

**THE FISHERIES STATUS IN INTEGRATED COASTAL RESOURCES  
MANAGEMENT, PAKKLONG SUB-DISTRICT,  
PATHEW DISTRICT CHUMPHON PROVINCE**

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## **I. INTRODUCTION**

This study was part of the Integrated Coastal Fisheries Management Project implemented in Pakklong Sub-district, Pathew District, Chumphon Province from 2002 to 2006. This project was the collaborative effort between the Department of Fisheries of Thailand (DOF) and the Southeast Asian Fisheries Development Center (SEAFDEC) to promote sustainable use of coastal fisheries resources. Pakklong Sub-district was chosen as a project site with six (6) activities implemented. Biological landing survey was continuously conducted for five (5) years because most of the local people in Pakklong Sub-district are fishermen and are the stakeholders of the fisheries sector, so marine resource is a major indicator of the livelihood of the people in this area. Suanrattanachai, *et al* (2002) reported that 6 out of the 7 villages in Pakklong Sub-district derive their main sources of daily income from the fisheries sector. Moreover, biological landing survey data have been used for the evaluation of the activities and for the whole program as well.

Eight (8) fishing gears were reported from the pre-survey data as the main fishing gears employed in Pakklong Sub-district. These are the: Indo-pacific mackerel gill net, squid cast net with light luring, crab gill net, shrimp trammel net, mullet gill net, anchovy falling net with light luring, collapsible crab trap, and cuttlefish trap. From these fishing gears, only four (4) fishing gears were continuously employed. For the data analysis of this study, the squid cast net with light luring and Indo-pacific mackerel gill net were chosen as representatives of the natural resources utilization fishing gears, while collapsible crab traps and shrimp trammel net were chosen as representatives of natural resources with enhanced utilization.

## **II. MATERIALS AND METHOD**

### **1. Sampling area and period**

The survey area is the Integrated Coastal fisheries Management Project area at Pakklong Sub-district, Pathew District, Chumphon Province comprising six (6) fishing villages. The survey was conducted between January 2002 and September 2006. Data and information were collected through interviews of the fishermen and from fish sampling at the piers in each village. Two main fishing gears were chosen as representatives of the natural resources, namely: the squid cast net with light luring and the Indo-pacific mackerel gill net. Another two main fishing gears represent the natural resources with enhanced utilization, namely: the collapsible crab traps and shrimp trammel net.

### **2. Data Analysis**

2.1 Catch per unit effort of all species and target species of the shrimp trammel net and Indo-pacific mackerel gill net were reported in terms of kg/100 m net. For squid cast net, the CPUE was kg/haul and for collapsible crab traps was kg/10 traps.

2.2 The total catch of squid and blue swimming crab was analyzed using the following formula:

$$T = \frac{Nd}{\bar{d}} \left( \frac{W_1 + W_2 + W_3 + \dots + W_n}{n} \right) \frac{1}{1000}$$

Where  
 $T$  = Total Catch (tons)  
 $N$  = Number of fishing boats  
 $d$  = Fishing day per boat (days)  
 $\bar{d}$  = Average day per trip (days)  
 $W_1, W_2, W_3 \dots W_n$  = Catch of each sampling boat per trip (kg)  
 $n$  = Number of sampling boat

2.3 Species identification of the catch are reported in terms of percentages.

2.4 The length of target species was recorded on punch paper by 0.5 class interval and analyzed as follows (Weera, 1994).

$$RF = \frac{W_t}{W_s}$$

Where  
 $RF$  = Raising Factor  
 $W_t$  = Total weight of target specie (kg)  
 $W_s$  = Weight of sampling target specie (g)

$$\bar{X} = \frac{\sum_{i=1}^n f_i x_i}{N}$$

Where  
 $\bar{X}$  = Average length (cm)  
 $f_i$  = Number in each length class interval  
 $x_i$  = Median of each length class interval  
 $N$  = Total number of that specie

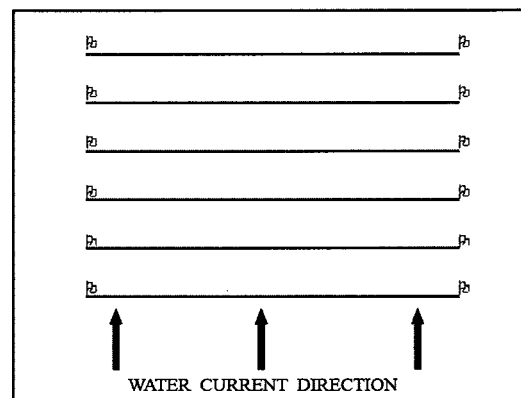
### III. RESULT AND DISCUSSION

#### 1. Shrimp trammel net

##### 1.1 Description of boat, fishing gear and fishing operation

There were 56 shrimp trammel net boats in Pakklong Sub-district. Most of the boats (18) were found in village no.1; while 16 boats were found in village no.7; 14 boats in village no.5; 6 boats in village no.6; and 1 boat each for village no.2 and 3 (Rotchanarut, 2004). Long tail boat was mostly used: 6-10 m in length with 7-90 horse power engines and 11-16 mostly.

Shrimp trammel net was 30 m in length each with 14 cm mesh size outer net and 4 - 4.5 cm mesh size inner net. About 10-15 nets are lined in 3-16 lines of nets using the water current direction, and marked with flags at the end of each line (Fig.1). The nets are left for 2-3 hours and hauled manually. The number of trips per day depends on the shrimp density and the sea condition. The target species are *Penaeus merguensis* and *Metapenaeus spp.* for fresh consumption.



**Fig. 1** Shrimp trammel net fishing operation in Pakklong Sub-district.

### 1.2 Shrimp trammel net fishing season and fishing ground

Fishing season for shrimp trammel net is during the northeast monsoon between November and February. The number of fishing boats per month is shown in Table 1. The fishing ground for shrimp trammel net is in 2-20 m water depth around Eiang island, Rung island, Sikong island, Thungmaba bay, Bang-bird bay, Tha-at fishing community and Lam-Yai cave (Fig. 2).

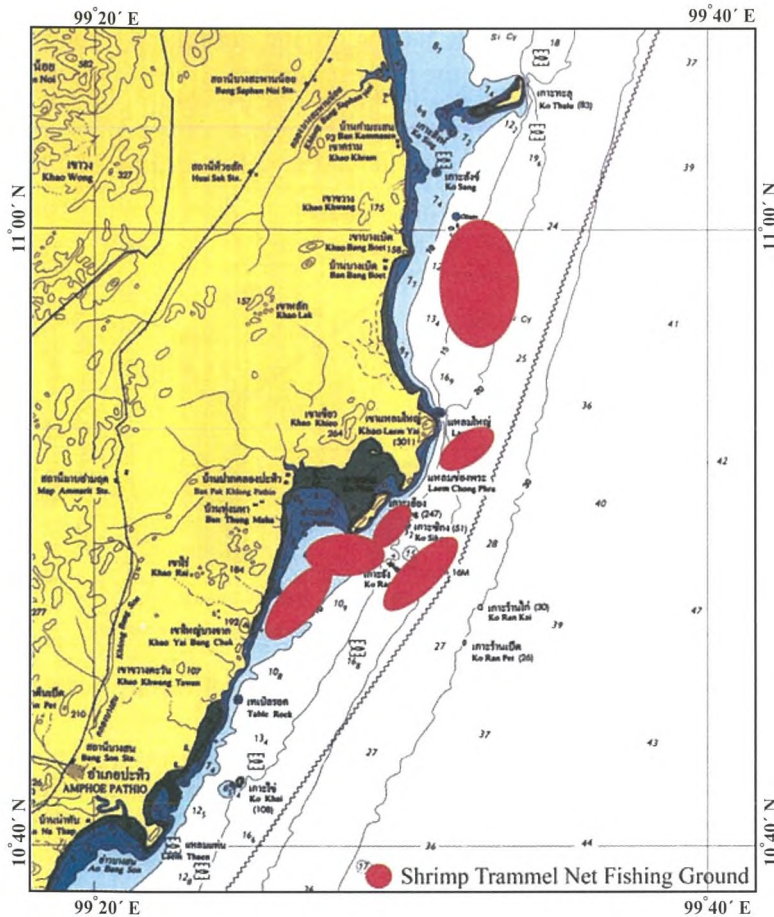


Fig. 2 Fishing ground of Shrimp trammel net in Pakklong Sub-district.

### 1.3 Catch rate of shrimp trammel net

All species and the shrimp catch per 100 m net are shown in Fig. 3. The CPUE of all species showed an increasing trend while the CPUE of the shrimps fluctuated.

