

CHAPTER II

MATERIALS AND METHODS

1. Study Sites

The study was carried out at Koh Pha-Ngan located on the west coast of the Gulf of Thailand, between latitude $9^{\circ} 10' - 9^{\circ} 48' N$ and longitude $99^{\circ} 57' - 100^{\circ} 06' W$. Sudara and Nateekanjanalarp (1989) and Sudara et al. (1989) reported that the seagrass beds were found along the coast from the west to the south and coral reefs were found from the north to the west and south coast of this island (Fig. 1). This study selected to be at the southwest coast of the island at Nai Wog Bay (Fig. 2) where the coral reef is found located seaward side to the seagrass bed (Fig. 3). The seagrass bed is dominated by *Enhalus acoroides* over the other two species of *Thalassia hemprichii* and *Halophila* sp.. The coral reef is dominated by *Porites lutea* and *Goniopora djiboutiensis*.

2. Sampling Period

The Gulf of Thailand is subjected to monsoons therefore the climatic conditions can be divided into 3 periods, the northeast monsoon (mid November to mid February), the intermonsoon, northeast to southwest monsoon (mid February to mid May), the southwest monsoon (mid May to mid October) and another intermonsoon, southwest to northeast monsoon, (mid October to mid November). From the Naga Expedition (1959 - 1961), the well development of monsoons were found in August for southwest monsoon and December for northeast monsoon (Robinson, 1963). The sampling periods were therefore designed for 4 times as followed: August, October (1991), January, and April (1992).

