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A Bibliographic Review: Identification and Prioritization of Research Gaps inthe Palk Bay (PB) Tamil Nadu

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Conservation and Sustainable Management of Coastal and Marine Protected Areas

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A Bibliographic Review: Identification and Prioritization of Research Gaps inthe Palk Bay (PB) Tamil Nadu

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Chapter 1

Introduction

Palk Bay is a land locked marine environment, geographically bounded by Tamil Nadu state in the west, Bay of Bengal in the North, the Gulf of Mannar in the South and Sri Lanka in the east. The Indian side of the Palk Bay coast line stretched ~500 km length. Nagapattinam, Pudukottai and Ramanathapuram Districts are the coastal districts of the Palk Bay in Tamil Nadu state of India. Point Calimere and Dhanushkodi are the two end points of the Palk Bay in India. The coast line boundaries laid between Longitude 10°16'N (Point Calimere) and 9°7' N (Ram Sethu/Adems' Bridge). Muthuppettai coastal lagoon is the only coastal lagoon with massive of mangrove canopy forest at the northern part of Palk Bay.

Need for this Bibliography

Palk Bay harbours various raw materials for seafoods and also rich with seagrass meadows. Out of 13 estuaries, Agni Estuary and Karangad estuary are the major estuaries in the Palk Bay. Each coastal district has 100s of shrimp/fish ponds along the Palk Bay coast line. According to coral reef in the Palk Bay region sited parallel to land up to the depth of ~9 m. Moreover, seaweed cultivation practices are available in the Palk Bay coastal water. Hence, the Palk Bay is shelter for numerous natural resources and artificial cultivation of the marine resources and as a consequence, they have huge economic value. However, the coastal habitats in the Palk Bay region are facing critical threats resulted from the developmental activities and overexploitation of natural resources. The following map (Figure 1) shows the geographical location of Palk Bay region.

Objectives/Scope of the Present Bibliography

- Provides comprehensive compilation of research works carried out in the Palk Bay region between 2008 and 2015.
- Based on the research works, major findings and issues pertaining to ample natural resources in Palk Bay region will be highlighted.

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

Figure 1
Geographical Location of Palk Bay

- Existing status and threats to these resources, their governance and issues that hinder or support their sustainable use will be described.

- Vital research gaps relevant to the management of natural resources in the Palk Bay region will be provided.

- In view of fulfilling the research gaps, viable research projects, which will help for better management of the natural resources in the Palk Bay region, will be recommended.

Materials and Methods

The research articles/research data/ research information pertaining to the Palk Bay region published during the period between 2008 and 2015 were collected by using a unique scientific search engines such as SciFinder, PubMed, and Google Scholar. The research abstracts were extracted from the collected articles with article title, keywords, author's affiliations and contact e.mail ID. The abstracts were formatted according to the Chicago Manual of Style referencing in Arial fond (12 pt) and finally aligned in alphabetical order.

Chapter 2

Review of Literature

Hydrography of Palk Bay

The Palk Bay contains coastline of around 296 km along Tamil Nadu, stretching from Kodiakarai (Point Calimere) in Nagapattinam district to Dhanuskodi in Ramanathapuram district, encompassing 5 revenue districts in Tamil Nadu which includes Nagapattinam (58 km), Thiruvarur (19 km), Thanjavur (29 km), Pudukkottai (49 km) and Ramanathapuram (141 km). The width of Palk Bay varies from 64 km to 137 km between Tamil Nadu and Sri Lanka. The water spread area of Palk Bay including both Indian and Sri Lankan side is 13,982 km^2, which is equally divided by the International Maritime Boundary Line (IMBL). Palk Bay is a shallow and flat basin whose depth is limited to maximum of 15 meters and the average depth hardly exceeds 9 meters. The shallowness feature of the Palk Bay region is considered as the backbone for its productivity and therefore it supports a wide diversity of marine living resources and also related different livelihoods. The shallowness facilitates penetration of sunlight to the bottom of the Bay, giving ample scope for photosynthesis and consequent primary production and supports a wide variety of fauna and flora.

Palk Bay is usually calm while the turbulent condition prevails during the onset of northeast monsoon. The whole Palk Bay area is exposed to the vagaries of both the southwest and northeast monsoons. The contribution of rainfall from the former is negligible and the major proportion of the annual normal rainfall occurs during northeast monsoon season. Rainfall is moderate to heavy during October to mid-December with occasional gales. The annual mean rainfall fluctuates between 762 and 1270 mm and relative humidity remains 80 ± 10% throughout the year. Except this natural monsoon rainfall, there is an absence of major fresh water flow into the Palk Bay region by means of rivers. The monthly average atmospheric temperature differs from 25°C to 31°C with the maximum and minimum temperatures occur during the months of May and January, respectively[1]. The wind speed varies between 3 and 21 knots with the maximum wind speeds could be observed

in the months of May and July. Tides originate in the Palk Bay coast are irregular, semi- daily or mixed type with the maximum tidal range of about 1.0 m (spring tide). During

neap tides the tidal range varies often and as a consequence slight changes occur in the water levels with a rise or fall of 2 to 5 cm. The Palk Bay is largely occupied by sand banks and shoals with two major coral reef formations. One is around 5.5 km long and from 20 m to 300 m wide extending from Munaikad to Thonithurai. Another reef formation is 25 to 30 km long with a width generally less than 200 m; which extends between Thangachimadam and Agnitheertham of Rameshwaram. Palk Bay acts as one of the major permanent, semi-permanent and temporary sinks for the sediments carried by the surf zone currents.

Seawater Quality Including Nutrients:

The surface water temperature is subjected to diurnal variations owing 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. The surface salinity value distribution of Palk Bay waters rely not only on the origin of the water mass but also on the evaporation from the surface. Unless the factors of evaporation, such as 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 32 ppt 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. Generally, the inshore water of the Palk Bay region has been a fall in salinity during the period between December and January. There is also a gradual decrease in the salinity of sea water along an axis in the southwest direction running from the Palk Strait and then more rapidly towards the further end of this axis, disregarding the shallow dip at the middle. Southwest corner of the Palk Bay region is pocketed with the high saline water owing to the incursion of Gulf of Mannar water through Pamban Pass. Like salinity the density of the sea water also decreases along an axis in the southwest direction from the strait.

The dissolved oxygen distribution 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. The temperature, salinity, density and dissolved oxygen of the surface waters of the Palk Bay region reveals that the Bay of Bengal waters entering the Palk Strait have major influence on its hydrographic condition, where as the water from the Gulf of Mannar influences the hydrological parameters to a minor extent. During monsoon season the inshore waters of Palk Bay region become muddy due to the presence of suspended sand and silt stirred up from the sandy shore by wave action.

The water quality parameters such as temperature, dissolved oxygen, salinity, pH, nutrients and Chlorophyll-a were analyzed between January and December 2014 in the coastal waters of Mandapam, Thoothukudi, Arumuganeri and Kanyakumari. The results revealed a noticeable difference in the water-quality parameters based on seasons and anthropogenic inputs. Elevated nutrient concentrations were observed during the monsoon season when compared to the other seasons owing to the considerable increase in the inflow of freshwater containing rich load of nutrients resulted from riverine and land run-off. This along with the seasonal tidal amplitude facilitates the continuous exchange of organic,

inorganic, plant and animal matters in the coastal water. The increase in the concentration of chlorophyll-a during the summer season indicates dominant saline conditions and the existence of higher photosynthetic activity. The status of the physico-chemical parameters in the study sites of the current concern is very useful to evaluate the health status of the coastal system and also to take precautionary measures to save the coastal environment[2].

The physico-chemical properties and plankton distribution in the coastal waters of Kattumavadi, Palk Bay region were found out from July 2011 to June 2012. The coastal waters exhibited high nutrient values during monsoon season and low values during summer season. Air and surface water temperatures were ranged from 26.7 ºC to 37.7 ºC and from 26.7 ºC to 35.4 ºC, respectively, while light extinction coefficients (LEC) were varied from 1.82 to 4.86. The salinity of the coastal waters was ranged from 26.7 to 37.5‰ and the pH was changed from 7.4 to 8.6. The nutrients concentration viz. nitrate (3.82 to 18.42 µM), nitrite (1.52 to 6.94 µM), inorganic phosphate (4.85 to 20.12 µM), reactive silicate (5.62 to 18.64 µM), free ammonia (0.01 to 0.59 µM), total nitrogen (3.76 to 11.95 µM) and particulate organic carbon (0.59 to 2.86 µM) also exhibited variations independently[5].

The higher nutrient concentration was recorded in the monsoon season and could be ascribed to the organic materials received from the catchment area during ebb tide. The seasonal changes in the biomass, productivity, leaf canopy height and shoot density of dominant seagrass species in the Palk Bay region, Cymodocea serrulata and Syringodium isoetifolium were influenced by nutrient factors and abiotic variables. Nutrients exhibited distinct seasonal variation due to fresh water inflow from land sources, nutrients utilization by phytoplankton, tidal action, mixing of water column and increase in the microbial population. Among the nutrients, inorganic phosphate and total organic nitrogen are the more crucial which accelerate the growth, biomass and productivity of both the seagrass species. The optimum growth of the seagrass species was noticed in monsoon and post monsoon seasons owing to the availability of more nutrients and other favourable environmental conditions.

All the nutrients recorded in the seagrass ecosystem of the coastal waters of Munaikadu and Devipattinum such as nitrate (0.25 to 7.3 µM), nitrite (0.03 to 2.91 µM), inorganic phosphate (0.12 to 4.1 µM) and silicate (0.65 to 7.4 µM) were high. In the seagrass bed of Sangumal, the increase in nutrient concentrations during monsoon season led to an increase in total suspended solids. Moreover, higher phosphate, nitrite and silicate concentrations were observed in the Sangumal which could cause adverse effect on seagrass diversity in that region. However, limitation of nutrients such as nitrate (0.33 to 1.38 µM), ortho phosphate (1.47 to 3.44 µM), total nitrogen (1.24 to 7.22 µM) and total phosphorus (3.51 to 5.98 µM) was observed in all the strata in the different seagrass ecosystem of Palk Bay region. Nutrient biogeochemical transformations across the sediment-water interface influence the productivity of seagrasses in the Palk Bay region. Moreover, excess nutrients pollution, eutrophication and light limitation due to algal mats decreased the growth of seagrasses. Even though the terrestrial nutrient inflow stimulates the seagrass growth, the excessive nutrients in seawater degrade the water quality by enhancing the growth of macroalgal bloom in coastal waters of the Palk Bay region. While considering the corals reefs in the nearshore areas of Palk Bay region, the discharges of sewage into the coastal waters enriched the nutrient load due to the coastal urban development and processing industries and as a consequence aggravate the physical stress on the coral reefs. The addition of nutrients by means of sewage leads to the algae growth over the coral reefs, which is detrimental to the vitality and distribution of coral reefs in the Palk Bay. An increasing trend in the nutrient concentration has been observed in the Palk Bay coastal waters, which would affect the coral skeleton formation and causes algal blooming. This affects the coral

reefs by reducing the availability sunlight to zooxanthellae for photosynthesis. The nutrient level enhancement in seagrass ecosystem would favour the epiphytes to grow and thereby minimize the photosynthetic efficiency of the seagrasses also. Hence, the future research should be concentrated on developing nutrient policies for sustainable management and restoration important coastal resources of the Palk Bay.

Biological Resources of Palk Bay

Marine Flora

Marine flora in Palk Bay includes the species of 32 green algae, 35 brown algae, 59 red algae, 3 blue green algae and 11 seagrasses.

Phytoplankton

In Palk Bay region, the primary productivity of phytoplankton in the upper layer of tropical oceans is limited by the availability of nutrients. Therefore, the physical processes that can bring nutrients into the photic zone are of prime importance since the seasonal increase in the supply of nutrients in the Palk Bay region primarily increased the growth rate of phytoplankton. The gross primary productivity due to phytoplankton varied between 142 and 472 mg C m-3 day-1, indicating that the Palk Bay region is biologically productive. During the South Inter- monsoon, the carbon biomass available in the plankton food web was significantly higher in the PB (av. 122.8 ± 47.60 mg C cm−3) than in the GoM (av. 81.89 ± 35.50 mg C cm−3). This was due to a strong microbial loop in the former region[8].

The diversity and concentration of marker pigments in PB was characterized by high concentration of zeaxanthin, indicating the dominance of photosynthetic prokaryotes (cyanobacteria). The substantial increase in the photoprotective carotenoids (PPCs) and photoprotection index (PI) in the PB was indicative of its low productivity, probably caused by the warm and turbid waters[70].

Considerable variations in abundance, composition and succession of phytoplankton have been observed from year to year. The recorded phytoplankton species in selected coral reef and seagrass ecosystems of the Palk Bay region was 133, of which, the species contribution from different families were Bacillariophyceae (98), Dinophyceae (15), Cyanophyceae (12) and Chlorophyceae (8). The percentage contribution of diatoms towards the composition of different groups of phytoplankton was high with 57.14 to 94.10% followed by dinoflagellates (3.12 to 28.57%), blue-green algae (2.43 to 12.5%) and green algae (3.7 to 7.69%)[141]. A strong seasonal influence was also observed in the phytoplankton density. The phytoplankton in the coral reef environment was two-fold more productive than the seagrass environment. The bloom forming blue-green algal species (Trichodesmium erythraeum) was noticed and this reveals that there are possibilities for the occurrence of toxic blooms[55]. A total of 103 species of phytoplankton were identified, among them, eighty three species were recorded from diatom, four species from blue green algae and sixteen species from dinoflagellate[162].

Generally 2 to 3 phytoplankton blooms have been recorded in the Palk Bay annually. The maximum number of occurrence of the Trichodesmium algae was 24 ×106 count l−1. 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 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 Gonyaula039.x33,34. During rainy seasons, the green algae would have been washed away from the nearby freshwater bodies and survive for a short period in the coastal waters. The total number of phytoplankton species recorded in the Thondi coastal waters was 15 that include diatoms (10 species) and dinoflagellates (8 species). The major phytoplanktons were found to be Biddulphia mobilensis and Biddulphia sinensis[82].

Macro Algae

The Palk Bay region is rich in seaweed resources of economic importance111. The widespread distribution of seaweed species in the Palk Bay region supports overabundance of marine organisms such as phytoplankton, zooplankton, shellfish, finfish etc. The dominant seaweed species are Gracilaria edulis, Gelidiella acerosa, Sargassum sp., Turbinaria sp., Fading sp. and Caulerpa sp. Local fisherfolk are attracted towards the collection of seaweeds because of their flourishing growth in the coral reef areas of Palk Bay region. The major seaweed collection centers in the Palk Bay region are Rameswaram and Pamban. Sargassum and Turbinaria species, as a potential raw material for carageenan production, are being collected mostly from the Munaikkadu and Thonithurai coastal regions64, whereas G. acerosa is largely collected and processed on the shores of Thangachimadam and Akkalmadam for agar agar and agarose production. The dead corals littered in the Palk Bay region form an excellent ground for abundant growth of Gelidium micropterum and various species of Gracilaria, which are among the chief Indian agar-yielding seaweeds. A very rich growth of Gracilaria lichenoides (kanji paasi), Sargassum and Turbinaria, which are good sources of algin are observed between the coral reef beds and the shore. The shoreline cultivation of exotic and invasion seaweed, Kappaphycus alvarezii had been successfully established along the Palk Bay coast and its abundance is clearly visible inshore waters of Rameshwaram and some other regions of the Palk Bay[98].

The seaweed species, Halimeda tuna, Enteromorpha intestinalis and Caulerpa racemosa collected from the Vadakadu coast exhibited greater antioxidant potential and therefore they have the prospect of future applications in medicine, food production or cosmetic industry157. The antifouling activity analysis of few seaweeds of Palk Bay region against couple of epiphytic diatoms (Navicula subinflata and Nitzschia palea) showed the existence of both micro and macrofouling properties in the seaweeds. Some edible and non edible seaweed species belong to the northern part of Mandapam coast showed trace elements (Zn, Fe, Co and Mn) concentration beyond the Acceptable Daily Intake (ADI) limits. Apart from the development of systematic taxonomic survey for exploring seaweed diversity, their quantitative, ecological/economical role and seasonal variation assessment, the future research efforts should be exert on the development of advance technologies towards cultivating the seaweeds efficiently along the coast of Palk Bay since the seaweeds are regarded as one of the vital resources for sustaining the economy of fisherfolk and moreover its cultivation is eco-friendly and does not produce any harm to the marine ecosystem.

Seaweeds encompass many valuable constituents, such as protein, fiber, vitamins, polyunsaturated fatty acids, macro and trace elements, as well as important bioactive compounds and as a result they are more beneficial for human and animal health. The seaweed species (C, racemosa, U. faciata, C. minima, P. gymnospora and A. Spicefera) contains rich in nutritive properties hence these seaweeds are used as food and pharmaceutical industries for various purposes[111].

The proximate compositions of fresh seaweeds; total carbohydrate, total protein, total amino acids, total phenol, WRC and sulphate content in crude carbohydrate of 16 red and 7 green seaweeds and GC-MS profile of fatty acids of red seaweeds were studied. The study found out that the red seaweeds, such as Gracilaria verrucosa, G. edulis, Hypnea musciformis, H. valentiae, Grateloupia filicina; and green seaweeds Ulva lactuca and Chaetomorpha linum are promising not only for traditional cell wall polysaccharides extraction but also as a source of specific nutraceutical values (dietary fiber, pigments, carbohydrates, protein and amino acids supplements in the food and fodder)13,125,152. The phycoerythrin isolated from Kappaphycus alvarezii had characteristic affinity towards different metal ions, inhibitors, organic solvents, preservatives at different monochromatic

irradiances and hence it may be further exploited towards various biotechnological applications[128].

Seagrasses

Seagrasses are regarded as one of the important and highly productive ecosystems since they support a variety of life forms ranging from microbes to marine mammals like dugongs. Distribution of 14 species of seagrasses along the Indian coast has been reported. The Palk Bay region has shallow and light penetrating seafloor with favourable topography and sediment texture that form the platform for the luxuriant seagrass growth and as a result luxuriant seagrass beds with rich associated biodiversity, in particular fishery resources are found in the Palk Bay region. Thousands of traditional fisher folk of Palk Bay depend on seagrass ecosystem for their livelihood[75,159]. These seagrasses meadows provide vital services including flood mitigation, water filtration and feeding and nursery ground for dugongs, turtles, many commercial and recreationally important fishes, prawns, shrimps and crabs. Moreover, they are home to seahorses, pipe fishes, worms, other algae, sponges and other invertebrates[32].

Historically, the seagrass resource has sustained coastal livelihoods for centuries based on their agricultural (fishing and farming) and medicinal utility. Density of seagrasses as well as their detailed mapping can be effectively performed by IRS IC/ID LISS III and pan merged data products. In this context, investigation on the aerial extent and distribution pattern of seagrass meadows in Pamban area of Rameshwaram, Shinge, Krusadai, Pullivasal and Pumarichan Island of the Gulf of Mannar Biosphere Reserve, Manoliputti, Manoli and Hare islands by means of visual interpretation and digital analysis of satellite data (IRS 1D LISS III (2000 and 2002) and IRS P6 LISS III (2004)) exhibited the presence of extensive seagrass beds. Around 3289.14 ha reef area, 794.45 ha reef vegetation were recorded in the Mandapam group of islands during the year 2004. There was a reduction in the reef area of about 160.65 ha between 2000 and 2004, which could be ascertained to several anthropogenic disturbances especially trap fishing in the reef areas. Apart from this, an additional 139.32 ha of reef vegetation was noticed owing to the gradual occupation seaweeds in the reef area that necessitates the regular harvesting of seaweeds from the live coral areas for saving the corals from degradation. The study recorded 726.15 ha dense and 601.00 ha sparse seagrass beds, 2004, accounting for a total of 1327.15 ha of seagrass beds, which figure was very low when compared to the earlier reported figure of 1856.51 ha during the year 2000. The substratum which favours seagrass growth is dominated by the coarse sand and shell/coral debris159. An area of 127.98 ha of seagrass cover was estimated in Munaikkadu site of the Palk Bay coast using satellite data. The atmospheric correction algorithm applied to the Landsat ETM+ image improved significantly the contrast between seagrass, sand and water. Overall accuracy in water leaving radiance (Lw) image (85.19% and 92.59%) showed significant improvement over the raw image accuracy (77.78% and 81.48%). The pixel size in Landsat ETM+ (30 m) produce bias in the accuracy of results because the heterogeneous nature of pixel[41].

The seagrass species, C. serrulata was found densely populated in the shallow coastal regions of Palk Bay and the seagrass species in these region exhibited considerable variations in the biomass, productivity and canopy height. The local environmental parameters such as, inorganic phosphate and total phosphorus are two important nutrients and sediment texture play vital roles in influencing seagrass biomass, productivity and canopy height and as a consequence increasing the growth of seagrasses. Continuous monitoring of ecological and biological variables with respect to time and space is needed towards the efficient management of seagrass resources[20]. The total seagrass cover in Palk Bay (Pamban to Thondi) was 175 km2 with dominant species of Thalassia hemprichii and Cymodocea serrulata. A high density of seagrass was noticed in the middle zone (3- 6 km from the shore)[75].

The distribution and zonation pattern of seagrass assessed by SCUBA diving assisted with Global Positioning System (GPS) in the Mandapam, Panaikulam and Thondi disclosed the seagrass distribution of about 175.2 km2 along the coastlines. The percentage of seagrass distribution and species composition in nearshore Mandapam region was 63.87% with 10 species, 43.56% in middle zone with 7 species and 26.27% in offshore with 4 species. It was 24.17% in nearshore with 7 species, 53.31% in middle zone with 6 species and 20.14% in the offshore 5 species in Panaikulam. Whereas, in Thondi it was 75.41% in nearshore with 9 species, 54.28% in middle with 8 species and 31.42% in offshore with 7 species. Among the 14 recorded species, Cymodocea serrulata was the most abundant species and the least was Enhalus acoroides73. The underwater surveys conducted by video transects method revealed the eight seagrass species, such as Cymodocea serrulata, Enhalus acoroides, Syringodium isoetifolium, Halophila ovalis, Halophila beccarii, Halodule pinifolia and Halodule uninervis in Sethupavachatram and Manamelkudi area. The underwater survey explored the presence of three types of seagrass beds in the Palk Bay region, such as coral reef associated seagrass bed in Mandapam, mangrove associated seagrass bed in Adirampattinam, Mallipattinam and Sethupavachatram and shallow sandy bottom seagrass bed in Thondi, Kottaipattinam and Jegathapattinam. The seagrass meadows were important fishing grounds for shrimps, crabs and squids[52].

The physico-chemical variability and biomass of seagrass in the Adiramapattinam and Manalmelkudi coasts showed a distinct seasonal and spatial variation in the above ground and below ground biomass Independent abiotic variables, such as air temperature, salinity, pH, dissolved oxygen, particulate organic carbon and nutrients could be attributed to the seasonal variations in the seagrass biomass35. The physico-chemical properties of coral reef and seagrass ecosystems separated by a distance of 25 km in the Palk Bay region the monthly variations in the air temperature of 27–35 °C, surface water temperature of 25.0–31.5 °C, LEC of 0.54–1.22 k), salinity of 28.0–36.0%0, pH of 7.0–8.2, DO of 3.15–6.68 mll−1, nitrate of 0.25–7.3 µM, nitrite of 0.03–2.91 µM, inorganic phosphate of 0.12–4.1 µM, reactive silicate of 0.6–7.4 µM and POC of 0.28–3.25 mg C l−1. There distinct spatial variation on the above parameters indicated that the seagrass ecosystems prefer specific environmental conditions for their survival[140].

The influence of non-monsoon sediment arrival on the high-diversity seagrass meadows in terms of species composition and shoot density of the Palk Bay using a gradient-based approach revealed that Cymodocea serrulata was the most abundant species and present in all sediment conditions and the sedimentation rates did not change shoot elongation rates in C. serrulata, but in contrast, increased vertical rhizome elongation rate. This increase was reflected in an increase in below ground biomass along the sediment gradient. C. serrulata appears to be able to adapt to the sediment dynamics in this area by allocating resources to rhizomes and roots to counteract burial and stabilizing sediments[31].

Seagrass productivity and standing crop varied primarily in response to changes in water temperature, salinity, which themselves varied mostly as a function of season, rainfall and freshwater inflow. The increase in the nutrient levels in the seagrass environment would favour the growth of seagrasses. Pal Bay regions have more percentage, shoot density, biomass and productivity because Palk Bay region which possess more salinity and more temperature, waves, currents, less depth, sandy-clay substrate and more day length, light, nutrient and sedimentation which favour the changes in seagrasses diversity and their population in future[32].

Porewater nutrient profiles (nitrate (0.33–1.38 µM), ortho phosphate (1.47–3.44 µM), total nitrogen (1.24–7.22 µM) and total phosphorus (3.51–5.98 µM)) in seagrass ecosystem subjected to different nutrient loading indicated

the limitation of porewater nutrients in all the strata of different sampling sites of Palk Bay region. Sediment pH in the seagrass beds were alkaline and anoxic condition increased with increase in depth (56.2 mV to –52.7 mV). Species-wise interpretation revealed C/N ratio greatly promoted the biomass in Halodule pinifolia and Cymodocea serrulata. The sediment C/N stoichiometry (4.7: 1–16: 1) indicated that autochthonous C sources regulate the C biogeochemical processes in seagrass ecosystem. Nitrogen limitation was evident in the porewater, however it was not reflected on seagrass biomass and productivity which was evidenced by the higher biomass of individual species. Nutrient biogeochemical transformations across the sediment-water interface influence the productivity of seagrasses in the Palk Bay region. In addition, nutrient pollution, eutrophication and light limitation due to algal mats decreased the growth of seagrasses and hence it is necessary to develop nutrient policies for sustainable management and restoration of seagrass ecosystem[158].

The seasonal and spatial variation of dominant seagrass species, such as Cymodocea serrulata and Syringodium isoetifolium in Manamelkudi, Thondi and Devipattinam revealed the existence of distinct seasonal and spatial variation in the total biomass, productivity and above ground biomass, leaf canopy height and shoot density due to the influence of abiotic variables and the nutrient factors. The optimum growth was observed in monsoon and post monsoon seasons. Particulate organic carbon, inorganic phosphate and total organic nitrogen influenced the enhancement of biomass, productivity, leaf canopy height and shoot density of seagrass species. Increase in seagrass growth was noticed during the monsoon season, owing to optimum temperature, low salinity, pH and addition of nutrients[37].

Human interferences viz. fishing, anchoring of mechanized and non- mechanized fishing boats on the seagrass meadows, oil spills, disposal of huge solid wastes and sewage factors are recognized as the major factors for the gradual reduction of seagrass resources in the region. Meanwhile, the drastic reduction of seagrass resources was largely mediated by the intensive collection of paper shell (Tellina angulata) by the local fisher-women as a source of alternative livelihood income generation. Apart from disturbing the existing seagrass meadows, the seagrass meadows dig out process during the T. angulata shells collection would also affect the further growth of seagrasses in this region and as a consequence, the destructive process would fully destroy the underground rhizomes and roots of the seagrasses. Hence, it is necessary to take up adequate management measures by means of identifying alternative income source (sustainable seaweed collection and seaweed culture operations) for the fisherwomen involved in shell collection and also stressed to develop and implement a National Seagrass Conservation Plan by the Government of India to conserve the seagrass resources of this region[142,159].

Mangroves

Overall, 17 species of mangroves and mangrove associate species were reported from 13 estuaries of the Palk Bay region. Among them, maximum number of species (7 species) was recorded in Semangkottai and R. Pudupattinam coastal areas and minimum number of species (3 species) was reported in Sundra Pandia Pattinam, Pattankadu, Mallipattinam and Rajamadam coastal areas. Around 6 true mangrove species with a coverage area of ~94 ha were recorded in the Pudukottai district coast line that lies between Palk Bay and Palk Strait. Avicennia marina was the predominant species followed by Excoecaria agallocha > Lumnicera racemosa > Aganthus illicifolius > Rhizophora mucronata and Pemphis acidula. The mangroves were found as discrete and isolated patches in different parts of the district87. A total of 16 mangrove species belong to nine families and 11 genera along with 23 mangrove associates belong to 17 families and 21 genera were recorded in 56 estuaries from Pulicat Lake to Manakkudy Estuary along 1076 km of coastline in Tamil Nadu, during 2012-2014. Among them, A. marina and associate

species, Pongamia pinnata, Lpomoea pes-caprae and Calotropis gigantea were found to be prevalent along the North Coromandel Coast while Bruguiera gymnorrhiza was only recorded in the Ariyankuppam and Thengaithittu estuaries. Two mangrove associates Acrostrichum aureum and Fimbristylis ferruginea were reported in the Manakkudy estuary. The mangroves along the along the North Coromandel Coast were represented more number of mangrove species. A. marina was the dominant species almost all collect sites. Few mangrove plants only available in some species of mangroves in particular study areas[124].

The water quality of these mangrove ecosystems forms the basis for the floral and faunal diversity. Due to complete tide influence in Muthukuda area mangroves with good formation were recorded and this area was dominated by A. marina. A large patch of healthy mangroves is present in the Devipattinam area, bordered by Palk Strait in the east, in Ramanathapuram District. While considering the mangrove regeneration, some of the sites located in the Keezhathottam and Velivayal located at Agni estuary in the northern Palk Bay region were established with natural and artificial regeneration of mangroves after a careful study on the soil quality, suitable species composition, availability of natural recruitment, land elevation, distance from the water source, grazing effect and land-use. Cattle grazing were responsible for the single largest threat to the mangroves, as the fringing mangroves were exposed in the absence of any natural barriers. Another considerable threat to the mangroves is digging of canal for aquaculture activities that fragmented the mangrove patches[142].

It is more vital to explore and utilize potential estuary points in the Palk Bay region for plantation of mangrove species to improve the mangrove associated biodiversity, which could in turn enhance fisheries status and socio-economic status of fishermen community in the Palk Bay region. The OMCAR Foundation has initiated the ecological mangrove restoration project in Agni Estuary (15 acres of degraded mangroves) of Palk Bay region with the help aid of village leaders, women self help groups and youth groups through village level meetings and awareness programmes. The school students were also brought to mangrove forest area for mangrove ecology field trips and subsequently they were involved in mangrove field research data collection, tagging and village awareness programmes. The project also provides solutions for mangrove fisher families to use solar cookers as alternative to mangrove fuel wood, and eco-friendly paddle pump and toilets to save electricity and ground water quality. A GIS map of mangroves and land use pattern was developed towards the mangrove village that aids the fisherfolks to understand the importance of mangroves in terms of preventing from natural disasters and protect it through participatory village development scheme by local government[15].

The antipathogenic potential of methanol extract of the genus Rhizophora (Rhizophora apiculata and R. mucronata) showed significant inhibition against quorum sensing dependent virulence factors production, such as LasA protease, LasB elastase, total protease, pyocyanin pigment production and biofilm formation in Pseudomonas aeruginosa clinical isolates10. Inhibitory effect of cyclo(L-leucyl-L-prolyl) from chloroform extract of mangrove rhizosphere bacteriume (Bacillus amyloliquefaciens (MMS-50)) towards cariogenic properties of Streptococcus mutans exhibited that the minimum and maximum inhibitory concentrations of MMS-50 AF against S. mutans were 100 and 250 µg/mL, respectively. Anti-virulence assays performed using below-sub-MIC levels of MMS-50 AF (30 µg/mL) resulted in significant reduction in adherence (68%), acid production, acid tolerance, glucan synthesis (32%), biofilm formation (53.5%) and cell surface hydrophobicity, all devoid of affecting its viability. Expression data showed significant reduction in expression of all studied virulence genes[40].

Marine Fauna

Zooplankton

The zooplankton density of the Palk Bay region varied between 103 and 1005 individuals per litre. The zooplankton were categorized under eight major groups and among them copepods, nauplii and bivalve larvae are the major contributing groups towards zooplankton diversity followed by larvae of echinoderms, chaetognaths, polychaetes and urochordates. Of these, copepods are the most prominent and their diversity index ranges between 2.67 and 4.24. Benthic organisms were categorized under eight major groups and it was found that polychaetes and gastropods were dominant in the benthic community of the area. 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. In Thondi coastal region, a total of 16 zooplankton species were recorded and among them, the predominant species were Copepoda, Eucalanus nauplii, Lucifer and fish egg. The more amount of zooplankton species were recorded in monsoon and post monsoon periods. 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[82]. During the analysis of plankton bloom in six stations of Palk Bay viz. Adhirampattinam, Mallipattinam, Ponnagaram (Manamelkudi) Gopalapattinam, Kottai Pattinam and Thondi, zooplanktons were recorded with limited populations of Paracalanus parvus, Oithona rigida, Copepod nauplii, Bivalve veliger, Oikopleura sp. and Sagitta sp[55].

The structure and trophic efficiency of plankton food webs revealed that the Gulf of Mannar (GoM) was more productive when compared to the Palk Bay (PB) waters in terms of phytoplankton and zooplankton stock. The phytoplankton accounted major proportion of the total plankton carbon biomass in the GoM during both southwest and northeast monsoons, while it was the microbial loop during the spring inter-monsoon. Whereas, the microbial loop contributed by the PB waters was considerably higher over the GoM waters irrespective of the seasons. When the microbial loop contributed most of the carbon in the food web during the spring intermonsoon, the trophic efficiency was much lower than that during the southwest and northeast monsoons. Hence, merely an increase in the microbial loop in natural waters alone is not sufficient to increase the mesozooplankton stock until efficient microbial loop consumers are abundant in the environment[8].

During the Spring Intermonsoon (SIM), the available carbon biomass in the plankton food web was significantly higher in the PB (av. 122.8 ± 47.60 mg C cm−3) than that of the GoM (av. 81.89 ± 35.50 mg C cm−3), which could be attributed to a strong microbial loop in the former region. The microbial loop was predominant in the PB, being as high as 83% of the total plankton biomass during the SIM. The relatively high mesozooplankton stock in the PB during the SIM was closely linked with a strong microbial loop, which contributed the major share (av. 101.6 ± 24.3 mg C cm−3) of the total organic carbon available in the food web (av. 126.6 ± 24.3 mg C cm−3). However, when microbial loop contributed >65% of the total organic carbon available in the food web, the trophic efficiency was found to be low (~3%), which could be ascribed to the wide dispersal of organic carbon in the microbial loop. During the Northeast Monsoon (NEM), when the copepod Paracalanus parvus was predominant in the PB, the trophic efficiency of the microbial loop dominant food web increased by more than a fold (7.2%). This proved that exceptionally high abundance of efficient microzooplankton consuming zooplankton can significantly increase the trophic efficiency of the microbial loop dominant plankton food web in the Palk Bay region[8].

The mesozooplankton community was dominated by copepods in the Palk Bay with 63 species. Non-metric Multidimensional Scaling (NMDS) and Agglomerative Hierarchical

Cluster Analysis (AHCA) on Bray–Curtis copepod similarity clearly estranged the Palk Bay waters during the SIM and the NEM could be ascertained to the truancy of durable mixing typical of these seasons. In contrast, aided by strong currents, the increased mixing resulted in a homogenous copepod population during the Southwest Monsoon. Moreover, the indicator and dominant species analysis for copepods divulged the spatial heterogeneity in species composition during the SIM and the NEM periods. Salinity was the most important variable accountable for the observed variance in copepod distribution. In general, the coastal copepod species largely inhabited the Palk Bay[44].

Corals

The Palk Bay region has a fringing reef distribution of 25-30 km length. The width of the reef varies between 200 and 600 m away from the shore at different places. The reef occurs at a depth of 1 m to 4 m. Till date 66 coral reef species belonging to 25 genera have been reported in the Palk Bay region. The live coral percent cover was substantially decreased with a live coral cover of 13.65 and 12.9% in Velapertumuni and Kathuvallimuni reefs, respectively[149]. Acropora cytherea and Favites abdita were the dominant and abundant species in Velapertumuni reef with relative abundance values of 21.08 and 10.85, respectively[108]. Acropora lamarcki was the most abundant species with a relative abundance value of 12.68 in Kathuvallimunai reef. All other species belonged either to common/uncommon species status. Though, the total live coral cover was found to be reduced, the increased recruitment of fast growing species like Acropora has contributed to a fair diversity. Investigations on the disease prevalence in hard corals indicated more incidences of diseases in massive corals as compared to branching corals165. Disease conditions such as brown band disease, Porites ulcerative white spot syndrome and pink line syndrome/porites pinking were recorded. A survey conducted in the Palk Bay region explored that large corals represented by the genera Porites, Goniopora and Favia were extensively bleached and considerable percentage of the live coral surface were found dead, due to the increase in the sea surface temperature and solar radiation[120].

The removal of herbivore reef fishes in the Palk Bay region put forth crucial impacts on reef building corals that lead to their mortality, mainly due to lack of control over macroalgal and turf algal propagation over live corals[72,107]. Apart from this, the continuous exploitation of reef fishes in the adjacent reefs also rules out the replenishment of the reef fish stock. Since the resilience potential of an affected reef largely depends on the supply of new recruits of the depleted communities from the neighbouring reefs, it becomes important to maintain a no fishing zones of reef fish in the neighbourhood of reef fishing hotspots. In order to minimize the damages caused by current fishing practices, refined methods involving fish luring devices or fish aggregating devices have to be used. In a long term, as the demand for reef fish increases, the exploitation also will increase. So, it is essential to promote alternative livelihood for the fishermen in Palk Bay in the cultivation of seaweeds of nutraceutical and pharmaceutical interests. This not only conserves the natural resources but also minimizes or prevents the damages to the reef. During monsoon season, the mechanical damage to corals in the Palk Bay region is most common, owing to the cyclonic winds with high velocity.

The variation in the number of species of scleractinian corals reported in the eastern sector of Palk Bay when compared to data recorded in previous study reports. Anthropogenic inputs of dissolved nutrients and organic particulate matter may also depress oxygen levels. The heavy sediment loads on corals may be lethal, lesser quantities of sediment may inhibit growth of corals, cause changes in the growth forms of colonies, decrease coral cover, alter species composition of reef- building organisms, and as well as inhibit coral recruitment[109]. A survey on bleaching and the secondary threats on bleached corals in the selected sites of Palk-Bay conducted during May and June 2010 revealed that massive

corals represented by the genera Porites, Goniopora, Favia were bleached extensively. Significant portion of the surface of live corals were found dead. Coral recovery after bleaching was at a great risk due to the algal overgrowth and sedimentation which would lead to their death and permanent loss[120].

Marine Sponges

Fishing pressure in the Palk Bay region leads to the overexploitation of marine resources, especially the benthic assemblages. Sponges are easily landed as a by catch discard in most of the bottom targeting fishing gears because of their nature of sedentary. The sponge fauna of Indian Territory is usually dominated by Demosponges (88.8%), followed by Hyalospongiae (9.1%) and Calcisspongiae (2.1%). The marine sponges account for 451 species in India and among them, the Gulf of Mannar and Palk Bay regions consist of 313 species belonging to 137 genera and 12 orders of demospongiae and 5 species of class Hexactinellida and 1 species of class calcarea138. The sponge populations have been under depletion trend owing to the over exploitation for commercial utility. The research on the taxonomy of marine sponges is very sparse in the Palk Bay region. There are 275 species of sponges reported in the Palk Bay region, among which 31 species belong endemic. Coral boring sponges of Palk Bay were well studied and reported 6 new species from Palk Bay. A total of 89 sponge species were identified from Indian part of Palk Bay region. A short term study on the distribution and diversity of the seagrass associated sponges in intertidal region of Palk Bay between Mandapam to Thondi was found out 9 species. The future research works should be concentrated on the through identification of sponges and their associated biological features in the Palk Bay region.

A study conducted in seagrass beds of the Palk Bay region recorded a total of 16 specimens belonging to 9 sponge species with 7 genera and 6 families. Genus Spirastrella was dominant and seems to be an integral part of seagrass ecosystems. Fishing pressure through bottom set gill nets and trawling were identified as major threats to sponges and other associated organisms in the seagrass communities. Apart from this, the natural factors like storms, cyclones and flood were the primary cause for mass degradation of sponge habitat in the seagrass ecosystem. Sedimentation due to river run off and pressure exerted by the Sethu Samudram excavation caused stress to the seagrass beds and its associated sponge resource and fiinally leading to mortality. Predation by spongivorous fishes obviously limits the distribution and abundance of sponge species[138].

The quorum sensing inhibitory (QSI) activity of marine sponges collected from the Palk Bay region was examined against acyl homoserine lactone (AHL) mediated violacein production in Chromobacterium violaceum (ATCC 12472), CV026 and virulence gene expressions in clinical isolate Serratia marcescens PS1. Among the 29 sponges, the methanol extracts of Aphrocallistes bocagei (TS 8), Haliclona (Gellius) megastoma (TS 25) and Clathria atrasanguinea (TS 27) inhibited the AHL mediated violacein production in C. violaceum (ATCC 12472) and CV026. Moreover, these sponge extracts inhibited the AHL dependent prodigiosin pigment, virulence enzymes, such as protease, hemolysin production and biofilm formation in S. marcescens PS1. But, these sponge extracts were not inhibitory to bacterial growth, which reveals the fact that the QSI activity of these extracts was not related to static or killing effects on bacteria. These results suggest that the marine sponges could pave the way to prevent quorum sensing (QS) mediated bacterial infections[9].

Fourteen heterotrophic and morphologically different bacterial strains isolated from the marine sponge, Spirastrella inconstans in Rameshwaram coast of Palk Bay region were adapter for culturing towards screening their antimicrobial activity against human pathogens. The pigmented strains exhibited moderate antimicrobial activity and among which, the bacterial strain MB13 showed inhibitory activity against all the tested pathogens and was identified

as Pseudoalteromonas piscicida. Therefore, the bacterial community isolated from the tissues of marine sponges can act as promising source of clinically important drug molecules and can consider sponge associated microbes as candidate for discovering active compounds21. The methanol and dichloromethane (1:1) extracts of sponges collected from Palk Bay were screened for their larvicidal and insecticidal properties. Around 40% of test extracts were active against the fourth-instar larvae of Aedes aegypti (Linn) and three to four day old of female houseflies, Musca domestica (Linn) at the concentrations of less than 100 ppm and 100 µg/ insect, respectively. The sponges, Psammaplysilla purpurea and Haliclona cribricutis were exhibited better larvicidal and insecticidal activities. The sponges, Psammaplysilla purpurea, Haliclona cribricutis, Dendrilla nigra, Haliclona pigmentifera and Petrosia testudinaria could also be used to obtain novel pesticidal molecules[115].

