands. *Hilsa kelee* is found to occur mainly in the inshore waters. More than 1400 hrs a large shoal of *Hilsa kelee* was sighted about 2 km north if Pamban light house in the Palk Bay on 2.11.1988. The shoal moved towards south with considerable surface agitation and finally entered the Gulf of Mannar near Therkuvadi via. Pamban pass. Later on some of

the fishermen operating non- mechanized boats at Therkuvasi encircled the shoal preventing them from moving further. A part of the shoal was caught by the fishermen using cast nets, gill nets and disco nets. The entire incident took place between 1430 hrs and 1700 hrs when nearly 15 tonnes of *H. kelee* was caught from the shoal. The fish merchants and ice merchants were purchased and stored in heaps. Nearly 3 tonnes of fishes were used for sun drying and local consumption . The size of *H.kelee* ranged from 152 to 712 mm, total length and weighed from 34 to 50 kg.

During the northeast monsoon period the water of Palk Bay are less saline as compared with that of Gulf of Mannar. During rainy days there is considerable incusion of fresh water into Palk Bay from Pillaimadam lagoon and surrounding areas making the surface waters of Palk Bay at Mandapam less saline. The heavy rain fall of October and on 02.11.1986 (12.3mm) in this region might have reduced the salinity of the surface waters of Palk Bay and the wind (18 km/ h) blowing north would have caused the mass movement of *Hilsa kelee* which generally prefers the inshore waters.

220. **Krishna Pillai, S and M. Badrudeen.** 1996. Report on a whale shark *Rhincodon typus* (smith) caught in shore – seine from the Palk Bay. *Mar. Fish. Infor. Serv. T & E. Ser.,* 142: 15-16.

Address : Mandapam Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp – 623 520.

Abstract : The present report is in the capture of a live female whale shark on 25.7.1989 from the Palk Bay in a shore – seine operated at pirappanvalasai, near Mandapam. The female whale shark *Rhincodon typus* weighed approximately 3.5 tonnes. And then the total length of specimen were 595 cm. The other morphometric parameters are, the snout to 1st dorsal fin base and the 2nd dorsal fin base and the length of pectoral fin and width of mouth were 320 cm, 448 cm, 137 cm, and 122 cm, respectively. Where the height of 1st dorsal fin and the length of 1st dorsal fin and the height of 2nd dorsal fin and then the length of 2nd dorsal fin base and the distance between 1st to 5th gill- slit and the length of gill – slit were 61 cm, 30.5 cm, 30.5 cm, 61 cm, 61 cm, respectively. Then the distance between extremities of lobes and the length of upper caudal lobes (damaged) and the girth of body at caudal peduncle, the length of lower caudal lobe were 122 cm, 88.5 cm, 91.5 cm, 91.5 cm, respectively. And the girth of body at 1st dorsal fin and the girth of body at region of belly and length of pectoral fin and then the distance between eye and pectoral fin origin and the distance between eye and eye diameter were 229 cm, 268 cm, 137.2 cm, 125 cm, 150 cm, and 5 cm, respectively. The tip of upper caudal lobe was damaged and healed. Earlier records of capture of the same species were more than 8 times occurred from the Palk Bay also given in it.

221. **Krishnamoorthy, P and P. Subramanian.** 1998. Meroplankton production in the Gulf of Mannar and Palk Bay on the southeast coast of India. *J.Mar. Biol. Assoc. India,* 39:44-48.

Address: Department of Animal Science, School of Life Science, Bharathidasan University, Trichy- 620 024, Tamilnadu, India.

Abstract: A study was carried out to understand the changes in the meroplankton production in the two adjoining seas, Gulf of Mannar (Site-I) and Palk Bay (Site-II). Fortnightly collections were made from each station round the year. These two collection sites are closer to each other but still varied in many physical oceanographic aspects. Numerical abundance of meroplankton were observed maximum during the month of November '93 (1,44,993 nos/m^3 at site I and 1,56,695 nos/m^3 at site II) and their minimum, were recorded during the month of July '94 at the site I (8814 nos/m^3) and May '94 at the site II (10,094 nos/m^3). The meroplanktoinic components include nauplius, protozoea and mysis larvae of prawns, such as *Penaeus semisulcatus, P. merguiensis, P. indicus, P. monodon,* zoea of branchyura, zoea of petrolisthes, zoea of *Emerita,* megalopa larvae, eggs, fish larvae, bivalves and gastropod larvae. The *in-situ* physico-chemical variables such as pH, temperature, dissolved oxygen, salinity and electrical conductivity and nutrients like phosphate, nitrate and silicate were also estimated. The relationship between physico-chemical variables and meroplankton is discussed.

222. **Krishnamoorthy, P. and P. Subramanian.** 1999. Organisation of commercially supporting meroplankton in Palk Bay and Gulf of Mannar Biosphere reserve areas, southeast coast of India. *Indian J. Mar. Sci.,* 28(2): 211-215.

Address: Department of Animal Science, Bharathidasan University, Tiruchirappalli, 620024, Tamil Nadu, India.

Abstract: The samples were collected along the southeast coast of India at three different stations - station 1 is nearer to Mandapam in Palk Bay, station 2 nearer to Mandapam, the head of Gulf of Mannar and station 3 nearer to Kudankulam, the foot of Gulf of Mannar. The Palk Bay and Gulf of Mannar (near Mandapam) are coral dominated, partially closed shallow seas, harbour rich flora and fauna. Kudankulam is directly exposed to open sea with rocky patches of sandy bottom. The highest species diversity was encountered in station 2 followed by station 3 and station 1 (2.18 > 2.1 > 1.9) indicates the high fertility and optimal environmental conditions of Gulf of Mannar. It was also underscored by high species evenness at station 2 followed station 3 and station 1 (1.5 > 1.4 > 1.3). The influence of west coast current, and conglomeration of open ocean species cause the maximum of species richness at station 3, which is followed by station 2 and station 1 (3.26 > 3.13 > 3.0). Dominance index (79.3 > 74.6 > 71.6) was found maximum at station 2 followed by station 1 and station 3 denote protective nature of coral beds for these young ones at Gulf of Mannar and Palk Bay.

223. **Krishnamoorthy, P and P. Subramanian.** 2003. Seasonal variations and species association of meroplankton in the Palk Bay and Gulf of Mannar along the east coast of India. *J. Mar. Biol. Assoc. India,* 45(2): 152-157.

Address: Department of Animal Science, Bharathidasan University, Trichy, Tamilnadu, India.

Abstract: A study on the seasonal variations and species association of the meroplankton from the Palk Bay and the Gulf of Mannar biosphere reserve areas along the southeast coast of India during October 1993 and November 1995 was undertaken. The results

indicated that the water quality differed between the two stations. The number of meroplankton reached maximum by October-December and gradually decreased during June to August. The average number of meroplankton was highest in Palk Bay. The meroplankton was constituted by the larval stages of commercial penaeids such as *Penaeus semisulcatus. P. indicus, P. monodon, Metapenaeus monoceros, M. dobsoni* and *M. affinis;* zoea and megalopa of crabs, veliger larvae of gastropods and bivalves; and the fish larvae. The veliger larvae of gastropod and bivalves constituted 66% of the total meroplankton.

224. **Krishnamoorthy, R., A. Sadiq Bukhari, S. Ravikumar and P. Shahul Hameed.** 2004. A study on the distribution of naturally occurring Radionuclides in the Ecosystem of an Atthangarai estuary (Palk strait). *Proceeding MBR 2004 National seminar on new Frontiers in Marine Biosciences Research,* January 22-23. pp.187-194.

Address : Environmental Research Laboratory, P.G. Department of Zoology, Jamal Mohamed College, Tiruchirappalli – 620 020. Email : drps–zo@jmc.edu

Abstract : This paper presents the distribution of terrestrial Gamma Radiation, Primordial Radionuclides, Gross Alpha and ^{210}Po in the ecosystem of Athangarai estuary. Measurments of Terrestrial Gamma Radiation, Primortial Radionuclides, Gross Alpha were made in sediment sample, Water, sediment and selected biota were subjected to ^{210} Po determination. The Terrestrial Gamma radiation level in Athangarai estuarine sediment are ^{238} U (0.9 Bq / kg), ^{232} Th (8.45 Bq/kg), ^{40} K (289 Bq/kg). The Gross Alpha level in Athangarai esturine was 6.4 mBq. G $^{-1}$. In water dissolved concentration of ^{210} Po was found to be 1.2 mBq / l and in sediment (6.3 Bq/kg). The ^{210} Po activity in the biota fell within the range of 12.3 to 345.8 Bq/kg. The bivalve mollusk Meretrix casta of the estuary was identified to concentrate higher level of ^{210} Po in their soft tissues, suggesting that it could be used as a sentinel organism for ^{210} Po in an estuarine system. The significance of the results are discussed.

225. **Kumar, S.P.** 1983. Geology and hydrocarbon prospects of Krishna-Godhavari and Cauvery basins, Petroliferous basins of India. *Petro.Asia J.*, pp.53-65.

226. **Kumar, V., V. Manivannan and V. Ragothaman.** 1996. Spatial and temporal variations in foraminiferal abundance and their relation to substrate characteristics in the Palk bay, off Rameswaram. In. *Contributions to XV Indian colloquium on micropaleontology and stratigraphy.* Malaviya Institute of Petroleum Exploration. pp. 367-379.

227. **Kumar, V and V. Manivannan.** 2000. Benthic foraminiferal responses to bottom water characteristic in the Palk bay off Rameswaram, southeast coast of India. *Indian J. Mar. Sci.* 30(3): 173-179.

Address : Department of Geology, National College, Tiruchirapalli-620 001, Tamil Nadu, India, Department of Geology, Government College, Salem 636 007, Tamil Nadu, India.

Abstract : Recent benthic foraminiferal assemblages from the shallow shelf sediments of the Palk Bay, off Rameswaram were studied qualitatively and quantitatively. The study

revealed that the microfaunal assemblage consisting of 108 benthic foraminiferal species belonging to 50 genera of 27 families. Various bottom water parameters were determined and correlated with the foraminiferal population and seasonal distribution of living population was evaluated. The ecology and distribution of eight widespread and abundant foraminiferal species of the study area viz. *Spiroloculina communis, Quinqueloculina seminulum, Triloculina insignis, T. trigonula, Ammonia beccarii, A. tepida, Pararotalia nipponica* and *Osangularia venusta* were discussed in detail. Increase in temperature, salinity and dissolved oxygen content of the bottom water were observed as favourable factors promoting the abundance of living population in the study area. (Abstract missing in original)

228. **Kumaraguru, A.K.** 2002. Assessment of the impact of bleaching phenomenon on the corals and their recovery in the Gulf of Mannar and Palk Bay. *Report No. 3-8/99,* 105 pp.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, Tamilnadu, India. E-mail: akkguru@eth.net

Abstract: After the 1998 bleaching phenomenon, the corals in the Gulf of Mannar and Palk Bay showed good recovery. The live coral cover improved from 25.74% in 1999 to 76.20% during the recovery stage-2 in 2001. The same pace of recovery was observed in the Palk Bay also. The live coral cover was 28.80% (i.e., after the bleaching phenomenon) and recovered to an extent of 64.24% during the recovery stage-2. The high resilience and the ability for rejuvenation of corals were exhibited well in the study area after the 1998 bleaching phenomenon. This was seen in the increase in live coral. However, this recovery was fast and restricted to corals which belong to the families *Faviidae* and *Poritidae* only. Recovery in the corals of the family *Acroporidae* was found to be very slow. The increase in live coral cover after the 1998 coral bleaching phenomenon has revealed the fact that corals can tolerate the stress of Bleaching and recover, although in a slow manner. In spite of the large scale bleaching in 2002, the corals are now recovering slowly in the Gulf of Mannar and Palk Bay. However, to study vulnerability of the species, which are affected by the bleaching phenomenon, it is essential to know quantitative and qualitative changes in the population and diversity of the coral communities. Therefore, a long term monitoring program of the coral reefs is required, which would give not only information on the status of corals but also the plans required for their sustainable management in the Gulf of Mannar and Palk Bay regions.

229. **Kumaraguru, A.K., J.J. Wilson and N. Marimuthu.** 2003. Recovery of corals from bleaching event of 2002 in Palk Bay, southeast coast of India. (Abstract only). *Nat. Sem. Reef ecosystem remediation;* SDMRI, Tuticorin- 628 001, 24th to 26th Sep'2003. p. 23.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, Tamilnadu, India. E-mail: akkguru@eth.net

Abstract: As a result of bleaching phenomenon of 2002, the Palk Bay reefs faced severe mortality. The present biophysical status of the Palk Bay in the Southeast coast of India was examined using Line Intercept Transect Method (English *et al,* 1997). The corals of Palk Bay were studied as three zones and each zone was observed repeatedly for biophysical

status of the corals. The highest overall percentage of live coral cover was recorded in the Mandapam zone (38.72%), followed by Rameswaram east zone (37.65%) and Rameswaram North zone (22.73%). Water samples were analyzed at fortnightly intervals to estimate the physico-chemical parameters. Nearly 90% of the corals were found to have recovered from the 2002-bleaching event. *Acroporidae* family faced severe mortality compared to other families *Poritidae* and *Faviidae*.

230. **Kumaraguru, A.K., K. Jayakumar and C.M. Ramakritinan.** 2003. Coral bleaching 2002 in the Palk Bay, southeast coast of India. *Curr. Sci.,* 85(12): 1787-1793.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, Tamilnadu, India. E-mail: akkguru@eth.net

Abstract: The bleaching of corals and their recovery in chosen study sites of the reefs of Palk Bay, southeast coast of India were monitored. The bleaching phenomenon occurred during the period from April to June 2002. A minimum of at least 50% and a maximum of 60% bleaching were noticed among the six different sites monitored. However, the corals started to recover quickly in August 2002 and as much as 52% recovery could be noticed. The coral-bleaching phenomenon might have occurred due to unusual rise in surface seawater temperature, which was 32°C in the peak of summer. This, confounded with the failure of the southwest monsoon winds during this period, might have exerted a stress on the corals leading to expulsion of zooxanthellae from their bodies, causing the bleaching phenomenon. Coral bleaching might affect the distribution of coral-associated animals, especially the food fishes which depend on the corals for feeding and breeding. This, in turn, can affect the livelihood of the reef resource users, particularly the fishermen in the Palk Bay region.

231. **Kumaraguru, A.K.** 2004. Studies on the ecology of Scleractinian corals of Palk Bay. *Report submitted to Department of Ocean Development, OSTC (Berhampur University), Government of India.* (DOD/11-MRDF/4/11/UNI/97). 26p.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, Tamilnadu, India. E-mail: akkguru@eth.net

Abstract: Fifty five Line Intercept Transects (LIT) were laid each month in the 11 stations of the 3 major zones of the Palk Bay, which were studied for the faunistic composition of corals. The observed coral fauna for the overall Palk Bay region were listed. Altogether, 37 species of Scleractinian corals were identified up to species level and 13 were identified up to generic level. Hence the total of 50 scleractinians of 27 genera that belonged to 11 families were identified up to March 2004. Species which have not been reported earlier were *Acropora millepora*, *Echinopora lamellosa, Favia stelligera*, *Favites complanata*, *Gardineroseris sp*., *Leptoria* sp., *Lobophyllia hemprichii*, *Lobophyllia corymbosa*, *Oulophyllia* sp, *Oxypora sp*., *Platygyra sinensis*, *Porites lobata*, *Psammocora* sp., and *Stylophora pistillata*. A thorough biophysical monitoring of corals was done to study the recovery rate of the corals after the 2002 bleaching phenomenon and it was noticed that the recovery of corals was found to be significant ($P<0.05$; $F_{2,6}=5.14,5.728$). The

ambient physico-chemical parameters were regularly monitored in three stations representing the three major zones of the Palk Bay.

232. **Kumaraguru, A.K., K. Jayakumar, J.J. Wilson and C.M. Ramakritinan.** 2005. Impact of the tsunami of 26 December 2004 on the coral reef environment of Gulf of Mannar and Palk Bay in the southeast coast of India. *Curr. Sci.,* 89(10): 1729-1741.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, Tamilnadu, India. E-mail: akkguru@eth.net

Abstract: The live coral cover of 48.5% in the Gulf of Mannar was reduced to 36% after the tsunami of 26 December 2004. Corals showing partial bleaching, infestation with disease, silt-smothered live corals, recently killed corals, broken corals, upturned corals and sea grass damage were found in many places around the 21 Islands. The coral cover under stress was 6.7%, which included corals showing partial bleaching and those infested with pink line disease syndrome. The silt-smothered coral cover was 30%. Damage to corals due to tsunami was 6.7% that included recently killed corals, upturned corals and broken corals. Sea grass damage was also found in low quantities. Landscape alterations revealed that Shingle, Mulli, Valai, Thalaiyari, Upputhanni, Van, Kasuwar and Karaichalli Islands experienced more shore erosion compared to the other Islands. Uprooted trees were found in all the Islands. Corals lying closer to the shore in all the Islands were affected by sedimentation. The live coral cover of 26.7% in the Palk Bay was reduced to 19.2% after the tsunami. The coral cover under stress was 2.8%, which included those showing partial bleaching and those with infestation of pink line disease. Silt-smothered coral cover was 10.5%. Unlike the Islands in the Gulf of Mannar, there was no change in landscape structure in the Palk Bay region. Only inundation of seawater was noticed in some places. There was substantial increase in sedimentation rate after the tsunami in the Palk Bay showing 12, 54 and 13 mg/cm^2/d during Nov. 2004, Dec. 2004 and Jan. 2005 respectively.

233. **Kunaratnam, K.** 1987. Short-period geomagnetic variations at two stations in Sri Lanka and their relation to channelling of induced currents through a conducting region beneath the Palk Strait. *Physics of The Earth and Planetary Interiors,* 49(3&4): 343-349.

Address : International Centre for Theoretical Physics, Trieste, Italy. Permanent address: Department of Physics, University of Jaffna, Jaffna, Sri Lanka.

Abstract : Electric currents induced in the deep ocean and channelled through a conducting region beneath the Palk Strait have been invoked by earlier workers to explain anomalies in transient geomagnetic variations such as bays, SSCs and substorms observed at some South Indian coastal stations. The need for confirmation of this idea by measurement on the Sri Lankan side across the Palk Strait has been emphasised by these workers. In the present study, rates of change in the geomagnetic field components in the period range 20–600 s recorded at Kondavil and Hikkaduwa, two stations in the equatorial electrojet belt near the northern and southwestern coasts, respectively, of Sri Lanka, have been analysed and discussed. The results are presented in the form of variation with period of ÄZ/ÄH and ÄD/ÄH at Kondavil, ÄZ/ÄH at Hikkaduwa and of ÄHC/ÄHH, the ratio of H

components at Colombo and Hikkaduwa. They provide strong confirmatory evidence for channelling of induced currents through a conducting region beneath the Palk Strait and could serve as valuable control data in any detailed modelling of the conductivity structure beneath the Palk Strait. A day-time enhancement of ÄZ/ÄH at Hikkaduwa at all periods in the observed range and a similar enhancement of ÄHC/ÄHH were observed. These enhancements are possibly due to the effect of the equatorial electrojet on the short-period variations.

234. **Kuppusamy Vijayaraghavan, Joseph Raj Jegan and Manickam Velan.** 2004. Copper removal from aqueous solution by marine green alga *Ulva reticulata*. *Electronic Journal of Biotechnology,* 7(1): 61-71.

Address : Department of Chemical engineering, Alagappa College of Technology, Anna University, Chennai-600 025, India. E-mail: erkvijay@yahoo.com

Abstract : The batch removal of copper (II) ions from aqueous solution under different experimental conditions using *Ulva reticulata* was investigated in this study. The copper (II) uptake was dependent on initial pH and initial copper concentration, with pH 5.5 being the optimum value. The equilibrium data were fitted using Langmuir and Freundlich isotherm model, with the maximum copper (II) uptake of 74.63 mg/g determined at a pH of 5.5. The Freundlich model regression resulted in high correlation coefficients and the model parameters were largely dependent on initial solution pH. At various initial copper (II) concentrations (250 to 1000 mg/L), sorption equilibrium was attained between 30 and 120 min. The copper (II) uptake by *U. reticulata* was best described by Pseudo-second order rate model and the rate constant, the initial sorption rate and the equilibrium sorption capacity were also reported. The elution efficiency for copper-desorption from *U. reticulata* was determined for 0.1 M HCl, H_2SO_4, HNO_3 and $CaCl_2$ at various Solid-to-Liquid ratios (S/L). The solution $CaCl_2$ (0.1 M) in HCl at pH 3 was chosen to be the most suitable copper-desorbing agent. The biomass was also employed in three sorption-desorption cycles with 0.1 M $CaCl_2$ (in HCl, pH 3) as the elutant.

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235. **Lal Mohan, R.S.** 1970. On the infestation of the gonadial nematode parasite *Philometra rajani* from the Sciaenid fish *Pennahia aneus* from Palk Bay. *J. Mar. Biol. Assoc. India.* 12(1&2): 226-227.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : *Philometra rajani* the gonodial nematode parasite was first described by Mukerjee (1966) from the ovaries of fishes *Polynenmus polydactylus* and *Sciaena coiter*, but unfortunately the places from where these fishes were obtained are not given by the author. While examining the *sciaenid* fish *Pennahia aneus* (Bloch) from Mandapam and Pamban (Palk Bay) many specimens infested with *Philometra rajani* were observed. The occurrence of *Philometra rajani in P. aneus* has not been so far recorded.

The number of *Philometra rajani* infesting the ovaries of one fish varies from one to twenty – five worms ranging from 3.0 mm, to 80.0 mm. In length. In some cases the infestation is so acute that the whole ovary is occupied by the parasites rendering the ovary black. A few fishes were collected with the parasites hanging out as a cluster through the anal opening probably due to lack of space in the ovary. Though the occurrence of the parasites does not appear to affect the well – being of the host, it causes great damage to the stock by destroying the eggs.

236. **Lal Mohan, R.S.** 1976. Some observations on the sea cow, *Dugong Dugon* from the Gulf of Mannar and Palk Bay during 1971-75. *J. Mar. Biol. Assoc. India,* 18(2): 391-397.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Sex ratio of the mature male and female dugongs was about 1:1 and that of younger size groups was 0.6 : 1.0. The size distribution varies from year to year. The size groups 150 to 199 cm were dominant in all the years except during 1972. March, August and October were the months when most of the dugongs got entangled in the nets. Dugongs are found fairly in good numbers around the Islands Valai and Musal in the Gulf of Mannar and Devipattanam and Thondi in Palk Bay. Gulf of Mannar accounted for 76 % of the dugongs. Large size dugongs were more common in Thondi (Palk Bay).

237. **Lal Mohan, R.S.** 1985. Capture of coastal birds in Pillaimadam lagoon at Mandapam, southeast coast of India. *Proc. Symp. Endangered Marine Animals and Marine Parks.* 1 : 352 - 354.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Regular observations were made on the coastal birds caught in the Pillaimadam lagoon by a specially designed nylon net. Blinded birds are used to lure the birds. *Gelochlidon nilotica*, *Sterna bengalensis, S. bergi, S. sandvicensis sandvicensis* and

Hydroprongne caspia are some of the common birds caught. Seasonal variation and the species composition were also observed.

238. **Lal Mohan, R.S.** 1988. Research needs for the better management of dolphins and dugong resources of India. *CMFRI Spec. Publ.,* 40: 98-99.

Address: Central Marine Fisheries Research Institute, Calicut, Kerala, India.

Abstract: The marine mammals which form a part of fishery bycatch are represented by dolphins and dugong. The smaller cetaceans that are caught along the Indian coast are *Stenella longirostris*, *Delphinus delphis*, *Sousa chinensis* and *Tursiops truncatus*. The dugongs are caught in the Gulf of Mannar and Palk Bay. Annually about 250 dolphins get entangled in the gill nets along the Indian coast. About 25 dugongs are caught in the Gulf of Mannar and Palk Bay.

239. **Lal Mohan, R.S.** 2000. The sea cow, *Dugong dugon* of India. *Golden Jubilee Celebrations Souvenir, 2000. Mandapam Regional Centre of CMFRI, Mandapam Camp,* pp.22-24.

Address: Conservation of Nature Trust, 43C, Water Tank Road, Nagercoil-1, Tamilnadu, India.

Abstract: The seacows or the dugongs are distributed in the Indo-Pacific region between longitudes 32°E and 170°W, latitudes 35° and 40°N. There are five population namely, East Australian, North Australian, Andaman-Malay Peninsula, Thailand and South China, South Indian and Sri Lanka, East African, Red Sea and Persian Gulf. Dugong has a wide distribution in the tropical Indo-Pacific region. They are recorded from East Africa, Mafia Island, Kenya, Red Sea, Persian Gulf, Gulf of Mannar, Palk Bay, Sri Lanka, Andaman Island, Burmese Coast, Merqui Archepelago upto New Caledonia and Philippines Island. At present the dugongs are found in good numbers in the coast of Australia but becoming depleted in other places.

240. **Lal, M.** 2001. Tropical cyclones in a warmer world. *Curr. Sci.,* 80(9): 1103-1104.

Address : Centre for Atmospheric Sciences, Indian Institute of Technology, Hauz Khas, New Delhi 110 016, India, e-mail: mlal@cas.iitd.ernet.in

Abstract : About 80 tropical cyclones (with wind speeds equal to or greater than 35 knots) form in the world's waters every year. Of these about 6.5% develop in the Bay of Bengal and Arabian Sea. Since the frequency of cyclones in the Bay of Bengal is about 5 to 6 times the frequency of those in the Arabian Sea, the Bay of Bengal's share comes out to be about 5.5%. The tropical cyclones forming in the Bay of Bengal hit the coast of India (particularly the states of Andhra Pradesh, Orissa and West Bengal) every year, causing heavy loss of life and property.

241. **Lida Pet-Soede, Mohideen Wafar, K. Venkataraman, P.T. Rajan and Dan Wilhelmsson.** 2000. The status of the coral reefs of India following the bleaching event of 1998. In : D. Souter, D. Obura and O. Linden, Coral Reef Degradation in the Indian Ocean. *Status Report* 2000. CORDIO, SAREC Marine Science Program, Stockholm University, Sweden. pp. 69-74.

Address: Independent Consultant & Institute of Environmental Studies, Free University Amsterdam, the Netherlands, National Institute of Oceanography, Dona Paula, Goa, India, Zoological Survey of India, Marine Biological Station, Chennai, India, CORDIO – South Asia, c/o SACEP, Colombo, Sri Lanka.

Abstract : The major reef formations in India are restricted to the Gulf of Mannar, Palk Bay, Gulf of Kutch, Andaman and Nicobar Islands and the Lakshadweep Islands (Hoon, 1997; Wilkinson, 1998). Each area, particularly the Gulf of Mannar, faces specific problems resulting from anthropogenic influences such as high fishing pressure (trawls), high sedimentation from poor upland and coastal agriculture practices, and high levels of pollution. Furthermore, the reefs of Lakshadweep and Nicobar Islands are considered the most polluted in the Indian Ocean because the seas around them serve as major routes for oil tankers.

242. **Lipton, A.P., S. Krishnapillai and P. Thillairajan.** 1994. Observation on the culture of green mussel in pillaimadam salt water lagoon, near Mandapam. *Mar. Fish. Infor. Serv. T & E. Ser.*, 127: 8.

Address: Mandapam Regional Centre of Central Marine Fisheries Research Institute, Mandapam – 623 520, Tamilnadu, India.

Abstract : Pillaimadam salt water lagoon present (09° 17' N and 79° 06' E) near Mandapam, in Ramnad district is bound by the Palk Bay on the north and the Rameswaram. It extents to a length of about 5.2 km, covering an area of about 450 ha. The lagoon is connected to the Palk Bay by a bar mouth, through which it receives the tidal water. The suitability of the lagoon for finfish culture mainly through the north – east monsoon (November and December) gets rain water. In this report the culture of shellfish ,the green mussel *Perna viridis* were cultured during January to April 1989. The hydrological conditions of the lagoon are found to be greatly influenced by the precipitation during the NE monsoon and the tidal water. In January 1989, the water temperature ,pH, surface and bottom water salinity of the culture site was 28.2° C, 7.5, 29.0 ppt and 29.5 ppt respectively. The dissolved oxygen level varied from 4.4 to 4.56 ml/ l (surface) and 2.85 to 4.3 ml/ l (bottom). In the case of nutrients, Phosphates fluctuated between 0.01 and 0.15 /µ at / l ; Silicates from 10.0 to 34.0/µg at / l ; nitrates value from 1.0 to 3.0/µg at/ l and nitrite values from 0.07 to 0.75/µg at / l. The green mussel was cultured by suspended bag method. The spat were stocked in bags made of nylon net material of 35 X 1000 cm size with 10 mm mesh, cut and stitched on sides. Each bag was stocked with 2.5 kg of green mussel after measuring the initial length, breath and weight. The bags were kept submerged under water. After 80 days the culture period over the mussel have grown from an initial length of 31.89 + 5. 93 mm to 42.33 + 3.21 mm size. The weight increase was faster during the first 40 days of rearing. However, during the second phase of 40 days a marginal increase of 0.10 kg was recorded. It is inferred that the growth of green mussels was slow and survival was poor so the Pillaimadam lagoon does not appear to the suitable for green mussel culture.

243. **Lipton, A.P and M. Selvakku.** 2001. Tagging and recapture experiments in the Indian

sacred chank, *Turbinella pyrum* along the Gulf of Mannar and Palk Bay, India. *Phuket Mar. Biol. Cent. Spec. Publ.,* 25(1): 51-55.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Concomitant to the heavy demand of the sacred chank, *Turbinella pyrum,* several methods of large-scale exploitation, including bottom trawling, take place in the Palk Bay and Gulf of Mannar region, leading to depletion of chank resources. The natural growth of the chank is not known. Tagging and recapture experiments were therefore conducted. Chanks were brought to the laboratory, reared in a flow-through system, and conditioned before tagging with 'Letro' labels attached to shells with Araldite. The measured and tagged chanks were released at specific sites in Gulf of Mannar and Palk Bay. Tagging and recapture data from 1994 to 1997 showed that in the natural habitat the increase of average Maximum Shell Diameter (MSD) ranged from 6.6 to 7.5 mm. Out of 1046 chanks tagged, the recovery ranged from 8.7 to 11.5%.