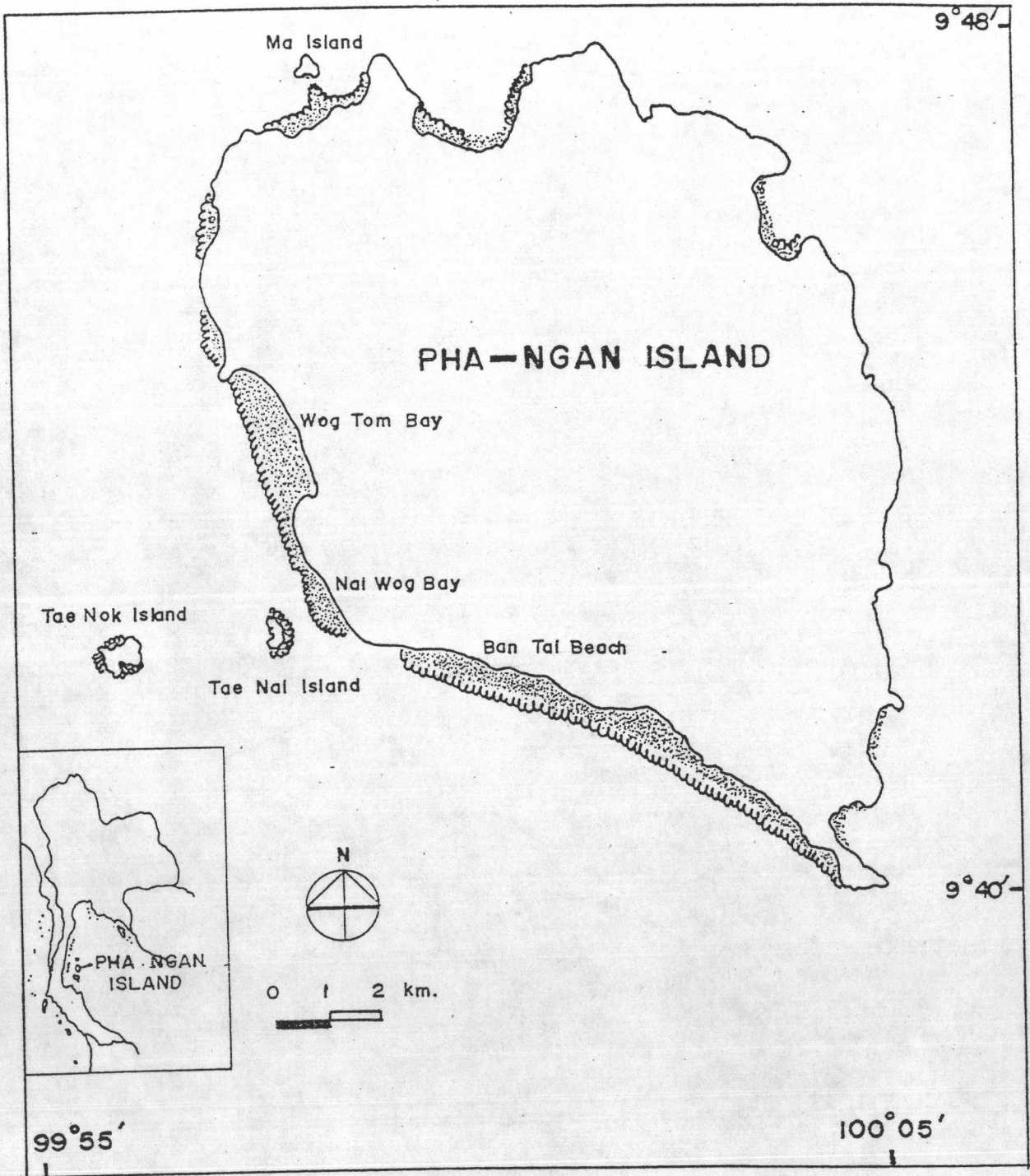


Figure 1. Map of Koh Pha - Ngan.

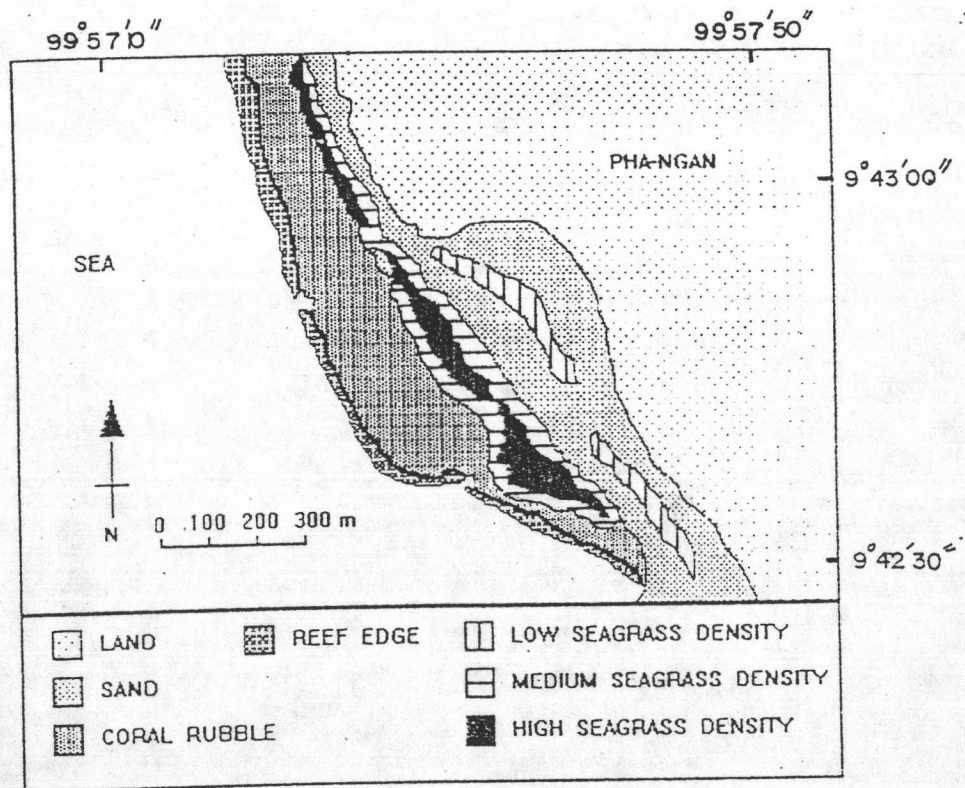


Figure 2. Map of Nai - Wog Bay, Koh Pha - Ngan.