Molluscs

The Palk Bay region is well known for the presence of economically important renewable resources, molluscs. The molluscan fauna is rich in the intertidal area and coastal habitats from Point Calimere to Mandapam. The bivalve molluscs in the Palk Bay region are mostly coral boring organisms, which act as biological agents in the erosion of hard coral stones and as a consequence the coral reefs are considerably destructed. A past record revealed that there were 73 coral associated molluscs species in Palk Bay, such as 46 gastropod species belonging to 17 families and 27 bivalve species belonging to 13 families. A recent study performed in the Mallipattinam and Kottaipattinam coast of Palk Bay region disclosed the presence of 61 species (25 families) of gastropod, which could be potential resources for development of small-scale shell industries. Most of the gastropod species were common in both landings centre with slight differences but some species (Turritella duplicate, Strombus canarium, Cyprae onyxadusta, Marginella angustata and Harpa major) were available in Mallipattinam but not in Kottaipattinam. The rich molluscan diversity in the Mallipattinam and Kottaipattinam coastal waters is likely to grow the fishing activity and mollusks had a tremendous impact on Indian tradition and conomy[30].

The Palk Bay region has a recent record of as many as 100 species of bivalves belonging to 4 orders, 19 families and 49 genera, among these 47 new species are found to be new distributional records. The maximum diversity of gastropod could be attributed to the more fishing activity in the Palk Bay region. According to the molluscs fishers, there has been a reduction in mollusc capture over the decade in the Palk Bay region. The occurrence of 3 new species of bivalves (Pen shells), Pinna bicolor, Pinna deltodes and Pinna incurva, belong to Pinnidae family is recorded from the seagrass meadows of Thondi coast. A study performed in the Karangad estuarine mangroves recorded 25 species of molluscs, among which 13 species were gastropods (Cerithidea fluviatilis,Terebralia palustris, Cerithium citrinum, C. scabridum, C. obeliscus, Littorina scabra, L. undulata, Planaxis sulcatus, Drupa margariticola, D. heptagonalis, Thais rudolphi, T. bufo, and T. tissoti) and 12 bivalve species (Gafrarium tumidum, G. pectinatum, Crassostrea madrasensis, Mactra cuneata, Tellina ala, T. bruguieri, Saccostrea cucculata, Modiolus metcalfei, M. tulipa, M. traillii, Meretrix meretrix and M. casta), which belonged to 14 genera, 10 families and 5 orders174. A specimen of watering pot shell, Brechites penis (Linnaeus, 1758) (Mollusca: Bivalvia: Anomalodesmata) collected from trawl net of fishermen operated in seagrass beds of Palk Bay is a new record in India. The habitat is supposedly similar to that of B. attrahens from the Red Sea27. New occurrence of three species of bivalves (Pinna bicolor, Pinna deltodes and Pinna incurva) belong to Pinnidae family was recorded in seagrass bed of Thondi Coast of Palk Bay region based on a live organisms and dead shells collected from the intertidal area. The bivalves were embedded in muddy sand and found associated with seagrasses at intertidal area. They were also found buried in hard substratum associated with living zoanthids and soft coral[145].

An inventory was performed to investigate the epiphytic cyanobacteria present on molluscs, their taxa and distributions in Thondi coastal waters of Palk Bay region by which, a total number of 17 genera belonging to chlorophyceae in Actinastrum (1), Ankistrodesmus (1), Arthrodesmus (1), Botryococcus (1), Chaetophora (1), Chlorella (1), Chlorococcum (1), Dactylococcus (1), Hydrodictyon(2), Oedogonium (1), Ooctysis (1), Scendesmus (1), Spirogyra (1), Ulothrix (1), Volvex (1), Westella (1) and Xanthidium (1) were recorded[36]. To conserve these economically important molluscs species from over exploitation and development activities, studies relevant to frequent documentation of molluscs fauna and chronic toxic effect studies on molluscs due to pollution, especially by metals are crucial.

Echinoderms

Sea cucumber fishery and trade were one of the top non-finfish income streams for the coastal people of Palk Bay owing to its good resource potential of sea cucumbers and beche-de-mer (processed sea cucumber) export from India[22]. In Palk Bay, six sea cucumber species were recorded that include high valued, Holothuria scabra, followed by Holothuria atra, Holothuria spinifera, Bohadschia marmorata, Stichopus horrens and Holothuria leucospilota108. In Palk Bay, the major species, H. scabra was reported from 96.2% and 19.2% of the sites reported their density >5000 nos. ha−1 and 30.8% with >1000 nos. ha−1 and 34% with juveniles. Around 60% of the sea cucumber demand was met from the Palk Bay region. Sea cucumbers are collected by skin divers including women in shallow waters from 2-10m depth. They were exported mostly to Penang and Hong Kong. Holothurians, to which the sea cucumbers belong, are detritus feeders and hence are found in seaweed habitats.

As there was no regulation to control the fishery, there was a concern on decline in sea cucumber populations. However, the fishery and trade of sea cucumbers were banned by including them under Wild Life Protection Act of 1972 since 2001. Though the ban might have helped in reviving the sea cucumber populations in the last 14 years; it would possibly had a social and economic impact on scores of people, who were dependent on the sea cucumber fishery. In view of restoring the income benefit of fishermen community in the Palk obtained through the sea cucumber trading, management options for conservation and sustainable use of sea cucumber resources should be framed. The mariculture of economically important sea cucumber species would be the opt solution for managing the sea cucumber resources in the Palk Bay region. The Bay of Bengal Large Marine Ecosystem (BOBLME) was implemented January-June 2015 towards understanding the sea cucumber stocks and implications of the ban on the livelihood of fishers in Palk Bay and Gulf of Mannar and also to suggest management options for conservation and sustainable use of sea cucumber resources. The activities of the project were inception workshop, preparation of status paper, resource surveys, interview surveys stake holder consultations and final workshop, pertaining to sea cucumbers. The abundance of the sea cucumbers was measured with an aid of trawl and dive surveys by adopting standard protocols. Population characteristics of sea cucumber resources were also estimated and were statistically interpreted[22].

Arthropods

Palk Bay is regarded as an important habitat for major arthropods, such as crabs, lobsters, shrimps, cephalopods, etc. Most of the landing centres situated in the Palk Bay region are received with considerable proposition of crabs. Lobsters, crabs and cephalopods are important foreign exchange earners of Palk Bay canal zone fishery. Scylla tranquibarica and Neptunus (Portunus) pelagicus are important among the crabs caught. The former is a foreign exchange earner and is exported alive. The crab net has been employed more in Palk Bay coastal regions of Thanjavur followed by Pudukottai and then Ramanathapuram district. About 14 crab species were recorded in the Muthupettai mangrove environment with crabs belong to the families Grapsidae and Ocypodidae were most dominant.

The possible factors that could influence zonation and abundance of the crabs in the Muthupettai mangroves are substrate suitability, effects of tidal inundation and distribution of mangrove plants. Around 12 commercially important crab species were recorded from landing centres between Arukkattuthurai and Pasipattinam of the Palk Bay region. Among them, the crabs recorded in the Mallipattinam landing centre were maximum in weight, while the Pasipattinam landing centre was recorded with maximum. The crab species, P. pelagicus was exhibited the maximum record while the C. truncata species recorded the minimum[169].

In another study, 79 individual crab species belonging to 21 families were recorded at 10 landing centres between Arukkattuthurai and Pasipattinam of the Palk Bay region with the similar maximum number (163) of species at Mallipattinam landing centre and the minimum (69) at the Pasipattinam landing centre. Maximum crab species recorded were belonging to the family Portunidae. The maximum collection of crabs was occurred during summer and monsoon when compared to the pre and post-monsoon. The crabs belonging to families of Calappidae, Portunidae, Potamidae, Grapsidae, Sesarmidae and Ocypodidae were obtained almost all seasons[170]. A new occurrence of Leucosiid crab species Lucosia anatum Herbst, 1783 was reported in the Palk Bay region crabs in the coastal region. This species was collected naturally via marine debris and ocean currents[171].

As far as cephalopods are concerned, the trawl boats used in the Palk Bay region are responsible for catching more than 70% of cephalopods and the remaining in shore seines. The squids Loligo duvaucelii, L. investigatoris, Dorytruthid sibogae and Sepioteuthis lessoniana are pelagic. The last one lays eggs on algae, seaweeds, rocks, corals and the others release eggs in the water column. Cuttlefishes, such as Sepia pharaonis, S. secleats and S. inermis commonly found in the Palk Bay coastal waters 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. Owing to the rich coverage of sea-grass ecosystem, the artisanal and mechanised sectors mainly target shrimps in the Palk Bay region. The antibacterial activity of different solvent extracts of accessory idamental glands (ANGs) from squids at different maturity stages (immature, maturing, ripe and spent) Palk Bay squid, Sepioteuthis lessoniana (Lesson, 1830) (Cephalopoda: Decapoda) were evaluated against four pathogenic strains of bacteria, such as Escherichia coli, Aeromonas hydrophila, Staphylococcus aureus and Bacillus megaterium. The extracts from different maturity stages (maturing, ripe and spent) exhibited diverse levels of antibacterial activity against the tested bacterial strains, except in B. megaterium. The butanol extract exhibited maximum antibacterial activity, followed by methanol extract. Maximum antibacterial activity was found in ripe stage, especially in butanol extract against E. coli (10.1 ± 1.65 mm) whereas minimum activity was found in ethanol extract against A. hydrophila (3.0 ± 0.94 mm) in the maturing stage[175].

Tunicates

The Palk Bay has a good source of tunicates. These jelly like organisms are mostly sedentary and contain a variety of bioactive compounds useful in making drugs. The first occurrence of colonial ascidian, Polyclinum nudum (Kott, 1992) was found associated with the seaweed culture rope of Gopalapatinam coastal area, Palk Bay region[57]. The proximate composition of the 10 commonly available ascidians collected from the Palk Bay region exhibited high nutritive value and hence these group especially solitary ascidians can be used for human consumption in terms of pickles, soup, curry and others after ensuring the safety of consumers[4]. They are rich source of bioactive and hence they could be used for novel antimicrobial drugs. The crude extract of the ascidian, Polyclinum madrasensis collected from Mandapam coastal water of Palk Bay region exhibited potential antimicrobial effect against clinical human pathogen, Staphylococcus aureus in crude methanol extract[43]. Another ascidian species, Microcosmus exasperates collected from the same coastal water showed a

broad spectrum of antibacterial activity against Pseudomonas aeruginosa in crude methanol extract[3].

Different solvent extracts of six ascidian species, such as Microcosmus helleri, Microcosmus curvus, Herdmania pallida, Polyclinum madrasensis, Didemnum psammatode and Didemnum moseleyi were examined against eight bacterial pathogens and five fungal pathogens. The maximum zone of inhibition (21 mm) was exhibited by the methanol extract of M. curvus against Shigela boydii and the same species showed the maximum zone of inhibition (9 mm) was noticed in methanol extract during antifungal activity against Aspergillus flavus58. The crude extract of ascidian, Tridemnum savignii collected from the low tide intertidal area at Palk Bay region showed broad-spectrum of antibacterial activity against the tested clinical pathogens such as Escherichia coli[77]. Hence, future research should be directed towards the screening of more ascidian species in the coastal waters of the Palk Bay region for their potential antibacterial activity.

Finfish

The Palk Bay region serves as a treasure house for valuable finfish species and more than 580 finfish species are reported till date. From ancient times onwards and up to late 1960s, fishing in this region was confined to finfish. Rabbit fish (Siganus canaliculatus) in the Palk bay region is one of the most economically important herbivorous finfish[45,47]. The fish grows faster on pelletted diets over ordinary seaweeds. The fish would reach a marketable size of 20 cm fork length in 6 months and as a consequence two crops can be harvested in a year. This would be a good source of income to fisher folk in Mandapam area. In some landing centres, its proportion is up to 30% of the total catch with an average between 5 and 10%. The species is mainly captured in traps baited with seaweed of the genera Kappaphycus alvarezii, Ulva spp., Hypnea spp., and Enteromorpha spp. The herbivorous habit in combination with the great demand for this species along the coast makes it a most suitable fish for culture in the region[47]. Palk Bay has the great potential for mariculture of S. canaliculatus and as a consequence interest, floating cage culture has emerged. The mechanized boats in the northern Mandapam region that adapt fish trawling to catch prawns, incidentally catch lot of commercially important and non commercial finfish with the dominance of cilver bellies, cat fish, elasmobranches, Hilsa keeli and Sardine as by catch. Larger economically valuable finfish in the by-catch are marketed as fresh ones and the smaller varieties are preserved through sun-drying or salting. Majority of the sun-dried specimens is used for local consumption while some quantity is exported. The culture of milkfish, Chanos chanos, which is one of the most important brackish water finfish species being cultured in Southeast Asia, would be a good source of income to coastal fisher folk in Mandapam. Milkfish culture has to be economically competitive compared to shrimp and other fish culture which do not contribute to local food supply. Milkfish eggs (1.1-1.2 mm in diameter) and larvae (3.5 mm at hatching) are pelagic and stay in the plankton for up to 2-3 weeks[46].

Reptiles

Sea Snakes

Sea snakes are common in Palk Bay however, majority of the sea snake records are from those entangle in nets of fishermen and as a consequence, most of the regional data on sea snakes coincide with the fishing grounds and fish landing centers. The sea snake species such as Acrochordus granulatus, Hydrophis cyanocinctus, Hydrophis (Microcephalophis) gracilis, Hydrophis spiralis and Thallasophina viperina were reported in the Palk Bay region. Additionally, another sea snake species Hydrophis caerulescens was reported from the Palk Bay off Rameswaram. Moreover, a sea snake was landed at the Rameswaram fish landing site as by-catch which was identified as Hydrophis caerulescens and the same was deposited as a voucher specimen to the collection of Bombay Natural History Society (Voucher # BNHS 3361). This represents the first record of Hydrophis

caerulescens species in the Palk Bay region. These species were mainly encountered as trawler bycatches during fishing and as a consequence, mortality of sea snakes occurred. Hence, the banning of trawl fishing is essential requirement towards the conservation of sea snakes in the Palk Bay region. The earlier collection of holotype in the Palk Bay region, belonging to sea snake species Hydrophis biturberculatus, whose locality is Colombo in Western Sri Lanka, suggested that further intensive surveys might lead to the rediscovery of this species in the Palk Bay region.

Turtles

The rich seagrass meadows present in the Palk Bay region facilitate important nursery habitats for turtles. Out of the 7 turtle species currently occurring in the world, 5 species, such as Olive Ridley (Lepidochelys olivacea), green (Chelonia mydas), Leatherback (Dermochelys coriacea), Loggerhead (Caretta caretta) and Hawksbill (Eretmochelys imbricata) are reported in the Palk Bay region. Among them, Olive Ridley, Loggerhead, Hawksbill and green turtles are coming under the family of Chelonidae, while the Leatherback turtles belong to the Dermocheliidae family. According to the International Union for Conservation of Nature (IUCN) Red list of threatened species, Olive Ridley, Leatherback and Loggerhead turtles are vulnerable, where as green and Hawksbill turtles are respectively listed in endangered and critically endangered category. Pamban coast is regarded as an important place for turtle nesting due to the continuous mixing of waters of Gulf of Mannar and Palk Bay regions. Green and Olive Ridleys turtles forage in the Palk Bay waters. Turtle fishing had been practiced for a long time in the Palk Bay region. The main fishing centres in the Palk Bay region were Rameswaram, Thondi, Tirupalakudi and Devipatnam. Special types of nets viz., Pachuvalai and Kattuvalai were used for turtle fishing and the green turtle constituted the major share along the Palk Bay region. The banning of turtle trade from the early 1980s and the inclusion of all the turtle species in Schedule I of the Indian Wildlife Protection Act (1972) minimized the exploitation of turtles to a considerable extent. However, in recent years, there is a growing concern on the population loss of turtles in the Palk Bay region as a consequence of incidental catch in fishing gear, weak enforcement of fisheries and Protected Area regulations and exploitation of turtles for meat and poaching of eggs. The mechanisation in fisheries induced the accidental catch of turtles in gillnets, which decline their population. The trawl operation in this region also resulted in a substantial increase in the accidental catch and mortality of sea turtles. Although rates of accidental catches of sea turtles are relatively high in the Palk Bay region, most of them are unreported. The illegal dynamite fishing practiced in the Rameswaram coast also creates mortality of turtles. Boat propellers can also cause damage to the flippers and shells of sea turtles. A recent study conducted in the Palk Bay region found that that the eggs laid by turtles were either eaten by stray dogs or collected by fishermen for consumption. These facts necessitates documentation and conservation of turtles in the Palk Bay region besides categorizing them as threatened, endangered and critically endangered species[66,74].

Observation on sea turtles along the southeast coast of Tamil Nadu, including Palk Bay region was performed during June 2012 to May 2013. Curved Carapace Length (CCL) and Curved Carapace Width (CCW) were measured when the carapaces of dead turtles were found intact. Data relevant to exploitation of turtles were collected by regular observations of turtle carapaces found near ditches, unused buildings and inside thickets that bordered the coastline. Green, olive ridley and hawksbill turtles exhibited exploitation ratio of 61.9, 34.2 and 3.9%, respectively during the study period. The reasons for the sea turtles extinction are death, exploitations and injury in commercial fisheries, loss of important habitat, pollution and climate change. The study emphasized the requirement of more proactive conservation measures for protecting sea turtles and also rebuilds their populations to healthy levels.

The vital actions needed to protect and restore sea turtle populations are reducing sea turtle interactions and mortalities in commercial fisheries, protecting key habitat areas on land and in the water, passing comprehensive legislation that establishes a system to protect and restore sea turtle populations[23].

Seahorses

Over fishing and increasing demand in Chinese market are the two crucial factors responsible for decline in the populations not only in India but also throughout the world. Six seahorse species, such as Hippocampus kuda, Hippocampus fuscus, Hippocampus histix, Hippocampus kelloggi, Hippocampus trimaculatus and Hippocampus spinossisimus are reported in India and among them H. trimaculatus is the dominant species and distributed all along the Indian coast and hence its conservation through genetic structure identification is most essential160. The seahorses of Palk Bay region are rich in diversity, owing to its shallow nature and dense cover of seagrass and macroalgae strands, which act as good feeding, breeding and nursery grounds for different seahorse species. The seahorse species occurred in the Palk Bay region are H. trimaculatus, H. kuda, H. fuscus, H. spinosissimus, H. borboniensis and H. mohinekei. Among them, the dominant species is H. kuda (85.29%) followed by H. trimaculatus (11.70%) and H. fuscus (2.94%)67,85. All species of seahorses found in the Palk Bay region are generally occurred at depths less than 10 m. The landing of seahorses was more abundant in the Palk Bay region. India has a long history of trade on seahorses and the Palk Bay region is regarded as the main contributor for seahorse export trade. Around 75% of seahorse catches and illegal trade in India is contributed from the Palk Bay region. The main centers of seahorse collection and trade in Palk Bay region are Thondi, Devipattinam, Mandapam North and Rameswaram. Among them, a percentage share of 68% in the total landings of seahorses is reported from the Thondi coast. There is a great demand for dried sea horse species (H. kuda) in south-east Asian countries such as Singapore, China, Thailand etc., mainly for its medicinal values. A large and linear trend of seahorse trading for traditional medicines and aquarium fishes leads to decline in their populations across the Palk Bay region.

The utility of DNA- based marker is generally determined by the technology that is used to reveal DNA- based polymorphism which is also employed to identify different species in the event of taxonomic disputes and also to detect genetic diversity in a species. Microsatellites are widely being adopted in animal genome mapping and phylogenetic analysis owing to their co-dominant inheritance and high degree of polymorphism. The molecular polymorphism of microsatellite DNA has proved to be a potent tool in the analysis of several aspects of population genetics. The genetic difference and structure of three selected populations of H. trimaculatus collected as by-catch in small trawl nets from Mullimunai (Palk Bay), Tuticorin (Gulf of Mannar) and Vizhinjam (south Malabar in India) by using four microsatellite primers revealed that the overall FST value (0.0989) of the microsatellite loci between Mullimunai and Vizhinjam was significantly different ($p<0.0001$). Successful cross- priming of microsatellite loci, between the fish species of closely related was demonstrated in this study. The use of heterologous PCR primers would significantly reduce the cost of developing similar set of markers for other Hippocampus species found in India. The observed genetic distance value was 0.183, 0.461 and 0.837 between Mullimunai and Tuticorin, Tuticorin and Vizhinjam and Mullimunai and Vizhinjam, respectively. A significant reduction in microsatellite heterozygosity, but non-significant loss of microsatellite alleles was observed in all the three seahorse populations. There was no statistical evidence of recent severe bottlenecks in any of the three populations. Finally, this study recommended the continuous monitoring of microsatellite variations within the H. trimaculatus populations in all the three locations to explore whether the genetic variation within the populations is stabilized between year classes160. Morphometric and meristic characters were analysed to infer the variation of

four Indian seahorse species, such as H. fuscus, H. kelloggi, H. kuda and H. trimaculatus). The plot of second sheared principle component and first factor (morphometric matrix) showed species overlapping. However, the plot of second sheared principle component and another first factor (meristic matrix) showed all the species were well grouped. Based on the hierarchical cluster analysis, trunk length, tail length and tail ring were the key character to distinguish the species[161].

Fishery stock structure analysis, mixed stock analysis, species and hybrid identification, hatchery and transplanted stock monitoring, conservation and quantitative mapping are usually carried out with an aid of DNA markers. In this respect, the cytochrome b (Cyt b) gene is regarded as one of the most important protein encoding genes on the heavy strand of mtDNA molecule and has been employed to study molecular evolution and classification of species. The genetic identity of three spotted H. trimaculatus seahorse populations collected from Mullimunai (Palk Bay), Tuticorin (Gulf of Mannar) and Vizhinjam (south Malabar coast) by using Cyt b molecular marker (620 bp of Cyt b gene sequence) indicated the genetic divergence value of 0.0016, 0.0016 and 0.0032 between Mullimunai and Tuticorin, Mullimunai and Vizhinjam & Tuticorin and Vizhinjam seahorse populations, respectively. The nucleotide diversity was 0.00161 ± 0.0023 in all the three populations. The seahorse populations showed two haplotypes with similar properties. The low haplotype diversity and low nucleotide diversity in all the three populations reveal that the populations are getting mixed up as a consequence of successful dispersal events. The low nuecleotide diversity values observed among the three populations of H. trimaculatus could be attributed to the apparently favouring the movement of haplotypes from eastern region to the west and vice- versa between Palk Bay and south Malabar sea. The genetic divergence study among and within the H. trimaculatus seahorse populations, performed using the analysis of molecular variance (AMOVA) by adopting haplotype frequency data alone (FST) and incorporating sequence divergence using pair-wise differences (□ST) exhibited that both □ST and FST had the value of 0.000 between populations, while the value of 1.000 within the populations indicating the absence of differences. This study stressed the requirement of subsequent investigations using more microsatellite markers and mtDNA sequence data (ATP synthase 6 or D loop/ control region along with Cyt b) to elucidate if the stocks of H. trimaculatus along the Indian coasts are homogeneous or not[163].

The incidental by-catch at the time of commercial fishing operations and targeted fishing practices, such as skin diving during high demand periods has pushed seahorses to the edge of extinction, especially in Southeast Asian countries. It has been estimated that more than 20 million seahorses are traded annually in over 45 countries towards traditional Chinese medicine. The three-spotted seahorse, H. trimaculatus (Leach, 1814) is a highly valued species in the medicinal and aquarium trades and is one of the heavily traded seahorse species contributing to about 35% of the total seahorse trade for traditional Chinese medicine from Southeast Asia. Hence, there is an urgent requirement for developing and standardising captive breeding and mass-scale rearing of this species towards their conservation and commercial purposes.

Recent establishment of techniques for captive breeding and closure of the life cycle of some seahorse species is expected to help in achieving the twin objectives of reducing pressure on wild stocks as well as providing alternative subsistence livelihoods to fisher-folk currently involved in seahorse fishing. In this regard, the reproductive efficiency of captive broodstock and the effect of exogenous factors (light intensity, prey type, ingestion and salinity) on survival and growth of juveniles of H. trimaculatus were investigated. Significantly higher reproductive efficiency was noticed when parent seahorses were fed with amphipods (Eriopisa spp.). Survival of pelagic phase juveniles reared under three different

light intensities (1000, 1500 and 2000 lx) varied significantly (P<0.05) with 2000 lx resulting in the highest survival rate. An ontogenetic shift in feeding behaviour from rotifer to copepod nauplii was observed days after birth (>2 DAB) of old juveniles. Estimated digestion period in 6 DAB old juveniles was 3 h 20 m and the DP reduced as the juveniles grew in size. Salinity tolerance experiments indicated that juveniles and adults of H. trimaculatus are able to tolerate salinities not extending below 26 and 17 ppt, respectively. The average growth rates peaked during 15–30 DAB (Ht, 1.64 mm day−1). The first sign of maturity in male (pouch development) and female (dropping of egg clutch) was noticed at 95 DAB and 115 DAB, respectively. The sex ratio of cultured seahorses skewed towards female (1:1.2) and differed significantly from equality (P<0.05). Mean number of newborn juveniles released by first mated males was 65 ± 20 juveniles seahorse−1 (n =9 pairs) and egg clutch droppings by newly matured females was 45 ± 17 eggs seahorse−1 (n = 21) in F2 generation. Maximum height (Ht) attained at the end of the culture period of 26 weeks was 125 mm with no significant difference in growth between the sexes (P>0.05). Mean growth attained (Ht, 119.9 ± 15.3 mm) and survival rate achieved (65%) at the end of 26 weeks of mass-scale rearing are comparable with reports on other seahorse species. It is expected that the results of this study could guide future programmes in hatchery technology and aquaculture of this commercially important fast dwindling seahorse species[84].

The spotted or yellow seahorse H. kuda samples collected from the east and west coasts of India were analyzed for the species identification and phylogenetic relationship, based on partial sequence information of mitochondrial genes 16S rRNA and Cytochrome Oxidase subunit I (COI). Estimates of genetic divergence with both 16S rRNA and COI genes, when compared with the sequence divergence values of H. kuda from other continents were sufficient enough to discriminate individuals of the same species from Indian waters. No significant genetic partitioning was observed between the Palk Bay and Gulf of Mannar populations[136].

A major proportion of the seahorse catch from India originates from the Palk Bay region. Particularly, H. kuda is one of the heavily exploited seahorse species for export in the Palk Bay region. The seahorses found in the shallow regions of Palk Bay are heavily exploited by drag nets, trammel nets and bottom trawl nets, which are most extensively used for fishing. Along the Palk Bay coast, the shrimp trawl by- catch generally brings in higher quantities of H. kuda. Morphometric and meristic character standardization is essential for conservation purpose; enabling effective communication among fishers, traders, scientists, fisheries officials and custom officials. Especially, it is important to monitor their populations regularly from all major habitats to determine their progressive revival to the optimum level[67].The fishing and export of dried seahorse almost ceased during the year 2001 and 2002 in the major centres along the Palk Bay region. The Wildlife Trust of India (WTI) is conducting awareness programmes through its Rapid Action Project (RAP) in the Palk Bay region with the aim of conserving seahorses. The above stated facts necessitated the need towards developing techniques pertaining to captive breeding and mass-scale rearing of commercially important seahorse species for conservation and aquaculture purposes. Aquaculture practices could reduce overexploitation of seahorses in Palk Bay region by supplying the trade with bred seahorses. In this context, apparent information pertaining to technical feasibility of intensive seahorse culture is essential towards reducing overexploitation of wild stocks and to improve their production.

Seabirds

The boundary zone of Palk Bay and the Gulf of Mannar is an important wintering ground for many species of seabirds and waders. Thousands of Lesser Crested Tern Sterna bengalensis come roosting and forage in the sea around the northern part of Pamban island during the daytime. They also breed on Adam's Bridge Island. According to the Environmental

Information System of the Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annanmalai University, there are 61 seabird species available in the Palk Bay region however, more detail information pertaining to the seabirds are not found elsewhere in the literature. The reproductive biology of sandbird octopus Amphioctopus aegina (Gray, 1849) in the Mandapam waters (Palk Bay) was investigated between October 2001 and September 2002. The sex ratio was biased towards males in most of the months (January to June). A constant increase in the ratios of males to females was observed with respect to weight. Four maturity stags were recognized for females and two for males. Maturation and spawning occur all year round, with a peak during October and another peak during January to February. In males, no definite seasonal changes were observed in gonadosomatic index (GSI) values however, in females two peaks in GSI values during October and January to February were noticed[42].

Mammals

The protected and enclosed natures of the Palk Bay facilitates excellent feeding and nursing grounds for marine mammals such as dugongs, dolphins, porpoises and whales.

Dugong

Dugong, (Dugong dugon) also called as 'Sea Cow', is one of the four surviving species in the order Sirenia and only existing species of herbivorous mammal depending on seagrass for subsistence that lives in the Palk Bay region. Dugong is an important ecological indicator for the healthy seagrass ecosystem that is observed to graze exclusively on the Cymodocea members. This endangered mammal species does not come close to the shore due to fishing pressures and are observed to live usually in groups of 5-7 individuals within 10 m depth in seagrass meadows. The occurrence of dugong population along the stretch between Pamban and Athiramapattinam was estimated between 34 and 105, which is reported to be the highest among all Indian waters. The underwater surveys conducted by video transects method revealed the eight seagrass species, such as Cymodocea serrulata, Enhalus acoroides, Syringodium isoetifolium, Halophila ovalis, Halophila beccarii, Halodule pinifolia and Halodule uninervis among which, fresh dugong feeding scars were observed in Cymodcea serrulata and Syringodium isotifolium beds in Sethupavachatram and Manamelkudi area. Fishers from these villages opined that dugongs which are locally called "avolia" or "Kadal pani are frequently seen in this area. Earlier studies conducted in the Institute have indicated that Dugongs feed on the sea-grasses like Cymodocea serrulata, Syringodium isoetifolium, Halodule uninervis, Halophila ovalis and Enhalus acoroides[52].

During the early part of the century, the dugongs were found in large numbers in the Palk Bay region. Dugongs are illegally poached by the coastal villagers along the Palk Bay. In Palk Bay, dugong fishing takes place in the minor coastal villages such as Karangadu, Nambuthaalai, Morepani and Mullimunai. The nets commonly used for trapping dugong in the shallow regions are drift net (valivalai), shore sceins (karaivalai) and gill net (thirukkaivalai). Meanwhile, explosives are also employed for catching the dugong around the deep regions of Thiruppalaikudi and Devipatinam, which are the major fish landing centers. Though, the dugongs are included in the schedule I of the Wildlife Protection Act (1972), the dugongs caught in the sea are cut into pieces in the boat itself and sold surreptiously to hoodwink the law enforcing authorities. The destruction of habitat (seagrass meadows) as a consequence of operating hundreds of fishing trawlers is another important reason for the depletion of the dugong population[52].

The frequent cyclones occurred during the monsoon season also have had impacts on the dugong population in this region. During southwest monsoon, when the sea in the Gulf of Mannar becomes rough, the migration of dugongs from the Gulf of Mannar to the Palk Bay takes place for the purpose of feeding seagrass. During northeast monsoon, the water in the Palk Bay becomes turbid and therefore the ship

movements through the area would prevent the movement of dugongs between the Gulf of Mannar and the Palk Bay. This would lead to the fragmentation of their habitat and the population of dugongs would further decline. Hence, a long term conservation strategy for dugongs in Palk Bay region should be developed to protect and enhance their populations.

Socio-Economic Status

Unlike other parts of the Tamil Nadu coast, the Palk Bay has a socially heterogenous group of fisheries. The cumulative and ultimate adverse impacts of fishing, non fishing and natural causes lead to the gradual deterioration of the Palk Bay marine ecosystem, decline in the stocks of fishery resources, continued reduction in fish production consequent crippling of the socio-economic status of the fishers draw the attention of Administrators, Researchers, Policy makers and Problem Managers and call for an amicable and implementable solutions. In the Palk Bay region, Ramanathapuram and Pudukkottai coastal districts together account for nearly 70% of the coastal area of the Bay are regarded as the poorest districts in Tamil Nadu in terms of economy and employment. In Ramanathapuram, seaweed farming is estimated to provide employment to the tune of 7,65,000 man days per annum based on the District's plan[86].

Nowadays, most of the castes, who are involved in fishing in the Palk Bay were traditionally depended on agriculture and moreover they were mostly migrated from nearby areas to the Palk Bay region. The lack of alternative employment sources within agriculture could be the major reason for their migration to the Palk Bay region. The number of fishing villages in the 4 southern districts of Palk Bay is 160, which are distributed across districts as given in brackets: Tiruvarur (13), Thanjavur (31), Pudukkottai (33), and Ramanathapuram (83). It is clear evident from the last decade that there has been an increase in the numbers of fishers over the last decade on the southern side of Palk Bay than in the north.

The Pudukkottai district in the Palk Bay region is well characterized by aridity, isolation and limited levels of economic development. The relatively less pollution in the Palk Bay region could be ascribed to its less industrial development when compared to its neighbourhood; however this also leads to a curse in that there is hardly any employment generation in the area. The Thanjavur district in the Palk Bay region is characterised by well-irrigated agriculture because of the presence of the Cauvery river system and as a result the people in the area have a more diversified livelihood profile and less dependence upon the Palk Bay resources. But, the people in the southern districts should depend mostly on fisheries for their livelihood. Consequently, unlike in many other parts of India, the fisheries sector has been subject to inmigration that is proportionately much higher than out-migration through the last four decades. It is difficult to say whether the population growth was a natural increase within the numbers of people in fisheries or due to increased in- migration of people, but going by the fact that much of the increase has taken place in Ramanathapuram, one can suggest that this may have to do with in migration of people from agriculture and other sectors. This is a cause for concern both from a management perspective as well as from a livelihood perspective.

Coastal Livelihoods

Fisheries

Fishing in the Palk Bay region was restricted to finfish and chank resources till the late 1960s. Fishing is done in the Palk 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 favourable for bottom trawling and hence good catches are obtained. A study was conducted to elucidate the trawl fishing of penaeid prawn in the Northern Mandapam coast of Palk Bay region. Total landings of penaeid prawns with an aid of trawling at northern Mandapam coast

during January to December 2008 was recorded as 2347.61 tones. Prawns were landed throughout the year however they were peak during August to September. The prawan catches were composed of Penaeus indicus, P. joponicus, Metapenaeopsis stridulans, P. semisulcatus and P. monodon. Among them, the dominant species was P.indicus with 1355.51 t. Along with the prawns, 14,549.573 tonnes of fishes were also landed as by catches. Among this 13,927.9 tonnes were commercial fishes (Leiognathus sp., Upenaus sp., Lutjanus sp., Mugil cephalus, Plotosus lineatus, Scarus sp., Siganus sp., Epinephalus sp., Carangoids sp., Sepia sp. and Pelagicus sp. etc.) and 620.673 tonnes were non commercial trash fishes (Congresox sp., Channa punctata, Tetradon sp., Canthigaster sp., Etroplus sp., Lactoria sp., Narcine timlei, Chaedoton sp. and Saurida tumbil). The study made a caution that the demolishing of prawn population is going on due to over fishing by trawl nets and also the commercial and non commercial fishes also being destroyed by this trawl fishing[65].

The coastal bio-resources especially coral reefs and seagrasses in the Palk Bay region were under the pressures of low to high threats and also warned the possibility of facing serious threats of destruction in the future, if the pressures sustain. Hence, it is highly essential to control the destructive activities in this region by implementing the existing rules and regulations strictly so as to safeguard the coastal bio-resources of the Palk Bay region[142].

Aquaculture

Preliminary investigation on the culture of Siganus canaliculatus in floating cages in Mandapam coastal water has revealed that the fish has high culture potential in the region. The Juvenile are abundant in the area of reef and seaweed bed and collecting in traps near Mandapam. Natural occurrence of juveniles of S. canaliculatus in large quantity was noticed during February through May in the Gulf of Mannar. The fish feeds mainly on seaweeds. It is reported that the fish can reach a marketable size of 20 cm fork length in 6 months. Hence, it is possible to start small-scale commercial farming in Palk bay area however, more focus is needed to identify the causes of occasional high mortalities during summer time and to overcome the same[45].

Similarly, the culture of S. canalicullatus in floating cages at Mandapam coastal water indicated the high culture potential of the fish. It is euryhaline, inhabiting areas where salinities range from 23%o to 35.8%o. The fish grows faster on pelletted diets than on ordinary seaweeds. It is estimated that the fish would reach a marketable size of 20 cm fork length in 6 months and as a result two crops can be harvested per year[47].

Seasonal variation and distribution of milkfish along the southeast coast of India were studied. The collection of wild seed near Mandapam area as well as production costs in cage was compared. Milkfish eggs (1.1-1.2 mm in diameter) and larvae (3.5 mm at hatching) were pelagic and stay in the plankton for up to 2-3 weeks. This would facilitate a good source of income to coastal fisherfolk in Mandapam coastal area. The study proposed to start nursery rearing in the collection centre itself and the budget also estimated[46].

The ecosystem of Palk Bay, which contributes to the rich marine fish production in the region at present, is under threat due to destructive fishing habits[142]. The indiscriminate use of habitat destructive fishing practices like bottom trawling, coral mining, dynamite fishing, and effluent disposal from aquaculture farms, contribute to the destruction of the most important marine ecosystems in the region[5,7,81,120]. This would lead to a definite reduction of fishery resources, ultimately affecting the fishing activity and particularly the traditional fishers in this region. To overcome above mentioned issues in terms of improving the fish population, an active aquaculture practice is carried out all along the Kattumavadi coast of Palk Bay region. Considerable nutrient load containing aquaculture effluents were discharged into nearby coastal waters, however the nutrient

levels were within the normal limits, which could be ascribed to the utilization of the same by the phytoplankton and other primary producers. Nevertheless, there is a probability of harmful algal blooms occurrence if the nutrient levels increase beyond the normal limits. Moreover, since most of the mangrove pockets in the Palk Bay region are bordered with aquaculture ponds, the digging of canal for aquaculture activities also fragment the mangrove patches. Besides, the direct discharge of aquaculture wastes on the seagrass beds of the Palk Bay region also pose a major threat by means of promoting green algal growth and as a result the reduction of seagrasses talks place along with mud flat area. However, there is a great potential towards aquaculture of seahorses in Palk Bay region, particularly in Thondi coast in view of prevent or minimize by their overexploitation. Hence, appropriate strategies should be formulated towards the promotion of eco-friendly aquaculture practices for the culture of economically important fishes, prawns, seaweeds, seahorses, pearls, seacucumbers etc. Moreover, formal education on community aquaculture is essential to help diversify fishermen's livelihoods[14].

Mariculture

Palk Bay region has the great potential for mariculture also. Seaweed mariculture is an economically viable livelihood option for the coastal fishing community especially for the fisherwomen. The first large scale commercial cultivation of seaweeds (Eucheuma cottoni and Hypnea musciformis) in India was initiated by Pepsi Foods Ltd., along a 10 km stretch of the Palk Bay side towards Mandapam with technical support from Marine Algal Research Center, CSMCRI, Mandapam[86]. The agar yielding seaweed species, Gracilaria edulis and Gracilaria acerosa were successfully cultured on coir/nylon ropes, nylon monoclines, frames, nets and dead coral stones in the coastal lagoon and inshore waters of Palk Bay at Mandapam.

Other issues

Pollution and Toxic Effect

The Palk Bay is getting polluted mainly due to sewage disposal, coastal soil erosion and oil spread due to trawler operations. Near shore areas of Palk Bay are polluted because of increased coastal urban development. Sewage outlets are increasing the suspended load, turbidity, nutrient etc. There are fish/ seafood processing, salt, and petrochemical industries situated near the coastline of Palk Bay. In addition to the famous pilgrim centre at Rameswaram, there are many major and minor fish landing centres are also present. The contaminants such as sewage, trace metals, phosphorous, pesticides, PCBs and polycyclic aromatic hydrocarbons liberated from the above sources get accumulated in the sediments and suspended matter in aquatic systems of the Palk Bay region. The untreated waste water resulted from aquaculture ponds and domestic sewage pose great threats to seagrass meadows and coral reefs. The coral reefs are under stress wherever processing industries let out their sewage. The sea water and sediment samples of collected from Palk Bay regions during 2014 reported that all the bacterial parameters were higher during the rainy season compared to summer season in all the sampling locations of the Palk Bay regions. The results indicated that the coastal environment is highly exposed to human excreta that suggesting to avoid direct contact[76].

The green algal population is greater in areas close to the sewage outlets of processing industries than in the reef systems. Even though the aquaculture industries are regarded as one of the pollution sources in the Palk Bay region, the water quality of Kattumavadi situated in the Palk Bay region is in normal condition and there is no indication of any coastal pollution even after the establishment of aquaculture industry[78].

Nutrient biogeochemical transformations across the sediment-water interface influence the productivity of seagrasses in the Palk Bay region. In addition, nutrient pollution, eutrophication and light limitation due to algal mats decreased the growth of seagrasses which need to be attempted to develop the nutrient policies for

sustainable management and restoration of seagrass ecosystem[158].

The concentration of heavy metals (Cd, Fe, Pb and Zn) in seawater, sediment and ascidians tissues of Palk Bay region exhibited distinct seasonal variations16. The results suggested that ascidians could be effectively employed as biological indicator for monitoring environmental pollution in the Palk Bay. Moreover, the increase in Cd content of the sediments also noted in the Palk Bay region. The abundance of trace elements in a tropical region situated off Rameswaram was found out as in the order: Al > Fe > Mn > Cr > Ni > Zn > Cu > Co > Pb > Cd. The recorded trace metals had negative correlation with the total ostracoda population[137]. The observed pollution index of the selected coastal sites by using sea water and sediment samples was in the order: Thondi > Mimisal > Manamelkudi > Devipattinam76. The bacterial counts variation at the Palk Bay region could be ascribed to the different sources that influenced the coastal pollution. More bacterial counts were recorded in Thondi coast owing to the higher load of faecal matters liberated from human and animals as a result of fishing activity. The results indicated that the coastal environment of Palk Bay region is highly exposed to human excreta and hence suggested to avoid its direct contact with the marine environment. This necessitate the throughout impoundment towards protecting coastal environment in Palk Bay region and moreover stress the continuous monitoring to prevent the microbial pollution in aquatic environment. Long-term pollution monitoring studies in the sensitive ecosystem of the Palk Bay region are also essential towards determining the impact of anthropogenic pollution and adoption of appropriate mitigation measures. It is required to formulate strict regulations for industrial effluent discharge, land based domestic sewage discharge, fish landing centre activities, coastal developmental activities and aquaculture and slat pan waste discharges to control pollution in the Palk Bay region.

