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IN THE SOUTH CHINA SEA AREA

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AVAILABILITY OF ENVIRONMENTAL DATA RELATED TO THE SHARED STOCKS IN THE SOUTH CHINA SEA

By:
RAJA MOHAMMAD NOORDIN,
KU KASSIM KU YAACOB
and
TENGKU ROZAINA TENGKU MOHAMAD

Marine Fishery Resources Development and Management Department
Southeast Asian Fisheries Development Center
Taman Perikanan Chendering
21080 Kuala Terengganu, Malaysia
Tel: 609-6175135, Fax: 609-6175136
e-mail: seafdef@po.jaring.my

ABSTRACT

The availability and of type environmental data in the South China Sea are discussed. Information from the papers presented in the last two shared stocks workshops were examined with regards to the availability of oceanographic data. Results of the recent collaborative survey conducted by SEAFDEC on MV SEAFDEC were presented particularly those obtained in the Eastern Peninsular Malaysia. It was found that the data currently acailable would be able to draw only few preliminary conclusions on the effects of the variability of oceanographic parameters on the pelagic fish stocks in the South China Sea area. However more data is required to fill the gaps and to ascertain accurate relationships between the pelagic fish and the environment in these tropical waters.

1. INTRODUCTION

Following the papers tabled in the two previous workshops of this series in March 1994 (Yanagawa, 1994) and July 1995 (Hamid, 1995) the proposed environmental studies and resources survey were implemented. A collaborative research program was formulated and conducted jointly by the Training Department (TD) and the Marine Fishery Resources Development and Management Department (MFRDMD) of SEAFDEC through four separate cruises using the MV SEAFDEC (Yanagawa, 1997). The studies were conducted in two areas namely Area 1, in the western Gulf of Thailand and Eastern Peninsular Malaysia and Area 2, the waters of Sarawak, Sabah and Brunei Darussalam. In both areas the sampling work and data collection were made before and after the North East Monsoons of the 1995/1996 and 1996/1997. Annually the South China Sea is exposed to the monsoons, that are comprised of the northeast winds blowing generally from November to February and the southwest winds from May to August. from another perspective the surveys were carried out during the transitional periods of the occurrence of the two monsoon periods. Area 1 has 81 stations whilst Area 2 has 79 stations. This paper aims to highlight some of the results of the survey in Area 1 in relation to the scope of this workshop.

2. STATUS OF OCEANOGRAPHIC RESEARCH

The first major collaborative oceanograpic survey and research program in the South China Sea area was probably the Intergovernmental Oceanographic Commission sponsored (IOC) program named the 'Cooperative Study of Kuroshio and Adjacent Seas (CSK). This program was conducted in the East and Southeast Asian Seas in 1965-1970 (Hirano, 1992). This program involved researchers from Indonesia, Japan, Malaysia, Philippines, Thailand and other countries participating.

Liong (1974) conducted the first documented study on oceanography in Malaysia in August 1972 in the Eastern Peninsular Malaysia. The study suggested the occurrence of a cold bottom current flowing westwards from the Natuna Islands and proceeding in parellel to the coast and surfacing into warmer waters in the north. The next well documented survey is a series of expeditions called the Matahari Expedition. The survey was jointly carried out by the Japanese scientists and the researchers of the Universiti Putra Malaysia (formerly, the Universiti Pertanian Malaysia) on board the vessel *RV Kagoshima Maru*. The survey intending to expose students in the field of fisheries science comprised of the Ekspedisi Matahari '85, Ekspedisi Matahari '86, Ekspedisi Matahari '87 and Ekspedisi Matahari '89.

Other surveys by Southeast Asian countries consisted of mainly sampling data in coastal waters and most data would be the oceanographic parameters pertaining to the red tide occurrence. Reports of data collection status made in the previous workshops did not elaborate or show clearly their relationship to the fish species.

Other notable documents include the survey by Wyrtki in 1961, the Naga Expedition in the 1959 - 1960 and the surveys conducted by the Marine Fishery Resources Department in 1970s.

In the Gulf of Thailand, many oceanographic investigations have been under-taken as early as in 1920s namely the oceanographical Expadition of the Carlberg Foundation Round the would of 1928-1930 by a Dadish RV Dana (Suvapepun, 1992). The Naga Expedition conducted sampling in the Gulf using the RV Stranger belonging to the Scripps Institution of Oceanography. A joint Thai-Japanese -SEAFDEC research program was conducted on board *RV Nagasaki Maru* and *MV Paknam.*

3. RESULTS OF THE MV SEAFDEC IN AREA 1

A Technical Seminar was held in Bangkok in February 1997 for the researchers of the collaborative project to present and highlight their research findings in Area 1. This area entailed cruises made from 4 September 1995 to 4 October 1995 and 23 April 1996 to 23 May 1996. This paper deals only with the results of the studies on plankton and nutrients that were presented in the seminar.