244. **Lipton, A.P and M. Thangaraj.** 2002. Present status of seahorses fishing along the Palk Bay coast of Tamil Nadu. *Mar. Fish. Infor. Serv., T & Ser.,* 174: 5-8.

Address : Vizhinijam Research Centre of CMFRI, Vizhinjam - 695 521.

Absract : Earlier reports says exploitation of seahorses by diving along the Palk Bay coast from places such as Thondi, Puthupattinum, Mullimunai and Thirupalaikudi of Tamil Nadu. The targeted fishing for seahorses expanded rapidly as well as high demand. August 2002, the ban by the government of India for some of marine fin fishing has also been reduced drastically. In Mullimunai, two traders collect seahorses, which depending on the success of collections by diving, they change the fishing effort by using drag nets or squid jigging devices to collect other finfish or cuttlefish and squid. In Puthupattinam there were occasional collection of seahorses by fishers which in turn were collected by traders. At present there is no collection and hence the fishers themselves go to Keelakarai and sell it to the resident traders. In Thondi July 2002 onwards, the seahorse collection has started gaining momentum. Four traders purchase the seahorse and send it to the nearby Kodipanku village. Devipattinam and Thirupalaikudai also collected seahorse when they go for diving for chanks, lambis and sea cucumbers. In Palk Bay there are three species (*Hippocampus kuda*, *Hippocampus trimaculants, Hippocampus fuscous*) which are available and the morphometric and meristic characteristics of the species were recorded from depth ranging from 3 to 8 meters in areas endowed with sea grasses. On observation day, the surface water temperature was ranging from 26 to 28.8 ° C and dissolved oxygen, 4.18 to 4.92 ppm. Global trade in sea horses boomed in the 1980's, the Chinese trade estimated an annual increase of 8 to 10%. Due to slumbering of south east Asian countries, the Chinese traders sought supplies as far as from Ecuador and Mozambique. This in turn indicates a possible spurt in fishing for seahorse in the Palk Bay coast as and when the ban is relaxed. The species availability and the growth rate of seahorse in the Palk Bay coast are to be investigated using genetic (DNA profile) marker studies and tagging experiments.

245. **Loveson,V.J., G. Victor Rajamanickam and K. Anbarasu.** 1990. Remote Sensing applications in the study of sea level variation along the Tamilnadu coast, India. In: G.Victor Rajamanickam (ed). *Sea level variation and its impact on coastal environment*, Tamil University, Thanjavur, pp.176-196.

Address : School of Earth Sciences, Tamil University, Thanjavur.

246. **Loveson,V.J., G. Victor Rajamanickam, N. Chandrasekar.** 1990. Environmental impact of micro-deltas and swamps along the coast of Palk Bay, Tamil Nadu, India. In : G.Victor Rajamanickam ed., *Sea level variation and its impact on coastal environment*, Tamil University, Thanjavur.

247. **Luther, G.** 1963. Some observations on the biology of *Liza macrolepis* (Smith) and *Mugil cephalus* Linneus (Mugilidae) with notes on the fishery of grey mullets near Mandapam. *Indian J. Fish.,* 10(1&2): 642-666.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Some observations on the biology of the grey mullets, *Liza macrolepis* (Smith) and *Mugil cephalus* Linnaeus from Palk Bay and the lagoon near Mandapam have been made during the period, April 1958 to December 1960. The length-weight relationship of *L. macrolepis* has been found to be $W= 0.00002222 L^{2.8750}$ and that of *M. cephalus*. $W= 0.00001950 L^{3.0274}$. The fluctuations in the relative condition factor have been studied for both the species.

248. **Luther, G.** 1973. The dorab fishery resources of India. *Proc. Symp. on Living Resources of seas around India.* pp. 445-454.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Two species of dorab, *Chirocentrus nudus* and *C. dorab* contribute to the commercial fishery along the east and west coasts of India. Their contribution of about 8,000 tonnes to the annual total marine fish catch forms about 1%. Madras State alone contributes to about half the annual total dorab catch of India, and Andhra Pradesh and Maharashtra contributing to 19% and 12% respectively come next. In Madras State, Andhra Pradesh and Orissa and Bengal dorab holds a place in their fisheries contributing to nearly 2-3% of the States total fish catch. The Palk Bay and the Gulf of Mannar contribute to a major portion of dorab catch of the Madras State. Some details about the dorab fishery resources of the Palk Bay and the Gulf of Mannar around Rameswaram Island are presented in the paper. Reference is also made to *Scomberomorus* spp., *Tachysurus* spp. and a variety of other fishes caught along with dorab. The dorab catch of the Island has shown a sharp increase during the course of the past 15 years. This is primarily due to settlement of enterprising fishermen in the Island from other places along the Gulf of Mannar, who launched into more offshore waters employing nylon drift nets on more sea-worthy boats. It is possible that with increased efforts the dorab catch could be stepped up in States

where it is now low.

249. **Luther, G.** 1982. Length-weight relationship of the fishes of the genus *Chirocentrus cuvier. J. Mar. Biol. Assoc. India,* 24(1&2): 105-111.

Address: Central Marine Fisheries Research Institute, Waltair, Andhrapradesh, India.

Abstract: *Chirocentrus nudus* and *C. dorab* from Palk Bay and Gulf of Mannar around Rameswaram Island were examined for this study. The regressions obtained for the length-weight relationships of males and female from the two localities were compared by analysis of covariance. The rate of growth of juvenile is different from that of adult for *C. nudus*, but it is the same in both for *C. dorab*. Consistent with its relatively slender body form *C.dorab* weights much less than *C. nudus, C. dorab* does not show significant difference in weight between sexes or localities. For *C. nudus*, however, male is heavier than female and fish from Palk Bay is heavier than that from the Gulf of Mannar. The latter could be due to the difference observed in the physiological state of the fish in the two localities.

250. **Luther, G and S.K. Dharma Raja.** 1982. Population studies on the fishes of the genus *Chirocentrus* Cuvier. *J. Mar. Biol. Assoc. India,* 24(1&2): 118-123.

Address: Central Marine Fisheries Research Institute, Waltair, Andhrapradesh, India.

Abstract: Four important morphometric characters namely, head length, predorsal distance, depth of body and pectoral fin length have been analysed in respect of the two species of *Chirocentrus* namely, *C. nudus* and *C. dorab* from the Palk Bay and the Gulf of Mannar around the Rameswaram Island. The method of regression was used and comparisons were made using the analysis of covariance to find out the significant difference in the regressions between the sexes and localities. The significance of the difference was tested at 1% level of probability. The results indicate that in the case of *C. nudus* the pectoral fin is longer in male than in female and that each species of *Chirocentrus* occurring in the two localities could belong to the same population.

251. **Luther, G.** 1985. Food and feeding habits of the two species of Chirocentrus from Mandapam. *Indian J. Fish.,* 32(4): 439-446.

Address: Central Marine Fisheries Research Institute, Waltair, Andhrapradesh, India.

Abstract: The two species of Chirocentrus, *C. nudus* and *C. dorab* , examined from the Palk Bay and Gulf of Mannar, appear to be diurnal predators preying mostly on fishes, depending for predation perhaps on vision. They seem to ingest the prey as a whole, swallowing its head first. When young, they feed mainly on the postlarvae and juveniles of Stolephorous and Sardinella and on Acetes , but, as adult they change over to adult sardines and other clupeoids. Though both the species belong to the same trophic level, *C.nudus* seems to avoid competition by feeding on relatively larger-sized prey, which they are able to do with the help of their larger mouth and stronger teeth.

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252. **Mahadevan, S.** 1958. Report on the "Kaaral" (*Leiognathus* spp.) and (*Gaza minuta*) Fishery of Rameswaram Island in the Gulf of Mannar and Palk Bay. *Proc. Indian Soc. Cong. Assn. 45th Session.*

Address : Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

253. **Mahadevan, S., K. Rangarajan and C. Sankarankutty.** 1962. On two specimens of *microproprosthema sp*. (*Decapoda Macrura*) from Palk Bay. *J. Mar. Biol. Assoc. India*. 4: (1&2): 235-239.

Address : Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

Abstract : A single male specimen of *Microprosthema sp*., measuring 13 mm long was first noticed in the laboratory moving among the tentacular bases of an expanded sea - anemone, *Gyrostoma sp*, on 2 –7-1961 which was collected earlier from a shallow pool of water under dead coral stones in the exposed tidal flat of Palk Bay. The occurrence of shrimp on sea – anemone, however, proved to be only accidental, since on a later occasion we were able to collect an ovigerous female, 15 mm, long on 10-9-1961 from the same locality under dead coral rocks. Holthuis (1947) gives a detailed account of the family *Stenopodidae* and has provided a useful key for the identification of the species of *Microprothema.* Of the four species recognized by him (*M. validum, M. semilaeve, M. plumicorne* and *M. sabricaudatum*), *M. validum and M. semiaeve* are very close and differ from one another in the presence or absence of a short longitudinal median carina at the posterior half of the dorsal surface of the third abdominal segment and in the number of teeth along the outer margin of *Scaphocerite.*

254. **Mahadevan, S. and K. Nagappan Nayar.** 1972. Distribution of coral reefs in the Gulf of Mannar and Palk Bay and their exploitation and utilization. *Proc. Symp. corals and coral reefs, MBAI.* pp. 181-190.

Address: Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

Abstract: Running parallel to the shore in the Gulf of Mannar along the Indian coast are situated 21 islands of limited extent between Lat. 8° 47' N – Long. 78° 12' E and Lat. 9° 15' N – Long. 79° 14' E. These islands are extensive in the depth and quantity of the coral reefs around them. In addition to these islands, coral reefs exist also around the Rameswaram Island, the largest island in this series, which is all but contiguous with the mainland but for a short span of 2 km from Thonithurai to Pamban. Here the reefs start from NNE of Rameswaram shore and run around Devil's Point parallel to the shore and extend up to Mandapam in Palk Bay where they end. The corals of these localities are being quarried for industrial purposes. The Tuticorin type of boats with a small crew of fishermen operate for breaking the corals during the months of October to May in the

Gulf of Mannar and May to September in the Palk Bay. The bulk of the stones quarried now are from the islands north of Nallatanni Tivu. The collection and utilisation of coral stones in the carbide industry and in the lime manufacture are detailed and the economics of the coral stone fishermen are given. The annual rate of removal of coral stones at the present level of exploitation seems to warrant a detailed survey of the exploitable coral resources in the area now exploited and the enforcement of a scheme for rational exploitation of the coral stones.

255. **Mahadevan, S and K. Nagappan Nayar.** 1973. Pearl oyster resources of India. *Proc. Symp. on Living Resources of seas around India.* pp. 659-671.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Of the 6 species of *Pinctada* Roding (Piteridae) viz., *Pinctada fucata* (Gould), *P. margaritifera* (Linn., *P. chemnitzi* (Philippi), *P. anomioides* (Recve,) *P. sugillata* (Reeve) and *P. atropurpurea* (Dunker), the first named species is the common pearl oyster of India, occurring on the pearl backs off Tuticorin coast in the Gulf of Mannar on the rocky ridges extending all along the coast of the gulf at depths of 15 m-25m. They are occasionally found in the Palk Bay also in shallower waters lying in loose clusters over a bottom of coarse sand covered with a matrix of dead shells. In the Gulf of Kutch they are found on the intertidal. The pearl fishery in the Gulf of Mannar is unpredictable and it is a question of utilizing the natural resource as and when the pearl oyster spat settle down and grow. It is difficult to have effective control over the conditions affecting the settlement and growth of the pearl oyster in the natural beds because of their occurrence in the open sea. For the purpose of conducting an organized fishery, the population of fishable oysters should be determined with accuracy. The existing method of estimation of population, the knowledge of the grounds and the method of fishing require reorientation. To this end a thorough survey of the areas of oyster settlement was undertaken for a period of 3 years and the grounds charted, for the first time, by means of direct under-water observation by SCUBA. The outlook for pearl fisheries in the next few years is rather bleak at present. The success and failure of the pearl fisheries of the past and the futile attempts made over a number of years to watch for the possible settlement of the pearl oyster spat show that the only alternative to put India in the map of pearl producing nations is to resort to pearl culture practices.

256. **Mahadevan, S and K. Nagappan Nayar.** 1974. Ecology of Pearl oyster and chank beds. *CMFRI Bulletin,* 25: 106-121.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The Gulf of Mannar and the Palk Bay zones of the southeast coast of India, the Halar coast of the Gulf of Kutch especially the reefs of Sachana, Salaya, Piroton, Ajad etc., and a narrow strip in the extreme southwest coast of India from Colachel to Trivandrum are all places where either the chanks or the pearl oysters or both occur in fairly large numbers. In addition to the above, chanks occur along the Coromandal coast upto Madras although

this stretch is of minor importance. In some places in Andamans also chanks occur in limited quantities. Of all the places the most productive areas, as far as the pearl oysters are concerned, are located in the Gulf of Mannar and very rich chank beds exist both in the Gulf of Mannar and in the Palk Bay. Naturally much attention has been focussed on these two regions to study the fisheries and ecology of these two commercially important molluscs as evidenced by the works of Hornell (1914,1916, 1922a), and Mahadevan and Nagappan Nayar (1966, 1967, 1968). Very little is known about the other areas except for Hornell's report (1909) on the marine biology of the Okhamandal coast of Kathiawar.

257. **Maheswarudu, G., P.E. Sampson Manickam, P. Vedavyasa Rao and M.R. Arpudharaj.** 1996. Observation on the exploitation of penaeid prawn resources in the Palk Bay of Mandapam during 1986 to 1993. *Indian J. Fish.* 43(3): 205-213.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu. India.

Abstract : The penaoid prawns contributed to 16. 70% of the total trawl landings at Mandapam during 1986 – '93. Out of the ten species represented in the catch, four species namely *Penneus semisulcatus, Metapenaeopsis stridulans, Trachypenaeus pescadorensis* and *Metapenaeus burkenroadi* supported the fishery throughout the year. Contributing to over 50%, *P. semisulcatus* was the dominant species, followed by *M. stridulans*. Over the years a gradual decline of *P. semisulcatus* in the species percentage composition and a steady increase of that of *M. stridulans* was observed. The change in the species composition during 1986 –'93 has been discussed. May – August was the other during November – December were observed for *P. semisulcatus.* The annual fishing effort fluctuated between 3,54,055 and 6,48,513 hours with an average of 4,90,361 hours. The annual prawn catch ranged per hour ranged from 0.8 to 2 kg. The MSY and corresponding optimum fishing effort was 726.2 t and 5,61,415 hours respectively.

258. **Maheswarudu, G., E. V. Radhakrishnan, N. N. Pillai, M. R. Arputharaj, A.Ramakrishnan, S. Mohan and A. Vairamani.** 1998. Tagging experiments on sea ranched Penaeus indicus in the Palk Bay, southeast coast of India. *Indian J.Fish.,* 45(1): pp.67-74.

Abstract : An attempt has been made to study the suitability of hatchery raised and farm grown *Penaeus indicus* for sea ranching, and to study the growth and movement of ranched population in the Palk Bay and Gulf of Mannar. The eggs released by a spawner without eyestalk ablation were raised up to juveniles through rearing in the hatchery, nursery cement tanks and in earthen ponds. The hatching rate and subsequent survival rare from nauplius-1 to PL-1 was 92.3 and 53.0 % respectively. Survival from PL-1 to PL-21 was 49.5%. The seeds thus raised were stocked in two coastal earthen ponds at a rate of 50,000/ha and fed with pellet diet daily at the rate of 5-10% of biomass. After 111 days, retrieved was 41,45% in pond I and 75% in pond II. The growth was from 22.95 mm TL to 111.7 mm TL/10.1 g wt. In pond I and 103.06 mm TL/8.1 g wt, in pond II. These juvenile prawns were tagged with loop tags and released in the Palk Bay off Mandapam at 3m depth. Recovery started from the subsequent day onwards in the trawl catches of

Palk Bay and Gulf of Mannar and continued up to 28 days. Of the 3,430 prawns released, only 19 were recovered accounting for <1% recapture. Distribution and movement of tagged prawns and the prospects of sea ranching of *P. indicus* have been discussed.

259. **Maheswarudu, G.** 2000. Shrimp culture during 1998-2000 at marine fish farm, Regional Centre of CMFRI, Mandapam Camp. *Golden Jubilee Celebrations Souvenir 2000, Mandapam R.C of CMFRI, Mandapam Camp,* pp. 36-39.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu. India.

Abstract: With the introduction of trawlers in the Palk Bay and Gulf of Mannar during the 1960s under Indo-Norwegian Project exploitation of shrimp began and it has reached commercial scale during the 1970s as many private entrepreneurs initiated trawl fishing. The annual shrimp landings ranged from 1,000 to 2,000 tonnes during the beginning of 1,990s in the Mandapam region. In the 1,960s *Metapenaeus affinis* was the dominant species followed by *Penaeus semisulcatus.* Gradually *M. affinis* was replaced by *P. semisulcatus* and by the 1,970s *P. semisulcatus* was dominant species of shrimp fishery in this region. As shrimp catches are promising and fetching lucrative income effort has gradually increased and the catch of *P. semisulcatus* has reached maximum sustainable level, and further increase in fishing effort by trawlers would lead to depletion of shrimp stock. The other source to augment the shrimp production is to adopt culture practice all along the coastal areas and to establish ranch fishery in the sea by releasing hatchery raised seed in large scale.

260. **Mallik, T.K and I. Ray.** 1975. Bottom sediments off Mandapam, Palk Bay, Tamil Nadu – A preliminary note. *Indian Minerals,* 29(3): 10-17.

261. **Mallik, T.K.** 1983. Shelf sediments and mineral distribution patterns off Mandapam, Palk Bay. *Indian J. Mar. Sci.,* 12(4): 203-208.

Address: Offshore Mineral Exploration and Marine Geology Division, Geological Survey of India, Calcutta, India.

Abstract: Grain size variation and heavy minerals of offshore and beach samples from Palk Bay, India, were studied. Offshore sediments consist of sand, silt clay and their admixtures, corals and algae. Most of the samples have 3 major types. Fluctuating energy condition is reflected by sorting differences. Probable sediment transport direction is towards the South and South-West offshore sediments have a primary mode around 1.5 to 2.0. Beach samples with good concentration of black sands are polymodal and indicate mixing from multiple sediment sources. Heavy mineral assemblage suggests contribution from high and low rank metamorphic rocks and igneous rocks of the adjacent area. The area can be divided into 4 mineralogic provinces depending on the mineral assemblage.

262. **Marichamy, R., A.A. Jayaprakash, N. Ramamoorthy and M. Bose.** 1992. Seasonal landings of oil sardines, *Sardinella longiceps* of Rameswaram, Pamban and Mandapam area. *Mar. Fish. Infor. Serv. T&E Ser.* 117: 9-11.

Address : Reginal Centre of Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu. India.

Abstract : Unusual landing of oil sardine, *Sardinella longiceps* were noticed at Rameswaram and Pamban during January and February 1992. But the resources was exploited by the pair and fish trawlers. Initially 30 to 40 pairs were operation per day. Fishermen found that there was good demand and marketing, the number of pair trawlers increased. The estimated catch of oil sardine at Rameswaram for January – February 1992 was 4.561 t. At Pamban the pair trawling during the period realized 741 t. The mechanized units 9.14 – 75 m OAL (45 – 70 HP diesel engines) conduct the operation. The normal trawling speed while fishing is 2.5 knots. But for fishing oil sardine the speed is kept at 3.5 knots. There are slight variations in the engines in the specifications depending on the power of the engines of the boats. The depth of the fishing grounds varies from 12-16 m and the bottom is muddy. The catch of oil sardine at Rameswaram amounted to 1,635.8 t during January and of 1,192 kg in February 1992. At Pamban the Pair trawling relished 203 t and 538 t during January and February 1992 forming 89.3% and 74.8% respectively. Other fishes occurring in the pair trawlers were lesser sardines, *Dussumieria acuta, Tachusurus caelatus, Himantura bleekeri*, etc. During October to December 1991 the shrimp trawlers at Rameswaram oil sardine formed 147 t at a C/E of 5.8 kg and the oil sardine catch of Pamban during October – December 1991 was 22 t which was 10 t less compared to previous year. Examination showed that they were in spent condition during October to December. Females dominated. Females dominated during January and males during February. All specimens were in the resting stage. Most of them were lean with the head remaining more prominent than the body showing a starved appearance. A detailed report on the monthly catch, seasonal catch and the biological characteristics covering all the gears in operation in this area and the migratory pattern correlating with the environment is under preparation.

263. **Marichamy, R., A.P. Lipton, A. Ganapathy and J.R. Ramalingam.** 1993. Large scale exploitation of sea horse *(Hippocampus kuda*), along the Palk Bay coast of Tamil Nadu. *Mar. Fish. Infor. Serv. T & E. Ser.,* 119: 17-20.

Address: Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu. India.

Abstract : In this article , the observations on this new trend of exploitation of sea horse (*Hippocampus kuda*) , the catch particulars, the fishery, the marketing aspects and uses are highlighted. *H. kuda* is more common in southeast coast of India. In addition, stray catches in trawl nets operated in deeper grounds are also brought to the procurement centers all along the coast of Ramnad. Sea horses are caught by divers, they select grounds in the sea with abundant growth of sea grasses, seaweeds or sponges, and dive to depth ranging from 4 meters to 8 meters. A diver, on an average collects 10 to 30 numbers of sea horse per day. The catch per effort was estimated at 7 to 10 sea horses/ hour of diving day. The average weight of the sea horse was 7.86 g and the mean size of the sample was 110.75±16.07 mm. The mean length was 86.38± 14.15 mm. They feed on minute organisms and plankton which they observe solemnly and then suck in through the

tiny mouth located at the end of the tubular snout. As they are slow movers, their survival depend on their concealment. The production of eggs and young ones is accomplished by the males. The sea horse fishery has come as a boon to them as the "attai" season of 1992 was not profitable to them. Enquiries from the Keelakarai merchants indicate that on an average 300 to 400 kg of dried seahorses per month are exported to Singapore market by unknown methods. This could indicate an estimated landings of 600 to 800 kg of sea horse from this coastal area. The average revenue is about Rs. 8,00,000 per month. The dried seahorse is in great demand in the South East Asian Counties especially in Singapore and China not only for extraction of soup, which is a delicacy but also for its medicinal values. The dried seahorse is used as a medcine to arrest the whooping cough in children. In some places , the sea horse is burnt in fire, mixed immediately with coconut oil and applied as medicine on cut wounds, and cures ' asthma' disease. Efforts should be made to observe the distribution pattern of this group at different depths. An awareness should be created among fishermen about the value of ecosystem, conservation and management.

264. **Marsh, H.** 1989. The status of the dugong in Palk Bay Gulf of Mannar Region: recommendations for management, education and research. *Report to the Bombay Natural History Society,* May 1989. 30 pp.

Abstract : Like humans, dugongs, dugongs are mammals. They live upto 70 years and grow upto a length of three meters. They are commonly called as " Sea cows" since they graze only on seagrass meadows. In India, dugongs are reported from Gulf of Kutch, Konkan coast on the West and Gulf of Mannar and Palk Bay on the East Coast. Although the dugong are known to occur since long in the coastal waters of India, no ascertain its population density. No reliable data are also available on dugong catches, the fact is that in India the dugong population is very meager and declining rapidly at an alarming pace. Decline in dugong numbers due to habitat loss was documented in India during 1964 cyclone. At Palk Bay, large quantities of sand brought by floods were deported over seagrass and algal beds completely destroying them. This led to the near total absence of turtles and dugongs in the late 1960s and early seventies (Silas and Fernanto, 1988). In this area, *Cymodacea serulata* and *C. isotifolida* from the major food items of dugong.

265. **Maruthanayagam, C. and P. Subramanian.** 1999. Hydrological and zooplankton biomass variation in Palk Bay and Gulf of Mannar along the east coast of India. *J. Mar. Biol. Assoc. India,* 41(1&2): 7-18.

Address: Department of Animal Science, Bharathidasan University Thiruchirappalli, Tamil Nadu, India.

Abstract: Data on the hydrological factors and zooplankton biomass variations, salinity, dissolved oxygen and nutrient salts in the inshore waters of the Palk Bay and Gulf of Mannar (three different stations) during the period November 1993 to October 1995 are presented. The total biomass, total plankton volume and number of zooplankton showed little variation between the stations. The Station I is slightly rich in terms of both volume and number of zooplankton followed by the stations III and II. The atmospheric temperature

of the three stations fluctuated between 28° C and 23° C, the surface water temperature was always little lower than the atmospheric temperature. Salinity showed a regular seasonal cycle, DO content maximum and minimum values fall on monsoon and summer months respectively. The maximum rainfall of 330 mm in stations I and II and 240 mm in stations III was recorded during monsoon months. A high TDS concentration in station I coincided with northeast monsoon and at station II and III with southwest monsoon. The nutrient load was high during the northeast monsoon in the Stations I and II, but in the station III it was during southwest monsoon the maximum nutrient load was observed when compared to the other stations.

266. **Maruthanayagam, C and P. Subramanian.** 2000. Diversity of copepods in Palk Bay and Gulf of Mannar along the southeast coast of India. *Seshaiyana,* 8(2): 13-14.

Address: Department of Zoology, A.V.C. College, Mayiladuthurai-609305, Tamilnadu, India.

Abstract: Copepods are lower crustaceans occurring in both marine and freshwater habitats. They occur both in the Planktonic realm and in the benthic environment. They vary greatly in size (mostly 1-4 mm long), occur in enormous numbers and have an widespread distribution. Copepods constitute one of the most dominant taxa of marine plankton. They play an important role in the food chain of the marine ecosystem.

267. **Maruthanayagam, C. and P. Subramanian.** 2001. The zooplankton of the inshore waters of Palk Bay and Gulf of Mannar along the east coast of India. *J. Ecobiology*. 13(3): 205-211.

268. **Maruthanayagam, C., C. Senthil Kumar and P. Subramanian.** 2001. Seasonal variation of protozoans in Palk Bay and Gulf of Mannar along the southeast coast of India. *J. Mar. Biol. Assoc. India,* 43(1&2): 186-189.

Address: Department of Zoology, AVC College, Mayiladuthurai-609 305, Tamilnadu, India.

Abstract: Regular fortnightly zooplankton sample collection was made for two years from November 1993 to October 1995 in the Palk Bay (Station l) and Gulf of Mannar (Station II & III) along the southeast coast of India. Among the zooplankton sample particularly protozoa diversity was identified. Their primary peak was observed at the middle of summer (Station 1) and premonsoon (Station II and III) months. The temperature and salinity and monsoonal factors mostly influenced the occurrence of protozoans, the results are interpreted and probable reasons discussed.

269. **Maruthanayagam, C and P. Subramanian.** 2002. Seasonal variation of cladoceran and copepod population in Palk Bay and Gulf of Mannar along south east coast of India. *Environment and Ecology,* 20(2): pp. 376-382.

Address : AVC College, Dept of Zoology, Mayiladuthurai 609305, India.

Abstract : The survey of zooplankton was carried out in Palk Bay near Mandapam (station I), Gulf of Mannar near Mandapam (station II) and Gulf of Mannar near

Kudankulam (station III) along southeast coast of India. Among zooplankton samples, the cladocerans and copepod species were identified. The maximum population of cladocerans were eroded during premonsoon months in stations I and III. Cladoceran populations were maximum during July, March and August at stations I, II and III, respectively.

270. **Menon, A.G.K.** 1991. Marine National park and conservation of fisheries resources. *CMFRI Bulletin,* 44(3): 668-672.

Address: Zoological Survey of India, Madras, Tamilnadu, India.

Abstract: Industrial development often takes priority over other sectors in developing countries. In the process, problems like pollution of air, water, growth of slums, lack of sanitary facilities and other environmental hazards greatly increase, reaching uncontrollable proportions. In the industrial development, in the sphere of both Fisheries and Tourism, mistakes of development are common. It is high time that we pay some attention to the proper planning and development of the seafood export industries along our fine fishing coast. Similarly the other economic activities of sea, in particular the exploitation of the bed and coastal zones in the west coast for oil, have increased in recent years to such an extent that the detrimental effects on the ecological balance in some habitats are no longer minor. IUCN and WWF have now launched a World Conservation Programme of the Oceans. The objective of the programme is the conservation of all marine forms of life. The urgent need for the establishment of Marine National Parks along the Indian coastline for the purpose of conservation of our Fisheries resources is highlighted in the paper. On the east coast of India on the Tamilnadu coast, the fauna and flora of the Palk Bay and the Gulf of Mannar are the richest in India. The Krusadai Island with the nearby Pullivasal and Shingle Islands and their reefs with the surrounding waters are proposed to be set aside as the Marine Park Research station. The string of sixteen coral Islands stretching south and west of Krusadai Island should be declared as a Coral Reserve and the stretch of beaches west of Mandapam up to Thondi on the Palk Bay and to Valinokkam on the Gulf of Mannar side can be developed as excellent beach resorts.

271. **Mookherjee, H.P.** 1985. Contributions to the molluscan fauna of India, Part III. Marine molluscs of the Coromandel Coast, Palk Bay and Gulf of Mannar - Gastropoda: Mesogastropoda (Part - 2) *Rec. Zool. Sur. India,* Occ. paper, 75 : 1-93.

272. **Moses, S.T.** 1924. The anatomy of chank (*Turbinella phyrum*). *Madras Fish. Bull.,* 17: 105-127.

Address: Madras Fisheries Department, India.

