INTRODUCTION

This report encapsulates all the learning outcomes that resulted from the field visit to Rameshwaram (Mandapam). The students of 1MBOT were accompanied on this 3 day trip (from 21/08/2019 to 23/08/2019) by our HoD. Fr. Jobi Xavier, professors, Dr. Paari KA, Mr. Joel Jose and Laboratory associate Mr. Joseph. With their expertise and knowledge, the trip proved to be a very informative and educative.

The Central Marine Fisheries Research Institute station at Mandapam is a rich reservoir of various marine algae belonging to several genera and species. It proved to be a great location for the collection of algae, and a good amount of algal samples were collected. The learning experience was enriched by Mr. Ramamoorthy, who was not only an extremely knowledgeable guide but also a compassionate host.

This report is a detailed analysis of the algal species collected during the field visit and the important events that occurred during the trip. The report also gives an insight into the various objectives of the trip and how these were fulfilled by the students. It also provides a view of the learning outcomes of the field visit.

OBJECTIVES

The study trip made to Rameshwaram had the main aim as collecting algae from their natural habitat. The students were thus exposed to the areas where the marine algae could be collected. The objective of the study trip are mentioned as follows:

- Providing knowledge of habitat of particular algae. The algae can either be freshwater habitants or marine. The collection trip gave each and every student who were part of the trip, an idea about the places where sea weeds are found in abundant.
- Exposure to collecting techniques- Proper safety is to be ensured while collecting algae from the sea. The collection is to be done only during the low tide and with proper cautions taken.
- Identification of collected algae- The algae were collected in presence of an efficient algologist who could describe the genus and species name of the collected samples. This enhanced the ability of each and every student to identify an alga even from its natural habitat.
- Knowledge of preservation of the collected algae- The collected algae were to be preserved for future uses in the laboratory and for other research works. The preparation of preserving solutions was prepared by the students themselves under guidance of an expert. This gave knowledge about constituents of the solution.

The trip therefore was arranged with all these aims ahead and thus imparted all essential knowledge about all the parameters mentioned above.

ABOUT THE INSTITUTE:

The Central Marine Fisheries Research Institute was established by Government of India on February 3rd 1947 under the Ministry of Agriculture and Farmers Welfare and later it joined the ICAR family in 1967. During the course of over 65 years the Institute has emerged as a leading tropical marine fisheries research institute in the world. CMFRI as branched out all over India as regional camps mainly on the western and eastern costal regions. One the main reginal camp is CMRFI Mandapam camp.

The Central Marine Fisheries Research Station at Mandapam is one of the recently established Central Institutes of the Government of India under the Ministry of Food and Agriculture. The Institution was started in 1947 with temporary laboratory accommodation provided by the University of Madras. The headquarters at Mandapam was set up in 1949 when the buildings constructed originally as a naval hospital by the Defence Department during World War II, were acquired and converted into laboratories and temporary residences for the staff. CMFRI, Mandapam is one of the largest research organisation in India, lots of marine research projects are conducted related to the estimation of marine fisheries, Fisheries management, coastal mariculture, sea farming, Bio diversity, Biotechnology etc. About ninety acres of land and the road leading to the site are being acquired at Mandapam on the Palk Bay side, for setting up an experimental Marine Fish Farm.

There is a Museum and aquarium opened for the view of tourists and research people. The marine museum located here is one of the largest marine museums in India and contains more than 3000 species. The species in the museum includes vast varieties of fishes and other fauna and flora, fossils etc., of Gulf of Mannar Bio reserve and from the seas around India which includes Andaman & Nicobar and Lakshadweep Islands.

DESCRIPTION OF THE COLLECTED ALGAE:

1) Caulerpa racemosa

Place of collection: These species were collected from Palk bay, near Rameswaram, Tamil Nadu. They were found attached to the substratum near the beach.

Classification:

Kingdom: plantae

Class : Chlorophyceae

Order : Siphonales

Family : Caulerpaceae

Genus : *Caulerpa*

Species : *racemosa*

Description: Like the closely related Caulerpa lentillifera, C. racemosa is edible. It is consumed widely in salads in Japan, Fiji, the Philippines, and Thailand. It is also eaten by local fishermen in Malaysia and Indonesia. They are rich in fibre, proteins, minerals (calcium and magnesium), folic acid, ascorbic acid, vitamin A, and vitamin B1 while also being low in fat.This plant has erect branches arising from the horizontal stolon attached to the sediment at intervals by descending rhizomes. A large number of branchlets, resembling spherical bodies on stalks, arise from each erect branch. Where the branches and stolon are close together, the branchlets form a dense spherical structures. The plants are coenocytic, i.e., the plant is multinucleate and no septate.