A study conducted reveals that mercury was highly toxic to both C. cingulata and M. philippinarum. While lead was resistant metal to both marine molluscs tested. Order of increasing toxicity of metals to C. cingulata was Hg > Cu > Zn > Cd > Pb and to M. philippinarum was Hg > Cu > Cd > Zn > Pb. Safe level concentrations for all 5 metals were also calculated. The LC50 values of the present study may be useful in deriving marine water quality standards in the coastal waters of Gulf of Mannar[110].

To provide baseline data on background radiation levels for the future assessment of the impact of nuclear and thermal power stations, a systematic study was carried out in the Mallipattinam ecosystem of Tamil Nadu, India. Mallipattinam is located between the Kudankulam and Kalpakkam nuclear power plants and near to Tuticorin thermal power plant. Water, sediments, seaweeds, crustaceans, molluscs, and fish were collected to measure the concentrations of 210Po and 210Pb. The concentrations of 210Po and 210Pb in most samples are comparable to values reported worldwide. In fish, the concentrations of 210Po and 210Pb are in the range 16–190 Bq kg−1 and 8–153 Bq kg−1, respectively. The concentration factors of 210Po and 210Pb for the biotic components ranges from 103 to 106 [153].

A systematic study on the natural radionuclides such as 210Po and 210Pb in the environmental matrices of Point Calimere ecosystem has been undertaken to establish a baseline data on the radiation profile of Point Calimere environment. The environmental samples such as water, sediment and biota (seaweeds, crustaceans, molluscs and fish) have been subjected to analyses. It has been observed that the concentration of 210Po and 210Pb in the water samples of Point Calimere to be 0.5 mBq/l and 1.3 mBq/l, respectively. The soft tissues of the organisms accumulated higher 210Po content while shells and bones contained more 210Pb. The bivalve molluscs Meretrix casta have been identified to accumulate higher concentration of 210Po suggesting that they could serve as bioindicator of radionuclides like 210Po in the Point Calimere ecosystem. The concentration

factor of 210Po for the biotic components ranged from ~ 103 to 106 while for 210Pb it ranged from ~ 103 to 105 154.

Tourism

The sea in the coastal stretch between Rameswaram and Thondi of Palk Bay region is not only calm with gentle waves but contains many excellent beaches. Besides the presence of numerous exotic fish species, the attractive futures also include sea horse, sea cucumber, seagrass, corals, dugongs (sea cow) etc., in the waters nearby shores of these beaches. It is regarded as one of the very few places in the country with this marine wealth abundantly. Massive lagoons, white sand, calm sea, gentle waves, pure air, and dazzling underwater life are characteristic features of sea in several stretches from Pamban to Devipattinam. Apart from one or two beaches, most of these unspoilt natural wonders remain in the other beaches are unknown to the outside world. Unlike Rameswaram, an important holy destination, which attracts a huge number of devotees / visitors across the country, the tourism of all these beautiful beaches remain undiscovered by the tourism industry. Moreover, these beaches are ideal places for establishing beach resorts. Hence, these beaches in the Palk Bay region could facilitate a great tourism potential and hence appropriate planning should be formulated for highlighting the rich value of tourism potential to the nation as well as international hoteliers, tourism promoters, travel agents, package tour operators and others so as to attract them to establish infrastructure and value additions to the existing nature's gift towards tapping this tourism potential without affecting the marine habitat by means of ecotourism.

Coastal Security

Regarding coastal security forces, the Palk Bay region has a Coast Guard Station at Mandapam strategically located to overseas for the Palk Bay operation. The Navy has a Naval Air Station near Uchipuli, Ramnathapuram District with the Chetak Helicopters providing aerial surveillance towards Operation Tasha since the termination of IPKF operations. There are also several naval detachments along the coast including one at Rameshwaram, one at Point Calimere and another at Nagapattinam to provide the necessary security mechanisms in the Palk Bay. Maritime Terrorism, drug trafficking and piracy are the major threats to the Palk Bay region[74]. Smuggling has also been emerged as a very serious problem in the Palk Bay region. The Indian Coast Guard and Tamil Nadu Police launched Coast Guard patrols marking the beginnings joint patrolling of the Palk Bay, to carry on surveillance against terrorism, drug trafficking, smuggling and piracy in the region[25]. Moreover, the joint patrolling by the Indian and Sri Lankan was suggested to keep "trouble-makers" at the Palk Bay region, unmanned aerial vehicles were also employed to do surveillance of the coast.

Conflict Issues

Palk Bay region separates the coastal regions of Tamil Nadu from northern parts of Sri Lanka. There is always existence of rigid conflict between Tamil fishermen on both sides that affects livelihood of thousands of the fishermen on both sides[142,148]. The fishing conflict in the Palk Bay waters between India and Sri Lanka has accelerated leading to arrest, detention and even death of Indian fishermen[133]. The fish resources of the Indian side of the Palk Bay have been declined due to the unrestricted fishing, extensive trawling operations carried out for fishing and continuous reduction in the freshwater flow from the major and minor streams all along the Palk Bay coasts. This stimulates the Indian fishermen to sail deep into Sri Lankan waters of relatively rich in marine endowments and is regarded as the major root cause for the conflict issue.

By dialectically analysing the various social, political and economic processes both on land and at sea in each these centres; the differences in management between Indian as well as Srilankan parts are an outcome of a series of complex interactions between several processes. The mismanagement of the Rameswaram fleet and the better managed Mandapam fleet cannot

be attributed only to the relative strength of the institutional set up on land but should also take into consideration the conditions at sea. Thus, managing a complex fishery system requires a better understanding of the interaction of various processes that happen at different places of concern to the everyday lives of the fishers, moving beyond the limited narrow focus of several place based studies which focus on a singular place, social group and scale[146].

With the declaration of a ceasefire between the Sri Lanka Government and the Tamil Tigers, a new dimension of problem has been emerged. The Tamil Tigers wanted to resume fishing and found the presence of Indian trawlers in the Sri Lankan waters to be a major impediment to their livelihood. The Sri Lankan Navy personnel, apart from arresting several Indian fishermen for crossing the International Maritime Boundary Line (IMBL) in many occasions, they have also fired at and killed Indian fishermen for fishing in the narrow Palk Strait. The major issue is that the Indian trawlers employ large nets that usually sweep the ocean floor and as a result they trap not only non-target organisms, but also a lot of young fish too. This affects the breeding cycle, and has led to the depletion of marine resources in Indian seas and therefore the Sri Lankan fishermen have now feared that the same depletion will occur in their waters if trawling continues. With these challenges looming large, small-scale fishermen who own plastic boats are severely affected. This ever escalating conflict in sharing fishing grounds and fishery resources of Palk Bay by the Indian and Sri Lankan fishers is a persistent and pronounced problem for both the Governments of these two countries and the people. Hence, the issue of fishermen from India and Sri Lanka crossing the IMBL has led to a conflict between fishermen of both countries. The trawlers pose a serious threat to marine resources and in the long run, it would affect not just fishermen of northern Sri Lanka, but all fishermen in the region, therefore the issue needs an urgent solution by the Government of both the countries with appropriate measures.

Chapter 4

Conclusions and Recommendations

1. The research gaps identified in the previous review of literature on coral reef (Gaps 1-4) were not fulfilled till date which includes, long term monitoring or corals, corals and its associated fishery resources, coral biology and rehabilitation in the Palk Bay region. Apart from these research gaps, the coral taxonomy including traditional and molecular techniques, diversity and distribution of corals should be studied.

2. Till date there are no scientific studies on the habitat, ecology and conservation of Dugong population in the Palk Bay region. Hence, a long term conservation strategy for dugongs in Palk Bay region should be developed to protect and enhance their populations.

3. Research on restoration of the seagrass ecosystem and a long term strategy for seagrass conservation are the need of the hour.

4. Frequent occurrence of dolphin stranding along the coast of the Palk Bay has been reported but so far no proper study on their biology, ecology and behaviour in nature.

5. The reports revealed that the eggs laid by turtles were either eaten by stray dogs or collected by fishermen for consumption. These facts necessitate documentation and conservation of turtles in the Palk Bay region.

6. The mangrove ecosystem of Muthupet was studied on these - aspects whereas the thickest vegetation of mangroves in Karangad need to be studies extensively for their conservation and support the livelihood of local fishers.

7. The estuarian ecosystems along the Palk Bay region should be adopted to develop mangrove ecosystem for their environmental, economic and social benefits.

8. Apart from the systematic studies on taxonomy, diversity for exploring seaweed resources towards their quantitative, ecological/economical values, the future

research efforts should be exert on the development of advance technologies towards cultivating the native / local seaweeds efficiently along the coast of Palk Bay since the seaweeds are regarded as one of the vital resources for sustaining the economy of fisherfolk and moreover its cultivation is eco-friendly and does not produce any harm to the marine ecosystem.

9. Studies pertaining to the economic value of seagrass ecosystem in terms of providing direct and indirect benefits to a wide range of stakeholders, research on restoration of the seagrass species and develop a long term strategy for seagrass conservation are the need of the hour.

10. The future research should be concentrated on the systematic studies on sponge diversity, ecology and biology and their associated biological features in the Palk Bay region.

11. The shell industries an important economic support for local fishermen and hence the exploitation of molluscan species should be scientific and sustainable. The culture aspects of molluscan species should be developed to support the growing demand of shell industries.

12. The mariculture of economically important seacucumber species would be the opt solution for managing the sea cucumber resources in the Palk Bay region.

13. The information pertaining to technical feasibility of intensive seahorse culture is essential towards reducing overexploitation of wild stocks and to improve their production.

14. The reports indicate ascidians as a potential source for biomedical substances like antibacterial activity etc. Apart from this, they also play a major role as bio- indicator of pollution and hence a proper study on diversity and distribution of these groups is the need of the hour.

15. The ecosystem of Palk Bay, which contributes to the rich marine fish production in the region at present, is under threat due to destructive fishing habits. The indiscriminate use of habitat destructive fishing practices like bottom trawling, coral mining, dynamite fishing, and effluent disposal from aquaculture farms, contribute to the destruction of the most important marine ecosystems in this region. Regulatory measures and sustainable fishery practices should be developed in the Palk Bay region.

16. The best practices of trawl operations are essential towards the conservation of benthic fauna in the Palk Bay region.

17. The check list on marine fauna and flora of Palk Bay should be documented by collaboration of experts / taxonomists in the various fields of research.

18. The appropriate strategies should be formulated towards the promotion of eco-friendly aquaculture practices for the culture of economically important fishes, prawns, seaweeds, seahorses, pearls, seacucumbers etc. Moreover, formal education on community aquaculture is essential to help diversify fishermen's livelihoods.

19. Information on sea snakes is very limited in the Palk Bay region and hence a long term survey on distribution and diversity of sea snakes is essential. The earlier collection of holotype in the Palk Bay region, belonging to sea snake species Hydrophis biturberculatus, whose locality is Colombo in Western Sri Lanka, suggested that further intensive surveys might lead to the rediscovery of this species in the Palk Bay region.

20. The potential bird sanctuaries in the Palk Bay region are Point Calimare, Udayamarthandapuram and Vettangudi. Till date there are 61 seabird species recorded in the Palk Bay region however, more detail information pertaining to the seabirds are

not found elsewhere in the literature. Hence the seasonal and long term survey of seabirds of Palk Bay coast should be conducted.

21. Most of the coastal villages release the sewage effluents directly into the coastal waters and the solid waste are dumped along the coast which ultimately contaminate the coastal waters and also affect the coastal ecosystem. Hence the continuous monitoring strategy towards protecting the coastal environment in Palk Bay region should be formulated to prevent the microbial and other pollutants.

22. It is required to formulate strict regulations for industrial effluent discharge, land based domestic sewage discharge, fish landing centre activities, coastal developmental activities and aquaculture and salt pan waste discharges to control pollution in the Palk Bay region.

23. The beaches in the Palk Bay region could facilitate a great tourism potential and hence an appropriate planning should be formulated for highlighting the rich value of tourism potential to the nation as well as international hoteliers, tourism promoters, travel agents, package tour operators and others so as to attract them to establish infrastructure and value additions to the existing nature's gift towards tapping this tourism potential without affecting the marine habitat by means of ecotourism.

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Abstract: This study aimed to evaluate the toxicity of Kappaphycus alvarezii methanolic extracts in albino rats. Sub-chronic toxicity was tested with a single dose of intraperitonal administration of the extract as per the OECD guidelines in the experimental group rats and the control group rats were fed with standard diet and water ad libitum. Mortality, behaviour changes, clinical signs and symptoms, food intake, body weight and any abnormalities of the visceral organs were observed. The results revealed that the algal extract resulted in neither mortality nor any abnormalities. The Most of the serum biochemical parameters and haematological values were similar in control and experimental groups, histopathological examination of the vital organs like liver, kidney, spleen, brain and heart revealed no obvious abnormality in the control group and Kappaphycus alvarezii treated group. It may be concluded that Kappaphycus alvarezii is rich in nutrient and nutraceutial potentials and also safety food for human consumption.

Keywords: Kappaphycus alvarezii, Sub-chronic toxicity, OECD guidelines, Human consumption

Anand, D. J. B., S. M. J. Kala, and P. Vijaya Kumar. 2015. "Monthly Variations of Water Quality along South East Coast of India." International Journal of Geology, Agriculture and Environmental Sciences 3 (3): 10–5.

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Abstract: The environmental factors of coastal areas are very important, because the variations in the physico-chemical properties, such as temperature, salinity, pH, dissolved oxygen and nutrients will impact the life span of the fauna and flora in the sea. It regulates the species richness in the coastal area. If the physico-chemical parameters are not suitable, it will affect the distribution and the life style of the Biota. The variation in the nutrients load along the coastal waters is due to the natural weathering, riverine, land and anthropogenic input. However, the natural seasonal changes keep the coastal waters well mixed and aerated, which help to scatter the nutrients useful for the Biota. In the present study, the environmental parameters such as temperature, DO, salinity, pH, nutrients and chlorophyll-a were recorded from January 2014 to December 2014. The data suggests that during the monsoon period, a significant increase of fresh water and

land side input into the coastal area and have elevated nutrient concentration compared with other seasons. The qualitative study showed the present status of the physico-chemical parameters, which is very useful to evaluate the health of the coastal system and also to take precautionary measures to save the coastal environment.

Keywords: Monthly Variations, Coastal waters, Water quality, South East coast of India

Ananthan, G., and K. Iyappan. 2013. "Investigation of Antibacterial Potential of Ascidian, Microcosmus exasperatus (Heller, 1878) against Human Urinary Tract Pathogens." World Journal of Pharmacy and Pharmaceutical Sciences 3 (1): 396–403.

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Abstract: The current investigation is based on the discovery of novel antibacterial from new sources which have not been amply exploited. The main objectives of this work was to ascertain the antibacterial efficacy of a marine ascidian, Microcosmus exasperatus, collected from Palk Bay, Southeast coast of India, against selected urinary tract pathogens. The crude methanol extract was more active and exhibiting a broad spectrum antibacterial activity than the crude ethyl acetate extract against each of the bacterial strains tested. Maximum inhibition zone (10.0 ± 0.1 mm) was observed against the gram negative Pseudomonas aeruginosa in crude methanol extract. The consequent zone of 6.5 ± 0.1 mm was observed in ethyl acetate extract in P. aeruginosa.

Keywords: Microcosmus exasperatus, Antibacterial efficacy, Zone of inhibition, Urinary tract pathogens

Ananthan, G., M. M. Karthikeyan, A. S. Prabhu, and C. Raghunathan. 2012. "Studies on the Seasonal Variations in the Proximate Composition of Ascidians from the Palk Bay, Southeast Coast of India." Asian Pacific Journal of Tropical Biomedicine 2 (10): 793–7.

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Abstract: The moisture content of ascidians was estimated by drying 1 g of fresh tissue at a constant temperature at 105 ^{o}C for 24 h. The loss of weight was taken as moisture content. The total protein was estimated using the Biuret method. The total carbohydrate in dried sample was estimated spectrophotometrically following the phenol-sulphuric acid method. The lipid in the dried sample tissue was gravimetrically estimated following the chloroform- methanol mixture method. Ash content was determined gravimetrically by incinerating 1 g dried sample in muffle furnace at about 550 ^{o}C for 6 h and results are expressed in percentage. It was found very difficult to compare the monthly variations, as all

the ten species, exhibited wide fluctuations in their proximate compositions. For the sake of convenience, average seasonal values were calculated by summing the monthly values. The proximate composition of the 10 commonly available ascidians showed high nutritive value and hence these group especially solitary ascidians can be recommended for human consumption in terms of pickles, soup, curry and others after ensuring the safety of consumers.

Keywords: Ascidians, Biochemical composition, Seasonal variations, Proximate composition

Anantharaj, K., A. P. Packiyalakshmi, and J. Ganesh. 2013. "Studies on the Physico Chemical Status of Kattumavadi Coastal Region, Southeast Coast of India." International Journal of Research in Marine Sciences 2 (2): 45–9.

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Abstract: The quality of water may be assessed according to its physico- chemical and biological characteristics because of increasing industrialization, urbanization and anthropogenic activities from coastal water bodies. At present industrial effluents sewage water, domestic wastes and agricultural wastes are being discharged into the river and oceans that causing degradation of water quality. The present study was carried out to determine the water quality in terms of physicochemical characteristics and plankton distribution in the coastal waters of Kattumavadi, Palk Bay for a period of one year from July 2011 - June 2012. Hydrological variables and dissolved nutrients such as nitrate, nitrite, inorganic phosphate, reactive silicate, free ammonia, total nitrogen and particulate organic carbon were analyzed in coastal water bio topes of Palk Strait coastal environment. Nutrients of water also exhibited high values during the monsoon season and low values were recorded during the summer seasons. Air and surface water temperatures varied from 26.7 ºC to 37.7 ºC and from 26.7 ºC to 35.4 ºC respectively, while light extinction coefficients (LEC) varied from 1.82 to 4.86. Salinity ranged from 26.7 to 37.5‰ and the pH ranged from 7.4 to 8.6. Variation in dissolved oxygen content was from 4.36 to 8.1 ml l−1. Concentration of nutrients viz. nitrate (3.82 to 18.42 µM), nitrite (1.52 to 6.94 µM), inorganic phosphate (4.85 to 20.12 µM), reactive silicate (5.62 to 18.64 µM), free ammonia (0.01 to 0.59 µM), total nitrogen (3.76 to 11.95 µM) and particulate organic carbon (0.59 to 2.86 µM) also varied independently.

Keywords: Physicochemical characteristics, Water quality, Nutrients, Coastal waters, Phytoplankton

Anbuchezhian, R. M., S. Ravichandran, P. Murugesan, and J. S. Serebiah. 2012. "Assessment of Soft Bottom Polychaete Diversity in Thondi, Palk Bay, India." Journal of Environmental Biology 33: 917–21.

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Abstract: Polychaete assemblages are relatively poorly known in comparison to other components from Indian waters. In the present study, the spatial and seasonal distributions of polychaetes were investigated in the Thondi coastal area. Polychaete assemblage structure seems to be influenced by environmental parameters, such as temperature, salinity, pH, dissolved oxygen and total organic carbon. A total of 34 polychaete species were found, of which 26 species were in station I while 22 species in station II. There was a pronounced variation in diversity of polychaetes between the studied sites. Among the families maximum percentage of species constituted by Glyceridae (12%) and minimum Owenidae (4%) at station I and in station II, the Eunicidae (14%) was maximum and Pisinidae as (4%) minimum. The population density varied from 1456 to 2456 no m−2 in station I; 2120 to 4424 in station II and diversity index varied from 1.96 to 2.48 in station I; 2.01 to 2.53 in station II. Species richness varied from 1.21 to 1.65 in station I; 1.36 to 1.69 in station II and evenness index varied from 0.9 to 0.97 in station I; 0.91 to 0.98 in station II. BIO-ENV analysis showed that salinity, TOC and temperature as the key variables in influencing the faunal distribution.

Keywords: Palk Bay, Polychaete, Diversity indices, Environmental parameters

Anithajothi, R., K. Duraikannu, G. Umagowsalya, and C. M. Ramakritinan. 2014. "The Presence of Biomarker Enzymes of Selected Scleractinian Corals of Palk Bay, Southeast Coast of India." BioMed Research International Article ID 684874: 1–6.

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Abstract: The health and existence of coral reefs are in danger by an increasing range of environmental and anthropogenic impacts. The causes of coral reef decline include worldwide climate change, shoreline development, habitat destruction, pollution, sedimentation and overexploitation. These disasters have contributed to an estimated loss of 27% of the reefs. If the current pressure continues unabated, the estimated loss of coral reef will be about 60% by the year 2030. Therefore, the present study was aimed to analyze the enzymes involved in stress induced by coral pathogen and its resistance. We focused on the enzymes involved in melanin synthesis pathway (phenoloxidase (PO) and peroxidases (POD)) and free radical scavenging enzymes (super oxide dismutase (SOD), catalase (CAT)) and glutathione peroxidase (Gpx) in selected scleractinian corals such as Acropora formosa, Echinopora lamellosa, Favia favus, Favites halicora, Porites sp., and Anacropora forbesi. Overall, PO activity of coral was significantly lower than that of zooxanthellae except for Favia favus. Coral colonies with lower PO and POD activities are prone to disease. Maximum antioxidant defensive enzymes were observed in Favia favus followed by Echinopora lamellosa. It is concluded that assay of these enzymes can be used as biomarkers for identifying the susceptibility of corals towards coral bleaching induced by pathogen.

Keywords: Biomarker enzymes, Zooxanthalae, Scleractinian corals, Palk Bay

Anjusha, A., R. Jyothibabu, L. Jagadeesan, A. P. Mohan, K. Sudheesh, K. Krishna, N. Ullas, and M. P. Deepak. 2013. "Trophic Efficiency of Plankton Food Webs:

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Abstract: This paper introduces the structure and trophic efficiency of plankton food webs in the Gulf of Mannar (GoM) and the Palk Bay (PB) – two least studied marine environments located between India and Sri Lanka. The study is based on the results obtained from a field sampling exercise carried out in the GoM and the PB in March 2010 (Spring Intermonsoon – SIM), September 2010 (Southwest Monsoon – SWM) and January 2011 (Northeast Monsoon – NEM). Based on multivariate analysis of major environmental parameters during different seasons, it was possible to clearly segregate the GoM and the PB into separate clusters, except during the SWM. This segregation of the GoM and the PB was closely linked with the seasonally reversing ocean currents in the region, as evident from the MIKE 21 flow model results. During the period of relatively low phytoplankton biomass (<23 mg C cm−3), the organic carbon contribution of the microbial loop was significantly high – both in the GoM and the PB. During the SIM, the carbon biomass available in the plankton food web was significantly higher in the PB (av. 122.8 ± 47.60 mg C cm−3) than in theGoM (av. 81.89 ± 35.50 mg C cm−3). This was due to a strong microbial loop in the former region. In the GoM, phytoplankton contributed a considerable portion (>50%) of the carbon biomass during the SWM and the NEM, whereas, microbial loop contributed significantly (80%) during the SIM. The microbial loop was predominant in the PB throughout the study period, being as high as 83% of the total plankton biomass during the SIM. As compared to the PB, the mesozooplankton biomass was higher in the GoM during the SWM and the NEM and lower during the SIM. The relatively high mesozooplankton stock in the PB during the SIM was closely linked with a strong microbial loop, which contributed the major share (av. 101.6 ± 24.3 mg C cm−3) of the total organic carbon available in the food web (av. 126.6 ± 24.3 mg C cm−3). However, when microbial loop contributed >65% of the total organic carbon available in the food web, the trophic efficiency was found to be low (~3%), which can be attributed to the wide dispersal of organic carbon in the microbial loop. Importantly, during the NEM, when the copepod Paracalanus parvus was predominant in the PB, the trophic efficiency of the microbial loop dominant food web increased by more than a fold (7.2%). The study provides evidences for the first time from the field that exceptionally high abundance of efficient microzooplankton consuming zooplankton can significantly increase the trophic efficiency of the microbial loop dominant plankton food web.

Keywords: Plankton, Food webs, Zooplankton, Multivariate analysis, Fluorescence microscopy, Arabian Sea, Bay of Bengal

Annapoorani, A., A. K. K. A. Jabbar, S. K. S. Musthafa, S. Karutha Pandian, and A. V. Ravi. 2012. "Inhibition of Quorum Sensing Mediated Virulence Factors Production in Urinary Pathogen Serratia marcescens PS1 by Marine Sponges." Indian Journal of Microbiology 52 (2): 160–6.

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Abstract: The focal intent of this study was to find out an alternative strategy for the antibiotic usage against bacterial infections. The quorum sensing inhibitory (QSI) activity of marine sponges collected from Palk Bay, India was evaluated against acyl homoserine lactone (AHL) mediated violacein production in Chromobacterium violaceum (ATCC 12472), CV026 and virulence gene expressions in clinical isolate Serratia marcescens PS1. Out of 29 marine sponges tested, the methanol extracts of Aphrocallistes bocagei (TS 8), Haliclona (Gellius) megastoma (TS 25) and Clathria atrasanguinea (TS 27) inhibited the AHL mediated violacein production in C. violaceum (ATCC 12472) and CV026. Further, these sponge extracts inhibited the AHL dependent prodigiosin pigment, virulence enzymes such as protease, hemolysin production and biofilm formation in S. marcescens PS1. However, these sponge extracts were not inhibitory to bacterial growth, which reveals the fact that the QSI activity of these extracts was not related to static or killing effects on bacteria. Based on the obtained results, it is envisaged that the marine sponges could pave the way to prevent quorum sensing (QS) mediated bacterial infections.

Keywords: Marine sponges, Quorum sensing inhibition, Acyl homoserine lactone, Serratia marcescens PS1, Biofilm, Bacterial pathogenesis

Annapoorani, A., B. Kalpana, K. S. Musthafa, S. Karutha Pandian, and A. V. Ravi. 2013. "Antipathogenic Potential of Rhizophora spp. against the Quorum Sensing Mediated Virulence Factors Production in Drug Resistant Pseudomonas aeruginosa." Phytomedicine 20 (11): 956–63.

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Abstract: Quorum sensing (QS) is a process of cell–cell communication mechanism occurs between the bacterial cells through the secretary signal molecules. This QS mechanism has been shown to control over the expression of various genes responsible for the production of virulence factors in several bacterial pathogens. Hence, the present study was intended to evaluate the antipathogenic potential of mangrove trees of the genus Rhizophora against the QS dependent virulence factors production in Pseudomonas aeruginosa PAO1, clinical isolates CI-I (GU447237) and CI-II (GU447238). The methanol extract of Rhizophora apiculata and R. mucronata (1 mg/ml) showed significant inhibition against QS dependent virulence factors production such as LasA protease, LasB elastase, total protease, pyocyanin pigment production and biofilm formation in P. aeruginosa PAO1, CI-I and CI-II. This study for the first time, reports the quorum sensing inhibitory (QSI) potential of Rhizophora spp. against P. aeruginosa infections.

Keywords: Quorum sensing, Pseudomonas aeruginosa, Quorum sensing inhibition, Virulence, Rhizophora

Anusha, J. R., and A. T. Fleming. 2014. "Cephalopod: Squid Biology, Ecology and Fisheries in Indian Waters." International Journal of Fisheries and Aquatic Studies 1 (4): 41–50.

Address: PG and Research Department of Advanced Zoology and Biotechnology, Loyola College, Chennai – 600 034, Tamil Nadu, India. Email: anushajr@gmail.com

Abstract: This short review summarizes the current status of the squid fisheries in Indian waters. It primarily considers the historical classification and biological characteristics of squid within the context to Indian squid varieties. Squid is an economically important cephalopod in India represented mainly by Loligo duvauceli, Sepioteuthis lessoniana, and Doryteuthis species. Among the squids, the Indian squid (Loligo duvauceli) is the dominant species, catching about 97% all over the country per year. The squid fish plays a major role in balancing the marine ecosystem. Generally, the temperature changes, ocean acidification and climatic changes are likely to affect marine ecosystems and their associated fisheries, adding to the challenges of managing fisheries sustainably. The proposed changes responded quickly in the squids and act as ecosystem indicators of environmental change by minimum growth rate and maximum production. Since, the increase in ocean temperatures can cause faster growth and shorter life spans of squid. In addition, briefly reviews the methods of exploitation of squid along with the current squid populations, fishing methods, export, utilization and marketing. India's squid fishing fleet accounted for 3% of the global squid production and makes up approximately 5–7% of U.S. squid imports. The processed squid meat has been exported in global level from the maritime states to Japan, US, EU, UAE, Italy and France through the major ports such as Kochi, Kollam, Tuticorin, Mumbai and Visakhapatnam. A brief analysis of the current status of the Indian squid fisheries and considers the potential for future development are provided in conclusion.

Keywords: Cephalopod, Squid, Ecosystem, Fisheries, Global utilization

Aravindraja, C., D. Viszwapriya, and S. Karutha Pandian. 2013. "Ultradeep 16S rRNA Sequencing Analysis of Geographically Similar but Diverse Unexplored Marine Samples Reveal Varied Bacterial Community Composition." PLoS ONE 8 (10): e76724.

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Abstract: Bacterial community composition in the marine environment differs from one geographical location to another. Reports that delineate the bacterial diversity of different marine samples from geographically similar location are limited. The present study aims to understand whether the bacterial community compositions from different marine samples harbour similar bacterial diversity since these are geographically related to each other. In the present study, 16S rRNA deep sequencing analysis targeting V3 region was performed using Illumina bar coded sequencing. A total of 22.44 million paired end reads were obtained from the metagenomic DNA of Marine sediment, Rhizosphere sediment, Seawater and the epibacterial DNA of Seaweed and Seagrass. Diversity index analysis revealed that Marine sediment has the highest bacterial diversity and the least bacterial diversity was observed in Rhizosphere sediment. Proteobacteria, Actinobacteria

and Bacteroidetes were the dominant taxa present in all the marine samples. Nearly 62–71% of rare species were identified in all the samples and most of these rare species were unique to a particular sample. Further taxonomic assignment at the phylum and genus level revealed that the bacterial community compositions differ among the samples. This is the first report that supports the fact that, bacterial community composition is specific for specific samples irrespective of its similar geographical location. Existence of specific bacterial community for each sample may drive overall difference in bacterial structural composition of each sample. Further studies like whole metagenomic sequencing will throw more insights to the key stone players and its interconnecting metabolic pathways. In addition, this is one of the very few reports that depicts the unexplored bacterial diversity of marine samples (Marine sediment, Rhizosphere sediment, Seawater) and the host associated marine samples (Seaweed and Seagrass) at higher depths from uncharacterised coastal region of Palk Bay, India using next generation sequencing technology.

Arunkumar, K., A. Palanivelu, and A. Darsis. 2014. "Proximate Composition, Nutraceutical Constituents and Fatty Acid Profile on GCMS of Seaweeds Collected from Balk Bay (Thondi), India." International Journal of Current Science 12: E 57–71.

Address: Post Graduate and Research Department of Botany, Alagappa Government Arts College, Karaikuadi – 630 003, India. Email: arunnir@yahoo.co.in

Abstract: The proximate compositions such as dry weight, ash content, total chlorophyll, accessory pigments (phycocyanin, allophycocyanin and phycoerythrin) and total lipids from fresh seaweeds; total carbohydrate, total protein, total amino acids, total phenol, WRC and sulphate content in crude carbohydrate of 16 red and 7 green seaweeds and GC-MS profile of fatty acids of red Gracilaria corticata var. corticata, G. verrucosa, Acanthophora spicifera and green Chaetomorpha linum were recorded, in the present study. Seaweeds such as red Gracilaria verrucosa, G. edulis, Hypnea musciformis, H. valentiae, Grateloupia filicina; and green seaweeds Ulva lactuca and Chaetomorpha linum are promising not only for traditional cell wall polysaccharides extraction but also as a source of specific nutraceutical values like dietary fiber, pigments, carbohydrates, protein and amino acids supplements in the food and fodder. Specifically seaweeds such as Gracilaria verrucosa, G. corticata var. corticata, Acanthophora spicifera and green seaweed Chaetomorpha linum can be utilized not only as source of nutraceutical supplements but also for fatty acids as well as bioactive compounds.

Keywords: Thondi, Seaweeds, Nutraceuticals, Proximate compositions, Crude carbohydrate

Balaji, V. (2013). "Research and Education at Palk Bay Center: Mangroves and Seagrass".

Address: Organization for Marine Conservation, Awareness and Research and OMCAR. Foundation, 156, Mannai Nagar, Mattusanthai Road, Pattukottai- 614601. Tamil Nadu, India. www.omcar.org

Abstract: The Palk Bay Centre in South India is dedicated to environmental education aimed at, children and adolescents as well as adults. As a coastal research field station with appropriate training programs, the PBC is also counseling center for coastal ecology and socio-economy of the northern Palk Bay. On the agenda are trainings for disaster management or trainings for alternative sources of income, especially for women in the region.

Balaji, V., F. Dahdouh-Guebas, and B. Satyanarayana (Eds.). 2012. "Community based Ecological Mangrove Restoration in Palk Bay". Proceedings of the International Conference 'Meeting on Mangrove ecology, Functioning and Management - MMM3', Galle, Sri Lanka, 2-6 July 2012. VLIZ Special Publication 57, xxxix + 192 pp.

Address: OMCAR Foundation, 69, Vendakottai Road, Pattukkottai – 614 601, Tamil Nadu, India. Email: omcarfoundation@gmail.com

Abstract: OMCAR Foundation has initiated the ecological mangrove restoration project in southeast coast of India. The project area is located in Agni Estuary. Village leaders, women self help groups and youth groups were organized by OMCAR through village level meetings and awareness programmes. 15 acres of degraded mangroves were selected in the Agni estuary region for mangrove restoration. The poster explains the time laps photographs of growth of mangroves and how the village women self help groups are involved in the project by backyard nursery and additional livelihood arrangements. The school students were brought to mangrove forest area for mangrove ecology field trips, after which they were involved in mangrove field research data collection, tagging and village awareness programmes. The project also provide solutions for mangrove fisher families to utilize the solar cookers instead mangrove fuel wood, and ecofriendly paddle pump and toilets to save electricity and ground water quality. A GIS map of mangroves and land use pattern was developed for the mangrove village that help the fisherfolks to understand the importance of mangroves against natural disasters and how to protect it through participatory village development scheme by local government. The poster briefly represents the successful achievements of the Mangrove restoration project and its impacts on local society.

Keywords: OMCAR, Ecological mangrove restoration, Growth, Livelihood, Fisherfolk

Balakrishnan, A., A. Ramu, and A. Murugesan. 2013. "Spatial Distribution of Heavy Metal Concentration in Groundwater in and around Palk Strait Sea Shore Area using GIS Techniques." International Journal of Innovative Research in Science, Engineering and Technology 2 (12): 7650–6.

Address: Department of Chemistry, Mohamed Sathak AJ College of Engineering, Siruseri, Chennai, India.

Abstract: Metal pollution is one of the common and important problem of water bodies and responsible for causing serious health effects to humans and animals. The aim of present study was to assess the heavy metal concentration

in groundwater in Palk Strait sea shore area during the post –monsoon season. Heavy metals like Arsenic (As), Manganese (Mn), Zinc (Zn), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg) and Lead (Pb) present in ground water were determined by atomic absorption spectrometer. The concentrations of heavy metals were compared with drinking water standard prescribed by WHO, BIS, ICMR and FAO. The spatial distributions of heavy metal in ground water were taken to Geological Information System (GIS). In Arc GIS, spatial distribution maps were prepared for the above analyzed heavy metals.

Keywords: Ground water, Palk Strait, Heavy metal, Arc GIS

Bamaniya, D. C., A. Pavan-Kumar, P. Gireesh-Babu, N. Sharma, P. Reang, N. Sharma, D. Reang, G. Krishna, and W. S. Lakra. 2015. "DNA Barcoding of Marine Ornamental Fishes from India." Mitochondrial DNA: The Journal of DNA Mapping, Sequencing and Analysis 23: 1–5.

Address: ICAR – Central Institute of Fisheries Education (CIFE), Mumbai, Maharashtra, India.

Abstract: India has rich marine ornamental fish diversity with 400 fish species distributed in Gulf of Munnar/Palk Bay, Gulf of Kutch, and in reefs around Andaman & Nicobar and Lakshadweep Islands. Marine ornamental fish identification at the field level is very difficult because of their high diversity and profound changes in appearance during their developmental stages and camouflage. To facilitate ornamental fish trading with ease and in compliance with the biodiversity act, DNA barcoding technique could be used to accurately identify species. In this study, DNA barcodes were generated for 31 species of commercially important marine ornamental fishes from India. The average genetic distance (K2P model) within species, genus, and family was 0.446, 13.08, and 20.09%, respectively. Intraspecific variation has increased several folds (15-20 times) after including conspecific sequences from different geographical locations. The presence of allopatric lineages/cryptic species was observed in the Indo-pacific region. The NJ tree constructed based on K2P values showed distinct clusters shared by congeneric species specific to populations.

Keywords: Allopatric divergence, DNA barcoding, Cytochrome C oxidase subunit I, Marine ornamental fishes

Bavinck, M., M. Sowman, and A. Menon. 2014. "Theorizing Participatory Governance in Contexts of Legal Pluralism - A Conceptual Reconnaissance of Fishing Conflicts and their Resolution." In Conflicts over Natural Resources in the Global South - Conceptual Approaches, edited by M. Bavinck, L. Pellegrini, and E. Mostert, 147–71. London, UK: CRC Press.

Address: Department of Geography, Planning and International Development Studies, University of Amsterdam, Netherlands.

Abstract: Many coastal fisheries, including those of South Asia and South Africa, are characterised by high levels of social conflict, environmental deterioration

and fragmented governance. The REINCORPFISH research project analyses the conflicts occurring in the fisheries of these two regions and promotes a governance process that recognises the existence of (a) multiple actors, and (b) legal pluralism. More importantly, it strives to further a governance style that does justice to fisher interests and builds from the bottom up. The present chapter provides a conceptual framework for analyzing such processes within the context of interactive governance theory. The starting point is the perspective of collective action that explains why and how individuals and groups, who rely heavily on specific natural resources, develop autonomous institutions for their management. Legal pluralism and political ecology theories provide tools for analyzing the roles and conflicting interests of other institutional actors, such as state agencies, in resource management, and the – positive and negative – interactions between various legal systems. The resulting framework is applied to investigate and compare the nature of fishery conflicts across the two regions and identify, from a theoretical perspective, the bottlenecks and chances for effective, participatory governance.

Keywords: Conflict, Governance, Legal pluralism, South Asia, South Africa, Fisheries

Bergman, A. M. 2013. "Phylogeography of Sepioteuthis lessoniana (the Bigfin Reef Squid) and Uroteuthis duvauceli (the Indian Squid)." Honors Theses, Southern Illinois University Carbondale. Paper 353.

Address: Southern Illinois University Carbondale.

Abstract: Sepioteuthis lessoniana (the bigfin reef squid) and Uroteuthis duvauceli (the Indian squid) are two squid species found in largely overlapping regions in the Indian and Pacific Oceans. While both squids are important to fisheries throughout their ranges, very little taxonomic work has been done on either of them. Previous studies have led scientists to believe that S. lessoniana is actually a species complex (for example, there appear to be three species of "S. cf. lessoniana" in Japanese waters alone). The similarly broad geographic range of U. duvauceli suggests that this species could also harbor substantial cryptic genetic diversity. In order to evaluate genetic variation within these two species, regions of two mitochondrial genes—the large subunit ribosomal RNA gene (16S) and the cytochrome oxidase I gene (COI)—from specimens caught in regions throughout the northern Indian and western Pacific Oceans were sequenced and compared. Sequences were obtained by extracting the DNA from tissue samples of both species, amplifying the DNA using the polymerase chain reaction (PCR), determining the sequences of both DNA strands using a automated DNA sequencer, and comparing sequences to one another to establish similarities and differences between geographic locations. To expand the significance of this study, we compared our sequences to data contributed by a collaborator (Samantha H. Cheng, Department of Ecology and Evolutionary Biology, UCLA) and data downloaded from GenBank (an online genetic database). Phylogeographic analyses showed that Sepioteuthis lessoniana from southern India represent two very distinct genetic lineages, suggesting that "S. cf. lessoniana" comprises

at least two cryptic species in south Indian waters. For Uroteuthis duvauceli, specimens from Iran are genetically distinct from those in Thailand and Japan, which may support the hypothesis of several undescribed species within "U. cf. duvauceli". This study is the first attempt to assess genetic diversity across the ranges of these two species; future work will require additional genetic markers and (most importantly) additional sampling from other geographic regions.

Keywords: Phylogeography, Sepioteuthis lessoniana, Uroteuthis duvauceli, Indian squid

Bharathi, K., P. Subhashini, S. Raja, R. Ranith, K. Vanitha, and T. Thangaradjou. 2014. "Spatial Variability in Distribution of Seagrasses along the Tamilnadu Coast." International Journal of Current Research 6 (10): 8997– 9005.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India.

Abstract: Seagrasses are one of the predominant groups of marine flora that grows in tidal and subtidal region of the shallow coastal environment. Spatial variability of seagrass distribution, biomass, canopy height, productivity and environmental parameters were recorded at 24 stations all along the Tamilnadu coast during 2011 and 2012. Thirteen seagrass species of six genera were recorded, among which H. ovalis was found to be distributed all along the coast of Tamilnadu, and C. serrulata was found densely populated in the shallow coastal regions of Palk Bay and Gulf of Mannar (GOM). H. beccarii is the rare species found only in Vellar estuary of Parangipettai. Biomass (36.2 gfr.wt.m−2 - 1218 gfr.wt.m−2), productivity (0.01 g C m−2d−1 - 4.34 g C m−2 d−1) and canopy height (0.28 cm - 107.73 cm) of seagrass species varied among all species of seagrasses. Correlation coefficient indicate that the local environmental parameters, particularly inorganic phosphate and total phosphorus are two important nutrients and sediment texture play a prominent role in influencing seagrass biomass, productivity and canopy height by enhancing the growth of seagrasses. Hence the present study suggests continuous monitoring of ecological and biological variables in time and space is highly required for managing the resources efficiently.

Keywords: Seagrass distribution, Biomass, Productivity, Canopy height, Environmental parameters, Tamil Nadu

Bharathiraja, S., R. Rajasekaran, and J. Suriya. 2014. "Antibacterial Activity of Marine Bacteria Isolated from Sponge Spirastrella inconstans." Journal of Chemical and Pharmaceutical Research 6 (11): 395–8.

Address: Faculty of Marine Sciences, CAS in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India.

Abstract: Sponge associated marine microbes recognised as potential candidate for screening and isolation of bioactive compounds for range of disease. In this study totally 14 heterotrophic and morphologically different bacterial colonies

were isolated from marine sponge Spirastrella inconstans. The isolated strains were cultured in marine broth and extracted with ethyl acetate for screening of antimicrobial activity against a panel of human pathogens. The pigmented strains showed moderate activity of which strain MB13 showed inhibitory activity against all the tested pathogens was identified as Pseudoalteromonas piscicida using 16s rRNA sequencing. Two of non- pigmented strains also showed week antimicrobial activity.