Abstract: The Sacred Chank (*Turbinella pyrum* Linn) is a large marine gastropod mollusc extremely abundant in our waters on the east coast being found in large numbers in the Gulf of Mannar, Palk Bay and hence northwards along the shore-line of the Madras Presidency as far as Nellore district. It is found also in smaller numbers off the coast of Travancore, and on the north-west shores of Kathiawar. A well-marked variety also occurs in the Andaman Islands. The distribution and variation of this species is dealt with in full

in a paper by Mr. James Hornell published in the memoires of the Indian museum.

273. **Mukherjee, D., P. Chandrasekaran, G. Subramanian, V. Ananth and K. Balakrishnan.** 1990. Some studies on the corrosion and biofouling behaviour of a H.S.L.A. steel at Palk-Bay, Mandapam. *Tool Alloy Steels.* pp. 394-401.

Address: Central Eelectro Chemical Research Institute, Karaikudi - 623006, Tamil Nadu, India.

Abstract: Biofouling studies, on a creep resisting HSLA steel, was conducted at Palk-Bay of Mandapam Coast for a period of one year. The corrosion rate weight loss and open circuit potential with respect to SCE were monitored to assess the corrosion and biofouling characteristics of the alloy. Data on water chemistry and accumulation of biomass on HSLA plates have been collected. Corrosion products were analysed for the presence of iron sulfide and chloride, along with enumeration of SRB by MPN method.

274. **Mukul Sharma.** 1999. In risky waters. Frontline, In: http://www.hinduonnet.com/fline/fl1619/16190650.htm.

Abstract : Rameswaram in Ramanathapuram district is an island situated in south-central Bay of Bengal. It has a coastline of approximately 80 km, a land area of some 38.5 sq km and a fishing community of around 35,000 people, of whom around 8,000 are sea-going fishermen. To the island's south is the Gulf of Mannar, and to its north is the Palk Bay. At its eastern tip is Dhanushkodi, from where it is only about 16 km to Talaimannar in Sri Lanka.

275. **Murthy, A.V.S and P.Udayavarma.** 1964. The hydrographical features of the waters of Palk Bay during March, 1963. *J. Mar. Biol. Assoc. India,* 6(2): 207-216.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The Palk Bay is a shallow and flat basin, the depth of which being on an average 9 metres and nowhere exceeding 15 metres. The hydrography and dissolved oxygen conditions of the Bay waters are studied during the month of March 1963. The distributions of temperature, salinity, density and dissolved oxygen of the surface waters of the Palk Bay indicate that the Bay of Bengal waters entering through the Palk Strait have major influence on the hydrographic conditions of the Palk Bay. The Gulf waters influence the Palk Bay to a minor extent only.

276. **Murthy, K.S.R.** 2005. First oceanographic expedition to survey the impact of the Sumatra earthquake and the tsunami of 26 December 2004. *Curr. Sci.,* 88(7): 1038-1039.

Address : National Institute of Oceanography, Regional Centre, 176 Lawsons Bay, Visakhapatnam 530 017, India e-mail: ksr@darya.nio.org

Abstraact : The preliminary observations of the First Post-Tsunami Oceanographic Expedition in Andaman Nicobar region are presented in this paper. Thirty one scientists from National Institute of Oceanography (NIO), Goa, India; NIO, Regional Centre, Visakhapatnam, Andhra Pradesh; National Centre for Antarctic and Ocean Research

(NCAOR), Vasco, Goa, India; National Physical and Oceanography Laboratory (NPOL), Kochi, Kerala have participated in a 37 day cruise onboard the Ocean Research Vessel Sagar Kanya from 16th January to 21st February 2005, within few weeks of the Great Sumatra earthquake and Tsunami event that has caused extensive damage both to the physiography and probably to the environment of the Andaman and Nicobar region. Multi-parameter oceanographic data including underway geophysical (bathymetry, gravity, swath-bathymetry, sub-bottom profiling), Physical parameters (CTD, XBT, Thermosalinograph, ADCP, etc), Chemical (Dissolved Oxygen, Nutrients, pH, etc), Biological (Phytoplankton, Zooplankton, etc) Geological (grab, spade and gravity cores) were collected in this cruise. Detailed analysis of the collected might reveal information on the post - tsunami impact in this region.

277. **Muthiah, K.** 1998. Unusual heavy landing of the toli shad, *Tenualosa toli* in some centres along the Palk Bay near Mandapam. *Mar. Fish. Infor. Serv. T & E. Ser.,* 155: 20.

Address: Mandapam Regional Centre of CMFRI, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The bumper catch of fishes of Mandapam area along the Palk Bay were recorded exclusively from the landings of mechanized trawlers, and it was interesting to observe an unusually heavy landings of the toli shad, *Tenualosa toli* locally called ' Ullam' by the shoreline units on 14.3.97 from four landing centers like Darhavalasi, Alagathanvalasai, Irumeni, and Chokkapillaimadam along the Palk Bay. During March 1997, the species was sporadic in the shoreline catches. Where as steep increase in the landings with the catch ranging between 1 to 3 tonnes per shore seines units. On 14.3.1997, the total estimated catch of 2 to 3 tonnes per unit from the four landing centers. And the estimated landings of the species on that day were nearly 50 tonnes. Shore seines mainly operated along with the oil sardine fishery. In the recent past, such a heavy landing of this toli shad, *Tenualosa toli* by shore seine is unheard. More than 90 % of the catch was sold in fresh condition at the rate of Rs. 5-8 per kg and was transported to places outside Tamil Nadu.

278. **Muthiah, K.** 2000. On the unusual landing of pomfret at Muthu vaduganathan pattinam along Palk Bay . *Mar. Fish. Infor. Serv. T & E. Ser.,* 166: 18-19.

Address : Regional Centre of CMFRI, Mandapam Camp – 620 520, Tamilnadu, India.

Abstract : Unusual landing of pomfrets (*Pampus argenteus)* while collecting fishery survey data, about a tonne at Muthuvaduganathanpattinam fish landing centre on 22.02.2000. About 90 trawlers were operated and the catch was observed in 60% of the units. They were caught at a distance of 20 km in the east direction from the shore and at a depth of 13 m. An unusual phenomenon and so far there was no landings of pomfrets in such magnitude at the fish landing centre. The total length of specimen ranged from 15-20 cm and weighed 250-800 g and the price fetched was Rs. 100.00 per kg.

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279. **Nagappan Nayar, K.** 1955. Studies on the growth of the wedge clam *Donax cuneatus*. *Indian J. Fish.,* 2(2): 325-348.

Address: Central Marine Fisheries Research Institute, Mandapam camp - 623 520, Tamilnadu, India.

Abstract: A sacoglossan Opisthobranch obtained from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam Camp has been ascribed to a new species of *Stiliger* Ehrenberg and named *S. nigrovittatus* because of the characteristic dark stripes present on the dorsal region of the rhinophores and the anterolateral regions of the body. Its external morphology and some aspects of internal anatomy have been described along with notes on its early development. Its systematic position and similarity or divergence with other species of Stiliger have been discussed.

280. **Nagappan Nayar, K. and S. Mahadevan.** 1967. Pearl and chank fisheries. A new outlook in survey and fishing. *Souvenir 20th Ann. CMFRI,* pp. 87-88.

Address: Fisheries College and Research Institute, Tuticorin - 628 008, Tamilnadu, India.

Abstract: The Gulf of Mannar and the Palk Bay Zones of the east coast of the Madras state, particularly the area from Rameshwaram to Manapad, are of very great fishing importance as far as the pearl and chank fisheries are concerned. The submarine plateau of the inshore areas of the sea here affords excellent habitat for the growth of the shellfish, *Xancus pyrum* (Linn.) (the sacred chank) and *Pinctada fucata* (Gould) (the pearl oyster). Chank fishing and pearl fishing in this zone had been conducted from time immemorial under the control of the State. All along the stretch of the sea-bottom, extensive, flat rocky patches occur at a distance of 8-12 miles from the shore within 7-12 fathoms, separated from one another and surrounded by equally extensive patches of fine sandy areas at the same or slightly deeper zones. Whereas the chanks prefer fine and soft sandy areas called locally 'Poochi-manal' or 'pirals' as their abode, the oysters are sedentary and are attached to hard rocky substrata called 'Paar'. Occasionally the one is found in the natural habitat of the other. There are more than 65 well known 'Paars' (rocky sea-bottom) and lesser in number of good chank grounds in the Gulf of Mannar known to fisherman by their depth and location fixed by land bearings. The sea bottom on Palk Bay side is not rocky, at the same time less shallow also. The chanks growing in this zone are classified as 'Patti' variety, which is priced less than the 'Jaadhi' variety fished from Rameshwaram to Tiruchendur.

281. **Nagappan Nayar, K. and S. Mahadevan.** 1973. Chank resources of India. *Proc. Symp. on Living Resources of Seas around India.* pp. 672-686.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The sacred chank *Xancus pyrum* (Linn.) is a commercially important gastropod fished in large numbers along the coasts of all but a few of the maritime states of India. Fishing is carried out mainly by skin diving, although hand-picking and net fishing are

also prevalent here and there. The fishery provides a good source of living to nearly 1,000 divers in the Madras State in addition to those engaged in the same profession along the Gujarat and Kerala coasts. The main market for these chanks is West Bengal where chank bangle industry is flourishing. Investigation conducted by means of SCUBA by the authors have brought to light good concentration of chank population suitable for commercial exploitation, over vast stretches in the Palk Bay and Gulf of Mannar. The statistics of annual chank landings, yield from area to area, account of the chank fishery in important centres, details of the diving method and the extent of the chank grounds are recorded. Possibilities for exploiting unfished areas and suggestions for increasing the fishing tempo are discussed in detail. In this context SCUBA diving for chanks has proved very advantageous and is recommended keeping in view the economic aspect of the divers as well as judicious exploitation of the stock.

282. **Nair, C.M., K.R. Salin and T.M. Yohannan.** 2004. The fishery, trade and conservation of seahorses along the Indian coast. *Proc. Nat. Sem. on New Frontiers in Marine Bioscience Research, January 22-23, 2004.* pp. 513-526.

Address: Central Marine Fisheries Research Institute, Calicut Research Centre, West Hill PO, Calicut, Kerala, India.

Abstract: Seahorses are among the most unusual fishes in existence, and are intended primarily for medicine rather than food. An organised fishery and trade of seahorses existed in India along the Palk Bay and Gulf of Mannar coasts. At the Palk Bay coast, seahorses are targeted by divers along with sea cucumbers and chanks. In the Gulf of Mannar, which provides a less suitable habitat, most of the seahorses are landed as by-catch of shrimp trawling. Seahorses are also fished from Kerala as a by-catch of trawling, though there exists no organised fishery and trade. A total of six species of seahorses were identified from the Palk Bay coast whereas only two species were obtained from Kerala. Most seahorses from India were exported to Singapore, Hong Kong, Malaysia and UAE from Chennai, Tamil Nadu, India. The volume of dried seahorse trade from India was estimated to be 9.75 MT as derived from the catch data in 2001, which was much higher than the official MPEDA statistics of 4.34 MT exported from India during 2001-02, underlying the fact that a lion's share of the exports might be through non-conventional means and had gone undeclared. Seahorses are vulnerable to degradation of their preferred sea grass, mangrove and coral reef habitats, apart from fishing. A holistic approach, based on a detailed study of the population dynamics of seahorses that is integrated with coastal zone protection measures and the known strategies of fisheries management, is critically important to conserve the seahorses.

283. **Nair, M.R., K.K. Appukuttan and T.S. Velayudhan.** 2004. An overview of pearl farming in India. *J. Shellfish Res.,* 23(1): p. 305.

Address: Aquaculture Research Scientist, USDA Land Grant, Cooperative Research and Extension, College of the Marshall Islands, PO Box 1258, Majuro, MH 96960, Republic of the Marshall Islands. e-mail: manojnair999@yahoo.com

Abstract: India is well known for the production of beautiful natural pearls. India has a

wealth of pearl producing oysters. The main ones among these are the Akoya oyster Pinctada fucata distributed from the famous Gulf of Mannar, Palk Bay, and Gulf of Kutch (mistakenly identified and wrongly reported by many even now as Pinctada radiata) and the Black lip pearl oyster Pinctada margaritifera in the Andaman and Nicobar Islands. Pearl culture in India was first conducted on an experimental scale in the early 1970s by the Central Marine Fisheries Research Institute (CMFRI) at its Tuticorin research center on the south eastern Coast of India. The institute had initiated experimental pearl production in 1972 and the first Indian cultured pearl produced the following year. Hatchery technology was developed by CMFRI for *P. fucata* and *P. margaritifera* in the early (1982) and late eighties (1987) respectively. With the technology, being standardized after repeated experimentation, sea farming of pearl oysters, cultured pearl production, hatchery production, etc was taken by private entrepreneurs and coastal community groups on both coasts of India pearl farming. This paper, in addition to giving an overview of evolution of the Indian marine pearl farming, also discusses the recent innovations like onshore pearl culture.

284. **Nammalwar, P. and M. Aravindakshan.** 1976. Whales, Dolphins and Porpoises of the Indian coasts. *Sci. Rep.,* 13 (11) : 673-675.

285. **Nammalwar, P., R. Marichamy, A. Raju, A.A. Jayaprakash, C. Kasinathan, N. Ramasamy and V. Sethuraman.** 1992. On the stranding of Sei Whale, *Balaenoptera borealis* Lesson at Mandapam along the Palk Bay coast. *Mar. Fish. Infor. Serv. T & E. Ser.,* 117: 18.

Address : Central Marine Fisheries Research Institute, Mandapam camp – 623 520, Tamilnadu, India.

Abstract : The frequency of stranding of whales in the east coast is more as may be seen from the published information. It appears that the sei whale, *Balaenoptera Borealis* frequents the coastal waters more often and gets stranded on many occasions.

286. **Nammalwar, P., A.P. Lipton, S. Krishna Pillai, G. Maheswarudu, C. Kasinathan, M. Bose, N. Ramamoorthy and P. Thillairajan.** 1994. Instances of finless black Propoise, *Neophocaena phocaenoides* caught in Mandapam region along the Palk Bay coast in Tamil Nadu. *Mar. Fish. Infor. Ser. T&E Ser.,* 127: 16-17.

Address: Mandapam Regional Centre of CMFRI, Mandapam Camp-623 520, TamilNadu.

Abstract : Incidental catch of porpoises *(Neophocaena phocaenoides*) reported in the west coast is more than in then east coast of India as may be seen from the published information. Porpoises are considered as endangered marine mammals, strict regulations have been imposed by the Government authorities for their conservation and management. More recently, incidental catch of porpoises are on the increase in Mandapam region. There are four female porpoises was caught in a gill net (' Choodai Valai') on 08.07.1988, off Mandapam, 11.08.1990 off Pillaimadam, 16.11.1990 off Verkodu near Rameswaram, 25.10.1992, off Agnitheertham near Rameswaram respectively. The total length of four animal was the 77 cm, 132 cm, 126 cm, and 132 cm respectively. In all the four animals

their morph metric measurements (in cm) also given in it.

287. **Nammalwar, P., R. Marichamy, A. Raju, P. Jayashankar, M.R. Arputharaj, C. Kasinathan and S. Palanichamy.** 1999. Collection, Transport and Maintenance of Asian Seabass *Lates Calcarifer* (Bloch). *Proc. Fourth Indian Fish. Forum,* dated 24th to 28th Nov'1996. pp. 45-47.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: This paper deals with the collection, transport and maintenance of live seabass, *Lates calcarifer* from the wild in Gulf of Mannar and Palk Bay region during April, 1990 - March, 1994. Preliminary surveys have revealed that most of the specimens collected from the wild were immature and maturing males throughout the year. This species has been found to be *protandrous hermaphrodite* and the size around with the males undergo sex change in the natural habitat has been studied. Forage fishes freshly killed sardines and formulated feed was given to the broodstocks during maintenance in concrete tanks and net cages in the sea. Broodstocks were administered with steroid hormones (â- estradiol - â diol) and human chorionic gonadotrophin @ 250mg and 50 I.U./Kg body weight respectively at 60 days intervals for the acceleration of gonadal maturation. Gonadal development of the broodstocks was monitored through live biopsy at 90 days intervals.

288. **Nandakumar, G. and R.V. Nair.** 1974. On a new prawn ground in the Gulf of Mannar. *Indian J.Fish.,*21(1):281-284.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Since the beginning of the last decade, systematic exploratory surveys to assess the fishery potential of the offshore regions of the Gulf of Mannar were undertaken by the Deep Sea Fishing Station, Government of India and the Indo-Norwegian Project from Tuticorin and Mandapam bases respectively. The results of these surveys have revealed certain productive fishing areas for fish and prawns (Rao, 1968; Rao and Dorairaj, 1969; James and Adolf, 1969). Encouraged by these results, entrepreneurs came forward to undertake offshore fishing on a commercial scale and at present there are about 250 mechanised boats regularly engaged in trawl fishing in the Gulf of Mannar and Palk Bay, with Mandapam, Pamban and Rameswaram as their bases of operation.

289. **Narayana Pillai, V.** 2000. *Bivalve mariculture in India* (Pearl oyster, edible mussel and oyster): A success story in coastal ecosystem development. Asia Pacific Association of Agricultural Research Institute, FAO office in India. New Delhi, 102 pp.

Address : Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Pearl is one of the oldest of the known gems, produced by the living animal called the pearl oyster. India is well known for the production of natural pearls from time immemorial. There are recorded historical evidences that the country had exported this valuable merchandise to Greece and Rome more than 2000 years ago. India has a wealth

of pearl producing oysters the *Pinctada fucata* distributed in the Gulf of Mannar, Palk Bay and Gulf of Kutch and the blacklip pearl oyster, *P. margaritifera* in the Andaman and Nicobar islands.

290. **Natarajan, A.V.** 1957. Studies on the egg masses and larval development of some *prosobranchs* from the Gulf of Mannar and the Palk Bay. *Proc. Indian Acad. Sci.,* 46B: 170-228.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: In recent years our knowledge of the eggs and larvae of marine gastropods has increased considerably. The investigations of Lebour (1937) and Thorson (1946) have added much to our knowledge of the eggs and larvae of *prosobranchs* from Plymouth and Danish waters. Francis (1948) investigations at Algiers and Banyuls supplement at many points the work of Lebour and Thorson. The breeding habits of this group of molluscs at Bermuda as well as in East Greenland and Iceland have also been studied by Lebour (1945) and Thorson (1935, 1941).

291. **Natarajan, P., K. Ramadoss, D. Sivalingam and P. Thillairajan.** 1988. Ornamental shell industry of Ramanathapuram coast. *CMFRI Bulletin,* 42(1): 106-110.

Address: Central Marine Fisheries Research Institute, Tuticorin - 628 001, Tamilnadu, India.

Abstract: As many as twelve shell craft industries established at Keelakarai and Rameswaram cater to the demand of the internal and external market of ornamental shells in India and abroad. Several species of molluscan shells which occur in the Gulf of Mannar and Palk Bay constitute the raw materials for these industries. Apart from very rare species, 15 important species are regularly exploited for this purpose. The Genus *Lambis* commonly known as 'Spider conch' is very important among them by virtue of its abundance. Of the 9 species of *Lambis* known from India, only 3 species are abundant in this coast. Exploitation of these shells are mostly by skin diving and to a limited extent by trawl, gill and drag nets employed mainly to catch finfishes, lobsters and crabs. This paper mainly deals with the ornamental curious and religious values of molluscan shells their industry, types of shells and species used by the industry, varied products, marketing, employment opportunities and certain aspects of costs and earning of the industry.

292. **Natpratcha, P. and V.L.C. Pieterz.** 1986. Attempts to stimulate development activities in fishing communities of Adirampattinam, India. *Rep. Bay Bengal Programme*, (25): p.13.

Abstract : The paper discusses the rationale, modus operand, conduct and outcome of a pilot project to help the development of coastal fishing communities near Adirampattinam, Tamil Nadu, India. In the main, the project tried to improve the access of fishermen and fisherwomen to bank loans and Government credit schemes; and organized leadership training courses to promote leadership and group action. The project's main goals are to develop, demonstrate and promote appropriate technologies and methodologies to improve the conditions of small scale fisher folk in BOBP's member countries.

293. **NEERI.** 2004. Environmental impact assessment for proposed Sethusamudram Ship Channel Project. In: http://sethusamudram.gov.in/EIA.asp

294. **NEERI.** 2004. Executive summary, Technical feasibility of proposed Sethusamudram Channel, NEERI July 2004.

295. **Neethiselvan, N., V.K. Venkataramani, R.K. Ramkumar.** 2002. Maturation and spawning of the Palk Bay squid *Sepioteuthis lessoniana* (lesson) at Thoothukkudi waters, South-east coast of India. *Cheiron*, Madras, 31(1&2): 60-62.

Address : Fisheries College and Research Inst, Thoothukkudi-628 008.

296. **Neethiselvan, N. and V.K. Venkataramani.** 2003. Population dynamics and stock assessment of Indian white squid *Loligo duvauceli* (Orbigny) in Thoothukkudi waters, southeast coast of India. Cheiron, Madras 2003, 32 (5-6), 115-119.

Address : Fishing Technology and Fisheries Engineering Department, Fisheries College and Research Institute, Thoothukkudi - 628 001.

297. **Nityananda, N., A.K. Agarwal and B.P. Singh.** 1977. Induction at short periods in the horizontal field variations in the Indian peninsula. *Physics of the Earth and Planetary Interiors*, 15(1): 5-9.

Address : Indian Institute of Geomagnetism, Colaba, Bombay 400005, India.

Abstract : A study of the horizontal components of certain short-period magnetic-fluctuation events, viz., storm sudden commencements and bays, shows appreciable anomalies at two of the five magnetic observatories in peninsular India. The electric current patterns deduced from the magnetic horizontal induced variations imply channelling of induced currents through the Palk Straits and around the southern tip of the Indian peninsula. An interesting feature of these anomalies is that while the induced magnetic vertical variations are strongly correlated with the horizontal northward magnetic field, the electric current concentrations flow parallel to the coast; southwest, near Annamalainagar, and north near Trivandrum. The observations are interpreted in terms of a regional, east-west, induced electric current pattern which is perturbed in the vicinity of the two observatories by the Indian peninsula.

298. **Nithyanandan, M.** 2003. Sea cucumbers: A resource in peril. Indiscriminate fishing of sea cucumbers in Indian seas has led to their overexploitation, *Samudra,* p. 24-26.

Address : La Ala Al Kuwait Real Estate Co., K.S.C., Al Khiran Pearl City Project, Souk Al Kuwait Building, office No. 613, Post Box No # 22964, Kuwait Code- 13090. Email: nandan.ocean@gmail.com.

Abstract : Sea cucumbers or Holothurians are an interesting group of marine invertebrates under the phylum Echinodermata. They are worm-like animals with exuberant colour, inhabiting a variety of marine habitats like mud flats, sand flats, seagrass beds, coral reefs and abyssal plains. They are bestowed with the power of regeneration and are capable of

growing into two separate individuals if cut into two equal halves. Ecologically, sea cucumbers are very important as 'bioturbators' reworking the grain size of the substratum and releasing nutrients from the substratum into the seawater. Sea cucumbers, by their repeated digging action, aerate the substratum.

P

299. **Pajot, G and J. Crockett.** 1980. Fishing trials with high opening trawls in Palk Bay, TN. In: *Working Papers* - BOBP/WP/10.

Address : Fishing Technologist; Bay of Bengal Programme, Development of Small-Scale Fisheries in the Bay of Bengal Madras, India.

Abstract : The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

300. **Pajot, G., J. Crockett, S. Pandurangan and P.V. Ramamoorthy.** 1982. Further trials of mechanised trawling for food fish in Tamil Nadu. FAO/SIDA. *Programme of Small - Scale Fish. Bay of Bengal, Madras (India)*. FAO, SIDA. 28 pp.

Address: FAO/SIDA, Bay of Bengal Programme, Madras, Tamilnadu, India.

Abstract: The aims, scope and results of experiments conducted with high-opening bottom trawls in Palk Bay, Gulf of Mannar and off the Coromandel Coast from July 1980 to May 1981 are described. The trials were designed to: 1) locate suitable fishing grounds in different geographical areas; 2) further development and adapt fishing gear (trawls) and methods to specific identified resources and fishing conditions: 3) construct demonstrations and provide in-service training for counterparts, net-makers and fishermen in the design, construction and use of fishing gear, equipment and methods and 4) further development of simple equipment and arrangements to improve fishing operations and gear handling with respect to efficiency, safety and comfort.

301. **Palanichamy, S and A. Rajendran.** 2000. Heavy metal concentrations in seawater and sediments of Gulf of Mannar and Palk Bay, southeast coast of India. *Indian J. Mar. Sci.,* 29(2): 116-119.

Address: Offshore Platform, Central Electro Chemical Research Institute, Tuticorin 628 004, Tamilnadu, India.

Abstract: An investigation was carried out to delineate the levels of heavy metals both in the seawater and sediments from the Gulf of Mannar and Palk Bay. The data, obtained during the year 1995 revealed that Cd could not be detected in the waters of Kanyakumari. However, at other stations the levels of Cd were in the order of Arumuganeri>Tuticorin>Thondi> Mandapam. In contrast, Pb levels were found to be maximum at Kanyakumari and minimum at Arumuganeri, while Hg was found to be maximum at Arumuganeri and minimum at Mandapam. Cd levels were found to decrease towards sea from the coast at Tuticorin. However no definite trend was observed at Mandapam and Thondi. Unlike Cd, Pb showed seaward increasing trend at Thondi transect. However, no definite trend was evident for other transects as seen for Cd. Bottom waters showed higher concentration of Cd and Pb as compared to those in surface water. Hg did

not show any trend in its distribution. Data on sediments showed that Cd registered maximum levels at Arumuganeri (4.33 ppm) while Kanyakumari exhibited the minimum (0.4 ppm). Similarly the levels of Pb were found to be minimum (1.15 ppm) at Kanyakumari. In conclusion, among the transects studied, Arumuganeri appeared to be polluted.

302. **Palraj, S and G. Venkatachari.** 2002. The influence of biospecies on the corrosion of zinc in Palk Bay waters. *Bulletin of Electrochemistry,* 18(5): 215-217.

Address : Central Electrochemical Research Institute, Karaikudi, India.

Abstract: Influence of macrofouling organisms on the corrosion behaviour of zinc has been studied for a year in Palk Bay waters. Algae, bryozoans and polychaete worms were the dominant species on zinc panels throughout the year. The surface coverage was 100% after one year exposure where dense mat of algae was observed. It indicated that toxicity of zinc on algae was least in Palk Bay Waters. The reason is discussed with product analysis by XRD. The weight loss data indicated that zinc had an annual corrosion rate of 6 mdd and biofouling rate of 0.38 Kg.m-2year-1. The relationship between biofouling and corrosion is discussed with biological and chemical characteristics of Palk Bay.

303. **Palraj, S., G. Venkatachari, and G. Subramanian.** 2002. Bio-fouling and corrosion characteristics of 60/40 brass in Mandapam waters. *Anti-Corrosion Methods and Materials*, 49(3): 194-198.

Address: Central Electro Chemical Research Institute, Karaikudi, Tamilnadu, India.

Abstract: The bio-fouling and corrosion characteristics of 60/40 brass were investigated in the Palk Bay waters of the Mandapan coast, India, over a period of a year. The experimental methods included corrosion rate by weight loss measurement and analysis of the corrosion product by X-ray diffraction. The biofouling characteristics of 60/40 brass were studied in terms of seasonality of recruitment of organisms and quantification of the fouling community development pattern. The XRD analysis of the products on brass threw more light on the protective nature of the compounds formed and their impact on the overall corrosion rate of the material. The organisms found in fouling deposits on brass included algae, bryozoans and hydroids. The results of the study are discussed in the light of the seawater characteristics and monsoon effects.

304. **Pant, P.S., A.R. Ramakrishnan and R. Jambunathan.** 1980. Cyclones and depressions over the Indian seas in 1977. *Mausam*, 31(3): 343-344.

305. **Parthasarathy, N., K. Ravikumar, R. Ganesan and K. Ramamurthy.** 1991. Distribution of seagrasses along the coast of Tamil Nadu, Southern India. *Aquat. Bot.,* 40(2): 145-153.

Address: Salim Ali School of Ecology, Pondicherry University, P.O. Box 154, Pondicherry 605 001, India.

Abstract: Twelve species of seagrasses are recorded in a survey of Tamil Nadu, southern India. Of the 38 stations studied, species diversity is high in the Gulf of Mannar and Palk Bay, while it is low in the Bay of Bengal. A note on the flowering and fruiting of the

species is provided. Further ecological observations on the nature of the substratum, the extent of biotic pressure on seagrass beds and the local use of seagrasses are presented.

306. **Pati, S.** 1980. Observations on the hydrography and inshore plankton of the bay of Bengal of Balasore. *Hydrobiologia*, 70(1&2): 123-132.

Abstract : The hydrographical features and the inshore plankton of the northern part of the Bay of Bengal was studied from the Balasore coast. The hydrology is mainly governed by the monsoons and river systems flowing into the bay. The surface temperature showed a bimodal pattern with a summer and autumn maximum. The salinity was below the oceanic average with the lowest value during October. The coastal water was found to be rich in nutrients, with peak values during the southwest monsoon. Three phytoplankton blooms followed by zooplankton maxima were observed between early spring and late fall.

307. **Patterson Edward, J.K., A. Murugan and K. Ayyakkannu.** 1994. Landing data and meat trade with *Chicoreus ramosus* and *Pleuroploca trapezium* in the Gulf of Mannar and Palk Bay, southeast coast of India. *IV Workshop of the Tropical Marine Mollusc Programme* (TMMP), Phuket (Thailand), 27th Oct to 2nd Nov 1993. *Spec. Publ. Phuket Mar. Biol. Cent.,* 13: 37-42.

Address: Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamilnadu, India.

