CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

1. Nutrients

When each type of nutrient was added seperately, nitrogen was the most limiting nutrient, then phosphorous. Trace element and chelator show weak stimulations. Looking at the combination of nutrient (PN, PE, PF, NE, NF, PNE, PNF, PNEF), the complete addition of nutrients caused high production. Highest gross primary production was measured with the combination of PNEF, although addition of P & N gave nearly the same production. Addition of P alone, or in combination of PE and PF, resulted in low and similar increased of gross primary production. Addition of E and F alone show no measurable effect on production of natural sea water. The trace element (F) increased phytoplankton growth slightly better than the chelator. It should also be noted that the only positive effect of E was measured when E & F were added together with P and N, resulting in maximum phytoplankton growth.

2. Coral water

The present study shows that the environment in the vicinity of the coral heads is different from the surrounding sea water. The high rates of primary production near coral heads were unexpected and suggested that nutrients released from corals

are recycled by a number of planktonic organisms flourishing near the coral heads. This suggests coral reefs to be self sustained to some degree. Nutrients such as phosphate and ammonia are released from the coral polyps after digestion of various zooplankton. The release of phosphate may benefit blue green algae capable of nitrogen fixation. Ammonia may be utilized directly by phytoplankton or pass the cycle of nitrification resulting in formation of nitrate which can be taken up by zooxanthellae and/or phytoplankton in order to support the hypothesis of self - sustained coral reefs. The pathways should have fast turnover rates. Otherwise the nutrients would be removed from the coral reef before the organisms of the reef could take advantage of the nutrients.

3. Mangrove water

From these results it can be concluded that this work supports the statement that "Mangroves in general are to be considered as highly productive areas." However, it is difficult to point out the real effects of environmental factors on primary production. In tropical estuaries, especially mangrove ecosystems, physical, chemical and biological factors are subject to extreme variations. Coastal influences, as well as islands, local climate, run-off, up welling and other factors can all influence production and give a simulated seasonal cycle.

4. Domestic sewage

Sewage discharge can supply nutrients for phytoplankton growth. In this respect the present work agrees with the general finding of other researchers, that sewage is a source of nutrients for phytoplankton growth (Dunstan & Menzel 1971; Ryther et al., 1972; Goldman et al., 1973, 1974; Graneli 1981). Sewage discharge needs treatment in order to prevent pollution in terms of eutrophication of coastal recipients. Bacteria also play an important role in waste water. They probably caused an underestimation of GPP of the order of 50% when assayed by the Winkler technique (Strickland + Parson, 1968).

This work also showed that not all kinds of waste water could increase phytoplankton growth. Some harmful conditions, sometimes, inhibited the plankton activities. Since heavy industry is lacking in Phuket, this fact can probably explain that the harmful effect was not found very often. However, toxic wastes such as heavy metals, are probably released from small scale industries and even from households. These compounds block photosyathesis in spite of high nutrient concentrations in the sewage.

5. Tin mine water

Tin mine water is somewhat rich in nutrients and may contribute significantly through the effluence, but the fine sediments can also caused unfavorable conditions if not properly trapped.

RECOMMENDATIONS

These experiments can predict the enveronmental changes in terms of gross primary production and be the basic data for the evaluation of the productivity of Phuket coastal water.

Because of limited number of studies about nutrients limitation on phytoplankton production in Thailand, the present study was performed. It is hoped that it can serve as a baseline for future research concerning primary production and provide data for the evaluation and prediction of the primary production in Phuket coastal water. Information is needed for the future plans of Phuket such as sewage treatment discharge, or controlling run off from industries and tin mining areas. The plans must be throughly thought of carefully because these waters often contains abundant chemical compounds some of which are available for phytoplankton, but mostly toxic. Regulations of P and N concentrations in sewage outlets should be carried out as they can stimulate phytoplankton growth. The simpliest approach would be to remove P from sewage and N cannot be fully utilized, phytoplankton growth will be kept down.

Coral reef communities are attractive to study in many ways. Coral reef ecosystem are highly productive areas. It is, therefore, suggested that future studies on primary production in coral reefs should include the respective contributions of all the different primary producers utilizing nutrients, recycling of nutrients, symbiotic zooxanthellae, possibly photosynthetic bacteria and phytoplankton. Such efforts at least will probably

remove some apparent contradictions regarding coral reef productivity.

From this work, and previously quoted studies, it cannot be pointed out clearly how and how much the various factors influence primary production in the mangrove. Further studies about mangroves need to be done in order to answer important questions concerning productivity management, conservation, protection of mangroves.

Because Phuket is now in a rapid development, hotels, tourists activities, town expansion, etc., will increase the amount of sewage discharge. It is obvious that Phuket, sooner or later, must consider some sort of improvement of the sewage system. Luckily, the marine recipient seems to be able to "digest" the amounts of sewage released under present day condition, but it should be noted that clear signs of eutrophication, including the resulting black muds, were observed during this study. Even if these signs do not, signify a risk of health, they do show that the esthetics of the environment are in danger.

Since a great deal of tin mining both on land and offshore are now operating in and around Phuket island, a lot more have to be studied in order to prevent the tin miner effluence from disturbing the quality of the environment and to prevent conflict of interest of all who are involved.