Keywords: Antimicrobial, Spirastrella inconstans, Pseudoalteromonas, Pathogens, Sponge

BOBLME. 2015. Sea cucumber conservation in Palk Bay and Gulf of Mannar – India. BOBLME-2015-Ecology-54.

Chandrasekar, K., and M. Srinivasan. 2013. "Sea Turtle Exploitation from Tamil Nadu, Southeast Coast of India." Journal of Entomology and Zoology Studies 1 (6): 11–4.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai, Tamil Nadu, India. Email: cchandrumbt@gmail.com

Abstract: The present observation was carried out on sea turtles along the southeast coast of Tamil Nadu during June 2012 to May 2013. Curved Carapace Length (CCL) and Curved Carapace Width (CCW) were measured when the carapaces of dead turtles were found intact. Data on exploitation of turtles were collected by regular observations of turtle carapaces found near ditches, unused buildings and inside thickets that bordered the coastline. The average size of encountered green turtles was 92.4 cm CCL (SD ± 14.6) and

88.3 cm CCW (SD ± 15.4). The mean size of Olive Ridley carapaces was 80.2 cm CCL (SD ± 10.0) and 77.13 cm CCW (SD ± 11.16). For Hawksbills, CCL was 68 cm (SD ± 10.4) and CCW was 60.33 cm (SD ± 13.8). Green, Olive Ridley and Hawksbill turtles show an exploitation ratio of 61.9%, 34.2% and 3.9% respectively during the June 2012 to May 2013.

Keywords: Exploitation, Observation, Sea turtles, Carapace, Size, Mean

Chennubhotla, V. S. K. 2015. "Status of Seaweed Culture in India. Seminar report on the status of seaweed culture in China, India, Indonesia, ROK, Malaysia, Philippines and Thailand".

Abstract: In view of the constant demand for seaweeds, research programmes on seaweed resources and their culture were taken up by the Central Marine Fisheries Research Institute and Central Salt and Marine Chemicals Research Institute at Mandapam at their Regional and Field Centre, respectively, and various other research organizations belonging to the state fisheries departments/universities. Seaweed farming experiments were mainly carried out with species of Ulva, Gelidiella acerosa, Gracilaria edulis, Gracilaria sp. Corhcata, Gelidiopsis variabilis,

Gelidium pusillum, Hypnea musciformis, Acanthophora spicifera, Hormophyta triqueta, Cystoseira trinodis and species of Sargassum. The experiments were main conducted by the method of vegetative propagation. Some trials were made with spores as well.

Das, P. 2013. Coastal Security: The Indian Experience. IDSA Monograph Series, New Delhi: Institute for Defence Studies and Analyses.

Deepa, S., M. Srikumar, and K. P. Padmakumar. 2014. "Antifouling Potential of Selected Macroalgae from the Gulf of Mannar, India." International Journal of Bioassays 3 (11): 3479–87.

Address: Department of Aquatic Biology and Fisheries, University of Kerala, Kariavattom Campus, Thiruvananthapuram, Kerala – 695 581, India.

Abstract: Marine macroalgae are mostly free from fouling organisms in the marine environment. They defend themselves against fouling directly through the production of antifouling compounds, or indirectly through regulating the attachment of micro and macrofoulers. In this study, the methanol extracts of 43 species of macroalgae, collected from the Gulf of Mannar and Palk Bay regions of India were evaluated for antifouling activity against the epiphytic diatoms (Navicula subinflata, Nitzschia palea) as well as cyprid larvae of Balanus amphitrite. It was found that extracts of 23 species of macroalgae exhibited antidiatom activity and 16 extracts inhibited settlement property of barnacle larvae. The algae, Asparagopsis taxiformis showed the highest inhibitory effect on both the test diatoms with inhibition of 11.5 ± 1.11 mm and14.25 ± 2.38 mm zones respectively. Meanwhile, Liagora erecta and Acanthophora spicifera exhibited highest activity against the diatom, Navicula subinflata. The assay using cyprid larvae revealed that 16 algal extracts showed antisettlement activity and the highest was recorded by Liagora erecta (84.80 ± 1.33% inhibition), with an IC50 of 77.45 µg ml−1. The observations in the present study revealed that ten species of macroalgae have both micro and macrofouling property. The Principal Component Analyses (PCA) was also employed to assess the antifouling activity of algae.

Keywords: Antifouling, Microfouling, Macrofouling, Antidiatom, Antibarnacle, Antisettlement

Deepak Samuel, V. K., T. Anbalagan, M. Nithyanandan, and N. Namboothri. 2013. "Watering Pot Shell, Brechites penis (Linnaeus, 1758), a New Record to India (Mollusca: Bivalvia: Anomalodesmata)." Journal of Threatened Taxa 5 (12): 4679–81.

Address: Energy and Environment Unit, United Nations Development Programme, GoMBRT, 102/26, Jawan Bhawan, Devipattinam Road, Kenikarai, Ramanathapuram, Tamil Nadu – 623 504, India. Email: deepakocean@gmail.com

Abstract: A new record to India. We understood from interaction with fishermen that the specimen of B. penis was collected from trawl net operated in seagrass beds of Palk Bay. The habitat is supposedly similar to that of B. attrahens from the Red Sea.

Keywords: Mollusca, New record to India, Brechites penis, Watering pot shell

Dittus, W. P. J. 2013. Subspecies of Sri Lankan Mammals as Units of Biodiversity Conservation, with Special Reference to the Primates." Ceylon Journal of Science (Biological Sciences) 42 (2): 1–27.

Address: Smithsonian Conservation Biology Institute, Washington DC 20013, USA. Email: wdittus@gmail.com

Abstract: Subspecies embody the evolution of different phenotypes as adaptations to local environmental differences in keeping with the concept of the Evolutionary Significant Unit (ESU). Sri Lankan mammals, being mostly of Indian-Indochinese origins, were honed, in part, by the events following the separation of Sri Lanka from Gondwana in the late Miocene. The emerging new Sri Lankan environment provided a varied topographic, climatic and biotic stage and impetus for new mammalian adaptations. This history is manifest nowhere as clearly as in the diversity of non-endemic and endemic genera, species and subspecies of Sri Lankan mammals that offer a cross-sectional time-slice (window) of evolution in progress: 3 of 53 genera (6%), and 22 of 91 species (24%) are endemic, but incorporating subspecies, the majority 69 of 108 (64%) Sri Lankan land-living indigenous mammal taxa are diversified as endemics. (Numerical details may change with taxonomic updates, but the pattern is clear). These unique forms distinguish Sri Lankan mammals from their continental relatives, and contribute to the otherwise strong biogeographic differences within the biodiversity hotspot shared with the Western Ghats. Regardless of the eventual fates of individual subspecies or ESU's they are repositories of phenotypic and genetic diversity and crucibles for the evolution of new endemic species and genera. Their importance is highlighted by recent taxonomic studies that have identified more than 20% of infra-specific populations as new endemic species. Such 'hidden species diversity' validates not only the policy to conserve the potential for evolutionary processes as manifest by infra-specific diversity, but also, to prioritize the conservation of subspecies over their precise taxonomic definitions. The conservation of biodiversity in practice, therefore, involves firstly the official acknowledgement of the existence and importance of infra-specific diversity, especially in taxa such as primates where it is well expressed; and secondly, the protection of highly threatened natural habitats that constitute the only realistic life- supporting environments for the conservation of Sri Lanka's diversity in mammals and many other life forms.

Keywords: Evolutionary Significant Units (ESUs), Endangered endemics, Infra-specific diversity, Wildlife management, Western Ghats-Sri Lanka biodiversity hotspot

Earth System Sciences Organization, National Institute of Ocean Technology. 2014. National Report: For the Workshop, under the Auspices of the United Nations, in Support of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, Including Socio-economic Aspects. Chennai.

Elaiyaraja, C., R. Rajasekaran, and V. Sekar. 2013. "Check List and Occurrence of Marine

Gastropoda along the Palk Bay Region, Southeast Coast of India." Advances in Applied Science Research 4 (1): 195–9.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai, Tamil Nadu, India.

Abstract: The marine biodiversity of the southeast coast of India is rich and much of the world's wealth of biodiversity is found in highly diverse coastal habitats. A present study was carried out on marine gastropod accessibility among Palk Bay region of Tamilnadu coastline to identify, quantify and assess the shell resources potential for development of a small-scale shell industry. A large collection of marine gastropod was made among the coastal line of Mallipattinam and Kottaipattinam found 61 species (25 families) of marine gastropods over a 12 months period from Aug- 2011 to July- 2012. A totally of 61 species belonging to 55 species of 40 genera were recorded at station 1 and 56 species belonging to 41 genera were identified at station 2. Most of the species were common in both landing centres with slight differences but some species like Turritella duplicate, Strombus canarium, Cyprae onyxadusta, Marginella angustata, and Harpa major were available in station 1 not available in station 2. The present study revealed that the occurrence of marine gastropods species along the Palk Bay region of Tamilnadu coastline.

Keywords: Check list, Gastropoda, Palk Bay, India

Gangal, M., R. Arthur, and T. Alcoverro. 2012. "Structure and Dynamics of South East Indian Seagrass Meadows across a Sediment Gradient." Aquatic Botany 98 (1): 34–9.

Address: Post Graduate Program in Wildlife Biology and Conservation, Wildlife Conservation Society – India Program, Centre for Wildlife Studies, National Centre for Biological Sciences, GKVK Campus, Bellary Road, Bangaloru – 560 065, Karnataka, India. Email: msgangal@gmail.com

Abstract: In this study we examine the influence of non-monsoon sediment arrival on the high diversity SE Indian seagrass meadows of the Palk Bay and the Gulf of Mannar. We used a gradient based approach to examine the influence of increasing sediment loads on species composition and shoot density. In addition, for the ubiquitous seagrass (Cymodocea serrulata), we tested the influence of sediment on its biomass and productivity. We identified three sites in Palk Bay and four sites in Gulf of Mannar (SE India) along a gradient of sediment input. At each of the seven locations, sediment traps were deployed to measure sedimentation rates. Nine seagrass cores were taken systematically along 50 m transects at a constant subtidal depth to measure shoot density and biomass. A few shoots of C. serrulata were marked to estimate the above ground seagrass growth rate. Our results indicate that sedimentation rates that ranged from 8.6 to 62.4 mg DW cm−2 d−1 could not explain species composition of the meadow or shoot density of the observed species. C. serrulata was, by far, the most abundant species and present in all sediment conditions. Sedimentation rates did not alter shoot elongation rates in C. serrulata, ranging from 1.54 ± 0.29 SD to 0.25 ± 0.02 SD cm d−1, but in

contrast, increased vertical rhizome elongation rate. This increase was reflected in an increase in below ground biomass along the sediment gradient (R2 = 0.582, p = 0.01). C. serrulata appears to be able to adapt to the sediment dynamics in this area by allocating resources to rhizomes and roots to counteract burial and stabilizing sediments. Given that siltation is one of the most important threats to seagrass meadows, understanding the species specific adaptive mechanisms of seagrass species in these high sediment, high diversity South Asian meadows is an important first step in ensuring their long term survival and functioning.

Keywords: Seagrass, Sedimentation, Shoot:root ratio, Cymodocea serrulata, Biomass

Govindasamy, C. 2013. "Spatial and Temporal Patterns of the Seagrasses Biodiversity in Palk Bay, Bay of Bengal." Journal of Ecosystem and Ecography 3 (4): 65.

Address: Department of Oceanography and Coastal Area Studies, School of Marine Sciences, Alagappa University, Thondi Campus, India. Email: drcgsamy@gmail.com

Abstract: Rapid environmental changes have precipitated a general concern for the state of Palk Bay ecosystem. Clearly there have been major changes in some water quality variables in this ecosystem last two decay. Present paper deal with the seasonal fluctuations in various physico-chemical parameters in the coastal waters off the Palk Bay. The increase in the nutrient levels in the seagrass environment would favour the growth of seagrasses. The temporal dynamics of seagrasses were monitored in the Palk Bay. Plant morphological characteristics; shoot density, biomass and productivity were monitored. Morphological characteristics showed seasonal variation and ecological characteristics of the seagrass are related to the seasonal variability of water temperature and nutrients. This study provided the data to establish seagrass distribution and to understand the interactions between seagrass and environmental factors. Seagrass associated flora and fauna are the main component of marine biodiversity of the Palk Bay. The study will contribute to the understanding of shallow water seagrass bed ecosystems of this region, which has been largely neglected until now. Spatial and temporal patterns in the biomass and productivity of seagrasses show in the results. Seagrass productivity and standing crop varied primarily in response to changes in water temperature, salinity, which themselves varied mostly as a function of season, rainfall and freshwater inflow. The present paper reveals that comparing to the seagrasses in all the four stations have more percentage, shoot density, biomass and productivity because Palk Bay region which possess more salinity and more temperature, waves, currents, less depth, sandy-clay substrate and more day length, light, nutrient and sedimentation which favour the changes in Seagrasses diversity and their population in future.

Govindasamy, C., and K. Anantharaj, 2012. "New Distributional Record of Epiphytic Diatom of Nitzschia longissima in Palk Strait – Scanning Electron Microscopy (SEM)." African Journal of Basic and Applied Sciences 4 (1): 25– 27.

Address: Department of Oceanography and Coastal Area Studies, School of Marine Sciences, Alagappa University, Thondi Campus – 623 409, Tamilnadu, India.

Abstract: Epiphytic diatom of Nitzschia longissima, a species in Nitzschiaceae family was observed during our recent collection of the Seagrass Cymodacea serrulata that was originally collected from Thondi Coastal region. This is the first record of this epiphytic diatom species on Seagrass live in Thondi. Morphology, taxonomy, habitat and distribution were introduced and discussed in detail and the species, which is found epiphytic to Seagrass of Cymodacae serrulata. The Scanning Electron Microscopic (SEM) observations have extended out knowledge of taxonomy, morphology and general biology of the species.

Keywords: Epiphytic diatom, SEM morphology, Taxonomy, Distributional record

Govindasamy, C., and K. Anantharaj. 2013. "Epiphytic Diatoms on the Seagrass Blade from Palk Strait, Tamilnadu, India." Botany Research International 6 (3): 67–70.

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Abstract: Diatom is a single celled eukaryotic group of epiphytic algae belonging to the division of Bacillariophyta. The cell walls are composed of silica. They are an important component distributed in ponds, rivers and most of the marine ecosystems. Seagrass of Cymodacea serrulata were collected in shallow region in and around of the Thondi coastal regions, Palk Strait and the epiphytic diatom viz., C. scutellum, C. meneghiniana and P. robustus were first time identified. The Scanning Electron Microscopic (SEM) studies showed fine nanostructure pore girdle and valves view and raphe is very legibly. This is the one of the new distributional record is observed, identified and reported from our "Palk Strait region", we formally detailed on its taxonomy, morphology and SEM observations have extended out knowledge of general biology of the species.

Keywords: Seagrass, Epiphytic diatoms, SEM, New distributional record, Taxonomy

Govindasamy, C., and M. Arulpriya. 2011. "Seasonal Variation in Seagrass Biomass in Northern Palk Bay, India." Biodiversity 12 (4): 223–31.

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Abstract: Seagrass meadows are highly productive and serve as shelter and feeding areas for a variety of marine animals. Luxuriant seagrass beds are found in specific regions along the Indian coast. One of the largest contiguous seagrass ecosystems is located on the shallow continental shelf adjacent to the east coast of India and is comprised of four seasonally transitory species of seagrass. An extensive survey was carried out during the period from August 2009

to November 2010 on the physico-chemical variability and biomass of seagrass in the Adiramapattinam and Manalmelkudi coastal areas along Palk Bay, Bay of Bengal. There was a distinct seasonal and spatial variation of the above ground and below ground biomass between the stations. Seasonal variation in the seagrass biomass could be influenced by independent abiotic variables such as air temperature, salinity, pH, dissolved oxygen, particulate organic carbon and nutrients. The present investigation concluded that all the seagrass species were highly influenced by temperature, salinity, dissolved oxygen and total dissolved organic nitrogen in both the study areas.

Keywords: Seagrass, Distribution, Biomass, Seasonal variation, Environmental variable

Govindasamy, C., K. Anantharaj, R. Srinivasan, and K. Gavaskar. 2013. "Epiphytic Cyanobacteria Linked on Molluscs in Palk Strait, Tamilnadu, India." Middle East Journal of Scientific Research 17 (6): p693.

Address: Department of Oceanography and Coastal Area Studies, School of Marine Sciences, Alagappa University, Thondi Campus – 623 409, Tamilnadu, India.

Abstract: Coastal ecosystems are integral part of ocean and provide numerous benefits to human beings directly or indirectly. An inventory was carried out to study the epiphytic cyanobacteria on molluscs, their taxa and distributions. Samples were studied in the laboratory and identified. A total number of 17 genera belonging to chlorophyceae in Actinastrum (1), Ankistrodesmus (1), Arthrodesmus (1), Botryococcus (1), Chaetophora (1), Chlorella (1), Chlorococcum (1), Dactylococcus (1), Hydrodictyon (2), Oedogonium (1), Ooctysis (1), Scendesmus (1), Spirogyra (1), Ulothrix (1), Volvex (1), Westella (1) and Xanthidium (1) are recorded in Thondi Coastal region, Bay of Bengal, India.

Keywords: Epiphytic, Cyanobacteria, Chlorophyceae, Mollucus

Govindasamy, C., M. Arulpriya, K. Anantharaj, P. Ruban, and R. Srinivasan. 2013. "Seasonal Variations in Seagrass Biomass and Productivity in Palk Bay, Bay of Bengal, India." International Journal of Biodiversity and Conservation 5 (7): 408–17.

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Abstract: Seagrass meadows are valuable habitats having economic and ecological importance in coastal ecosystem. The major seagrass meadows in India exist along the southeast coast of India, particularly in Palk Bay region. The dominant seagrass species of this region was Cymodocea serrulata and Syringodium isoetifolium and these two species were taken for the survey. In this study, a survey was carried out for a period of two years from August 2009 to November 2011 on the seasonal and spatial variability of these two seagrass species. There was a distinct seasonal and spatial variation in the total biomass, productivity and above ground biomass,

leaf canopy height and shoot density of these two species between the stations. The seasonal variation in the biomass, productivity, leaf canopy height and shoot density could be influenced by the abiotic variables and the nutrient factors. Results conclude that the particulate organic carbon, inorganic phosphate and total organic nitrogen ($p>0.001$ level) influenced the enhancement of biomass, productivity, leaf canopy height and shoot density. Increase in seagrass growth was observed in the monsoon season, due to optimum temperature, low salinity, pH and addition of nutrients.

Keywords: Seagrasses, Seasonal changes, Biomass, Productivity, Leaf canopy height

Govindasamy, C., M. Arulpriya, P. Ruban, and V. R. Meenakshi. 2012. "Hydro- Chemical Evolution of Palk Strait Region, Bay of Bengal." Journal of Tropical Life Science 2 (1): 1–5.

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Abstract: Analysis was carried out on the physico-chemical parameters measured at two stations, Thondi and Soliyakudi in the southeast Palk Strait region during the monsoon and post monsoon seasons (November 2008 – March 2009). High temperature (31 °C) and salinity (35‰) were recorded in the month of March (post monsoon). During the monsoonal season, dissolved oxygen content was found to be high (5.2 O2 mg l−1) and the total phosphorous concentration when compared to other nutrients such as NO3, NO2 and SiO2, was also high in both the stations. In general, concentrations of all the nutrients were high in Thondi during the monsoon season (November and December) which could be due to the addition of nutrients through the sewage, agricultural and land run off.

Keywords: Seasonal variation, Nutrients, Correlation, Palk Strait

Govindasamy, C., M. Arulpriya, P. Ruban, L. F. Jenifer, and A. Ilayaraja. 2011. "Concentration of Heavy Metals in Seagrasses Tissue of the Palk Strait, Bay of Bengal." International Journal of Environmental Sciences 2 (1): 145–53.

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Abstract: Seagrasses are considered as good indicators of heavy metals in the marine environment. Palk Strait is situated in the southeast coast of India, dominated with the seagrasses. The aim of this investigation to measure the various metals concentration (Mn, Fe, Cu and Zn) in two seagrasses species, Cymodocea serrulata, Syringodium isoetifolium in four selected stations (Karankadu, Soliyakudi, Thondi and Sundrapandiyapattinam) along the Palk Strait. In order to get more information and environmental conditions of the experimental area, total metal

concentration was determined in coastal water and in the sediment. From the result, C. serrulata accumulates more amounts of metals than S. isoetifolium. Among all the four stations, station III (Thondi) observed high amount of metal concentration in seagrass tissues as well as its ambient environment.

Keywords: Cymodocea serrulata, Syringodium isoetifolium, Heavy metals, Palk Strait

Gowrishankar, S., B. Poornima, and S. Karutha Pandian. 2014. "Inhibitory Efficacy of Cyclo(L-Leucyl-L-Prolyl) from Mangrove Rhizosphere Bacteriume – Bacillus amyloliquefaciens (MMS-50) toward Cariogenic Properties of Streptococcus mutans." Research in Microbiology 165 (4): 278–89.

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Abstract: Since Streptococcus mutans is the principal etiologic agent causing dental caries, by encompassing an array of unique virulence traits, emerging treatment strategies that specifically target the virulence of this pathogen may be promising as alternative approaches compared to conventional antibiotic therapy. In this perspective, we investigated chloroform extract of cell-free culture supernatant from mangrove rhizosphere bacterium Bacillus amyloliquefaciens (MMS-50) in terms of anticariogenic properties of S. mutans, without suppressing its viability. Crude chloroform extract of MMS-50 was subjected to column and high performance liquid chromatographic techniques to obtain the active fraction (AF), and MMS-50 AF was used for all further assays. GC-MS and FT-IR were carried out to identify the major components present in MMS-50 AF. Comparative gene expression analysis of some biofilm- forming and virulence genes (vicR, comDE, gtfC, and gbpB) was done by real- time PCR. Cyclo(L-leucyl-L-prolyl) was found to be the chief compound in MMS-50 AF responsible for bioactivity. The minimum and maximum inhibitory concentrations of MMS-50 AF against S. mutans were found to be 100 and 250 µg/mL, respectively. Anti-virulence assays performed using below-sub-MIC levels of MMS-50 AF (30 µg/mL) resulted in significant reduction in adherence (68%), acid production, acid tolerance, glucan synthesis (32%), biofilm formation (53.5%) and cell surface hydrophobicity, all devoid of affecting its viability. The micrographs of CLSM and SEM further confirmed the antibiofilm and anti-virulence efficacies of MMS-50 AF. Expression data showed significant reduction in expression of all studied virulence genes. Thus, the current study unveils the anticariogenic potential of cyclo(L-leucyl-L-prolyl) from B. amyloliquefaciens, as well as its suitability as a novel and alternative anticariogenic agent against dental caries.

Keywords: Mangrove rhizosphere bacteria, Glucosyltransferases, Bacillus amyloliquefaciens, Anticariogenic agent

Gunasekara, S. S., and A. K. Mishra. 2014. "Mapping the Coverage of Seagrass Meadows of Gulf of Mannar and Palk Bay (India) using Landsat ETM+ Data." Proceedings Peradeniya University International Research Sessions 18: 1.

Address: National Building Research Organisation, 99/1, Jawatta Road, Colombo 5, Sri Lanka.

Abstract: In this study it is attempted to develop new approaches using remote sensing satellite data for better mapping and monitoring of sea grass in shallow waters (< 15 m) of the Gulf of Mannar and Palk Bay. The methodology adopts atmospheric correction of satellite data, water column corrections and supervised classifications for characterization of the sea grass. Reconnaissance survey of the area was done to collect the ground-truth and field spectroradiometer was used for measuring reflectance of sand and bottom substrate types. Atmospheric correction was carried out to retrieve water leaving radiance and water column correction was carried out using analytical algorithm for Landsat ETM+ band 1-3. Although the panchromatic band has higher spatial resolution (15 m) that could not use for the mapping due to its wider bandwidth (0.515–0.896 µm) and low relative spectral response. In addition to the above depth-invariant index method was also used. The atmospheric correction improves the contrast of the images which helps to map and characterize the seagrass and other features in a better way. Seagrass areas of Gulf of Mannar and Palk Bay were classified and mapped along with ground truth using the satellite data. An area of 127.98 Ha of seagrass cover was estimated in Munaikkadu site of the Palk Bay coast and 386.19 Ha of seagrass cover was estimated in Vethalei site of the Gulf of Mannar. The atmospheric correction algorithm applied to the Landsat ETM+ image improved significantly the contrast between seagrass, sand and water. Overall accuracy in Water leaving radiance (Lw) image (85.19% and 92.59%) showed significant improvement over the raw image accuracy (77.78% and 81.48%) for both study sites. The pixel size in Landsat ETM+ (30 m) produce bias in the accuracy of results because the heterogeneous nature of pixel. Besides the inherent spectral and spatial limitations of Landsat ETM+ data in studies of seagrass meadows and other submerged habitats, this method is useful for remote sensing in coastal environments.

Keywords: Seagrass mapping, Gulf of Mannar, Palk Bay, Landsat ETM+, supervised classification

Ignatius, B., M. Srinivasan, and S. Balakrishnan. 2011. “Reproductive Traits of Sandbird Octopus, Amphioctopus aegina (Gray, 1849) from Mandapam Coastal Waters (Palk Bay), Southeast Coast of India.” Ocean Science Journal 46 (3): 145−54.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai – 608 502 Tamil Nadu, India. Email: mahasrini1@gmail.com

Abstract: The sandbird octopus Amphioctopus aegina (Gray, 1849) is one of the important octopod species in trawl catches in Mandapam waters (Palk Bay). The reproductive biology of this species from these waters was studied from October 2001 to September 2002. In the majority of months (Jan-June), the sex ratio was biased towards males. The ratios of males to females increased consistently with respect to weight. Total weight at first maturity was 78.78 g for females and 40.8

g for males. Four maturity stags were recognized for females and two for males. Maturation and spawning occur all year round, with a peak during October and another peak during January-February. In males, no definite seasonal changes were observed in gonadosomatic index (GSI) values. In females there were two peaks in GSI values during October and January-February. For individuals of a DML range of 67-85 mm fecundity varied between 2,962 and 8,820 oocytes. The average relative fecundity was estimated at 68 to 83 and the average number oocytes per gram of ovary were 488 to 539.

Keywords: Amphioctopus aegina, Maturation, Spawning, Fecundity, Size at maturity

Iyappan, K., and G. Ananthan. 2014. "Isolation and Partial Characterization of the Active Metabolite of Ascidian, Polyclinum madrasensis from the Palk Bay Region, Southeast Coast of India." African Journal of Biotechnology 13 (48): 4471–5.

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Abstract: Ascidians are rich source of bioactive against which could be used for novel antimicrobial drugs. The present investigation inspects the antibacterial potential of ascidian, Polyclinum madrasensis collected from Mandapam, the Palk Bay region, Southeast coast of India. The crude extracts were tested for inhibition of bacterial growth against human pathogens. Antibacterial assay was carried out by agar well diffusion method. The maximum inhibition zone (12.0 ± 0.5 mm) was observed against the Staphylococcus aureus in crude methanol extract. The consequent zone of 6.5 ± 0.1 mm was observed against S. aureus in ethanol extract and minimum inhibition zone (3.2 ± 0.5 mm) was noticed with Pseudomonas aeruginosa. Molecular weight of tissue protein was determined through sodium dodecyl sulphate polyacryalamide gel electrophoresis (SDS-PAGE) and active matabolites were characterized by Fourier Transform Infrared spectroscopy (FTIR) analysis. The protein bands were at 36.5, 20.5, and 10.5 kDa, in SDS- PAGE and O-H stretch carboxylic acid compounds identified as the peak 3533.59 cm−1. It could be concluded from the present study that crude extract of the ascidian, P. madrasensis has potential antimicrobial effect against human pathogens.

Keywords: Polyclinum madrasensis, Bioactive compounds, Fourier Transform Infrared spectroscopy (FTIR), Sodium dodecyl sulphate polyacryalamide gel electrophoresis (SDS-PAGE)

Jagadeesan, L., R. Jyothibabu, A. Anjusha, A. P. Mohan, N. V. Madhu, K. R. Muraleedharan, and K. Sudheesh. 2013. "Ocean Currents Structuring the Mesozooplankton in the Gulf of Mannar and the Palk Bay, Southeast Coast of India." Progress in Oceanography 110: 27–48.

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Abstract: The Gulf of Mannar and the Palk Bay, located between India and Sri Lanka, are the two least studied marine environments in the northern Indian Ocean. We hypothesis, perceptible physical barriers that exist between the deep Gulf of Mannar and shallow Palk Bay, and seasonally reversing surface circulation patterns in the region have a concerted effect on the ecology of these oceanographically important areas. In the present study, data collected from 30 locations in the Gulf of Mannar and the Palk Bay in March 2010 (Spring Intermonsoon), September 2010 (Southwest Monsoon) and January 2011 (Northeast Monsoon) were used to investigate the role of ocean currents in molding mesozooplankton community characteristics in these, geographically closer and ecologically important transitional zones. Spatial difference in salinity was evident in the area with consistently higher values in the Gulf of Mannar as compared to the Palk Bay. The surface salinity was maximal during the Southwest Monsoon followed by the Spring Intermonsoon, and the Northeast Monsoon. These variations in salinity were closely linked with the seasonally reversing ocean currents as revealed in MIKE 21 flow model results. The mesozooplankton community dominated by copepods showed significant difference in species richness between the Gulf of Mannar (81 species) and the Palk Bay (63 species). Non-metric Multidimensional Scaling (NMDS) and Agglomerative Hierarchical Cluster Analysis (AHCA) on Bray–Curtis copepod similarity clearly estranged the Gulf of Mannar and the Palk Bay waters during the Spring Intermonsoon, and the Northeast Monsoon, attributable to the truancy of durable mixing typical of these seasons. In contrast, aided by strong currents, the increased mixing resulted in a homogenous copepod population in the Gulf of Mannar and the Palk Bay during the Southwest Monsoon. Furthermore, the indicator and dominant species analysis for copepods divulged the spatial heterogeneity in species composition during the Spring Intermonsoon and the Northeast Monsoon periods. Multivariate Redundancy Analyses showed salinity as the most important variable accountable for the observed variance in copepod distribution. In general, the copepod community in the Gulf of Mannar was composed both of coastal and offshore species whereas, coastal species largely inhabited the Palk Bay. This kind of a study depicting zooplankton community organization as governed by seasonally reversing monsoon circulation patterns forms the first record from the Indian coastal waters. The findings attain absolute significance considering its ecological implications on oceanographically transitional systems like the Gulf of Mannar, and the Palk Bay.

Jaikumar, M. 2012. “A Review on Biology and Aquaculture Potential of Rabbit Fish in Tamil Nadu (Siganus canaliculatus).” International Journal of Plant, Animal and Environmental Sciences 2 (2): 57−64.

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Abstract: Preliminary investigation on the culture of Siganus canaliculatus in floating cages in mandapam coastal water has revealed that the fish has high culture potential in the region. It is euryhaline, inhabiting areas where salinities range from 17 ppt to 37.0 ppt. The Juvenile are abundant in the area of reef and seaweed bed and collecting in traps near mandapam. Natural occurrence of

juveniles of S. canaliculatus in large quantity was noticed during February through May in the Gulf of Mannar. The fish feeds mainly on seaweeds. It is reported that the fish can reach a marketable size of 20 cm fork length in 6 months. The rabbit fish is cultured in South East Asian countries. India has enormous potential for rabbit fish culture.

Keywords: Siganus canalicullatus, South coast, Traps, Fisher folk

Jaikumar, M., C. Suresh Kumar, R. S. Robin, P. Karthikeyan, and A. Nagarjuna. 2013. "Milkfish Culture: Alternative Revenue for Mandapam Fisherfolk, Palk Bay, Southeast Coast of India." International Journal of Fisheries and Aquaculture Sciences 3 (1): 31−43.

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Abstract: Milkfish (Chanos chanos) is one of the most important brackish water finfish species being cultured in Southeast Asia. Natural milkfish fry occur along the southeast coast of India in fairly large numbers during the months of March-June and October-November. Present study emphasizes the seasonal variation and distribution of milkfish along the southeast coast of India. Milkfish culture has to be economically competitive compared to shrimp and other fish culture which do not contribute to local food supply. Annual total production from the Philippines, Indonesia, and Taiwan has been exceeding 0.5 million tons since 2009. The industry has relied on wild-caught milkfish fry, which is unpredictable, until hatchery fry became available in 1987. This paper compares the collection of wild seed near mandapam area as well as production costs in cage. Milkfish eggs (1.1-1.2 mm in diameter) and larvae (3.5 mm at hatching) are pelagic and stay in the plankton for up to 2-3 weeks. This would be a good source of income to coastal fisher folk in Mandapam.

Keywords: Chanos chanos, Fry, Chinnapalam, Economics

Jaikumar, M., L. Kanagu, C. Stella, and B. Gunalan. 2011. "Culturing a Rabbit Fish (Siganus canalicullatus) in Cages: A Study from Palk Bay, South East Coast of India." International Journal of Water Resources and Environmental Engineering 3 (11): 251−7.

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Abstract: Preliminary investigation on the culture of Siganus canalicullatus in floating cages in Mandapam coastal water has revealed that the fish has high culture potential in the region. It is euryhaline, inhabiting areas where salinities range from 23‰ to 35.8‰. The fish grows faster on pelletted diets than on ordinary seaweeds. It is estimated that the fish would reach a marketable size of 20 cm fork length in 6 months; hence two crops can be harvested in a year. This would be a good source of income to fisher folk in Mandapam area.

Keywords: Siganus canalicullatus, Mandapam coast, Cage culture, Fisher folk

Jaikumar, M., R. Ramkumar, L. Kanagu, P. Senthil, C. Stella, and H. Muraleedharan. 2010. "Corrosion Behaviour of Mild Steel in Putrid Seaweed System at Thondi Coastal Area-(Palk Bay) Southeastern Coast of India." World Applied Sciences Journal 11 (7): 791–802.

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Abstract: This paper reports result of putrid system seaweeds in Thondi coast (Latitude 90° 44' N and Longitude 79° 00'45'' E) natural seawater. Observation made weight loss measurement in room temperature, polarization technique and Impedance measurement. Three seaweeds were taken up for present study Ulva, Hypnea and Gracillaria. The bacteria counts of the Heterotrophic bacteria in the putrid system were very high in the range 5.5 * 106 CFU/cm2 to 5.9 * 107 CFU/cm2, Initially there is no sulphate reducing bacteria, after 30th day can observed blackening in the putrid seawater, Hence we can observed high bacteria count in the putrid seawater system. The corrosion rates by weight loss measurement mild steel in Thondi seawater and its control system corrosion rate was high at 0.0332 g to 0.0509 g observed in the 75 days in the immersion period, where as in the putrid system the corrosion was less in the range of 0.0222 g to 0.1750 g and the electro chemical polarization study indicated that icorr values were same in the putrid system and the control system but Less weight loss reducing corrosion current and increasing resistance has been observed in the putrified seaweed system. It is concluded that margacite sulphide films to form a productive coating on mild steel during putrification were observed during the study.

Keywords: Mild steel Corrosion, Putrid seaweed system, Heterotrophic Bacteria, Polarization technique, Impedance measurement

Jayapal, K. A. 2014. Fisheries Policy Note 2014-2015. Chennai: Animal Husbandry, Dairying and Fisheries Department.

Jayaprakas, V., and R. Radhakrishnan. 2014. "Indian Coral Reefs: Diversity, Anthropogenic Influences and Conservation Measures." BEST: International Journal of Humanities, Arts, Medicine and Sciences 2 (4): 25–36.

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Abstract: India is a country well known for its Biodiversity rich ecosystems. The coral reef ecosystems are indeed very unique and are home to a multitude of organisms. Currently there are 5 major reefs in India that include Gulf of Kutchch, Gulf of Mannar, Palk Bay, Lakshadweep Islands and Andaman and Nicobar islands and minor reefs are distributed along the intertidal regions of Ratnagiri, Malvan and Redi, South of Bombay, west of Mangalore and the Hermatypic corals along the shore are reported from Quilon in the Kerala Coast to Enayem in Tamil Nadu.

But these rich abodes are facing a number of anthropogenic threats and the current status of the Indian reefs is also discussed in this review.

Keywords: Economic and environmental, Anthropogenic, Wildlife protection

Jerald Wilson, J., and M. R. Kitto, 2012. “Marine Sponge and Evolving Science – The Need for a Comprehensive Systematic Inventory for Peninsular India.” Current Science (Correspondence) 102 (4): 545–6.

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Jeyabaskaran, R., L. R. Khambadkar, A. M. Abbas, and V. Kripa. 2013. Underwater Exploration of Dugong Habitats in Palk Bay. CMFRI Newsletter. 138: 7.

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Abstract. The dugongs (Dugong dugon) are the only strictly-marine herbivorous mammals depending on seagrass for subsistence. One of the important habitats of dugongs is the seagrass beds of Palk Bay along the southeast coast of India. During last century, several herds were reported to have inhabited the Palk Strait between India and Sri Lanka. However, the population has drastically depleted and is nearing extinction. One of the main reasons attributed to this is the degradation of seagrass habitats. In order to find the present status of seagrass communities in the Palk Bay, underwater explorative survey was done during the period 18th to 28th September 2013 by Fishery Environment & Management Division of CMFRI. Underwater surveys were conducted by using video transects method. About eight species of seagrasses such as Cymodocea serrulata, Enhalus acoroides, Syringodium isoetifolium, Halophila ovalis, Halophila beccarii, Halodule pinifolia and Halodule uninervis observed during the survey. Among these, fresh dugong feeding scars were observed in Cymodcea serrulata and Syringodium isotifolium beds in Sethupavachatram and Manamelkudi area. Fishers from these villages opined that dugongs which are locally called “avolia” or “Kadal pani are frequently seen in this area. Earlier studies conducted in the Institute have indicated that Dugongs feed on the sea-grasses like Cymodocea serrulata, Syringodium isoetifolium, Halodule uninervis, Halophila ovalis and Enhalus acoroides. In the captive rearing experiments conducted at Mandapam Regional Centre of CMFRI during the second half of last century, they were fed with the seagrasses Cymodocea serrulata and Halodule uninervis. The underwater exploration revealed three types of seagrass beds are present in Palk Bay such as (i) Coral reef associated seagrass bed as observed in Mandapam area (ii) Mangrove associated seagrass bed as in Adirampattinam, Mallipattinam and Sethupavachatram area and (iii) Shallow sandy bottom seagrass bed as found in Thondi, Kottaipattinam and Jegathapattinam area. The seagrass meadows were important fishing grounds for shrimps, crabs and squids. Traditional fishing methods like stake net (adappu valai), squid fishing (Kanava maaru), shore gillnet (Nandu valai) and single trawl net (Othai madi) are used in this area. Apart from assessing the seagrass community

structure, the ecology of these unique habitats and the avian fauna associated with these ecosystems were also studied in detail.

Jyothibabu, R., A. P. Mohan, L. Jagadeesan, A. Anjusha, K. R. Muraleedharan,

K. R. Lallu, K. Kiran, and N. Ullas. 2013. “Ecology and Trophic Preference of Picoplankton and Nanoplankton in the Gulf of Mannar and the Palk Bay, Southeast Coast of India.” Journal of Marine Systems 111–112: 29–44.

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Abstract: The Gulf of Mannar (GoM) and the Palk Bay (PB) are two least studied marine environments located between India and Sri Lanka. The environmental and smaller plankton (0.2–20 µm) data from 30 locations in the GoM and PB during the northeast monsoon (November–February) are presented in this paper. Coastal currents during the study period was from the east to west and as a result, the PB had Bay of Bengal (BoB) waters, which was low saline (av. 28.98 ± 1.34) as compared to the GoM (av. 31.96 ± 0.58). The BoB waters caused signifi cantly higher turbidity in the PB (av. 7.84 ± 13.59 NTU) as compared to the GoM (av. 1.76 ± 1.38 NTU). Multivariate analyses of hydrographical parameters demarcated two separate clusters in the study area clearly segregating the GoM and PB. This was mainly due to the physical barriers (Rameswaram Island, Ramsethu and Mannar Island) that inhibit the mixing of waters between the GoM and PB. The fluorescence microscopy and flow cytometry data showed a high abundance of picoeukaryotes, heterotrophic bacteria and autotrophic nanoplankton in the GoM whereas, Synechococcus and heterotrophic nanoplankton were higher in the PB. The picoplankton and nanoplankton carbon biomass was higher in the GoM (av. 62.2 mgCm−3) as compared to the PB (av. 47.6 mgCm−3). The carbon biomass in the GoM and PB was mainly contributed by nanoplankton (>70%) signifying their trophic preference in the study area. The carbon contribution of different plankton components in the GoM was autotrophic nanoplankton > heterotrophic bacteria > heterotrophic nanoplankton > Synechococcus > picoeukaryotes. On the other hand, heterotrophic nanoplankton was the second most dominant component in the PB followed by heterotrophic bacteria, Synechococcus and picoeukaryotes. The redundancy analysis (RDA) showed that picoeukaryotes, heterotrophic bacteria and autotrophic nanoplankton are positively correlated with salinity and nitrate, whereas Synechococcus and heterotrophic nanoplankton are positively correlated with turbidity, phosphate and dissolved oxygen. The data presented in this paper forms the first information on the relative trophic preference of various fractions of smaller plankton in Indian coastal waters.

Keywords: Plankton, Multivariate analysis, Flow cytometry, Fluorescent microscopy, Gulf of Mannar, Palk Bay, Arabian Sea, Bay of Bengal

Jyothibabu, R., N. V. Madhu, L. Jagadeesan, A. Anjusha, A. P. Mohan, N. Ullas, K. Sudheesh, and C. Karnan. 2014. “Why do Satellite Imageries Show Exceptionally High Chlorophyll in the Gulf of Mannar and the Palk Bay during the Norteast Monsoon?” Environmental Monitoring and Assessment 186: 7781–92.

Address: Regional Centre, CSIR National Institute of Oceanography, Kochi – 682 018, India.