Abstract: Monthly surveys were carried out at coastal villages of the Gulf of Mannar and the Palk Bay, on the southeastern coast of India. Sixteen potential landing centres were identified, 12 in Gulf of Mannar region and 4 in the Palk Bay region. The average monthly landings at all the 16 landing centres were calculated. The *Chicoreus ramosus* and *Pleuroploca trapezium* fishery is mainly associated with lobster fishery. Monsoon winds (northeast and southwest) influence these fisheries and hence the fishing season differs from one center to another. The export value of the meat of these 2 gastropods has attracted the attention of the fisher folk and it has emerged as an additional source of income for them. In addition to the fishermen involved in fishing these gastropods, there are about 60 other persons engaged in the gastropod meat trade. The mode of their activity and the problems of the trade are discussed.

308. **Patterson Edward, J.K and K. Ayyakkannu.** 1996. Changes in natural coastal systems in the Gulf of Mannar and the Palk Bay, southeast coast of India with particular emphasis on coral reef ecosystem. *Conference on Coastal Change, BORDOMER 95. Proceedings jointly organized by the Intergovernmental Oceanographic Commission of UNESCO and BORDOMER Organization*, France, Bordeaux, France, 10-16 February,1995 (ed.) E. Duursma. UNESCO, Paris-France. 105: 402-406.

Address: Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai - 608 502, Tamilnadu, India.

Abstract: A coral reef ecosystem is a habitat extremely conducive to different species, with abundance of economically important bilological resources like finfishes, shell

fishes, seaweeds etc. Coral acts as a natural barrier against sea erosion. There are about 20 coral Islands in the Gulf of Mannar region of the Southeast coast of India, covering about 683 hectares from Mandapam to Tuticorin. This fragile ecosystem is under severe threat due to the indiscriminate anthropogenic effects such as pollution, mining, aquaculture, fishing and tourism. Efforts to conserve this ecosystem for proper utilization have already been initiated by various Government and research organizations. Coral reefs, the most conspicuous of marine habitats, are important in terms of productivity and diversity. It cannot be denied that coral reef habitats are the marine ecosystem richest in species and are responsible for creating a part of the coastal ecosystem. Though coral reef ecosystems are found in different places in the southeastern coast of India, the ecologically and economically valuable coral reefs are found in the Palk Bay and the Gulf of Mannar region. The region between Rameswaram and Kanyakumari along the mainland coast to a distance of about 170 nautical miles is included in the Gulf of Mannar region. This Gulf is part of the southward extension of the Bay of Bengal as it meets the Indian Ocean. It consists of 20 small Islands situated between lat. 8° 46' and 9° 14' N and long. 78° 9' and 79° 41' E, each about 5 km^2 in area. The present day patch reefs are a secondary formation, resulting in the emergence of contemporary reefs and Islands. The corals of the Gulf of Mannar are more diverse and abundant than those of the Palk Bay (Pillai, 1971). The Palk Bay has lagoons of depth ranging from 1.0 to 2.0 m but they are generally devoid of coral except for a single reef. The seas are turbulent in the Palk Bay. Turbid waters from September to May and the siltation have a greater effect on the corals in the inshore areas of Palk Bay than in the Gulf of Mannar. There are 120 species (33 genera) of the fringing and patch coral reefs in the Gulf of Mannar and Palk Bay region. Of these, 110 species are hermatypic and 10 ahermatypic corals (Pillai 1971). The conspicuous species of the corals belong to the family *Acroporidae* (*Acropora, Astreopora* and *Montipora*). *Montipora* and *Acropora* put together constitute 39% of the total species recorded. Species belonging to *Poritidae* and *Faviidae* constitute the dominant reef builders here (Pillai 1971). There is scope for sustained income through the exploitation of natural resources in any ecosystem in order to fulfil our requirements, it is essential that attention should be focused on any particular ecosystem with a view of its utilization for a longer time without destroying it. Looking at the Palk Bay and Gulf of Mannar coral reef ecosystem, one can understand the ruthless destruction of that habitat by human activity.

309. **Prabhakaran, S and N. Ganesh.** 2000. Depositional environment and petroleum habitat of cretaceous reservoirs in southern Nagapattinam sub-basin, Cauvery Basin, India. 2000 AAPG International Conference and Exhibition. American Association of Petroleum Geologists.

Address : Oil And Natural Gas Corporation Ltd, SRBC, CMDA Building, Egmore, Chennai, Tamilnadu, 600 008, India, fax: 91-44-8534088, ongc.madras@gems.vsnl.net.in.

Abstract : Hydrocarbon occurrences in southern part of Nagapattinam basin are within Palk Bay Formation (Turonian and older) and Nannilam Formation (Santonian to Maastrichtian). Contrasting style of provenance, sand dispersal and tectonics are discussed, for these two formations. In contrast to earlier models, it is established that the Palk Bay Formation sediments are attributed to have been dispersed from Srilankan-

Vedaranyam massif from South, Southwest and reservoir sands were deposited in a shallow marine environment as coastal beaches, beach dune/bar and tidal channels during Cenomanian transgression which covered from North to South. Consequent upon a regional tilt Nannilam Formation was deposited from a Westerly provenance. The reservoirs are within wave dominated delta comprising of transgressive bars and tidal channels. Basinal tilt is envisaged to be towards North during Palk Bay Formation and East during Nannilam Formation which is a shift from the earlier concept of gradual easterly tilt. Hydrocarbon entrapment in Palk Bay Formation is observed to be strati-structural and diagenetic, with bigger pools in north and smaller pools in South, whereas in Nannliam Formation accumulation is structural with smaller pools to the North. The prospective reservoirs are within Palk Bay Formation in Northwest to Southeasterly elongation with narrow width.

310. **Prabhu, M.S.** 1954. The perch fishery by special traps in the area around Mandapam in the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 1(1&2): 94-129.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: An account of the perch-fishery by special traps and the different methods of operating them in the Gulf of Mannar and Palk Bay around Mandapam are given. Among the 23 species of fishes caught in perch-traps, only 18 species were true perches. From a study of the percentage composition of the different species caught in perch-traps, *Lethrinus cinereus* was found to be the main species occurring in the catches from both the areas and the second important species *Callyodon ghobban* in the catches from Gulf of Mannar was found to be replaced by *Teuthis marmorata* in Palk Bay. The percentage of non-perches in the traps in the Gulf of Mannar catches was 26.28; *C. ghobban*, a non-perch, alone forming 25.98%, whereas in Palk Bay catches it was only 0.36 corresponding to 0.3% excluding *C. ghobban* from Gulf of Mannar.

311. **Prakash Chauhan, Sailesh Nayak, R. Ramesh, R. Krishnamoorthy, S. Ramachandran.** 1996. Remote Sensing of Suspended Sediments along the Tamil Nadu Coastal Waters. *Photonirvachak*, 24(2): 105-114.

312. **Prasanna Varma, R.** 1959. Studies on the succession of marine algae on a fresh substratum in Palk Bay. *Proc. Indian Acad. Sci.,* 49B : 245-263.

Abstract : The growth and succession of marine algae on a fresh substratum in the inter – tidal zone in Palk Bay. The study of chosen place is at a distance of 76.2 meters from the mean shore line. The average water level at low tide and high tide were 1.37 meters and 1.82 meters respectively. The sandy substratum of about 10 meters from the experimental spot towards the shore, has a dominance of corals, mostly dead ones, towards the left of the spot the shore is sandy clay. But a small channel about 400 meters from the mean shore line, the Bay experimental area is more or less uniformly shallow one.

313. **Prasanna Varma, R and K. Krishna Rao.** 1964. Algal resources of Pamban area. *Indian J. Fish.,* 9(1): 205-211.

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314. **Qasim, S.Z., P.M.A. Bhattathiri and V.P. Devassy.** 1972. The influence of salinity on the rate of photosynthesis and abundance of some tropical phytoplankton. *Mar. Biol.*, 12(3): 200-206.

Address : Biological Oceanography Division, National Institute of Oceanography, Cochin, India and Central Marine Fisheries Research Institute, Cochin-11, India.

Abstract : Several species of phytoplankton were grown in unialgal, but not bacteria-free, cultures. These clones when exposed to varying salinities, from 5 to 35, showed a marked increase in their rates of photosynthesis at low salinities. The optimum requirement of salinity, however, varied in different species. Observations on the relative abundance of phytoplankton in an estuary, where the salinity changes were fairly large, confirmed that, within limits, waters with low salinities support a greater abundance of phytoplankton in nature. The wide adaptability of phytoplankton to changes in salinity corresponds to the conditions brought about by the monsoon system along the southwest coast of India, where large dilutions are associated with the enrichment of water with nutrients.

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315. **Radhakrishnan Nair, P.N and M. Badrudeen.** 1975. On the occurrence of the soft-shelled turtle, *Pelochelys bibroni* (Owen) in the marine environment. *Indian J. Fish*., 22(1&2): 270-274.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: A soft-shelled turtle, *P. bibroni*, caught alive from Palk Bay a new record from the southern part of Indian peninsula - proves beyond doubt that the species can tolerate the marine environment, as against the belief that it is purely a freshwater form. The behaviour of the animal was studied keeping it under captivity for 14 days. The taxonomic details and the distributional record of the species are given.

316. **Radhakrishnan Nair, P.N., K.K. Appukuttan and C.S. Gopinadha Pillai.** 1976. New horizon in marine products export exquisite handicrafts from shells & corals. *Seafood Export J.,* 8(9): 11-19.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The demand for polished shells and handicrafts there of, at home and abroad, was an incentive to many entrepreneurs in South India especially in Ramnathapuram District in Tamilnadu, to start cottage industries producing beautiful curios and several utilitarian objects with molluscan shells. *Dentalium* is collected from the intertidal zones of Palk Bay and Gulf of Mannar for making toys and models. Details about the ornaments from molluscan shells are given.

317. **Radhakrishnan Nair, P.N.** 1982. Diurnal variation in the feeding habits of *Dussumieria acuta* Val. from the Gulf of Mannar and the Palk Bay. *J. Mar. Biol. Assoc. India,* 24(1&2): 112-117.

Address: Central Marine Fisheries Research Institute, Vizhinjam, Kerala, India.

Abstract: A distinct variation in the feeding intensity was noticed in *Dussumieria acuta* between the day and night. This was due to the diurnal variation in the feeding habits of this fish, feeding actively during day time and starving during the night. The study over a period of two years in 1969-70 and 1970-71 showed that in day samples only 6.05% fish during the first year and 2.57% fish during the second year were with empty stomachs, whereas in the night samples 98.33% during the first year and 98.16% during the second year were either with empty or with “little” stomachs.

318. **Radhakrishnan Nair, P.N.** 1991. The age and growth rate of rainbow sardine *Dussumieria acuta* from Mandapam area and its age group composition in the fishery. *J. Mar. Biol. Assoc. India,* 33(1&2): 229-240.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract : The age and growth rate of *Dussumieria acuta* of the Gulf of Mannar and the

Palk Bay, during April 1969 to March 1971 was studied. According to the Peterson's method of length frequency analysis the fish grows to a total length of 73 mm, 95.5 mm and 113 mm at the end of 1st, 2nd and 3rd quarters of and year and to 128 mm at the end of 1st year, resulting in an average growth rate of 10.75 mm per month. Results of the Probability Plot technique of Cassie (1954) applied to the data, showed perfect agreement with those of Peterson's method. Von Bertalanffy's growth equation was fitted and the estimated values of the growth parameters were: L_8 = 191 mm, K = 0.20701 and t_0 = -1.34 quarters. Theoretically the fish grows to a length of 128.05 mm, 163.28 mm and 178.91 mm at the end of 1st, 2nd and 3rd years. No growth rings were traceable on the otoliths, but a straight-line relationship could be noticed between the lengths of otolith and the fish. The growth by weight showed that the optimum age for exploitation of *D. acuta* is when the fish is 1 to 1 is equivalent years old. A study of the age composition of *D. acuta* in the commercial catches during 1969-71 showed that in the shore seine and the gill net catches 1-year group dominated, whereas in the trawl net catch the 0-year class dominated during 1969-70 and 1-year class during 1970-71.

319. **Radhakrishnan Ramesh.** 2006. Wake up Sri Lanka! Wake up now!! Sethusamudaram Risks West Coast to Future Tsunamis. In: http://www.recoverlanka.net/docs/Ignorance.pdf.

Address : Kanuvai, Coimbatore, Tamil Nadu, India.

Abstract : The Government of India (GoI) has cleared Sethusamudaram Project (SSCP) at a worst possible time. The whole of Palk Bay is reeling today, under an excessive stress caused by the December 26th tsunami. Most of its biotic and physical resources remain challenged partially or fully by the tsunami. However, the Ministry of Shipping has decided to start the dredging work for the canal in three weeks time from now. The work would begin in Palk Strait - a place, least studied by the dredgers or by the organization that had prepared the SSCP technical feasibility report. The estimated quantity to be dredged would be 12 to 13 million cubic meters initially. This is 22 to 26% of the dredging work estimated for the Palk Strait area or 13.6 to 16 % of the dredging work estimated for the whole project. That means that the first one seventh of the work would be initiated within the next 20 days.

320. **Radhkrishnan, N.** 1957. A contribution to the biology of Indian sand whiting *Sillago sihama* (Forskal). *Indian J. Fish.,* 4(1&2): 254-283.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The Indian Sand Whiting, belonging to the family *Sillaginidae* (Order *Percomorphoidea*), is of some importance to the coastal and estuarine fisheries of India. Very little detailed study of this fish seems to have been made, except for a short account of its food and feeding habits by Chacko (1949), notes on the larval and post-larval stages by Gopinath (1942, 1946), general notes by Devanesan and Chidambaram (1948), and observations on the eggs and larvae by Chacko (1950). Cleland (1947) has given an account of three Indian species, *Sillago sihama, Sillago panijus* and *Sillago maculata,* the first constitutes by far the largest element in the commercial catches around Mandapam

and Rameswaram Island in the Gulf of Mannar and Palk Bay. A detailed study of the biology of the commonest species was therefore taken up in September 1953 at the suggestion of Dr. N.K. Panikkar, the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam Camp, and a note, forming part of the work, has already been published (Radhakrishnan, 1954).

321. **Raghu Prasad, R.** 1953. Swarming of Noctiluca in the Palk Bay and its effect on the "Choodai fishery" with a note on the possible use of *Noctiluca* as on indicator species. *Proc. Indian. Acad. Sci.,* 40: 49-57.

322. **Raghu Prasad, R.** 1954. Hydromedusae of the Gulf of Mannar and Palk Bay near Mandapam. *Proc. Indian Sci. Congr., (41st Sess):* 170.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

323. **Raghu Prasad, R. 1956.** Further studies on the plankton of the inshore waters of Mandapam. *Indian J. Fish.,* 3(1&2): 1-42.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: A comparative study of the intensity, distribution and fluctuations of plankton at two inshore stations G and P in the Gulf of Mannar and the Palk Bay respectively, was made. 261 Samples, 90 from Station G and 171 from Station P, collected during July 1951 to June 1953, formed the material for this study. The fluctuations in the net plankton volume from month to month were greater at Station G than at Station P and during several months a relatively higher standing crop of plankton was recorded at the latter station. The phytoplankton cycles at Stations G and P showed distinct differences and further, the magnitude of phytoplankton population in several months as well as the total annual production, as judged from the standing crop, was distinctly higher at Station P. The abundance and succession of many species of diatoms showed some degree of annual variation, but a few species exhibited extreme fluctuations. One such interesting example is that of *Rhizosolenia alata* and *R. imbricata* which were noticed to cause local blooms in March 1950 and February 1951 respectively. In 1952 and 1953, although there were blooms of diatoms in the Gulf of Mannar, they were not caused by a single species as in 1950 and 1951 and further numbers during January – February 1952.

324. **Raghu Prasad, R and K.N.K. Kartha.** 1959. A note on the breeding of copepods and its relation to diatom cycle. *J. Mar. Biol. Assoc. India,* 1(1): 77-84.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The breeding of copepods in the Gulf of Mannar and Palk Bay has been discussed. The maximum breeding in the Gulf takes place during September-March, whereas in Palk Bay it is from May-September. The difference in the intensity of breeding at the two regions is more apparent than real and the possible reasons for the observed

differences are discussed. The species of copepods breeding during these periods at the two regions are different. The close relation between breeding of copepods and the diatom cycles of the two regions is discussed and it is observed that in both the areas breeding, to a very large extent, is dependent on the diatom cycle.

325. **Raghu Prasad, R and P.V. Ramachandran Nair.** 1960. Observations on the distribution and occurrence of diatoms in the inshore waters of the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 7(1&2): 49-68.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Forty-nine out of the fifty-one species of diatoms occurring commonly in the plankton of Mandapam area have been classified into bio-geographical groups and the general character of the diatom flora of the Gulf of Mannar and Palk Bay is described. The seasonal variations and periodicities exhibited by fifteen species, which are well-represented in the plankton have been compared for both the places. It is found that the biological spring falls in May and the 'autumnal maximum' occurs in October or November. Most of these species are forms with spring maxima but which remain more or less important throughout the season while a few are with distinct spring and autumn maxima. The data suggest that Palk Bay is having a larger breeding stock of autochthonous diatoms, which are mostly neritic, whereas in the Gulf of Mannar there are more oceanic diatoms. The validity of the existing bio-geographical grouping of some of the species of diatoms and the necessity of widening the concept of species habits and habitats are mentioned in the light of the available data.

326. **Raghuram, K.P and K. Venkataraman.** 2003. Staghorn corals of Gulf of Mannar. *Nat. Sem. Reef Ecosystem Remediation,* 24th –26th Sep'03, SDMRI, Tuticorin, India*,* p33.

Address: Marine Biological Station, Zoological Survey of India, 130, Santhome High Road, Chennai-600 028, Tamilnadu, India.

Abstract: Gulf of Mannar is one of the four major coral reef areas in India and is famous for its rich marine biodiversity. Till today 208 species under 60 genera and 15 families of scleractinian (hermatypic) corals have been reported from India of which 82 species under 13 genera are from Gulf of Mannar Biosphere Reserve (GoMBR). Among the hermatypic corals the genus *Acropora* (possessing axial corallite and distinct radial corallites) is the largest genus among all scleractinian corals with 170 species worldwide (Wallace, 1999), of which 47 are from the reefs of India. In GoMBR, 13 species are recorded, in other reef areas such as Gulf of Kachchh(1) and Lakshadweep (14). Andaman and Nicobar Islands however, have rich diversity of the *Acropora* species (42) than the other reef areas of India. Pillai (1983) reported 12 species of *Acropora* from the south east coast of India (GoMBR and Palk Bay). The present report deals with five new records of the species of *Acropora* of which one species is new record to India collected during 1998-2003 from different islands of GoMBR.

327. **Rajagopalan, M.** 1997. Present Status of Sea Turtles and their Conservation in India. In: *Bioethics in India: Proceedings of the International Bioethics Workshop in Madras*:

Biomanagement of Biogeoresources, 16-19 Jan. 1997, University of Madras; Editors: Jayapaul Azariah, Hilda Azariah, & Darryl R.J. Macer, Copyright Eubios Ethics Institute 1997.

Address : Madras Research Centre, Central Marine Fisheries, Research Institute, 68/1, Greams Road, Chennai-600 006.

Abstract : Sea turtles have very long geologic history, the present day species having evolved in the early Ecocene epoch to the Pleistocene, 10 to 60 million years BC. Sea turtles occur all along the coast of India including the Lakshadweep and Andaman and Nicobar Islands. As the turtle population is endangered, great interest is now focused on the study of sea turtles to develop proper conservation and management measures. Five species of sea turtles inhabit the Indian water for feeding and breeding purposes. They are the olive ridley, *Lepidochelys olivacea*, the green turtle, *Chelonia mydas*, loggerhead turtle *Caretta caretta*, the hawksbill *Eretmochelys imbricata* and the leatherback *Dermochelys coriacea*. All the five species are highly migratory and visit parts of our coast and Bay Islands for nesting during specific months. Very high concentration of the most common sea turtle in India waters, the olive ridley occurs during mass nesting period in Gahirmatha beach, Orissa during January to March every year. It is reported that 2,40,000 olive ridleys nest on an average every year in the Gahirmatha beach. The other four species nest periodically all along the Indian coast. All the five species of sea turtles are completely protected and included in the Wild Life (Protection) Act 1972, Schedule I. They are also been incorporated in the CITES. Capture and killing of sea turtles is an offense under the existing laws.

328. **Rajan, C.T.** 1963. On the Larval stages of *Solmundella bitentaculata* Browne. *J. Mar. Biol. Assoc. India,* 5(2): 314-316.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Solmundella bitentaculata* Browne (Order: Narcomedusa, Family: Aeginidae) is very widely distributed and has been recorded from the Indian waters by Menon (1932). *S. bitentaculata* of the tropical Atlantic and Pacific was originally described by Quoy and Gaimard as *Charybda bitentaculata* and subsequently by Haeckel as *Aeginella bitentaculata* and by Mass as *Solmundella (Aeginopsis) hensinii.* The development of *S. mediterranea* has been studied by Muller, Metschnikoff, Mass and Woltereck (Ref. Mayer, 1910). There is at present only very little information about the larval stages of *Solmundella bitentaculata.* While engaged in the quantitative determinations of planktonic animals, a series of larval stages of *S. bitentaculata* were collected. These samples were from two- four- and six-fathom lines of the inshore waters of Palk Bay during May 1960 to September 1962 and collected every week from the surface and bottom, the latter with the aid of a casella bottle. One litre of a well-stirred sub-sample was sedimented with formalin for 24 hours, the clear portion decanted and the remaining part centrifuged for about 15 minutes at 2000 rpm. Out of a total of 250 samples only 10 contained the larval stages, mostly during the months of August-September. Due to the paucity of occurrence of the various stages it was difficult to rear them in the laboratory. In this connection it would be worth

mentioning that the larvae have not so far been observed in similar plankton collections made from 5 stations in the Gulf of Mannar.

329. **Rajapandian, M.E and K.S. Sundaram.** 1967. A case of complete albinism in the marine Catfish *Tachysurus dussumieri* (Cuvier and valenciennes). *J. Mar. Biol. Assoc. India,* 9(1): 194-195.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: One specimen of the marine catfish, *Tachysurus dussumieri* (Cuvier and Valenciennes) exhibiting complete albinism was collected on board a purse seiner of the Indo-Norwegian Project, on 5th July 1966, off Mandapam in Palk Bay (Long. 79° 2' Lat. 9° 21') at a depth of 5 fathoms. On removal from the net it was immediately transferred to a drum containing seawater, but it did not survive. Since this is the first instance of albinism recorded in *T. dussumieri,* particulars regarding the same are given.

330. **Rajasimhan, T.E.** 2005. A canal that's more than a waterway. *The Hindu* Business line dated 02nd Jul. 05.

Abstract : The project has been under demand by various cross-sections of the society, including maritime industry, public and administrators. According to a report prepared by L&T Ramboll, between 1860 and 1922, as many as nine proposals were formulated for cutting a canal across the narrow strip of land mostly through the Rameswaram island to connect the Gulf of Mannar with Palk Bay.

331. **Rajasuriya, A and A. Premaratne.** 2000. Seas at the Millennium: An environmental evaluation. In: *Regional Chapters: The Indian Ocean to the Pacific,* 64: 175-187. Charles Sheppard (ed), Elsevier Science Ltd, Oxford, England.

Abstract : The chapter deals with Palk strait, climate, geography, fisheries, currents, lagoon, lagoon algae, marine mammal, pollution, industrial impact, ecology, conservation, management, mangrove, shrimp farming, seagrass, dugong, dolphin, whale, sea turtle, coral reef, mineral resources, fisheries industry, fish production, ornamental fisheries, chank fishery, sea cucumber fishery, coastal environment, coastal erosion, marine pollution, agricultural waste, coral mining and coastal protection.

332. **Raju, A.** 2000. Fish and fisheries of Gulf of Mannar. *Golden Jubilee Celebrations, Souvenir 2000, Mandapam R.C. of CMFRI, Mandapam Camp,* pp. 44-46.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: India has an extensive coastline length of 7,150 km. The Gulf of Mannar region occupies the southeast coast of India (Latitude-8° 55'-9°15'N Longitude- 78°-79°16'E). The entire coastline of Gulf of Mannar from Thoothukudi to Dhanuskodi is sheltered from the fury of wind and waves by the existance of a chain of Islands or sand clays. The Island system and coral reefs spread over this region offer shelter for a variety of marine

fauna and flora. Both mechanized trawlers and non-mechanised vessels carry out fishing throughout the year. But the shore seine fishing is seasonal in certain areas particularly in the southern region, When the Gulf of Mannar covering its southern portion becomes rough during April to September, the shore seine operations shift to Palk Bay and when the Palk Bay becomes rough during October to March, the units migrate to Gulf of Mannar. There are eight trawl fish landing centres such as Pamban (Therkuvadi), Mandapam (boat building yard), Keelakarai, Ervadi, Valinokkam, Mundhal, Vembar and Thoothukudi.

333. **Raju, A., C. Kasinathan, N. Ramamoorthy and P. Villan.** 2004. On the stranding of sea cow, *Dugong dugon* at Mandapam along the Gulf of Mannar coast. *Mar. Fish. Infor. Serv., T&E Ser.,* 181: 11-12.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: In the seas around India, sea cows are distributed in the Gulf of Mannar, Palk Bay, Gulf of Kutch and Andaman islands. On 18.9.2003, a dead male sea cow *Dugong dugon* (Muller) measuring 194 cm in total length and about 125kg in weight was stranded along the Gulf of Mannar coast at Mandapam, Tamil Nadu. The animal had extreme wounds in the posterior side of body and a part of alimentary canal was found protruded outside the body near the genital region. It appeared that the injury might have been caused by a propeller of inboard engine vallam operating in the near shore waters. The morphometric measurements of specimen are given.

334. **Ramachandra Nair, P.V.** 1960. On two diatoms from the inshore waters of Palk Bay. *J. Mar. Biol. Assoc. India,* 2(2): 196-198.

Address : Central Marine Fisheries research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : Observations on the occurrence and distribution of diatoms at station P in Palk Bay have been made systematically since 1951 (Prasad, 1956). In 1957 March, two species of diatoms were noticed for the first time in the routine plankton collections. On detailed examination they were found to belong to the genera Stictocyclus (*Family Eupodiscaceae*) and Ceratulus (*Family Biddulphiaceae*). Since theses two species are new records from the Indian coast and taxonomic account of them together with some remarks on their occurrence was discussed.

335. **Ramachandran Nair, P.V., Sydney Samuel, K.J. Joseph and V.K. Balachandran.** 1973. Primary production and potential fishery resources in the seas around India. *Proc. Symp. Living resources of seas around India,* 184-198.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The paper deals with an account of the results of investigations on primary production using oxygen and ^{14}C techniques in the Gulf of Mannar, Palk Bay and the west coast of India. These together with the data of *GALATHEA* and International Indian Ocean Expeditions have been used to estimate the productivity of the different regions.

It is found that the maximum production is towards the coast within 50 meters depth and gradually decreases seaward. The mean value over the shelf on the west coast is 1.19 g C/m^2/day for <50 meters, yield as the ratio of carbon production is 1.7 million tonnes. On the east coast, the average for the shelf is 0.43 g C/m^2/day for <50-200 meters and 0.18 g C/m^2/day for <200 meters. Based on this potential yield as the ratio of carbon production is 1.7 million tonnes. On the east coast, the average for the shelf is 0.63 g C/m^2/day and 0.14 g C/m^2/day outside the shelf, though very high rates of 2.0 g C/m^2/day are usually found in the shallow near shore regions of Gulf of Mannar and Palk Bay, the estimated yield from the east coast is over 0.6 million tonnes. Hence the potential resources over the entire shelf region of the west and east coasts of India together would be of the order of 2.5 to 3 times the present yield.

336. **Ramachandran, S.** 2000. Southeast India. *Seas at the millennium - An environmental evaluation*, 2: 161-173.

Address: Institute for Ocean Management, Anna University, Chennai - 600 025, Tamilnadu, India.

Abstract: The seas along the southeastern states of India, totalling approximately 1,860 km, are described in this chapter. Covering the States of Tamilnadu and Andhrapradesh, the ecologically important and distinctive sites are the Gulf of Mannar, Palk Bay, Vedaranyam, Pichavaram, Pulicat Lake, the Godavari-Krishna delta and the Coringa mangroves. Economically important areas and centres of industry include Tuticorin, Nagapattinam, Cuddalore, Chennai, Nighampattinam, Kakinada and Vishaghapatnam. The coastal population density is 20 to 600/km^2, and more than 9 million people live along these coastal areas. The major activities that cause degradation of coastal ecosystems in these areas are disposal of untreated domestic and industrial wastes, port and harbour activities, ocean traffic, exploration and exploitation of minerals, oil and gas, as well as natural hazards such as storm surges. Both coastal erosion and siltation of river mouths are major problems in some of these areas as well. Reduction of freshwater flow in the rivers due to the construction of dams for irrigation purposes has affected coastal ecosystems and the stability of coasts. The rapid development of activities and the increasing coastal population are threatening the health of seas and their resources. Fisheries have stagnated during the past five years and environmental degradation is evident through the reduction of biodiversity, loss of habitats, reduction in mangroves and by impacts on coral reefs. Community participation in integrated coastal zone management plans and strict implementation of those plans are required for the sustainable utilisation of marine resources and conservation of biodiversity.

337. **Ramadoss, V.** 2002. Studies on the Ecology and Biology of Butterflyfish *Chaetodon collare* in the Gulf of Mannar and Palk Bay. *Ph.D Thesis*, Madurai Kamaraj University, Madurai. 272 pp.

Address: Centre for Marine and Coastal Studies, School of Energy, Environment and Natural Resources, Madurai Kamaraj University, Madurai - 625 021, Tamilnadu, India.