Hamid (1997) found that microphytoplankton were more abundant than microzooplankton in the Gulf of Thailand and Eastern Peninsular Malaysia. The majority of the microphytoplankton at the genus level found were *Coscinodiscus, Chaetoceros* and *Rhizosolenia.* These general were high in density in the Eastern Peninsular Malaysia. Majority of the microzooplankton genus found comprised of *Ceratium* and *Peridinium.* Apparently the plankton density was higher in September 1995 than in April 1996. In other words, the plankton density was higher during teh pre-monsoon period. The diversity and eveness indices were high in coastal areas.

Nutrients are the source of plankton growth and below the euphotic zone photosynthesis could not occur. Thus the nutrients vital for the plankton growth would need to be taken upwards to be within the euphotic zone. The normal process of bringing the nutrients up is through upwellings where water at the bottom that consists higher levels of nutrient flows up and disperses. It is often observed that the nutrients at the surface are much less than at the bottom, this being due to the uptake by pytoplankton.

The existence of high-density phytoplankton is crucial to the zooplankton and larval fish. It was shown that zooplankton and larval fish need a certain critical density to survive and this level of density usually occurs within the phytoplankton patches but not outside them.

4. REMOTE SENSING STUDIES IN THE SOUTH CHINA SEA

Literature on the remote sensing studies in the waters of the Southeast Asian countries is even much scarcer. Apart from the few studies in coral reets, remote seasing applications have been founed on land and the sea has been minimal. Realizing this in 1994 MFRDMD installed a High-Resolution

Picture Transmission (HRPT) system to receive NOAA AVHRR (National Oceanic and Atmospheric Administration Advance Very High Resolution Radiometer) data. Prior to this, attempts had been made to start fish forecasting studies as early as in 1993 using other satellite images. NOAA AVHRR data is free and this is one of the reasons why the HRPT system is purchased. However the dicipline itself requires skilled and knowledgeable staff to conduct studies in the area. Nevertheless, Malaysian researchers are currently conducting a study on the remote sensing of fishing zones in cooperation with some purse-seiners in the waters of Eastern Peninsular Malaysia.

Noordin and Ku Kassim (1997) attempted to use NOAA AVHRR images to determine the extent of the estuarine plume flow of the Mekong River into the South China Sea. They hypothesized that the shrimp resources found in the Eastern Peninsular Malaysia during the North East Monsoon originated from the mangrave coasts of Southern Vietnam. This they reckoned was attributed to the northeast winds that blew continously during the North East Mansoon to carry the shrimps along with the currents to the eastern shores of Terengganu.

5. SOME ENVIRONMENTAL INFLUENCES ON FISH RESOURCES

The physical effects of the environment would derive from the motion of the winds, which affects the sea. As described earlier, in the South China Sea the monsoon winds have a large effect on the processes occurring in the sea.

Drinkwater (1986) described the profound effects of the river input that can extend to over a thousand kilometers. For example in the South China Sea, the effect of the Coriolis force would have some effects on flow of the Mekong River plume. During the South West monsoon season, the plume would therefore be exerted by two forces, the southwest winds and the Coriolis force. The plume flows in the northeast direction and the extent of the plume flow is estimated to be about 100 - 200km (Noordin and Ku Kassim, 1997). Conversely during the North East monsoon, the north east winds are stronger than the influence of the Coriolis force. Such an image is yet to be analyzed and which would show the direction of the plume flowing in the southwesterly direction and perhaps extending as far down to about 300 km. In addition, the tidal flow in the area will affect the flow and consequently the timely image that would be required in this study is when the plume is flowing during the ebb tide. This is when the river runoff is high and the plume is more distinct. This kind of image is still being sorted for further analysis.

The effects of the freshwater runoff of the Mekong River that effected by the Northeast winds could bring large abundance of shrimps into the coastal waters of the Eastern Peninsular Malaysia. This corredsponds to the seasonally of shrimps in the Terengganu waters of the area. The shrimps are abundant during the Nort East monsoon season (Ibrahim Johari and Syed Abdullah, pers. comm.) and they seem to disappear after the monsoons. The distance between the Mekong estuary and the Terengganu coast is about 300 nautical miles (560 km).

In order to understand the extent of the plume flow in a wide area such as the South China Sea one approach is to use daily NOAA cloud-free images. A similar study has been conducted succesfully in temperature waters of the West Coast of Ireland by Huang et al., 1993). The NOAA AVHRR has been shown by Spitzer and Roozekrans (1990) to be useful in the synoptic assessment of the sea surface temperature and the total suspended matter in the North Sea.

Changes in the terrestrial environment obviously affect the sea where the rivers flow into it. Therefore such study of the plumes in this semi-enclosed ecosystem will enable scientists to understand better the fate of the nutrients and the living resources particularly fish larvae that are present in the plumes (Govoni et al, 1989). In the context of the South China Sea, the 'terubok' fish (*Tenualosa toli*) of Sarawak is one anadromous species that spawn in the river and spend their adult tage in the coastal waters. According to Yong (1994) the eggs, larvae and juveniles of 'terubok' fish are found in the Sarawak rivers all the year round.