Abstract: The Gulf of Mannar (GoM) and the Palk Bay (PB) are two least studied marine environments located between India and Sri Lanka. Exceptionally high chlorophyll a concentration in the GoM and the PB during the Northeast Monsoon (November–February) is a consistent feature in satellite imageries, which has been attributed to the intrusion of the Bay of Bengal (BoB) waters. The analyses of the Moderate Resolution Imaging Spectroradiometer (MODIS) and field chlorophyll data collected from 30 locations in the Indian sector of the GoM and the PB in January 2011 showed significant overestimations in the satellite data. This error was much higher in the PB (60– 80%) as compared to the GoM (18–28%). The multivariate analyses evidenced that the exceptionally high satellite chlorophyll in the PB is contributed largely by turbidity, colored dissolved organic matter (CDOM), and bottom reflectance. The paper cautions that though MODIS is superior in estimating chlorophyll a in optically complex waters, there are still chances of overestimations in regions like the PB.

Keywords: Chlorophyll, Phytoplankton, Multivariate analysis, Sediments, Turbidity, Satellite imagery, Gulf of Mannar, Bay of Bengal

Kaja Magdoom, B., and M. Kalaiselvam. 2009. "A Study of Plankton Bloom in Palk Bay Region (South East Coast) of India." Research Journal of Biological Sciences: 18–24.

Address: CAS in Marine Biology, Annamalai University, Parangipettai, Cuddalore District, Tamil Nadu, India. Email: bkmagdoom@hotmail.com

Abstract: Plankton bloom was analysed on six stations of Palk Bay: Adhirampattinam, Mallipattinam, Ponnagaram (Manamelkudi) Gopalapattinam, Kottai Pattinam and Thondi. Two algal species Trichodesmium (T. Erythraea and T. Thiaburti) were found numerically abundant in all stations. Zooplanktons were recorded with limited populations of Paracalanus parvus, Oithona rigida, Copepod nauplii, Bivalve veliger, Oikopleura sp. and Sagitta sp. The study revealed that the Shannon diversity ranged between 0.7866 and 0.9686, the Margalef richness between 0.5573 and 0.5992 and the evenness varied from 0.3783 to 0.4658. The V-statistics was also calculated to compare the observed diversity with predicted diversity through the Caswell model. The V values which ranged from 0.7866 to 0.9686 exhibited that the observed diversity was lower than the predicted diversity. This indicates the polluted nature of the ecosystem.

Keywords: Plankton bloom, Trichodesmium, Palk Bay, Ecosystem, Pollution

Kalaiarasi, M., P. Paul, C. Lathasumathi, and C. Stella. 2012. "Seasonal Variations in the Physico-Chemical Characteristics of the Two Coastal Waters of Palk-Strait in Tamil Nadu, India." Global Journal of Environmental Research 6 (2): 66–74.

Address: Department of Oceanography and Coastal Area Studies, Alagappa University Thondi Campus, Thondi – 623 409, Tamil Nadu, India.

Abstract: In the present study the hydrographical parameters like temperature, hydrogen ion concentration (pH), salinity, conductivity, light penetration, turbidity, total suspended solids (mg/l), total dissolved solids, dissolved oxygen (mg/l), biological oxygen demand (mg/l) and nutrients of the surface waters were studied in both stations of Manamelkudi and S.P. Pattinam. All the physico-chemical parameters and nutrients were not showed any significant variations in both the stations. Knowledge of nutrients relating to their contributory sources, utilization levels and their availability will be of great value to assess the productivity potential of marine ecosystem.

Keywords: Physico-chemical parameters, Seasonal variations, Palk Strait

Karthikeyan, M. M., and G. Ananthan. 2013. "First Record of Colonial Ascidian, Polyclinum nudum (Kott, 1992) from Palk Bay, Southeast Coast of India." Advances in Biological Research 7 (1): 15–18.

Address: Department of Zoology, Pachaiyappas College for Men, Kanchipuram – 631 501, Tamilnadu, India.

Abstract: The colonial ascidian, Polyclinum nudum (Kott, 1992) is recorded for the first time in the Indian waters. The species was found associated with the seaweed culture rope of Gopalapatinam coastal area, Palk Bay region Southeast coast of India in February 2008.

Keywords: Polyclinum nudum, Gopalapatinam coast, Palk bay, Southeast coast of India

Karthikeyan, M. M., G. Ananthan, and T. Balasubramanian. 2009. "Antimicrobial Activity of Crude Extracts of Some Ascidians (Urochordata: Ascidiacea), from Palk Strait, (Southeast Coast of India)." World Journal of Fish and Marine Sciences 1 (4): 262–7.

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

Abstract: Ascidians have some pronounced pharmacological activities or other properties which are useful in the biomedical area. In the present study methanol, ethanol, hexane and butanol crude extracts from six species of ascidians; (simple ascidians, (Microcosmus helleri, Microcosmus curvus and Herdmania pallida) and colonial ascidians (Polyclinum madrasensis, Didemnum psammatode and Didemnum moseleyi) were tested against eight bacterial pathogens and five fungal pathogens. In bacterial activity the maximum inhibition zone (21 mm) was observed from M. curvus methanol extract against (Shigela boydii). In antifungal activity the maximum inhibition zone (9 mm) was noted from methanol extract against Aspergillus flavus. The following orders of the maximum antimicrobial activity were observed species in level: M. curvus > M. helleri > D. moseleyi > H. pallida > P. madrasensis > D. psammatode. The maximum zone inhibition crude extract level methanol > ethanol > hexane > butanol respectively. In conclusion,

the present study was the first to analyze the antimicrobial activity from the tissue extracts of six species of ascidians tested against different pathogenic bacterial and fungal strains.

Keywords: Ascidians, Antibacterial, Antifungal, Mandapam coast

Kasambe, R. 2012. "Identification of Potential Marine Important Bird Areas in India." MISTNET 13 (4): 13–16.

Kasim, H. M. 2015. "Resources and Livelihoods of the Palk Bay: Information from India and Sri Lanka." Conference Paper. https://www.researchgate.net/publication/28119832

Kathiravan, K., N. Usha, and R. Vishnunath. 2014. "Water Quality of Rameswaram Island, Southeast Coast of India – A Statistical Assessment." International Research Journal of Environment Sciences 3 (10): 12–23.

Address: Centre for Water Resources, Anna University, Chennai – 600 025, Tamil Nadu, India.

Abstract: Rameswaram Island, located on the southeast coast of India in Tamil Nadu, is the main pilgrimage site influenced by anthropogenic intercessions. Assessment of physicochemical characteristics of nearshore water quality was carried out during April 2011 – March 2012 to explicate its quality variations. Principal component analysis was applied to the whole data to be factorized from which the total variability extraction and existing set of different physicochemical parameters linear relationships were obtained. In PCA, high loadings were obtained for pH, temperature, SPM, salinity, DO, BOD, nutrient species of nitrogen, phosphorus and chlorophyll-a. Seasonal variations of the physicochemical parameters are observed with high deterioration of the water quality during summer.

Keywords: Rameswaram Island, Nearshore water, Physicochemical, Seasonal variation, Principal component analysis

Kathiravan, K.,. N. Usha, and R. Vishnunath. 2014. "Spatio-Temporal Variability of Hydro-Chemical Characteristics of Coastal Waters of Gulf Of Mannar Marine Biosphere Reserve (GoMMBR), South India." Applied Water Science: DOI 10.1007/s13201-014-0251-1

Address: Centre for Water Resources, Anna University, Chennai – 600 025, India. Email: u_natesan@yahoo.com

Abstract: The intention of this study was to appraise the spatial and temporal variations in the physico-chemical parameters of coastal waters of Rameswaram Island, Gulf of Mannar Marine Biosphere Reserve, south India, using multivariate statistical techniques, such as cluster analysis, factor analysis and principal component analysis. Spatiotemporal variations among the physico-chemical

parameters are observed in the coastal waters of Gulf of Mannar, especially during northeast and post monsoon seasons. It is inferred that the high loadings of pH, temperature, suspended particulate matter, salinity, dissolved oxygen, biochemical oxygen demand, chlorophyll a, nutrient species of nitrogen and phosphorus strongly determine the discrimination of coastal water quality. Results highlight the important role of monsoonal variations to determine the coastal water quality around Rameswaram Island.

Keywords: Coastal water quality, Rameswaram Island, Physico-chemical variables, Factor analysis (FA), Principal component analysis (PCA) and cluster analysis (CA).

Koigoora, S., I. Ahmad, R. Pallela, and V. R. Janapala. 2013. "Spatial Variation of Potentially Toxic Elements in Different Grain Size Fractions of Marine Sediments from Gulf of Mannar, India." Environmental Monitoring and Assessment 185: 7581–9.

Address: Toxicology Unit, Biology Division, Indian Institute of Chemical Technology, Hyderabad – 500 007, India. Email: jvraoiict@gmail.com

Abstract: Marine sediments of the Gulf of Mannar (GoM), India are contaminated by potential toxic elements (PTEs) due to anthropogenic activities posing a risk to the existing fragile coral ecosystem and human health. The current study aimed to assess the distribution of PTEs (arsenic – As; cobalt – Co; copper – Cu, molybdenum – Mo; lead – Pb; and zinc – Zn) in marine sediments of different grain size fractions, viz., medium sand (710 µm), fine sand (250 µm), and clay (<63 µm) among the different coastal regions of Pamban, Palk Bay, and Rameswaram coasts of GoM, using grain size as one of the key factor controlling their concentrations. The concentrations of PTEs were measured in the different size fractions of sediment using inductively coupled plasma mass spectrophotometer. The order of accumulation of all PTEs in the three fractions was ranked as Zn > Cu > Pb > As > Co > Mo and in the three locations as Rameswaram > Palk Bay > Pamban. The concentration of PTEs in Palk Bay and Rameswaram coast was significantly different ($P < 0.05$), when compared to Pamban coast. Measured geoaccumulation index (Igeo) and contamination factor (CF) indicated significant enrichment of Co and Pb from Rameswaram coast when compared to other two coasts. Although the concentration of Co was low but the measured Igeo and CF values indicated significant enrichment of this PTE in Rameswaram coast. The increased input of PTEs in the coastal regions of GoM signifies the need to monitor the coast regularly using suitable monitoring tools such as sediments to prevent further damage to the marine ecosystem.

Keywords: Gulf of Mannar, Potential toxic elements, Grain size, ICP-MS, India

Krishnan, M., and R. N. Kumar. 2010. Socio Economic Dimensions of Seaweed Farming in India. Kochi, India: CMFRI Special Publication No. 104.

Address: Principal Scientist (Agricultural Economics) Central Institute of Brackish water Aquaculture, Chennai and Director Central Marine Fisheries Research Institute, Kochi-682 018, India. Email: mdcmfri@md2.vsnl.net.in

Abstract: The Ramanathapuram district in Tamil Nadu was identified as the target location for studying the structure, conduct and performance of seaweed farming in India in view of its historical background, locational advantages, industry interactions, socio-economic institutional framework and opportunities for expansion and growth. For these reasons, the Ramanathapuram district has long been recognized as the center of the seaweed farming in India. Although 434 species of red seaweeds, 194 species of brown seaweeds and 216 species of green seaweeds naturally occur in India, it was only until the beginning of the twenty-first century that the country made any concrete progress towards organized seaweed farming. The tardy progress was caused by a number of factors including locational disadvantages, inconsistent performance of species for commercial exploitation, absence of a complete package of farming practices, and industry and policy support. Although the commercial potential of Kappaphycus alvarezii had been previously recognized and its culture technology had been perfected by the Central Salt and Marine Chemicals Research Institute (CSMCRI), culture at a commercial scale only began when PepsiCo India Holdings Ltd (PepsiCo) made its entry into the venture with a pilot-scale investment in the early 2000s. The entry of PepsiCo turned out to be decisive, acting as a catalyst to rejevunate the industry- institutional linkages. The concept of Self Help Groups (SHG) spearheaded by the National Bank for Agricultural and Rural Development (NABARD) also led to rapid development in the Mandapam area of Ramanathapuram, which soon became the hub of seaweed farming in the country. Self Help Groups in the fishing villages of Vedalai, Thonithurai, Ariyankkundu and R. Vadakadu currently operate more than 1,000 rafts. Many of the SHGs have been able to obtain a yield of more than 50 kg per raft per day (dry weight). Based on findings from this study, seaweed farming offered 161 and 144 days of employment per annum in the Rameshwaram and Mandapam areas, respectively. With current development projections targeting 5,000 families in the near future, the seaweed sector could generate around 765 thousand man- days of employment in the Ramanathapuram district. It has been estimated that India can produce one million tonnes of dried seaweed and provide employment to 200 thousand families with annual earnings of around ` 0.1 million per family. The annual turnover of Kappaphycus seaweed farming alone can be safely estimated to be 2.0 billion. Spearheaded by private investments, the clear institutional and financial support of the Government of India through development agencies and research establishments has been fundamental for the development of the sector. The distinct possibility of expansion of operations based on successful commercial trials in sites in Andhra Pradesh and Gujarat will give a significant boost to the sector. Seaweed farming has all the potential to rise from a low-income livelihood activity into a reasonably profitable commercial enterprise in coastal India.

Krishnan, T. S. R., S. Rajesh, and Jamila Patterson. 2012. “Trawl Fishing of Penaeid Prawn in the Northern Mandapam Coast of Palk Bay.” World Journal of Fish and Marine Sciences 4 (3): 278–83.

Address: Suganthi Devadason Marine Research Institute, Tuticorin, India.

Abstract: Total landings of penaeid prawns due to trawling at northern Mandapam coast during January to December 2008 was 2347.61 tones. Prawns were landed throughout the year with a peak season during August to September. The catches were composed of Penaeus indicus, P. joponicus, Metapenaeopsis stridulans, P. semisulcatus and P. monodon. The prawn fishery was dominated by P. indicus (1355.51 t) followed by P. joponicus (629.318 t), M. stridulans (217.457 t), P. semisulcatus (78.885 t) and P. monodon (66.44 t). Along with the prawns 14,549.573 tonnes of fishes were landed as by catches. Among this 13,927.9 tonnes were commercial fishes and 620.673 tonnes were non commercial trash fishes. commercial fishes includes Leiognathus sp., Upenaus sp., Lutjanus sp., Mugil cephalus, Plotosus lineatus, Scarus sp., Siganus sp., Epinephalus sp., Carangoids sp., Sepia sp., Pelagicus sp., etc. and non commercial fishes includes Congresox sp., Channa punctata, Tetradon sp., Canthigaster sp., Etroplus sp., Lactoria sp., Narcine timlei, Chaedoton sp. and Saurida tumbil. Demolishing of prawn population is going on due to over fishing by trawl nets and also the commercial and non commercial fishes also being destroyed by this trawl fishing.

Keywords: Prawn fishery, Commercial fishery, Non commercial fishery, Trawler

Kurian, A. 2013. Marine Turtles along the Indian Coast: Distribution, Status, Threats and Management Implications. WWF-India.

Lipton, A. P., and M. Thangaraj. 2013. “Distribution Pattern of Seahorse Species (Genus: Hippocampus) in Tami Nadu and Kerala Coasts of India.” Notulae Scientia Biologicae 5 (1): 20–4.

Address: Centre for Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, TamilNadu, India. Email: coralholder@yahoo.com

Abstract: The survey along the Tamilnadu and Kerala coats of India reveled that six species of seahors (Hippocampus fuscus, H. kelloggi, H. kuda, H. histrix, H. mohnikei and H. trimaculatus) were distributed with different density. Out of the six species, H. fuscus, H. kuda and H. trimaculatus, were the commonly available in all the observed areas. In Palk Bay, H. kuda was the dominant species constituting 49.10% of the total seahorses encountered. Hippocampus trimaculatus was the second dominant species which accounting 39.28%. The Gulf of Mannar region also most abounded with H. kuda (68.98%) followed by H. trimaculatus (20.80%), H. fuscus (9.80%), H. kelloggi (2.23 %) and H. histrix (0.37%). In Kerala coast, H. trimaculatus was the dominant species (79.68%) followed by H. kuda (9.89%), H. kelloggi (8.33%) and H. fuscus (2.08%). To infer the variation of six seahorse species, the morphometric and meristic characters were analyzed. The important morphometric and meristic characters are trunk rings, tail rings, pectoral and dorsal fin rays, trunk length, tail length, coronet height, head length, snout length, snout depth and head depth. Variations in overall body shape, relative snout length, coronet height, number of tail ring was sufficient to separate the specimens to Hippocampus fuscus, H. kelloggi, H. kuda, H. histrix, H. mohnikei and H. trimaculatus. The species density and diversity depends on the habitat

and biogeography of those areas. Majority of seahorse fishing in Tamilnadu was by shrimp trawl, by-catch and very few target catch by divers also seen in some villages in Palk Bay and Gulf of Mannar region. The shrimp trawl by-catch only bringing more H. trimaculatus than the other seahorse species in Kerala coasts.

Keywords: Distribution pattern, Gulf of Mannar, Morphometric, Meristic variation, Palk Bay, Seahorse, South Malabar

Lucas, C., T. Thangaradjou, and J. Papenbrock. 2012. "Development of a DNA Barcoding System for Seagrasses: Successful but Not Simple." PLoS ONE. 7 (1): e29987.

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Abstract: Seagrasses, a unique group of submerged flowering plants, profoundly influence the physical, chemical and biological environments of coastal waters through their high primary productivity and nutrient recycling ability. They provide habitat for aquatic life, alter water flow, stabilize the ground and mitigate the impact of nutrient pollution at the coast region. Although on a global scale seagrasses represent less than 0.1% of the angiosperm taxa, the taxonomical ambiguity in delineating seagrass species is high. Thus, the taxonomy of several genera is unsolved. While seagrasses are capable of performing both, sexual and asexual reproduction, vegetative reproduction is common and sexual progenies are always short lived and epimeral in nature. This makes species differentiation often difficult, especially for non-taxonomists since the flower as a distinct morphological trait is missing. Our goal is to develop a DNA barcoding system assisting also non taxonomists to identify regional seagrass species. The results will be corroborated by publicly available sequence data. The main focus is on the 14 described seagrass species of India, supplemented with seagrasses from temperate regions. According to the recommendations of the Consortium for the Barcoding of Life (CBOL) rbcL and matK were used in this study. After optimization of the DNA extraction method from preserved seagrass material, the respective sequences were amplified from all species analyzed. Tree- and character-based approaches demonstrate that the rbcL sequence fragment is capable of resolving up to family and genus level. Only matK sequences were reliable in resolving species and partially the ecotype level. Additionally, a plastidic gene spacer was included in the analysis to confirm the identification level. Although the analysis of these three loci solved several nodes, a few complexes remained unsolved, even when constructing a combined tree for all three loci. Our approaches contribute to the understanding of the morphological plasticity of seagrasses versus genetic differentiation.

Keywords: Seagrass, DNA, Barcoding, Palk Bay, India

Madhu, N. V., M. Paul, N. Ullas, R. Ashwini and T. V. Rehitha. 2013. "Occurrence of Cyanobacteria (Richelia intracellularis)-Diatom (Rhizosolenia hebetata) Consortium in the Palk Bay, Southeast Coast of India." Indian Journal of Geo-Marine Sciences 42 (4): 453–7.

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Abstract: Symbiotic association of heterocystous cyanobacterium, Richelia intracellularis Schmidt with oceanic centric diatom, Rhizosolenia hebetata is reported from the Palk Bay, southeast coast of India. One to six trichomes of R. intracellularis were occluded inside the periplasmic space of R. hebetata, with their prominent heterocyst pointing towards the valve of the host. Each of these trichomes had 14 to 23 vegetative cells caped bya terminal heterocyst enriched with the nitrogenase enzyme. Density of Rhizosolenia containing R. intracellularis ranged between 120 and 260 cells L−1, and present uniformly in the water column. R. intracellularis is a diazotroph, can contribute substantially to the N2 budgets thereby, promoting a different food web in the Palk Bay.

Keywords: Cyanobacterium, Diatom, Diazotrophy, Palk Bay

Madhu, N. V., N. Ullas, R. Ashwini, M. Paul, T. V. Rehith, and K. R. Lallu. 2014. "Characterization of Phytoplankton Pigments and Functional Community Structure in the Gulf of Mannar and the Palk Bay using HPLC– CHEMTAX Analysis." Continental Shelf Research 80: 79–90.

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Abstract: Phytoplankton marker pigments and their functional groups were identified for the first time in the Gulf of Mannar (GoM) and the Palk Bay (PB), located in the southeast coast of India using HPLC–CHEMTAX analytical techniques. The GoM generally remained more saline, productive (in terms of chlorophyll a) and less turbid than the PB during southwest and northeast monsoon periods. The diversity and concentration of marker pigments were high in the GoM, whereas the PB was characterized by high concentration of zeaxanthin, indicating the dominance of photosynthetic prokaryotes (cyanobacteria). The CHEMTAX analysis revealed that the phytoplankton biomass (chlorophyll a) in the PB was mainly derived from cyanobacterial community. However, abundance of fucoxanthin and peridinin in the GoM indicated micro phytoplankton (20 to 200 µm) as the dominant group. The CHEMTAX results showed that more than 50% of chlorophyll a in the GoM was contributed by micro phytoplankton, in particular diatoms and dinoflagellates. The substantial increase in the photoprotective carotenoids (PPCs) and photoprotection index (PI) in the PB was indicative of its low productivity, probably caused by the warm and turbid waters.

Keywords: Phytoplankton, HPLC, Biomarkers, Cyanobacteria, Palk Bay, Gulf of Mannar

Mandal, S. K., V. A. Mantri, S. Haldar, K. Eswaran, and M. Ganesan. 2010. "Invasion Potential of Kappaphycus alvarezii on Corals at Kurusadai Inland, Gulf of Mannar, India." Algae 25 (4): 205–16.

Address: Discipline of Marine Biotechnology and Ecology, Central Salt and Marine Chemicals Research Institute (CSMCRI), Council of Scientific and Industrial Research (CSIR), Gijubhai Badheka Marg, Bhavanagar, Gujarat – 364 002, India. Email: skmandal@csmcri.org

Abstract: The marine red algae Kappaphycus alvarezii is a major source of k-carrageenan. It has been introduced in 20 countries including India. Recently, several reports have expressed concern about Kappaphycus invasion on Acropora corals at Kurusadai Island in the Gulf of Mannar, India, which is part of marine bioreserve. To understand the extent of the Kappaphycus invasion, 27 randomly selected locations around Kurusadai Island and the mainland coast were surveyed during May-August 2008 and July 2009. Our rigorous sampling revealed that the K. alvarezii was confined to two different patches of 105 m × 55 m and 8 m × 9 m located at the southeastern part of Kurusadai Island. The actual extent of the K. alvarezii canopy coverage was 76.7 m2, accounting for less than 0.0035% of the total coral reef area. The daily growth rate of the K. Alvarezii at Kurusadai was 0.7%. K. Alvarezii was not observed in the coral reef area of the adjoining Pullivasal and Poomarichan Island of the Palk Bay area cultivation sites. The lack of functional reproductive cycle, low spore viability, and the absence of microscopic phases in the life cycle of this alga coupled with the abundance presence of herbivores may restrict the further spread of this alga, so its invasive potential at Kurusadai Island is considered remote.

Keywords: Acropora, Corals, Gulf of Mannar, Invasion, Kappaphycus alvarezii, Kurusadai Island

Manikandan, B., J. Ravindran, S. Shrinivaasu, N. Marimuthu, and K. Paramasivam. 2014. "Community Structure and Coral Status across Reef Fishing Intensity Gradients in Palk Bay Reef, Southeast Coast of India." Environmental Monitoring and Assessment 186 (10): 5989–6002.

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Abstract: Coral reef fishes are exploited without the knowledge of their sustainability and their possible effect in altering the community structure of a coral reef ecosystem. Alteration of the community structure could cause a decline in the health of coral reefs and its services. We documented the coral community structure, status of live corals and reef fish assemblages in Palk Bay at the reef fishing hotspots and its nearby reef area with minimum fishing pressure and compared it with a control reef area where reef fishing was banned for more than two decades. The comparison was based on the percent cover of different forms of live corals, their diversity and the density and diversity of reef fishes. The reef fish stock in the reef fishing hotspots and its neighbouring reef was lower by 61% and 38% respectively compared to the control reef. The herbivore fish Scarus ghobban and Siganus javus were exploited at a rate of 250 kg and 105 kg month−1 fisherman−1 respectively, relatively high comparing the small reef area. Live and dead corals colonized by turf algae were predominant in both the reef fishing

hotspots and its nearby coral ecosystems. The percent cover of healthy live corals and live corals colonized by turf algae was <10% and >80% respectively in the intensively fished coral ecosystems. The corals were less diverse and the massive Porites and Favia colonies were abundant in the intensive reef fishing sites. Results of this study suggest the impact of reef fish exploitation were not solely restricted to the intensively fished reefs, but also to the nearby reefs which play a critical role in the resilience of degraded reef ecosystems.

Keywords: Palk bay, Coral, Community structure, Reef fish, Exploitation

Manikandan, S., S. Ganesapandian, and K. Parthiban. 2011. "Distribution and Zonation of Seagrasses in the Palk Bay, Southeastern India." Journal of Fisheries and Aquatic Science 6 (2): 178–85.

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Abstract: The distribution and zonation pattern of seagrass was assessed by SCUBA diving assisted with Global Positioning System (GPS) and 100 M transects at every 0.5 km, in the area between Mandapam and Thondi in the Palk Bay during March-July 2009. The study area has been divided into 3 regions, viz., Mandapam, Panaikulam and Thondi. Seagrass were distributed in about 175.2 km2 coastlines in the study area. The percentage of seagrass distribution and species composition in Mandapam it was 63.87% in nearshore with 10 species, 43.56% in middle zone with 7 species and 26.27% in offshore with 4 species. Likewise in Panaikulam it was 24.17% in nearshore with 7 species, 53.31% in middle zone with 6 species and 20.14% in the offshore 5 species. Whereas, in Thondi it was 75.41% in nearshore with 9 species, 54.28% in middle with 8 species and 31.42% in offshore with 7 species. Overall all the 14 species were observed among the Cymodocea serrulata was the most abundant species and the least was Enhalus acoroides in these study region. Shoot density and biomass of 14 species of seagrass and epiphytic biomass in different zonation were analyzed. This study gives clear cut idea about distribution and zonation of seagrass in Palk Bay region.

Keywords: Palk Bay, Seagrass, Biomass, Zonation of seagrass, Offshore, Cymodocea serrulata

Marale, S. M., and R. K. Mishra. 2011. "Status of Coastal Habitats and its Management in India." International Journal of Environmental Protection 1 (1): 31–45.

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Abstract: In supersession of Coastal Regulation Zone (CRZ) 1991, with a view to ensure livelihood security to the fisher and other communities living in coastal areas, to conserve and protect coastal stretches the Government of India imposed CRZ notification 2011. The areas such as mangroves, corals, mudflats, national marine parks, salt marshes, turtle nesting grounds, horse shoe crab habitats, sea

grass beds, nesting grounds of birds, and archaeology and heritage sites were considered as an ecologically sensitive area (ESA) where setting and expansion of industries, operations or processes are restricted. This article aims to critically observe the status of coastal habitats in the light of coastal thereats such as habitat loss, coastal pollution and nutrient load, climate change, overexploitation and invasive alien species. Some remedial measures and recommendations for conservation of coastal habitats including strengthening CRZ rules were suggested.

Keywords: Coastal habitats, Coastal Regulation Zone, Management, India, Livelihood

Mathews, G., K. D. Raj, T. Thinesh, J. Patterson, J. K. Patterson Edward, and D. Wilhelmsson. 2010. "Status of Seagrass Diversity, Distribution and Abundance in Gulf of Mannar Marine National Park and Palk Bay (Pamban to Thondi), Southeastern India." South Indian Coastal and Marine Bulletin 2 (2): 1–21.

Address: Suganthi Devadason Marine Research Institute, 44-Beach Road, Tuticorin – 628 001, Tamil Nadu, India. Email: edwardjkpatterson@sdmri.in

Abstract: Seagrasses are marine flowering plants and one of the ecologically sensitive habitats. The Gulf of Mannar and Palk Bay in southeastern India have luxuriant seagrass beds with rich associated biodiversity, in particular fishery resources. Thousands of traditional fisher folk of Gulf of Mannar and Palk Bay depend on seagrass ecosystem for livelihood. The diversity, distribution and abundance of seagrasses were assessed in these low coastal areas during 2007-2008. The total seagrass cover in Gulf of Mannar Marine National Park was 76 Km2 and in Palk Bay (Pamban to Thondi) it was 175 Km2. Thalassia hemprichii and Cymodocea serrulata are the dominant seagrass species in both areas. In Gulf of Mannar, seagrass abundance was comparably high in the shoreward side of the islands and in Palk Bay, and a high density was noted in the middle zone (3-6 km from the shore). The present assessment aimed at collecting comprehensive baseline data, which will be helpful to conduct further monitoring and to implement management measures including restoration activities in order to effectively conserve the resources for sustainable utilization.

Meera, B. 2016. "Prevalence of Pollution Indicators in Palk Bay Coastal Zone, Southern India." International Journal of Advances in Scientific Research 2 (01): 027–31.

Address: Department of Microbiology, Thanthai Hans Roever College, Perambalur, Tamil Nadu – 621 212, India. Email: meer.n82@gmail.com

Abstract: In this study, the sea water and sediment samples of four different locations were collected from Palk Bay regions during 2014 for pollution indicators study. All the bacterial parameters were higher during the rainy season compared to summer season in all the sampling locations of the Palk Bay regions. In the water samples, among the pollution indicator bacterial groups, TC and TS counts were highest 0.67 – 10.3 [×103] ml−1 and 0.8 –10.8 [×102] ml−1 during monsoon, and the least 0.54 – 8.5 [×103] ml−1 and 0.7 – 9.0 [×102] ml−1

were noticed during summer. In monsoon sediment sample, the higher VC count was observed in Thondi (2100 g−1) followed by Mimisal (1700 g−1), Manamelkudi (960 g−1) and Devipattinam (200 g−1). The pollution index (PI) of each location was calculated and was showed a remarkable microbial contamination was observed in sediment sample than water sample. The order of PI observed were Thondi > Mimisal > Manamelkudi > Devipattinam. The highest PI ratio (15.5) was observed in Devipattinam sediment sample at monsoon season while lowest (2.5) was noticed in Devipattinam water sample at summer season. The results indicated that the coastal environment is highly exposed to human excreta that suggesting to avoid direct contact. Hence, throughout impoundment is needed to protect coastal environments.

Keywords: Pollution indicators, Palk bay, Fecal coliforms, Pollution index, Thondi

Melba, D. C. C., G. Ananthan, and C. Stalin. 2013. “Antibacterial Activity of the Crude Extract of Tridemnum savignii (Herdman 1886) against Clinical Pathogens.” International Journal of Pharmaceutical, Biological and Chemical Sciences 2 (4): 01–5.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: casananthan@yahoo.co.in

Abstract: Antibacterial activity of the ascidian, Tridemnum savignii was tested against human clinical pathogens by agar well diffusion method. Different concentrations of 0.5 mg/ml and 1 mg/ml of the crude extract were analyzed in this experiment. The crude methanol extract showed more active and broad-spectrum of antibacterial activity than the ethanol extract. The maximum inhibition zone (14 mm) was observed against Escherichia coli at 1 mg/ml concentration while the minimum inhibition zone of 2 mm was noticed in 1 mg/ml of ethanol extract against Vibrio parahaemolyticus. Highest MIC and MBC (1.10) were observed in methanol extract of 1 mg/ml concentration than the ethanol extract. The result indicates that the crude extract of Tridemnum savignii have an excellent antibacterial activity against the tested clinical pathogens. Further studies will fulfill the purification and the structural elucidation of antibacterial drugs and secondary metabolites from this ascidian.

Keywords: Antibacterial activity, Ascidian, Tridemnum savignii, Crude extracts, MIC and MBC

Mithra, R., S. Sivaramakrishnan, P. Santhanam, S. Dinesh Kumar, and R. Nandakumar. 2012. “Investigation on Nutrients and Heavy Metal Removal Efficacy of Seaweeds, Caulerpa taxifolia and Kappaphycus alvarezii for Wastewater Remediation.” Journal of Algal Biomass Utilization. 3 (1): 21–7.

Address: Marine Planktonology and Aquaculture Division, Department of Marine Science, School of Marine Sciences, Bharathidasan University, Tiruchirappalli – 620 024, Tamil Nadu, India. Email: sanplankton@yahoo.co.in

Abstract: Aquaculture is source of significant amount of wastes, which generally leads to general deterioration of water quality. A simple alternative to this is use of biofilters to reduce the nutrient load. Hence, the marine macroalgae Caulerpa taxifolia (biosorpent) was screened for its nutrients and heavy metal absorption capacities at various initial concentrations and contact period in laboratory conditions. Likewise, the red alga Kappaphycus alvarezii was tested for nutrient utilization besides its growth in waste water. The experiment on nutrient absorption by seaweed C. taxifolia inferred that all time intervals (6, 12, 18 and 24 hrs) maintained at different pH (4-10) in the present study showed significant amount of nutrients absorption. Of these, 24 hours biosorption at pH 7 showed the utmost removal of all the tested nutrients. The maximum absorption of zinc was recorded in pH 7 and at 24 hours with 0.5 g concentration of the seaweed being optimum under laboratory conditions. The experimental study using K. alvarezii in shrimp waste water confirmed excellent potentials of the seaweed in absorbing nutrients and thereby aiding its growth.

Keywords: Biosorption, Nutrients, Heavy metal, Waste water treatment, Seaweed, Bioremediation

Miththapala, S. 2012. The Gulf of Mannar and its Surroundings: A Resource Book for Teachers in the Mannar District. IUCN Sri Lanka Office, Colombo: IUCN (International Union for Conservation of Nature).

Morais, S. R., and K. Chitra, 2016. “Marine Sponge - Genus Spirastrella - A Review.” World Journal of Pharmaceutical Research 5 (1): 379–86.

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Abstract: Marine sponges are potential sources of many unique metabolites, which includes antiangiogeneic, cytotoxic, antimicrobial and anticancer compounds. The purpose of this article is to present structurally reviewed pharmacological activities in the different species of Spirastrella, isolation of active constituents from various species of Spirastrella and its contribution as bioactive compounds. It also discusses the destructive role of the boring sponge Spirastrella on the reef.

Keywords: Spirastrella, Antiangiogeneic, Cytotoxic, Antimicrobial

Mukherjee, N., D. G. Farid, K. Vena, R. Arthur, K. Nico, S. Aarthi, and S. Kartik. 2010. “From Bathymetry to Bioshields: A Review of Post-Tsunami Ecological Research in India and its Implications for Policy.” Environmental Management 46: 329–39.

Address: Laboratory of Plant Biology and Nature Management, Faculty of Sciences and Bio-Engineering Sciences, Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium. Email: nibedita.41282@gmail.com

Abstract: More than half a decade has passed since the December 26th 2004 tsunami hit the Indian coast leaving a trail of ecological, economic and human

destruction in its wake. We reviewed the coastal ecological research carried out in India in the light of the tsunami. In addition, we also briefly reviewed the ecological research in other tsunami affected countries in Asia namely Sri Lanka, Indonesia, Thailand and Maldives in order to provide a broader perspective of ecological research after tsunami. A basic search in ISI Web of Knowledge using Keywords ''tsunami'' and ''India'' resulted in 127 peer reviewed journal articles, of which 39 articles were pertaining to ecological sciences. In comparison, Sri Lanka, Indonesia, Thailand and Maldives had, respectively, eight, four, 21 and two articles pertaining to ecology. In India, bioshields received the major share of scientific interest (14 out of 39) while only one study (each) was dedicated to corals, seagrasses, seaweeds and meiofauna, pointing to the paucity of research attention dedicated to these critical ecosystems. We noted that very few interdisciplinary studies looked at linkages between pure/applied sciences and the social sciences in India. In addition, there appears to be little correlation between the limited research that was done and its influence on policy in India. This review points to gap areas in ecological research in India and highlights the lessons learnt from research in other tsunami-affected countries. It also provides guidance on the links between science and policy that are required for effective coastal zone management.

Keywords: Tsunami, Review, Coastal ecology, India, Policy

Muraleedharan, H., Abhilash, and R. Ramasubbu. 2010. "Physio-Chemical Parameters and Planktons Analysis of Sea water of Thondi of Palk Bay, Tamil Nadu." Journal of Biosciences Research 1 (1): 20–4.

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Abstract: Physico-chemical parameters and planktons available in the sea water of Thondi of Palk Bay were analyzed. A total number of 15 species of phytoplankton were recorded from Thondi coastal water which includes 10 species of diatoms and 8 species of dinoflagellates. The maximum number of species recorded (from surface region) in months of December and January. A total number of 16 species of zooplankton were recorded from this region in the months of January and February. The major phytoplanktons in the study area found to be Biddulphia mobilensis and Biddulphia sinensis. The zooplanktons were also found in increased amount in monsoon and post monsoon months. The major zooplanktons species were Copepoda, Eucalanus nauplii, fish egg, etc.

Keywords: Diatoms, Dinoflajellates, Planktons, Physico-chemical

Murugan, A., and R. Durgekar. 2008. "Beyond the Tsunami: Status of Fisheries in Tamil Nadu, India: A Snapshot of Present and Long-term Trends." UNDP/UNTRS, Chennai and ATREE, Bangalore, India. 75pp.

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Abstract: This study was conducted along the Tamil Nadu coast over a period of 1 year. It aims to qualitatively and quantitatively characterise the fish landing, various fishing practices along the entire coast, understand the long term trends and dynamics of marine fish landings, it's probable impacts on the marine biodiversity and its impact on endangered species of marine organisms. Long term trend analysis of marine fish landing from 1985 to 2006 showed that in spite of improving techniques and increasing effort invested into catching fish, the fishing yield is declining steadily in recent years along with the already declining trophic level. The trends indicate that there will be a considerable decline in fish catch overthe next decade, and improperly managed fishing practices could have considerable ecological and economic repercussions for the future.

Keywords: Tsunami, Fishery status, Tamilnadu, India

Murugan, A., S. Dhanya, R. A. Sreepada, S. Rajagopal, and T. Balasubramanian. 2009. "Breeding and Mass-Scale Rearing of Three Spotted seahorse, Hippocampus trimaculatus Leach under Captive Conditions." Aquaculture 290 (1–2): 87–96.

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Abstract: Recent establishment of techniques for captive breeding and closure of the life cycle of some seahorse species is expected to help in achieving the twin objectives of reducing pressure on wild stocks as well as providing alternative subsistence livelihoods to fisher-folk currently involved in seahorse fishing. The relatively higher fishing pressure on the three-spotted seahorse, Hippocampus trimaculatus Leach, one of the commercially important species sought in traditional Chinese medicine, necessitated the need to develop techniques for captive breeding and mass-scale rearing for conservation and aquaculture purposes. In this paper, we present data on the reproductive efficiency of captive broodstock and the effect of exogenous factors (light intensity, prey type, ingestion and salinity) on survival and growth of juveniles of H. trimaculatus. Significantly higher reproductive efficiency (number of juveniles released) was observed when parent seahorses were fed with amphipods (Eriopisa spp.) ($P<0.05$). Survival of pelagic phase juveniles reared under three different light intensities (1000, 1500 and 2000 lx) differed significantly ($P<0.05$) with 2000 lx resulting in the highest survival (77.3±3.1%). An ontogenetic shift in feeding behaviour from rotifer to copepod nauplii was observed in >2 DAB (days after birth) old juveniles. Estimated digestion period (DP) in 6 DAB old juveniles was 3 h 20 m and the DP reduced as the juveniles grew in size. Salinity tolerance experiments indicated that juveniles and adults of H. trimaculatus are able to tolerate salinities not extending below 26 and 17 ppt, respectively. The average growth rates peaked during 15–30 DAB (Ht, 1.64 mm day−1). The first sign of maturity in male (pouch development) and female (dropping of egg clutch) was noticed at 95 DAB and 115 DAB, respectively. The sex ratio of cultured seahorses skewed towards female (1:1.2) and differed significantly from equality ($P<0.05$). Mean number of newborn juveniles released by first mated males was 65 ± 20 juveniles seahorse−1 (n =9 pairs) and egg clutch droppings by newly matured females was 45 ± 17 eggs seahorse−1 (n = 21) in

F2 generation. Maximum height (Ht) attained at the end of the culture period of 26 weeks was 125 mm with no significant difference in growth between the sexes (P>0.05). Mean growth attained (Ht, 119.9±15.3 mm) and survival rate achieved (65%) at the end of 26 weeks of mass-scale rearing are comparable with reports on other seahorse species. It is expected that the results of this study could guide future programmes in hatchery technology and aquaculture of this commercially important fast dwindling seahorse species.

Keywords: Captive breeding, Survival, Growth, Mass-scale rearing, Three spotted seahorse, Hippocampus trimaculatus

Murugan, A., S. Dhanya, S. Rajagopal, and T. Balasubramanian. 2008. "Seahorses and Pipefishes of the Tamil Nadu Coast." Current Science 95 (2): 253–60.

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Abstract: This study provides baseline information on the abundance and identification of seahorses and pipefishes of the Tamil Nadu coast. Monthly sampling for seahorses and pipefishes from the by-catch was made during 2000-01 at 15 landing centres along the Tamil Nadu coast. Five species of seahorses belonging to one genus and seven species of pipefishes belonging to four genera were recorded. Hippocampus kelloggi and Trachyrhamphus bicoarctatus were recorded for the first time in the Indian waters. H. kelloggi was abundant in the Coromandel Coast, H. kuda in the Palk Bay and H. trimaculatus in the Gulf of Mannar. H. fuscus was absent in the Coromandel Coast and H. kelloggi was not recorded in the Palk Bay and the Gulf of Mannar. Seagrasses, seaweeds and dead corals were the preferred habitat of seahorses. H. kelloggi was recorded at 10-20 m depth and the others were found at depths less than 10 m. Abundance of seahorses was more in the Palk Bay than in the Gulf of Mannar and the Coromandel Coast. Area-wise and species-wise abundance of seahorses was maximum during northeast monsoon and minimum during summer. In all, 104,018 seahorses were collected from the by-catches, comprising 34% H. trimaculatus, 29% H. kuda, 19% H. spinosissimus, 9% H. kelloggi and 9% H. fuscus. This 2000-01 survey on the abundance of seahorses may serve as a yardstick to assess the impact of the excavation and subsequent navigation of the Sethu Canal. With preference to seagrasses and seaweeds, the pipefish, Syngnathoides biaculeatus was the most common species in the shallow coast. In the Palk Bay and the Gulf of Mannar, the percentage composition of S. biaculeatus was more than that of seahorses, while seahorses constituted more than 78% of the total syngnathid landings of the Coromandel coast. Other pipefish species were rare along the Tamil Nadu coast.

Keywords: Abundance, By-catch, Identification, Pipefishes, Seahorses

Narayanakumar, R., and M. Krishnan. 2013. "Socio-Economic Assessment of Seaweed Farmers in Tamil Nadu - A Case Study in Ramanathapuram District." Indian Journal of Fisheries 60 (4): 51–7.