Abstract: In the present study economically important and popularly known reef

associated butterflyfish, *Chaetodon collare*'s biology and ecology were studied. In a period of 2years from January 1996 to July 1997, 200 specimens of *C. collare* ranging from 30 to 122 mm were collected and studied. Morphology and biometric characters such as total length, standard length, and weight of the fishes were studied. The meristic characters of dorsal spines, anal spines, dorsal rays and anal rays were observed. The relationship between standard length and other morphometric characters revealed that the pre-anal length had the fastest growth and the slowest growth was observed in pre-orbital length and in the length of 2nd anal spine. Pre-dorsal length, depth of the body, head length, pelvic fin length, pectoral fin length, snout length, length of the 3rd dorsal spine, eye diameter, post-orbital length, inter orbital space and depth at caudal peduncle have exhibited growth rates in the descending order. Most of the Morphometric combinations (99 out of 105) showed more than 25% of positive correlation between the two optional factors and the statistical calculations of the correlation coefficients of all combinations showed significance at 5% level. A total of 1,520 fishes of both sexes were used to study the length weight relationship, which showed the value of the exponent 'n' as less than 3 in the parabolic equation and this was due to the deeply compressed nature of the body of *C. collare*. Gut content analysis was done using Index of Preponderance Method, which showed significant difference in the feeding habits of adults and juveniles. The study confirmed that the fishes were omnivorous during their adult and juvenile stages. Surface water temperature ranged from 26.2ºC to 32ºC. No major difference in pH values of surface water in the Gulf of Mannar (8.2) and Palk Bay (8.7) was observed. The same trend was recorded in salinity and dissolved oxygen concentrations of the surface waters of Gulf of Mannar (salinity 35.8 ppt and DO 7.7 ppm) and Palk Bay (salinity 35.3 ppt and DO 8.6 ppm). The level of dissolved nutrients such as phosphate, nitrate, nitrite, and silicate in the study locations were analyzed. The concentration of dissolved phosphate in the surface water of Gulf of Mannar was 10.67 ppb and in the Palk Bay it was 14 ppb. Similarly, the dissolved silicate in the Gulf of Mannar was 1.18ppm and the same in Palk Bay was 0.66 ppm. The concentration of dissolved nitrate in the surface water of Gulf of Mannar was 89.32 ppb and that in the Palk Bay was 64.41 ppb. Maturation and spawning stages were studied in the reproductive phase of *Chaetodon collare*. The spawning of butterfly fish occurs twice in a year; one during northeast monsoon and the other during southwest monsoon. In the present study maturity of gonad, both in male and female fish were observed and the development and percentage of occurrence of gonad was related to the size of the fish. Fecundity of *C. collare* varied from 70,686 to 100,252 in individuals measuring a total length of 80 to 130 mm with body weight that ranged from 25 to 75g.

338. **Ramakrishnan, K.S.** 2004. Sethusamudram: will the ships use it? In: *The Hindu* dated 21st Dec 2004.

Address : Deputy Chairman, Chennai Port Trust, Former Managing Director of the Poompuhar Shipping Corporation.

Abstract : The Basic justification advanced in favour of the Sethusamudram Ship Canal Project (SSCP) is that it will reduce the distance between Kolkata and Tuticorin by 340

nautical miles and between Chennai and Tuticorin by 434 nautical miles, thereby saving, for the ships plying between these places, both fuel cost and time involved in sailing the additional distance. This justification will be readily valid if the SSC is a free seaway which ships can sail through without any payment to the project authority. But the SSC cannot be a free seaway because the grounding of a wayward coal or oil ship that strays from the alignment or a collision of two ships in the channel will result in an ecological disaster of unimaginable proportions to the Gulf of Mannar and the Palk Bay.

339. **Ramana, M.V., V. Subrahmanyam, K.V.L.N.S. Sarma, B.T.V., Seshavataram.** 1995. Marine magnetic studies over a lost wellhead in Palk Bay, Cauvery Basin, India. *Geological Society of India*. 45(2): 201p.

340. **Ramasamy, S.M., D. Ramesh, M.A. Paul, Sheela Kusumgar, MA. Yadava, A.R. Nair, U.K. Sinha and T.B. Joseph.** 1998. Rapid land building activity along Vedaranniyam coast and its possible implications. *Curr. Sci.*, 75(9): 884-886.

Abstract : The old epic"Ramayana' says that ' Lord Rama' tried to reach the Sri Lanka by cross over the Bay of Bengal from three points along the southestern fringe of the Indian coast. First Vedaranayam to Kodiyakkarai, and from Manamelkudi and lastly crossed over to Sri Lanka from Rameswaram Island, the former to coastal locations were separated from Sri Lanka by Bay of Bengal and the Rameswaram Island was nearer to Sri Lanka during that period. The processes of sediment accretion in this area where requires detailed studies particularly in the context of the contemplated Sethusamudram Project' for navigation through the Palk Strait. The Vedaranniyam area forms a spectacular triangular shaped coast in the southeren parts of India. The digitally processed IRS 1A image of 1990 shows offshore sand bars up to 27 km southeast of Vedaranniyam nose inside the sea. Collected the shell samples were collected fro 1.2 to 3 m depth from the four beach ridge complexes from NNw to SSE, at Chettipulam and its possible implications were reported.

341. **Ramesh, R., R. Purvaja, S. Ramesh and R.A. James.** 2002. Historical Pollution Trends in Coastal Environments of India. *Environ. Monit. Ass.*, 79: 151–176.

Address : Institute for Ocean Management, Anna University, Chennai, India. email: rramesh_au@hotmail.com, ramesh@annauniv.edu.

Abstract : Seventeen sediment cores were collected from different coastal ecosystems of Tamil Nadu, India that include coastal lagoon (Pulicat), polluted rivers in Chennai (Adyar and Cooum), Coral reef (Gulf of Mannar) and a perennial river (Tamiraparani). Radiometric dating has been used to determine the modern sedimentation rates in these ecosystems. The Pulicat Lake and the polluted rivers (Adyar and Cooum) yield an average sediment accumulation rate of 12.34 and 7.85 mm yr-1, respectively. In the Gulf of Mannar coral reef, the sedimentation rate averages 17.37 mm yr-1, while the rate in Tamiraparani River is 11.00 mm yr-1. In the Tamiraparani River basin, the deposition rates were an order of magnitude higher when compared to the erosion rates, which may be due to bank erosion and the intense human activity. In general high rates of sedimentation observed in the

coastal ecosystems not only reflect the capacity of the coastal regions as sinks for trace metals but also denote increased input of pollutants into the coastal environments in the recent past. The deposition rates of heavy metals – Fe, Mn, Zn, Cu, Cr and Ni in the depth profiles have been computed using sedimentation rates and their distribution is discussed. It can be seen that the mean deposition rates of all the measured elements in the Tamil Nadu coastal ecosystems are high compared with rates determined for the sediments of the deltaic regions of India and the Bay of Bengal.

342. **Ramesh, R.** 2005. Will to Disaster Post-Tsunami Technical Feasibility of Sethusamudram Project. In:http://www.freeindiamedia.com/guest_column/04_July_05_guest_column.htm.

Address : yadhi65@rediffmail.com

Abstract : This article attempts a thorough scientific analysis of the question of the SSCP's technical feasibility and the need to muster clear, transparent answers from the project proponents to all the questions raised so far by experts in India and abroad.

343. **Ramesh, R.** 2005. Is the Sethusamudram Shipping Canal Project technically feasible? *Economic and Political Weekly,* 40(4): 271-273, 275 map.

344. **Ramesh, R.** 2005. Sethusamudram Shipping Canal Project. *Curr. Sci.,* 88(4):536-537.

Address : Current Science Association: C.V. Raman Avenue, PB 8001, Bangalore - 560 080, India.

Abstract : The Palk Bay is one of the five major permanent sediment sinks of India, and Chandramohan et al. have calculated the total annual sediment load for this sink as 58.8 X 106m3. This sediment load is said to cause a sea depth reduction of 1 cm/year. Rivers draining into the Palk Bay from the Sri Lankan and Indian coasts and the sea contribute sediments. The longshore currents from the Bay of Bengal in the north and the Gulf of Mannar in the south transport these sediments into the Palk Bay. Sanil Kumar et al. have calculated the net quantum of littoral sediments entering into the Palk Bay from the Nagapattinam coast as 0.2657 X $106m^3$. The Environmental Impact Assessment (EIA) for SSCP by National Environmental Engineering Research Institute (NEERI) has calculated the net annual sediment transport by long shore current and tides in the Adams Bridge area as 0.2657 X $106m^3$. The sediment contribution from the rivers has not been calculated yet. Therefore, it looks like we are yet to account for about 99.39% of the total sedimentation volume.

345. **Rangarajan, K.** 1963. On the occurrence of *Lepidasthenia ohshimai* Okuda (Polynidae, Polychaeta) in Palk Bay, South India. *J. Mar. Biol. Assoc. India* 5(1): 103-107.
Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The genus *Lepidasthenia* enjoys a world wide distribution and has been reported from all Oceans of the world. In 1931 Prof. H. Ohshima and Mr. H. Ikeda observed another interesting instance of commensalisms in this genus. Okuda (1936) observed certain

peculiarities in the steal structure of these two worms and described them as *Lepidasthenia ohshimai*, a species new to science. It is remarkable that this is the only species in this genus which lives as a commensal with a holothurians. This species has not been reported so far from elsewhere, and even in the type locality several attempts to collect this specimen in 1935 were not successful. During the course of investigation of the bottom fauna of Palk Bay (79 º 09' E, 9 0º 20' N.), two specimens of this genus were collected from a depth of 6 fathoms using a Petersen's grab. One measuring 88 mm, in length was slightly incomplete at the posterior portion, but the other was complete with the pygidium and measured 96 mm, in length. After careful examinaion and comparison with Okuda's (1936) description, they have been identified as *Lepidasthena ohshimai*, and their occurrence in Palk Bay extends the distribution of this species to Indian Ocean.

346. **Rangarajan, K.** 1964. A new polychaeta of the family *pilargidae* from the Palk Bay, south India. *J. Mar. Biol. Assoc. India.*10: 366-369.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : During the study of the bottom fauna of Palk Bay, South India, two incomplete specimens of *Ancistargis* were collected from a depth of 10 meters on July 12, 1961. Subsequently another incomplete specimen was taken on August 22, 1962 from the same locality at a depth of 7 meters. The three specimens which from the basis of the present account, differ markedly from *Ancistargis papillosus* and *Ancistargis matsunagaensis* and are designated here as *Ancistargis brevicirris* sp. nov.

347. **Rekha Nair, J.** 2005. Silverbelly fishery of Palk Bay and Gulf of Mannar with special reference to "*Leiognathus jonesi*" (James, 1967). *Indian J. Fish.,* 52(2): 189-195.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: Silverbellies constitute an important group of demersal fishery resource along Tamilnadu coast. They are exploited by trawl and a variety of artisanal gears like shore seines, boat seines and gill nets. The southeast region contributed nearly 85% of the silverbelly landings of India and Tamilnadu's share was 70%. Out of 20 species of silverbellies known from India, 15 species are found in varying proportions from the Palk Bay and Gulf of Mannar. Good fishery for silverbellies at Rameswaram was recorded from February to September and October to March at Pamban, during the years 1996-2000. The length-weight relationship of *L. jonesi* was W = 0.000076197 L 2.38. The growth parameters L and K (annual) were 161 mm and 0.71 respectively. The MSY was estimated at 209.7t.

348. **Richard Brook Cathcart.** 2004. Palk Bay: A future industrial complex site? *Curr. Sci.,* 87(7): 849-850.

Address : Geographos, 1608 East Broadway, Suite #107, Glendale, California 91205–1524,USA e-mail: rbcathcart@msn.com.

Abstratct: After a lapse of some years, foreign investors have returned to Sri Lanka as that

attractive nation's economic prospects brightened during 2004. Reorganization of the traditional sea lines of communication between China and the Suez Canal are currently being planned by macroengineers. Without the benefit of a proposed Kra Canal, small boats have already passed across an intervening peninsula. India has publicly examined the possibilities of significant commercial exports to China via a Rangoon–Mandalay–Kunming route. An overland railroad and a motor highway, affording China access to the Andaman Sea, would alter China's relationship with both India and Sri Lanka, and make a sea level Kra Canal unnecessary. Palk Bay, situated between India and Sri Lanka, may become an industrialized regional complex, consisting of complementary floating and land-fixed facilities, serving both countries during the early 21st Century. Eventually, the Palk Bay may become a base seaport servicing a funicular space elevator anchored to a floating passenger and freight station sited in calm waters at the equator. India already has claimed a submarine deposit of poly-metallic nodules on the Southern Hemisphere seafloor almost due south of Palk Bay.

349. **Richard Brook Cathcart.** 2006. Sethusamudram ship channel macroproject: Anti-tsunami and storm surge textile arrestors protecting Palk Bay (India and Sri Lanka). *Curr. Sci.,* 91(11): 1474-1476.

Address : Geographos, 1300 West Olive Avenue, Suite M, Burbank, California 91506-2225, USA. e-mail: rbcathcart@charter.net

Abstract : During times of periodic storm and unpredictable tsunami causing public peril in Palk Bay, textile barrier (dam) technology can be employed to protect an economically important region between India and Sri Lanka. Anti-tsunami and storm surge arrestors are a new development applicable to Palk Bay, especially with the construction of the Sethusamudram Ship Channel.

350. **Rohan Arthur.** 2000. Coral bleaching and mortality in three Indian reef regions during an El-Nino southern oscillation event. *Curr. Sci.,* 79(12): 1723-1729.

Address : Centre for Ecology Research and Conservation, 3076/5, IV Cross, Gokulam Park, Mysore - 570 002, Karnataka, India.

Abstract : The 1997-1998 El Nino Southern Oscillation (ENSO) event, which elevated Sea Surface Temperatures (SSTs) of tropical oceans by more than 30°C, was one of the most extreme ENSO events in recent history. Such increases in SSTs above the seasonal average can trigger widespread bleaching in coral reefs. This study examined bleaching in three Indian coral reef regions in relation to SSTs using quantitative rapid assessment methods between April and July, 1998. The Gulf of Kutch reefs showed an average of 11% bleached coral with no apparent bleaching-related mortality. In contrast, bleached coral comprised 82% of the coral cover in lagoon reefs of Lakshadweep and 89% of the coral cover in the Gulf of Mannar reefs. Bleaching-related mortality was high -26% in Lakshadweep and 23% in Mannar. The coral mass mortality may have profound ecological and socioeconomic implications and highlights the need for sustained monitoring for coral reef conservation in India.

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351. **Sajid I. Khan and S. B. Satam.** 2003. Seaweed Mariculture: Scope And Potential in India. Aquaculture Asia, 8(4): 26-29.

Address : College of Fisheries, Dr. B. S. Konkan Agricultural University, Ratnagiri.

Abstract : Seaweeds are macrophytic algae, a primitive type of plants lacking true roots, stems and leaves. Most seaweeds belong to one of three divisions - the Chlorophyta (green algae), the Phaeophyta (brown algae) and the Rhodophyta (red algae). There are about 900 species of green seaweed, 4000 red species and 1500 brown species found in nature1. The greatest variety of red seaweeds is found in subtropical and tropical waters, while brown seaweeds are more common in cooler, temperate waters.

352. **Salin, K.R., T.M. Yohannan and C. Mohanakumaran Nair.** 2005. Fisheries and trade of seahorses, *Hippocampus* spp., in southern India. *Fish. Manage. Ecol.,* 12(4): 269-273.

Abstract: Seahorses (*Hippocampus* spp.) are a major commodity fished from the shallow coastal seas of the south coast of India where there is an abundance of sea grasses, sponges and corals. They are in great demand for export as traditional medicines, curios and aquarium fish. Organised fishing and trade of seahorses exist in India along the Palk Bay and Gulf of Mannar coasts. At the Palk Bay coast, seahorses are targeted by divers along with sea cucumbers (*Holothuria* spp.) and gastropods (e.g. *Murex* spp., *Xancus pyrum* Hornell). In the Gulf of Mannar, most of the seahorses are landed as bycatch of shrimp trawling. Seahorses are also fished from Kerala as a bycatch of trawling, although no organised fishery and trade exist. Five species of seahorses were identified from the Palk Bay coast, whereas only two species were obtained from Kerala. Most seahorses from India are exported to Singapore, Hong Kong, Malaysia and the United Arab Emirates. The volume of dried seahorse trade from India was estimated to be 9.75 t as derived from catch data in 2001, which was much higher than official statistics of 4.34 t during 2001-2002, suggesting the major part of the exports might be through non-conventional means and goes undeclared. Some aspects of the impact of large-scale fishing and trade on conservation of these seahorses are discussed.

353. **Sam Bennet, P.** 1961. Further observations on the fishery and biology of "Choodai" (*Sardinella* sp.) of Mandapam area. *Indian J. Fish.,* 8(1&2): 152-168.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The paper deals with a general account of the Choodai fishery in the Mandapam area, with particular reference to data on *Sardinella albella* collected during May 1958 to March 1960. Age and size groups of fish occurring in the commercial landings of Palk Bay and Gulf of Mannar are discussed. Old large fish and young small fish predominated in commercial catches from the Palk Bay; commercial catches from the Gulf of Mannar are mainly composed of young fish of medium size. There is a slight predominance of females over males up to 80mm. The sex composition of catches during the period may

be stated as 40.8% females, 31.3% males and 27.9% indeterminates. The index of relative abundance of *Sardinella albella* is more than that of *Sardinella gibbosa* in the Palk Bay; in the Gulf of Mannar *S. gibbosa* is relatively more abundant than *S. albella.*

354. **Sampson Manickam, P.E., M.R. Arputharaj and P. Vedavyasa Rao.** 1988. A survey of the exploitation of juveniles of green tiger prawn, *Penaeus semisulcatus*, along Palk Bay and its impact on the prawn fishery of the region. *CMFRI Spec. Publ.,* 40: 20-21.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The green tiger prawn *Penaeus semisulcatus*, contributes to over 50% of the total prawn catch landed along the Palk Bay coast. Intense fishing for juvenile prawns, which inhabit the seagrass ecosystem near the shore, is taking place all along the coast. The results of a survey carried out on this exploitation pattern are reported. The prawn catch, the bulk of which is composed of juvenile *P. semisulcatus*, is found to vary from 2 kg to 10 kg per unit per day. The size of the exploited *P. semisulcatus* ranges from 31 mm to 100 mm total length with the dominant size group at 45-70 mm. As the catch is composed exclusively of small-sized juvenile prawns and since the nets are operated in the seagrass beds that form the nursery grounds for the prawn resources, the impact of this exploitation on the overall *P. semisulcatus* resource in the region is discussed.

355. **Sampson Manickam, P.E., M.R. Arpudharaj and P. Vedavyasa Rao.** 1989. Exploitation of juveniles of green tiger prawn *Penaeus semisulcatus* along Palk Bay and its impact of India. *Mar. Fish. Infor. Serv. T&E Ser.* 163: 13.

Abstract : In this report, on many occasions Finless black porpoises locally called "Mini kutti" often occur in the nearshore waters along the Palk Bay coast around Mandapam region. On 18.1.99, a female Porpoise *Neophocaena phocaenoides* was landed at Rameswaram Verkode. This animal was caught by local gillnet Vali valai, operated at a depth of 18 m off Rameswaram in the Palk Bay. The morphometric measurements of the animal were, the total length and weight of animal consist of 144cm, and 40 kg. The tip of upper jaw to tip of caudal fluke and the origin of flipper and then the tip of upper jaw to centre of eye, and the tip of upper jaw to centre of blowhole were ranged 144cm, 32 cm, 12 cm, and 14 cm, respectively. The length of upper jaw and of lower jaw and width of eye are 6.5 cm, 6 cm, and 3 cm, respectively. Where the width of blowhole are 2cm, and the length of blowhole are 2.5 cm, the sex of animal was not known.

356. **Sandhya Sukumaran, Rani Mary George and C. Kasinathan.** 2005. Assessment of species diversity and coral cover of velapertumuni Reef, Palk Bay, India. *J. Mar. Biol. Assoc. India,* 47(2): 139-143, 2005.

Address : Regional Centre of Central Marine Fisheries Research Institute, Marine Fisheries P.O., Mandapam Camp – 623 520. Tamil Nadu, India, email : sandhyasukumaran@hotmail.com

Abstract : Velapertumuni reef, a fringing reef of Palk Bay was surveyed for the assessment of the coral cover and biodiversity during September 2004, following the Line intercept

Transect Method and their geographical positions were fixed using the global Positioning system. The percentages of live and dead coral cover at each site were derived and a total of 12 hard coral species were found on the transects; *Porites solida* was the major species at 6 sites, followed by *Favia pallida* at 2 sites and *acropora cythera* and *Porites lutea* were dominant in 5th and 8th sites repectively. Therefore, except for one site the massive corals were dominant in all other areas. The total live and dead coral cover for the reef as a whole was estimated as 44% and 26% respectively and the remaining part was covered with coralline algae, sand and rubble. Dead coral cover was dominated by *poritids*, but a*croporids* showed the highest ratio of dead coral to live coral cover. Further, relative abundance values were derived for each species and they were assigned status as dominant / abundant / common / uncommon / rare. Accordingly, *P. solida* was the only species in the "dominant " category; *P. lutea and F. pallida* belonged to the category " abundant " and all other species were given either " common" or "uncommon" status. The Shannon indices of diversity in most of the sites were low varying from 0-2 and the reef as a whole showed a diversity of 1.47. The species richness and evenness values also showed low values of 5.4 and 0.59 respectively.

357. **Sanil Kumar, V., N.M. Anand and R. Gowthaman.** 2002. Variations in nearshore processes along Nagapattinam coast, India. *Curr. Sci.,* 82: 1381–1389.

Address : Ocean Engineering Division, National Institute of Oceanography, Dona Paula, Goa 403 004, India, e-mail: sanil@darya.nio.org

Abstract : Directional wave data collected at 10 m water depth, at 2 km distance off Nagore from March 1998 to February 1999, were used to estimate the longshore currents and longshore sediment transport rate considering the sea and swell waves separately using the CERC formula. Daily littoral environmental parameters were observed at three stations and longshore sediment transport rate was estimated using Walton's equation. A comparative study was carried out on theoretical and measured longshore currents. The ratio of spectral energy at the first and second spectral peaks shows that energy at the second peak was more than 50% of the energy at the first peak in 43% of the data collected, due to the presence of sea and swell waves. The difference between the sediment transport rate estimated based on the two methods is around 3.5%. The sediment transport using CERC formula shows that average annual gross transport was 0.448×106 m^3 and the average annual net transport (towards south) was 0.098×106 m^3 and this contributes to the supply of sediment to the Palk Bay.

358. **Sanil Kumar, V., K.C. Pathak, P. Pednekar, N.S.N. Raju and R. Gowthaman.** 2006. Coastal processes along the Indian coastline. *Curr. Sci.,* 91(4): 530-536.

Address : Ocean Engineering Division, National Institute of Oceanography, Dona Paula, Goa 403 004, India, e-mail: sanil@darya.nio.org

Abstract : Based on the measured data, wave height and current speed at a few locations are presented along with the estimated sediment transport rates. The maximum significant wave height recorded during the passage of a cyclone along the west coast in a water

depth of 27 m was 6 m. The current measurements show that the maximum currents vary from about 1.4 m/s in the open ocean to about 3.2 m/s in the Gulf of Khambhat. The gross longshore sediment transport rate was about 1 X 106m^3 per year along south Kerala and south Orissa. The estimated longshore sediment transport rates show that net transport along the east coast of India is towards the north, whereas along the west coast it is mostly towards the south.

359. **Sankarankutty, C.** 1965. On decapoda brachyura from the Gulf of Mannar and Palk Bay. *Proc. Symp. on Crustacea, MBAI,* 1(2): 347-362.

Address: Central Marine Fisheries Research Institute, Mandapam camp, Mandapam-623 520, India.

Abstract: Materials forming the basis of the present investigation are 88 species of Brachyura representing the families Dromiidae, Dorippidae, Calappidae, Leucosiidae, Hymenosomidae, Parthenopidae, Pinnotheridae, Gonoplacidae, Portunidae, Grapsidae, Ocypodidae and Xanthidae collected from the Indian coast of the Gulf of Mannar and Palk Bay. Of the total of 88 species, *Zalasius indica* is new to science, *Portunnus samoensis* (Ward) is perhaps known only from the type locality and *Rhabdonotus pictus* A. Milne Edwards has so far been reported only by A. Milne Edwares (1978) and De Man (1888); the additional records for the Indian region are *Dromidiopsis craniopsis cranioides* (De Man), *Dorippe polita* Alcock and Anderson, *Elamena sindensis* Alcock, *Halimus aries* (Latreille), *Metopograpsus frontalis* Miers, *M. thukuar* (Owen), *Thalamita spinifera* Borradaile, *T. parvidens* Rathbun, *Charybdis* (Charybdis) *anisodon* (De Haan), *Portunus pubescens* (Dana) and White, *Philyra verrucosa* Henderson and *Aethra scruposa* (Linnaeus) are species of interest. A brief outline on the species of Brachyura associated with the various habitats of this area has been given, in so doing only species typical of the particular habitat is included.

360. **Satyanarayana Rao, K and K. Dorairaj.** 1971. On the occurrence of the fan shell Atrina *(Servatrina) pectinata pectinata* (Linnaeus) off Mandapam in Palk Bay. *J. Mar. Biol. Assoc. India,* 13(1&2): 139-142.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

361. **Satyanarayana Rao, K and K.S. Sundaram.** 1972. Ecology of intertidal mollusca of Gulf of Mannar and Palk Bay. *Proc. Ind. Natn. Sci. Acad.,* 38B (5&6): 462-474.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The distribution of Fauna in the intertidal zone in the Gulf of Mannar and Palk Bay in the vicinity of Mandapam Camp has been studied. Distinct zonation has been observed in the occurrence of the fauna and three sub-zones the supralittoral fringe, midittoral zone and infralittoral fringe were recognized in the intertidal region. In the Gulf of Mannar, *Littorina scabra*, L. *undulata*, *Tecarius* spp, *Crassostrea cucullata* and

Chthamalus stellatus stellatus have been recorded in the supralittoral fringe. In the midlittoral zone, *C. stellatus* is usually abundant along with some *Cellana radiata, Modiolus striatula, Tectarius* spp, *Donax* spp and *Prianospio* sp. In the Infralittoral fringe, tubiculous Vermetid Gastropods, prosobranches like, sponges and sea anemones have been recorded. In Palk Bay the supralittoral fringe is mostly sandy and on some dead coral stones a few *Littorina scabra* and *Tectarius* spp are found. The midittoral zone fauna includes *Planaxis sulcatus, Nerita maura*, *Crassostrea cucullata*, a few *Littorina* spp. And *Tectarius* spp on coral stones. In the infralittoral fringe prosobranches like *Cerithium* spp, *Rissoina bertholleti* and *Pyrene diminuta*, bivalves (*Arca* spp, *Isognomon* spp, etc.), sponges, hydroids, polyzoans, polychaetes, isopods, amphipods and crabs occur. The probable factors influencing the variations in abundance of the fauna, particularly the molluscs in different stations and the habits of the molluscs in relation to low and high tides, temperature, etc., have been discussed.

362. **Schuiling, R.D.** 2004. Palk Strait: Repairing Adam's Bridge with gypsum? *Curr. Sci.,* 6(10): 1351-1352.

Address : Department of Earth Sciences-Geochemistry, Faculty of Geosciences, Utrecht University, P.O. Box 80.021; 3508 TA Utrecht, The Netherlands, e-mail: schuiling@geo.uu.nl

Abstract : The first plan for the construction of a land connection between India and Sri Lanka dates back1 to about 1876. Recently, Cathcart has proposed the use of such a fixed connection to establish a series of wind turbines and vertical-axis hydro turbines, which would help meet future electricity demands in India and Sri Lanka. The shallow area of the Palk Strait, in places only about five fathoms deep, is underlain by thick Miocene Jaffna limestone, which also covers large parts of the Jaffna peninsula. A mostly submerged atoll barrier known as Adam's Bridge stretches from Danushkodi (India) to Thalaimannar (Sri Lanka). Although the land connection between India and Sri Lanka was interrupted by sea-level rise at the end of the last Ice Age, about 9–10 ka ago, the present tendency is towards sediment accretion, according to Ramasamy et al. It is even claimed that sediment accretion might in the future, in a few thousand years, reconnect the Vedaranniyam part of the Indian peninsula with the Jaffna peninsula.

363. **Sekharan, K.V.** 1955. Observation on the "Choodai" fishery of Mandapam area. *Indian J. Fish.,* 2(1): 113-131.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The choodai fishery of Mandapam area is essentially a fishery for small sardines, confined mainly to the inshore waters of Palk Bay. Shore-seines, hand-nets (along with torches) and gill-nets are the main type of gear employed in the fishery. The methods of fishing are briefly described. *Sardinella albella* and *S. gibbosa* constitute the bulk of the catches. Studies on length-frequency distribution show that the fishery operates mainly on the 0-year class; the proportion of older fishes in the catches is small. Both *S. albella* and *S. gibbosa* spawn at about the end of the first year of their life.

364. **Sekharan, K.V.** 1962. On the Mackerel fishery of the Mandapam area. *Indian J. Fish*., 9(1&2): 714-727.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Mackerel supports a minor fishery in the Mandapam area, especially along the Gulf of Mannar coast, during the December – March period. The catches on the Palk Bay side are generally negligible, but in October 1956, there were unusually large catches here also. Shore-seine is the main gear employed. Monthly catch-per-man-hour based on observed landings is given. As on the West coast, so also in the Mandapam area, mackerel approach the nearshore waters at a time when salinity and temperature show an upward trend after attaining their minimum values. On the Gulf of Mannar side net-plankton volume also has a maximum during the January-March period. The fishery appears to be supported mainly by a single age group. The modal size varied from 227 to 242 mm, during the December-March periods of 1952-56. These modal sizes are larger than those occurring at Malpe and Karwar during the December-March period. Catch-per-man-hour (in numbers) for night-hauls was considerably greater than that for daytime-hauls. On the other hand, the average length of mackerel in night catches was slightly smaller. During 1952-53 the length-weight relations of mackerel in day-and night catches were estimated separately. The difference between the two regression coefficients was not significant at the 5% level. During 1952-53, an average cube of length of mackerel for each haul was calculated and plotted against the catch in numbers. A tendency for the catches to drop in relation to average L3 was noticed.

