V SUMMARY
1. The present study on "Microbial production of antibiotics from mangrove ecosystem" was carried out for a period of one year in four selected stations, Mangalavana, Narakkal, Puthuvyppu and light house area of Puthuvyppu (9°55' - 10°10'N and 76°10' - 76°20'E) from January to December 1991. Though much emphasis has been given to occurrence and distribution of actinomycetes, an attempt was also made to understand the distribution patterns of other microflora in the sediments. Data on physico-chemical parameters were also collected to find out their relationship if any with the microflora.

2. Seasonal distribution of actinomycetes showed that monsoon recorded the highest number of actinomycetes. The actinomycetes ranged between 1.0 to 243.0x10^4/gm in monsoon, 1.0-111.0x10^4/gm in post-monsoon and 1.0-13.0x10^4/gm in pre-monsoon.

3. Whenever number of actinomycetes increased, number of genera of actinomycetes decreased. It was also found that whenever number decreased type of genera increased.

4. Streptomycetes was always found predominant in all the selected stations sampled especially during pre-monsoon season.

5. The isolates usually had broad salinity and temperature spectra.

6. Analysis of variance of the microflora studied (bacteria, fungi and actinomycetes) did not show any significant difference between the seasons or stations.

7. Distribution of bacteria showed a positive correlation with B/F and B/A ratio in all the four mangrove stations studied.
8. Distribution of fungi showed a positive relationship with F/A ratio at all the four stations and at the light house area of Puthuvyppu the fungal distribution had a negative correlation with B/F and B/A ratio.

9. Negative correlation was found between the distribution of actinomycetes and B/A, F/A, ratio at mangalavana. Distribution of actinomycetes at Narakkal showed a positive correlation with pH of water, pH of sediment, organic carbon and a negative correlation with B/A. At Puthuvyppu distribution of actinomycetes did not show any relation with any of the parameters studied. Positive correlation existed between total actinomycete and total bacteria at the light house area of Puthuvyppu.

10. Positive correlation at 5% level was found between bacteria and actinomycete at Puthuvyppu and light house area of Puthuvyppu in the post-monsoon season. The pooled data for all the season showed positive relationship with 5% significant difference at light house area of Puthuvyppu for total counts of bacteria and actinomycetes.

11. Direct relationship was found between fungal and actinomycete counts at 5% level in the pre-monsoon season at Mangalavana and Narakkal and during monsoon at Narakkal, Puthuvyppu and light house area of Puthuvyppu.

12. 1591 actinomycetes were retrieved from the four fixed mangrove stations. Maximum number [427 (44.71%)] of actinomycetes were obtained from Narakkal during monsoon. In the post-monsoon season maximum number of actinomycetes 183 (33.83%) were recorded at Narakkal and 35 (36.84%) was the maximum number of actinomycetes recorded during pre-monsoon at Mangalavana.
13. Among 1591 actinomycetes encountered, five colour series were recorded viz., white (42.50%), grey (52.80%), red (4.40%), orange (0.25%) and green (0.06%). Grey colour series dominated followed by white colour series in abundance. 62.62% of grey coloured actinomycetes were encountered during the period of monsoon. Only one green coloured actinomycete was observed throughout the period of study.

14. Five selective media were used to retrieve actinomycetes viz. oat meal agar, Grein and Meyer's agar, glucose asparagine agar, Kuster's agar and sea water agar. Out of these 5 media used sea water agar was found to be best for isolation and maintenance of actinomycetes.

15. Out of 1591 actinomycetes encountered 104 cultures were isolated and maintained in sea water agar. Among 104 actinomycetes isolated 26 were from Mangalavana, 26 from Narakkal, 27 from Puthuvyppu and 25 were isolated from light house area of Puthuvyppu.

16. Maximum number of actinomycetes were isolated during pre-monsoon 55 (52.89%) followed by 27 (25.96%) during monsoon and 22 (21.15%) actinomycetes were isolated during the period of post-monsoon.

