Chapter 1

Introduction

1.1 Background

Southeast Asian Fisheries Development Center (SEAFDEC) carried out two intensive field observations in the western part of the Gulf of Thailand and the East Coast of Peninsular Malaysia in September 1995 and April-May 1996. It was the first systematic and intensive oceanographic measurement, since the Joint Thailand-Vietnam-US NAGA Expedition in 1959-1961 (Robinson, 1963). Unfortunately, the study areas were not cover all the Gulf of Thailand area because of the exclusive economic zone (EEZ) of neighbor country. However, the SEAFDEC survey data was the most complete and accurate oceanographic data set in this area.

1.2 The study area

The study area was from Latitude 1°30' to 12°30' N and Longitude 99°30' to 106° E, covering the area of so call the Gulf of Thailand and East Coast of Peninsular Malaysia (Fig. 1.1).

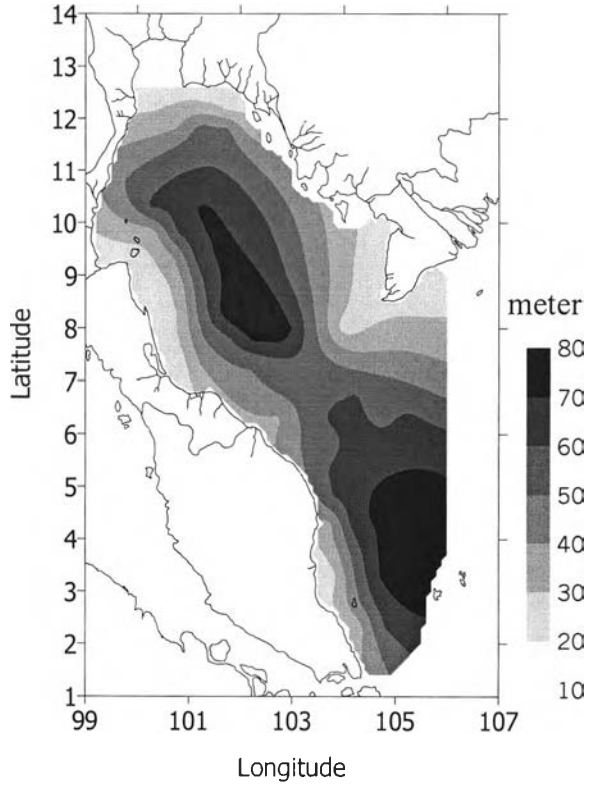

Figure 1.1 Study area and bottom topography, contour depths are from the interpolation of bottom depth of oceanographic station during September 1995 survey and NAGA Expedition during 1959-1961 (Robinson, 1963).

The Gulf of Thailand is a semi-enclosed Gulf with two sills at the southern most part. The first sill runs from Camau Peninsula (08°42'N, 103°11E) to the southwest about 100 km at a depth of less than 25 m. The second runs from Kota Bharu (06°15'N, 102°23' E) at a depth of less than 50 m to the northeast of 150 km. There is a channel connecting the deepest part of the Gulf to the South China Sea. This underwater channel is about 60 m in depth and about 50 km wide at the center of the mouth of the Gulf of Thailand (Piyakarnchana, 1989). The average depth is about 50 meters.

The East Coast of Malay Peninsular is a part of the South China Sea. The depth of the study area was between 22 and 78 meter. The average depth is about 57.4 meters (Fig.1.1).

Surface current in the study area is driven by the monsoon wind (Lowwittayakorn, 1998). In Northeast monsoon season (November to March), surface current flow from the South China Sea near the Camau Peninsula to the upper part of the Gulf of Thailand with a counter clockwise direction. In April which is a transition period from northeast monsoon to southwest monsoon, surface current direction is varied. However, mostly is from the South to the upper part of the Gulf with a counter clockwise rotation. Surface current flows into the west coast of the Gulf in Southwest Monsoon season (May to September). It's a clockwise circulation, which flows out to the South China Sea at the east coast near Camau Peninsula. There is another small counter clockwise circulation at the coastal area of Surathanee province in this season. During ttransition period from the southwest monsoon season to northeast monsoon season (October), there is a strong inflow of surface current to the Gulf along the East Coast. The direction turns to the Northwest with a counter-clockwise circulation then flow out along the west coast of the Gulf.

The seasonal variation of sea surface wind, heat flux through the sea surface, river discharge, density-driven currents, wind driven currents and the degree of stratification of water in the Gulf of Thailand was explained and schematically summarized (Fig.1.2) by Yanagi et al. (2000). The strong northeast monsoon blows in January, the sea surface is cooled, a vertically well mixed condition is developed in the Gulf of Thailand and the inverse estuarine circulation is generated. In April, large sea surface heating and the weak Southwest monsoon develop stratification. Low salinity surface water spreads from Peninsular Malaysia to the east. The largest water exchange between the Gulf of Thailand and the South China Sea is expected during this season. A moderate Southwest monsoon blow in June, giving little sea surface heating and moderate river run off generates moderate stratification. A large river discharge, moderate sea surface heating and a moderate Southwest monsoon generates moderate stratification in September.