365. **Sekharan, K.V.** 1966. On the food of the sardines, *Sardinella albella* and *S. gibbosa* of the Mandapam area. *Indian J. Fish.,* 13(1&2): 96-141.

Address: Central Marine Fisheries Research Institute, Mandapam camp, Mandapam-623 520, India.

Abstract: A study was made of the food of *Sardinella albella* and *S. gibbosa* in relation to plankton in 1953-54 and 1954-55. Emphasis was laid on the food of the fishes of the 20 –79 mm groups, immature and commercially important on the Palk Bay coast. For a year-round study, larger fishes were also collected from Gulf of Mannar, where the fishery is poor. The sample values of food varied with the catches for sampling days, lunar months and seasons. Plankton was collected from the Palk Bay; 5-6 hours after the fish samples were collected in 1953, and at the time of fishing in 1954.

366. **Sekharan, K.V.** 1968. Growth rates of the sardines, *Sardinella albella* (Val) and *S. gibbosa* (Bleek), in the Mandapam area. *Indian J. Fish*., 15 (1&2): 68-80.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Mandapam, Tamilnadu, India.

Abstract: The monthly mean lengths of the O-year-classes of *S. albella* and *S. gibbosa* were estimated for the Palk Bay seasons of 1952-56. They indicated that, for the greater part of the Palk Bay season, the length of each species increased at a decreasing rate. But

towards the end of the season it appeared to increase at an increasing rate. The von Bertalanffy equation was fitted to the former part, the growth curve so obtained was extrapolated to the latter part of the season also, and the observed and expected mean lengths were compared. It was seen that the differences in the rate of change of the monthly mean lengths between years were statistically non-significant. The asymptotic maximum lengths of the two sardines, estimated on the basis of the growth data of the first 6-7 months of life are considerably less than the modal sizes attained by them at the end of the first year of life, indicating that a change in growth rate has to take place if these modal sizes are to be attained. This expectation is supported by the observation that the mean lengths towards the end of the Palk Bay season are larger than those expected on the basis of the growth data of the earlier months and indicate the start of an exponential phase of growth. Hence there appears to be a periodicity in the growth of these young fishes, comparable to what is observed in temperate water fishes. The environmental data also indicate that a change in the growth rate towards the end of the Palk Bay season is possible. The estimated monthly growth coefficients of the two species compare very well with each other and also with that of the Japanese sardine.

367. **Sekharan, K.V.** 1975. Observations on the occurrence and habits of juvenile fishes in the nearshore region of the Mandapam area. *J. Bomb. Nat. Hist. Soc.,* 72(1):83-89. SFA 22(1).

368. **Seralathan, P.** 2006. Disposal of dredge spoil from Sethusamudram Ship Channel Project. *Curr. Sci.,* 90(1): 146-147. 2006.

Address: Department of Marine Geology and Geophysics, Cochin University of Science and Technology, Cochin - 682 016, Kerala, India, E-mail: pseran@yahoo.com

Abstract: The Sethusamudram Ship Channel Project (SSCP), Tamil Nadu, India involves dredging for a length of about 35 km in the Adam's Bridge sector and about 54 km across the Palk Strait and will generate respectively 48 and 34.5 million cubic meters of sediments. The materials dredged from Adam's Bridge area will be dumped in the Gulf of Mannar region at 20-30m water depths with in the Indian territorial waters about 30 km away from Adam's Bridge. The sediments dredged from Palk Bay will be dumped in the Indian Ocean at about 25-30m water depths. Dumping of sediments in open sea will cause turbidity in the water column and submergence of large bottom community by the sand contained in the dredged sediments. Such environmental effect over vast areas for considerably long time span will have long-term impact. Instead, the dredge spoil can be dumped at one place in the sallow western Palk Bay at water depths of about 10 or 12m (30-35 km off Thondi) so that an island with land area of about 6-8 km^2 can be created. Alternatively the dredge spoil can also be used to enhance the size and relief of a section of the narrow spit of the northeastern Rameswaram Island, as it is vulnerable for erosion. The land area that can be reclaimed between Rameswaram town and Dhanuskodi using the sediments dredged from Adam's Bridge area alone is about 10 km^2. As the proposed dumpsites are considerably away from the coral islands of the Gulf Mannar, suspended sediments may not be able to reach the coral island areas.

369. **Shenoy, A.S.** 1977. Holothurians and its commercial utility. *Seafood Export J*. 9(12):17-20.

Abstract: The author states that sea cucumber is usually collected by diving to a depth of 1.5 to 6 meters in the shallow seas of Gulf of Mannar and Palk Bay. During low tide they are either picked up by hand or small scoop nets tied to the end of the bamboo pole. During trawling also at Gulf of Mannar and Palk Bay, a small quantity of *Beche de mer* is collected along with shrimps.

370. **Shiell, G.** 2005. Information on juvenile holothurians: a contribution by Dr. D.B. James. *Beche-de-Mer information bulletin,* 21: 26-27.

Address : School of Animal Biology (M092), The University of Western Australia, 35 Stirling Hwy, Nedlands, WA 6009 Australia, email:cucumber@cyllene.uwa.edu.au

Abstract : Following a request for anecdotal information on the habitat of juvenile holothurians in Beche-de-mer information bulletin (19: 2004), observations made by Dr. D.B. James of India were submitted to the author. Twenty-one holothurian species were observed, in seventeen of which observations juveniles were in the same habitat as adults, and in four observations no adults were present. These observations corroborate the patterns noted in a short article entitled, 'Field observations of juvenile sea cucumbers' published in Beche-de-mer information bulletin (20: 2004). However, Dr James also provides evidence to suggest that juveniles of selected species may occupy different habitats to that of the adult form. This trend, which is now reported in a number of species such as *Holothuria fuscolgilva; Holothuria whitmaei* (previously *Holothuria nobilis*); *Cucumaria frondosa*; and *Stichopus hermanni* requires more research.

371. **Siddeek, M.S.M.** 1986. Mesh selectivity and biological impact studies on a new fish-cum shrimp trawl in Palk Bay, Sri Lanka. [Manila], pp. 417-420; Maclean, J.L. ; Dizon, L.B.; Hosillos, L.V. (eds.); *The First Asian Fisheries Forum;* Manila: Asian Fisheries Society.

Abstract : Shrimp trawling in Palk Bay, Sri Lanka, is conducted in a 9.m mechanized craft with 30 -hp inboard engine, *Penaeus semisulcatus* is the major species. An experiment consisting of twenty trawl operations employing the covered codend technique was carried out using 25, 30, and 40 mm codend in the fish-cum-shrimp trawl nets for mesh selectively studies. The codend with the 25-mm mesh size hardly released any, whereas others released a fair number of commercially valuable *P. semisulcatus.* The 50% retention lengths for *P.semisulcatus* were 1.96 cm and 2.27 cm for the 30-mm and the 40-mm codend, respectively. When compared with the traditional trawls, the new fish-cum-shrimp trawl with larger mesh size performed better by bringing a slightly larger amount of shrimp and greater quantity of fish. The instantaneous fishing mortality values during January to June 1984 ranged from 0.16 to 0.38 for *P. semisulcatus* and 0.09 to 0.37 for the by catch. Yield-per recruit analysis indicated no immediate threat from the new trawl to the shrimp resources in Palk Bay, but rather a beneficial effect because of the introduction of larger mesh size in the codend.

372. **Silas, E.G and C. Sankarankutty.** 1965. Field investigations on the shore crabs of the

Gulf of Mannar and Palk bay, with special reference to the ecology and behaviour of the pellet crab *Scopimera proxima* Kemp. *Proc. Symp. on Crustacea, MBAI,* 3: 1008-1025.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: In the course of carrying out observations on the ecology and behaviour of shore crabs of Palk Bay and Gulf of Mannar in 1959-60, special attention was given by us for studying the burrowing habits, sexual dimorphism, mating behaviour, etc., of the pellet crab *Scopimera proxima* Kemp details of which are embodied in this paper.

373. **Silas, E.G.** 1986. Occurrence of whale sharks in the coastal waters of India, Irumeni, Palk Bay, Tamil Nadu. *Mar. Fish. Infor. Serv., T & E Ser.,* No. 66 : 1 -19**.**

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp – 623 520.

Abstract : In general, notable contributions summarizing our knowledge of the known habits of the whale sharks and its occurrence in Indian coastal waters have been made by Gudger (1935), Chevey (1936) and Prater (1941). Subsequent records and observations on whale sharks *(Rhiniodon typus smith*) from Indian coastal waters and other parts of the world have added to our knowledge of this leviathan of the open seas. Although a rarity, the fishermen are familiar with the whale shark which is Tamil is locally known as ' Panai meen', while the name ' Panai meen' by which it is known at Palk Bay is applied by the Cape fishermen to the baleen whale. The known occurrence of the whale shark in Indian coastal waters, season and its mode of development their sex ratio with that of size are given. Then the food habit of whale shark is not known . Gudger (1953) mentions intestinal parasites as the only mortal enemies of the whale shark, while ramming by ocean going vessels also accounts for a few others being killed. And also its schooling behavior, the tendency to associate with larger schooling fish especially with tunas suggests that they might have been together in seeking their food. Commercial harvesting of whale sharks is practically non-existent. In a very few areas, direct fishing of practiced especially for its liver oil which is used as a preservative for the timber used in boat hulls. Both natural and regional co-operative research programmers may be necessary to study more about this, the largest of all fishes. In India, this could be done thought the CMFRI through its field and research staff and the Department of Fisheries of concerned maritime states and union territories.

374. **Silas, E.G.** 1986. Occurrence of another whale shark on July, 1960 near Thangachi madam, Rameswaram Island, Palk Bay, Tamil Nadu. *Mar. Fish. Infor. Serv., T & E Ser.,*

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp – 623 520.

Abstract : While operating bottom-set gill net (kalaivalai) on 19.10.85 at 8 m depth in Palk Strait off Adirampatinam netted a whale shark and towed it the same day to the landing centre, It is reported that since last 30 years this is the first time such a huge whale shark has been caught in this area. The total length of the animal was 900 cm, while the height of the body and girth of body then the length of first fin and length of second fin re 210 cm, 450 cm, 123 cm, and 120 cm respectively. When the dorsal fin and the second

dorsal fin then the length of caudal fin are 115 cm, 85 cm, and 198 cm respectively.

375. **Silas, E.G. and A.B. Fernando.** 1988. The Dugong in India - Is it going the way of the Dodo? *Proceedings of the Symposium on Endangered Marine Animals and Marine Parks.* Marine Biological Association of India. pp. 167-176.

376. **Silas, E.G.** 2003. Pearl Culture - A new hope for Aquaculture in the 21st century. *1st Indian Pearl Congress & Exposition,* 5th to 8th February, 2003. pp. 5-9.

Address: Kerala Agricultural University, Cochin-682 020, Kerala, India.

Abstract: Mankind has always been attracted to pearls, the most mesmerizing and noble of gems. The history of the cultured pearl has been traced from the time of its invention. The famous fisheries for Indian oriental pearls in the Palk Bay, Gulf of Mannar and the Gulf of Kutch have been described. The pioneering work of James Hornell on pearl fisheries and culture and the subsequent advances made in pearl culture in Indian marine pearl oysters and freshwater mussels by CMFRI and CIBA are outlined. The future course of action for producing value added, internationally competitive pearls are provided.

377. **Singh, H.S.** 2002. Marine protected areas of India, Status of coastal wetland conservation. In : http://www.iucn.org/themes/wcpa/newsbulletins/news/pressreleases/MPA_WCPAindia.pdf

Abstract : Marine ecosystem diversity is attributed to geo-morphological and climatic variation along the coast. The climate along the coast varies from one that of true tropical region in south to that of sub-tropical and arid environment in Kachchh in northwest. Rainfall varies from only 300 mm in the semi-arid region of Kachchh to average maximum of 3200 mm in Andaman-Nicobar in south. On the eastern coast, there the gigantic deltas of the rivers Ganges-Bramhaputra, Krishna- Godavari, Mahanadi, and Cauvery, which support large area of estuaries and excellent growth of mangroves. Most of the rivers in India flow to east coast in Bay of Bengal and carry tremendous amount of silt during monsoon. This is the main reason why coral reefs are absent, but mangroves grow well. There is no important delta on the western coast at present, although Rann of Kachchh was considered a deltaic area in the ancient past when the Indus, the Saraswati and their tributaries were discharging rainwater before change in geomorphological and climatic conditions in the region.

378. **Sivalingam, P.** 2000. A brief report on the Sethusamudram Ship Canal Project. Seminar on Sethusamudram Canal Project organized by Institutions of Engineers (India), Madurai.

Address : Vice Chancellor, Anna University, Tamilnadu, India.

Abstract : India had maritime trade with various countries of the world since time immemorial. Shipping trade among the various coastal ports both on the west and east coast was also going on for a very long period. India has a peninsular coast of 3554 nautical miles. However, it is rather unfortunate that India does not have a continuous navigable sea lane running within her territorial waters. Consequently, ships from the east

coast of India to Tuticorin have to go around Sri Lanka. This is because of a Sand Stone Reef, called Adam's bridge, at Pamban near Rameswaram between the Southern-Eastern Coast of India and Talaimannar of Sri Lanka. The depth of the sea in this portion is very shallow and is hardly about 11 feet only. Because of this shallow depth, the ships have to go around Sri Lanka increasing the travel distance considerably, when they have to call at ports on the East coast of India like Vishakapatnam, Pardeep, Calcutta and Haldia. In order to reduce the steaming distances and take advantage of navigation along the coast within our territorial waters, a number of proposals were considered for cutting a Ship Canal called the Sethusamudram Ship Canal through Rameswaram Island, to connect the Gulf of Mannar with Palk Bay.

379. **Srinivasan,V., A.R. Ramakrishnan, and R. Jambunathan.** 1980. 'Cyclones and depressions in the Indian seas in 1978', *Mausam,* 31 : 501-502.

380. **Sriramachandra Murty, V.** 1968. On some interesting and new records of marine fishes from India. *J. Mar. Biol. Assoc. India,* 10(1): 126-132.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: While examining the fish landings by shore seines and trawl nets at various fishing centres along the Palk Bay and Gulf of Mannar in the vicinity of Mandapam the author came across several specimens of *Drepane longimana* (Bloch and Schneider) which is little known and *Drepane punctata* (Linnaeus) which was recognised as the only valid species of the genus *Drepane.* A study of these specimens has shown that these two species are distinct as shown by some authors (vide Text). A brief comparative account of these two species is given in this paper, along with a few remarks and key to distinguish the two species. The author has also been able to collect specimens of *Platycephalus isacanthus* Cuvier from the above catches, and a single specimen of *Stethojulis interrupta* (Bleeker) from the inshore waters of Gulf of Mannar caught in dragnet, whose occurrence, in Indian seas, is so far not known. Brief descriptions of these two species are also given in this paper.

381. **Stoddart, D.R and C.S.Gopinatha Pillai.** 1972. Raised reefs of Ramanathapuram, India. Trans. *Inst. Br. Geogr.,* 56: 111–125.

Abstract : Raised reefs are described on the coast of Palk Bay at the western end of Adam's Bridge between India and Ceylon. The reefs outcrop on the Mandapam peninsula and on Rameswaram Island, and are overlaid, particularly to the east, by tightly-cemented grids. Altogether, thirty-three scleractinian corals in sixteen genera are recorded from the raised reefs and, of these, twenty-two species are new records for the raised reefs. All the species with one exception are found in present day living reefs in this area, though many species present in the modern are absent from the raised reefs. The appearance of the reefs and other evidence indicate their recency, and a core sample gives a radiocarbon age of 4020 ± 160 years B.P. This is compared with similar data from other Indian Ocean and pacific reefs, and it is tentatively concluded that there is insufficient

evidence to indicate eustatic emergence the raised reef in south India probably results from a local uplift.

382. **Subramanian, T.S.** 2005. A case for the canal. *Frontline,* In: http://www.hinduonnet.com/fline/fl2201/stories/20050114004502800.htm

Address : Chairman, Tuticorin Port Trust (TPT), Tuticorin.

Abstract : The NEERI report acknowledges that the sea-borne activity in the form of logistic and support services during the construction of the canal will have a "significant adverse impact on the traditional fishing activities by the licensed fisher folk and consequently on their income levels". In the Palk Bay, extensive dredging will be done over 66 km, not continuously but in different stretches. "The contention, therefore, that there can be a partial loss of livelihood (for fishermen) during the construction phase is not unfounded," Raghupathy says. There will be a reduction of less than 10 per cent from the total area available for fishing during this phase.

383. **Subramanian, T.S.** 2005. Ecologists' anguish. Frontline, http://www.hinduonnet.com/fline/fl2201/stories/20050114005002600.htm

Abstract : Not since the Silent Valley Project in Kerala has a project generated such spirited protests from environmentalists as the proposed Sethusamudram ship canal. If the canal is excavated, it will slice through the Gulf of Mannar and the Palk Bay, both of which are closed marine systems, and cause irreversible damage to a variety of marine life there. The Gulf of Mannar and the Palk Bay are akin to large lagoons, undisturbed by ship traffic because of their shallow waters. They are home to a wide variety of marine ecosystems. The Gulf of Mannar alone boasts 3,268 species of flora and fauna, including 377 species that are endemic to the region. The region provides livelihood to the families of several lakhs of fishermen in 140 coastal villages in Ramanathapuram and Tuticorin districts of Tamil Nadu.

384. **Subramanian, T.S.** 2005. In rough waters. *Frontline,* In: http://www.hinduonnet.com/fline/fl2201/stories/20050114005902400.htm

Abstract: The Sethusamudram Ship Canal Project (SSCP), which envisages dredging a shipping canal that will connect the Gulf of Mannar with the Bay of Bengal through the Palk Bay, thereby providing a continuous navigable route between the east and west coasts of India within its own territorial waters, is once again a fiercely debated issue in Tamil Nadu. Fishermen of the coastal districts of Ramanathapuram and Tuticorin, who had earlier seen it as "A dream project", fear the proposed alignment of the canal will dispossess them of their traditional livelihood. Environmentalists say the project could turn the Gulf of Mannar, a biologist's paradise, into a purgatory.

385. **Subramanian, T.S.** 2005. Of gains and losses. *Frontline,* In: http://www.hinduonnet.com/fline/fl2201/stories/20050114004602900.htm

Abstract : According to the NEERI report, the annual operation and maintenance costs for

a 12-metre-deep Sethusamudram canal will be Rs.15 crores, including Rs.5.5 crores for maintenance dredging. George Gomez, Coordinator, Tamil Nadu Manual Workers' Union, Tuticorin, who has several decades of experience in the shipping industry, says the project cost will work out to Rs.3,000 crores. He says the project "will be a sick unit" as the money invested can never be recovered. "I don't think any container ship will use the canal," he says. Major container operators, deploying mother-vessels, will not use it. The difference in time between ships using the canal and those going round Sri Lanka will only be a few hours. Ships would not be able to cruise fast on the canal because they will have to be piloted, he argues. Not only mother-vessels but 80 per cent of the vessels going round Sri Lanka will not use the canal, Gomez says. Moreover, the canal would have to be dredged continuously.

386. **Sudarsan, D.** 1961. Observations on the Chaetognatha of the waters around Mandapam. *Indian J. Fish.,* 8(1&2): 364-382.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Observations on the Chaetognatha of the Gulf of Mannar and Palk Bay were made. Weekly surface plankton samples from January 1955 to December 1958 formed the material for this study. Ten species, *Sagitta enflata, S. neglecta, S. robusta, S. bedoti, S. tenuis, S. hispida, S. pulchra, Krohnitta pacifica, K. subtilis* and *Spadella cephaloptera* are recognized form the samples. The first nine species are common to both the Gulf of Mannar and Palk Bay but the last mentioned species is recorded only from Palk Bay. The record of *K. subtilis* is new for this area. Of the two areas studied Gulf of Mannar is quantitatively richer in Chaetognatha, November to March being the period of abundance. In Palk Bay Chaetognatha are invariably more abundant in the second half of the year, the peak period being July-September.

387. **Surendran S.N., S.H.P.P. Karunaratne, Z. Adams, J. Hemingway and N.J. Hawkes.** 2005. Molecular and biochemical characterization of a sand fly population from Sri Lanka: evidence for insecticide resistance due to altered esterases and insensitive acetylcholinesterase. *Bull. Entomol. Res.,* 95(4): 371-380.

Address : Department of Zoology, University of Jaffna, Jaffna, SRI LANKA, Department of Zoology, University of Peradeniya, Peradeniya, SRI LANKA, Entomology Department, The Natural History Museum, Cromwell Road, London, SW7 5BD, ROYAUME-UNI, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool, L3 5QA, ROYAUME-UNI.

Abstract : With an increasing incidence of *Cutaneous leishmaniasis* in Sri Lanka, particularly in northern provinces, insecticide-mediated vector control is under consideration. Optimizing such a strategy requires the characterization of sand fly populations in target areas with regard to species composition and extant resistance, among other parameters. Sand flies were collected by human bait and cattle-baited net traps on Delft Island, used as an illegal transit location by many refugees returning to the north of Sri Lanka from southern India where *leishmaniasis* is endemic. For species identification, genomic DNA was extracted and a fragment of the ribosomal 18S gene

amplified. The sequence from all flies analysed matched that of *Phlebotomus argentipes Annandale & Brunetti,* the primary vector in India and the most likely vector in Sri Lanka. Independent morphological analysis also identified *P. argentipes.* To establish the current susceptibility status of vector species, data were obtained at the biochemical level, from which potential cross-resistance to alternative insecticides can be predicted. The Delft Island collection was assayed for the activities of four enzyme systems involved in insecticide resistance (acetylcholinesterase, non-specific carboxylesterases, glutathione-S-transferases and cytochrome p450 monooxygenases), establishing baselines against which subsequent collections can be evaluated. There was preliminary evidence for elevated esterases and altered acetylcholinesterase in this population, the first report of these resistance mechanisms in sand flies to our knowledge, which probably arose from the malathion-based spraying regimes of the Anti-Malarial Campaign.

388. **Surendran, S.N., A. Kajatheepan, N.J. Hawkes and R. Ramasamy.** 2005. First report on the presence of *morphospecies* A and B of *Phlebotomus argentipes sensu lato* (Diptera: *Psychodidae*) in Sri Lanka – implications for *leishmaniasis* transmission. *J. Vect. Borne Dis.,* 42: 155–158.

Address : Department of Zoology, University of Jaffna, Jaffna, Sri Lanka.

Abstract : *Phlebotomus argentipes Annandale* and *Brunetti* (Diptera : Psychodidae) is the major Indian vector of visceral *leishmaniasis* (VL), caused by *Leishmania donovani.* However, whilst the geographic range of *P. argentipes* extends from Iran and Afghanistan in the west to Malaysia and Indonesia in the southeast1, VL is confined to northeastern and southern India, and neighbouring Nepal and Bangladesh2, 3. Despite being located 32 km from the Indian state of Tamil Nadu, where VL is endemic, autochthonous cases of leishmaniasis were not reported in Sri Lanka until 1992. Prior to this *leishmaniasis* was detected only in persons who had contracted the disease while working in the middle east4. However, since 1992 the incidence has been rising steadily, with 65 cases documented by Siriwardena *et al.,* 5 in 2003. The parasite was identified in several Sri Lankan patients as *L. donovani* zymodeme MON-376. However, this typically causes VL in India, in Sri Lanka the clinical manifestations are characteristic of cutaneous *leishmaniasis.*

389. **Suryanarayan, V.** 2005. *Conflict over fisheries in the Palk Bay region.* Lancers Publishers & Distributors, K-36A (FF) Green Park Main, New Delhi-110016. 207p.

Abstract : The Palk Bay Region which separates the coastal regions of Tamil Nadu from northern parts of Sri Lanka has been in the headlines during recent years. The rich fishing waters especially lucrative on the Sri Lanka side of the maritime boundary became a bone of contention between TN fishermen and the Sri Lanka Navy during the years of the ethnic conflict. This book is an attempt to throw light on some relevant critical issues.

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390. **Talwar, P.K.** 1960. The Biology and fishery of *Hemirhamphus cuvier* in the Gulf of Mannar and Palk Bay . *Ph.D Thesis* of the university of Rajasthan.

391. **Talwar, P.K.** 1962. Studies on the food and feeding relationships of the half beak fishes (Hemirhamphidae) from the Gulf of Mannar and Palk Bay. *Indian J. Fish*., 9(1&2): 1-9.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: In the present study the food and feeding habits of the half beaks, *Hyporhamphus georgii* (C.V.), *H. quoyi* (C.V.), *Hemirhamphus marginatus* (Forsk.) and *H. far* (Forsk.) were studied for a period of about three years. The gut contents were analyzed by the Points and Numerical methods. The seasonal variations in the composition of the gut contents are discussed in relation to the environmental biota and maturity stages. The studies have revealed that different types of feeding relationships are maintained by the different species and that they do not belong to the group of filter feeders but feed selectively.

392. **Talwar, P.K.** 1962. A contribution to the biology of the half beak *Hyporhamphus georgii* (cuv. & val.). *Indian J. Fish*., 9(1&2): 168-196.

Address: Central Marine Fisheries Research Institute, Mandapam Camp- 623 520, Tamilnadu, India.

Abstract: The hemirhamphids constitute an important group of the neretic-pelagic fisheries of the Gulf of Mannar and Palk Bay. Although there are eight species of halfbeaks distributed in these waters, *Hyporhamphus georgii* (C.V.) and *Hemirhamphus marginatus* (Forsk.) are the only species which may be considered of sufficient importance to constitute a distinct fishery. In a view to obtaining accurate information on the fishery biology of these common species, a detailed investigation was taken up during 1957-59. Most of the work so far done on the halfbeaks is more or less of taxonomic nature and very little precise information is available on their biology. The most significant references on the subject are those of Delsman (1924) Uchida (1930 and 1958), Nakamura (1933), Devanesan (1937), Job and Jones (1938), Hubbs and Kampa (1946), Devanesan and Chidambaram (1948) Ling (1958) and Hattori and Seki (1959). The present paper deals with the results of the investigation on the various aspects of the biology *Hyporhamphus georgii* (C.V.).

393. **Talwar, P.K.** 1968. Mural-thoondi, a gear for half beak fishes. *J. Bomb. Nat. Hist. Soc.,* 65(1): 235-236.

Abstract: The mural-thoondi is an indigenous gear for the capture of halfbeaks in the Gulf of Mannar and Palk Bay (Mandapam area). Capture by this gear is so ingenious as to be worthy of record.

394. **Thomas, P.A.** 1987. Demospongiae of the Gulf of mannar and Palk Bay. pp. 205-365. In: *Recent Advances in Marine Biology.* P.S.B.R. James (ed.), 591 pp.

395. **Thajuddin, N and G. Subramanian.** 1995. Additions to the new reports of marine cyanobacteria from the east coast of India. *Phykos,* 34(1&2): 33-37.

Address: National Facility for Marine Cyanobacteria, Bharathidasan University, Tiruchirapalli-620 024, Tamilnadu, India.

Abstract: A detailed survey of cyanobacterial flora covering over 2,660 km of the coastline from Tirakol of Goa state (Lat. 15° 45'N and Long. 72° 37'E) to Cape Comorin (Lat. 8° 5'N and Long. 77° 33'E) of Tamil Nadu and from Cape Comorin to Bhimunipatnam of Andhra Pradesh (Lat. 17° 55'N and Long. 83° 25'E) encompassing the regions such as Arabian sea, Indian Ocean, Gulf of Mannar, Palk Bay, Palk Strait and Bay of Bengal was made. The survey included different habitats like open sea and shore, stagnant seawater ponds and puddles, backwaters and saltpans. A total of 196 species of 51 genera belonging to 14 families were recorded.

396. **Thajuddin, N and G. Subramanian.** 2005. Cyanobacterial biodiversity and potential applications in biotechnology. *Curr. Sci.,* 89(1): 47-57.

Address : National Facility for Marine Cyanobacteria, Department of Microbiology, Bharathidasan University, Tiruchirapalli 620 024, India.

Abstract : Cyanobacteria (also known as blue-green algae) are a group of extraordinarily diverse Gram-negative prokaryotes that originated 3.5 billion years ago. Their diversity ranges from unicellular to multicellular, coccoid to branched filaments, nearly colorless to intenscly pigmented, autotrophic to heterotrophic, psychrophilic to thermophilic, acidophilic to alklophilic, planktonic to barophilic, freshwater to marine including hypersaline (salt pans). They are found both free living and an endosymbionts. They are considered to be one of the potential organisms which can be useful to mankind in various ways. A number of important advances have occurred in cyanobacterial biotechnology in the recent years. World wide attention is drawn towards cyanobacteria for their possible use in mariculture, food feed, fuel, fertilizer, colouant, production of various secondary metabolites including vitamins, toxins, enzymes, pharmaceuticals, pharmacological probes and pollution abatement. Only a few cyanobacterial stains (including Spirilina) have been well-characterized or exploited commercially. Basic research is needed to identify new cyanobacterial strains of high value products, strain improvement using molecular tools for rapid growth rate, ability to withstand varied environmental conditions and enhancement of synthesis of high value products. This review is intended to focus on the biodiversity of cyanobacteria in various environments, recent application and new developments that are diversifying the directions for commercial exploitation.

397. **Thangaraj, M and A.P. Lipton.** 2004. Species-specific proteins in closely-related seahorses. *Curr. Sci.,* 86(12): 1645-1647.