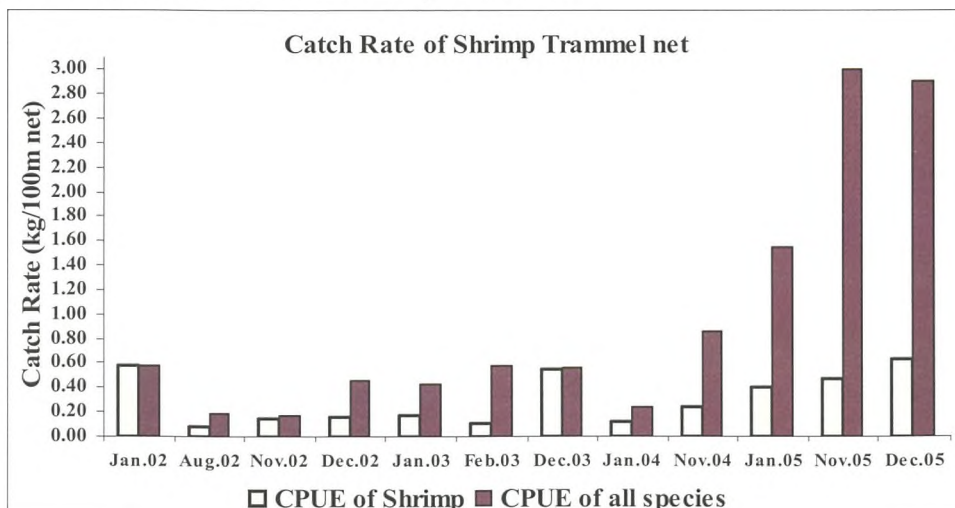


Fig. 3 Catch rate of Shrimp trammel net in Pakklong Sub-district.

The average CPUE of white shrimp (*Penaeus merguensis*) by fishing season and the number of fishing boats per month was compared. (Fig. 4) Results showed that from November 2002-February 2003, and November 2003- February 2004, the CPUE of white shrimps had increasing trend, the same trend as the number of fishing boats indicating high density of the white shrimp resource. In November 2003- February 2004, the CPUE of the white shrimp was the highest while there was also high number of fishing boats. This period also showed the highest density of the white shrimp, which could be due to the white shrimp releasing program using P45 post-larvae conducted in June 2003. The shrimp had taken 7.5 months to reach about 15 cm total length and have moved to the fishing ground during the fishing season of the same year. From November 2004 to February 2005, the highest number of boats per month led to the decreased CPUE but the November 2005- February 2006 CPUE was a little bit higher because of the decreasing number of boats.

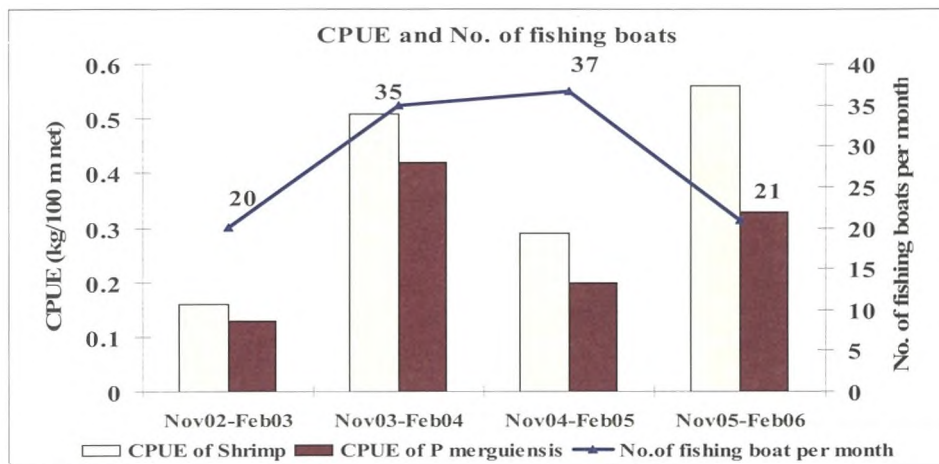


Fig. 4 CPUE of shrimp and white shrimp by fishing season and number of fishing boats per month of Shrimp trammel net in Pakklong Sub-district.

The average CPUEs of all species and shrimps between November 2002 to February 2003 were 0.36 and 0.16 kg/100 m net, respectively, while from November 2003 to February 2004, the CPUE were 0.54 and 0.51 kg/100 m net, respectively. From November 2004 to February 2005 the CPUE were 1.07 and 0.29 kg/100 m net, respectively and from November 2005 to February 2006 the CPUE were 2.95 and 0.56 kg/100 m net, respectively (Table 1).

#### 1.4 Species composition and size composition.

The species composition of catch from the shrimp trammel nets was 40.41% shrimp consisting of *Penaeus merguensis*, *P. monodon*, *Metapenaeus affinis* and other shrimps (26.30%, 1.49%, 11.25% and 1.37%, respectively (Fig. 5)). The monthly species composition is shown in Table 2.

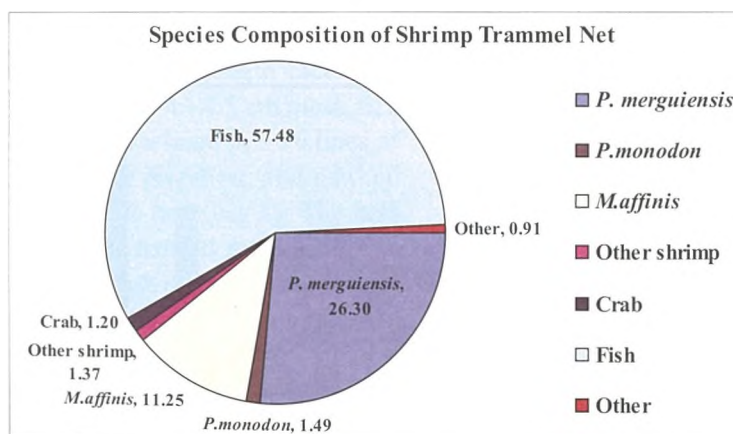


Fig. 5 Species composition of shrimp trammel net between 2002 – 2006 in Pakklong Sub-district.



Large size shrimps were selected by the shrimp trammel net's mesh size. The average total length of *P. merguensis* was 12.73-17.74 cm and *M. affinis* from 11.50 to 13.07 cm (Table 3). Comparing the average total length of *P. merguensis* to the first maturity size of 14.60 cm (Taweep, 1994), Fig. 6 shows that the catch were mostly bigger than the first maturity size. Thus, shrimp trammel net in Pakklong Sub-district was suitable for shrimp fishing without the gear destroying the marine shrimp resources.

Table 4 shows the age ( $t$ ) and total length ( ) of *P. merguensis* from shrimp trammel net by  $L_t = 25.89(1 - e^{-1.40(t+0.0048)})$  (Taweep, 1994) equation. *P. merguensis* between 5.9 to 10.0 months old were however caught. The fishing season of shrimp trammel net in Pakklong Sub-district is November to February as described above. Therefore, any shrimp releasing program should be done between April and July during which time P45 shrimp post-larvae should be released.

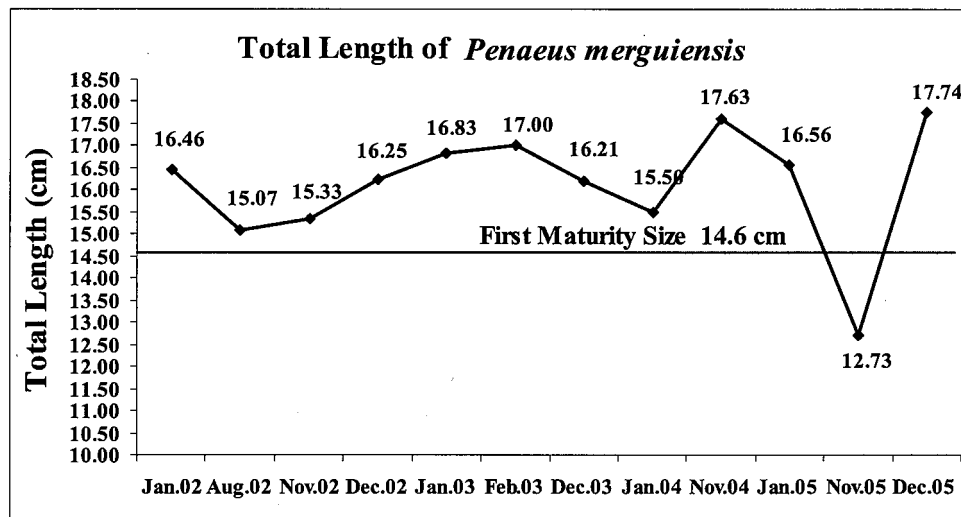


Fig. 6 Average total length of *P. merguensis* compared to first maturity size

## 2. Squid cast net with light luring

### 2.1 Description of boat, fishing gear and fishing operation

There were 109 boats for squid cast net with light luring in Pakklong Sub-district, mostly found in village no.1 (46); 21 boats in village no.3; 18 boats in village no.6; 11 boats in village no.7; 8 boats in village no.5; and 5 boats in village no.2. (Sansanee, 2004)

Long tail boats were the mostly used in this area, 5-15 m in length and 7-11 m mostly while the boats with inboard engine were 11-15 m in length and 10-24 m mostly. Generators (1-2) were used to acquire 5-40 kw light power and 10-20 kw mostly. Fluorescent lamps (400-500 w) were also used (mostly 10-30 lamps, 10-15 lamps and a combination of 2-8 mercury lamps).

