Chapter 1

Introduction

Blue swimming crab, *Portunus pelagicus* (L.) is one of the living aquatic resources which have high demand and high value in the local and world markets. Trend in quantity of blue swimming crab can be one of important indicators for the status of commercial fisheries. In Thailand, commercial catches of blue swimming crab have increased rapidly in the past decade, primarily due to changes in gear fishing technology, reaching from 349,180 tons in 1986-1995 to 388,360 tons in 1996-2005. The highest total catch of blue swimming crab occurred in Satun, Nakhon Si Thammarat and Songkla respectively (Department of Fishery, 2004-2007). Songkhla Lake is an important fishing area because of its connecting to the Gulf of Thailand and blue swimming crab is one predominant species found in the Lake. Therefore, this thesis, we attempted to apply the multiple regression methods to analyze trend of blue swimming crab catch and seasonal influence on effectiveness of the blue swimming crab catch by three major gear types. The multiple regression was also used to examine relationship between the catch and some environmental factors.

Data of blue swimming crab in Songkhla Lake from 2003 to 2006 were obtained from National Institute of Coastal Aquaculture (NICA), Songkla province. Some environmental data were obtained from Southeastern Regional Meteorological Center, Songkla province.

1.1 Background

The blue swimming crab is an important coastal species found around the world, especially in tropical coastal country. It is found throughout the West Indian and East Pacific Oceans: from Japan, and The Philippines throughout Southeast and East Asia, the East of Australia, and Fiji Islands, and westward to the Red Sea and East Africa. The blue swimming crab occurs also in the Mediterranean Sea as lessepsian species along the coast of Egypt, Israel, Lebanon, Turkey, the Syrian Arab Republic, Cyprus and the east southern coast of Sicily (FAO, 2009) as shown in red on Figure 1.1.

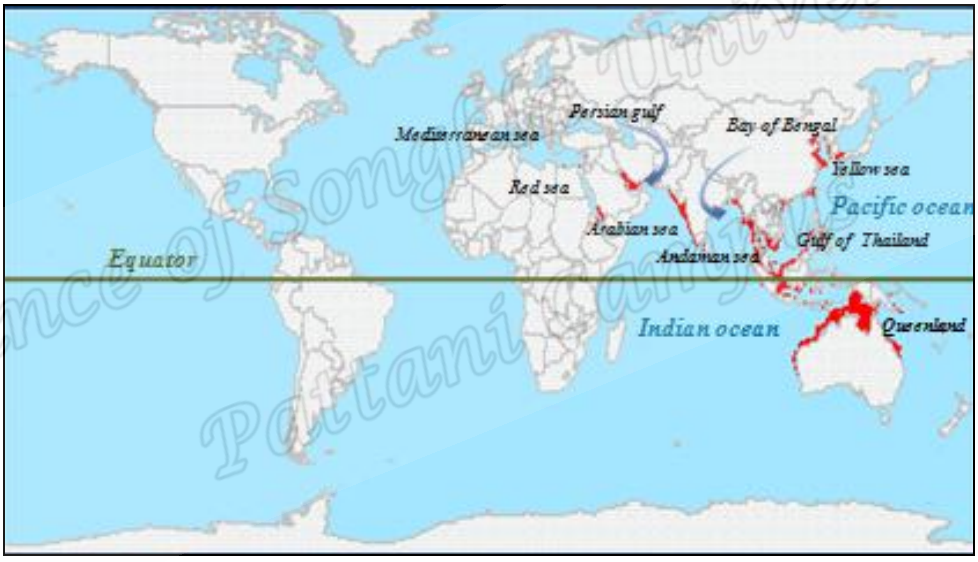

Figure 1.1: Geographical distribution of blue swimming crab

The overall catch of blue swimming crab around the world in 1999 was about 133,938 tons. The catch increased to 186,000 tons in 2003 and decreased to 153,000 in 2006. High quantity of catch was from China and the Philippines (FAO, 2009).

In Thailand, the blue swimming crabs were found in both the Gulf of Thailand and the Andaman Sea. The Gulf of Thailand on the South China Sea which has a coastline of

about 1,825 kilometer and the West Coast of Thailand on the Andaman Sea with a coastline of about 740 kilometer as shown in Figure 1.2.