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Abstract: Seaweed mariculture is an economically viable livelihood option for the coastal fishing community especially for the fisherwomen. In Tamil Nadu, along the south-east coast of India, the organised seaweed farming on an industrial scale was initiated by the Pepsi Holdings India Private Limited (Pepsi Co) in 2000 in Gulf of Mannar in Ramanathapuram District. After proving the economic viability of seaweed farming, Pepsi Co modified its business model in 2003 by organising the fishers to take up seaweed farming on contract basis through Self Help Groups (SHGs). In this paper, an assessment of the socio- economic status of seaweed farmers in Ramnathapuram District of Tamil Nadu has been made, which is the pioneering district in India in seaweed farming. Fishing and seaweed farming are the most important occupations in this district. The average family size of respondents for the present study ranged from 4.5 in Mandapam to 5.5 in Rameswaram. Significant structural changes have taken place in the socio-economic status of many fishermen who have taken up seaweed farming over the last 10 years. In Ramanathapuram, seaweed farming is estimated to provide employment to the tune of 7,65,000 man days per annum based on the District's plan. The gains, hitherto realised through the SHG model of seaweed farming, should be consolidated with consistent institutional and financial support to the seaweed farmers.

Keywords: Employment generation, Livelihood option, Seaweed farming, Social impact, Socio-economic status, Structural change

Nedumaran, T. 2014. "Diversity of Mangroves in Palk Bay and Palk Strait Coastal Regions, Southeast Coast of India." International Journal of Current Trends in Research 3 (2): 39–42.

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Abstract: A survey was made on the distribution of true mangroves at Pudukottai district in Palk Bay coastal regions, 6 species was recorded. Pudukottai district is located between 10°13' N Latitude and 79°22' E Longitude, in the southern district of Tamil Nadu. It lies between Palk Bay and Palk Strait, 42 km long coast line constituted by long stretches of back waters small tidal creeks, estuary with mangroves are distributed. It has an estimated total area of 94 hectares. The mangroves are found as discrete and isolated patches in different parts of the district. Overall Avicennia marina was represented followed by Excoecaria agallocha > Lumnicera racemosa > Aganthus illicifolius > Rhizophora mucronata and Pemphis acidula. The preliminary results from this study can be used as base line data to monitor environmental change if further developmental activities continued.

Keywords: Mangroves, Palk Bay, Palk Strait

Nedumaran, T., and S. Manokaran. 2009. "Cyanobacterial Flora in some Salt Pans of Pudukkottai District, Tamilnadu, India." Journal of Phytology 1 (3): 169– 71.

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Abstract: The present study was conducted diversity of Cyanobacterial flora in the salt pans of Kattumavadi, Prathaparamanpattinam, Manamelkudi and Ammapattinam located in Palk bay and Palk Strait during the summer season 2008. A total number of 25 cyanobacterial species were collected 11 of Oscillatoriaceae 6 Chroococcaceae 5 Nostocaceae and 3 each of Scytonemataceae, Rivulariaceae and Stigonemataceae, Physico-chemical parameters were also studied.

Keywords: Cyanobacteria, Physico-chemical parameters, Salt pans

Newmaster, A. F., K. J. Berg, S. Ragupathy, M. Palanisamy, K. Sambandan, and S. G. Newmaster. 2011. "Local Knowledge and Conservation of Seagrasses in the Tamil Nadu State of India." Journal of Ethnobiology and Ethnomedicine 7: 37.

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Abstract: Local knowledge systems are not considered in the conservation of fragile seagrass marine ecosystems. In fact, little is known about the utility of seagrasses in local coastal communities. This is intriguing given that some local communities rely on seagrasses to sustain their livelihoods and have relocated their villages to areas with a rich diversity and abundance of seagrasses. The purpose of this study is to assist in conservation efforts regarding seagrasses through identifying Traditional Ecological Knowledge (TEK) from local knowledge systems of seagrasses from 40 coastal communities along the eastern coast of India. We explore the assemblage of scientific and local traditional knowledge concerning the 1. Classification of seagrasses (comparing scientific and traditional classification systems), 2. Utility of seagrasses, 3. Traditional Ecological Knowledge (TEK) of seagrasses, and 4. Current conservation efforts for seagrass ecosystem. Our results indicate that local knowledge systems consist of a complex classification of seagrass diversity that considers the role of seagrasses in the marine ecosystem. This fine-scaled ethno-classification gives rise to five times the number of taxa (10 species = 50 local ethnotaxa), each with a unique role in the ecosystem and utility within coastal communities, including the use of seagrasses for medicine (e.g., treatment of heart conditions, seasickness, etc.), food (nutritious seeds), fertilizer (nutrient rich biomass) and livestock feed (goats and sheep). Local communities are concerned about the loss of seagrass diversity and have considerable local knowledge that is valuable for conservation and restoration plans. This study serves as a case study example of the depth and breadth of local knowledge systems for a particular ecosystem that is in peril. Key words: local health and nutrition, traditional ecological knowledge (TEK), conservation and natural resources management, consensus, ethnomedicine, ethnotaxa, cultural heritage.

Keywords: Local health and nutrition, Traditional ecological knowledge (TEK), Conservation and natural resources management, Consensus, Ethnomedicine, Ethnotaxa, Cultural heritage

NIOT. 2014. "For the Workshop, under the Auspices of the United Nations, in Support of the Regular Process for Global Reporting and Assessment of the State of the Marine Environment, Including Socio-economic Aspects".

Address: Earth System Sciences Organization, National Institute of Ocean Technology, Ministry of Earth Sciences (Government of India), Chennai – 600 100.

Nisha, D., J. K. Patterson, and N. M. Ishwar. 2013. "Final Report: Survey and Assessment of Seagrass Beds in the Gulf of Mannar and Palk Bay to Support Strategy to Conserve and Manage Seagrass Habitats". Suganthi Devadason Marine Research Institute (SDMRI). 29pp.

Address: Suganthi Devadason Marine Research Institute (SDMRI), Thiithukudi, Tamilnadu, India.

Abstract: The seagrass beds at the study sites in the Gulf of Mannar comprised of eight species. In three of the study sites (between Vipar and Periyasamipuram, between Periyaswamipuram and Vembar, and between Valinokam and Ervadi), Cymodocea serrulata was by far the most dominant species (ranging from 36 -38%) with Thalassia hemprichii following behind. Halophila ovate was the least dominant (ranging from 0 – 3.24%). the species was not found between Valinokam and Ervadi. The two Halodule species were found in exceeding low abundance (ranging from 4.5 – 6.9%). By stark contrast, between Koswari and Kariyachalli, the seagrass compositional structure differed varied to the other three sites. Three species dominated Cymodocea serrulata, Halophila ovalis and Halodule pinifolia (at approximately 20% each). An eighth species, Enhalus acoroides (not found in any other of the other sites) was also observed. Halodule uninervis had the least coverage in the site (at 2.2%). The seagrass beds at the study sites in the Gulf of Mannar comprised of eight species. In three of the study sites (between Vipar and Periyasamipuram, between Periyaswamipuram and Vembar, and between Valinokam and Ervadi), Cymodocea serrulata was by far the most dominant species (ranging from 36 -38%) with Thalassia hemprichii following behind. Halophila ovate was the least dominant (ranging from 0 – 3.24%). the species was not found between Valinokam and Ervadi. The two Halodule species were found in exceeding low abundance (ranging from 4.5 – 6.9%). By stark contrast, between Koswari and Kariyachalli, the seagrass compositional structure differed varied to the other three sites. Three species dominated Cymodocea serrulata, Halophila ovalis and Halodule pinifolia (at approximately 20% each). An eighth species, Enhalus acoroides (not found in any other of the other sites) was also observed. Halodule uninervis had the least coverage in the site (at 2.2%).

Keywords: Seagrass, Dugong, Palk Bay, Gulf of Mannar

Nithya, C., and S. Karutha Pandian. 2010. "Isolation of Heterotrophic Bacteria from Palk Bay Sediments Showing Heavy Metal Tolerance and Antibiotic Production."

Microbiological Research 165 (7): 578–93.

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Abstract: Analysis of culturable and unculturable bacteria and their potential bioactive compounds from Palk Bay is yet to be explored. The present study for the first time characterizes the culturable bacteria from Palk Bay sediment using 16S rRNA gene sequencing. The characterized bacteria were also screened for antibacterial activity against human and aquaculture pathogens. In the 16S rRNA gene sequence analysis characterized that most of the bacteria were affiliated to members of Firmicutes and less with Gammaproteobacteria, Actinobacteria and Alphaproteobacteria. A high portion of (39%) of the bacteria showed antibacterial activity against both Gram positive and Gram negative test strains. The antibiotics from the strain S6-05 were partially purified using solvent extraction followed by TLC and silica column and further characterized by IR analysis. Two active principles A and B showed difference in the activity against Gram positive and Gram negative pathogens. But in the synergistic application they showed excellent activity against all the test pathogens. This study provides the first evidence on the existence of certain Bacillus species in the marine environment, namely Bacillus arsenicus, Bacillus indicus, Bacillus boroniphilus, Bacillus cibi and Bacillus niabensis which also had antibacterial activity. Several of the isolates exhibited tolerance to arsenic and boron to a new level of 25 and 100 mM, respectively. The current study reveals the fact that a great deal remains in the bacterial diversity of Palk Bay region.

Keywords: Palk Bay, Arsenic tolerance, Boron tolerance, Antibiotic production, Culturable bacterial diversity

Nithya, C., and S. Karutha Pandian. 2012. “Evaluation of Bacterial Diversity in Palk Bay Sediments Using Terminal-Restriction Fragment Length Polymorphisms (T-RFLP).” Applcation Biochemistry Biotechnology 167: 1763– 77.

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Abstract: Although it is known that Palk Bay sediments harbor diverse and novel bacteria with important ecological and environmental functions, a comprehensive view of their molecular diversity is still lacking. In the present study, bacterial diversity in Palk Bay sediments was characterized using the molecular method terminal-restriction fragment length polymorphisms (T- RFLP). The bacterial assemblages detected by T-RFLP analysis revealed that the nearshore sediment harbored high number of bacterial count, whereas the 2.5-m sediment harbored diverse and distinct bacterial composition with fine heterogeneity. The major bacterial groups detected in all the three sediment samples were Actinobacteria, Bacteroidetes, Firmicutes, Proteobacteria (including alpha (α), gamma (), delta (δ), and epsilon (ε)-Proteobacteria), and uncultured bacteria. This is the first study that reveals the presence of Bacteroidetes, delta (δ)- and epsilon (ε)-

Proteobacteria, and uncultured bacteria in Palk Bay sediments. The hitherto unexplored wide microbial diversity of Palk Bay coastal area was unraveled in the current study through culture-independent approach. These data suggest that the continued use of cultivation-independent techniques will undoubtedly lead to the discovery of additional bacterial diversity and provide a direct means to learn more about the ecophysiology and biotechnological potential of Palk Bay coastal area.

Keywords: T-RFLP, Palk Bay, Marine sediments, 16S rRNA gene

Nithya, C., B. Gnanalakshmi, and S. Karutha Pandian. 2011. "Assessment and Characterization of Heavy Metal Resistance in Palk Bay Sediment Bacteria." Marine Environmental Research 71 (4): 283–94.

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Abstract: The present study aimed at characterizing the heavy metal resistance and assessing the resistance pattern to multiple heavy metals (300 mmol L−1) by Palk Bay sediment bacteria. From 46 isolates, 24 isolates showed resistance to more than eight heavy metals. Among the 24 isolates S8-06 (Bacillus arsenicus), S8-10 (Bacillus pumilus), S8-14 (B. arsenicus), S6-01 (Bacillus indicus), S6-04 (Bacillus clausii), SS-06 (Planococcus maritimus) and SS-08 (Staphylococcus pasteuri) exhibited high resistance against arsenic, mercury, cobalt, cadmium, lead and selenium. Plasmid curing confirmed that the heavy metal resistance in S8-10 is chromosomal borne. Upon treatment with the heavy metals, the strain S8-10 showed many morphological and physiological changes as shown by SEM, FTIR and AAS analysis. S8-10 removed 47% of cadmium and 96% of lead from the growth medium. The study suggests that sediment bacteria can be biological indicators of heavy metal contamination.

Keywords: Heavy metals, Palk Bay, Scanning electron microscopy, FTIR, AAS, Bioaccumulation, Biomonitoring

Nithya, C., C. Aravindraja, and S. Karutha Pandian. 2010. "Bacillus pumilus of Palk Bay Origin Inhibits Quorum-Sensing-Mediated Virulence Factors in Gram- Negative Bacteria." Research in Microbiology 161 (4): 293–304.

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Abstract: The aim of the current study was to inhibit quoring-sensing (QS)-mediated virulence factors of representative Gram-negative bacteria by marine bacterial isolates. Bacteria isolated from Palk Bay sediments were screened for anti-QS activity. Eleven strains inhibited QS signals in Chromobacterium violaceum (ATCC 12472) and C. violaceum CV026. The marine bacterial strain S8-07 reduced the accumulation of N-acyl homoserine lactone (AHLs) and showed significant inhibition of LasA protease (76%), LasB elastase (84%), caseinase (70%), pyocyanin

(84%), pyoverdin and biofilm formation (87%) in Pseudomonas aeruginosa PAO1. Strain S8-07 also showed highly significant reduction (90%) in prodigiosin, secreted casienase (92%), hemolytic activity (73%) and biofilm formation (61%) in Serratia marcescens. Strain S8-07, identified as Bacillus pumilus (accession number FJ584416), showed distinct profiles of inhibition against the virulence factors of both P. aeruginosa PAO1 (las, rhl) and S. marcescens (shl). Polar extraction and proteinase K treatment of the culture supernatant confirmed that the anti-QS activity of S8-07 was indeed due to a protein molecule. Acidification assay and HPLC analysis revealed that the degradation of AHL was not due to lactonase activity, but rather, was due to acylase activity of S8-07. Thus, novel anti-QS acylase activity is reported for the first time from a B. pumilus strain of marine origin.

Keywords: Anti-quorum-sensing, Bacillus pumilus, Pseudomonas aeruginosa PAO1, Serratia marcescens, Marine bacteria

Palanivelu, A., A. Darsis, and K. Arunkumar. 2012. "Nutraceutical Values of Seaweeds Found Along the Coast of Thondi (Palk Bay, India) with Specific Investigation on Fatty Acids Methyl Esters through GC/MS." Journal of Green Bioenergy 1 (1): 3–18.

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Abstract: In the present investigation, biochemical constituents of 16 red and 7 green seaweeds found abundantly along the coast of Thondi (Palk Pay), Tamil Nadu, India were evaluated for nutraceutical values. Coralline red alga Jania rubens was recorded at significantly maximum dry weight and ash content. Total lipid was recorded significantly at maximum and minimum in G. verrucosa and Jania rubens, respectively. Total chlorophyll was higher in green seaweeds than in red seaweeds whereas accessory pigments and crude carbohydrate were high in the latter. Crude carbohydrate yield was high in Gracilaria species (Agarophytes) followed by Hypnea and other red seaweeds and differences in crude carbohydrate yield among the species of the same genus mostly not significant. Total carbohydrate was recorded at maximum in Gracilaria edulis. Of the red seaweeds, the high total protein and total amino acids were recorded in Gracilaria verrucosa whereas among the green seaweeds, Ulva lactuca. Generally total phenol content was not showed much variation and the differences were mostly insignificant among the seaweeds in general, red seaweeds in particular. WRC (water retention capacity) was recorded higher in the crude carbohydrate of seaweeds (agarophytes and carrageenophytes) known for commercially valuable for phycocolloid than other seaweeds. Significantly higher agar yield was extracted in G. canaliculata but among others no significant difference in agar yield was recorded. The high yield of carrageenan was recorded in Hypnea musciformis followed by H. valentiae, H. flagelliformis and Grateloupia filicina among the carrageenophytes. Sulphate content exhibited significant difference among the seaweeds. This study showed that seaweeds such as red Jania rubens, Gracilaria verrucosa, Gracilaria edulis, Hypnea musciformis, H. valentiae, Grateloupia filicina and green seaweeds Ulva lactuca and Chaetomorpha linum are promising not only for traditional cell wall

polysaccharides extraction but also as a source of specific nutraceutical values like dietary fiber, pigments, carbohydrates, protein and amino acids supplements in the food and fodder.

Keywords: Seaweeds, Nutraceuticals, Pigments, Crude carbohydrate, Fatty acid methyl esters

Pandiaraj, D., D. M. Ali, R. P. Kumar, S. Ravikumar, and N. Thajuddin. 2012. "Molecular Characterization and Phylogeny of Marine Cyanobacteria from Palk Bay Region of Tamil Nadu, India." Ecologia 2 (1): 23–30.

Address: Department of Microbiology, School of Life Science, Bharathidasan University, Tiruchirapalli, India. Tel: +91 431 240702

Abstract: Most of the marine cyanobacteria especially to the order Chroococcales, Oscillatoriales, Nostocales occur ordinarily as planktonic forms. Their taxonomic assignment was based on morphological and cytological characteristics. The genetic variation in the species and strain level morphological and cytological features is not reliable and molecular characterization of cyanobacteria is necessary for better identification. The samples were collected from Thondi and Kattumavadi in Palk Bay region of Tamil Nadu, India. Biodiversity of cyanobacteria were documented, purified and maintained. The two strains, Phormidium chlorinum NTMPO1 and Jaaginema psedogeminatum NTMPO2 were selected for further molecular characterization based on 16S rDNA sequence in the strain. Evolutionary relationship and secondary structure was constructed with the sequence. The sequences were submitted to GenBank with accession numbers GU812856 and GU812857.

Keywords: Biodiversity, Cyanobacteria, 16S rDNA, Phylogeny, Gene sequence

Periyasamy, C., P. Anantharaman, and P. V. Subba Rao. 2015. "Experimental Farming of Kappaphycus alvarezii (Doty) Doty with Income Estimates at Different Sites in the Mandapam Region, Palk Bay, Southeast Coast of India." Journal of Applied Phycology 27 (2): 935–44.

Address: CAS in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India. Email: periyasamy.c@live.com

Abstract: The cultivation of Kappaphycus alvarezii, a kappa carrageenan producing red seaweed, was done for 1 year from April 2012 to March 2013 in subtropical waters of Indian Peninsula at three different sites (Mangadu in Rameswaram Island, Munaikadu and Vedalai–on main land coast) on Palk Bay side of Bay of Bengal of Rameswaram–Mandapam region of southeast coast of India. These experiments were carried out to confirm the results obtained in an earlier study (April 2011 to March 2012) at more or less the same sites–one is different (Mangadu) and two are the same (Munaikadu and Vedalai). The maximum crop yields of 326.55 ± 10.23 and 316.65 ± 15.13 kg FW raft−1 were obtained in October 2012 at Mangadu and Munaikadu, respectively, and 308.40 ± 8.89 kg FW raft−1 in

March 2013 at Vedalai. Similarly the maximum daily growth rates (DGRs) of 3.76 ± 0.07 and 3.69 ± 0.11 % were found in October 2012 at Mangadu and Munaikadu, and 3.64 ± 0.06 % was obtained in March 2013 at Vedalai. A significant negative correlation between DGR and seawater temperature at Mangadu (r=−0.604) and Munaikadu (r= −0.700) was found (at 0.05 level). Further, a significant positive correlation was seen (at 0.05 level) between nitrite and phosphate at Mangadu (r=+0.613) and Vedalai (r=+0.599). However, salinity and seawater temperature were significantly positively correlated (r=+0.693) at Munaikadu (at 0.05 level). ANOVA showed that the growth rates among these three sites were found to be statistically insignificant. Tip grazing by Siganus javus and Diodon holocanthus during the monsoon period (October 2012 to January 2013) was observed. Seasonal epiphytes Lyngbya majuscula and Cladophora facsicularis were the main problematic epiphytes from April to June. Net income would be Rs. 15,000 to Rs. 16,000 (US$250–US$265) per month, and if the cultivation is taken up in earnest perspective, the farmers would improve their living standards.

Keywords: Seaweed farming, Daily growth rate, Kappaphycus, Red seaweed, Carrageenan

Periyasamy, C., P. V. Subba Rao, and P. Anantharaman. 2015. “Spatial and Temporal Variation in Carrageenan Yield and Gel Strength of Cultivated Kappaphycus alvarezii (Doty) Doty in Relation to Environmental Parameters in Palk Bay Waters, Tamil Nadu, Southeast Coast of India.” Journal of Applied Phycology 28: 525–32.

Address: CAS in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India. Email: periyasamy.c@live.com

Abstract: Cultivated Kappaphycus alvarezii Doty (Doty) was analyzed for its dryweed quality (moisture and clean anhydrous weed (CAW) contents), carrageenan (semi-refined carrageenan (SRC)) yield, and gel strength with respect to environmental parameters (seawater temperature, salinity, nitrate, and phosphate) for 1 year from April 2012 to March 2013 from three different localities, viz. Mangadu, Munaikadu, and Vedalai, located in Palk Bay, Ramanathapuram District, Tamil Nadu, Southeast coast of India. Dryweed quality, viz. moisture content (35.00 ± 0.00 to 38.39 ± 0.19 %), clean anhydrous weed (39.26 ± 1.37 to 45.22 ± 0.57 %), and 5.57 g cm−2), was found to vary differently at all the sites during the study period. Two way ANOVA showed that seawater temperature, salinity, and nitrate were significant spatially, while carrageenan (SRC) yield and gel strength were found to be significant (p=0.05 level) both spatially and temporally. The carrageenan (SRC) obtained in this study met international specifications with respect to dryweed quality, carrageenan yield, and gel strength, suggesting its production indigenously for internal consumption as well as for export using the cultivated raw material and thus providing employment to the coastal rural people in India and earning foreign exchange.

Keywords: Kappaphycus alvarezii, Carrageenan, Yield, Gel strength, SRC, India

Prabhahar, C., K. Saleshrani, and R. Enbarasan. 2011. “Studies on the Ecology and Distribution

of Phytoplankton Biomass in Kadalur Coastal Zone Tamil Nadu, India." Current Botany 2 (3): 26–30.

Address: Department of Zoology, Annamalai University, Annamalai Nagar – 608 002, Chidambaram, Tamil Nadu, India. Email: prabhaharc@yahoo.com Abstract: The present investigation is an attempt to ascertain the nature of the environment at Kadalur, a coastal village of Tamil Nadu. Pytoplankton of the palk Bay was studied during June 2009 to July 2010. For the present study three sampling Stations were fixed viz., Station 1 (Palar river), Station 2 (Palar estuary) and Station 3 (Kadalur sea coast). The percentage contribution of each group of phytoplankton was in the decreasing order of Myxophyceae > Chlorophyceae > Bacillariophyceae > Eugleninae at Station 1 and Diatoms > Dianoflagellates > Bluegreens > Greens > Others at Stations 2 and 3. However, Station 2 recorded more percentage of diatoms and dinoflagellates than Station 1 and 3. Phytoplankton population density and species diversity were high during the summer season. Phytoplankton species were invariably sparse during the monsoon season at all the stations. The density of phytoplankton population, as observed in the present study, was more or less equal with compared to the densities reported by earlier workers from various other marine environs of the South East Coast of India. It showed an inverse relationship with the nutrients concentrations. Species richness and evenness of phytoplankton showed an inverse relationship with the dominance index and the dominance index showed significant spatial variation. Distribution of chlorophyll 'a' concentration closely followed the pattern of the fluctuation in phytoplankton population and it also varied seasonally. Phytoplankton chlorophyll 'a' concentration increased with increasing phytoplankton standing crop and gross primary productivity. In general, Station 2 recorded more species composition, population density, gross primary productivity, and chlorophyll 'a' concentration than Stations 1 and 3, which may be due to the occurrence autochthonous particulate food matter in fresh water. The diversity of coastal marine species may have been associated with the allochthonous species from the estuary.

Keywords: Phytoplankton, Biomass, Physico-chemical properties, Water quality

Prakash, S., N. K. Ahila, V. Sri Ramkumar, J. Ravindran, and E. Kannapiran. 2015. "Antimicrofouling Properties of Chosen Marine Plants: An Eco-Friendly Approach to Restrain Marine Microfoulers." Biocatalysis and Agricultural Biotechnology 4 (1): 114-21.

Address: Research Institute, SRM University, Kattankulathur – 603 203, Kancheepuram District, Tamil Nadu, India. Email: alagaprakash@gmail.com Abstract: Biofouling is a panic issue in the marine environment where the major perpetrator is the biofilm forming microbial cells like bacterial groups. Hence, the present study was focused to study the diversity and density of marine biofilm forming bacteria on different experimental panels immersed in Palk Bay region. The results are inferred that the density and distribution of biofilm forming bacterial groups were significantly ($P < 0.05$) varied, whereas the Pseudomonas spp. (15.78–22.22%) had maximum distribution in the immersed all the test panels. The current antifouling paints create toxic effects

on non-target organisms. Of late, natural products were replaced with current toxic antifouling problems. In the present study, the four marine plants viz. two seaweeds (Sarconema furcellatum, Sargassum wightii) species and two seagrasses (Syringodium isoetifolium, Cymodocea serrulata) species were selected to screen their antimicrofouling activity. From this, the crude acetone extract of S. furcellatum exhibited the good antimicrofouling activity over the other marine plant extracts against test microfoulers; anti-bacterial (7 ± 0.16 to 13 ± 0.26 mm) with least concentration of MIC and MBC values (12.5–25 µg/ml and 25–50 µg/ml), antimicroalgal (50–300 µg/ml) and Artemia cytotoxicity (LC50 133.88 µg/ml; $P < 0.001$) and anticrustacen activity was significantly ($P < 0.05$) increased mortality within creasing test concentrations of crude extracts. Also, phytochemical studies of the four marine plants revealed the presence of Chemical constituents such as flavanoids, alkaloids, phenols and sugars. Further studies on the purification and identification of active compounds from S. furcellatum might help to characterize the nature of eco-friendly antifouling compounds filed study.

Keywords: Marine biofilm bacteria, Seaweeds, Seagrasses, Antimicrofouling, Cytotoxicity, Antifouling

Prasanna Kumar, S., N. Ramaiah, and R. A. Sreepada. 2015. Characterisation Ecosystem of Indian Coast with Special Focus on West Coast. CSIR-NIO, Goa, India.

Premanandh, J., B. Priya, D. Prabaharan, and L. Uma. 2009. “Genetic Heterogeneity of the Marine Cyanobacterium Leptolyngbya valderiana (Pseudanabaenaceae) Evidenced by RAPD Molecular Markers and 16S rDNA Sequence Data.” Journal of Plankton Research 31 (10): 1141–50.

Address: National Facility for Marine Cyanobacteria, Bharathidasan University, Palkalaiperur, Tiruchirapalli – 620 024, India. Email: jpanandh@yahoo.com

Abstract: The distribution and diversity patterns of the cosmopolitan marine cyanobacterium Leptolyngbya valderiana(Pseudan abaenaceae, Cyanobacteria) were studied. To assess the level of genetic diversity, morphotypes from different geographical locations (Coast of south India and Andaman) were subjected to randomly amplified polymorphic DNA (RAPD) analysis and partial 16S rRNA gene sequence studies. Morphologically and ecologically, all strains fit the currently circumscribed L. valderiana. However, RAPD primers yielded 100% polymorphism among the studied strains, indicating a considerable degree of intra-specific genomic heterogeneity, with percent similarity between 13 and 82%. Partial 16S rDNA sequence similarity values ranged from 91 to 99%. In conclusion, the genetic variability observed within the marine strains of L. valderiana indicates the presence of cryptic species. Thus, future investigations combining well characterized ultra- structural morphology with additional molecular markers are essential to characterize and clarify the patterns in the evolution and biogeography.

Priya, E., R. Thenmozhi, A. Nagasathya, N. Thajuddin, and G. Muralitharan. 2014. “Diversity of Actinobacteria in Mangrove Ecosystem of Muthupet, India.” International Research Journal of Environment Sciences 3 (4): 13–17.

Address: Department of Microbiology, JJ College of Arts and Science (A), Namunasamudram, Sivapuram, Pudukkottai – 622 422, Tamilnadu, India.

Abstract: Totally 57 actinobacteria isolates were obtained from four sediment samples collected from four different seasons (pre monsoon, post monsoon, summer and monsoon) of Palk Strait region situated along the, South East coast of India. Among them, 6 dominant isolates in all seasons were found to be morphologically identified on the basis of color of front mycelium and reverse side color formation and sporophore morphology. The primary identification of this isolates were based on biochemical and physiological characteristics of the isolated strains. Furthermore, the analysis of nucleotide sequence of the 16S rRNA sequencing. Six isolates were assigned to the actinobacteria Streptomyces niveoruber, S. heliomycini, S. flavomacrosporus, Lechevalieria aerocolonigenes, L. flava and Dactylosporangium vinaceum.

Keywords: Diversity, Actinobacteria, Mangrove ecosystem, 16S rRNA sequencing

Raghunathan, C., K. Venkataraman, C. Satyanarayana, and R. Rajkumar. 2013. An Invasion of Snowflake Coral Carijoa riisei (Duchassaing and Michelotti 1860) in Indian Seas: Threats to Coral Reef Ecosystem. Ecology and Conservation of Tropical Marine Faunal Communities 381–393.

Address: Zoological Survey of India, Andaman and Nicober Regional Centre, Andaman and Nicober Islands, Port Blair, India – 744 102. Email: raghuksc@rediffmail.com

Abstract: Carijoa riisei is a shallow water fast growing zooxanthellate octocoral, native to the tropical Atlantic and Caribbean Sea. Since its first invasion discovered from Hawaii Islands in 1972, the species spreads across several countries. Presently this species is reported to occur in the coral reef ecosystems of Indian Seas. Carijoa riisei is typically found in a wide variety of habitats that provide shade, but in deeper water uninhibited by light and can be found on exposed hard substrate. Though the occurrence of this non- indigenous species invasion in Indian Seas is relatively minor component of the total biota, it is essential to prevent further spreading on the coral reef ecosystem by adopting effective managerial plans. When limited information is available on marine bioinvasion in tropical counties especially in India, there is an urgent need of study on the occurrence and impacts of non-indigenous species that are focused on coral reef environment as this ecosystem habors 25% of total marine biodiversity and contribute 10% fishery production. This chapter summarises the occurrence of Carijoa riisei in coral reefs, impacts and policies for bioinvasion in Indian context.

Keywords: Bioinvasion, Carijoa riisei, Corel reef, Indian seas

Rajakumaran, P., and B. Vaseeharan. 2014. “Survey on Penaeidae Shrimp Diversity and Exploitation in South East Coast of India.” Fisheries and Aquaculture Journal 5 (3): 1–8.

Address: Crustacean Molecular Biology and Genomics lab, Department of Animal Health and Management, Alagappa University, Karaikudi – 630 003, Tamil Nadu, India. Email: vaseeharanb@gmail.com

Abstract: The assessment of Penaeidae species diversity in a particular region is very important in formulating conservation strategies. In the present study, the survey on diversity of Penaeidae species in south east coast of India has been assessed on the basis of landing of variety of species in this group. Penaeidae species were collected from various main landing centers of south east coast of India for three years. Identification and nomenclature was done based on previously published literature. Among the 59 species observed, the Penaeus semisulcatus, Penaeus monodon and Fenneropenaeus indicus were found mostly in all landing centers. As first and foremost, the Metapenaeus papuensis, Metapenaeus anchistus, Metapenaeopsis wellsi, Parapenaeopsis sinica (Kishinouyepenaeopsis amicus), Parapenaeopsis hungerfordi, Parapenaeopsis venusta, Parapenaeopsis coromandelica, Parapenaeopsis gracillima, Trachysalambria longipes and Parapenaeus lanceolatus landed in south east coast of India. As far as Penaeidae shrimp diversity is good in south east coast region of India, and needed the fishing site and mesh size regulation to protect the juvenile and adult of Penaeidae from inshore and offshore catching.

Keywords: Penaeidae, Diversity, Nomenclature, Exploitation, Conservation

Rajasuriya, A., 2014. Field Guide to Reef Fishes of Sri Lanka. Vol. 2 Colombo: IUCN Sri Lanka Office.

Rajkumar, M., R. Aravind, and A. K. P. Pandey. 2013. “Flora and Fauna of Coral Reef Habitats Excluding Fishes.” Ecology, Environment and Conservation Paper 19 (4): 1073–8.

Abstract: A study was conducted to explore the flora and fauna in the Mandapam region of Palk Bay during 2012 at 79° 17’ E to 79° 8’ E longitudes and 9° 17’ N latitude. The flora and fauna in the coral reef beds were observed by SCUBA diving. The flora and fauna recorded in coral reef habitats of Palk Bay region belonged to corals (12 species), gastropods (6 species), seaweeds (7 species), bivalves (5 species), jellyfish (3 species), and one species of sponges, crab, shrimp, holothurian, brittle star, seagrass each. Among the coral reef species Porites sp., Favia sp., Sinularia sp., Turbinaria sp. were the most dominant species followed by seaweeds (Halimeda obuntia), gastropods (Lambis sp.), bivalves (Pinctada sujilata), jellyfish (Rhopilema sp.), crustaceans (Alpheus sp.), holothurians (Holothuria atra), seagrass (Cymodocea sp.), brittle star (Ophiothrix fragilis) and sponges (Cliona sp.). The study will provide the baseline data of flora and fauna excluding fishes present in the coral reef habitats of Palk Bay.

Ramadas, V., and K. R. Rajeswari. 2011. “The Effect of Oil Pollution and Disposal of Domestic Sewage on the Vitality and Diversity of Coral Reefs of Palk Bay, Mandapam Region, South-east coast of India.” 2nd International Conference on Environmental Science and Technology. IPCBEE 6 IACSIT Press, Singapore.

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Abstract: Coral reefs-the 'rainforests of the sea,' are an endangered ecosystem and are disappearing at an alarming rate due to numerous threats, including over-fishing, global warming and pollution, particularly oil spills. The sewage pollution is an increasing problem in tropical marine environment. These habitats hosting a rich diversity of marine organisms and are also potential sources of life-saving medicines and food for humans. The present investigation deals with the ecological status of coral reefs with reference to impact of disposal of domestic sewage from nearby human settlements and waste diesel and engine oil approximately from 700 fishing boats anchored in the lagoon existing between fringing reefs of Palk Bay and mainland at Mandapam. A narrow navigational channel separates the Palk Bay Reefs into two sectors viz. western (Station-I) and eastern sector (Station-II). The reef is situated about 200 to 600 meters away from the shore at different places. In the lagoon area of eastern sector (Station-II) of the Palk Bay waste diesel, engine oil, the terrestrial runoff of nutrients and domestic sewage cause severe pollution in the area and also pose various ecological problems. Whereas, the lagoon in the western sector (Station-I) of the reef is free from such disturbances except a few plank boats involved in the fishing activities and seaweed collection. Line Intercept Transect (LIT) method was used to assess the live coral covers of the selected sites. The biophysical forms coming under 20 m transects laid on the reef roughly parallel to the shore were recorded using snorkeling and skin diving techniques were used to observe shallow waters up to 3m, and beyond this depth SCUBA diving, technique was used. A comparative study of the impact of pollutants on the vitality and diversity of coral reefs in Station - I and Station – II was carried out. The average percentage of Live Coral Cover (LCC) (Station – I (50%) and Station – II (40%), Coral Infected with Disease (CID) (Station –I – (8.3%) and Station-II – (13.3%) and the Filamentous and Turf Algae (FTA) (Station –I - [13.3%] and Station - II – [16.6%]) were recorded. Mostly the values recorded in Station – II were higher when compared to Station – I. This is because of the impact of pollutants disposed in Station – II which challenges the vitality and diversity of coral reefs of Palk Bay. The present study indicates the variation in the number of species of scleractinian corals in the Station-II when compared to data recorded in previous study reports. Anthropogenic inputs of dissolved nutrients and organic particulate matter may also depress oxygen levels. The heavy sediment loads on corals may be lethal, lesser quantities of sediment may inhibit growth of corals, cause changes in the growth forms of colonies, decrease coral cover, alter species composition of reef-building organisms, and as well as inhibit coral recruitment. Besides toxic substances may induce metabolic changes in corals, also decrease rates of growth and reproduction, or reduce viability of corals. Further research is needed on the impact of major components of sewage effluent on coral reef ecosystem. The most critical need is long-term studies of sewage impacts.

Keywords: Palk Bay, Coral Reefs, Oil and sewage pollution, Detrimental to coral vitality

Ramakritinan, C. M., R. Chandurvelan, and A. K. Kumaraguru. 2012. "Acute Toxicity of Metals: Cu, Pb, Cd, Hg and Zn on Marine Molluscs, Cerithidea cingulata G., and Modiolus philippinarum H." Indian Journal of Geo-Marine Sciences 41 (2): 141–5.

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

Abstract: Present study was intended to compare the acute static renewal toxicity tests on marine snail, Cerithidae cingulata and bivalve, Modiolus philippinarum that were performed with Cu, Cd, Pb, Zn and Hg. The 96 h LC50 values for C. cingulata were 0.521, 9.193, 15.507, 8.990 and 0.053 mg.l−1 and the 96 h LC50 values for M. philippinarum were 0.023, 0.221, 2.876, 2.337 and 0.007 mg.l−1 in respective metals. This study indicated that mercury was highly toxic to both C. cingulata and M. philippinarum. While lead was resistant metal to both marine molluscs tested. Order of increasing toxicity of metals to C. cingulata was Hg > Cu > Zn > Cd > Pb and to M. philippinarum was Hg > Cu > Cd > Zn > Pb. Safe level concentrations for all 5 metals were also calculated. The LC50 values of the present study may be useful in deriving marine water quality standards in the coastal waters of Gulf of Mannar.

Keywords: Acute toxicity, Snail, Bivalve, Heavy metals, LC50

Rameshkumar, S., C. M. Ramakritinan, and M. Yokeshbabu. 2013. "Proximate Composition of Some Selected Seaweeds from Palk Bay and Gulf of Mannar, Tamilnadu, India." Asian Journal of Biomedical and Pharmaceutical Sciences 3 (16): 1–5.

Address: School of Energy, Environment and Natural Resources, Madurai Kamaraj University. Madurai Kamaraj University, Madurai, Tamilnadu. Email: srameshkumar71@hotmail.com

Abstract: The Gulf of Mannar and Palk Bay of South East Coast are rich in seaweed resources. Seaweeds are one of the important marine living renewable resources and are used for human consumption, animal feed and as manure in several countries. So, some of the representatives from Chlorophyta, Phaeophyta and Rhodophyta were investigated in the present study for biochemical composition. The macroalgae showed varied quantities of biochemical constituent are namely Amino acids, Proteins, Lipids, Carbohydrates and Phenol. High concentration of Glutamic acid and Aspartic acid was recorded in red algae Acanthopora spicefera 17.4% and 15.7% respectively and lowest value of Methionine was recorded in all species except Chnoospora minima (3.1%). Highest protein was recorded in Acanthopora spicefera 18.9% and low value was recorded in brown algae Padina gymnospora (10.5%). Lipid content was high in green algae Caulerpa recemosa (19.1%) and low value in Ulva faciata (0.5%). Carbohydrate content was high in green algae Caulerpa racemosa 83.2% and low in Chnoospora minima 28.5%. In phenol the highest value in Acanthopora spicefera and lowest in Caulerpa racemosa 14.3%.

Keywords: Proximate composition, Seaweeds, Gulf of Mannar and Palk Bay, India

Ramkumar, V. S., E. Kannapiran, and M. Magesh. 2011. "Variations in Heterotrophic Bacteria and Phosphate Solubilizing Bacteria from Karangadu and Devipattinam Coast, Palk Strait, Southeast Coast of India." Annals of Biological Research 2 (5): 602–9.

Address: School of Marine Sciences, Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi Campus, Thondi, Tamil Nadu, India.

Abstract: In shallow coastal regions, bacteria are believed to play an important role in the recycling of matter. A study concerning total heterotrophic bacteria and phosphate solubilizing bacterial populations in the water and sediment samples of the Karangadu and Devipattinam, Palk Strait, Southeast coast of India were carried out from July 2008-May 2009. THB and PSB were high in November month. THB was ranged between 5.23-9.75 × 105 cells ml−1 and 2.36-11.21 × 105 cells ml−1 and PSB was fluctuated between 0.98-5.6 × 103 cells ml−1 and 1.12-6.84 × 103 cells ml−1 from water and sediment samples respectively. Among all the PSB isolates, twenty proficient PSB strains were selected for phosphatase activity and P solubilization efficiency under in vitro condition.

Keywords: Total heterotrophic bacteria, Phosphate solubilizing bacteria, P solubilization, Phosphatase activity, Palk Strait

Ramkumar, V. S., E. Kannapiran, and M. Palanisamy. 2011. "Prevalence and Distribution of Total Heterotrophic Bacteria from Kottaipattinam Coast, Palk Strait, Southeast Coast of India." Archives of Applied Science Research 3 (5): 593–8.

Address: School of Marine Sciences, Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi Campus, Thondi, Tamil Nadu, India.

Abstract: Samples of water and sediment were collected from July to December 2009 in Kottaipattinam coast (Palk Strait, Southeast coast of India). Kottaipattinam coast is one of the major fish landing centre in Palk Strait and receives a considerable amount of sewage and man made waste. Qualitative and quantitative analysis of the composition of the microbial flora were conducted on samples from three stations. The highest bacterial densities, in water and in sediment samples, were found in December and the lowest, in August. Among Gram-negative bacteria, the predominant genus was Pseudomonas; Aeromonas, Vibrio and Flavobacterium were also recorded. Gram-positive bacilli were abundant at all sampling points. Along with physico- chemical parameters were also monitored at every month of sampling.

Keywords: Physico-chemical parameters, Total heterotrophic bacteria, Kottaipattinam coast, Pseudomonas, Aeromonas, Bacillus, Vibrio and Flavobacterium

Rao, D. V. S., K. S. Rao, C. S. P. Iyer, and P. Chittibabu. 2008. "Possible Ecological Consequences from the Sethu Samudram Canal Project, India." Marine Pollution Bulletin 56 (2): 170–86.

Address: Bedford Institute of Oceanography, Habitat Ecology Division, Department of Fisheries and Oceans, P.O. Box 1006, Dartmouth, NS, Canada B2Y 4A2. Email: onyx@accesswave.ca

Abstract: The Sethu Samudram Canal Project (SSCP), considered as a harbinger of economic growth in India, is a mega engineering project being developed to provide a 260 km long, 300 m wide and 12 m deep shipping channel between the Arabian Sea and the Bay of Bengal. This project impacts the unique biota and biodiversity of a 10,500 km2 Marine Biosphere Reserve. This man-made link facilitates exchange of water masses between the less saline Bay of Bengal and the more saline Arabian Sea. Initial construction, subsequent dredging for channel maintenance, and the associated ship traffic would result in irreversible changes to the already over-exploited and stressed environment. Additionally, the channel would form a deep ocean route for future tsunamis. However, to provide assurance to the public, particularly the 50,000 fishing folk, in 47 villages in this area, it would be crucial that a long-term environmental monitoring program is instituted. A thorough evaluation of the impending environmental impacts, similar to those Addressed by a Before/After and Control/ Impact (BACI model) is recommended.

