SUMMARY & CONCLUSION
SUMMARY

The environmental quality of oceans in general and coastal zone and estuaries in particular has forced changes in ecological structure, productivity, and diversity. The monitoring of the theoretical and experimental aspects to determine the ecological state helps us to assess and probably predict the changes in the coastal ecosystems. The present study "SURF PHYTOPLANKTON, ECOLOGY AND POPULATION DYNAMICS" forms a valuable contribution to the understanding of surf-ecosystem, hitherto lesser known in India. It also forms a valuable contribution in the assessment of marine pollution and management of coastal zone.

The thesis is presented in six chapters and brief contents is as follows:

Chapter - I

This chapter contains general introduction about the importance of ocean, coastal zone and estuaries. Physical, chemical, geological and biological factors are discussed in short, along with their relevance to the study of phytoplankton.
Chapter - II

Surf zone is a coastal ecosystem extending from where the waves first break to the highest point they reach on beach face. The review of literature on surf-ecosystem showed that the work on this ecosystem is restricted mainly to South Africa. This chapter comprises of studies on floristic composition, density, seasonality and blooms of surf-phytoplankton.

There was clear dominance of diatoms with a diverse assemblage of species. The premonsoon flora was dominated by small sized diatoms such as Leptocylindrus minimus, Chaetoceros laciniosus, C. socialis, C. debilis, L. danicus, along with large sized diatoms such as Asterionella japonica, Corethron hystrix, Coscinodiscus spp. etc. Dinoflagellates formed a negligible fraction.

Monsoon period observed the bloom of Skeletonema costatum along with mixed blooms of Asteromphalus flabellatus, C. debilis, C. socialis, F. cylindrus etc. Postmonsoon period of 1989-90 showed the continued dominance of S. costatum. However during 1990-91 period C. socialis, C. debilis, were dominant along with S.
costatum. The total cell number ranged from 2 to 38422 x 10^3 cells/L during the entire study period.

Seasonal succession was amply illustrated in the present study. Salinity and transparency appear to be the most important factors controlling phytoplankton succession because nutrients are not generally a limiting factors for phytoplankton growth and abundance in this region. Only four genera had been reported so far to bloom in the surf zone, however the present study has added another five genera of diatoms and one species of cyanophyceae. The list includes *Leptocylindrus* spp, *S. costatum*, *Corethron hystrix*, *Asteromphallus flabellatus*, *F. oceanica* and *Trichodesmium* spp.

Chapter - III

This chapter deals with diel or circadian rhythms. The study summarises the result from 24 hrs. sampling carried out during premonsoon, monsoon and postmonsoon seasons. The density of phytoplankton was high during high tide phase during premonsoon. Two density peaks were observed during monsoon. One during low to high tide phase and another during high to low tide phase. Postmonsoon season showed one peak at low tide phase.
and another at midtide phase. There was a clear diel pattern with low density and chlorophyll values during night as compared to the values during the day. This was in conformity with earlier studies of diel changes in phytoplankton in general and surf phytoplankton in particular.

Chapter - IV

Nanoplankton contribute significantly to the productivity and biomass of various marine provinces. This chapter deals with the significance of nanoplankton in surf zone which is hitherto unknown. The daily samples were collected at high tide phase for one week in different seasons. The observations over a week revealed that nanoplankton contributed about 73%, 74% and 77% of chlorophyll a during premonsoon, monsoon and postmonsoon seasons respectively. Diel studies at 3 hrs. interval undertaken on a 24 hrs. cycle for nanoplankton contribution revealed that they contribute 74%, 69% and 73% of chlorophyll a during premonsoon, monsoon and postmonsoon seasons respectively.
Chapter - V

This chapter deals with the impact of cross shore and longshore component of the wind on surf zone phytoplankton density. The stress exerted by the winds on the ocean surface is one of the main forcing functions influencing the coastal processes. Accumulation of cells in the surf zone is a major feature of the dynamics of surf diatom population and these occur largely as a result of advective forces. The coincidence of cell density peaks with positive cross shore component (indicative of onshore drift) has confirmed the earlier findings that the surf diatom blooms are not due to cell division but are also due to advective forces. The water column is actively exchanged between surf-zone and nearshore, whereas the surf phytoplanktons and foam were found to be trapped within the surf zone. It was also observed that during the presence of strong longshore component, the cell density decreased, indicating the removal of cells to the lateral boundaries of the surf zone.
CONCLUSIONS

1. Surfzone phytoplankton consists of a diverse assemblage of species and diatoms dominate the assemblage.

2. The diatoms: *Leptocylindrus minimus*, *Chaetoceros laciniosus*, *G. debilis*, *C. socialis*, *Asterionella japonica*, *Corethron hystrix*, *Skeletonema costatum*, *Asteromphalus flabellatus*, *Fragillaria oceanica* dominated the flora with occasional domination by *Trichodesmium spp.*

3. The surf phytoplankton show a clear diel pattern, with high density and chlorophyll a values during the day as compared to the values during the night.

4. Nanoplankton contribute 69 to 77% of chlorophyll a and thus are significant contributors to the primary production of surfzone ecosystem.

5. The positive cross-shore component (on-shore drift) brings phytoplankton from nearshore into the surfzone. The water column is exchanged between the surfzone and nearshore. Whereas, the surf
water and foam are trapped within the surfzone. This dichotomy is utilized by the surf diatoms in order to build up a concentration gradient in the surfzone by rising to the surface. Hence, it is concluded that surf diatom 'blooms' are not due to cell division alone but are actually 'accumulations' or patches due to advective forces.