C. racemosa reproduces vegetative by fragmentation. When pieces of the plant get broken off they develop into new plants. Small pieces of tissue only a few millimetres across are capable of doing this. C. racemosa can also reproduce sexually and in so doing exhibits holocarpy. This means that all the organism's cytoplasm is used up in the creation of the gametes and only a husk remains at the site of the original plant. The assimilators acts as gametangia and produce gametes which comes out through intrusion of papillae. The plants are monoecious with male and female gametes(anisogamous) being produced by the same plant and liberated into the water column where they unite to give spherical zygotes.

2) Caulerpa peltata

Place of Collection: Gulf of Mannar (Rameshwaram)

Classification:

Class: Chlorophyceae

Order: Bryopsidales

Family: Caulerpaceae

Genus*: Caulerpa*

Species: *peltata*

Description: Plants with well developed stolons. Stolons, naked, horizontal, creeping over the substratum, robust or delicate, much branched, giving off rhizoids below and erect assimilators above. Rhizoids, cylindrical, delicate, colourless, erect axis, vertical varying from 1-10 cm in length, with numerous short branchlets. Branchlets, closely set, radiating in all the directions, each branchlet terminating in a peltate assimilating disc, the ramenta. Ramenta pointing directly obliquely upwards, 3-8 mm across, more usually 3mm or 2.5-4 mm in diameter. Colour light green. Substance, cartilaginous, ramuli and ramenta membranous, tough. It is edible in form of salad.

3) Caulerpa taxifolia

Place of collection: Gulf of Mannar (Rameshwaram)

Classification:

Division: Chlorophyta

Class: Chlorophyceae

Order: Bryopsidales

Family: Caulerpaceae

Genus: *Caulerpa*

Species: *taxifolia*

Description: Plants, gregarious, growing in larger or smaller tufts on rocks, stones or creeping on muddy sea floors of lagoons. Stolon, naked, creeping, several inches long, branched, 2mm or more thick, rooting from the lower surface at intervals and with erect branches above. Roots deeply descending. Fronds, in one plane, lanceolate linear, simple or branched, 20 -30 cm or more long. Branches, irregular, shorter than the main frond, but similar to main frond. Stipe of frond, short, up to 5mm long at base of round, bare of pinnae. Above, rachis 1 – 1.5 mm thick, closely pinnate up to the apex. Pinnae, opposite, erect, nearly equal, slightly constricted at base, surface glossy. Substance, soft membranous or localities or even in deeper waters, etc.

4) Valonia utricularis

Place of collection: Palk bay, near Rameshwaram district, Tamil Nadu

Classification:

Class : Chlorophyceae

Order : Cladophorales

Family : Valoniaceae

Genus : *Valonia*

Description: The plant body is cushion like with a tuft of cylindrical to clavate vesicles making it look like a hemispherical dome. They are green and grow upto a height of about 5cm. Vesicles are profusely branched and interconnected by hapteroid growths of lenticular cells. Valonia is found in the intertidal rocks and stones in coral reefs, often in tide pools.

5) Ulva lactuca

Place of collection: Palk Strait, Gulf of Munnar

Classification:

Phylum: Chlorophyta

Class: Chlorophyceae

Order: Ulvales

Family: Ulvaceae

Genus: *Ulva*

Description: *Ulva lactuca* is also known as sea Lettuce. It is a thin, flat green algae growing from a discoid holdfast. The margin is ruffled and torn. It may reach 18 centimetres or more in length, through generally much less. The membrane is two cells thick, soft and translucent and grows attached without a stipe, to rocks or to other algae by a small disc- shaped holdfast. It is green to dark green in colour. The chloroplast is cup- shaped in this species and sometimes it is parietal plate in others with one to three pyrenoids. It is locally used in Scotland, Japan and many South Asian countries in soups and salads. It is a marine macro algal flora of coastal areas.