The squid cast nets had mesh sizes of 1-1.5 inches and 1.25 inches mostly, with width and height 4 and 1.5 times of the boat length, respectively. The cast net is hung to a square shape over the sea surface. The squids are lured with light, which keeps blinking until high density of squid is found. The net is cast covering the school of squids and using purse line, the net with the squid is hauled. (Fig. 7) Squid fishing is carried out for 2-23 days/month depending on the sea condition. Average fishing day per month in 2002, 2003, 2004, 2005 and 2006 were 19.66, 6.51, 4.06, 3.83 and 2.92 days/month, respectively, showing a decline in trend.

The target species, *Loligo spp.* are consumed as fresh and preserved as sun dried squid. Small pelagic fish caught with the squid are sold to middlemen for animal feed production in processing plants and other species are used for household and domestic consumption.

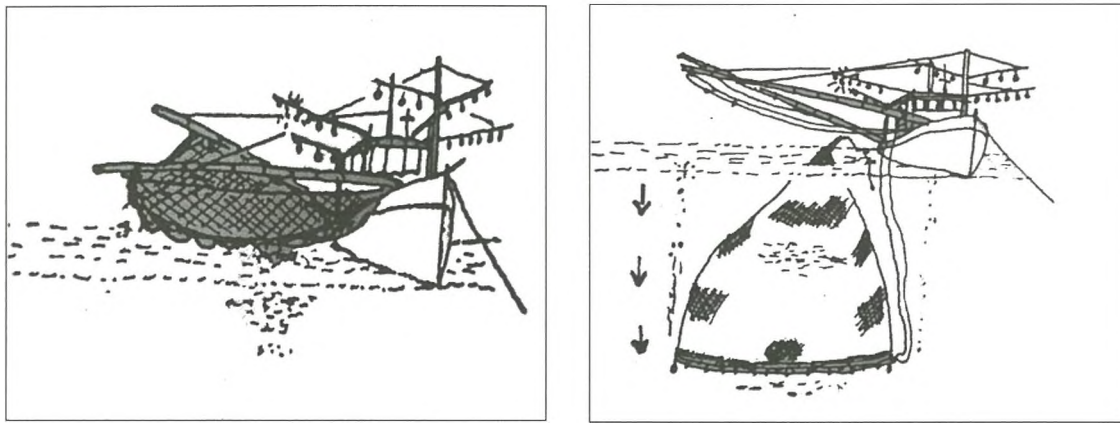


Fig. 7 Squid cast net with light luring fishing operation (Department of Fisheries, 1997)

## 2.2 Squid cast net with light luring fishing season and fishing ground

Fishing is done almost all year round but concentrated at the end of northeast monsoon and throughout the southwest monsoon between March to October. (Fig. 8 and Table 5)

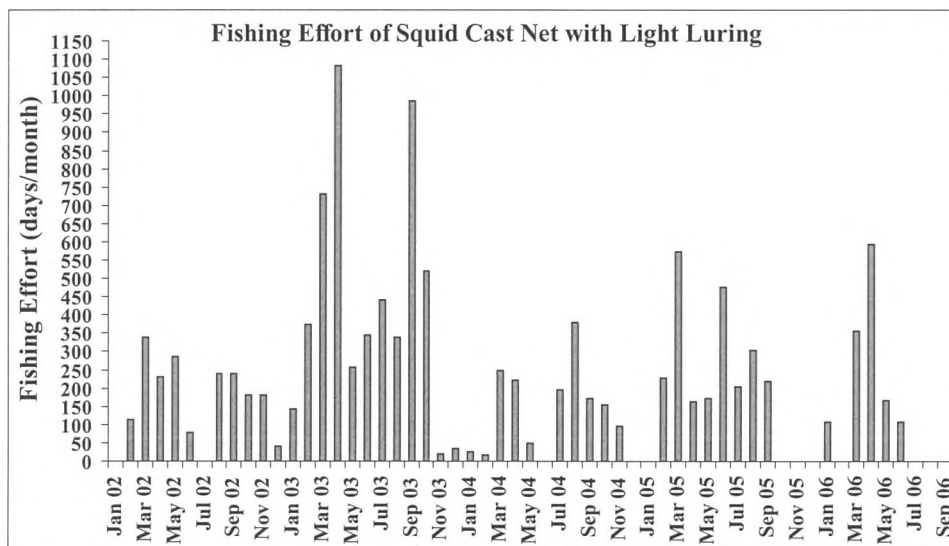


Fig. 8 Fishing effort of squid cast net with light luring in Pakklong Sub-district.

The fishing ground of the squid cast net is at 5-42 m depth waters, concentrated at 8-20 m depth around Eiang island, Rung island, Sikong island, Talu island, Ran-ped Ran-kai island, Thungmaha bay, Bang-bird bay, Thum-thong bay, in front of Bang chark mountain (Fig. 9).

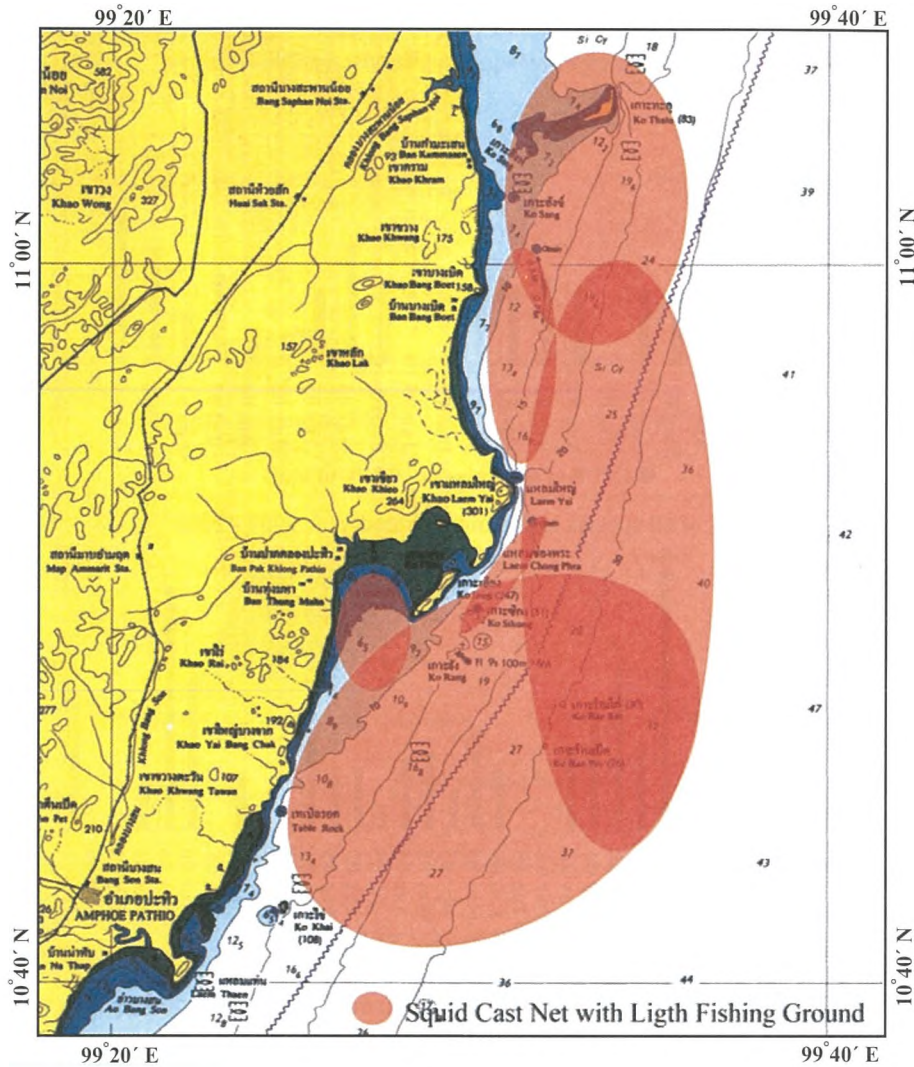


Fig. 9 Fishing ground of squid cast net with light luring in Pakklong Sub-district.

### 2.3 Catch rate of squid cast net with light luring

The all species and squid catch per haul are shown in Fig. 10. The CPUEs for all species and squid showed increasing trend at the end of the northeast monsoon (February-March) and at the end of the southwest monsoon (August-October). For the inter-monsoon season, the CPUEs showed a decreasing trend.