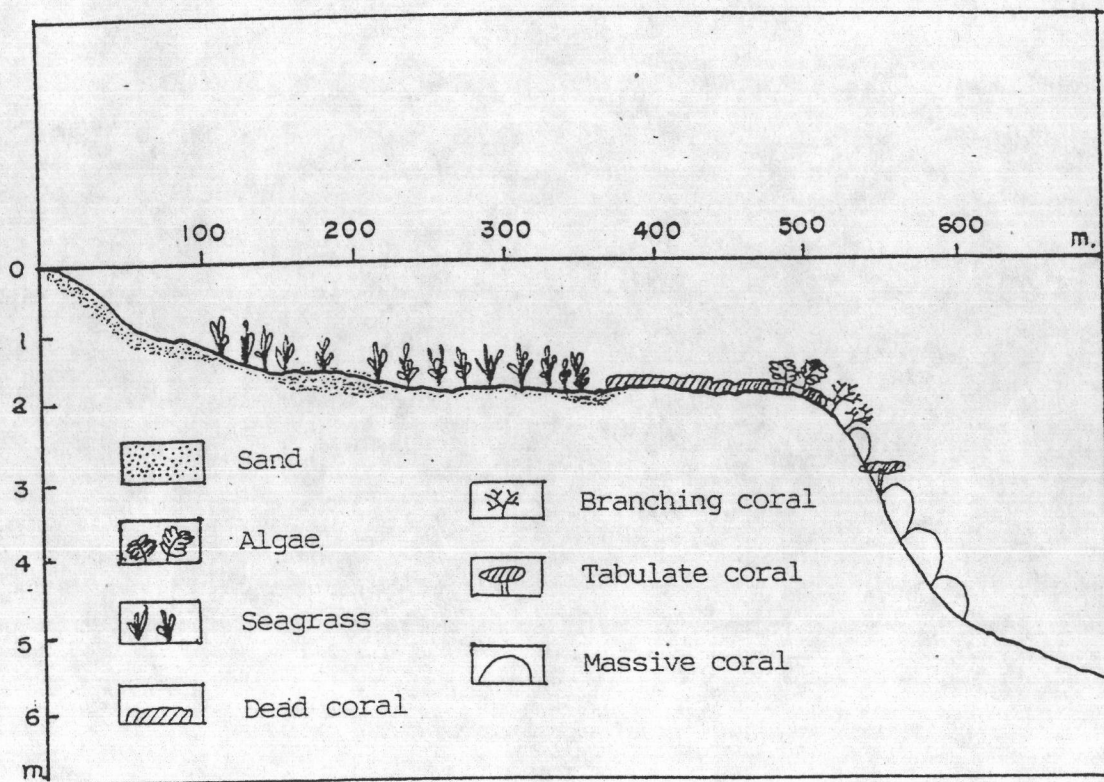


Figure 3. Shore profile at Nai - Wog Bay.

3. Methodology

3.1 Coral reef fish community

Fish visual census technique use in ASEAN-Australia Project on Marine Science : Living Coastal Resources was adopted for this study as described in the manual (Dartnall and Jones, 1986). A continuous transect line of 150 m. was laid parallel to the shore, on the reef slope, at the depth of 3 meters. All censuses were carried out during the day time. Censusing starts after a settling period of at least 20 minutes to allow fishes to resume normal behavior after the line has been set. The abundance of fish species are estimated or counted within either sides of and above the observer who recorded onto the writing board. Fishes were classified into 3 main groups: Target species (Haemulidae, Lethrinidae, Lutjanidae, and Serranidae); Indicator species (Chaetodontidae) and Major families (other families). Actual count of the target and indicator species were conducted while the major families were estimated for the abundance using cummulatively on log₄ abundance categories. Size of fishes (total length) and/or life history stages were also recorded.

Log 4

Abundance Category	Individual of Fishes
1	1
2	2 - 4
3	5 - 16
4	17 - 64
5	65 - 256
6	257 - 1024
7	1025 - 4096
8	4097 - 16384

3.2 Seagrass fish community

Seagrass fishes were collected by using beam trawl technique as recommended in the ASEAN-Australia Project. The trawl net having mesh

size of 2 mm., 6 meters in length and cod end of 1 meter long. The samples were collected during both day and night times. The beam trawl was towed with the speed of 1 m/s for 5 minutes within the seagrass bed. The collected samples were preserved with 10% formalin-seawater solution for further species identification in the laboratory and the number were recorded. The total length (cm) and wet weight (g) of fishes were measured.