6) Halimeda

Place of collection: Palk bay, Tamil nadu

Classification:

Class-Chlorophyceae

Order-Siphonales

Family-Codiaceae

Genues -*Halimeda*

Description: They grow in shallow depressions, cracks and crevices, between hard corals and other somewhat protected areas of the reef, down to 55 m. It is constructed of articulated sequences of flattened calcified segments (plates) of various shapes, alternating with non-calcareous joints (nodes). The Growth form can be erect, pendant, or sprawling, achieving a height (length) of a few centimetres to a meter or more. Attachment to substratum can be with a single large bulbous holdfast this typically and consists of fine siphons with adhering sand particles or a single small, discrete holdfast of tuffed filaments.

7) Enteromorpha compressa

Place of collection: Mandapam

Classification:

Division: chlorophyte

Class: chlorophyceae

Order: ulvales

Family: ulvaceae

Genus: *Enteromorpha*

Description: plants, gregarious, attached to rocky substratum and coralline rocks and boulders. Frond, tubular, compressed, varying in dimensions, narrow at base, dilated above at apex, broadly rounded, 10-15cm high. Branches usually simple. Colour, bright to dark green. Substance membranous.

8) Dictyota

Place of Collection: Palk Bay in Tamil Nadu

Classification:

Class: Phaeophyceae

Order: Dictyotales

Family: Dictyotaceae

Genus: *Dictyota*

Description: It is a marine algae found widely distributed in tropical areas growing attached to rocks in intertidal zones. They are known to contain numerous chemicals (diterpenes) which have potential medicinal value. As at the end of 2017, some 237 different diterpenes had been identified from across the genus The plant body is flat, ribbon-like, attached to the substratum by means of hold-fast. The thallus is dichotomously branced. The apical portion of the frond is acute and has an entire margin. The short life cycle (less than 3 months) of Dictyota has three overlapping alternation of generations.The holdfast helps in anchorage.

The thallus consist of cylindrical stalk and an extensively branched top portion. The internal structure has three layers of cell. The cells have large vacuole with chromatophore. Asexual reproduction is by tetrasporangia formation. Sexual reproduction is by means of oogamous reproduction. The antheridia and oogonia occur in cluster called sori. female sori are deep brown, appearing as spots on both sides of the thallus, containing 25–50 oogonia arranged in rows with sterile oogonia at the margins. Each oogonium contains one egg cell, is fertilized externally, and develops to form the sporophyte. Haploid aplanospores or tetraspores are usually produced on mature sporophytes.

9) Padina

Place of collection: Palk bay, Rameshwaram, Tamil Nadu.

Classification:

Kingdom: Plantae

Class: Phaeophyceae

Order: Dictyotales

Family: Dictyotaceae

Genus: *Padina*

Description: Padina is a marine brown alga widely distributed throughout the tropics. The thallus is fan-shaped with thin and translucent fronds. It is olive brown to yellow brown in colour. The frond typically consists of two or more layers. The upper surface is calcified. In the erect to recumbent fan-like fronds of Padina, calcium carbonate in the form of aragonite is precipitated within the circinate apical portions and deposited as needle or hair like structures which gives it a ringed appearance. It is attached to the substratum by a persistent mass of rhizoids. It reproduces asexually by spore-production (tetraspores) and sexually by isogamy. Padina shows alternation of isomorphic generations with a dominant sporophytic phase.

10) Sargassum wightii

Place of collection: Mandapam,Gulf of Munnar

Classification:

Division: Phaeophyta

Class: Phaeophyseae

Order: Fucales

Family: Sargassaceae

Genus*: Sargassum*

Description: Sargassum wightii, Greville (Sargassaceae) belonging to the family Sargassaceae is an abundant marine brown alga commonly found in the shorelines of India, coast of Taiwan and shore waters of northern Arabian Sea. It is a macroscopic, multicellular, photosynthetic, non-vascular, pelagic marine species rich in sulphated polysaccharides that manifest potent free radical scavenging and antioxidant effects. Root expanded and disc like. Stem erect, several, generally undivided. Branches several and distichous. Leaves are long, narrow and lanceolate. Receptacles are axillary, filiform, compressed and much divided.

11) Sargassum lanceolatum

Place of collection: It is found abundantly in all the beaches of Rameshwarm including Gulf of Mannar, Palk bay and Mandapam beach also.

