CHAPTER 1

INTRODUCTION

1. Background and Rationale

Pattani province is situated on the eastern coast of Southern Thailand, with an area of 1,940 square kilometres or 2.7 % of the total land area of the South. The northern and eastern parts of the province consist of coastal plains while the central and lower parts are alluvial plains and mountainous ranges extending from Pattani into Yala and Narathiwat provinces. There are two major rivers: the Pattani and the Sai Buri Rivers, originating in the mountains in Yala and Narathiwat and flow northward into the sea to the Muang and Sai Buri districts, respectively. Other minor rivers include the Yaring or the Yamu River, which flows through Mayo district and has its estuary at Pattani Bay in Yaring district, and the Nongchik River (also called Tu Yong Canal), which branches from the Pattani River in Yarang district and has its estuary in Nongchik district. There are other short brackish rivers, which are vital to the fishing and aquaculture industries of the people residing around Pattani Bay (Pattani Provincial Bureau, 1997).

Pattani Bay is a part of Pattani province. Its topography is that of a wetland and is considered a very important hydrological area of South East Asia (Jintanugool and Round, 1989). The Bay is located between latitudes 6° 53' and 6° 57' North and longitudes 101° 14' and 101° 21' East, covering approximately 74 square kilometres with 70,000 rais of hinterland. At the north of the Bay lies Laem Poh, a peninsula that stretches out into the Gulf of Thailand in a westerly direction and has the appearance of a sand spit. The length of the peninsula is about 16 kilometres and extends on the east-to-west parallel to the shoreline. The mouth of the Bay opens up into the Gulf of Thailand in the east. The area to the south of the Bay comprises the mouth of the Yaring River, which flows through the district of Yaring.

The two major rivers; the Pattani and the Yaring, have their estuaries in Pattani Bay, giving the Bay a rather murky appearance. The salinity level is high, at approximately 17-32 ppt. During the floods, between November to December, the salinity levels in the Bay decrease substantially since the amount of fresh water

flowing into the Bay from the two major rivers increases. The areas around the estuaries of both rivers are extremely fresh with salinity levels close to zero. The shoreline around Pattani Bay consists of muddy tracts, sandy beaches, and mangroves (wetlands), some of which are unreachable by sea-water. The mangroves in Yaring district are considered the most fertile on the Gulf of Thailand (handouts distributed at the Workshop on Poverty Problems of Small Fishermen in Pattani, 1996, page 1). The sand spit is quite old and the area is rather sludgy (sedimental), creating a rich environment for living organisms. The ecological characteristics vary, depending on the conditions at the location. The living resources of Pattani Bay and the area surrounding the Bay consists of both marine life and wildlife, various kinds of water plants and other tropical plants. The Bay also thrives with many varieties of bird life, migrating from other areas of the world as well as the native birds living around the fertile Bay.

2. Review of Literature

2.1 The Significance of Pattani Bay

Swennen (1984), from the Netherlands Institute for Sea Research, indicates that Pattani Bay has a comparatively greater biological growth rate than the Gulf of Thailand, the Gulf of Mexico, India and Africa. The Bay provides shelter for different species of mollusc. Along the Bay different varieties of mollusc such as mussel and cockle are found. Estuarine organisms are abundant in the Bay. With Pattani Bay as a sheltered nursery ground, the Bay is important to both inshore and offshore fisheries, similar to the Waddenzee, an inlet of the North Sea off North Netherlands (handouts distributed at the Workshop on Poverty Problems of Small Fishermen in Pattani, 1996:1). Pattani Bay is the area where fresh water and sea water exchange matter and energy. The Bay plays an important role in determining spring and neap tides, tidal waves, sedimentary deposits, and biological adjustment of animal life. The circulation and whirling of the Bay currents bring about deposition of sediment, minerals and various benthic organisms such as molluscs and seaweed. Pattani Bay is thus fertile

In terms of ecological effects, mangrove forests, water plants and benthic organisms help break the force of the currents, as well as the waves and the wind. This, in turn, causes deposition of sediment and minerals, prevents shoreline erosion, and creates new mudflat areas. Pattani Bay also acts like a natural wastewater treatment plant before the sewage is discharged into the sea. In addition, Laem Poh, which runs east-to-west parallel to the shoreline, also serves as the breaker of the northeast monsoon, and therefore renders the Bay suitable for anchorage.