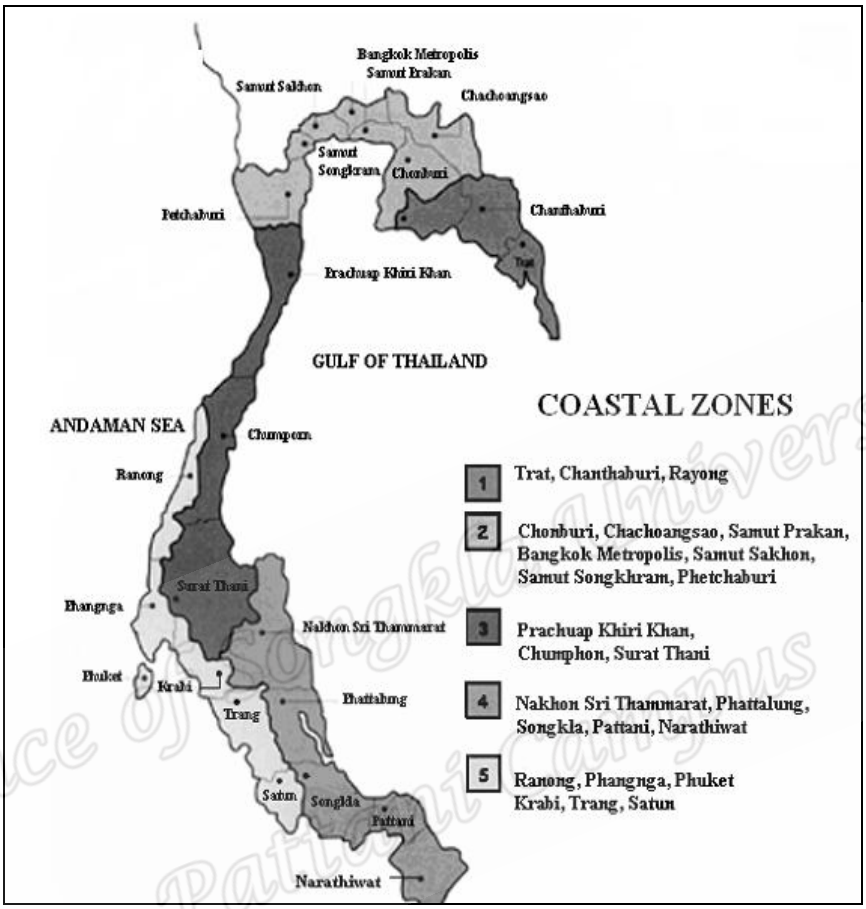

Figure 1.2: Map of Thailand coastal zones crab

In Thailand the catch quantity records of blue swimming crab are combined with other crabs. Department of fisheries has recorded total crab catch at fishery ports throughout the country, as shown in Table 1.1. This table shows quantity of crab catch throughout the country from 2001 to 2005; the total catch of all crabs was 55,195 tons. Of this around 72% is blue swimming crab (Department of Fisheries, 2006). The fisheries ports in Satun, Nakhon Si Thammarat, and Songkla are the three ports that had high quantity of crab landed.

Province	Fishery port catch (1000 tones)				
	2001	2002	2003	2004	2005
Trat	541	616	572	694	601
Chantaburi	28	99	91	81	52
Rayong	121	91	101	86	73
Chonburi	416	725	704	553	412
Chachoengsao	0	0	0	0	124
Samut Prakan	509	392	606	589	390
Samut Sakhon	454	414	290	304	134
Samut Songkhram	98	1	52	44	48
Phetchaburi	21	31	35	76	106
Prachuap Khiri Khan	0	0	0	0	128
Chumphon	143	183	113	141	124
Surat Thani	67	824	740	795	637
Nakhon Si Thammarat	1,824	1,946	1,652	1,486	1,106
Songkla	818	684	805	1339	587
Pattani	441	669	711	558	678
Narathiwat	10	15	75	49	13
Ranong	309	356	911	1,010	1,064
Phuket	921	331	352	400	456
Trang	732	788	880	607	1,217
Satun	3,100	2,699	2,329	2,902	3,095
Total	10,553	10,864	11,019	11,714	11,045

Table 1.1: Total crab landed at fishery ports in Thailand during 2001-2005

Songkhla Lake is the greatest lagoon in Thailand and one of the most important fishing areas. It is located in the southern region, approximately 900 kilometres from Bangkok. The Songkhla Lake has an area of 8,729 square kilometres including 1,024

square kilometres of main lake water body and 7,687 square kilometres of land area, extending into three provinces from Songkla, Phatthalung and Nakhon Si Thammarat (Office of Natural Resources and Environmental Policy and Planning, 2005). This region is important for blue swimming crabs because Nakhon Si Thammarat and Songkla provinces were the second and third highest crab catches in Thailand (Department of Fisheries, 2006)