The average CPUE for all species and squid per trip in 2002, 2003, 2004, 2005, and 2006 were 41.10 and 39.70, 56.64 and 52.87, 55.51 and 36.97, 34.74 and 33.04, 88.48 and 41.80 kg/trip, respectively. The average CPUE per haul of all species and squid were 7.09 and 6.83, 10.70 and 9.99, 13.86 and 9.23, 7.12 and 6.77, 14.72 and 6.95 kg/haul, respectively. (Table 5)

A comparison of the average CPUE of squid per haul and average fishing effort (Fig. 11), indicated that in 2003 the CPUE of squid and fishing effort were the highest suggesting the highest density of the squid resource as well. In 2004, the CPUE of squid was lower than before with less fishing effort, indicating low density of squid because of water pollution. Based on the fishermen's observation, the direct releasing of waste water to the sea from shrimp farms may have caused this problem. In 2005, the fishing effort was higher than in 2004 and the CPUE has decreased a little bit and in 2006, the CPUE increased a little while the fishing effort decreased. Therefore in 2005-2006, the squid resource was stable.



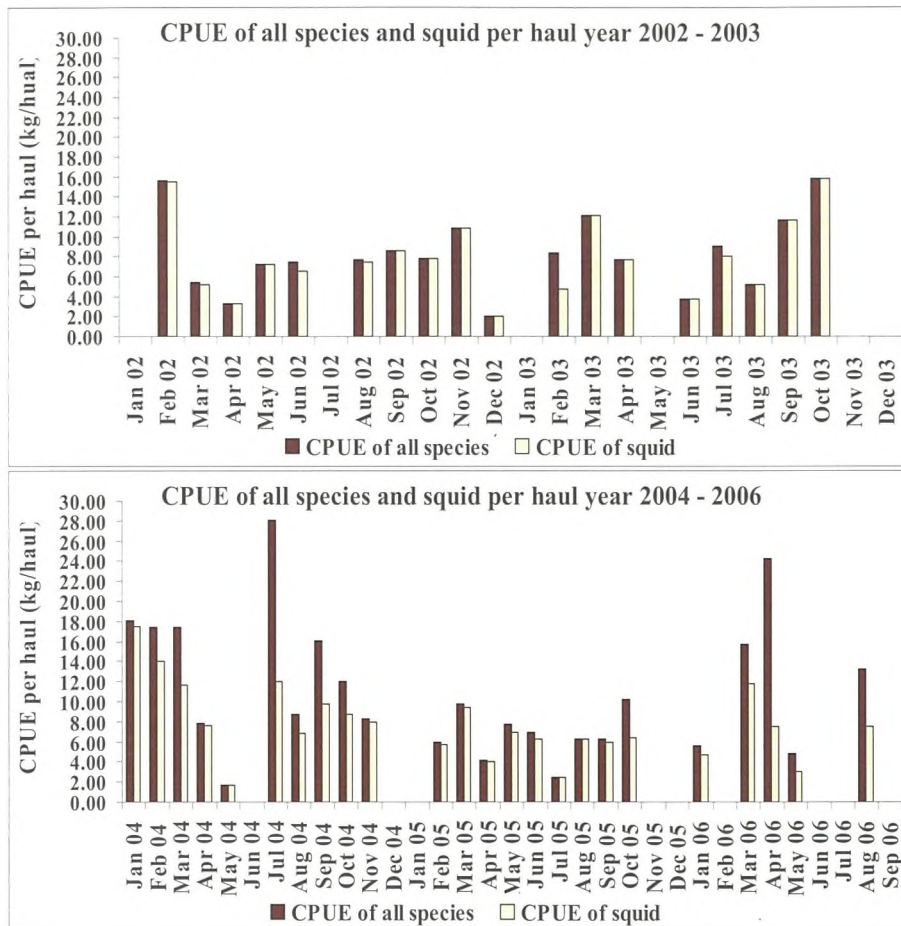


Fig. 10 CPUEs of squid cast net with light luring in Pakklong Sub-district.

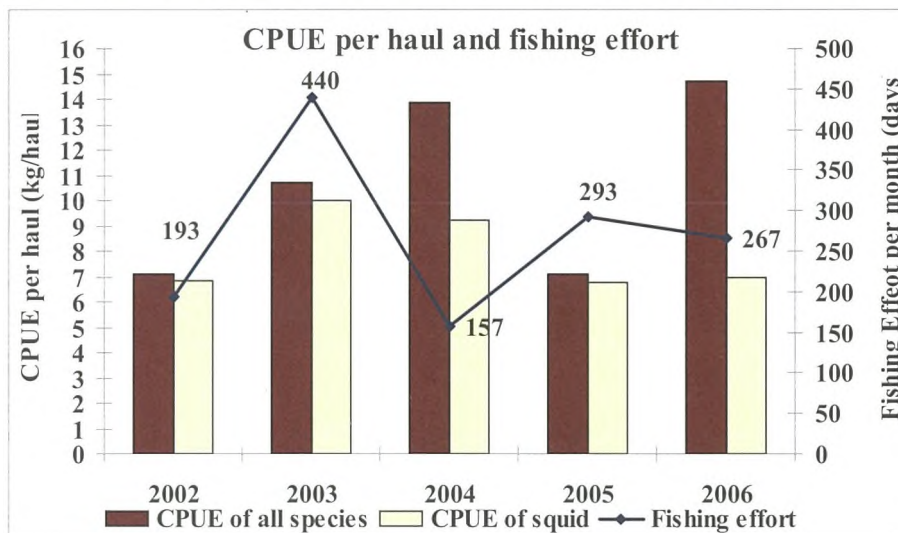


Fig. 11 CPUE and fishing effort of squid cast net with light luring in Pakklong Sub-district.

#### 2.4 Species composition and size composition

The species composition of catch from squid cast net with light luring in 2002 was: 98.58% Indian squid, 1.17% pelagic fish, 0.24% other squids and 0.01% other fishes. In 2003, the composition was: 93.35% Indian squid, 6.02% pelagic fish and 0.63% other squids. In 2004, the composition was: 66.60% Indian squid, 33.16% pelagic fish and 0.24% other squids. In 2005, 95.10% Indian squid, 4.30% pelagic fish and 0.60% other squids; and in 2006, 47.25% Indian squid, 52.49% pelagic fish 0.24% other squids and 0.02% others. (Fig. 12 and Table 6)



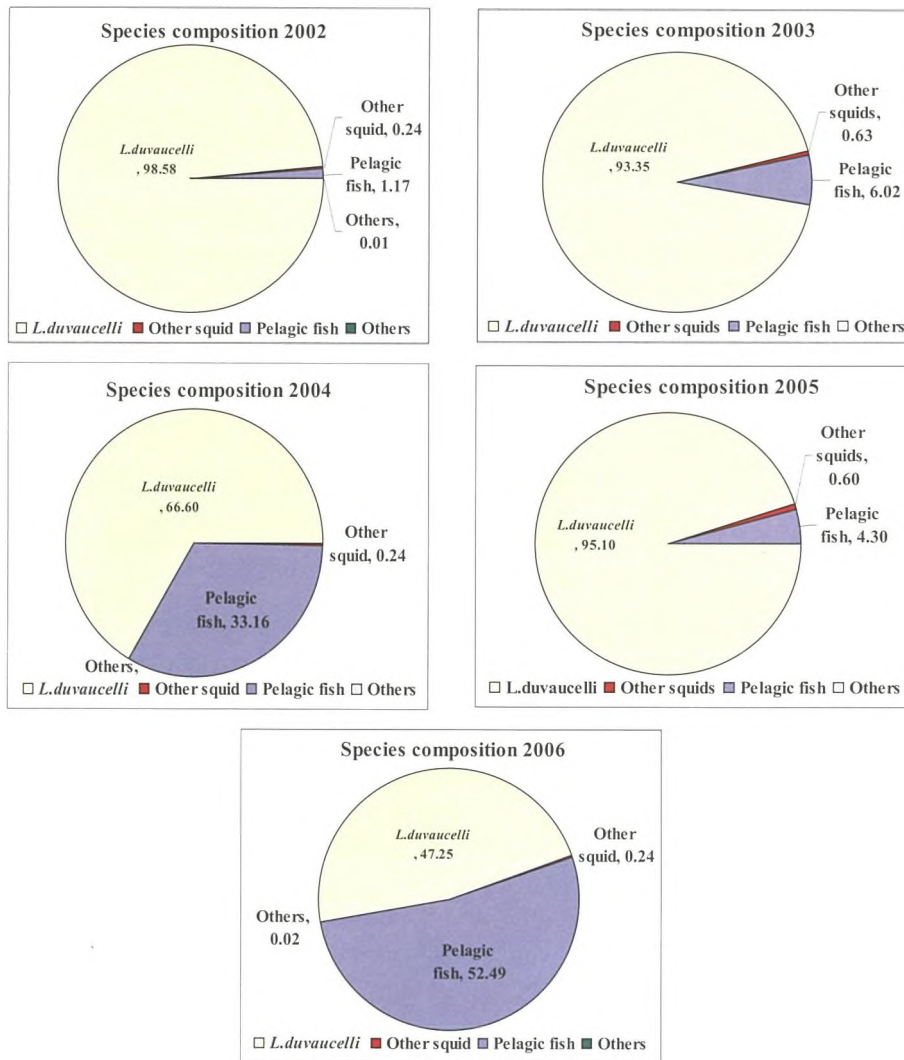


Fig. 12 Species composition of catch from squid cast net with light luring in Pakklong Sub-District.