Keywords: Mega-engineering shipping channel, Environmental impacts, Tsunamis, India-Sri Lanka region

Rao, J. V., P. K. Usman, and J. B. Kumar. 2008. “Larvicidal and Insecticidal Properties of some Marine Sponges collected in Palk Bay and Gulf of Mannar Waters.” African Journal of Biotechnology 7 (2): 109–13.

Address: Toxicology Unit, Biology Division, Indian Institute of Chemical Technology, Hyderabad – 500 007, India. Email: jv@iict.res.in, jv@india.com

Abstract: Among marine invertebrates, sponges are one of the most productive marine ecosystems, with regard to presence of novel bio-active compounds. Few sponges (n = 18) were collected from Palk Bay and Gulf of Mannar waters of India and their methanol and dichloromethane (1:1) extracts were screened for larvicidal and insecticidal properties. Among them, around 40% of test extracts were active against the fourth-instar larvae of Aedes aegypti (Linn) and three to four day old of female houseflies, Musca domestica (Linn) at the concentrations of less than 100 ppm and 100 µg/insect respectively. Among the sponges Psammaplysilla purpurea and Haliclona cribricutis were found to be more active with both larvicidal and insecticidal properties. Considering both these activities, the following sponges Psammaplysilla purpurea, Haliclona cribricutis, Dendrilla nigra, Haliclona pigmentifera and Petrosia testudinaria could be used to obtain novel pesticidal molecules.

Keywords: Marine Sponges, Biological screening, Aedes aegypti, Musca domestica, India

Ravi, R., and M. K. Manisseri. 2013. "Alterations in Size, Weight and Morphology of the Eggs of Blue Swimmer Crab, Portunus pelagicus Linnaeus, 1758 (Decapoda, Brachyura, Portunidae) during Incubation." Turkish Journal of Fisheries and Aquatic Sciences 13: 509–15.

Address: Central Marine Fisheries Research Institute, P.O. Box No: 1603, Cochin – 682 018, Kerala, India. Email: raghunathravi@yahoo.com

Abstract: Portunus pelagicus Linnaeus, 1758 is an important candidate species for culture in India and trials are for developing its hatchery technology. The present work investigates the changes occurring in diameter, volume, wet weight and morphology of P. pelagicus eggs during incubation which would improve the knowledge base on embryology of species. Mated females from wild were maintained under similar physico-chemical conditions. Once spawned, the egg samples were collected from each animal daily and their diameter, volume, and wet weight were assessed. Based on the changes occurring in egg morphology at 24 hour intervals, the embryo development was classified into eight 'periods'. The egg size and wet weight varied significantly (P<0.01) among crabs and egg size was unrelated with the carapace width of female. The average diameter, volume and wet weight of the egg were 0.324 mm, 0.016 mm3 and 0.048 mg, respectively. Diameter, volume and wet weight of the eggs increased to 13.58, 46.52 and 49.05%, respectively and the major share of increment occurred in last two days.

Keywords: Embryo development, Egg diameter, Egg volume

Ravikumar, M., and T. Sivakumar. 2012. "A Study on Distribution of Fungi in Sea Foams in Estuarine Ecosystem." International Journal of Current Microbiology and Applied Sciences 1 (1): 63–5.

Address: Department of Plant Biology and Biotechnology, Government. Arts College for Men, Nandhanam, Chennai, Tamilnadu, India. Email: ravi_micro@rediffmail.com

Abstract: The present study was carried out in Muthupet habitat along the east coast of Tamil Nadu. The sea foams were collected and fungal species isolated by plating and direct observation techniques. Totally 64 species of fungi were isolated of which 48 by plating and 29 by direct observation techniques. The marine fungi like Halosphaeira maririma, Didymosphaeria maritima, Varicosporina ramulosa and Pleospoara aquatica were also isolated. Aspergillus was the common genus followed by Drechslera, Alternaria and Curvularia.

Keywords: Mangroves; Marine and marine fungi; Direct and dilution technique; Direct observation

Ravikumar, S., J. Thirumalairaj, and R. Gokulakrishnan. 2013. "Assessment of Microbial Diversity in Relation to Biochemical Constituents along Palk Strait." International Journal of Innovative Research in Science, Engineering and Technology 2 (11): 6431–7.

Address: School of Marine Sciences, Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi Campus, Thondi – 623 409, Tamil Nadu, India.

Abstract: The present study was made an attempt to enumerate the total heterotrophic bacteria (THB), E. coli, actinomycetes and fungi population and to evaluate the biochemical parameters from water and sediment samples. The samples were collected from eight different stations viz., Kodiyakkarai, Mallipattinam, Manora, Manamelkudi, Kottaipattinam, Mimisal, S. P. Pattinam and Thondi along Palk Strait coast of South India. The results suggested that, the maximum THB (12 × 105 CFU.mL−1) and E. coli (14 × 105 CFU.mL−1) counts were recorded in water sample at Mallipattinam coast during the month of January and February. The maximum (5 × 105 CFU.g−1) counts of actinomycetes were recorded in sediment at Thondi during the month of March. Moreover, the counts of fungi were found maximum (12 × 105 CFU.g−1) in sediment at Mimisal during the month of March. The correlation analysis revealed that, the counts of THB showed positive correlation ($p<0.05$) with amino acids in both water and sediment samples and showed negative correlation ($p<-0.05$) with carbohydrates and proteins. The counts of E. coli showed positive correlation ($p<0.05$) with amino acids in sediment and also showed positive correlation ($p<0.05$) with carbohydrates and non-reducing sugar in water. The counts of actinomycetes showed negative correlation ($p<-0.05$) with amino acids in sediment. The fungal counts showed positive correlation ($p<0.05$) with protein and reducing sugar in sediment.

Keywords: Actinomycetes, E. coli, Fungi, Microbial diversity, Palk Strait coast, Total heterotrophic bacteria

Ravikumar, S., K. Nanthinidevi, T. T. Ajithkumar, and M. Ajmalkhan. 2011. “Antibacterial Activity of Seagrass Species of Cymodocea serrulata against Chosen Bacterial Fish Pathogens.” Annals of Biological Research 2 (1): 88–93.

Address: School of Marine Sciences, Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi campus, Tamil Nadu, India.

Abstract: The purpose of this study was to investigate antibacterial activity of seagrass Cymodocea serrulata. The 6th acetone fraction from C. serrulata root extract showed maximum activity [12 mm, 12 mm and 12 mm] against three [A. hydrophila, B. subtilis and Serratia sp.,] of the five fish pathogens tested and minimum activity of 7 mm, 8 mm was noticed against V. parahaemolyticus, V. harveyi respectively. The 1st fraction of hexane from C. serrulata root extract showed antibacterial activity against five fish pathogens viz., B. subtilis, A. hydrophila, V. parahaemolyticus, Serratia sp., and V. harveyi. This showed maximum activity [10 mm] against V. parahaemolyticus and minimum activity of 8 mm, 7 mm were observed against B. subtilis, Serratia sp., respectively.

Keywords: Cymodocea serrulata, Antibacterial activity, Fish pathogens, Seagrass

Ravindran, J., E. Kannapiran, B. Manikandan, R. M. Murali, and A. Joseph. 2012. "Bleaching and Secondary Threats on the Corals of Palk Bay: A Survey and Proactive Conservation Needs." Indian Journal of Geo-Marine Sciences 41 (1), 19−26.

Address: CSIR- National Institute of Oceanography, Regional Center, Dr. Salim Ali Road, Post Box No 1913, Kochi – 682 018. India. Email: jravi@nio.org

Abstract: A survey on bleaching and the secondary threats on bleached corals in the selected sites of Palk-Bay were conducted during May and June 2010. Massive corals represented by the genera Porites, Goniopora, Favia were bleached extensively. Significant portion of the surface of live corals were found dead. Coral recovery after bleaching was at a great risk due to the algal overgrowth and sedimentation which would lead to their death and permanent loss. Destruction of the slow growing corals by natural and altered environmental conditions warrants the proactive conservation approach guided by scientific principles. Current conservation methods in India offers physical protection to corals by entry restriction and a ban on collection of corals under wild life act. This is inadequate as they could not prevent secondary stressors taking toll on corals during environmentally induced stress conditions.

Keywords: Bleaching, Coral, Sedimentation, SST, Solar irradiance, Stress, Palk Bay

Saarrankan, A. 2013. "Impacts of Demography on Household's Fish Productivity of Small Scale Fishing Community in Jaffna District, Sri Lanka." Ryukoku University Institutional Repository: Departmental Bulletin Paper 52 (1– 2): 1–12.

Address: Graduate School of Economics, Ryukoku University, Kyoto, Japan.
Abstract: Fishing sector play a prominent role as the second largest economy of Jaffna District in Sri Lanka and having potential to support livelihood of more than 25% of population of Jaffna district. The purpose of the study is to identify determinants of fish productivity in terms of household characteristics. Household characteristics such as size, gender, age, family structure, residence status and religion were hypothesized as determinants of household's ability in fish catches. Primary data were collected from 90 households of Jaffna fishing community whom were interviewed with guidance of structured questionnaire during August and September of 2010. Descriptive statistics, correlation, and multiple linear regressions were used to analyze the primary data. As results of analysis, the model suggested household's ability in fish catch is determined by household's direct involvement in fish catches, household's religion as Christianity and household living with stem family. In addition, more proportions of male and adults in a household motivated household to be more active in fish catches.

Keywords: Fish productivity, Household demography, Jaffna district, Sri Lanka

Safhi, M. M., S. M. Sivakumar, A. Jabeen, and S. Sanobar. 2015. "Preliminary Phytochemical and Anti Bacterial Screening of Fractions of Gracilaria corticata against the Selected Bacterial Strains." World Journal of Pharmaceutical Research 4 (4): 198−203.

Address: Division of Pharmaceutical Biotechnology, College of Pharmacy, Jazan University, Jazan, Kingdom of Saudi Arabia.

Abstract: Gracilaria corticata is a red alga which is abundantly present in many seacoasts around the world. Phytochemical analysis of fraction 3 of crude methanolic extract of Gracilaria corticata has shown presence of carbohydrates, alkaloids, tannins, flavinoids, terpenoids and proteins. The anti bacterial activity of fraction 3 of crude methanolic extract of Gracilaria corticata was tested against certain human pathogens such as Bacillus subtilis MTCC 441, Bacillus cereus MTCC 492, Staphylococcus aureus MTCC 121, Streptococcus pyogenes MTCC 442, Klebsiella pneumonia MTCC 530, Salmonella typhi MTCC 531 and Escherichia coli MTCC 443. The predominant activity was observed against all the organisms tested except Klebsiella pneumonia. Studies suggested that potential anti bacterial compounds can be isolated from Gracilaria corticata.

Keywords: Seaweeds, Gracilaria corticata, Phytochemical screening, Antibacterial action

Sajan, J., P. K. B., Mutyam, K. Sivakumar, and C. C. Binod. 2012. "An Assessment of Legally Protected Marine Fauna in Curio Trade - A Market Study from Tamil Nadu, India." International Journal of Conservation Science 3 (3): 217–30.

Address: Wildlife Institute of India, Post Box # 18, Chandrabani, Deharadun, Uttarakhand, India. Email: sajanjohn09@gmail.com

Abstract: In an endeavor to prioritize the conservation of marine environment, species that are threatened were given protection under various Schedules of the Indian Wildlife (Protection) Act, 1972. Though the protection is sturdy on paper, marine fauna, such as sea shells, corals and sea horses are often illegally collected from their natural environment and are traded as marine curiosities. To assess those protected marine species in the curio trade in the state of Tamil Nadu, South India, certain major tourist and pilgrimage hot spots were surveyed during 2007. Among surveyed curio markets, Kanyakumari was found to have an alarming number of protected species being traded through huge number of marine curio shops. 15 species of legally protected mollusks, 10 species of corals and one sea horse species were found, along with other non-protected marine taxa in curio trade. Species protected through Schedule I were often highly priced than those under Schedule IV. The present survey suggests that protected marine species are an integral part in the growing marine curio business. High market demand, coupled with a lack of awareness and an inadequate enforcement were found to be major driving forces for the illegal marine curio trade. Awareness campaigns, along with a promotion ofviable and alternate sources of income for seashell / coral collectors and strengthening of law enforcement may curtail the illegal marine curio trade.

Keywords: Marine curios, Protected species, Illegal trade, Conservation, South India, Molluscs, Corals

Sakthivel, K., P. Thirunavukkarasu, and K. Kathiresan. 2014. "Mangroves and Associates in the Estuaries of Tamil Nadu Coast of India." International Journal of Marine Science 4 (58): 1–7.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: ksakthi7@yahoo.co.in

Abstract: Mangroves and associated plant species were surveyed in 56 estuaries from Pulicat Lake (13º25' 955" N. 080º 19' 284" E) to Manakkudy Estuary (08º 05' 254" N. 077º 29' 049" E) along 1076 km of coastline in Tamil Nadu, during 2012-2014. The study area was divided into five groups: West coast of Tamil Nadu, Gulf of Mannar, Palk Bay, South and North Coromandel coasts. A total of 16 mangrove species, belonging to nine families and 11 genera, were recorded along with 23 mangrove associates belonging to 17 families and 21 genera. The mangrove species, Avicennia marina and associate species, Pongamia pinnata, Lpomoea pes-caprae and Calotropis gigantea were found to be prevalent along the North Coromandel Coast. The mangrove species, Bruguiera gymnorrhiza was only recorded in the Ariyankuppam and Thengaithittu estuaries while Avicennia alba was only found in the Palayakayal Estuary in the Gulf of Mannar. Two mangrove associates Acrostrichum aureum and Fimbristylis ferruginea were reported in the Manakkudy estuary.The mangroves along the along the North Coromandel Coastwere represented more number of mangrove species. Avicennia marina was the dominant species almost all collect sites. Few mangrove plants only available in some species of mangroves in particular study areas, further investigation about mangroves plants diversity or continue monitoring is necessary. Field studies are wanted for unexplored minor estuaries and hence the present work was undertaken. The aim of the study was to identify the more number of rare mangrove species by survey more number of collection sites.

Keywords: Mangroves, Coromandel coast, Avicennia, Rhizophora, Gulf of Mannar, Palk Bay

Sakthivel, R., and K. P. Devi. 2015. "Evaluation of Physicochemical Properties, Proximate and Nutritional Composition of Gracilaria edulis Collected from Palk Bay." Food Chemistry 174 (1): 68–74.

Address: Department of Biotechnology, Alagappa University, Karaikudi – 630 004, Tamil Nadu, India. Email: devikasi@yahoo.com

Abstract: Gracilaria edulis, a red alga present in southeast coast of India was evaluated for its nutritional composition. FT-IR analysis of soluble polysaccharides revealed the presence of galactans, 3,6-anhydro-α-L- galactopyranose, sulphated galactose and the gelling agent agar, with the sulphate content estimated as 51.01 µg/mg of polysaccharide. Results of physicochemical properties and nutritional profile reveal the presence of dietary fibre (8.9 ± 0.62% DW), carbohydrate (101.61 ± 1.8 mg/g DW), crude protein (6.68 ± 0.94 mg/g DW) and lipid content (8.3 ± 1.03 mg/g DW). G. edulis contains biologically important fatty acids like

palmitic acid (2.06%), linolenic acid (2.56%), and oleic acid (1.98%). The other nutritional components present in high amounts are proline, chlorophyll A and B, all the essential amino acids and vitamin A, E and C. These findings suggest that G. edulis has potent nutritional value which might be used as a source of nutrients for human and animals.

Keywords: Physicochemical properties, Nutritional profile, FT-IR, Red alga, Sulphate content

Salagrama, V. 2014. A Livelihood-Based Analysis of Palk Bay, Tamil Nadu and Suggestions for an Implementation Strategy for CSM-CMPA Project. Final Report, Indo-German Biodiversity Programme Conservation and Sustainable Management of Existing and Potential Coastal and Marine Protected Areas.

Saminathan, N., A. Kannathasan, and K. Rajendran. 2012. "Hydrographic Characteristics of Palk Strait Region of the Mallipattinam, Southeast Coast of India." International Journal of Biology, Pharmacy and Allied Sciences 1 (6): 840–8.

Address: PG & Research Department of Zoology & Biotechnology, A.V.V.M. Sri Pushpam College (Autonomous), Poondi, Thanjavur – 613 503. Email: sami77phd@gmail.com

Abstract: The physic-chemical parameters such as temperature, pH, salinity, dissolved oxygen, phosphate, nitrates, rainfall, humidity and photoperiod were studied from Mallipattinam coast water (Lat. 10°12′ NS. and Long. 79°20′ EW) on south east coast of Bay of Bengal during April-2009 to March-2011. The result of the present study showed that there was a significant monthly variation. The atmospheric and water temperature was found to be high in summer and low in monsoon months. Salinity was found to be minimum during monsoon months and maximum during summer months. The pH of the water was found in alkaline range throughout the study period. DO (Dissolved Oxygen) showed marked variation. However phosphate and nitrate were found to the slight monthly variation. There was a direct relationship noticed between rainfall, humidity and photoperiod. The present study indicates that the fluctuation of physic-chemical parameters in the coastal region of Mallinpattinam, in southeast coast of India.

Keywords: Physico-chemical Parameters, pH, DO, Salinity, Nutrients

Sangeetha, P., S. Babu, and R. Ramasamy. 2012. "Extraction of R- Phycoerythrin from Kappaphycus alvarezii (Doty) Doty ex Silva and Analyses of its Physico-chemical Properties." Journal of Academia and Industrial Research 1 (7): 407–11.

Address: Centre for Advanced Studies in Botany, University of Madras, Guindy Campus, Chennai – 600 025, India. Email: vasanthbabu402@gmail.com

Abstract: The phycoerythrin (PE) is a protein acting as a photosynthetic accessory pigment in red algae (Rhodophyta). This protein has gained many biotechnological applications in food science, cosmetics and analytical

processes. In this study, phycoerythrin of red macro alga Kappaphycus alvarezii was extracted by freezing and thawing method in sodium phosphate buffer (0.1 M). The protein was precipitated with 60% ammonium sulphate saturation and dialysed against the same buffer (10 mM) and lyophilized. The R-PE was analysed for its various physic-chemical properties and the analyses revealed that R-PE has characteristic affinity towards different metal ions, inhibitors,organic solvents, preservatives at different monochromatic irradiances.

Keywords: Phycoerythrin, Red algae, Kappaphycus alvarezii, Metal ions, Inhibitors, Organic solvents

Sanil, R., and C. L. Prabhu. 2009. "Studies on the Impact of Biotic Stress in Near Shore Coral Areas of Palk Bay." Journal of Basic and Applied Biology 3(1 and 2): 87–92.

Address: Department of Wildlife Biology, Government Arts College, Stone House Hill P.O. The Nilgiris.

Abstract: An impact assessment study was conducted at Palk bay to trace the biotic stress. Palk Strait is between Indian and Srilanka and is the inlet of Bay of Bengal. Palk bay is considered asone of the five major reef formations in India. The study shows that fishing, explosion, urban waste, waste of processing industry, exploitation of sea horse, Dugong are the major biotic stress to the Coral reefs of the bay . The study also discusses the possibilities of the impact due to the proposed Sethu-samudram project and resultant dredging. In can be concluded that the dredging and the resultant deposition of waste disturb the ecological balance of the protected Gulf of Mannar and Palkbay and can be another ecological backlash.

Keywords: Palk Bay, Biotic Stress, Sethusamudram Project, Dredging

Saravanan, R. and T. Sivakumar, 2013. "Biodiversity and Biodegradation Potentials of Fungi Isolated from Marine systems of East Coast of Tamil Nadu, India." International Journal of Current Microbiology and Applied Sciences 2 (7): 192–201.

Address: Department of Microbiology, Kanchi Shri Krishna College of Arts & Science, Kilambi – 631 551, Kancheepuram, Tamil Nadu, India. Email: shiva_fungi@rediffmail.com

Abstract: The present study was confined to the marine ecosystem in and around Mamallapuram coast, Tamil Nadu comprising of Mammallapuram and Water, sediment, and natural substrates of marine ecosystem were collected to isolate the fungi. All the collected samples were plated, incubated and the fungal colonies were identified. The water and sediment sample were collected separately and analysed for temperature, pH, biological oxygen demand, salinity and total dissolved solids on water. A total of 41 fungal species were isolated and enumerated by plating, techniques. In this study, 24 species of fungi were recovered from sediment samples whereas water samples yielded 30 species and natural substrates with 24 species. Among the Hyphomycetes, Aspergillus

was the common genus represented by 14 species followed by Penicillium and Cladosporium. Totally, 10 species of fungi were used for hydrocarbon studies. The growth pattern of fungi in diesel is T. viride had a maximum growth 24 mm with A. sulphueus had the least growth on the 5th day at 9 mm with A. niger. The growth pattern of fungi in petrol is P. citrinum had maximum growth on the 5th day at 90mm and minimum with 9 mm by A. oryzae. The growth pattern of fungi in Crude oil shown A. flavus had a maximum growth at on the 5th day mm and minimum growth rate was observed in A. oryzae with 9 mm. The growth pattern of fungi in kerosene is P. janthinellum had a maximum growth at 27 mm and the lowest growth rate in A. oryzae with 5 mm.

Keywords: Marine fungi, Isolation of fungi, Physico- chemical parameters, Species Diversity, Hydrocarbon degradation

Sathish, G. P., and K. Saravanan, 2014. "Environmental Planning for Sustainable Use of Gulf of Mannar Biosphere Reserve." Journal of Industrial Pollution Control 30 (1): 117–23.

Address: Department of Architecture, Sri Renugambal College of Architecture, Vellore, Tamil Nadu, India. Email: sathishgpr@yahoo.co.in

Abstract: This study provides guidelines for the sustainable use and conservation of biological diversity and for the improvement of the relation between people and their environment globally. Sanctuaries, National parks and Biosphere Reserves are considered as protected areas. There are 13 Biosphere Reserves in India. The program of Biosphere Reserve was initiated under "The man and Biosphere (MAB)" program by UNESCO in 1971. Biosphere Reserves are areas of terrestrial and coastal or marine ecosystem, or a combination thereof, which are internationally recognized for promoting and demonstrating a balanced relationship between people and nature. This paper focuses on environmental planning of Gulf of Mannar Biosphere Reserve which extends from Rameswaram Island to Tuticorin. There are 21 islands running almost parallel to the coastline of Gulf of Mannar. It spreads over an area of 10500 sq. km having 3600 species of flora and fauna.130 species of corals are found here. This study provides a guideline for sustainable use of resources, activities to be permitted along coastal stretch, coastal highways, and mangroves, reclamation of saline and alkaline soil, coastal pollution, sedimentation, avifauna, settlements, tourism and recommended vegetation.

Keywords: Ecosystem, Biodiversity, Corals, Mangroves, Flora, Fauna, Avifauna

Saxena, A. 2015. "Coral Reefs and Their Conservation – A Review." Biological and Chemical Research: 187–206.

Address: Fishery Resource Management College of Fisheries, G.B. Pant University of Agriculture and Technology, Pantnagar – 263 145, India. Email: amitasaxena36@gmail.com

Abstract: Coral reefs are colonies of tiny animals found in marine water which is having nutrients/minerals. Most of the coral reef built from stony coral polyps in a big group of cnidaria. Polyps secrete hard carbonate exoskeletons for support and protection. It is a rainforest of sea which better grow in warm, shallow, sunny, clear and agitated water, but in deep waters and cold water they also exist in small scales. Coral reefs are good for fisheries, tourism and shoreline protection. The annual global economic value of coral reefs is about US$30.1-37.5 billion.

Keywords: Coral, Reefs, Corallum, Tourism, Fisheries conservation

Scholtens, J., M. Bavinck, and A. S. Soosai. 2012. "Fishing in Dire Straits: Trans-Boundary Incursions in the Palk Bay." Economic and Political Weekly XLVII (25), 87–96.

Address: University of Amsterdam, Netherlands. Email: j.m.bavinck@uva.nl
Abstract: Controversies related to Indian trawlers crossing into Sri Lankan waters of the Palk Bay have repeatedly been the subject of newspaper headlines in both India and Sri Lanka since 1990. The first aim of this paper is to provide grass-roots insights into the post-war status of the north Sri Lankan fishing population and how their recent recovery has added a new dimension to the Palk Bay conflict. The second purpose is to create a better understanding of the nature of this conflict and to analyse the relevance of existing and proposed governance responses. Contrary to popular perception in India, this paper argues that since the end of the civil war in Sri Lanka the nature of the conflict in the Palk Bay has changed from one in which Indian trawler fishermen were faced with the Sri Lankan navy, to one which sets them primarily in opposition to the technologically less advanced Sri Lankan fishermen. It concludes that the governmental and fisher-based efforts to settle the conflict are ineffective as long as Indian parties do not acknowledge the nature of the conflict and the Sri Lankan authorities do not bring the fishermen and their government closer together.

Shanker, S., and P. Vijayanand. 2014. "Abnormal Starfish, Pentaceraster regulus from Thondi, East Coast of India." Cell & Developmental Biology 3 (2): 1–3.

Address: Faculty of Marine Science, Annamalai University, Parangipettai, Tamilnadu, India. Email: shanker.sel@gmail.com

Abstract: Starfish Pentaceraster regulus was collected from Thondi coast, this species usually have 5 arms. An unusual, abnormal sea star, P. regulus was found with only 4 arms. Then its length and weight of arm's length were measured and tabulated.

Keywords: Abnormal sea star, P. regulus, four arms, Thondi

Silva, E. I. L., J. Katupotha, O. Amarasinghe, H. Manthrithilak, and R. Ariyaratna. 2013. "Lagoons of Sri Lanka: From the Origins to the Present." Colombo, Sri Lanka: International Water Management Institute (IWMI). 122p. doi: 10.5337/2013.215

Address: Sri Lanka Development Initiative, International Water Management

Institute, 127 Sunil Mawatha Pelawatta, Battaramulla, Sri Lanka. Email: h.manthri@cgiar.org, Website: www.iwmi.org

Singh, K. V., W. S. Lakra, A. Gopalakrishnan, M. J. Modayil, A. K. Malakar, and R. C. Sobti. 2011. "Molecular Identification and Phylogenetic Relationship of Seahorse, Hippocampus kuda (Bleeker 1852) using Mitochondrial 16s rRNA and COI Gene Sequences from East and West Coasts of India." The Indian Journal of Animal Sciences 81(1).

Abstract: Traditionally, fish species identification is based on morphological characters, yet, in many cases it is difficult to establish identity as in the case of seahorses which lack key species diagnostic morphological features. The spotted or yellow seahorse Hippocampus kuda has a complex identity and the samples collected from the east and west coasts of India were analyzed for the species identification and phylogenetic relationship, based on partial sequence information of mitochondrial genes 16S rRNA and Cytochrome Oxidase subunit I (COI). Estimates of genetic divergence with both 16S rRNA and COI genes, when compared with the sequence divergence values of H. kuda from other continents (as obtained from NCBI accessions) were sufficient enough to discriminate individuals of the same species from Indian waters. Pairwisef ST values using AMOVA indicated significant levels of genetic differentiation of H. kuda populations among east coast, Kerala and Konkan populations; However, no significant genetic partitioning was observed between the Palk Bay and Gulf of Mannar populations.

Keywords: Cytochrome oxidase subunit I (COI), Hippocampus kuda, Mitochondrial DNA, Seahorse, 16S rRNA gene

Sithu, S. G. D., B. Kuppusamy, M. Subramaniyan, and H. M. Sheik. 2015. "Sediment Geochemistry with Population of Recent Benthic Ostracoda in Palk Bay, Southeast Coast of India." Geosciences Journal: 1–9. DOI 10.1007/s12303-015-0035-0

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Abstract: Seasonal observation on trace elements of shallow inner shelf sediments and their correlation with the population of recent benthic ostracoda off Rameswaram, Ramanathapuram District, Tamil Nadu, Southeast coast of India is the aim of this study. The sediments were analysed for trace elements Al, Fe, Mn, Zn, Cu, Pb, Cd, Ni, Co and Cr and being correlated with the population of benthic ostracoda for four different seasons. Cu has a positive correlation, and Fe, Mn, Zn, Pb, Cd, Ni, Co and Cr have negative correlation with the total population of ostracoda. Al has no considerable correlation with the total population of ostracoda. In the middle segment plenty of corals were found in the study area and their effect being discussed.

Keywords: Trace elements of sediments, Recent benthic ostracoda, Seasonal correlation

Sivaleela, G., Deepak Samuel, T. Anbalagan, and S. Shrinivaasu. 2013. "Seagrass Associated Marine Sponges in Palk Bay." Records of the Zoological Survey of India 113 (Part-3): 01–7.

Address: Marine Biology Regional Centre, Zoological Survey of India, 130, Santhome High Road, Chennai – 28. Email: gsivaleela@yahoo.com

Abstract: In the Palk Bay a total of 16 specimens as belonging to 9 species of sponges as belonging to seven genera and six families were recorded from the seagrass beds. Genus Spirastrella was dominant and seems to be an integral part of seagrass ecosystems. Fishing pressure through bottom set gill nets and trawling were identified as major threats to sponges and other associated organisms in the seagrass communities.

Space Applications Centre, ISRO. 2012. Coastal Zones of India. Ahmedabad, India: Space Applications Centre, ISRO.

Sridhar, R., T. Thangaradjou, and L. Kannan. 2008. "Comparative Investigation on Physico-Chemical Properties of the Coral Reef and Seagrass Ecosystem of the Palk Bay." Indian Journal of Marine Sciences 37 (2): 207–13.

Address: Ministry of Environment and Forests, Paryavaran Bhavan, CGO Complex, Lodhi Road, New Delhi – 110 003, India.

Abstract: Coral reef and seagrass ecosystems separated by a distance of 25 km in the Palk Bay region were investigated for their physico-chemical properties. Monthly variations of different parameters investigated are as follows: air temperature (27 – 35 °C), surface water temperature (25.0 – 31.5 °C), LEC (0.54 – 1.22 k), salinity (28.0 – 36.0%0), pH (7.0 – 8.2), DO (3.15 – 6.68 mll−1), nitrate (0.25 – 7.3 µM), nitrite (0.03 – 2.91 µM), inorganic phosphate (0.12 – 4.1 µM), reactive silicate (0.6 – 7.4 µM) and POC (0.28 – 3.25 mg C l−1). There is distinct spatial variation on the above parameters between the stations. The present study had elucidated that the ecosystems like coral reefs and seagrass are prefer specific environmental conditions for their survival.

Keywords: Physico-chemical characteristics, Coral reefs, Seagrasses, Water quality, Nutrients, Palk Bay

Sridhar, R., T. Thangaradjou, and L. Kannan. 2010. "Spatial and Temporal Variations in Phytoplankton in Coral Reef and Seagrass Ecosystems of the Palk Bay, Southeast Coast of India." Journal of Environmental Biology 31 (5): 765–71.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Science, Annamalai University, Parangipettai – 608 502, India. Email: umaradjou@gmail.com

Abstract: Spatial and temporal behavior of distribution of phytoplankton of the coral reef and seagrass environment of the Palk Bay was studied during April 2002 to March 2003. A total of133 species of phytoplankton was recorded during

the study period, of which, 98 species belong to Bacillariophyceae, 15 species belong to Dinophyceae, 12 species belong to Cyanophyceae and 8 species belong to Chlorophyceae. Diatoms (57.14 to 94.10%) contributed more towards the percentage composition of different groups of phytoplankton at the two stations, followed by dinoflagellates (3.12 to 28.57%), blue-greens (2.43 to 12.5%) and greens (3.7 to 7.69%). Higher phytoplankton population density was recorded during the summer season at both stations (St.1. 62,000 cells l−1 and St.2. 55,000 cells l−1). Coral reef environment was two-fold more productive (2.10 to 130.21 mg C m−3 hr−1) than the seagrass environment (3.30 to 85.56 mg C m−3 hr−1). Chlorophyll 'a' concentration showed higher values at station 1, corresponding to the higher phytoplankton population density recorded at this station along with primary productivity.

Keywords: Phytoplankton, Palk Bay, Coral reef, Seagrass, Ecosystem

Sridhar, R., T. Thangaradjou, L. Kannan, and S. Astalakshmi, 2010. "Assessment of Coastal Bio-Resources of the Palk Bay, India, using IRS-LISS- III Data." Journal of the Indian Society of Remote Sensing 38: 565−75.

Address: Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamilnadu, India. Email: umaradjou@yahoo.com

Abstract: Coastal resources viz., coral reefs, seagrasses, mangroves, and coastal land features viz., sandy beach, mudflats and salt pan/aquaculture ponds were classified and assessed in the Palk Bay region of the south-east coast of India using IRS LISS III satellite image (1996, 2000, 2002 and 2004). The study recorded an area coverage of 286.95 ha of reef area during 2004, which is 177.54 ha lesser than that of the reef area of 1996. The reef vegetation composed mainly of seaweeds has gained over 29.44 ha during the same period. Likewise, sand over reef area has also increased alarmingly i.e. 120.34 ha between 1996 and 2004. The seagrass beds of Munaikkadu region of the Palk Bay are comparatively protected and have gained over 7.5 ha between 1996 and 2004. It has been found that both the dense (2.99 ha) and sparse (36.45 ha) mangroves have gained their areal coverage considerably between 1996 and 2004. Whereas in Devipattinam region, many anthropogenic pressures are exerted only on the seagrass resources which has led to the reduction of over 785.5 ha of dense seagrass beds between 1996 and 2004. The study clearly indicated that the resources are under the pressures of low to high threats, especially the coral reefs and seagrasses, if the pressures continue, coastal resources of the Palk Bay may face serious threats of destruction in this part of the Bay in the years to come.

Keywords: Seagrass, Mangroves, Coral reefs, Mapping, Palk Bay

Srinivasakumar, K. P., and M. Rajashekhar, 2009. "The Population Abundance, Distribution Pattern and Culture Studies of Isolated Microalgal Strains from Selective Sampling Sites along the South East Coast of India." African Journal of Biotechnology 8 (16): 3814–26.

Address: Department of Biosciences, Mangalore University, Mangala Gangothri, Karnataka, India – 574 199. Email: srinibiotech@yahoo.co.in Abstract: The present study was conducted to understand the microalgal dynamics and surveillance in the selective sites along the south east coast of India. Algal isolation was carried out in 61 sampling stations characterized by different ecological features. In total 10 microalgal species were isolated under laboratory condition from the collected samples. The composition of microalgal distribution and their surveillance were related to the environmental factors are discussed in the present paper. From the results it was observed that Isochrysis galbana [MA1] has the maximum surveillance at 37 spots [60.7%]. It was also observed that 25.7% of the collection spots may share same microalgal dynamics and surveillance. In order to understand the better background information about the importance of culture condition in the optimal growth of microalgal strains, experimental setup were designed using modified Walne's and Guillard f/2 medium. Studies were also carried out to understand the relation between the growth conditions and environmental factors including salinity, temperature, pH and dissolved oxygen. The growth study was further designed by providing the culture setup with 2 different light : dark illustration of 24:0 with 1000 lux setup and 16:8 with 1000 lux. The results show 70% of the isolated samples grown in Walne's medium and 60% of samples grown on guillard's f/2 medium prefer to grow optimally under 16:8 light : dark illustration. It was also observed that Walne's medium encourages better growth for the collected microalgal samples when compared with the Guillard's medium.

Keywords: Microalgae, Inoculum, Phytoplankton, Dissolved oxygen, GPS

Stella, C., and S. Vijayalakshmi. 2012. Diversity of Bivalves – Palk Bay: Classification and Description of Bivalve Species from Palk Bay Area- In Tamil Nadu, South East Coast of India. Saarbrücken, Germany: LAP Lambert Academic Publishing.

Stella, C., P. Paul, and C. Ragunathan. 2015. "Three New Distributional Records of Pen Shells (Bivalvia: Pinnidae) from Seagrass Beds of Palk Bay Area in Tamil Nadu." Sustainability, Agri, Food and Environmental Research 3 (1): 17–25.

Address: Department of Oceanography and Coastal Area Studies, Alagappa University, Thondi Campus – 623 409, Tamil Nadu, India.

Abstract: The new occurrence of three species of bivalves from Pinnidae family is recorded for the first time from Palk Bay area based on a live organisms and dead shells collected from the intertidal area. All the three species are under the family of Pinnidae, Pinna bicolor, Pinna deltodes and Pinna incurva. In seagrass bed of Thondi Coast, all the species of Pen shells Pinna bicolor, Pinna deltodes and Pinna incurva were embedded in muddy sand and found associated with seagrasses at intertidal area. It was also found buried in hard substratum associated with living zoanthids and soft coral. The collected specimens were identified as, (1) Pinna bicolor, (2) Pinna deltodes and (3) Pinna incurva by using both morphometric and meristic characters. The paper described the taxonomic status and the description of the three species of bivalves collected from Palk Bay areas.

Keywords: Pinna bicolor, Pinna deltodes, Pinna incurva, Morphometry, Bivalves

Stephen, J. 2014. "A Place to Live and Fish: Relational Place Making Among the Trawl Fishers of Palk Bay, India." Ocean and Coastal Management 102, 224–33.

Address: Amsterdam Institute of Social Science Research, University of Amsterdam, The Netherlands. Email: johnyste@gmail.com, m.s.g.stephen@uva.nl

Abstract: In Palk Bay (India), fishing is intrinsically tied to a complex and dynamic geo-political situation. The trawl fishers from India are finding it increasingly difficult to operate in the bay due to the strict enforcement of the International Maritime Boundary Line (IMBL) by the Sri Lanka Navy and the increasing animosity of the small scale gill netters of Northern Sri Lanka, who accuse the Indian trawlers of encroaching and destroying their livelihood. In the multi-scalar nature of this conflict, it is easy for policy makers and researchers to get distracted by processes happening at different scales (regional, national) thereby ignoring the local processes that shape everyday fishing. By analysing the everyday lives and lived places of the fishers in the two trawl centres of Rameswaram and Mandapam, this article exclusively focusses on the scale of the local. A closer look at these centres, located in close proximity to each other, reveals substantial differences in the way fisheries are managed. The objective of this paper is to understand how one of these centres is able to manage its fleet better (better price for fishes, lower discards and higher compliance) than the other, increasing understanding of the dynamics of resource usage in Palk Bay to give clues for possible solutions. Through the ethnographic method, the research uses the concept of relational place making in analysing local fishery resource usage. By dialectically analysing the various social, political and economic processes both on land and at sea in each these centres; I conclude that the differences in management between them are an outcome of a series of complex interactions between several processes. Based on my analysis, I argue that the mismanagement of the Rameswaram fleet and the better managed Mandapam fleet cannot be attributed only to the relative strength of the institutional set up on land but should also take into consideration the conditions at sea. Thus, managing a complex fishery system requires a better understanding of the interaction of various processes that happen at different places of concern to the everyday lives of the fishers, moving beyond the limited narrow focus of several place based studies which focus on a singular place, social group and scale.

Stephen, J., 2015. "Fishing for Space: Socio-Spatial Relations of Indian Trawl Fishers in the Palk Bay, South Asia, in the Context of Trans-Boundary Fishing." Ph.D. Thesis, FMG: Amsterdam Institute for Social Science Research (AISSR). http://hdl.handle.net/11245/1.470302

Stephen, J., A. Menon, J. Scholtens, and M. Bavinck. 2013. "Transboundary Dialogues and the 'Politics of Scale' in Palk Bay Fisheries: Brothers at Sea?" South Asia Research 33 (2), 141–61.

Address: Madras Institute of Development Studies, Chennai, India.

Abstract: This article examines how the politics of scale affect a process of dialogue led by civil society actors over fishing conflicts taking place at the local level in South Asia. The location is the Palk Bay and the fishers are Tamils from India and Sri Lanka. An agreement over fishing rights reached between these fishers in August 2010 remains largely unimplemented, but takes centre stage for this article, which examines the negotiation processes in terms of politics of scale and highlights the various difficulties encountered. Major pitfalls in a dialogue of this sort are the failure to recognize diversity within the population(s) involved and lack of recognition of the linkages of this population with other actors at different scales or levels. In a transboundary context, national and regional identities at times override local identity and interests, thereby making locally constructed solutions difficult, if not impossible, to implement.

Keywords: Civil society, Collective governance, Community initiatives, Conflict resolution, Fisheries, Geography, India, Locality, Politics of scale, Region, Space, Sri Lanka, Tamils and transboundary commons

Sukumaran, S., R. M. George, K. Vinod, K. S. Sobhana, T. S. Naomi, and K. M. Manisseri. 2011. "Temporal Patterns in Biodiversity and Health Status of Reef Corals of Palk Bay." Indian Journal of Fisheries 58 (1): 73–7.

Address: Mandapam Regional Centre of Central Marine Fisheries Research Institute, Marine Fisheries P. O., Mandapam Camp – 623 520, Tamil Nadu, India. Email: sandya_sukumaran@yahoo.com

Abstract: A detailed study aimed at identifying the changes in biodiversity, live coral cover as well as health status of the Palk Bay Reef corals was carried out over a period of 4 years. The live coral percent cover was measured using Line Intercept Transect method at fixed sites in the reefs of Palk Bay in 2008 in order to study and make comparisons with the surveys conducted in 2004. Substantial decrease in live coral cover was observed over the last four years with a live coral cover of 13.65% and 12.9% in Velapertumuni and Kathuvallimuni Reefs respectively. Acropora cytherea and Favites abdita were the dominant and abundant species respectively in Velapertumuni Reef with relative abundance values of 21.08 and 10.85 respectively. However, in Kathuvallimunai Reef, Acropora lamarcki was found to be the most abundant species with a relative abundance value of 12.68. All other species belonged either to common/uncommon species status. Variations in community structure were also noticed in both the reefs. Even though, the total live coral cover was found to be reduced, the increased recruitment of fast growing species like Acropora has contributed to a fair diversity as indicated by the diversity indices. Studies on the disease prevalence in hard corals indicated more incidences of diseases in massive corals as compared to branching corals. Disease conditions such as brown band disease, Porites ulcerative white spot syndrome and pink line syndrome/porites pinking were recorded.

Keywords: Biodiversity, Coral reefs, Health status, Palk Bay

Sulochanan, B., A. K. Kumaraguru, and L. S. Korabu. 2011. "Hydrological Conditions in Seagrass Beds in Palk Bay and Gulf of Mannar, Southeast Coast of India." Journal

of Marine Biological Association of India 53 (1): 108–15.

