INTRODUCTION

Since time immemorial, the coastal waters have been of great significance to man - economically, culturally and scientifically. At present due to human population explosion and dwindling resources on land, man is increasingly turning his attention towards ocean - as a major source of food, industrial chemicals and energy - and in this process the plant life, both attached and floating, is become of immense importance.

However, inspite of the enormous potential, the actual utilization of the marine plants has remained rather modest. In the marine ecosystems, benthic plants are important components of algal bed and reefs as well as estuarine ecosystems and hence were called as seaweed ecosystems. Among the marine plants, seaweed ecosystems have been recognized to be important in relation to other organisms of the sea (Fuse, 1962) and also in their roles in nutrient cycles and fixing energy in the coastal regions (Littler and Arnold, 1982; Norton 1985). Thus, seaweeds are valuable aquatic products which have contributed to human life, especially as utility in natural ecosystems, food for man and live-stock and industrial material. However, the variety and profusion of the marine flora are very inadequately appreciated by the average person, to whom they are just sea-weed. Most of

them therefore, are ignorant of the very existense of the vast forests of the sea which are in every way comparable with those on land, and contain a multiplicity of strking forms some of giant proportions, like the kelps of the colder water. They are the real Titans of the marine plant world, the giant kelp, Macrocystis, the Sea Plams (Lessonia) and Durvillaeas being typical examples. These occupy vast tracts and are remarkable for their large diamensions as well as for their customary growth in dense communities which may aptly be compared with the forest of land.

The dense growth of brown sea-weeds near shore as well as the red sea weeds which often grow intermingled with them, form a sort of scrub vegetation in comparison. But they can also cover extensive areas. The algal vegatation of tropical seas is much like the latter.

The red and brown algae are economically important as producers of agar-agar and algin which form staple raw material for several industries. Thus, these forests of the sea are vitally important natural resources.

Besides constituting a large source of food to the sea, these algal forests, succeed in utilizing a large section of the

sea bottom which is too dimly lightened to raise any appreciable growth of algae.

They also provide an adequately lighted place of attachment for the smaller epiphytes and epizooids. Finally, they form an effective break water, fringing the coast and markedly damping the wave action on the shore side.

Thus, these "forests of the sea" are vitally important natural resources. Hence, attempts to assess the quantity of economically important sea weeds have been made in our country from time to time. Some of the earlier accounts do not give a clear statement regarding the methods employed in arriving at the estimates and in those instances where definite methods have been described.

Agar manufacturers in India mostly use Gelidiella acerosa as the raw material and to a less extent Gracilaria edulis is also used. Other sea weeds which may be used as sources of agar are Gracilaria corticata, G. folifera and G. verrucosa. Hypnea musciformis, which is a very common alga gives an extractive with a low gelling capacity but this can be improved

by suitable treatment. Our alginate industry depends mainly on Sargassum and Turbinaria to a lesser extent, as the raw material.

The past two decades have put India on the world map as one of the maritime nations which are serious on developing their seaweed resourcees and as one which has made a mark by establishing seaweed industries. During the fifties, and the early sixties, we were engaged in equipping ourselves with all the two well known techniques of agar-agar production. Now is the opportune moment to take stock of the situation and plant suitably for the future.

Once we were feeding the voracious industries elsewhere with our raw material along with others but now much to our dismay, we are unable to feed our own industries fully so that we can utilise them to their full capacity, and some industries seem to have faced closer owing to raw material shortage. It is good to analyse the causes and make suitable provision in our research programmes to avoid such situations in the future.

Unfortunately, collecting for industry seems to have gone on rather indescriminately disturbing ecological conditions without any care for recovery and regeneration. It is time we paid some attention to conservation and proper husbanding of our

resources. Side by side, cultivation of useful species on large scale for augmenting existing resources, the drawing up of regulated harvest schedules with harvest holidays, setting up of a chain of feeder cottage industries, utilizing drift material and charting out of a whole series of R and D activities based on our past experience and those of others in the seaweed industry are all urgently needed, if we are to safe guard the future of our own sea weed based industries.

Available estimates clearly indicate that the seaweed resources of the country are by no means adequate. With the setting up of more manufacturing units as is likely in the near future, the demand for raw material may soon far exceeed the availability. Therefore, there is a vital need for augmenting the seaweed resources of the country.

Besides, the sea weeds are rich source of vitamins, minerals, fertilizers and above all are used as food, feed and fodder. Thus, there is a need for greater cooperation in tackling problems in research and development. There is scope for many agencies to join hands in this effort. Extension programmes and field studies can conveniently be carried out in farms that can be established at different points in our coast. We, in this

country, deifnitely lack farms with competant staff capable of engaging themselves in marine algae and it is our hope that sooner or later we should begin seriously thinking on establishing these farms.