2.2 Pollution and Environmental Problems in Pattani Bay

In recent years Pattani Bay has been interfered with, at a disturbing rate, by economic and industrial expansion in accordance with the country's economic development policy to establish Pattani as a centre of development for provinces in the lower South. The expansion of urban communities, industrial plants, coastal aquaculture as well as mangrove forest concessions, cause various ecological problems. Habitats of benthic organisms and seaweed areas have been destroyed by trawlers and fishing boats. Release of sewage without proper treatment from local communities and discharge of waste organic matter from congested factories has reduced the quality of the water in the Bay (Hattha, 1992: 6-7). The quantity and species of marine life in the Bay have rapidly decreased, and the ecosystem of the Bay has deteriorated markedly. All these problems have direct effects on the residents and people who benefit from the Bay and pose impacts on the overall resources and environment of the Bay.

Everaats and Swennen (1987) reported large traces of heavy metal in benthic organisms living in the sediment around the Bay. Larger traces of zinc, copper, cadmium and lead in these benthic organisms in Pattani Bay were more than those in the Ban Don Bay (Suratthani province) and the Jeram Bay (Malaysia). The Pattani Bay Research Centre at the Faculty of Science and Technology, Prince of Songkla University (1989) reported that the ecosystem of the Bay has been disturbed by the country's economic and industrial expansion. Much of the terrain around the Bay and its rich resources has been extensively exploited. Land use in some areas is inappropriate and this results in the deterioration of the area. Proclamation of the area

near the mouth of the Pattani River next to Pattani Bay as an industrial zone, expansion of the wharves, construction of coastal aquaculture in the tidal areas as well as expansion of urban communities, all contribute to increasing amounts of effluent and the deterioration of the Bay. It is anticipated in the above report that the acceleration of economic expansion by both public and private sectors will intensify all these problems.

In addition, Pattani Provincial Industrial Bureau (1992) reports that most seafood factories in the industrial zone produce large quantities of wastewater containing high organic matter. At present there is no central for wastewater treatment; each factory is responsible for its own treatment, which is quite inefficient. Furthermore, there is no systematic and proper storage and disposal of garbage. Most factories resort to open dumps and the problems of smell, flies and waste liquid from garbage are the results.

In a report at a seminar on Guidelines to the Development of Pattani Bay areas (Prince of Songkla University, 1986), it is stated that Pattani Bay areas are sheltering nursery grounds and habitats of various aquatic animals in both larval and adult stages. If the ecosystem of the Bay areas is sustained, Pattani Bay will be a fertile aquatic production source and a nursery, which, in turn, will be beneficial to all communities around the Bay.

Within the past decade, use of the areas in and around the Bay has substantially increased. Diverse activities have been extensively developed: more factories in the industrial zone, growing urban communities, more coastal aquaculture and fisheries, more fishing boats entering and using the water. Many people are now aware of the increasing amount of effluent, discharge of oil from boat engines, and increasing deterioration of natural resources in the Bay. Prince of Songkla University's 1986 seminar reports indicated that commercial fisheries and industries had drastically deteriorated the fertility of the Bay. In his study of the quantity and variation of macronutrients within the 24-hour cycle in the Pattani River near the Dechanuchit Bridge during the rainy and dry seasons, Cheewasedtham (1996) made the following findings with respect to nutrients and related variables.

Nitrite

Very little quantity of nitrite was found in the River; the quantity varied between 0.011-0.040 µg-at/1. The average quantity was 0.023 µg-at/1. In the dry season the quantity varied between 0.004-0.070 µg-at/1, with an average of 0.020 µg-at/1. In the rainy season the quantity varied between 0.011-0.046 µg-at/1, with an average of 0.025 µg-at/1.

Nitrate

The quantity of nitrate varied between 0.87-8.93 µg-at/1 and the average quantity 7.16 µg-at/1. Less quantity of nitrate was found in the dry season than in the rainy season; that is, the quantity ranged from 5.76-7.59 µg-at/1, with an average of 6.89 µg-at/1 in the dry season while it ranged from 2.66-11.75 µg-at/1, with an average of 7.40 µg-at/1 in the rainy season.