The plume has also some effects on the population of the squids. In a tagging study of squids (Raja Bidin, 1993), there were apparently two populations of squids found in the waters of Terengganu. Squids tagged in the north part of the Terengganu river mouth would migrate northwards and conversely those tagged in the southern part moved south along the coastline. He suggested that the river outflow of the Terengganu River caused the segregation of the squids into possibly two stocks.

6. PROBLEMS AND CONSTRAINTS

The biggest constraint is the lack or total absence of fisheries oceanographers in the region. There are specialists in the field of fish biology, stock assessment and oceanography but there are yet to be found experts in fisheries oceanography. The combination between the fields of fisheries and oceanography requires long term study and commitment.

The other problem faced in this area is not so much of the lack of adequate data but the lack of communication between researches even in one's own country. This is evidenced in the papers presented in country reports in the previous two workshops. Attempts were made to indicate positively the status of oceanographic research but the data were not detailed as that shown for the status of pelagic fisheries.

7. CONCLUSIONS

The proposal to have a standard survey manual as suggested by Yanagawa (1994) in the first workshop should be accepted and implemented. Results obtained using such a manual could be compared and conclusions drawn.

Most of the data available were obtained mostly when the weather permitted. Data during the North East monsoon constitute the gap and this requires immediate survey through national surveys or using latest techniques involving the deployment of moored buoys installed with telecommunications gadgets for relays to the shore based receivers. Thus these buoys will provide data during the adverse weather conditions and such data will complete the scenario of the processes working in the South China Sea.

The study of river run-offs should also be considered. This is important in the study of larval transport of anadromous fish species. From remote sensing, the future abundance of the species could be predicted by the pattern of the plume which bears the fish species. Thus future research should also look at the presence of fish larvae of the pelagic species or even the demersal to obtain an indication of the stocks in the future. Shared stock of the demersal species which straddle along the common boundary of two countries should also be considered.

It has been recognized that tropical seas have low variations in the sea surface temperature (SST). Due to this, it is much more difficult to develop algorithms most suited to the fisheries. The next alternative for future consideration would be to use the density of plankton to detect the concentration of fish. Thus this line of argument would suggest more in-depth study of the feeding habits of the pelagic fish and the process of the plankton blooms and its dynamics.

A concerted effort should be made to combine the oceanographic study of plankton and the application of remote sensing. As the insidences of the fish are also directly related to the plankton, locating the occurrences of plankton blooms and type would reveal the species of fish in the temporal and spatial scales. Although the bloom would occur in short periods of time, this information could nevertheless be used in combination with the physical parameters to indicate the migratory patterns of the small pelagics. Future studies should therefore focus on the remote sensing of the plankton and food habits of pelagic fish.

With complete data, expected output could be developed in accordance to the sketch by Mann and Lazier (1991) as depicted in Figure 1. The sketches would show clearly the flows of all the shared stocks thus enabling the managers to decide on the proper measures which are supported by strong scientific data.

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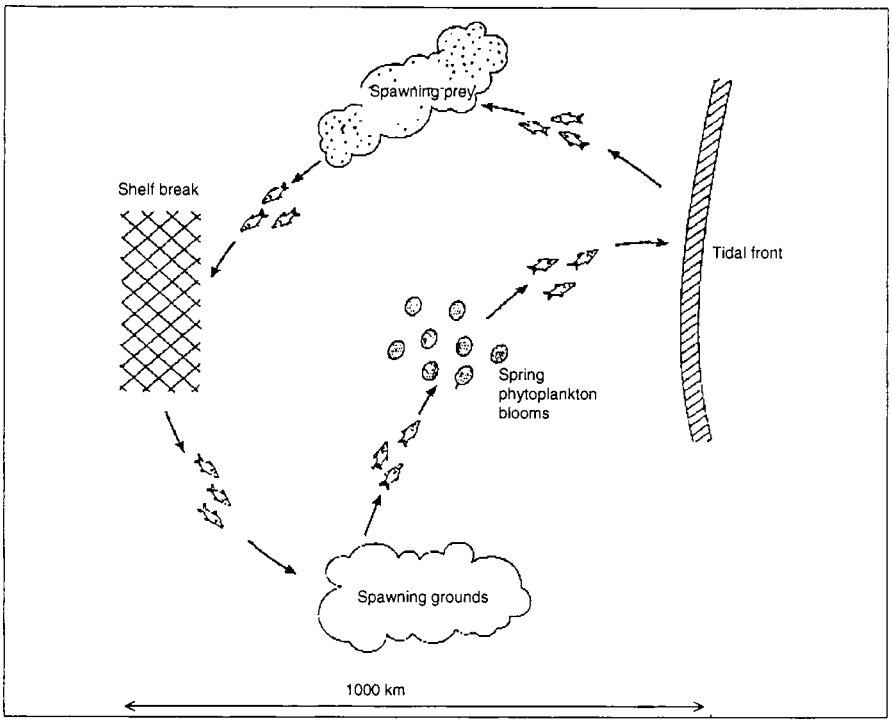
Figure 1: A schematic diagram showing the flow of stock which could cut across many coastal states bordering the South China Sea. (From Mann and Lazier, 1991)



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