Generally, the Lake is classified into three distinctive zones from north to south. The upper lake (Thale Luang or Upper Lake) covers an area of 491 square kilometres of turbid and windswept fresh to brackish water. The middle lake ("Thale Sap" or "Inner Lake" or "Middle lake") has an area of 336 square kilometers of brackish water containing many islands. This is a contact zone between fresh and saline waters, leading to sedimentation that has been significantly changed by a salinity barrier separating it from the outer lake. The lower lake ("Outer Lake") is a marine ecosystem with an area of 190 square kilometers containing intensive fishing gear (set bag nets and sitting traps), fish cage culture, and surrounded by shrimp ponds, livestock, agricultural farms, agro-processing factories, restaurants, and housing development. This area is also a regionally important wildlife resource being developed for tourism (Chesoh, 2009).

The Songkhla Lake is connecting to open sea (Gulf of Thailand). The weather in this area was reported by Southeastern Regional Meteorological Center, Songkla province. The hot season was usually from February 16 to May 15. The first period of rainy season normally starts from May 16 to October 15 and second starts from October 16 to February 15. Generally, it is not heavy rain in the first period but in second period is.

Blue swimming crab is one of the most important small-scale fisheries that have played an important economic role by contributing to the domestic seafood market, because of its high market price. It is therefore reasonable to use the blue swimming crab catch in Songkhla Lake as a sampling species for data collection of this study. Since the lake is rich in biodiversity, various types of fishing gear are used and thousands of fishermen are involved.

Ten major fish catch landing sites around the entire Songkhla Lake: Khu Tao (KT), Kuan Nieng (KN), Pak Pa Yoon (PY), Jong Ke (JK), Lampam (LP), Thale Noi (TN), Ra Nod (RN), Ko Yai (KY), Khu Kud (KK) and Hua Khao Daeng (HD) were selected for blue swimming crab data sampling as shown in Figure 1.3 (Chesoh et al, 2009).

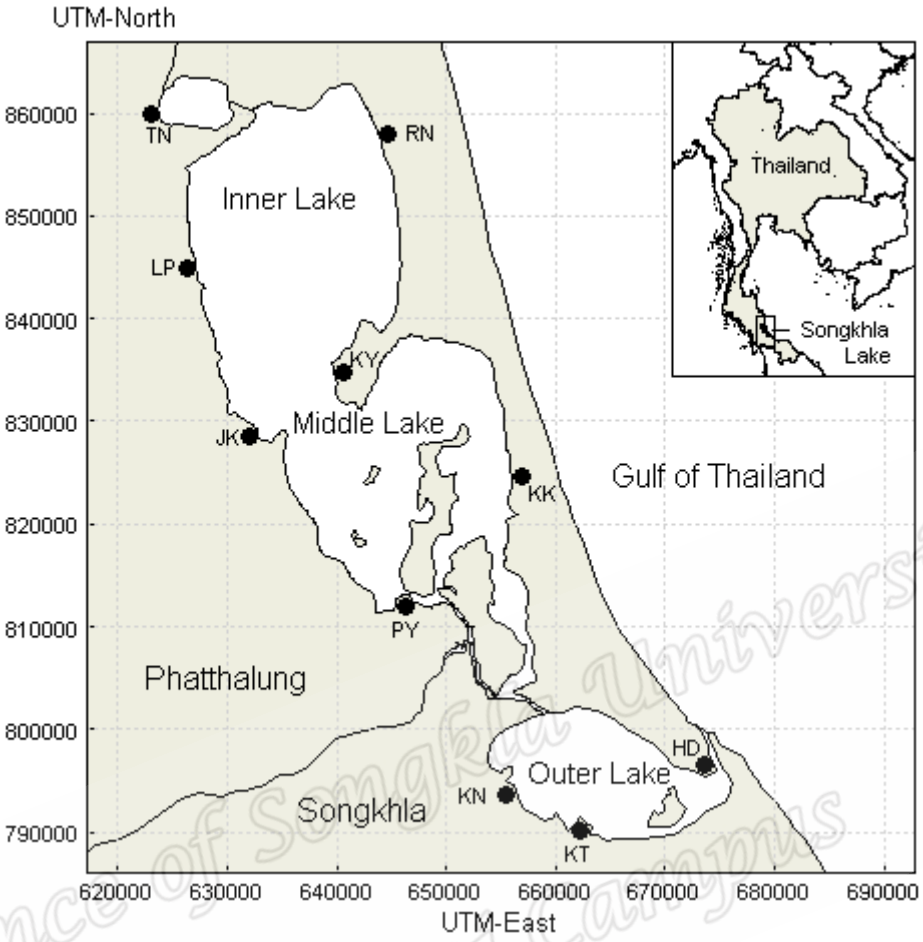

Figure 1.3: Map of Songkhla Lake and ten fish catch landing sites for data collection

The objectives of this study were to investigate trend and seasonal influence on effectiveness of the blue swimming crab catch by three major gear types that landed via fishing ports around Songkhla Lake from 2003 to 2006 and to examine relationship between the catch and some environmental factors.