17. White colour series dominated among the isolates 60 (57.69%) followed by grey coloured series 29 (27.89%), red colour 10 (9.62%), orange colour series 4 (3.85%) and only one (0.96%) green coloured actinomycete was isolated.

18. 50% of the isolated actinomycetes were subjected to characterization according to the methods recommended by ISP and identified up to species level. Among 18 Actinomycetes identified 10 species were recorded, and 24 species were identified out of 35 Streptomyces cultures.
19. In order to characterize the actinomycetes, aerial mass colour, spore and sporophore morphology, pigment production and carbon utilisation were carried out (Table 20) and the species description of 52 actinomycetes are outlined.

20. White, grey and red were the predominant colour series observed in the isolated actinomycetes. Rectiflexible (RF); Retinaculiaperti, Spiral (RAS); Spiral (S) and RARF were the four types of sporophore morphology recorded among which (57.69%) RF type dominated. Spore-morphology of actinomycetes can be grouped into smooth, spiny, warty, hairy and rough type, however only smooth and spiny type were recorded during the present study.

21. D-glucose, L-arabinose, D-xylose, i-inositol, D-mannose, D-fructose, rhamnose, sucrose and raffinose, were selected to study the carbon utilisation of the actinomycetes in order to identify them upto species level. Only glucose was utilised by all the actinomycetes identified. Most of the isolates were not able to utilise either, L-arabinose, D-xylose or D-fructose. Only few were not able to utilise D-mannose. About 30% of the isolates were not able to utilise either i-inositol, rhamnose or raffinose. Only 50% of the isolates were able to utilise sucrose.

22. Sodium chloride tolerance test was carried out to know the origin of the isolates. It was found that most of the isolates (46.15%) were able to tolerate sodiumchloride upto 3% level. It was also noted that, most of the actinomycetes studied exhibited (53.85%) good growth even when sodiumchloride and sea water was omitted in the medium.
23. The antagonistic activity was tested using 14 test pathogens viz - *Vibrio anguillarum*, *V. cholerae*, *V. alginoliticus*, *V. parahaemolyticus*, *Aeromonas*, *Pseudomonas*, *Salmonella-I*, *Salmonella-II*, *E. coli*, *Bacillus*, *Staphylococcus*, *Rhodotorula rubra*, *R. marina* and *Cladosporium*. All the cultures tested showed antagonistic activity towards one or more of the test pathogens.

24. Out of 104 actinomycetes tested for their antimicrobial activity, about 56% exhibited antagonistic effect towards Gram-negative bacteria, 35.6% towards Gram-positive bacteria. 100% of the isolates were able to inhibit the growth of the filamentous fungi (*Cladosporium*) and 90% of the isolates were antagonistic towards non-filamentous fungi (*R. marina* and *R. rubra*).

25. Antibiogram of the actinomycetes against test pathogens showed that two extreme zones (Category I and Category X) of inhibition was exhibited by most of the antagonistic actinomycetes.

26. Six isolates exhibiting different antimicrobial activity were selected and mass cultured for the extraction of crude antibiotics.

27. It was found that few test pathogens which were resistant to original strain were sensitive to their antibiotic extracts.

28. pH 4.0 was found to be suitable when ethyl acetate was used as a solvent for the extraction of antibiotics and pH 7.0 was found to be optimum when ethyl ether and chloroform were used.
29. From the present study it was found out that, most of the isolates (56%) were able to inhibit Gram-negative bacteria and all the isolates were able to inhibit Cladosporium the filamentous fungi.

30. Extracted antagonistic compounds were able to inhibit most of the pathogens tested exhibiting the broad-spectrum antibiotic activity. These studies considerably enhances our knowledge of distribution of antagonistic actinomycetes in mangrove environment of Cochin which play a significant role in the economy of the sea. Further studies in the isolated antagonistic compounds are needed in order to produce new antibiotics effective against fish pathogens.