3.3 Migration of fishes across the habitats

Between the seagrass bed and coral reef, three sets of gillnet were staked at the edge of the seagrass bed before getting on to the coral reef. Each set consists of 3 different mesh size of gillnets, 25 mm, 40 mm and 60 mm. Each gillnet is 20 meters in length and 1.5 meters in depth. The gillnets were positioned in the field on the afternoon and the collection were launched every 6 hours for 24 hours cycle. Samples were taken 4 times a day (1800, 2400, 0600 and 1200) from fishes caught by nets. Fishes collected were divided into 2 groups, fishes that enter the seagrass bed and fishes that leave the seagrass bed. All fishes collected were preserved with 10% formalin-seawater solution.

In the laboratory, all fishes collected were identified to species level and counted. Total length (cm) and wet weight (g) were also recorded. Fishes collected were dissected for stomach content analysis. Food in the stomach of fishes collected were identified to the best possible.

4 Data Analysis

In comparing of abundance of fishes of fishes collected from the coral reef, seagrass bed and the area between them in different times and from different the sampling periods, the differences were so obvious that the statistical analysis would not be necessary. The ecological indices, species diversity and similarity indices, as described by Clifford and

Stephenson (1975), and Ludwig and Reynolds (1988) were used to compare fish communities in coral reef and seagrass bed, and fishes collected from the area between them in different sampling times and from different sampling periods.

4.1 Species diversity index

The Shannon - Weaver index (H') was calculated to compare the fish communities in coral reef and seagrass bed between the different sampling times and from different the sampling periods.

$$H' = - \sum_{i=1}^S \left[\left(\frac{n_i}{N} \right) \ln \left(\frac{n_i}{N} \right) \right]$$

n = the number of individuals belonging to the i th of S species in the sample

N = the total number of individuals in the sample.

4.2 Dissimilarity coefficients

Bray and Curtis dissimilarity coefficients (1957) was used to test the differences in species composition of fishes found in the coral reef, seagrass bed and the area between them in different sampling times from different sampling periods. The Dendrogram of the cluster analysis ~~(group average strategy) were constructed.~~

$$DC = \sum_{i=1}^n \frac{|X_{1i} - X_{2i}|}{|X_{1i} + X_{2i}|}$$

DC = Dissimilarity Coefficients

X_{1i} = the value of i^{th} species of the first sample

X_{2i} = the value of i^{th} species of the second sample

n = total number of species found in both samples

SC = Similarity Coefficients (1 - DC)

4.3 Stomach content analysis

Food within the stomachs were classified and analysed. Each food items were counted and measured the wet weight. Three approaches (Klumpp and Nichols, 1989) were used to determine the contribution of different food items to each fish species: 1) percentage of number, $N = (I_s/I_t) \times 100$, I_s is the total number of a food item, and I_t is the total number of all food items; 2) percentage frequency of occurrence, $F = (S_s/S_t) \times 100$, S_s is the number of stomach containing at least a prey species, and S_t is the total number of stomachs (including empty one); 3) percentage weight, $W = (W_s/W_t) \times 100$, W_s is the total weight of a food item, W_t is the total weight of all food items.

The index of relative importance (IRI) was also calculated to incorporate all three approaches and yield a better assessment of the dietary important of each food category, $IRI = (N+W)F$, N is the percentage of number; W is the percentage of weight and F is the percentage of frequency of occurrence (Hyslop, 1980; Clark et al., 1989).

5. Salinity and Temperature

The salinity and temperature of sea water were measured by using the salinometer (refractometer) and thermometer during both day and night times of all sampling periods. ~~The salinity of sea water at Nai - Wog Bay, Pha - Ngan Island was high during January and April, and lower during August and October. There was not different salinity between the day and night times of all sampling periods. The water temperature was high in April, August and October but lower in January. The difference in water temperature was found between the day and night times of all sampling periods which was high by day and lower at night (Table 1).~~

Table 1 Salinity and temperature of sea water at Koh Pha - Ngan
during the day and night times from August 1991 - April 1992.

Sampling period	Salinity (ppt.)	Temperature ($^{\circ}$ C)
August 1991		
Day time	28.0	27.5
Night time	28.0	26.0
October 1991		
Day time	28.5	27.0
Night time	28.0	25.5
January 1992		
Day time	32.0	26.0
Night time	32.0	24.0
April 1992		
Day time	33.0	28.0
Night time	32.5	27.0