1.2 Literature Reviews

Taxonomy and Morphology of Blue Swimming

Blue swimming crab is the common name given by food and agriculture organization of the United Nations (FAO) for species of *Portunus pelagicus* and Thai local name is

Pooma. Taxonomy of blue swimming crab is Phylum Arthropoda, Class Crustacea, Subclass Malacostraca, Order Decapoda, Family Portunidae, and Genus *Portunus (Linnaeus)* (Currie and Hooper, 2006).

Description of Morphology

Blue swimming crabs have five pairs of legs and a flat body. Crabs have last pair of legs specially formed for swimming and one pair of strong sharp claws for use in defense and feeding. Their carapace is rough in texture, convex and covered with small granules. Frontal margin has four spines in addition to orbital spines and antero spines. The antero-lateral border is armed with nine sharp spines including post-orbital spines. Chelipeds have strong spines, its surface scabrous as shown in Figure 1.4 (Zinski, 2006)

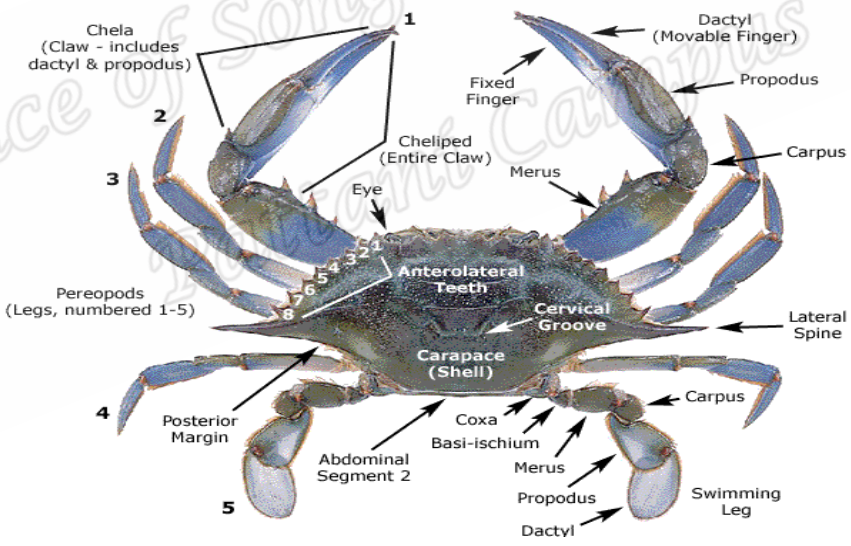

Figure 1.4: Morphology of blue swimming crab (Portunus pelagicus)

Meanwhile, a striking difference in colour is shown between the male and female from the dorsal view. When alive, the female is mottled yellowish green or greyish brown. The pincer claws of male are blue and are much longer than those of the female; and the male is decorated with an irregular blue network. The pincer claws of

the female are greyish brown and much shorter than those of the male as shown in Figure 1.5 (Currie and Hooper, 2006).

Male *Female*

Figure 1.5: Sexual dimorphisms of blue swimming crabs (Portunus pelagicus

Biology of Blue Swimming Crab

Blue swimming crab is opportunistic, bottom-feeding carnivore and scavenger. There are almost active in forgoing and feeding at sunset. They are adapted to a life in warmer waters. Blue swimming crab occurs in a wide range of algal and seagrass habitats and on both sandy and muddy substratum, from the intertidal zone to at least fifty meters of depth. In coastal waters, smaller crabs are found in shallow waters, while adults are found in comparatively deeper waters (Department of Fishery Government of Western Australia, 2007).

