THE MFRDMD/SEAFDEC FIRST REGIONAL WORKSHOP ON
REMOTE SENSING OF PHYTOPLANKTON

Kuala Terengganu, Malaysia, 17-18 November, 1998

SEAFDEC/MFRDMD/WS/98/CR. 5

COUNTRY STATUS REPORT

THAILAND

STATUS OF MARINE REMOTE SENSING APPLICATIONS IN THAILAND

By:

MONTANA PIROMNIM AND RUPERT ELSTOW

Fishery Environment Division,
Department of Fisheries,
Kasetsart University
Phaholyotin Road,
Bangkok 10900, Thailand

1.0 Status of marine remote sensing applications in Thailand

Thailand administers 1,840 kilometers of coastline of the Gulf of Thailand and 865 kilometers of Andaman Sea coast with jurisdiction out to the territorial water limits. As a country where fish plays a major role as a prime ingredient in the national diet, Thailand is extremely aware of the part played by the primary production and the marine food chain in maintaining fish stocks. It is also well aware of the profound link between phytoplankton and the environment. Over many years the fisheries authorities have measured the abundance of phytoplankton using standard TM methods, however, the authorities are open to alternative methods of assessment that define the cyclic extent of this resource in Thai waters.

One area of investigation and assessment has been satellite remote sensing. Extensive use is made of the satellite receiving station set up by the Government of Thailand. Participation in the remote sensing program of the United States has been under way and active since 1972. Since 1982 there has been direct access to signals from the NOAA, LANDSAT 2 and LANDSAT 3 data. In 1984 the station was upgraded to access LANDSAT 4 and LANDSAT 5, and SPOT. A separate antenna to receive MOS was installed in 1988. There is, as yet, no provision for accessing data from SeaWiFS launched by NASA in 1997, this satellite holds the most promise for sea colour linking for phytoplankton assessment.

The use made of the remote sensing program has been extensive in terms of land use and relevant disciplines including forestry, land development, crop-mapping, water resources, soil erosion, estuarine studies and geology. The program for these spheres of interest is ideal, simply because the establishment of "ground truth" is easy and the time span for "ground truth" longevity is extended, with a slow rate of change. Although sedimentary movement, distribution and changes in pattern around Phuket and the rivers in the upper Gulf have been the subject of remote sensing, together with some observations of turbidity, little use has been made in the marine field. During a period in 1993 to 1994 some use was made of LANDSAT 5 TM data to study chlorophyll distribution in the Gulf of Thailand. In this project the logistics of the establishment of a "sea-truth" was found to be problematic and cloud radiance and cloud edge diffusion also presented difficulties. The data resulting from this work bore a correlation with turbidity rather than chlorophyll. The use of remote imagery in the marine environment has several unsolved constraints with little hope of problem resolution in the immediate future. As a result of these constraints Thailand does not use satellite imagery or remote sensing in its phytoplankton program, but keeps an active watching brief on developments in both the hope and expectation that the present problems will eventually be solved.

There are three major factors that militate against the use of remote sensing for fisheries resources management in Thailand, the first is one that is common to the marine environment throughout the world and that is the establishment of a "sea-truth". The temporal nature of sea characteristics makes the reference baseline difficult to achieve. Although it does not influence Thailand, recently, NASA and MOBIS have deployed a marine optical sensing buoy off the coast of Lanai Island, Hawaii, with the objective of providing light absorption and water radiance correctional data to the SeaWiFS program. This after only ten months operation

speed and direction. The light band discrimination should help to give baseline conditions of water light colour absorbency and indirectly chlorophyll determination.

Phytoplankton abundance is monitored through shipboard sampling, the opportunities for this are many, but they are not regular, or to any schedule. Algal blooms are monitored in co-operation with other government departments who organise volunteer aircraft from the private sector to over-fly various sea areas to observe anomalies in sea conditions including red tide phenomena sightings.

Other methods of plankton collection have been looked at by Thailand including the SAHFOS plankton continuous collection project. This system is effectively a towed array of silk-screening subsequently subjected to entrapped plankton abundance analysis. The array is towed behind commercial vessels, the SAHFOS term for this is a "ship of opportunity" plying between ports on specified routes. This is an innovative method showing some promise of being a viable practice. A shortcoming of the system is that only the shipping lanes are explored and take little account of other sea areas.

In closing this country report for Thailand, I should like to reiterate that any tool that may be successfully used for fisheries resource management is of interest to the country and that where regional considerations are concerned information and experience will be readily discussed.