Address : Vizhinjam Research Centre of Central Marine Fisheries Research Institute, Vizhinjam, Thiruvananthapuram 695 521, India. e-mail: liptova@yahoo.com

Abstract : Non-denatured polyacrylamide gel shows the respective species-specific

characteristics on the muscle protein of *Hippocampus kuda* and *H. trimaculatus.* Two proteins of molecular weight 66.8 and 39.8 kDa were found exclusively in *H. kuda.* These constituted about69.8 and 16.2% respectively of its protein. In *H. trimaculatus*, two other specific proteins with molecular weight of 674.3 and 50.5 kDa were recorded, which constituted 46.0 and 7.5% respectively of its protein. These species-specific proteins are important for species identification, which paves avenues for further characterization and upgrading of the available information on seahorse taxonomy.

398. **Thangaraj, M and A.P. Lipton.** 2007. Occurrence of the Japanese seahorse *Hippocampus mohnikei* Bleeker 1854 from the Palk Bay coast of south-eastern India. *J. Fish. Biol.,* 70: 310–312.

Address : Marine Biotechnology Laboratory, Vizhinjam Research Centre of CMFRI, Vizhinjam, Thiruvananthapuram 695521, India.

Abstract : The occurrence of the Japanese seahorse, *Hippocampus mohnikei* is reported for the first time from the Palk Bay coast of south-eastern India.

399. **The Hindu** 2007. Olive ridleys washed ashore. In: *The Hindu* dated 11th Jan '07.

Abstract : More than a dozen olive ridleys (sea turtles) have been washed ashore at Nagapattinam, Vedaranyam and Point Calimere in the last two days. Fisheries and Forest department officials believe mechanised trawlers might have killed them. Forest department officials are taking steps to remove the carcasses. The Wildlife department is investigating the cause of death. Olive ridley, an endangered species, weighs about 50 kg. They feed on crabs, shrimp, rock lobsters, sea grasses, algae, snails and fish. Sometimes they feed on jellyfish in shallow waters. The beaches of Orissa are nesting grounds of olive ridleys. Their population continues to dwindle in the Atlantic Ocean but is rising in the tropical regions of Pacific and Indian oceans.

400. **Thomas, M.M.** 1968. On a new distributional record of *Parapenaeopsis tenella* from the south eastern coast of India. *J. Mar. Biol. Assoc. India,* 10(1): 166-167.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Parapenaeopsis tenella* (Bate) has been recorded from Japan (Bate, 1888 ; Kishinouye, 1900); China (Liu, 1955); and Australia (Dall, 1957) in the Pacific Ocean. In 1961 Hall reported it from Malaysia. DeBruin's (1965) record of this species from the east coast of Ceylon extended the distribution of this species further west. Racek and Dall (1965) considered the Palk Strait at the zoogeographical barrier limiting the distribution of the species from the west coast of India where its congener *Parapenaeopsis acclivirostris* (Alcock) occurs. But the present collection of *Parapenaeopsis tenella* from Palk Bay and Gulf of Mannar has established its presence beyond the Palk Strait which obviously does not act as a barrier. The discontinuous distributional records are probably due to the small size of the specimen and hence the rarity in the commercial catches. Male and female specimens of *Parapenaeopsis tenella* were collected from the early morning landings on the Gulf of Mannar side of Mandapam Camp and the Palk Bay side of Rameswaram

Island. The specimens were obtained only from the night catches of shore seines as well as boat seines from depths of 1-2 fathoms and 5-6 fathoms respectively.

401. **Thomas, M.M.** 1969. Notes on some interesting penaeid prawns (Crustacea Decapoda) from the southeast coast of India. *J. Mar. Biol. Assoc. India,* 11(1&2): 191-197.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: During routine collection of prawn samples of commercial catches from certain localities in Palk Bay and Gulf of Mannar on the southeast coast of India specimens of *Penaeus latisulcatus* Kishinouye, *Trachypenaeus pescadoreensis* Schmitt, *Trachypenaeus sedili* Hall and *Parapenaeopsis uncta* Alcock were collected. The occurrence of these prawns is reported for the first time from this area.

402. **Thomas, M.M.** 1977. A New Record of *Epipenaeon ingens nobili* (Bopyridae, Isopoda) Parasitic on *Penaeus semisulcatus* De Haan From Palk Bay and Gulf of Mannar. *Indian J. Fish*., 24(1&2): 258-261.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: The isopod *Epipenaeon ingens* Nobili parasitic on *Penaeus semisulcatus* De Haan is reported for the first time from Indian waters. One of the parasites is given along with the percentage of incidence and the effect on the host.

403. **Thomas, M.M.** 1978. Food and Feeding of Prawns. *CMFRI Spl. Publ.,* 3: 44-48.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: The study of food, feeding and assimilation is of fundamental importance for the proper understanding of the growth rate, population concentrations, gonadial maturation and other metabolic activities. Although prawns which inhabit the shallow areas form the bulk of the crustacean resources of the world very little work has been done in many countries on the food, feeding and assimilation in these animals. Detailed studies have been made in India on the 'stomach' contents of *Penaeus indicus* (Gopalakrishnan 1952) food and feeding of *Penaeus monodon* from Korapuzha Estuary (Thomas 1973), *Penaeus semisulcatus* from the Gulf of Mannar and Palk Bay.

404. **Thomas, M.M.** 1980. Food and feeding habits of *Penaeus semisulcatus* De Haan at Mandapam. *Indian J. Fish.,* 27(1&2): 130-139.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: *Penaeus semisulcatus* feed on a variety of food items viz., polychaetes, crustaceans, molluscs, diatoms, foraminiferans and radiolarians, even though detritus and sand formed bulk of the stomach contents. There was marked difference in the food composition of the species from the Palk Bay and Gulf of Mannar. Actively fed prawns were found to be more in the night catches. The species do not exhibit preference to any particular food item. It is concluded that the abundance of a particular food item was dependent on its availability during the season when they are predominant. There was no

significant difference in the food and feeding habits in the various size groups.

405. **Thomas, M.M.** 1986. Decapod crustaceans from Palk Bay and Gulf of Mannar, pp. 405-438. In: *Recent advances in Marine Biology,* (ed.) P.S.B.R. James, Today and Tomorrow, New Delhi, 591 pp.

Address: Central Marine Fisheries Research Institute, Cochin-682 018, India.

Abstract: Extensive collections were made from various places in the Gulf of Mannar from Tuticorin to Kundugal and in Palk Bay from Rameswaram to Muthupet. Besides, field collections were made from shallow waters in the coral reefs of Vala Tivu, Hare Island, Manauli Island, Pulli Island, Pullivasal Island, Krusadai and Shingle Islands and their lagoons. The details of the material with their distribution, and notes on topics of interest are given for twenty four species of penaeid prawns belonging to the genera, *Penaeus, Metapenaeopsis, Trachypenaeus* and *Parapenaeopsis* and eleven carideans belonging to the genera, *Palaeman, Macrobrachium, Periclimenes, Anchistus, Hippolysmata, Hippolyte, Latreutes* and *Alpheus* are presented in this paper.

406. **Thomas, P.A.** 1965. The occurrence of the red mullet (Goat fish) *Upeneus luzonius* in the Indian seas. *J. Mar. Biol. Assoc. India,* 7(2): 473-475.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: During my studies on the taxonomy and biology of goatfishes some specimens of *Upeneus luzonius* Jordan and Seale (1907) hitherto unreported from Indian waters have been collected from the Palk Bay and Gulf of Mannar near Mandapam. This species has been previously reported from Philippines (Jordan and Seale 1907, Herre and Montalban 1928, and Fowler 1933), Borneo (Seale 1910, Herre and Montalban 1908 and -Fowler 1933) and Singapore (Herre and Myers 1937).

407. **Thomas, P.A.** 1968. Studies on Indian sponges-I: Two new species of silicious sponges belonging to the genera *Echinodictyum Ridley* and *Rhadberemia Topsent*. *J. Mar. Biol. Assoc. India,* 10(2): 245-249.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Our knowledge of the sponges of the Indian region is still in its infancy. The only area which has been studied somewhat extensively is the Gulf of Mannar by various spongologists like Carter (1E80, 1881), Dendy (1905), Burton (1930, 1937) and Rao (1941). Besides these, some occasional reports are there about the sponges of Madras or of Gulf of Kutch; but such information often is too fragmentary when the vast shoreline of about 4800 km of India is taken into consideration. With the idea of studying the Indian sponges in a comprehensive manner, the present author took up this work in 1964. Collections from various parts of India by the author himself over the years have been supplemented by those forwarded by many other scientists from different parts of the country including Andamans and Laccadive Islands. The Mandapam region, however,

has been surveyed in greater detail, with particular stress given to the Palk Bay, since the sponges of Palk Bay is poorly known. The sponge fauna of the Indian region has been found to be quite rich and varied and its relationship with those of adjacent parts like the Red Sea and the Australian region is quite striking. The taxonomy of those species that are of special interest is presented here, in a series 'Studies on Indian Sponges' of which the present communication forms the first part. All types described here are deposited in the Reference Collection Museum of the Central Marine Fisheries Research Institute, Mandapam Camp.

408. **Thomas, P.A.** 1970. Studies on Indian sponges-VI. Two new records of silicious sponges (*Poecilosclerida: Tedaniidae*) from the Indian ocean. *J. Mar. Biol. Assoc. India,* 12(1&2): 43-50.

Address: Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Mandapam, India.

Abstract: The occurrence of two species of silicious sponges, *Acarnus thielei* Levi and *Acanthacarnus souriei* is reported here from the Palk Bay and the Gulf of Mannar. These are new records for the Indian region.

409. **Thomas, P.A.** 1972. Boring sponges of the reefs of Gulf of Mannar and Palk Bay. *Proc. Symp. Corals & Coral reefs, MBAI.* pp. 333-362.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Boring sponges form a major group among the marine organisms causing considerable destruction to the reef system. The bores made by the sponges weaken the entire reef, making it more susceptible to the wear and tear caused by waves. A systematic account of the major coral-boring sponges of the fringing reefs of Gulf of Mannar and Palk Bay, based on a study over a period of three years, is presented in this paper. Other aspects like intensity of boring, pattern of growth are also briefly discussed.

410. **Thomas, P.A.** 1986. Demospongiae of the Gulf of Mannar and Palk Bay : pp.205-365. In: *Recent advances in Marine Biology,* (ed.) P.S.B.R. James, Today and Tomorrow, New Delhi, 1986. 591 pp.

Address: Central Marine Fisheries Research Institute, Vizhinjam Res. Cent., Vizhinjam, Kerala, India.

Abstract: The author, while engaged in the study of Indian marine sponges during the years 1964-70, could pay special attention to the sponge fauna of the Gulf of Mannar and Palk Bay and the present account entitled "Demospongiae of the Gulf of Mannar and Palk Bay" is an outcome of this investigation. Faunistically speaking the Gulf of Mannar is rather well known. Whereas no published account is available till date on the sponges of the Palk Bay. In the present study a total of 94 species is recorded for the first time from the Palk Bay. In the present work it is attempted to provide an exhaustive account on the systematics and distribution of the Demospongean fauna of both the Gulf of Mannar and

Palk Bay. For the comprehensiveness of the account, species which have been reported previously from the Gulf of Mannar by the earlier workers are also incorporated. The total number of valid species from both the Gulf and Bay is 275 and is referable to 8 orders. 38 families and 136 genera. Details regarding the morphology, colour, skeletal arrangement and spicules etc., are provided to facilitate an easy identification.

411. **Toor, H.S.** 1971. Taxonomic position of *Lethrinus mahsenoides* Valenciennes and *Lethrinus sanguineus* Smith. *Res. Bull. Panjab. Univ.,* 22(3&4): 375-378.

Address: Department of Zoology and Entomologym, Punjab Agriculture University, Ludhiana, India.

Abstract: The taxonomic position of *L. mahsenoides* and *L. sanguineus* is discussed. Diagnostic characters of *L. mahsenoides* have been presented. This new record of *L. mahsenoides* from Indian Coast (Palk Bay and Gulf of Mannar) has bridged the Gulf in the distribution of this species, which has already been reported from South Africa on the one hand, and Australian waters on the other.

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412. **Udhaya Shankar, T.R.** 1986. Vegetation of Mandapam Region: A note on economic importance, *Souvenir, 35th Anniversary, Recreation Club of Regional Centre of CMFRI, Mandapam Camp,* pp. 37-41.

Abstract: The vegetation of Mandapam region mainly comprises of zerophytes, the plants that are adapted to low water requirements and Mesophytes, the plants of habitats, which are neither extremely dry nor very wet, owing to low rainfall mostly limited between September and December during the Northeast monsoon. Apart from these plant communities, the littoral fringes of the coasts of Gulf of Mannar and Palk Bay support a varied number of halophytes or the plants of saline and marsh habitat The seas around Mandapam harbour a diversity of marine flora consisting of microalgae, Seaweeds and Seagrasses.

413. **Umamaheswara Rao, M.** 1968. Additions to the Algal Flora of the Gulf of Mannar and Palk Bay from Mandapam area. *J. Mar. Biol. Assoc. India,* 10(2): 366-369.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: As early as 1927, Prof. M. O. P. Iyengar gave a brief account of the flora of Krusadai Island and other collecting grounds in the Gulf of Mannar and Palk Bay areas near Mandapam. Later Boergesen (1937a, b; 1938) reported a large number of the algae occurring around Mandapam in his contributions on south Indian algal flora, but the green algae of this area were not included in this work. Since then, detailed attempts have not been made to study the algal flora of Mandapam, but for a provisional list of algae of Krusadai Island (Chacko *et. al.,* 1955) and this paper on a new species of *Halicystis* (Iyengar & Ramanathan, 1954). While working on some ecological aspects of marine algae of Mandapam, the author had the opportunity to collect algae in the different seasons of the year, in the vicinity of Mandapam (79°8' E, 9°17' N) and nearby places like Pudumadam and Keelakarai. Among the collections made since 1964 some plants have not been previously recorded from Mandapam area a list of these algae is given in this report with brief notes on their distribution.

414. **Umamaheswara Rao, M.** 1972. Coral reef flora of the Gulf of Mannar and Palk Bay. *Proc. Symp. Corals and Coral reefs, MBAI.,* pp. 217-230.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The flora of the coral reefs occurring in the Gulf of Mannar and Palk Bay areas around Mandapam was studied, selecting transects from shore to the fringing reefs. Marine algae and Sea Grasses growing on the transects were sampled at five-metere intervals and a total number of 1,850 samples was taken all along the 19 transects surveyed. Physical conditions of the transects and relative abundance of the algae and sea grasses are given, along with a list of macroscopic forms present in the quadrat samples. Distribution of the

important and common algae like *Halimeda, Caulerpa, Ulva, Microdictyon, Padina, Pocockiella, Sargassum, Turbinaria, Gelidiella, Amphiroa, Gracilaria* etc., and sea grasses is described. Influence of the nature of substratum and other environmental conditions on the algal distribution are discussed.

415. **Umamaheswara Rao, M.** 1973. Growth and reproduction in some species of *Gracilaria* and *Gracilariopsis* in the Palk Bay. *Indian J. Fish.,* 20(1): 182.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Mandapam, India.

Abstract: Growth and fruiting behaviour of the populations of *Gracilaria edulis, Gracilaria folifera* and *Gracilariopsis sjoestedtii* are described based on the field studies conducted from January 1969 to June 1971 in the Palk Bay near Rameswaram. Populations of these three agar-yielding red algae have been observed throughout the year with two half yearly growth cycles, one from October/November to April and the other from May/June to September. The rate of growth was found to vary in the growth cycles. Plants with reproductive structures occur in *Gracilaria edulis* and *Gracilaria folifera* in all months of the year and in *Gracilariopsis sjoestedtii* for a short period from November to March. Variations observed in the abundance of sexual, asexual and sterile plants and the abnormal features noticed in the reproductive behaviour of these three algae have been discussed.

416. **Umamaheswara Rao, M.** 1973. Growth and Reproduction of *Gelidiella acerosa* in the Palk Bay and Gulf of Mannar near Mandapam. *Indian J. Fish*., 20(2): 411-416.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Mandapm, India.

Abstract: Studies on Growth and Reproduction of *Gelidiella acerosa* growing in the Palk Bay near Rameswaram and in the Gulf of Mannar near Pudumadam, have been carried out for three years from 1968 to 1970. Results obtained show that the plants of *Gelidiella aceroso,* which occur throughout the year, attain maximum size in two seasons with a half yearly growth cycle and that the main growth season varies in the Palk Bay and Gulf of Mannar. The main growth season with peak number of large size fronds was found between December and April on the Palk Bay side and between July and August on the Gulf of Mannar side; The fruiting cycle of *Gelidiella acerosa* extends for a period of 1 to 9 months in a year and maximum number of tetrasporic plants occur in the population just after the two peak growth periods. Considering the local changes in growth behaviour, slow growth rate and the fruiting cycle, the period from December to April was found to be suitable for collecting *Gelidiella acerosa* in the Palk Bay and from July to August / September in the Gulf of Mannar.

417. **Umamaheswara Rao, M.** 1973. The Seaweed potential of the seas around India. *Proc. Symp. Living Resources of seas around India*. pp. 687-692.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The present paper deals with the Indian seaweeds of economic value and the potential resources available in the inshore waters of the country. Results of the sample surveys carried out to estimate the standing crops of all marine plants growing in the Palk Bay area are given. Possibilities of cultivating the commercially valuable species in sheltered and calm areas of the coastline are indicated based on the culture experiments conducted with *Gracilaria lichenoides* and *G. corticata.*

418. **Umamaheswara Rao, M.** 1974. Additions to the algal flora of the Gulf of Mannar and Palk Bay from Mandapam area. *Phykos*, 13:56-69.

419. **Ummerkutty, A.N.P.** 1961. Studies on Indian copepods 5. On eleven new species of marine cyclopoid copepods from the South-east coast of India. *J. Mar. Biol. Assoc. India,* 3(1&2): 19-69.

Address: Central Marine Fisheries Research Institute,, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Eleven new species of cyclopoid copepods, four belonging to the section *Siphonostoma* and the rest to the section *Poecilostoma* are described in detail. Six of the species are represented by both the female and the male sexes while others are known only from the females. The material of the present investigations was collected both from the Gulf of Mannar and the Palk Bay off Mandapam on the southeast coast of India during the months of May, June, July and August 1960. The collections were made in the inshore waters and the methods of collection are discussed. The composition of the cephalosomal appendages of the *siphonostomatous* cyclopoids is briefly considered. The present study shows that there are four pairs of oral appendages, the mandible, the maxillule, the maxilla and the maxilliped besides the preoral antennule and antenna on the cephalosome.

420. **Ummerkutty, A.N.P.** 1966. Studies on Indian copepods-16. On some rare and interesting copepods from South east coast of India. *J. Mar. Biol. Assoc. India,* 8(2): 302-319.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: During the period of a three year investigation at the Central Marine Fisheries Research Institute, Mandapam Camp on the copepod fauna of the surrounding Gulf of Mannar and Palk Bay, a total of one hundred and eighty two species of copepods were gathered and identified. Out of these, twenty three species were found to be new to science, and they have been described elsewhere (Ummerkutty, 1960, 1960a, 1960b, 1961, 1963, 1966, 1966a, 1966b). In the present communication brief notes are given on some rare and interesting copepods.

V

421. **Vasudevan,V. And A. Seetaramaswamy.** 1983. Distribution of clay minerals in modern sediments of Palk Bay. *Indian J. Mar. Sci.* 12: 218-219.

Address: Marine Sciences Division, Centre for Earth Studies, Trivandrum, 695 010. And Department of Geology, Andhra University, Waltair 530 003.

Abstract : X-ray diffraction studies on clay minerals from the surface sediments of the Palk Bay indicate the presence of montmorillonite, illite and kaolinite. These minerals show spatial variation with the amount of montmorillonite increasing from the shore towards the deep bay and illite showing a reverse trend.

422. **Vedavyasa Rao, P., M.M. Thomas and G. Sudhakar Rao.** 1973. The Crab fishery resources of India. *Proc. Symp. Living Resources of seas around India.* pp. 581-591.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Crabs support a sustenance fishery of appreciable importance, although, its present status is not comparable with that of those major crustacean fisheries such as prawns and lobsters. In addition to the marine fishery, large numbers of crabs are landed from the estuaries and brackish water lakes adjoining the coastal areas. To meet the increasing demand for frozen crab meat and to develop an organized crab fishing industry, an evaluation of the existing resources is quite essential. The fishery at present is supported mostly by the edible crabs belonging to the family Portunidae and available information on the various aspects of the fishery show that the fishing is restricted to the inshore areas mostly by operations of small indigenous crafts and gears. In most of the places crabs form an ancillary catch along with other crustaceans and fishes, intensive fishing for crabs alone existing only in selected areas. The annual catch which is less than 4,000 tons is subject to marked fluctuations. However, the distribution of the species and the trend in production indicate scope for further expansion. An attempt is made here to study the abundance and production of crabs from three general areas *viz.,* west coast of India, Gu1f of Mannar and Palk Bay and the northern part of the east coast from Point Calimere to Sunderbans with a view to understand the crab resources of the country. The estimation of the potential resources of the offshore waters as indicated by the trawler catches is also made. The need for biological investigations on factors governing yield and crab population is stressed.

423. **Vedavyasa rao, P., P. Livingston and Atmaram Misra.** 1988. A report on the whale sighted off Mandapam on the Palk Bay side on 5th July, 1988. *Mar. Fish. Inf. Serv. T&E. Ser.,* 95: 10.

Address : Mandapam Regional center of CMFRI, , Mandapam Camp - 623 520, Tamilnadu, India.

Abstact : Report on the whales sighted off Mandapam Bay in front of Coast Guard Station, on 5.7.1988, at about 10:30 hrs. A couple of whales were seen swimming the surfacing of whales at frequent intervals at about 2.5-3 km away from the shore.

Observations at a closer distance onboard revealed the presence of three whales, one larger and two smaller. The blow was rather feeble and only of a moderate height. During surfacing, the body appeared to be slender, overall co lour of the exposed upper surface being black. And the external characters of this whales the fin appeared to be narrow, concave on its outer margin and tapering, the tail fluke was concave margin. The eye estimation of the size of the larger whale was about 4-5 m and that of the smaller ones, 2.5-3m. On the basis of the observed characteristic the present whales might belong to the species *Pseudorca crassidens Owen,* popularly known as False killer whale. The species is oceanic in habit and moves in shoals, in the present case also, it appears that a few specimens might have got separated from the main shoal and moved to the shallow waters of the Bay. The present sighting of this species off Mandapam in the Palk Bay is the first report.

424. **Vedavyasa Rao, P., A.A. Jaya Prakash and M. Ramamoorthy.** 1988. On a Leatherback turtle caught from Palk Bay, off Mandapam. *Mar. Fish. Inf. Serv. T&E. Ser.,* 95: 9.

Address : Mandapam regional Centre of CMFRI, Mandapam Camp - 623 520, Tamilnadu, India.

Abstact : On a olive leatherback turtle *Dermochelys coriacea,* popularly known as ' Eluvarai aamai' or Dhoni aamai' in Tamil was got in gill net ('Choodai valai) operated cyanosed indigenous boats in the fishing ground, on 3.7.1988, 12 km northwest of Mandapam in the Palk Bay, was brought ashore at the Mandapam fish landing centre near the fish farm of the Regional Centre. Where the gill net was operated at a depth of 12m of the fishing ground. The morphometric measurements of the specimen was a male the total carapace length and the total weight were 152 cm, and 260 kg respectively. The carapace width and plastron length and the width of plastron were 81 cm, 144.5 cm, 83 cm, respectively. Where the length of anterior flipper and of posterior flipper was a96 cm, and 58 cm are given in this report. And one more thing the specimen on hand appears to be relatively narrow bodied compared to the female specimens reported earlier.

425. **Velankar, N.K.** 1955. Bacteria in the inshore environment at Mandapam. *Indian J. Fish.,* 2(1): 96-112.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The quantitative distribution of bacteria in the sea-water, in association with plankton, and in the bottom muds of the Palk Bay and the Gulf of Mannar at Mandapam, at a distance of two miles from the shore was investigated during a four year period (1950-53). Bacteria were present in the sea water to the extent of a few hundreds per ml., determined by plate counts on sea-water agar; they were more numerous in the water from the surface than from near the bottom. Bacteria were present associated with plankton in large numbers, ranging from a few thousands to over 500,000 per ml of plankton, and appear to be influenced numerically by the nature of the plankton. Plate counts of the mud ranged from a few thousands to over a million per g (wet basis). Anaerobic counts were often less than the aerobic counts. Numerical changes in the sea-water bacterial

population showed trends which are probably seasonal. The presence of nitrifying, denitrifying, nitrogen fixing, agar digesting and sulphate reducing bacteria in the seawater and/or mud is reported. Gram negative non-sporing motile rods predominated in the bacterial flora. The normally occurring heterotrophic bacterial flora of the environment is briefly described.

426. **Velankar, N.K.** 1957. Bacteria isolated from seawater and marine mud off Mandapam (Gulf of Mannar and Palk Bay). *Indian J. Fish.,* 4(1&2): 208-227.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Bacteria of the Indian coastal waters have not been studied so far. A study of these bacteria and their comparison with the marine bacteria recorded in other regions would be interesting, particularly from a consideration of the temperature differences. Moreover, a knowledge of these bacteria is necessary in the processing and presentation of fish, since fish spoilage flora is derived largely from the bacterial flora associated with the living fish (on the slime, gills and in the gut) and hence has a marine origin.

427. **Velappan Nair, R., R.S. Lal Mohan and K.S. Rao.** 1974. The Dugong, *Dugong dugon*. *CMFRI Bulletin,* 26:1-38.

Address: Central Marine Fisheries Research Institute, Cochin - 682 018, India.

Abstract: The dugong, *Dugong dugon* (Muller), which is found in the coastal waters in several parts of the Indo- Pacific region, occurs in India in the Palk Bay, the Gulf of Mannar and in the Saurashtra waters and has been exploited for its flesh for several centuries. Apart from its economic importance, the dugong, also called the sea cow, is a very interesting marine herbivore with features like muzzle, horny plates on jaws, massive bones and hair on the body. It is probable that the resemblance of dugongs to human beings when seen at a distance and the female dugong suckling the young one by holding it with a flipper might have given rise to the numerous stories of mermaids told by sailors especially in medieval times. In recent years there has been a marked decline in the dugong population in most areas of distribution. At present dugongs are found in good numbers only in the Australian region around Queensland, Northern territory and Western Australia. The number of dugongs captured annually in Palk Bay and Gulf of Mannar in recent years has decreased considerably as compared with the early part of this century. Undoubtedly there is great need for protecting the dugong from indiscriminate exploitation since it is a rare animal. For proper and effective conservation and management of the dugong populations adequate information on the distribution, habits, biology and the present level of exploitation is necessary. The taxonomy, morphology, distribution and natural history of dugong have been studied. Dugongs are being reared for the past fifteen years at the Regional Centre of the Central Marine Fisheries Research Institute at Mandapam Camp, which is the only place in the World where they are held in captivity, and aspects like habits, growth, food and parasites have been investigated. In this Bulletin the available information on the dugong is presented comprehensively so that it will stimulate further research work on this very interesting rare marine mammal.

428. **Venkataraman, G., M. Badrudeen and R. Thiagarajan.** 1962. Studies on the food and feeding relationship of the half beak fishes (*Hemirhamphidae*) from the Gulf of Mannar and Palk Bay. *Indian J. Fish.,* 9A: 1-9.

Abstract : The present study deals with the seasonal composition of the food items of four species of half – beaks and its relation to the environmental biota and their stages of sexual maturity. These studies have revealed that different types of feeding relationships are maintained by the different species and that they do not belong to the groups of filter feeders but feed selectively.

429. **Venkataraman, G and M. Badrudeen.** 1974. On the diurnal variation in the catches of silverbellies in Palk Bay. *Indian J. Fish.,* 21(1): 254-265.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: A comparison of the trawl landings from Palk Bay by day and night fishing showed a marked variation in the catches of silverbellies observed on full moon nights than on new moon nights both in Palk Bay and Gulf of Mannar. From an analysis of the size groups of *Leiognathus jonesi* and *L.brevirostris* caught, it was seen that the proportion of smaller size group was greater in the night catches than in the day catches whereas the proportion of the larger size group was greater in the day catches than in the night catches. The diurnal variation in the catches of silverbellies shows that they stay at the bottom during day time and at night good many of them migrate from there and rise to surface and sub-surface waters. This and the instances of sharp difference in the catch rates observed between full moon and new moon nights indicate a close link between light and the process of migration in silver bellies. The probable cause for the variation in the size groups in the catches by day and night fishing is pointed out. Fishing at the surface, sub-surface and mid water levels at night by using suitable gear is suggested for augmenting the production of silver bellies.

430. **Venkataraman, G., M. Badrudeen and R. Thiagarajan.** 1982. Population dynamics of silver belly *Leiognathus jonesi* in Palk Bay. *Indian J. Fish.,* 28(1&2): 65-86.

Abstract : Based on catch, effort and length – distribution data on *Leiognathus lonesi* collected at Mandapam over a period of six seasons, age and growth, selection factor, coefficient of total mortality (Z) and coefficient of natural mortality (M) were derived. For the estimated natural mortality rate (2.1) and for the mesh size (25 mm codend) now in operation, the optimum effort has been found to be 50,000 standard night effort, (= 5,000 std. Day effort), the yield per hundred recruits being 310 g. The isopleth diagram indicates that there was over fishing of silverbellies in 1973 – 74 and 1974 – 75 when the effort far exceeded the optimum level. The isopleth diagram also shows that the present mesh size yield the best catch and in increase in mesh size to 35 mm or decrease to 15 mm leads only to a decrease in yield. For a scientific management of the fishery, it is suggested that the effort be maintained at 50, 0000 night standard effort with the present mesh size at 25 mm so as to obtain sustained yield of this fish in the coming years.

431. **Venkataraman, K. and C.H. Satyanarayana.** 2000. Where did the sea cow vanish? *Seshaiyana, ENVIS News letter* in Estuaries, Mangroves, Coral reefs and lagoons, Annamalai University, pp. 1-3.