The average mantle length of the Indian squid was 6.58-13.81 cm. (Table 7) A comparison of the average mantle length and the first maturity size of *Loligo duvaucelli* : 8.5 cm (Supongpan, 1998) is shown in Fig. 13. A high percentage of Indian squid with smaller mantle than the first maturity size was observed in February-April and July-September. (Fig. 14 and Table 8)

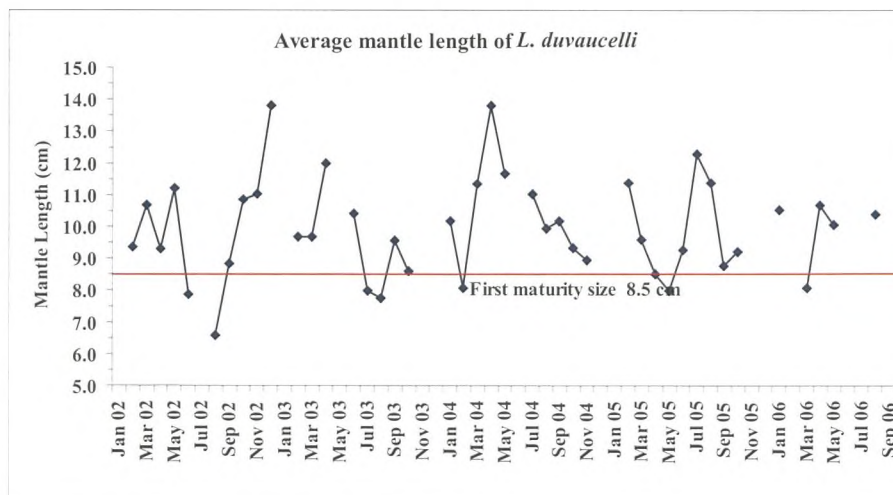


Fig. 13 Average mantle length of *L. duvaucelli* from squid cast net with light luring in Pakklong Sub-district

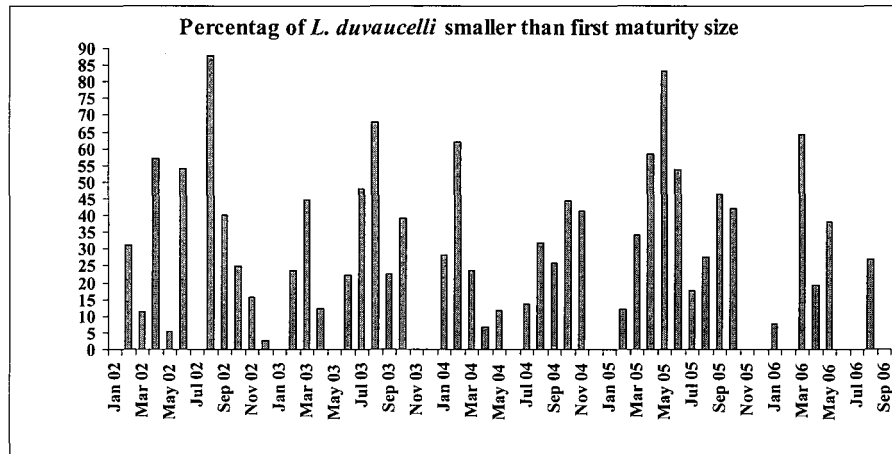


Fig. 14 Percentage of *L. duvaucelli* which smaller than first maturity size

Table 8 shows the age ( $t$ ) and mantle length ( ) of *L. duvaucelli* from squid cast net with light luring by  $L_t = 26.6(1 - e^{-1.67(t+0.0026)})$  (Taweep, 1998) equation. *L. duvauceli*, 2.1-5.3 months old was caught. A comparison of the age with the Chumphon spawning season (January-April and June-July) as Supongpan and Sinoda(1998) reported showed small catch of Indian squid from this area which high percentage smaller mantle than the first maturity size in February-April and July-September spawned in the same year.

### 2.5 Indian squid total catch

The total catch of Indian squid in 2002, 2003, 2004 and 2005 was 75.94, 279.01, 69.30 and 78.36 tons/year, respectively (Table 7). The highest total catch was in 2003 due to high fishing effort.

## 3. Collapsible crab trap

### 3.1 Description of boat, fishing gear and fishing operation

There were 26 collapsible crab trap boats in Pakklong Sub-district, mostly found in village no.7 (17 boats); 6 boats in village no.1; and 1 each for village no. 3, 5 and 6. Long tail boats were used, 4.0-11.5 m in length with 5-13 horse power engines.

Collapsible crab traps are made of wire rectangular in shape, 36x52x18 cm estimated size with 2 entrances. The traps are covered with 1.25 inch mesh size polyethylene net except at the bottom side which has 2.5 inch mesh size. Trash fishes are used as bait skewered at the center of the traps. About 100-400 traps are used per fisherman by fixing these to a main line at a distance of 12 m from each other and fixed by 2 sinkers (10 g) between each trap. The sets of crab traps are put in the fishing ground in a zigzag direction. The distance between lines is 20-25 m and marked with flags at the end of each line. (Fig. 15) The traps are left overnight then hauled manually.

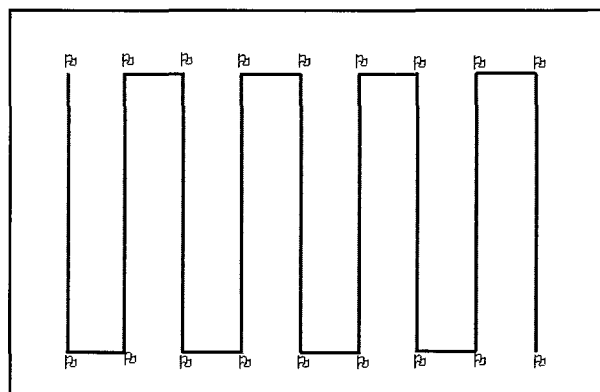


Fig. 15 Collapsible crab trap fishing operation in Pakklong Sub-district.

The target species is the Blue swimming crab (*Portunus pelagicus*), which are processed as boiled crab meat and sold to middlemen.

### 3.2 Collapsible crab trap fishing season and fishing ground

The fishing season is all year round because of the shallow fishing ground and the island is protected from wind which is beneficial to the fishermen. The fishing ground for collapsible crab trap fishery is at 2-5 m depth in front of the Koh-Teab fishery community, Pra island and Eiang island (Fig. 16). The average fishing day per month in 2002, 2003, 2004, 2005 and 2006 were 20.67, 24.34, 24.64, 26.82 and 27.20 days/month, respectively (Table 9)