2.0 Comment on the proposals for a network of fisheries remote sensing technologists

The objective to form a core-expert group is a good idea, but discussion among colleagues seems to indicate that the specified "fisheries remote sensing" discipline may be too limited in its remit. It seems to us that whereas remote sensing may be good for hydrology and oceanographic conditions it may be limited in its application to fisheries management. It is thought that the disciplines of the core-experts should be closer to participants in fisheries management with remote sensing knowledge rather than fisheries remote sensing alone, as specified. Remote sensing is a tool to be used in, rather than the purpose of, fisheries management. In other words, the primary objective in fisheries management seems more aligned with fisheries, starting with primary production rather than wholly with its measurement.

3.0 Suggested areas of collaborative research in remote sensing within the Southeast Asian Region.

- While Thailand cannot successfully use remote sensing for phytoplankton abundance assessment at this time, this does not mean that it is not an effective tool for the rest of the region. Thus, as far as collaborative regional research is concerned it is proposed that fundamental research be conducted to establish a synoptic regional baseline "sea truth" within the periphery of the satellite footprint. This would be essential before meaningful remote sensing can be undertaken. This may be achieved by multiple shipboard sampling on a regulated basis, or by the deployment of MOBIS type buoys that monitor light absorption and water radiance on a continuous basis. The essential parameter is that the readings be taken simultaneously while the satellite is covering the region.

displayed degradation of spectral response varying between 3 and 5% on several of the discriminating bands employed. The buoy data will be used to modify the algorithms used for baseline sea colour. This buoy deployment will provide another step in the progress toward consistency in data accuracy and since the buoy deployment is in clear water it may provide a reference that has a bearing on the waters with which Thailand in concerned. Even so, this does not solve another major difficulty afflicting particularly the Gulf of Thailand, the problem here is turbidity. NASA themselves admit this problem exists, and I quote, "Over turbid waters atmospheric correction yields noticeably non-uniform aerosol radiances, epsilons etc., which impact the pigment products. This is not surprising as the NIR reflectance in these waters may deviate from zero. Schemes may be envisioned which either correct for the near infrared reflectance somehow or extrapolate the atmospheric correction parameters from near-by non-turbid waters, but the project does not have a methodology in place for addressing this situation." This leaves Thailand with a difficulty in using data from SeaWiFS, on the grounds that the Gulf of Thailand is turbid with run off from rivers and mining activities and the entrained silt generated. This makes the use of remote sensing in Thai waters of doubtful value. This is also true to a lesser degree, of the waters of the Andaman Sea. Another problem besetting coastal sea areas like the Gulf of Thailand is the entrained atmospheric dust. Thailand is afflicted by relatively high and variable concentrations of Æolian dust. This absorbs in the visible light bands resulting in unreliable readings. The present set of atmospheric models does not include any models for dust primarily because the phase function and indices of refraction are not well known. High concentrations of dust trigger the cloud mask in the SeaWiFS equipment, but low concentrations are processed leading to erroneous derived products, e.g. high pigment estimates. There is no method for flagging dust contaminated pixels, let alone correcting for them. NASA recognizes this fact.

Because of the lack of technical facility and a paucity of funding, it is not possible for Thailand to generate its own scientific satellite program. Even if it did, it would be faced with the same problems that NASA presently face and which, despite their overwhelming competence, have not yet been able to solve.

Although Thailand does not presently use satellite imagery for its routine phytoplankton studies, this does not discount its use at a later date. In the interim it has involved itself with the SEAWATCH system of oceanographic data buoys, eight of which are deployed around and in the Gulf of Thailand and elsewhere. While this buoy system does not constitute remote sensing in the satellite meaning of the word, it is remote sensing in the sense that data derived is constantly updated in remote, that is unmanned, conditions. The readings of the instrumentation are sent to the INMARSAT satellite and retrieved from a ground station. The system installed under the auspices of National Research Council of Thailand (NRCT) and the Norwegian Company, Oceanor, has suffered many problems in terms of sensor failure and unreliability. This is hardly surprising, as the sea is an extremely hostile environment for electronics in any form. Civilian persons, possibly fishermen, have also, it is suspected, tampered with the buoys. The results of this program are not as conclusive as it was hoped and expected they would be. Having said that, some readings taken by the buoys show some anomalous conditions that are not yet satisfactorily explained. The parameters the buoys report are: current velocity and direction, wave height and period, red, green and blue light band absorbency, salinity, sea temperature and wind

- Other areas for research may well lie in the Carbon Dioxide levels in the atmosphere, the global warming effect and the level of conversion of Carbon Dioxide by phytoplankton. Does the increased level of Carbon Dioxide presage an increase in phytoplankton abundance? What is the Carbon Dioxide saturation level of phytoplankton and how would phytoplankton abundance equate between increased levels of Carbon Dioxide and the predation of decreasing numbers of pelagic species. Such research involves both remote sensing in oceanography linked to laboratory research.