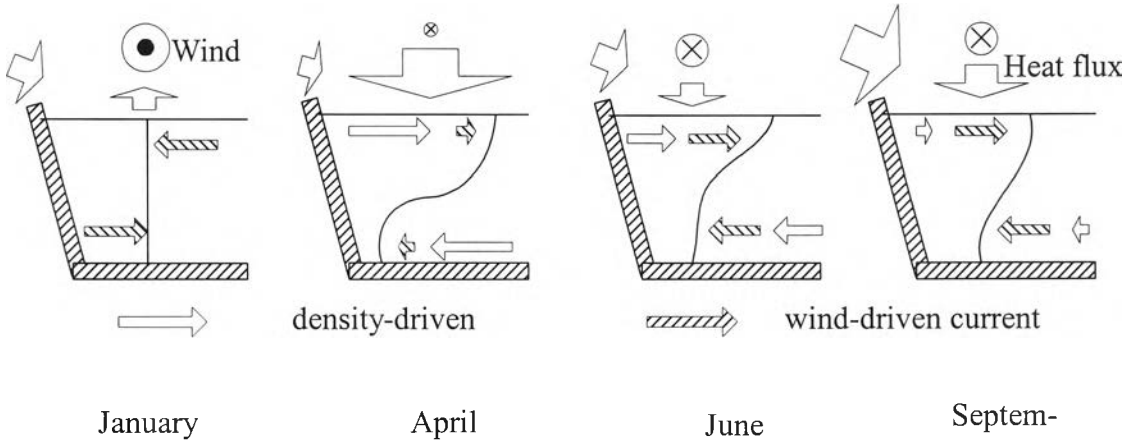

Figure 1.2 Schematically summarize the seasonal variations in sea surface wind, heat flux through the sea surface, river discharge, density driven currents, wind driven currents and the degree of stratification from Yanagi et al, (2000).

1.3 Water mass studies in the Gulf of Thailand and East Coast of Peninsular Malaysia

Most of the studies of water masses in the area using temperature and salinity properties to classify water masses in the Gulf of Thailand and the South China Sea. The result of the study showed that there were three water masses in the study area; upper, intermediate and deep water masses (Siripong, 1984). The Gulf of Thailand and East Coast of Peninsular Malaysia is occupied by an upper water mass, with average temperature at 27.688 °c and average salinity at 32.789 $^{o}/_{oo}$.

Another example was the use of temperature and salinity of water to show the distinct property of the southward - flowing current. It was a narrow belt-like water mass of high temperature (over 29°c) and low salinity (below 33 $^{o}/_{oo}$) from the Gulf of Thailand flowing to the East Coast of Peninsular Malaysia at 10 to 20 meter depth in the NE monsoon (Suzuki and Hooi, 1973).

Phosphate and salinity had been used to identify water mass in the South China Sea as the P-S diagram (Phosphate-Salinity diagram). The P-S diagrams were used to show different patterns between coastal and offshore water (Shirota, 1973). In coastal water, there was a tendency that water with high salinity has low PO_4^- contents where as water with low salinity was accompanied by high PO_4^- contents. However, in offshore waters such tendency has not been observed.

1.4 Plankton and pelagic fish in the study area

1.4.1 Plankton

Distribution, abundance and species composition of phytoplankton and

zooplankton were influenced by the monsoon season (Boonyapiwat, 1997, Jiwaluk, 1997 and Brinton, 1963). The abundance of phytoplankton in the Gulf of Thailand in each area also shows different relationship with the environmental factors. In the Upper Gulf, especially at the river mouths and the west coast of the Gulf, the abundance of phytoplankton was influenced by nutrient, temperature, salinity and water transparency while in the east coast of the Gulf, nutrient is more important than the others (Manowejbhan, 1985).

1.4.2 Pelagic fish

The Gulf of Thailand is considered as one of the most productive areas of the world with a high abundance of fisheries resources. The coastal small pelagic fish frequently inhibit the area of nutrient-rich coastal water, while the larger pelagic are found offshore. (Chullasorn, 1997). Research on the fisheries concluded that variation of fish yield in this area was due to three factors (Piyakarnchana, 1989);

1. The increase of catch of certain species is correlated with the increasing number of trawlers.
2. Environmental changes; property of water, wind, etc.
3. Fishermen change the catch pattern. They may change fishing gear or sometime fishing ground. These changing patterns should be reduced the pressure of fishing to some fish stock.

1.5 Objectives

Most of the studies on the relationship between physical and chemical properties of water and biological data were done by studying the relationship between individual parameter with individual species or each group of marine life which might not be appropriate as individual species usually relate to several parameters. The study on water masses, which tries to classify water by their properties and origins, may give a better answer than each parameter study. Because each water mass can be composed of the same kind of organic or inorganic matter, minerals, trace metals etc., which are important for life.

It is well known that in this area monsoon plays an important role in the properties of the water. In this study, it was expected that distribution and abundance of plankton and pelagic fish would be different in the two different seasons. The objectives of this study are

1. To classify and study the distribution of water masses in the Gulf of Thailand and East Coast of Peninsula Malaysia
2. To study the relationship between water masses, species abundance and distribution of plankton and relative abundance of pelagic fish