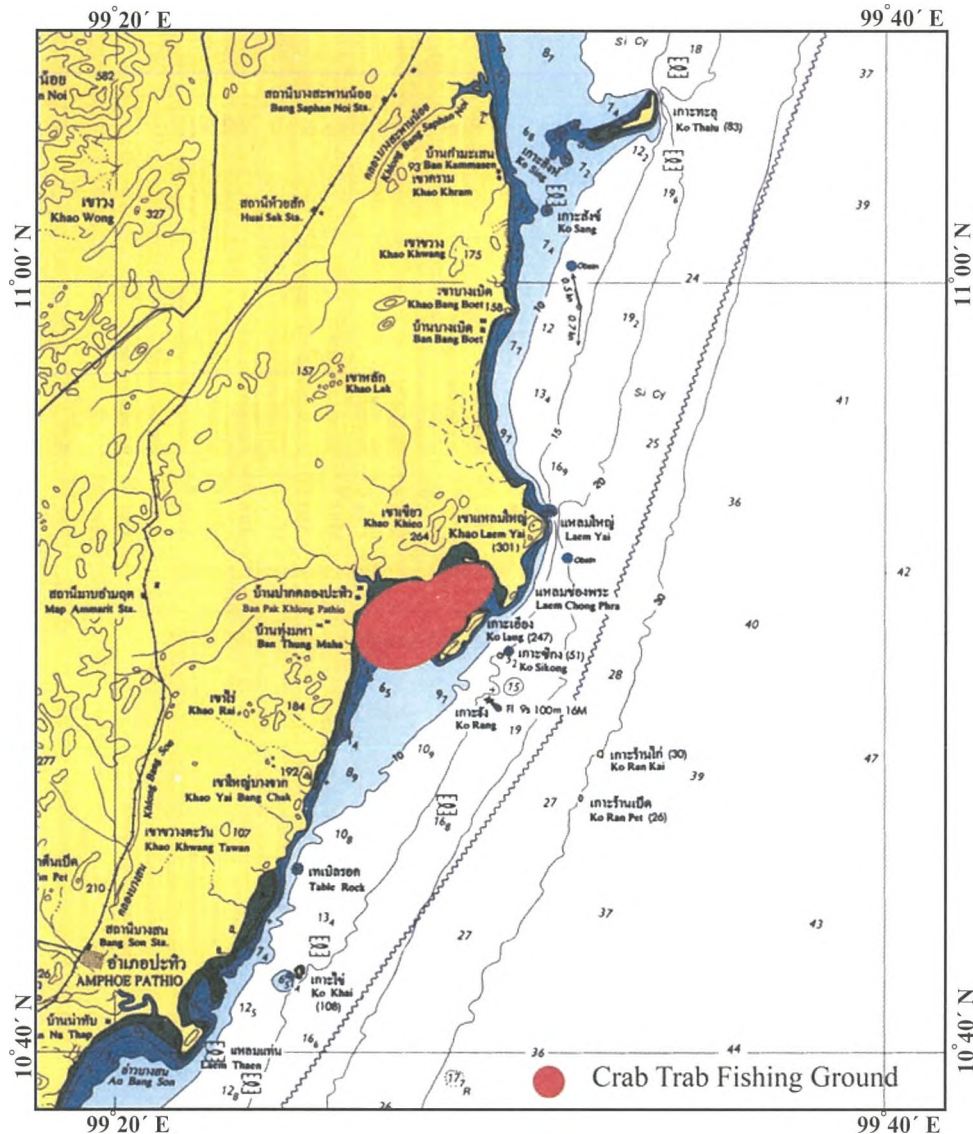


Fig. 16 Collapsible crab trap fishing ground in Pakklong Sub-district

### 3.3 Catch rate from collapsible crab trap fisheries

All species and blue swimming crab catch per 10 traps are shown in Fig. 17. The CPUEs of all species and blue swimming crab fluctuated, however, there was an increasing trend between April-June and September-November except in 2005, when in April-June the trend was not clear.

The average CPUEs of all species and Blue swimming crab per trip in 2002, 2003, 2004, 2005, and 2006 were 9.90 and 9.60 9.22 and 8.49 14.84 and 14.44 14.71 and 13.54 14.44 and 12.96 kg/trip, respectively. The average CPUEs per 10 traps of all species and Blue swimming crab were 0.59 and 0.57 0.52 and 0.47 0.65 and 0.63 0.61 and 0.56 0.62 and 0.55 kg/10 traps, respectively (Table 9).



A comparison of the average CPUE of Blue swimming crab per 10 traps and the fishing effort (Fig. 18), showed that the CPUE in 2003 slightly decreased from 2002 because of higher fishing effort. In 2004, both CPUE and fishing effort were high indicating that the fishing effort of collapsible crab trap fisheries in this year was not higher than the blue swimming crab's production capacity. In 2005, CPUE slightly decreased from 2004 because of the highest fishing effort and in 2006 fishing effort declined while CPUE remained the same as before. Therefore, we can estimate the suitable fishing effort from the relationship between the CPUE and fishing effort in 2005 and 2006 for blue swimming crab resource management.

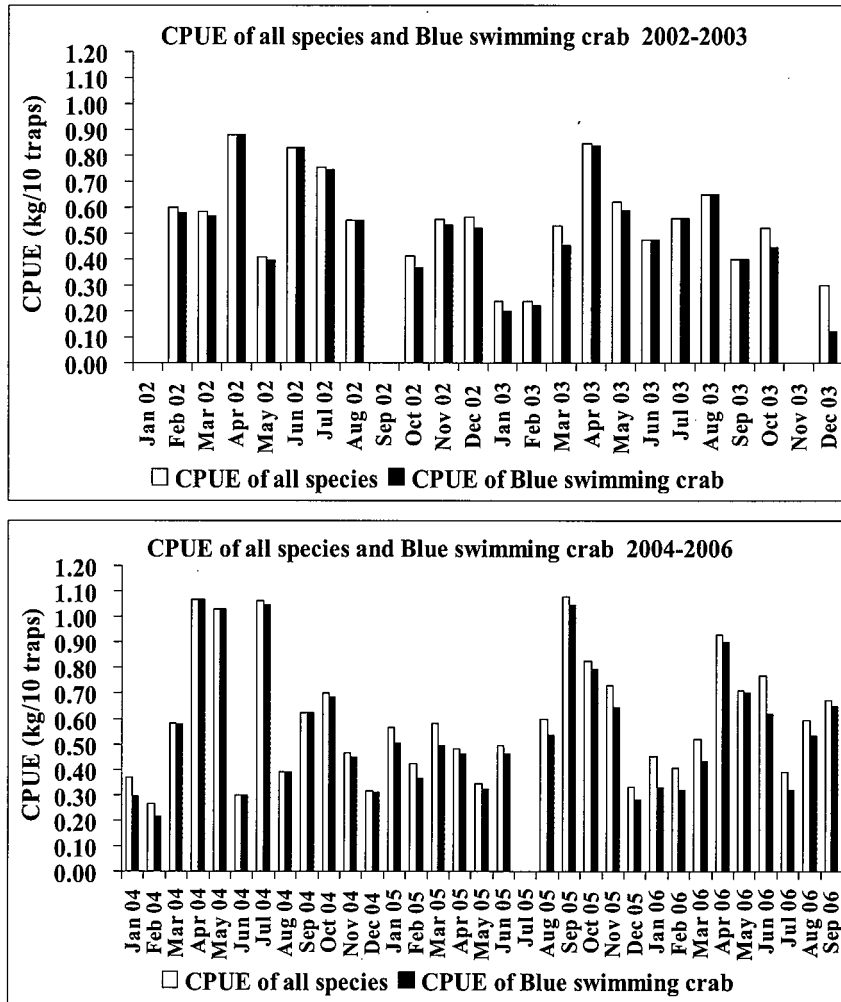
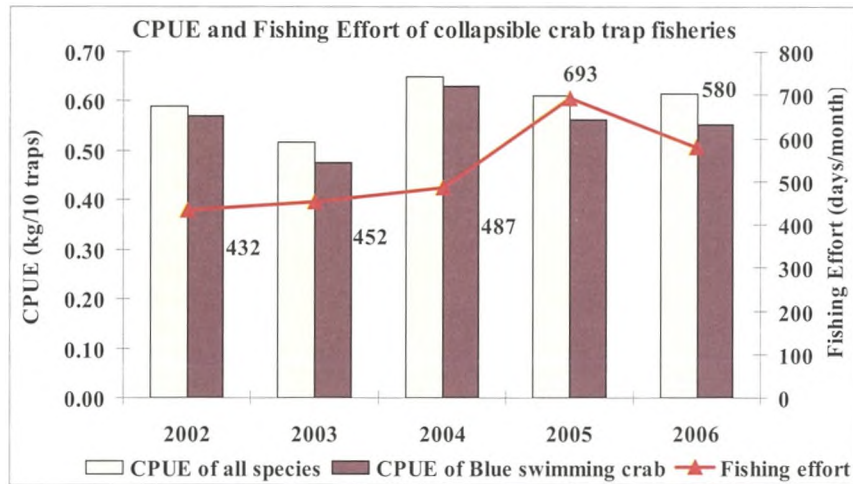


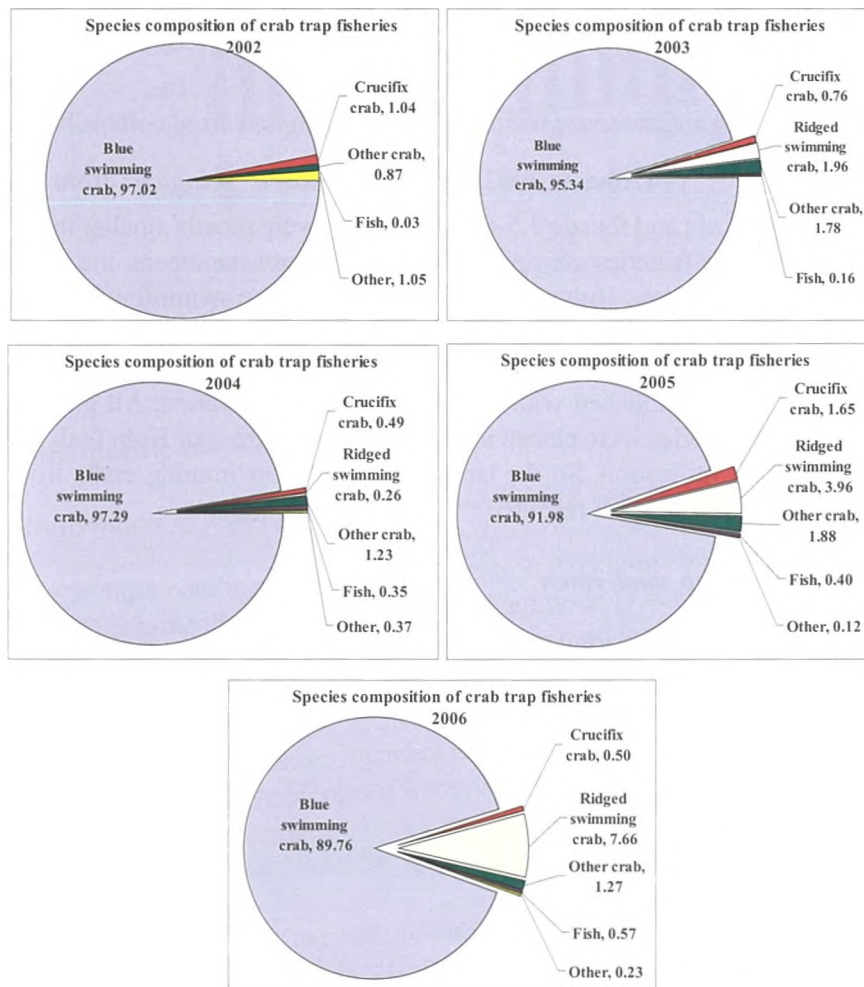
Fig. 17 CPUEs of all species and Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district.