Phosphate

The quantity of phosphate within the 24-hour cycle in the Pattani River near the Dechanuchit Bridge varied between 5.78-36.69 µg-at/1 and the average quantity was 18.32 µg-at/1. A greater quantity of phosphate was found in the dry season than in the rainy season; that is, the quantity ranged from 11.45-59.61 µg-at/1, with an average of 28.62 µg-at/1 in the dry season, while it ranged from 3.84-13.52 µg-at/1, with an average of 8.01 µg-at/1, in the rainy season.

Dissolved Oxygen

The quantity of dissolved oxygen in the Pattani River near the Dechanuchit Bridge varied between 4.59-6.11 mg/l. Its quantity within the 24-hour cycle in the dry season varied between 2.81-4.69 mg/l and the average quantity was 3.53 mg/l. More dissolved oxygen was found in the rainy season than in the dry season; that is, the quantity ranged from 6.36-7.57 mg/l, with an average of 6.95 mg/l. The average quantity of dissolved oxygen in both seasons was 5.24 mg/l. It has also been observed that in both seasons the variation of dissolved oxygen increased during the day and decreased during the night.

Temperature

The temperature of the Pattani River within the 24-hour cycle varied within a narrow range. The temperature during the two seasons varied between 27.8-29.6 °C and the average temperature was 28.7 °C. In the dry season the temperature had a greater range of variation than in the rainy season; that is, it varied between 27.9-30.9 °C, with an average of 29.3 °C in the dry season and between 27.8-29.6 °C, with an average of 28.7 °C in the rainy season. It was also found that the temperature variation increased during the day and decreased during the night.

pH

During the two seasons, pH in the Pattani River varied between 7.3-7.42 and the average pH was 7.12. pH was higher in the dry season than in the rainy season; that is, in the dry season pH varied between 7.35-7.69, with an average of 7.43, and between 6.66-7.14, with an average of 6.82 in the rainy season. pH variation was similar to that of dissolved oxygen: increasing during the day and decreasing during the night.

Wiriyanon (1989) reported the chemical and physical analyses of the water characteristics in Pattani Bay, the surface current velocity was at a minimum of 0.03 m/s at Ban Dato and at a maximum of 0.17 m/s at the center of the Bay. Transparency was at a minimum of 0.25 m at Tunyong Lulo and a maximum of 0.61 m at the center of the Bay. The water temperature was 29.5 °c and the salinity was at minimum of 19.8 ppt at Bang Pu and at a maximum of 29.3 ppt at Rusamilae. Dissolved oxygen was at a minimum of 4.94 ppm at the Pattani River Mouth and at a maximum 9.02 ppm at Bang Pu, were several kinds of algae were found in abundance. The pH value was 7.90. the total suspended solids were at a minimum of 175 ppm at Bang Pu and Dato and at a maximum of 334.2 ppm at Tunyong Lulo. Both nitrite – nitrogen and nitrate – nitrogen concentration were at the low levels of 7.9 and 21.5 ppb respectively, and phosphate – phosphorus concentration was 26.0 ppb.

Having encountered this entire problem in recent years, it is expected that the Pattani Bay may soon reach a crisis beyond recovery. Therefore to make people around the Bay aware of and be concerned with the threats is an urgent task. Researchers have observed that the temperature, salinity, transparency, alkalinity,

oxygen, pH, nitrite, nitrate, phosphate and silicate in Pattani Bay are of extreme importance. These must be taken into consideration when any further development is proposed so as to preserve the fertilization of future aquatic life in Pattani Bay.

3. Research Objectives

This thesis has two objectives, as follows.

3.1 To investigate the pattern of some hydrographic variables such as temperature, salinity, transparency, alkalinity, oxygen, pH, nitrite, nitrate, phosphate and silicate within Pattani Bay

(a) With the season of the year

(b) at various locations in the Bay

3.2 To develop a model that can be used to describe this spatial temporal variation

In Chapter 2 the methods used in the study are described. Chapter 3 gives preliminary results, using appropriate graphical methods, while in Chapter 4 further statistical analyses are detailed. Chapter 5 gives the conclusion, further discussion, and suggestions for additional research.