Classification:

Class- Phaeophyceae

Order- Fucales

Family: Sargassaceae

Genus: *Sargassum*

Species: *lanceolatum*

Description: All the characters are same as that of other Sargassum species the only difference is in the shape of leaves. The leaves are in the Lance shape. The taxonomic author of this species is J. Agardh. This specie is native to Western Australia.

12) Sargassum duplicatum

Place of collection: Gulf of mannar, Palk bay

Classification:

Kingdom : Plantae

Division : Phaeophyta

Class : Phaeophyceae

Order : Fucales

Family : Sargassaceae

Genus : *Sargassum*

Species : *duplicatum*

Description: *Sargassum* algae grows in sea waters that have a rock bottom substrate, dead coral, volcanic rock and massive objects that are at the bottom of the water. *Sargassum* algae grow from intertidal, subtidal to coastal areas with large waves and heavy currents. It grows in depth of 0.5-10m and the genus is widely known for its planktonic (free-floating) species. *Sargassum duplicatum* have very wide variation ranges of leaves and vesicles, regardless of few cup-shaped characteristic leaves. It consists of a holdfast, a stipe, and a frond and berrylike gas-filled bladders that help the fronds float to promote photosynthesis. Oogonia and antheridia occur in conceptacles embedded in receptacles on special branches in the form of finger like projection.

13) Turbinaria

Place of Collection: Palk Bay

Classification:

Class: Phaeophyceae

Order: Fucales

Family: Sargassaceae

Genus: *Turbinaria*

Description: Turbinaria is a genus of Brown Algae found primarily in tropical marine waters. It generally grows on rocky substrates. The plants are characteristically cone shaped, yellowish-brown in colour. The plants are profusely branched and its basal portion is formed of Hapteron.

14) Amphiroa

Place of collection: Palk bay coast of Tamil Nadu.

Classification:

Class- Rhodopyceae

Order: Gelidiales

Family- Gelidiaceae

Genus- *Amphiroa*

Description: The thallus is multi axial and as long and short cells in the intergenicular region, and grows in lower mid littroal zone and favors sheltered area. The thallus articulate, attaining the height of 4-6 centimeter. Branching is dichotomous. Intergenicular are short and the upper one comparatively longer. Basal geniculate are prominent and brownish. Dichotomous branching generally have a common genicula. Genicula in this alga resembles as swollen pad, structurally the thallus is multiaxial, meristematic cells at the apical region

are covered by single layer of cover cells having a diameter 6-8 microns. Intergenicular medulla consists of long and short cells.

15) *Gracillaria corticata* var corticata (J.Agardh) J.Agardh

Place of collection: Gulf of Munnar

Classification:

Division:Rhodophyta

Order:Gracilariales

Class: Rhodophyceae

Family: Gracilariaceae

Genus: *Gracilaria*

Description: Plants grow in dense tufts ,several growing together from a firm and hard hold fast on rocky substratum .Thallus reaching 10-15 cm high ,rigid ,cartilaginous for greater part except for the extremities of the ramuli ,repeatedly branched somewhat di or tripartite ,width of segments 1-2 mm or 2-3 mm; in some cases even up to 3-4mm. Apices of segments acute or obtuse .Some plants ,however having narrow almost linear thallus, tapering a little towards extremities, regularly divided with cuneate elongated segments .Thickness of frond more or less uniform .This red alga is a dominant member of the algal community in the intertidal zones and a little lower, as well as on rocky faces constantly washed by violent breakers in many places Along the coasts .It can be blended with other species of Gracillaria for manufacture of agar.

16) *Gracillaria follifera* (Forsskal) Boergesen

Place of collection: Gulf of munnar

Classification:

Division: Rhodophyta

Class: Rhodophyceae

Order: Gracilariales

Family: Gracilariaceae

Description: Plants are bushy ,brownish red ,15 to 20cm tall; Polydichotomously branched, irregularly and sometimes pinnately branched with thin and brittle fronds; margins proliferous. It grows abundantly in shallow lagoons and submerged coral reefs and very

rarely in the intertidal zone. It is a good source for production of agar along with other Gracillaria species.