**Fig. 18** CPUEs of all species and Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district.

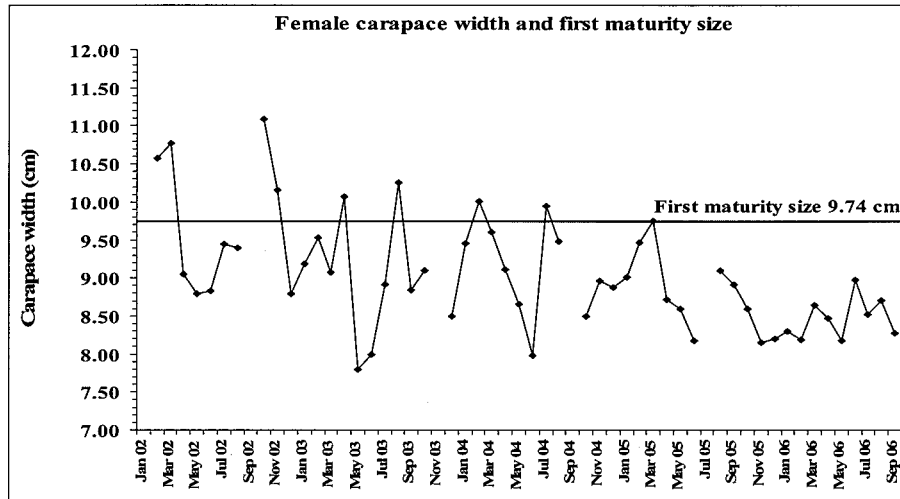
**3.4 Species composition and size composition**

The main species composition of catch from collapsible crab trap fisheries was the Blue swimming crab. In 2002, 2003, 2004, 2005 and 2006 the percentage of blue swimming crab were 97.02%, 95.34%, 97.29%, 91.98% and 89.76%, respectively. (Fig. 19 and Table 10)



**Fig. 19** Species composition of catch from collapsible crab trap fisheries in Pakklong Sub-district

The average carapace width of the male Blue swimming crab was 7.10-11.47 cm and female 7.80-11.09 cm. (Table 11) A comparison of the average carapace width to the first maturity size of female *Portunus pelagicus* of 9.74 cm (Amara, 2002) is shown in Fig. 20. Most female Blue swimming crab caught from collapsible crab trap fisheries in Pakklong Sub-district were smaller than the first maturity size because the fishing ground is in shallow waters same as Sansanee (2004) reported that Blue swimming crab caught in shallow waters was smaller than deeper waters even though bigger mesh size of crab traps were used.



**Fig. 20** Carapace width of female Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district.

Table 11 shows the age ( $t$ ) and carapace width ( ) of *P. pelagicus* from collapsible crab trap fisheries by  $L_t = 18.48(1 - e^{-1.64(t+0.041)})$  (Amara, 2002) equation. Male *P. pelagicus* from crab trap fisheries between 3.1 to 6.6 months old and female 3.5-6.2 months old were mostly smaller than the first maturity size. If collapsible crab trap fisheries are operated without any management, the Blue swimming crab resource will decline continuously. However, the CPUE of the Blue swimming crab in this area has not continuously declined because of the implementation of the Crab Bank enhancement program. Raising awareness programs were conducted continuously to change the fishermen's attitude and the Crab Bank enhancement program was established with the fishermen's participation. All gravid Blue swimming crabs from the crab trap fisheries were placed in floating cages in front of Koh-Teab fishery community for them to spawn before utilization. So the larvae of the Blue swimming crabs from the Crab Bank comprise the new recruit for the crab resource.

### 3.5 Blue swimming crab total catch

The total catch of the Blue swimming crab in 2002, 2003, 2004 and 2005 were 41.72, 44.34, 76.89 and 98.34 tons/year, respectively. (Table 12) High total catch was recorded in 2004 and 2005 because of high fishing effort in those years. (Fig. 21)



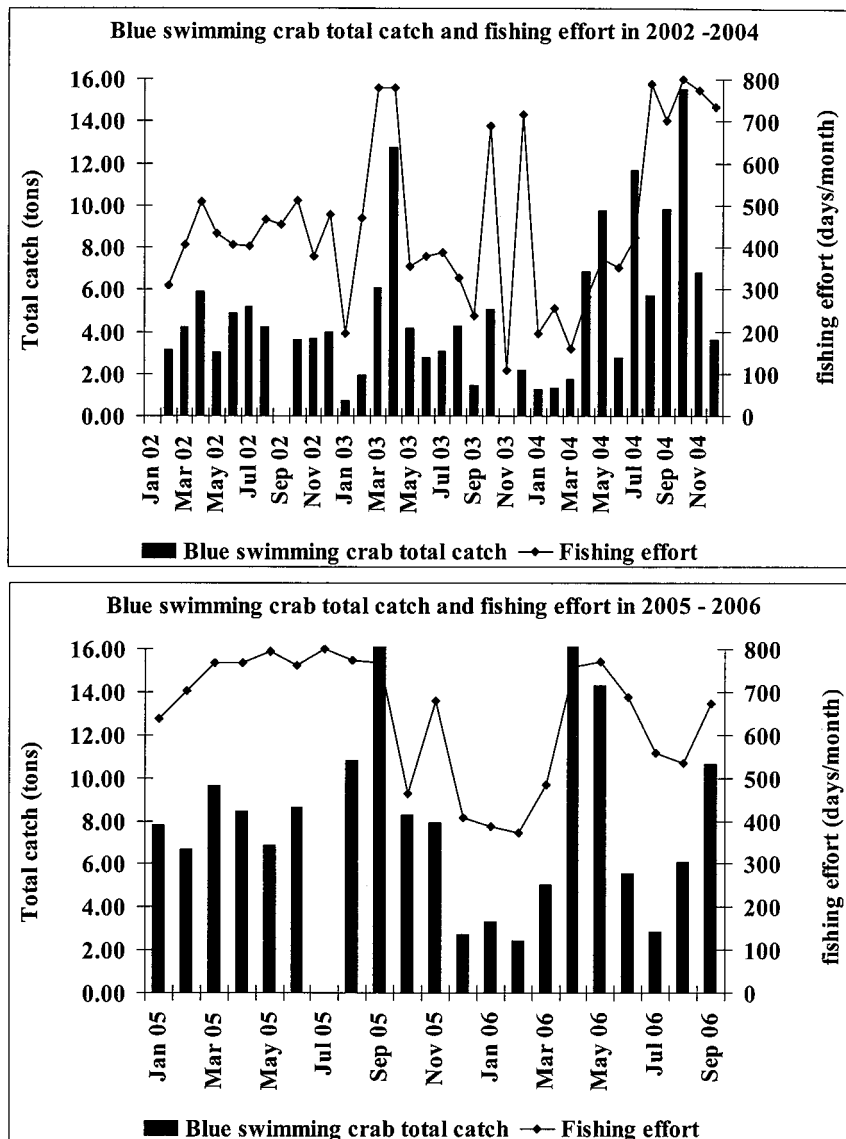


Fig. 21 Total catch of Blue swimming crab from collapsible crab trap fisheries and fishing effort in Pakklong Sub-district.

#### 4. Indo-pacific mackerel gill net

##### 4.1 Description of boat, fishing gear and fishing operation

There were 95 Indo-pacific mackerel gill net boats in Pakklong Sub-district, mostly found in village no.1 (27 boats); 22 boats in village no.7; 22 boats in village no.5; 11 boats in village no.6; 9 boats in village no.3; and 4 boats in village no.2. Long tail boats are mostly used in this area with 6-9.5 m in length and with 5-22 horse power engines.

Indo-pacific mackerel gill net is a ligament net with 2.5, 3.5, 4.0 and 4.5 inch mesh size, which 3.5 inch mesh size is mostly used. Small plastic buoy, 3.8 cm in diameter and 4.5 cm thick are attached at 50-90 cm apart along the net. For floats, 10 cm diameter plastic buoys are placed at 18-20 m apart along the net and 10 g sinkers are used at 30-60 cm apart. The total length of the net is 360-2,700 meters.

Operation time is usually during early mornings. The nets are bound together to the line and where flags are used to mark the end of each line (Fig. 22). The nets are left for 1-2 hours and then hauled manually. The Indo-pacific mackerel are removed from the nets and sold to middlemen for the local market.