Address : Zoological Survey of India, Chennai, Tamilnadu, India.

Abstract : The greed of human beings has already taken a toll in the form of elimination of many species, thus creating a hostile place an earth for him to survive, and dugong is now in the average of elimination or extinction. Dugongs are mammals. They live up to 70 years and grow up to a length of three meters. They are commonly called as " sea cows " since they graze only on sea grass meadows. Dugongs are related more to elephant's than to other marine mammals. Dugongs are distributed along shallow tropical and subtropical waters of the pacific region which include nearly 43 countries mostly falling between twenty seven degree North and South of the equator.

In India, dugongs are reported from Gulf of Kutch, Konhan coast and Malabar coast on the west and Gulf of Mannar and Palk Bay on the East coast. Although the dugong are known to occur since along in the coastal waters of India. No systematic survey has hitherto been undertake to ascertain its population density. No reliable date are also available on dugong catches. However, the fact is that in India the dugong population is very meager and declining rapidly at an alarming pace.

Surveillance and enforcement have to be increased to prevent illegal fish netting and hunting involvement of Coast guard and Navy to enumerate dugong population by Aerial surveys and to chide poachers must be considered for effective conservation.

432. **Venkataraman, K., Ch. Satyanarayana, J.R.B. Alfred and J. Wolstenholme.** 2003. Diversity of Corals: Palk Bay and Gulf of Mannar. pp 10-12. ***In***: *Hand Book on Hard corals of India.* (*eds*.) K. Venkataraman, Ch. Satyanarayana, J.R.B. Alfred and J. Wolstenholme. Zoological Survey of India. 350 pp.

Address: Zoological Survey of India, Chennai, Tamilnadu, India.

Abstract: The threats to the Palk Bay and Gulf of Mannar are through indiscriminate exploitation of natural resources by poachers for commercial purposes. There are about thirty-eight fishing villages on the coastal stretch of Ramnathapuram district with a population of little over 32,000, entirely depending on fishing. Extensive areas of sea grass beds with species such as *Cymodocea sp., Thalassia sp.* and *Enhalus sp.* are being disturbed by stake net fishing and intensive trawling operation around the islands. Exploitation of fishery resources in the inshore waters has been the sole occupation of hundreds of fishing families along the coast for centuries. Reef exploitation includes reef fishery, shell (chanks) and pearl fishery, ornamental shell trade and illegal mining of corals. Villagers around Palk Bay harvest holothurians, seahorses and pipefishes. The coral reefs of Palk Bay and Gulf of Mannar have been quarried for industrial purposes from the early sixties from Mandapam to Tuticorin before the declaration of the Marine Biosphere Reserve and National Park. The estimate of coral quarried varies. The exploitation of corals for extraction of lime and for manufacture of cement from Mandapam area alone during the sixties and early seventies was to the tune of 250 m^3 per day.

433. **Venkataraman, K. and M.V.M. Wafar.** 2005. Coastal and marine biodiversity of India. *Indian J. Mar. Sci.,* 34(1): 57-75.

Address : Zoological Survey of India, Chennai, Tamilnadu, India.

Abstract : This paper summarizes what is known of the coastal and marine biodiversity of the Indian seas and their various ecosystems, from past literature, museum records and other lesser-known sources of information. The synthesis suggests that the number of species known could be of the order 13,000 or higher. However, the inventory is very detailed only in the case of commercially important groups such as fishes or molluscs and is very weak with respect to minor phyla or microbial organisms. In terms of spatial coverage, probably only two-thirds of the total marine habitat has been covered till today and the remote islands and other minor estuaries still virtually remain untouched. It is, therefore, likely that true inventory of coastal and marine biodiversity could be several times higher than what is known today. Lack of trained taxonomists, however, is a serious constraint to achieve this. Conserving what we have today is hampered by lack of management measures including outreach and our ability to predict what would live in Indian seas, by lack of data relating changes in biodiversity to those of environment.

434. **Venkataramanujam, K., M. Venkataswamy, V. Ramadhas and B. Srikrishnadhas.** 1987. Stranding of sperm whale Physter macrocephalus at Manapad , Palk Bay India. *Investigations on Cetacea.* 20: 253-256.

435. **Victor Jerald Leo, S.** 2000. Antimicrobial activity of crude extracts of some stony corals in the Gulf of Mannar and Palk Bay. *M.Phil., Dissertation* Madurai Kamaraj University. 55 pp.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625021, India.

Abstract: Majority of synthetic antibiotics are considered to be safe, because of their ability to kill the target microorganisms at extremely low concentrations. So, they can be used as therapeutic agents to treat various diseases. But some pathogenic bacteria have gained resistance to these synthetic antibiotics and also the overuse of antibiotics has contributed to a profoundly dangerous medical threat to modern health care. Hence, many chemical alternatives are being tried in recent years for combating this threat. Antimicrobial compounds from marine flora and fauna are well known for their profound physiological and pharmacological properties and thus form the basis of potent bioactive compounds. Eventhough, many bioactive compounds from marine flora and fauna have been used as drugs, not much attention has been paid for exploring the possibilities of making antibiotics out of them. Gulf of Mannar and Palk Bay contain the habitats of many corals, coral reefs and shelter a variety of flora and fauna. However, studies on the extraction of bioactive compounds from marine stony corals from this area with potential antibacterial activity are very few. Hence, in the present study, the crude extracts from stony corals were tested for antibacterial properties against *E. coli* cultures. The stony corals in this study were collected from the intertidal areas of Gulf of Mannar and Palk Bay. There are quite a number of

assays used to study the inhibition growth of test organism (*E. coli*) by an antibiotic.

436. **Victor Rajamanickam,G., V.J. Loveson.** 1990. Results of Radiocarbon dating from some beach terraces around Rameshwaram island, Tamil Nadu. In: *Sea level variation and its impact on coastal environment,* G.Victor Rajamanickam (ed)., Tamil University, Thanjavur.

437. **Victor, A.C.C., M. Badrudeen, C. Kasinathan and N. Ramamoorthy.** 1999. On the stranding of sea cow at Alagankulam along the Palk Bay and CMFRI jetty along the Gulf of Mannar coast. *Mar. Fish. Infor. Serv. T & E. Ser.,* 159: 19.

Address : Mandapam Regional Centre of CMFRI, Mandapam Camp – 623 520. India.

Abstract : On 20.03.1998, a male sea cow *Dugong dugong* (Muller) in dead condition was brought ashore at Alangankulam along the Palk Bay. And another male sea cow *Dugong dugong* was also stranded at CMFRI, jetty along the Mandapam , the Gulf of Mannar coast on 30.04.1998. The animal had injuries might have been due to the propeller movement of the fishing trawlers in the near shore waters of Mandapam. The other morphometric parameters are off , the total length and total weight of both animal were 245 cm, 281 cm and 200kg,220 kg respectively. The 1st animal's length of flipper , length of muzzle, width of muzzle and the tip of muzzle to vent and muzzle to genital opening were 35 cm, 18 cm, 24 cm, 160 cm, 121 cm, respectively. Then the distance between genital opening and anus, and the circumference of the belly region ,the origin of flippers were 33 cm, 164 cm, 126 present in this report. Where the second one from the CMFRI side, the measurement of this animal were the length of flipper ,and the width of muzzle, then the origin of flipper were 40 cm, 18 cm, 24 cm, and 60 cm respectively. The origin of blow hole and the length of caudal fluke were ranged in 30 cm, and 54 cm respectively. After the examination over both specimen were buried.

438. **Victor, A.C.C.** 2000. Mandapam Regional Centre of CMFRI, Mandapam Camp: Its Research activities and achievements. *Golden Jubilee Celebrations Souvenir 2000, Mandapam Regional Centre of CMFRI, Mandapam Camp.* pp. 1-5.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The Mandapam Regional Center of Central Marine Fisheries Research Institute at Mandapam Camp is one of the Premier Institutions for R&D in the field of Marine Fisheries Research and is an advanced center of its kind among the subordinate establishment of Central Marine Fisheries Research Institute. It is located on an impressive and picturesque elevated sand dune spread over 84 acres overseeing the Palk Bay in the north and Gulf of Mannar in the south. The history of the center dates back to 1943. The proposal for establishing various Central Fisheries Research Institutes, under the Union Government, was first made in 1943. The Fish Sub Committee of the Policy Committee on Agriculture and Fisheries in its report in 1945 endorsed this proposal. Subsequently on the basis of the "Memorandum on the proposed Fishery Research Institute" submitted by Lt. Col. RB. Seymour Sewell in 1946, the Central Marine Fisheries Research Institute (CMFRI) came into existence on the 3rd February 1947 at the Zoology Laboratory

building of the Madras University. The establishment was later shifted to Mandapam Camp in 1949 where it was housed in the Naval Building Complex, which was acquired in 1946 and modified into laboratories, administrative wings and temporary residential accommodation.

439. **Victor, A.C.C.** 2000. Sethusamudram ship canal project in the Gulf of Mannar Marine Biosphere Reserve - Its impact on environment. *Golden Jubilee Celebrations Souvenir 2000, Mandapam Regional Centre of CMFRI, Mandapam Camp,* pp. 25-27.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The Gulf of Mannar is located on the southeastern tip of India in the State of Tamil Nadu. It is in this region India's first and foremost Marine Biosphere Reserve is located. Popularly known as the Biologists paradise, this region harbours more than 3,600 species of plants and animals, making it one of the world's richest marine biosphere reserves. Owing to its shallowness, semi enclosed nature, less fluctuating temperature regimen, biophysical and ecological uniqueness, nutrient enrichment etc., it has acquired special status in the bio-diversity map of the Indo-Pacific oceanic realm. In recent years, the Government of India has been taking steps to initiate the excavation of the Sethu Samudram ship canal in the Rameswaram Island to connect the Palk Bay with Gulf of Mannar to facilitate the passage of ships without touching Colombo and circumnavigating Sri Lanka. In the budget for the year 2000-2001, the Government of India has sanctioned funds of Rs.4.8 crores for a detailed feasibility study and environmental impact assessment of the project. While the Government of Tamilnadu has expressed its happiness over the undertaking of the project, some environmentalists have raised questions on the positive and negative impacts of the project. The primary objective of this article is to analyse the positive and adverse aspect of the project.

440. **Victor, A.C.C., D. Kandasami, I. Jagadis, Boby Ignatius, A. Chellam, G. Chitra, P. Villan and M. Rajkumar.** 2001. Results of the mother oyster culture and pearl production in *Pinctada fucata* (Gould) in the inshore waters of the Gulf of Mannar and Palk Bay. *Perspectives in Mariculture. (eds.)* N.G. Menon and P.P. Pillai, Cochin-India. MBAI. pp. 251-258.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: It is established experimentally that the inshore areas of the Gulf of Mannar and Palk Bay bordering Mandapam Camp, Tamil Nadu, India can profitably be used for mother oyster culture and cultured pearl production. The depth of the inshore waters of the Gulf of Mannar is comparatively deeper where the raft culture can be adopted from November to May, the near shore waters of Palk Bay is shallow where rack can be used to farm the oysters from June to October, thus a continued farming is possible in all months in a calendar year. Though the hydrological and environmental conditions of both the seas are almost same, it is found that Gulf of Mannar is better suited for mother oyster culture as indicated by the better growth rates of spat and oysters. If farming is done

properly, high survival rates of spat, mother oysters and implanted oysters can be achieved with an enhanced rate of production of better quality-cultured pearls.

441. **Virabhadra Rao, K.** 1954. Biology and fishery of the Palk Bay squid *Sepioteuthis arctipinnis. Indian J. Fish.*, 1(1&2): 37-67.

Address : Central Marine Fisheries Research Station, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : The Palk Bay squid which supports a minor fishing industry in the Ramnad Distrct of Madras State has been reffered to a widly distributed myopsid, dibranchiate cephalopod, *Sepioteuthis arctipinnis* Gould. Squid fishery in the Palk Bay off Mandapam and Rameswaram is regular and seasonal from February or March to June, and the type of net chiefly used is the 'olai valai'. The fishery in the Gulf of Mannar depends upon occasional catches obtained in the shore seines. Random samples of the market carch showed nearly 60% of the young and immature individuals. The fishery to be capable of further developmentas the present fishing activities are only on a very small scale.

442. **Virabhadra Rao, K.** 1961. On two opisthobranchiate Molluscs, *Placobranchus ocellatus* and *Discodoris boholiensis* from Indian waters not hitherto been recorded. *J. Mar. Biol. Assoc. India,* 3(1&2): 253-256.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: *Placobranchus ocellatus* Hasselt 1824.- In the month of July 1960 a small sea slug from among the Sea Weeds found on dead coral in the shallow water region of the Palk Bay in front of the fish farm was collected by Dr. S. Jones. Subsequently in October 1960 two more numbers of this form were obtained by him from the same locality. These were later identified as *Placobranchus ocellatus* van Hasselt under Family Elysiidae and Order Sacoglossa (Thiele 1931a).

443. **Virabhadra Rao**, **K.** 1962. On the structure and life history of a new Aeolid *favorinus argentimaculatus* from Palk Bay. *Proceeding of the symposium on mollusca, Part-III.* pp. 1009-1016.

Address : Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract : A tiny nudibranch mollusc collected from the shallow waters of the Palk Bay in the vicinity of Mandapam has been ascribed to a new species of *Favorinus argentimaculatus* of the family Favorinidae. The species differs from the members of the genus in the presence of silvery spots all over the integument and also in the general arrangement of the cerata. Its structure, feeding habits, spawn, early development, and larval and post-larval stages have been described.

444. **Virabhadra Rao, K and K. Prabhakara Rao.** 1963. *Stiliger wigrovittatus* sp. Nov. A

Sacoglossan Mollusc from the Gulf of Mannar. *J. Mar. Biol. Assoc. India,* 5(2): 232-238.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: The species under the genus *Stiliger* Ehrenberg 1831 known hitherto from the coastal waters or backwaters and estuaries of India are very few. *S. pica* Annandale and Prashad (Sewell & Annandale, 1922) from Chilka Lake and S. gopalai Rao (1937) from Madras backwaters are the only species on record. *Stiliger viridis* (Kelaart) as described by Eliot (1906a) from the Ceylon coast of Gulf of Mannar and *S. tentaculatus* Eliot (1916) from Siam are two other species known from regions very close to Indian coasts. *S. nigrovittatus* described here is one of the few species collected by the present writers from the Palk Bay and the Gulf of Mannar in the vicinity of Mandapam. It has been experienced that a careful search among the members of filamentous algae like Chaetamorpha revealed one or the other species of the *sacoglossan, Opisthobranchs* which feed on those algae. A few individuals of *S. nigrovittatus* were obtained from the Gulf of Mannar close to the Central Marine Fisheries Research Institute, Mandapam Camp, on November 29, 1962, for the first time. Subsequently they were collected from the same locality and also from Kundagal Point near Pamban in all months upto March 1963. They were observed on algal growths of *Cladophoropsis zoolingeri* (Kuetz.) Boergs., covering the rocks in the intertidal region. In captivity they were found feeding on this alga as also on Chaetomorpha sp.

445. **Virabhadra Rao, K and L. Krishna Kumari.** 1974. On some aspects of Taxonomy, structure and early development of the nudibranchiate Gastropod *Discodoris fragilis. J. Mar. Biol. Assoc. India,* 16(3): 689-699.

Address: National Institute of Oceanography, Panaji, Goa, India.

Abstract: The present paper deals with observations on specimens of a doridacean nudibranch, *Discodorisfragilis* (Alder & Hancock) found among the sea grass *Cymodocea ciliata* in the Palk Bay lagoons along the south eastern coast of India. *D. fragilis* is a widely distributed species in the Indo-Pacific. The species has often been confused by same workers with other species having certain outward resemblances. With the help of photographic representations the taxonomic characters of the species have clearly been described. The morphological characters of this species with related species have been compared. The nature of the dorsal tubercles which are low conical spiculate and with blunt white tips, the foot with a frontal groove but without a median notch, the rhinophores each with a write line on its posterior face, the labial disc having paired elongated triangular patches of close-set rodlets, the radula with a varying number of lateral hamate teeth in numerous transverse rows but without the rachidial teeth, an enlarged prostate in two distinct lobes and a conical penis without armature among the reproductive organs are good taxonomic characters when taken along with the distinct pattern of coloration of the mantle and the foot. The mantle is very fragile and the animal often autotamizes it in portions. The mating habits, spawn and early developmental stages have been described. The just hatched veliger measured about, 180 p. on its long axis, having rather a broad spiral shell of a pale pinkish hue.

446. **Viswanathan, R.** 1959. Characteristics of seawater off Mandapam, 1950-1954. *J. Mar. Biol. Assoc. India,* 1(1): 85-88.

Address: Central Marine Fisheries Research Institute, Mandapam Camp - 623 520, Tamilnadu, India.

Abstract: Some of the chemical and biological characteristics of sea water off Mandapam have been analyzed for trends. Salinity and dissolved oxygen were lower in Palk Bay than in the Gulf of Mannar. Oxygen-phosphate relationship and likewise trends in phytoplankton were different; it is considered likely that this association is of some significance.

W

447. **Wafar, M.V.M.** 1986. Corals and Coral reefs of India. *Proc. Indian Acad. Sci. (Anim. Sci./ Plant Sci.) Suppl., November* 1986: 19-43.

Address: Biological Oceanography Division, National Institute of Oceanography, Dona Paula, Goa, India.

Abstract: This paper summarises the present state of knowledge on the ecology, productivity and resources of Indian coral reefs. In Indian waters, reef-building corals occur at, Palk Bay, Gulf of Mannar, Gulf of Kutch and central west coast along the mainland India, Andaman and Nicobar islands in the Bay of Bengal, and Lakshadweep Islands and Gaveshani Bank in the Arabian Sea. Coral formations at Palk Bay, Gulf of Mannar, Andaman and Nicobar islands are of fringing type. Patch reefs occur along the central west coast, on the Gaveshani Bank and around Gulf of Kutch islands. Lakshadweep islands are well developed atoll reefs. Diversity of coral genera is the greatest in the Nicobar Islands, with 42 genera followed by Lakshadwecp islands (28), Gulf of Mannar (26), Andaman Islands (25), Palk Bay (21), Gulf of Kutch (20), central west coast (9) and Gavcshani Bank (5). *Acropora* is the most diverse genus in Indian reefs whereas *Porites* is the most important reef builder. Gross primary production of Indian reefs vary from 2 - 4 to 9.1 g $Cm^{-2}d^{-1}$ which are in the range known for world reefs. All reefs studied are autotrophic with the exception of one reef in the Andaman Islands. Bulk of the primary production is contributed to by benthic autotrophs, and phytoplankton production is negligible. Nannoplankton is an important fraction of phytoplankton in reef waters. The corals recycle and conserve nitrogen very efficiently accounting for the high primary productivity of the reefs located in oligotrophic waters. Production of particulate organic aggregates is an important pathway of energy transfer in coral reefs and can be as high as 20% of gross production. Food fishes and aquarium fishes constitute the pelagic resources of coral reefs. The potential food fish yield from all Indian reefs is about 0.2 million tons yr^{-1}. Potential yield and export value of aquarium fishes, however, are not known. Trade for ornamental shells is also an important industry in many of the Indian reef areas. Overexploitation of coral resources is a serious threat to Indian reefs. Coral mining also leads to shore erosion. The increasing trade in corals for ornamental purposes is also a contributing factor to the decline in coral resources. Present management and conservation measures for Indian coral reefs are inadequate. In certain reef areas, protection for overexploited species exists; however, its enforcement is not strict. Proper management of space and species of coral reefs, and creation of an awareness among the public of the importance of the coral reef ecosystem, are the measures urgently needed for the conservation of our coral reefs.

448. **Wikipedia.** 2007. Palk Bay. ***In:*** http://en.wikipedia.org/wiki/palkstrait . Adam's Bridge lies within the Palk Strait.

Abstract: The Palk Strait is a strait that lies between the Tamil Nadu state of India and the island nation of Sri Lanka. It connects the Bay of Bengal to the northeast with the Gulf of Mannar to the south. The strait is 40 to 85 miles (64-137 Km) wide. Several

rivers flow into it, including the Vaigai River of Tamil Nadu. The strait is named after Robert Palk, who was a governor of Madras Presidency (1755-1763) during the British Raj period.

It is studded at its southern end with a chain of low islands and reef shoals that are collectively called Adam's Bridge (or Rama's Bridge). This chain extends between Dhanushkudi on Rameswaram in Tamil Nadu and Talaimannar in Mannar in Sri Lanka. The island of Rameswaram is linked to the Indian mainland by the Pamban Bridge.

The shallow waters and reefs of the strait make it difficult for large ships to pass through, although fishing boats and small craft carrying coastal trade have navigated the strait for centuries. Large ships must travel around Sri Lanka. Construction of a shipping canal through the strait was first proposed to the British government of India in 1860, and a number of commissions have studied the proposal up to the present day. The most recent study of the Sethusamudram Shipping Canal Project, as it is now called, was an Environmental impact assessment and a technical feasibility study commissioned by the Tamil Nadu government in 2004.

Like the English Channel, the Palk Strait has been taken up as a challenge by many long distance swimmers.

The Indian epic poem Ramayana, written in Sanskrit and an important Hindu text, recounts how Rama, with the help of an army of vanaras, built a bridge of stones across the sea to Lanka to rescue his wife Sita from the Asura king Ravana. The Ram Karmabhumi movement, encouraged by a NASA satellite photograph which they say proves that remnants of this bridge still exist, was formed to prevent the shipping canal from being built.

The name Adam's Bridge comes from the story that Sri Lanka was the site of the biblical earthly paradise, and that Adam's Bridge was created when Adam was expelled from paradise**.**

449. **Wilson, J.J., N. Marimuthu and A.K. Kumaraguru.** 2004. Sedimentation of Sceleractinian corals of Palk Bay in the southeast coast of India. *Nat. Sem. Ecological Balance and Sethusamudram Canal*; Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi- 623 409, 1st to 3rd Oct'2004. p. 54.

Address: Centre for Marine and Coastal Studies, Madurai Kamaraj University, Madurai-625 021, Tamilnadu, India. E-mail: jjeraldwilson@hotmail.com

Abstract: The corals of Palk Bay are fringing and patchy type distributed from Rameswaram to Vedhalai (North). The northeast monsoon brings large quantities of sediments to the Palk Bay compared to southwest monsoon. The 2002 bleaching event caused severe mortality among the corals of Palk Bay reefs. Abnormal atmospheric depression which occurred in June- 2004 resulted in high accumulation of sediments in the Palk Bay region. A study was conducted to assess the biophysical status of corals of Palk Bay using Line Intercept Transects, Sediment traps and SCUBA diving techniques. The coral reefs of Palk Bay were divided into three zones and each zone was repeatedly observed from June-2004 to Sep-2004. The Live-Coral and Sedimentation rates were monitored in this study and the results are discussed.

450. **Wilson, J.J., N. Marimuthu and A.K. Kumaraguru.** 2005. Sedimentation of silt in the coral reef environment of Palk Bay. *J. Mar. Biol. Assoc. India,* 47(1): 83-87.

Address : Centre for Marine and Coastal Studies, School of Energy Sciences, Madurai Kamaraj University, Madurai - 625 021, Tamilnadu, India. Email: jjeraldwilson@hotmail.com

Abstract: The sedimentation of silt in five locations in the coral reef environment of Palk Bay was studied for a period of six months form May to October 2004 for a rapid assessment. The rate of sedimentation was in the range 1mg/cm^2/d to 42 mg/cm^2/d. The sedimentation was greater during June 2004 coinciding with the onset of southwest monsoon season. An assessment of live coral cover indicated that there was less coral cover in the location where there was greater sedimentation. Corals of the family Acroporidae were found to be severely affected.

451. **Wolstenholme, J and K. Venkataraman.** 2003. Identification of Scleractinian corals. *Coral Taxonomy Training Workshop, India-Australia Training and Capacity Building Project, MoEF, Delhi*. 265 pp.

Address: Museum of Tropical Queensland, Australia & Zoological Survey of India, Chennai, India.

Abstract: The Gulf of Mannar reefs are developed around a chain of 21 islands that lie along the 140 km stretch between Tuticorin and Rameswaram. These islands are located between latitude 8° 47' N and 9° 15'N and longitude 78° 12'E and 79° 14' E. The islands lie at an average distance of 8 km from the mainland. They are a part of the Mannar Barrier reef, which are 140 km long and 25 km wide between Pamban and Tuticorin. Different types of reef forms such as shore, platform, patch and fringing type are also observed in the Gulf of Mannar. The islands have fringing coral reefs and patch reefs around them. Narrow fringing reefs are located mostly at a distance of 50 to 100 m from the islands. On the other hand, patch reefs rise from depths of 2 to 9 m and extend to 1 to 2 km in length with width of as much as 50 meters. Reef flat is extensive in almost all the reefs in the Gulf of Mannar. Reef vegetation is richly distributed on these reefs. The total area occupied by reef and its associated features is 94 sq km. Reef flat and reef vegetation including algae occupies 65 and 14 sq km, respectively (DOD and S.A.C., 1997). Usually monsoons, coral mining and high sedimentation load affect the visibility. These reefs are more luxuriant and richer than the reefs of Palk Bay. Pillai (1986) provided a comprehensive account of the coral fauna of this region. There are about 94 species of corals belonging to 32 genera in the Gulf of Mannar. The most commonly occurring genera of corals are *Acropora, Montipora* and *Porites.* Coral associates such as ornamental fishes belonging to the family Chaetodontidae, (butterfly fish); *Amphiprion* spp (clown fish), *Holocentrus* spp (squirrelfish), *Scarus* spp (parrotfish), *Lutjanus* spp (snapper fish) and *Abudefduf saxatilis* (sergeant Major) are found. Extensive seagrass beds are present; green turtles, olive ridley turtles and dugongs are dependent on the seagrasses.

Y

452. **Yadav, K.P.S.** 2006. Short circuit. *Down to Earth,* 15th March, p. 35.

Abstract: On the face of it, the ambitious Sethusamudram project to bridge the east coast with the west coast of the country seems a great idea. The prospect of not having to circumnavigate Sri Lanka and cutting short travel periods by 30 hours sounds as interesting as it did 150 years ago when a draft plan for the canal was first mooted. A Tamilian dream is now beginning to take shape. The channel across the Palk Straits between India and Sri Lanka is expected to be operational by 2008: it will allow ships sailing between the east and west coasts of India a straight passage through India's territorial waters, instead of circumnavigating Sri Lanka. India doesn't have a continuous navigable route here due to the presence of a shallow ridge (1.5 metre to 3.5 metre deep) called 'Adam's Bridge'. The Palk Bay is also too shallow for navigation. The Rs 2,427-crore Sethusamudram Shipping Canal Project (SSCP) will create a continuous ship channel by dredging Adam's Bridge and the shallow parts of Palk Bay. The channel's total length will be 167.5 km. Of this, about 90 km needs dredging, which will be done for 35 km length in the southern leg at Adam's Bridge and for a length of 54 km in the northern leg at Palk Straits. Intervening stretches of Palk Bay, not requiring dredging, is 78 km long. Dredging will be done to achieve a depth of 12 metres for ships with a draft of 10 metres, those that reach 10 metres into the water. In terms of weight, a fully loaded 30,000 deadweight tonnage ship will sail through. The EIA report is one of the most contentious of issues. The final EIA report was submitted by NEERI to TPT in May 2004. It was paid Rs 1-crore to put together the EIA and the techno-economic feasibility report. About a year earlier, NEERI had submitted a rapid EIA. Many activists and professionals believe that the same was later submitted as the comprehensive report. The total amount of dredged material for the entire project stands at a whopping 82.5 million cubic metres (mcm). This amount of mud, if spread on land, will create an 82,500 km long wall of one metre width and one metre height. This is one of the biggest dredging projects ever undertaken. By mid-January, "Dredge-12", a dredger of DC I, had already removed three mcm of seabed material from the Palk Straits region. The ship is currently dredging the sea floor in the Palk Straits, 25 km off the coast from Point Calimere in Nagapattinam district. Project authorities say they have made sure that dredging and dumping will not have any adverse impacts.

453. **Yapa, K.K.A.S.** 2000. Seasonal variability of sea surface chlorophyll-*a* of waters around Sri Lanka. *Proc. Indian. Acad. Sci. Earth Planet Sci.,* 109(4): 427-432.

Address: Department of Physics, University of Ruhuna Matara, Sri Lanka.

Abstract : Remotely sensed data on ocean colour of waters surrounding Sri Lanka received from the Coastal Zone Colour Scanner (CZCS) are processed and analyzed. Raw data of 1 km resolution on relatively cloud free days during 1978-1986 are processed to produce sea surface chlorophyll maps within latitudes 4.5° N – 11° N and longitudes 78° E – 85° E, a region in the Indian Ocean surrounding Sri Lanka. The processed data include about 110 single day maps and composite averages for each month and season. The months of July, August and September are omitted in the calculation of averages due to insufficient

data. The waters in the Gulf of Mannar and Palk Bay areas show high chlorophyll-*a* concentrations throughout the year. However, these high values may represent other suspended particles and dissolved organic matter besides chlorophyll-a as this region is shallow (< 100 m). Regions with high chlorophyll concentrations (> 0.5 mg m^3) along the coast and western ocean region can be seen in the months of October and November, after the southwest monsoon period. As high surface chlorophyll concentrations may indicate high productivity, these regions need extensive measurements of primary production and also continuous monitoring of fish catches, during and after the southwest monsoon. Studies of particle composition in shallow water areas, in particular waters in Palk Bay and Gulf of Mannar, should be carried out in order to elucidate the effect of non-phytogenic contribution.

Subject Index

(The Numbers Indicate Reference Numbers in the Bibliography)

C

R

T

V

Taxonomy Index

(The Numbers Indicate Reference Numbers in the Bibliography)

T

Author Index

(The Numbers Indicate Reference Numbers in the Bibliography)

P

Q

R

S

T

U

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