Marine algae commonly known as seaweeds have been used since time immemorial for various purposes throughtout the world.Considering their significant potentiality it is debated, whether seaweeds can become food and energy resource of 21st century (Leeper, 1976). Recently this marine wealth has attracted the attention world over as renewable source of energy, apart from their uses as food, feed, fertilizer, chemical and pharmaceutical.

Today various research organizations in India and in various other countries of the world are actively engaged in exploring ways to exploit algae as a potent source of feed to combat the problem of rapidly growing world population, and also as a possible food source in space flight.

Besides, the marine algae have recently been investigated for the production of methane gas (Hanisak 1981), paper (Kiran et al., 1980), bio active compounds in pharmacy (Hoppe et al. 1979), dyes (Novak and Rasmussen, 1981) and in

human diseases (Stein and Borden, 1984).

More recently physiologists, biochemists, molecular biologists and geneticists have realised that these organisms not only provide ideal experimental material for the investigation of general biological problems, but they possess interesting features peculiar to themselves. At the same time the ecological importance of algae has become more generally recognized and it is accepted that understanding of their behaviour is necessary if soil and water are to be made to yield more food for the human race and if the effects of pollution are to be mitigated.

Thus, Marine algae are one of the major living resources of the seas. There are about 20,000 marine algal species distributed throughout the world today. About 7,000 species from chlorophyta; 1,500 from phaeophyta, 4,000 from rhodophyta; 1,100 from phyrrophyta (of which 93% are planktonic); constitute of minerals such as potash and iodine, are used for commercial extraction from past few centuries (Chapman, 1970). Seaweeds like Laminaria, Fucus, Sargassum and Ascophyllum are used as fodder in many areas of great Britain and Japan.

Rhodymenia is a common cattlefeed in France. Seaweeds are also

used as fertilizer because of presence of trace metals like phosphorus and potassium which are essential for the growth of plants. They also accumulate chemical substances from the marine environment; thus they can also be used as pollution indicators (Youngblood et al. 1971).

The huge Indian coastline covering 7,600 Km is being explored by marine algalogists since 19th century for various aspects such as ecology, biochemistry, morphology etc.. The detailed observations on marine algae are available largely due to the studies of Boergessen (1930); Iyengar (1938); Dixit (1940); Biswas (1945); Thivy (1957), Desikachary (1954), Shah (1962), Rao and Sreeramulu (1963), Rao and Krishnamurthy (1963), Iyengar and Thivy (1964), Krishnamurthy (1965), Joshi and Krishnamurthy (1972), Subbaramiah (1974), Joshi (1976), Untawale (1980), Chougule and Gunale (1981), Rao and Chavan (1982).

The information gathered indicates that, Maharashtra represents quite high percentage of marine algae than those found along Indian coast. It is estimated that about 76 genera and 152 species are growing along its coast. According to Dhargalkar et al. (1980) the biochemical estimation of marine algae along Maharashtra coast is to the tune of 20.12% proteins in

chlorophyceae and 23.1% in rhodophyceae. Whereas carbohydrates are 52.24%, 35.89% and 56.6% in chlorophyceae, phaeophyceae and rhodophyceae respectively.

Marine algae of Maharashtra coast have been studied by several workers at various times preferably for studying intertidal vegetation. However, very little attention has been paid towards the study of marine algae for its potential use.

During last fifty years the industrial revolution has resulted in polluting coastal environment, mainly due to the effluent discharges and other human resources. This might have influenced the ecological and biochemical conditions of the sea water around; in which all effluents are released. Since the marine algae are getting more and more importance commercially, it is necessary to exploit various pockets of Indian coast having luxurient algal growth in view to inculcate the idea of marine park.

In this respect, Malvan (Sindhudurg Dist.) is unique pocket just 150 Kms away from Kolhapur, situated on North latitude 16.03' and East longitude 73.28' on the west coast of Maharashtra (India). This location is ideally sduited for the development of luxurient algal vegetation. Moreover, for marine

also see p 27

position of Malvan

phycologists this station can be considered as a "paradise of algae" and hence selected for studying ecophysiological aspects of some representative algae belonging to class chlorophyceae, phaeophyceae and rhodophyceae.

The subject matter, therefore, of this dissertation mainly confined to the study of :

1. Algal vegetation.
2. Hydrological data of the station.
3. Organic constituents such as chlorophylls, carotenoids, carbohydrates, polyphenols, proteins and amino acid composition.
4. Seasonal variation in mineral uptake.
5. CHN analysis.

In addition, the efforts have also been made to exploit the potentiality of the representative algae for biotechnological aspects such as alginate, mannitol and agar-agar content.

The dissertation has been divided into - Introduction, Review of Literature, Materials and Methods and Results and Discussion and Summary and Conclusions. The extensive literature survey carried out by referring the recent journals, review articles, books and monographs is listed at the end of dissertation under the head Bibliography.