Blue swimming crab life cycle consists of five stages start from the eggs hatch into the first larval stage called the zoea. Zoeas are too small to swim and simply float in the ocean waters where they feed on phytoplankton. After four or five weeks of floating in ocean currents, a zoea develops into the second larval stage called a megalopa. A zoea molts seven times before becoming a megalopa. The megalopa

looks a bit like a crossover between a crab and a lobster. In this phase, the crab is still too small and too weak to swim. It was carried by the currents and the tidal flow from the ocean. The megalopa is a voracious eater and feeds mainly on the other zooplankton. This larval stage only lasts for about a week, at the end of which the megalopa molts into the first crab stage, a tiny juvenile crab. This happens about 45 days after the initial hatching of the eggs Juvenile crabs are tiny crabs that can swim or walk on the muddy bay bottom. The juvenile crabs continue to migrate into the Bay along the shallow areas and use the underwater sea grasses as refuges. By hiding in these beds of underwater grasses they can escape from large crabs and other predators. After about 12 to 18 months, a juvenile crab reaches maturity. When young female crabs become mature, it is time for them to mate in creating the next generation of blue crabs. After mating, the mature females migrate to the mouth of the Bay carrying her brood of eggs. Mature males do not migrate toward the mouth of the Bay. They remain in the rivers and inlets of the Bay. During winter, they move to the deeper waters where the temperature does not fluctuate as much as in the shallow areas. The crabs bury themselves into the mud and slow down their metabolism for a period of hibernation. They will hibernate throughout the winter feeding only infrequently. When the Bay starts to fill with spring runoff and the waters begin to warm, the crabs start to become active again and move to the shallow rivers, creeks, and tidal wetlands. The life cycle has evolved to complete growth and reproduction during the warmer part of the year when water temperatures are elevated to those similar to the tropical regions (Department of Fishery Government of Western Australia, 2007) as shown in Figure 1.6.

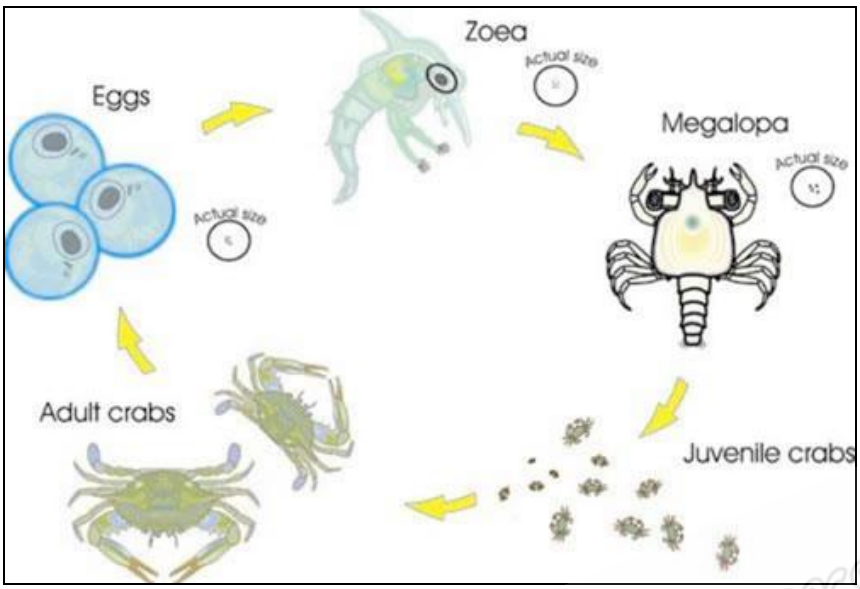

Figure 1.6: Life cycle of blue swimming crab

Statistical methods for analyze blue swimming crab catch

There are various statistical methods have been used to analyze the trends of blue swimming crab catch and catchability of gear types in previous studies. Choonhapran (1996) used descriptive statistics to analyze data on fishery resource and population change in Songkhla Lake by three types of gears (trap, set bag net and gill net) from 1994 to 1995. The conclusion from this study was found that the blue swimming crabs were distributed only in outer lake and the effective gears were set bag net, gill net and trap. The highest catch by set bag net was in June, by gill net in May and by trap in September. Komontree et al (2006) used both daily and monthly time series models for eight types of marine fish of Pattani fishery ports from 1999 to 2003, and concluded that trend of crab catch was constant. Bellchambers and de Lestang (2005) used analysis of variance to investigate catchability of four gear types of the sampling of the blue swimming crab during July 1996 to June 1997, and concluded that catchability of all four gear types was vary seasonally. Chande et al (2003) reported

high crab catches between January and July in the coastal of Dar es Salaam, Tanzania between the years 1995-1996. Trisak et al (2009) reported the highest average catch per unit effort (CPUE) in the eastern gulf of Thailand from October 2006 to September 2007 that was considered as cool season. The cool season ranges from October 15 to the end of February. The lowest CPUE was in rainy season. The rainy season starts from May 5 to October 14. Sumton et al (2003) used a generalized linear modeling approach to analyze the catch and factors influencing catch of blue swimming crab. The conclusion from this study was found that average water morning temperature (15 ˚C – 29˚C) between 4 a.m. to 10 a.m. is considered as the time when crabs are the most active and more prone to being caught.