Address: Regional Centre of Central Marine Fisheries Research Institute, Marine Fisheries P.O., Mandapam Camp – 623 520, Tamil Nadu, India. Email: binduchaithanya@yahoo.co.in

Abstract: Comparative analysis has been made on the water quality parameters in three seagrass sites, Sangumal and farm pond in Palk Bay. Thonithurai and one non seagrass site - Kundhukaal point in the Gulf of Mannar from January 2006 to December 2007. The atmospheric temperature ranged from 24.8 °C to 35.3 °C, sea surface temperature from 25 °C to 35°C, pH from 7.44 to 8.44, dissolved oxygen from 1.0 ml l−1 to 5.9 ml l−1 and total suspended solids from 10.7 mg l−1 to 122 mg l−1 in the four sites. The maximum concentration of phosphate, silicate, nitrite and nitrate in the water were 1.22 µmol l−1, 5.83 µmol l−1, 0.63 µmol l−1 and 2.03 µmol l−1, respectively. Sangumal had the maximum input of nutrients especially during the northeast monsoon. Pearsons correlation coefficient showed significant positive correlation ($\rho<0.01$) of sea surface temperature with pH, salinity, dissolved oxygen and negative correlation with total suspended solids, nitrite and ammonia. Though ANOVA did not show significant difference in water quality parameter between sites with and without seagrass, highly significant difference ($\rho<0.001$) was observed seasonally in sea surface temperature, salinity, nitrite, ammonia, wind velocity, rainfall and number of rainy days, thereby influencing the growth of seagrass beds.

Keywords: Seagrass, Nutrients, Sea surface temperature, Chlorophyll, Rainfall, Palk Bay, Gulf of Mannar

Suresh, V., C. Anbazhagan, R. Thangam, D. Senthilkumar, N. Senthilkumar, S. Kannan, R. Rengasamy, and P. Palani. 2013. “Stabilization of Mitochondrial and Microsomal Function of Fucoidan from Sargassum plagiophyllum in Diethylnitrosamine Induced Hepatocarcinogenesis.” Carbohydrate Polymers 92 (2): 1377–85.

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Abstract: Crude fucoidan from Sargassum plagiophyllum extracted from blade and purified by Q-Sepharose fast flow anion-exchange chromatography and three fucoidan fractions were obtained. Maximum sulphate containing fucoidan fraction was considered as purified fucoidan and purity was checked with agarose gel electrophoresis. The monosaccharides of purified fucoidan analysed by HPLC revealed the presence of the sugars such as fucose as a major sugar were 70.8 mol%. The percentages of other sugars were galactose (13.5%), xylose (2.5%) and mannose (11.2%). GPC was used to analyse molecular weight of purified fucoidan and it was found to be 35 kDa. The levels of ICDH, SDH, MDH, a-KGDH, Phase-I biotransformation enzymes, and Phase-II biotransformation enzymes were decreased in cancer bearing animals which may be due to oxidative stress and mitochondrial damage and fucoidan restored these enzyme activities. The inhibition of carcinogen metabolic activation indicates the anticancer activity of fucoidan in DEN induced liver cancer.

Keywords: Fucoidan, Sargassum plagiophyllum, Diethylnitrosamine, Hepatocarcinogenesis, Mitochondrial enzymes, Biotransformation enzymes

Suresh, V., N. Senthilkumar, R. Thangam, M. Rajkumar, C. Anbazhagan, R. Rengasamy, P. Gunasekaran, S. Kannan, and P. Palani. 2013. "Separation, Purification and Preliminary Characterization of Sulfated Polysaccharides from Sargassum plagiophyllum and its in vitro Anticancer and Antioxidant Activity." Process Biochemistry 48 (2): 364–73.

Address: Centre for Advanced Studies in Botany, University of Madras, Chennai, Tamil Nadu, India. Email: palanii7@yahoo.com

Abstract: Sulfated polysaccharides (SPs) were identified in different portions of the thallus of Sargassum plagiophyllum C. Agardh, with TBO staining. SPs were extracted using a blade and purified by Q sepharose fast flow anion- exchange chromatography, resulting in SP fractions F1, F2 and F3, with molecular weights of 30, 35 and 20 kDa, respectively. An SP yield of 43.1% was obtained in F3, while F2 yielded a sulfate content of 21.9%. Furthermore, the in vitro anticancer and antioxidant activities of the polysaccharide fractions were evaluated. The F2 fraction showed higher anticancer activity against HepG2 and A549 cells than the other two fractions, with IC50 values of 600 µg/mL and 700 µg/mL, respectively. The normal breast epithelial cell line (HBL- 100) exhibited IC50 concentrations of 1200 and 1400 µg/mL for crude sulfated polysaccharides (CSPs) and all SP fractions (F1–F3). These results indicated that the anticancer activity of F2 could be related to its sulfate content. However, the antioxidant activities of F1–F3 were low at their tested concentrations.

Keywords: Seaweeds, Sulfated polysaccharides, Antioxidant, In vitro anticancer, Apoptosis, Cell cycle arrest

Suriyanarayanan, S., G. M. Brahmanandha, K. Samivel, S. Ravikumar, and P. Shahul Hameed. 2010. "Assessment of 210Po and 210Pb in Marine Biota of the Mallipattinam Ecosystem of Tamil Nadu, India." Journal of Environmental Radioactivity 101: 1007–10.

Address: Nagasaki University Radioisotope Research Center, Radio Isotope Center, 1-12-4, Sakamoto, Nagasaki 852-8523, Japan. Email: brahma_king@yahoo.com

Abstract: To provide baseline data on background radiation levels for the future assessment of the impact of nuclear and thermal power stations, a systematic study was carried out in the Mallipattinam ecosystem of Tamil Nadu, India. Mallipattinam is located between the Kudankulam and Kalpakkam nuclear power plants and near to Tuticorin thermal power plant. Water, sediments, seaweeds, crustaceans, molluscs, and fish were collected to measure the concentrations of 210Po and 210Pb. The concentrations of 210Po and 210Pb in most samples are comparable to values reported worldwide. In fish, the concentrations of 210Po and 210Pb are in the range 16–190 Bq kg−1 and 8–153 Bq kg−1, respectively. The concentration factors of 210Po and 210Pb for the biotic components ranges from 103 to 106.

Keywords: Polonium, Lead, Palk Strait, Biota

Suriyanarayanan, S., G. M. Brahmanandhan, J. Malathi, S. Ravi Kumar, V. Masilamani, P. Shahul Hameed, and S. Selvasekarapandian. 2008. "Studies on the Distribution of 210Po and 210Pb in the Ecosystem of Point Calimere Coast (Palk Strait), India." Journal of Environmental Radioactivity 99 (4): 766–71.

Address: Solid State and Radiation Physics Laboratory, Department of Physics, Bharathiar University, Coimbatore – 641 046, Tamil Nadu, India. Email: brahma_king@yahoo.com

Abstract: A systematic study on the natural radionuclides such as 210Po and 210Pb in the environmental matrices of Point Calimere ecosystem has been undertaken to establish a baseline data on the radiation profile of Point Calimere environment. The environmental samples such as water, sediment and biota (seaweeds, crustaceans, molluscs and fish) have been subjected to analyses. It has been observed that the concentration of 210Po and 210Pb in the water samples of Point Calimere to be 0.5 mBq/l and 1.3 mBq/l, respectively. The soft tissues of the organisms accumulated higher 210Po content while shells and bones contained more 210Pb. The bivalve molluscs Meretrix casta have been identified to accumulate higher concentration of 210Po suggesting that they could serve as bioindicator of radionuclides like 210Po in the Point Calimere ecosystem. The concentration factor of 210Po for the biotic components ranged from ~ 103 to 106 while for 210Pb it ranged from ~ 103 to 105.

Keywords: Polonium, Lead, Point Calimere, Biota

Suryanarayan, V. 2008. Conflict over Fisheries in the Palk Bay Region. New Delhi, India: Lancer.

Suryanarayanan, T. S., A. Venkatachalam, N. Thirunavukkarasu, J. P. Ravishankar, M. Doble, and V. Geetha. 2010. "Internal Mycobiota of Marine Macroalgae from the Tamilnadu Coast: Distribution, Diversity and Biotechnological Potential." Botanica Marina 53 (5): 457–68

.**Address**: Vivekananda Institute of Tropical Mycology (VINSTROM), Ramakrishna Mission Vidyapith, Chennai – 600 004, India. Email: t_sury2002@yahoo.com

Abstract: Eleven brown algae, six green algae and eight red algae occurring along the coast of Tamilnadu state, southern India were screened for their fungal endophyte assemblages. The green algae had a low diversity of endophytes but were more densely colonized. The brown algae supported a higher diversity of endophytes. There were a few dominant endophyte species with a wide host range and several with low colonization frequency that were restricted to a few algal species. The endophytes produced bioactive compounds that inhibited bacteria, an alga and a fungus. They also produced antioxidants and insecticidal metabolites.

Keywords: Diversity, Endophytes, Fungal metabolites, Macroalgae, Marine algae

Sutha, S. P., M. Venkatesan, and K. Arunkumar. 2011. "Endobiotic Bacteria in Some Seaweeds of Thondi Coastal Region in Palk Bay, Tamil Nadu, India." Journal of the Marine Biological Association of India 53 (2): 251–6.

Address: Department of Botany, Alagappa Government Arts College, Karaikudi – 630 003, Sivagangai District, Tamil Nadu, India. Email: arunnir@yahoo.co.in

Abstract: Fifteen bacterial isolates were enumerated from the six seaweeds collected along the coast of Thondi in Palk Bay, India. Among the 15 isolates, 6 bacteria (Bacillus licheniformis, B. subtilis, B. pumilus, B. marinus, Staphylococcus aureus and Streptomyces coelicolar) were Gram's +ve and 4 bacteria (Pseudomonas fluorescens, Actinopolyspora sp., Vibrio mimicus and Serratia marscesens) were Gram's –ve. The species of Bacillus were dominant among 10 bacteria isolated. Bacillus subtilis ASbs 05 and Staphylococcus aureus ASsa 06 were isolated from the red seaweed Acanthophora spicifera whereas from Hypnea valentiae 3 bacteria such as Pseudomonas flourescens HVpf 03, Actinopolyspora sp. HVa 04 and Bacillus licheniformis HVbl 02 were isolated. The latter was also found in Gracilaria edulis GEbl 01 which was the only bacterium isolated from this alga. Of the 9 isolates of bacteria found in green seaweeds, Bacillus subtilis was isolated from Enteromorpha intestinalis EIbs 08 and Ulva lactuca ULbs 12 which was also found in red seaweed Acanthophora spicifera ASbs 05. Other two bacteria of 3 isolated from E. intestinalis were Bacillus pumilus EIbp 09 which was also found in E. flexuosa EFbp 10 whereas Streptomyces coelicolar EIsc 07 was exclusively found in E. intestinalis. Of the 2 bacteria isolated from E. flexuosa, Vibrio mimicus EFvm 11 was also found in Ulva lactuca ULvm 13. Among the 4 bacteria isolated from Ulva lactuca, the other two bacteria were Serratia marscesens ULsm 14 and Bacillus marinus ULbm 15 which were exclusively reported in this alga.

Keywords: Seaweeds, Endobiotics, Bacteria, Tamil Nadu, Palk Bay

Thangaradjou, T., M. B. K. Prasad, P. Subhashini, S. Raja. E. Dilipan, and E. P. Nobi. 2015. "Biogeochemical Processes in Tropical Seagrass Beds and their Role in Determining the Productivity of the Meadows." Geochemistry International 53 (5): 473–86.

Address: Centre of Advanced Study in Marine Biology, Faculty of Marine Sciences, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: umaradjou@gmail.com

Abstract: Porewater nutrient profiles such as nitrate (0.33–1.38 µM), ortho phosphate (1.47–3.44 µM), total nitrogen (1.24–7.22 µM) and total phosphorus (3.51–5.98 µM) in seagrass ecosystem subjected to different nutrient loading indicated the limitation of porewater nutrients in all the strata of different sampling sites of Palk Bay region. Sediment pH in the seagrass beds were alkaline and anoxic condition increased with increase in depth (56.2 mV to – 52.7 mV). Significant positive correlation was observed between silt content and carbon ($r = 0.359$, $P < 0.05$) and nitrogen contents ($r = 0.381$, $P < 0.05$) of the sediment. Species-wise interpretation also indicated C/N ratio of the stations greatly promoted the biomass in Halodule pinifolia and Cymodocea serrulata. The sediment C/N stoichiometry (4.7: 1–16: 1) indicated that autochthonous C sources regulates the

C biogeochemical processes in seagrass ecosystem which is well corroborated by the least square regression value (R2 = 0.92) obtained between the C/N ratio and biomass. Meanwhile, the N/P ratio (11.7: 1–17.2: 1) indicated P deficiency in the seagrass beds. Though, nitrogen limitation was evident in the porewater, but it has not reflected on seagrass biomass and productivity which is, evidenced by the higher biomass of individual species. Nutrient biogeochemical transformations across the sediment-water interface influence the productivity of seagrasses in the Palk Bay region. In addition, nutrient pollution, eutrophication and light limitation due to algal mats decreased the growth of seagrasses which need to be attempted to develop the nutrient policies for sustainable management and restoration of seagrass ecosystem.

Keywords: Seagrass, Biogeochemistry, Pore water content, Sediment chemistry, C/N ratio, Palk Bay

Thangaradjou, T., R. Sridhar, S. Senthilkumar, and S. Kannan. 2008. "Seagrass Resource Assessment in the Mandapam Coast of the Gulf of Mannar Biosphere Reserve, India." Applied Ecology and Environmental Research 6 (1): 139–46.

Address: Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: umaradjou@yahoo.com
Abstract: Aerial extent and distribution pattern of seagrass meadows in the Mandapam group of islands viz. Pamban area of Rameshwaram, Krusadai, Pullivasal and Pumarichan Island of the Gulf of Mannar Biosphere Reserve were studied. Visual interpretation and digital analysis of satellite data viz. IRS 1D LISS III (2000 and 2002) and IRS P6 LISS III (2004) showed the presence of extensive seagrass beds in these areas. Present study has recorded 3289.14 ha of reef area, 794.45 ha of reef vegetation, 726.15 ha of dense and 601.00 ha of sparse seagrass beds in this part of the Gulf during the year 2004. Further, spread and changes in seagrass cover in this region have been classified and loss has been estimated. In addition, drastic reduction in the seagrass resources of the Gulf of Mannar in certain places was identified and management plans to conserve this resource have been suggested.

Keywords: Seagrass, Assessment, Remote sensing, Anthropogenic

Thangaraj, M., A. P. Lipton, L. John, and A. Gopalakrishnan. 2012. "Genetic Diversity of Thee Spotted Seahorse, Hippocampus trimaculatus (Leach, 1814) in India Using Four Microsatellite Loci." Notulae Scientia Biologicae 4 (4): 07– 13.

Address: Annamalai University, Faculty of Marine Sciences, Parangipettai – 608 502, Tamil Nadu, India. Email: coralholder@yahoo.com

Abstract: Seahorse populations are declining year by year not only in India but also throughout the world, because of over fihing and increasing demand in Chinese market. The three spotted seahorse, Hippocampus trimaculatus is one of the dominant species and distributed all along the Indian coast. To study the genetic structure is very essential to conserve these species effctively. Hippocampus trimaculatus samples (n = 60/population) were collected from Mullimunai in

Palk Bay, Tuticorin in Gulf of Mannar and Vizhinjam in south Malabar in India as by-catch in small trawl nets. Microsatellites are being widely applied in animal genome mapping and phylogenetic analysis because of their co-dominant inheritance and high degree of polymorphism. The molecular polymorphism of microsatellite DNA has proved to be a potent tool in the analysis of several aspects of population genetics. In the present study, four microsatellite primers were used to investigate the genetic difference and structure of three selected populations of H. trimaculatus. The result showed the overall FST value (0.0989) of the microsatellite loci between Mullimunai and Vizhinjam was signifiantly diffrent ($p<0.0001$). Th genetic distance between Mullimunai and Tuticorin was 0.183; between Tuticorin and Vizhinjam was 0.461; and Mullimunai and Vizhinjam was 0.837. Thre was no statistical evidence of recent severe bottlenecks in any of the three populations. Continuous monitoring of microsatellite variations within the populations of all the three locations was suggested to determine whether genetic variation within the populations is stabilized between year classes.

Keywords: Hippocampus trimaculatus, Genetic diversity, Microsatellite, Molecular marker

Thangaraj, M., and A. P. Lipton. 2011. "Morphological Characterization of Four Selected Seahorse Species (Genus: Hippocampus) from India." Annals of Biological Research 2 (4): 159–67.

Address: Vizhinjam Research Centre of Central Marine Fisheries Research Institute, Vizhinjam, Thiruvananthapuram, Kerala, India.

Abstract: To infer the variation of four Indian seahorse species (Hippocampus fuscus, H. kelloggi, H. kuda and H. trimaculatus), the morphometric and meristic characters were analysed. The plot of second sheared principle component and first factor (morphometric matrix) showed species overlapping. However the plot of second sheared principle component and another first factor (meristic matrix) showed all the species were well grouped. Based on the hierarchical cluster analysis, trunk length, tail length and tail ring were the key character to distinguish the species.

Keywords: Seahorse, Hippocampus, Morphometric, Meristic characters

Thayalan, M., A. Priya, V. N. Hameetha Banu, M. G. Bhagavathi Roopini, and J. Sesh Serebiah. 2015. "Comparative Spatial Assessment of Phytoplankton and Productivity in Coastal Fresh Water Pond, Estuary and Neritic Water of Palk Bay, South East India." International Journal of Advanced Research in Biological Sciences 2 (3): 301–14.

Address: Jehovah Shamma Center for Marine and Wildlife Research, Ramanathapuram, Tamil Nadu, India. E-mail: seshserebiah@yahoo.com Abstract: Spatial distribution of phytoplankton, hydrobiological parameters and productivity were investigated in coastal fresh water pond, estuary and neritic water of Palk bay, India. The temperature of the study area varied from 30.8 °C to 38.1 °C. Salinity of the study area ranged from 0.57 ppt to 34.28 ppt. pH during study ranged from 7.5 to 8.2. Dissolved Oxygen (DO) concentration of the study area ranged from 3.36

mg/l to 4.75 mg/l. A total of 103 species of phytoplankton were identified, among them, eighty three species were recorded from diatom, four species from blue green algae and sixteen species from dinoflagellate. The highest phytoplankton density in coastal fresh water pond, estuary and neritic waters of Palk Bay were 112000, 388750, 296800 cells l−1 respectively. Net primary productivity recorded was high in the neritic waters (148 mg.C/m3/hr) followed by estuarine water (138 mg.C/m3/hr) and low in the coastal fresh water pond (28 mg.C/m3/hr).

Keywords: Phytoplankton, Primary productivity, Pappankanniar estuary, Diversity and Canonical Correspondence Analysis

Theangaraj, M., and A. P. Lipton. 2010. "Genetic Identity of Three Indian Populations of Three Spotted Seahorse, Hippocampus trimaculatus." Advances in Biological Research 4 (1): 37–41.

Address: Centre for Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India.

Abstract: The genetic identity of three populations of Hippocampus trimaculatus was estimated using a molecular marker (Cyt b). About 620 bp of Cyt b gene sequence was compared and analysed. The genetic divergence between the Mullimunai and Tuticorin populations was 0.0016; between Mullimunai and Vizhinjam was 0.0016 and between Tuticorin and Vizhinjam the genetic distance was 0.0032. The nucleotide diversity was 0.00161 ± 0.0023 in all the three populations respectively. AMOVA result showed that the ΦST and the FST was 0.000 between the populations. But within populations, ΦST was 1.000 and FST was also 1.000 indicating no differences in populations.

Keywords: Seahorse, Hippocampus trimaculatus, Genetic identity, Mt DNA

Thilagavathi, B., D. Varadharajan, J. Manoharan, S. Vijayalakshmi, and T. Balasubramanian. 2012. "Taxonomy and Distribution of Benthic Foraminifera from the Sediment of Palk Strait, South East Coast of India." International Journal of Pharmaceutical and Biological Archives 3 (5): 1129–36.

Address: Faculty of Marine Sciences, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: thilaga_marine@yahoo.com

Abstract: A systematic study of benthic foraminifera has been made based on depth wise sediment samples collected in Palk Strait region. A total of 101 benthic foraminifera species belonging to 36 genera, 15 families. 8 subfamilies and 5 suborders are identified. The above species were compared to inventories given by earlier workers on east west coast faunas. The result shows that the presence of 38 species for the first time in this Strait. All the 38 species are illustrated here and their taxonomical details are provided. Composition of Foraminifera and their concentration at different depth have been studied with Standard reference and planktonic foraminifera being dealt with separately.

Keywords: Palaeontology, Foraminifera, Distribution, Palk Strait, India

Thinesh, T., G. Mathews, and J. K. Patterson Edward. 2011. "Coral Disease Prevalence in the Palk Bay, Southeastern India – with Special Emphasis to Black Band." Indian Journal of Geo-Marine Sciences 40 (6): 813–20.

Address: Suganthi Devadason Marine Research Institute, 44-Beach Road, Tuticorin – 628 001, Tamil Nadu, India.

Abstract: Present study consists the details related to the nature of coral disease in nine locations from Vethalai to Rameswaram north in the Palk Bay. Among the overall corals 21% were affected by disease. Six disease types were documented. Black Band Disease (BBD) is high with 9.8% followed by white band (5.5%), white spot (2.2%), pink spot (1.9%), white plague (1.1%) and yellow band (0.6%). Eight coral genera were found to be affected wherein Acropora and Porites showed severe damage and the high prevalence of diseases. The coral genus, Porites was found to be affected by four different types of diseases. BBD affected colonies were tagged and photographed at regular intervals to quantify the progression rate in two coral genera, Acropora and Platygyra and the disease progression rate was 3 cm per month. White band disease was widespread and was found to affect exclusively Acropora sp. Corals like Symphylia sp. and Cyphastrea sp. in the Palk Bay were comparatively not affected by diseases. Total heterotrophic bacteria and pathogenic microbial forms in the reef environment were also examined in the present study.

Keywords: Palk Bay, Coral disease, Pollution, Temperature

Thiruneelakandan, B., T. J. R. Kumar, C. Dushiyanthan, R. Suresh, K. Karthikeyan, and D. Davidraju. 2014. "A Study on Spectral Reflectance with Surface Water Quality and Chlorophyll-A Concentrations in Muthupet Lagoon of Thiruvarur District, Tamilnadu." International Journal of Innovative Technology and Exploring Engineering 3 (9): 8–11.

Address: Department of Earth Sciences, Annamalai University, Annamalai Nagar – 608 002. India.

Abstract: In this paper, processing techniques for field measurements of spectral reflectance on chlorophyll-a in part of Muthupet lagoon, Thiruvarur district, Tamilnadu. This study focused upon improving the accuracy of chlorophyll quantification by applying wavelet analysis to reflectance spectra. Spectral reflectance measurement was carried out 5 different locations using ASD Field spectrometer in month of July 2011. The reflectance factor was computed and analyzed in RS3 software package the compared spectral curve shows peaks between 400 to 850 nm in most of the measuring locations. The chlorophyll-a content in spectral investigated locations 0.046, 2.258, 2.181, 3.569, 2.378 µg/l. Our results show that spectral signatures for chlorophyll-a observed in the lagoon and the field had similar characteristics with high reflectance in visible region of the spectrum from 500 to 650 nm, but low in the NIR region from 750 to 850 nm.

Keywords: Chlorophyll-a, Reflectance, Spectral Signature

Umagowsalya, G., R. Anithajothi, K. Duraikannu, and C. M. Ramakritinan. 2015. "The Dynamic Aerobic Culturable Microbes from Coral Niches and their Antimicrobial Properties." International Conference on Plant, Marine and Environmental Sciences (PMES-2015) January 1-2, 2015 Kuala Lumpur (Malaysia).

Address: Department of Marine and Coastal Studies, Madurai Kamaraj University, Tamilnadu, India.

Abstract: Marine invertebrates such as corals and sponges from deep oceans to shallow coastal area colonize taxonomically diverse bacteria that are rich sources of novel bioactive compounds. The bacterial communities associated with scleractinian corals are highly specific in nature. Thus the present study is aimed to isolate aerobic bacteria from the coral surface for exploring their antimicrobial properties. The crude extracts from the isolates were assessed for its potential acitivity against Gram positive, Gram negative bacteria and Candida albicans using the agar well diffusion method. About 42 culturable coral surface associated aerobic bacteria were isolated. Among the 42 isolates 5 showed maximum activities (≤ 25 to 33 mm zone of inhibition) and their phylogenetic analysis were done using 16S rRNA sequencing. The phylogenetic analysis of coral associated bacterial belongs to Pseudomonas, Firmicutes and Brevibacterium sp. These bacterial isolates can be exploited for pharmaceutical application.

Keywords: 16S rRNA, Antimicrobial activity, Coral associated bacteria, Scleractinians

Umamaheswari, G., M. Srinivasan, and T. Ramanathan. 2011. "Heavy Metal Concentration from Shrimp Culture Ponds at Point Calimer Area." Current Research Journal of Biological Sciences 3 (2): 73–7.

Address: C.A.S. in Marine Biology, Faculty of Marine Science, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India.

Abstract: Palk Strait estuarine water was highly polluted by Cu, Fe, Pb, Zn and Hg. The study was carryout the interactions between heavy metals and microorganisms. The study area paying attention on the role of probiotic bacteria such as Bacillus cereus, Aeromonas hydrophila, Pseudomonas aeruginosa, Azotobacter vinelandii, and Lactobacillus sp. to remove the metals from polluted nine aquaculture ponds through the way of bioremediation, bioaccumulation and mineralization process. The highest inhibition zone was absorbed in Pseudomonas aeruginosa against Hg (3.796 mm) and Cu (0.060 mm), Aeromonas hydrophila against Pb (5.526 mm) and Bacillus cereus against Zn (4.504 mm) and Fe (1.635 mm). No inhibition zone was produced by Azotobacter beijerinckii and control also maintained.

Keywords: Heavy metals, Palk Strait, Penaeus monodon

Varadharajan, D., and P. Soundarapandian. 2012. "Commercially Important Crab Fishery Resources from Arukkattuthurai to Pasipattinam, South East Coast of India."

Journal of Marine Science: Research and Development 2 (4): 1–6.

Address: Faculty of Marine Sciences, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: heartvaradhan@gmail.com

Abstract: The documentation of crab landings especially commercially important crabs are need of the hour to get clear picture about total landings of crabs and also their seasonal availability for better management. So it is attempted to record the individual as well as total crab landings from Arukkattuthurai to Pasipattinam. The individual male, female and berried crabs were reported uniformly maximum in Mallipattinam and minimum in Pasipattinam (Mallipattinam > Manamelkudi > Jegathapattinam > Sethubavachatram > Pointcalimere > Arukkattuthurai > Muthupettai > Adirampattinam > Kattumavadi > Pasipattinam). However total landings of male (48976 kg), female (38745 kg) and berried (16533 kg) crabs were recorded maximum in Mallipattinam. However male (23932 kg), female (16087) and berried (5418) crabs were minimum in Pasipattinam. Among 12 crab species reported P. pelagicus (165297.8 kg) was maximum and C. truncata (18371.28 kg) was minimum for all sexes. Among various stations crabs were landed maximum in Mallipattinam (104254 kg) and minimum in Pasipattinam (45437 kg).

Keywords: Crab, P. pelagicus, P. sanguinolentus, Resources, Arukkattuthurai, Pasipattinam

Varadharajan, D., and P. Soundrapandian. 2014. “Crab Biodiversity from Arukkattuthurai to Pasipattinam, South East Coast of India.” Indian Journal of Geo-Marine Sciences 43 (4): 676–98.

Address: Faculty of Marine Sciences, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India. Email: heartvaradhan@gmail.com

Abstract: Coastal environment provides a greater range of habitats and thus potentially supports greater biodiversity. Before starting to produce seeds in a hatchery and culture them in ponds, thorough knowledge about their distribution in nature is important. So the present study is aimed to know the biodiversity of crabs from Arukkattuthurai to Pasipattinam. Totally 79 individual crab species were recorded belonging to 21 families from all 10 stations. Maximum crab species were recorded belonging to the family Portunidae than others families and also the maximum number of crab species 163 were recorded in Mallipattinam (station5) and minimum 69 species in Pasipattinam (station10). Occurrence of crab species in different stations were in the following order; Mallipattinam (163) > Sethubavachatram (161) > Manamelkudi (127) > Pointcalimere (117) > Muthupettai (116) > Jegathapattinam (110) > Kattumavadi (101) > Arukkattuthurai (92) > Adirampattinam (85) > Pasipattinam (69). Crabs were collected plenty during summer and monsoon than pre- monsoon and post-monsoon. The crabs belonging to families viz., Calappidae, Portunidae, Potamidae, Grapsidae, Sesarmidae and Ocypodidae were obtained almost all seasons.

Keywords: Crabs, Family, Portunidae, Distribution, Abundance

Varadharajan, D., P. Soundarapandian, T. Balasubramanian, and B. Thilagavathi. 2012. "Lucosia anatum - A Newly Recorded Crab in Indian Coast." Journal of Exclusive Management Science 1 (7): 1–7.

Address: Faculty of Marine Sciences, Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu, India.

Abstract: The Palk Bay along the Indian coast is well known for their faunistic richness and variety. A number of species of previously unknown marine animals have been discovered thriving in one of the strangest habitats on Earth. In the present study the species Lucosia anatum Herbst, 1783 is also described and recorded from the Indian coast in recent years, raising the number of Leucosiid crabs in the coastal region. This species collected naturally via marine debris and ocean currents. Most introduced marine species are bening causing no known adverse effects. However some species become invasive in a new environment.

Keywords: Decapoda, Leucosiidae, Leucosia, Lucosia anatum

Vasanthabharathi, V., V. Kalaiselvi, and S. Jayalakshmi. 2013. "Biosynthesis of Silver Nanoparticles from Marine Sponge Callysspongia diffusa Associated - P. fluorescens BCPBMS-1." Egypt Academic Journal Biological Sciences 5 (1): 40–48.

Address: CAS in Marine Biology, Faculty of Marine Sciences Annamalai University, Parangipettai, Tamilnadu, India. Email: bharathigene@rediffmail.com

Abstract: New applications of nanomaterials are rapidly emerging. The synthesis of nanoparticles is a cornerstone of nanotechnology. Microbialcells are highlyorganized units, regarding morphology and metabolic pathways, capable of synthesizing well size-calibrated and well-structured particles. Furthermore, biogenic nanoparticles often are water-soluble and biocompatible, which is essential for many applications. Molecular identification of a novel strain P. fluorescens BCPBMS-1 from sponge Callysspongia diffusa (Mandapam Coast) through 16s rRNA ribotyping (Gen bank accession number: HQ907732). The silver nanoparticles were analyzed by UV-Visible spectroscopy. Their chemical composition was determined by FT-IR spectroscopy. SEM observation revealed that silver nano particles are having spherical shape. The antibacterial activities of silver nanoparticles were screened against common human pathogen Escherichia coli, Proteus mirabilis, Salmonella typhi, Salmonella paratyphi, Vibrio cholerae, Klebsiella oxytoca, Klebsiella pneumoniae and Staphylococcus aureus. Among these 5 mm antibacterial activity was observed with E. coli, 4 mm with P. mirabilis and S. typhi, 3 mm activity was observed with S. paratyphi. These results suggest that Ag nanoparticles can be used as effective growth inhibitors in various microorganisms, making them applicable to diverse medical devices and antimicrobial control systems.

Keywords: Silver nanoparticles, FT-IR, SEM.

Venkatachalam, A., M. B. Govinda Rajulu, N. Thirunavukkarasu, and T. S. Suryanarayanan. 2015. "Endophytic Fungi of Marine Algae and Seagrasses: A Novel Source of Chitin Modifying Enzymes." Mycosphere 6 (3): 345–55.

Address: Vivekananda Institute of Tropical Mycology (VINSTROM), Ramakrishna Mission Vidyapith, Chennai – 600004, India. Email: t_sury2002@yahoo.com

Abstract: Endophytic fungi (which infect living tissues of plants and reside in them without causing any visible disease symptoms) were isolated from 19 seaweed and 10 seagrass species growing in Mandapam (Palk Bay, 9°16'N, 79°7'E), Keezhakarai (Palk Bay, 9°13'N, 78°46'E), Kodiyakkarai (Palk Strait, 10°16'N, 9°49'E) and Kovalam (Bay of Bengal, 8°22'N, 76°59'E) along the eastern coast of Tamilnadu state, southern India and screened for the production of chitinase and chitosanase enzymes. This study was done during July 2012 - December 2012. Of the 117 fungi screened, 14% was positive for chitinase, 41% was positive for chitosanase acting on chitosan of 56% degree of acetylation, 66% was positive for chitosanase acting on chitosan of degree of acetylation 38% and 56% was positive for chitosanase acting on chitosan of degree of acetylation 1.6%. Among the isolates, a Penicillium sp. and a Cladosporium sp. showed high chitinase activity. Presence of NaCl in the medium influenced the production and activity of chitinase and chitosanase. This study identifies for the first time endophytic fungi of marine plants as a novel source of chitin modifying enzymes which find use in food, cosmetics, agriculture and pharmaceutical industries.

Keywords: Chitinase, Chitosanase, Marine-derived fungi, Marine angiosperms, Seaweeds

Venkatesan, V., C. Kalidas, P.U. Zacharia, and S. Rajagopal. 2010. "Distribution of Molluscan Fauna in the Karangad Estuarine Mangroves, South East Coast of India." Advances in Environmental Sciences - International Journal of the Bioflux Society 2 (2): 113–20.

Address: Regional Centre of Central Marine Fisheries Research Institute, Mandapam Camp, India. Email: venkatcmfri@yahoo.co.in

Abstract: A survey has been made during February 2010 to know the pattern of molluscan fauna in the mangroves located along the Karangad estuary. During the present investigation in the research area, 25 species of molluscs were recorded. They belong to 14 genera, 10 families and 5 orders. In the study area, 13 species of gastropods namely, Cerithidea fluviatilis,Terebralia palustris, Cerithium citrinum, C. scabridum, C. obeliscus, Littorina scabra, L. undulata, Planaxis sulcatus, Drupa margariticola, D. heptagonalis, Thais rudolphi, T. bufo, and T. tissoti and 12 species of bivalves – Gafrarium tumidum, G. pectinatum, Crassostrea madrasensis, Mactra cuneata, Tellina ala, T. bruguieri, Saccostrea cucculata, Modiolus metcalfei, M. tulipa, M. traillii, Meretrix meretrix and M. casta - were recorded.

Keywords: Mangrove, Malacofauna, Karangad estuary, Molluscs, India

Venkatesan, V., R. Saravanan, S. Meenakshi, S. Umayaparvathi, and T. Umakalaiselvi.

2014. “Antibacterial Activity in the Extracts of Accessory Nidamental Gland of the Palk Bay Squid Sepioteuthis lessoniana (Lesson, 1830) (Cephalopoda: Decapoda).” Indian Journal of Fisheries 61 (4): 145–7. Address: Central Marine Fisheries Research Institute, Kochi – 682 018, Kerala, India. Email: venkatcmfri@yahoo.co.in

Abstract: The present study illustrates antibacterial activity from the accessory idamental glands (ANGs) of Palk Bay squid, Sepioteuthis lessoniana (Lesson, 1830). ANGs from squids at different maturity stages (immature, maturing, ripe and spent) were used for extraction using various solvents viz., acetone: alcohol, ethanol, butanol and methanol. The antibacterial activity of the extracts was evaluated by disc-diffusion method, using four pathogenic strains of bacteria (Escherichia coli, Aeromonas hydrophila, Staphylococcus aureus and Bacillus megaterium). The extracts from different maturity stages (maturing, ripe and spent) showed different levels of antibacterial activity against the tested bacterial strains, except in B. megaterium. The immature stage ANG- extracts did not exhibit any antibacterial activity while the other stages showed pronounced activity. Among the four extracts, butanol extract showed the maximum antibacterial activity, followed by methanol extract. Maximum antibacterial activity was found in ripe stage, especially in butanol extract against E. coli (10.1 ± 1.65 mm) and minimum activity was found in ethanol extract against A. hydrophila (3.0 ± 0.94 mm) in the maturing stage.

Keywords: Accessory nidamental glands, Antibacterial activity, Palk Bay Sepioteuthis lessoniana

Venkateshwarlu, P., D. Raman, and M. Vijay. 2014. “Atomic Absorption Spectroscopic Determination and Comparison of Trace Elements in the Seaweeds.” International Journal of Modern Chemistry and Applied Science 1 (2): 5–10.

Address: Analytical Chemistry Division, Indian Institute of Chemical Technology, Tarnaka, Hyderabad, India – 500 607. Email: gouthumm@gmail.com

Abstract: Many marine algae are being used by humans, in many edible, medicinal and commercial products. Sargassum wightii, Dictyota dichotoma, Hypnea musciformis, Jania rubens, Halimeda, Kappaphycus alvarezii, Turbinaria conoides, Cylindracea and Padina gymnospora were collected from Palk Bay, Mandapam, Tamilnadu, India. Toxic (Pb, Cd, Pt, Pd and Cr) and essential (Zn, Mn, Ni, Co, Cu and Fe) metals in eight algae were determined by Flame atomic absorption spectrometry (FAAS). Our results showed that iron, zinc, lead, manganese and cadmium were found in significantly more than the other assessed elements in the studied algae. Of all the studied seaweed species the concentration of Cd, Ni, Cu and Cr are above the ADI limits except in Kappaphycus alvarezii (Cu and Cr<ADI). Palladium concentration in Dictyota dichotoma was below the detection limit, whereas in all other algal species it was observed above the ADI limit. Lead content in Dictyota dichotoma (28.5 ppm), Hypnea musciformis (22.5 ppm), Jania rubens (54.8 ppm) and Halimeda cylindracea (78.8 ppm) was observed to be above the ADI limits. The trace elements Zn, Fe, Co and Mn also found in some edible and non edible algae beyond the ADI limits.

Keywords: Heavy metals, Algae, India, FAAS

Vinoth, R., and S. Ravikumar. 2012. "First Record of Dorid Nudibranchs Chromodoris geminus (Rudman, 1987) from the Palk Strait of South East Coast of India." Advances in Biological Research 6 (5): 182–5.

Address: Department of Oceanography and Coastal Area Studies, School of Marine Sciences, Alagappa University, Thondi Campus, Thondi – 623 409, Ramanathapuram District, Tamil Nadu, India. Tel: +91-4561-243470.

Abstract: Nudibranchs are soft bodied sea slugs diversified along tropical India oceans. It has derived defense chemicals since the upper Cambrian the sea slugs are reported in Gulf of Mannar of south India. The present study reports the first time distribution of sea slugs along Palk Strait region of south India.

Keywords: First record, Sea slugs, Chromodoris geminus, Palk Strait

Viswanathan, S., N. Usha., and P. Anitha. 2013. "Seasonal Variability of Coastal Water Quality in Bay of Bengal and Palk Strait, Tamilnadu, Southeast Coast of India." Brazilian Archives of Biology and Technology 56 (5): 875–84. Address: Centre for Water Resources, Anna University, Chennai. Email: u_natesan@yahoo.com

Abstract: The aim of this work was to study the physicochemical parameters of water quality collected from 12 sampling stations from Topputhurai to Muthupet in Vedaranyam located on the southeast coast of India from January to December 2008. Results showed that the DO and nutrients were the maximum in the Bay of Bengal during the monsoon period. High concentration of the nutrients in summer season was obtained near the Muthupet mangroves compared to the Palk Strait, which showed that this acted as a source of nutrients to the adjacent coastal waters. Low concentrations of the nutrients observed in the monsoon could be attributed to the terrestrial runoff from Muthupet lagoon. The physicochemical characteristics of coastal waters between the Point Calimere and Muthupet could be used as a baseline data for the monitoring, conservation and management of Point Calimere Wildlife and Bird sanctuary, Great Vedaranyam swamp and Muthupet mangrove ecosystem.

Keywords: Coastal zone, Physico-chemistry of water, Nutrients, Vedaranyam, Bay of Bengal, Palk Strait

Viszwapriya, D., C. Aravindraja, S. Karutha Pandian. 2015. "Comparative Assessment of Bacterial Diversity Associated with Co-Occurring Eukaryotic Hosts of Palk Bay Origin." Indian Journal of Experimental Biology 53 (06): 417– 23.

Address: Department of Biotechnology, Alagappa University, Science Campus, Karaikudi – 630 004, Tamil Nadu, India. E-mail: sk_pandian@rediffmail.com

Abstract: Epibacterial communities of co-occurring eukaryotic hosts of Palk Bay origin (five seaweed species (Gracilaria sp., Padina sp., Enteromorpha sp., Sargassum sp., and Turbinaria sp.) and one seagrass [Cymodaceae sp.]) were

analyzed for diversity and compared using 16S rRNA based Denaturant Gradient Gel Electrophoresis analysis. Diversity index revealed that Turbinaria sp. hosts highest bacterial diversity while it was least in Gracilaria sp. The DGGE band profile showed that the epibacterial community differed considerably among the studied species. Statistical assessment using cluster analysis and Non-metric multidimensional scale analysis also authenticated the observed variability. Despite huge overlap, the composition of bacterial community structure differed significantly among the three closely related species namely Sargassum, Turbinaria and Padina. In addition, Enteromorpha and Sargassum, one being chlorophyta and the other phaeophyta showed about 80% similarity in bacterial composition. This differs from the general notion that epibacterial community composition will vary widely depending on the host phyla. The results extended the phenomenon of host specific epibacterial community irrespective of phylogeny and similarity in geographical location.

Keywords: Cymodaceae, DGGE, Epibacterial community, Enteromorpha, Gracilaria, Host associated microbiota, Metagenome, Padina, Sargassum, Seagrass, Seaweed, Turbinaria

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The CMPA Project

The Project "Conservation and Sustainable Management of Coastal and Marine Protected Areas" (CMPA) is a project of the Indo-German technical cooperation. It is funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and implemented by the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of BMUB.

Established to support the achievement of the Aichi targets of the Convention on Biological Diversity, the Project's overall goal is to contribute to conservation and sustainable use of biodiversity in selected areas along the coast of India. Taking into consideration the economic importance of the coastal zone for large segments of the population, the Project's approach is people-centered, thus ensuring the support for conservation by those depending on coastal ecosystems.

CMPA Technical Report Series

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A Bibliographic Review: Identification and Prioritization of Research Gaps inthe Palk Bay (PB) Tamil Nadu

March 2016

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Indo-German Biodiversity Programme
Conservation and Sustainable Management of Coastal and Marine Protected Areas