17) Kappaphycus alvarezii

Place of collection: Palk Bay coast of Tamil Nadu

Classification:

Division: Rhodophyta

Class: Florideophyceae

Order: Gigartinales

Family: Solieriaceae

Genus: *Kappaphycus*

Description: Kappaphycus is a genus of red algae. It is a marine alga. Growing attached to calcareous solid materials of detrital origin. Genus Kappaphycus is "morphologically plastic", with few visible characters that can be used to separate the taxa, so distinguishing the species can be difficult. In addition, many commercial varieties have been bred. Molecular analyses can be used. In general, these algae have fleshy thalli that grow erect from one or more anchors. The longest individuals can exceed a meter in length. All species produce kappa-carrageenan. Gavino Trono is a Filipino biologist called the "Father of Kappaphycus farming". Kappaphycus alvarezii is widely cultivated as a raw source of carrageenan, and other species are used, as well. Several Kappaphycus are invasive species. Kappaphycus also contains monounsaturated fatty acids and polyunsaturated fatty acids which are associated with beneficial changes in metabolic syndrome such as increased HDL-cholesterol, decreased triglycerides, and improved cardiovascular and liver health. Kappaphycus alvarezii, was evaluated for its potential to prevent signs of metabolic syndrome through use as a whole food supplement. Major biochemical components of dried Kappaphycus are carrageenan (soluble fiber ~34.6%) and salt (predominantly potassium (K) 20%) with a low overall energy content for whole seaweed.

18) Acanthophora

Place of collection: This alga is found to be in the waters of Gulf of Mannar.

Classification:

Class: Rhodophyceae

Order: Ceramiales

Family: Rhodomelaceae

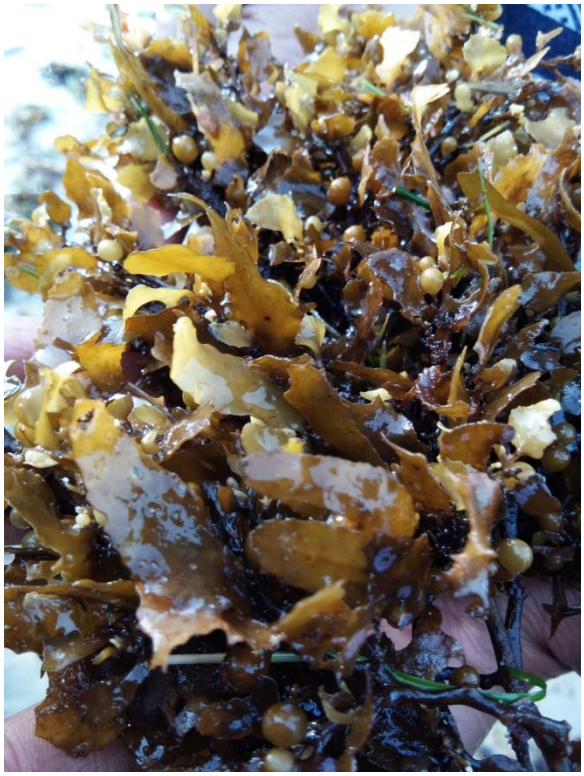
Genus: *Acanthophora*

Description: Acanthophora is marine red algae. The alga is branched. The branches are smooth, cylindrical and heavily corticated. Apices of the alga are pointed bearing dichotomous hair-like trichoblasts that can envelop mature apices. Holdfast is an irregularly lobed, disc-like, thickened crust from which several erect axes arise. It shows triphasic life cycle which includes three phases- sporophytic, gametophytic and formation of tetrasporangia. Gametophytes are dieceous. On the adaxial surface of the thallus, cystocarps are present.

CONCLUSION

It was very enthusiastic and memorable experience. We were able to collect different types of algae even though there were high tides. We collected many algal specimens, of which we preserved some and few algae enabled us to study morphology and anatomy of the same. We visited Central Marine Fisheries Research Institute, saw various specimens of marine life, and saw the processing and cultivation of ornamental fishes and edible fishes. The field trip helped us to identify and study the characteristic features of different algae for our curriculum.

PHOTO GALLERY



Sargassum wightii

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Sargassum duplicatum

Turbinaria

Valonia

Sargassum lanceolatum

Gracilaria corticata

Enteromorpha

Ulva

Acanthophora

Kappaphycus