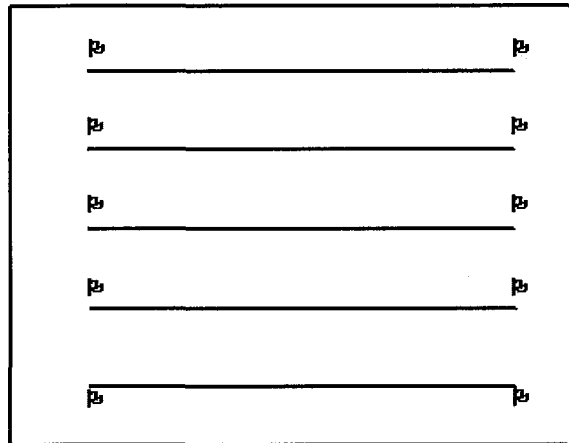


Fig. 22 Indo-pacific mackerel gill net fishing operation in Pakklong Sub-district.

#### 4.2 Indo-pacific mackerel gill net fishing season and fishing ground

Indo-pacific mackerel gill net is operated at three (3) periods per year between January-March, May-June and September-October. (Fig. 23)

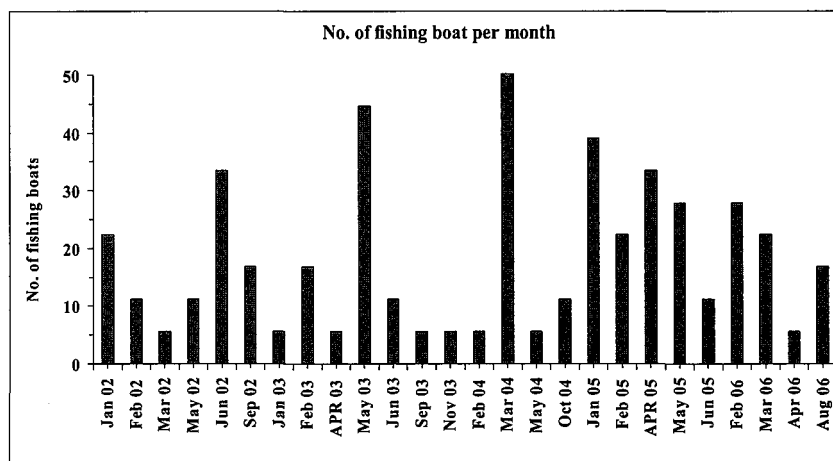


Fig. 23 Fishing effort of squid cast net with light luring in Pakklong Sub-district.

The fishing ground for the Indo-pacific mackerel gill net is at 3-22 m depth waters around Eiang island, Pra island, Rung island, Sikong island, Talu island, Singha island, Ran-ped Ran-kai island, Thungmaha bay, Bang-bird bay and Thum-thong bay. (Fig. 24)

The average fishing boats per month in 2002, 2003, 2004, 2005 and 2006 were 17, 14, 18, 27 and 18 boats, respectively. (Table 13)

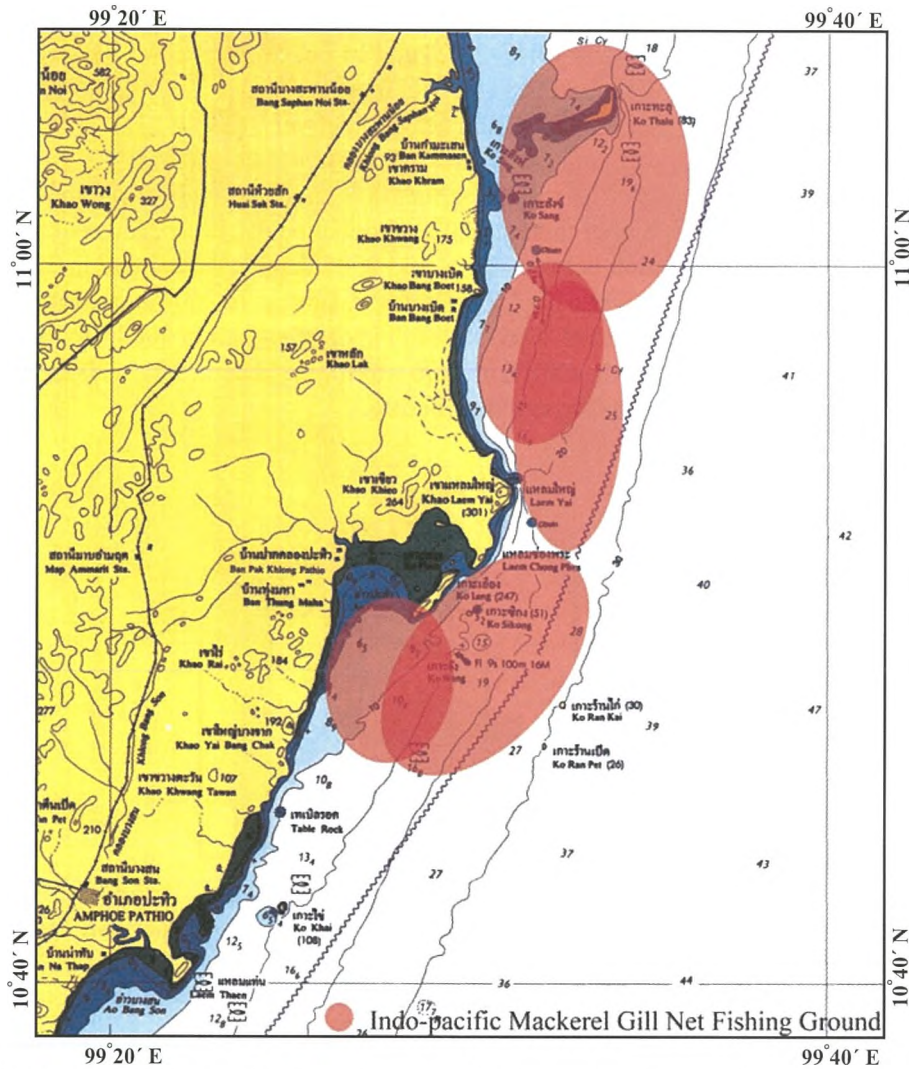


Fig. 24 Fishing ground of Indo-pacific mackerel gill net fisheries in Pakklong Sub-district

#### 4.3 Catch rate of the Indo-pacific mackerel gill net

The average of all species and Indo-pacific mackerel per 100 m net fluctuated. High catch rate was observed during the first period of the year, i.e. in January and March 2002, February and April 2003, February 2005 and February 2006. (Fig. 25)

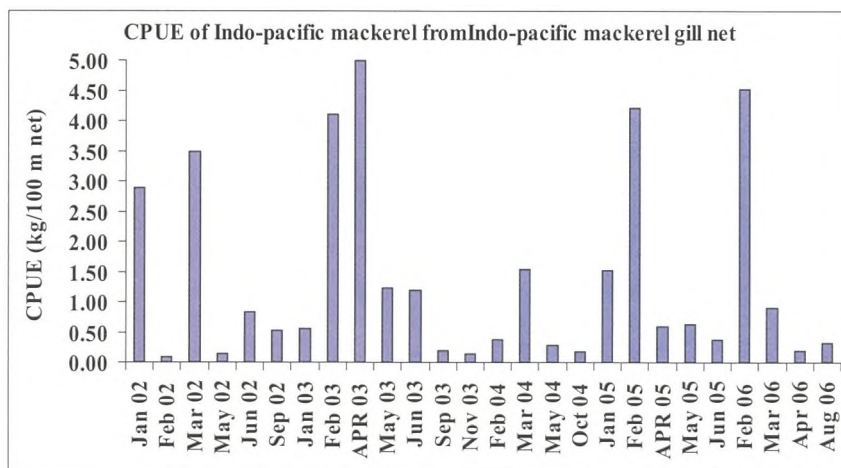


Fig. 25 CPUE of Indo-pacific mackerel from Indo-pacific mackerel gill net in Pakklong Sub-district



The CPUEs of all species and Indo-pacific mackerel per trip in 2002, 2003, 2004, 2005, and 2006 were 23.77 and 10.66, 33.55 and 23.34, 24.98 and 14.47, 23.24 and 14.66, 48.34 and 41.88 kg/trip, respectively. The CPUEs per 100 m net of all species and Indo-pacific mackerel were 2.14 and 0.96, 2.40 and 1.67, 2.04 and 1.18, 1.92 and 1.21, 2.61 and 2.26 kg/100m net, respectively. (Table 13)

A comparison of the CPUE of Indo-pacific mackerel per 100 m net and average fishing boats (Fig. 26) showed that the CPUE in 2003 was higher than in 2002 but declined in 2004 because of high number of fishing boats. However, the comparison between 2004 and 2005 data indicated that in 2005 the highest number of fishing boats was recorded while the CPUE was the same as in 2004 suggesting that the Indo-pacific mackerel in Pakklong Sub-district in 2005 was high in density than in 2004. In 2006, the number of fishing boats declined until 2004 but the CPUE in 2006 was higher. Therefore, in 2005-2006, the Indo-pacific mackerel resource was higher in density than before.

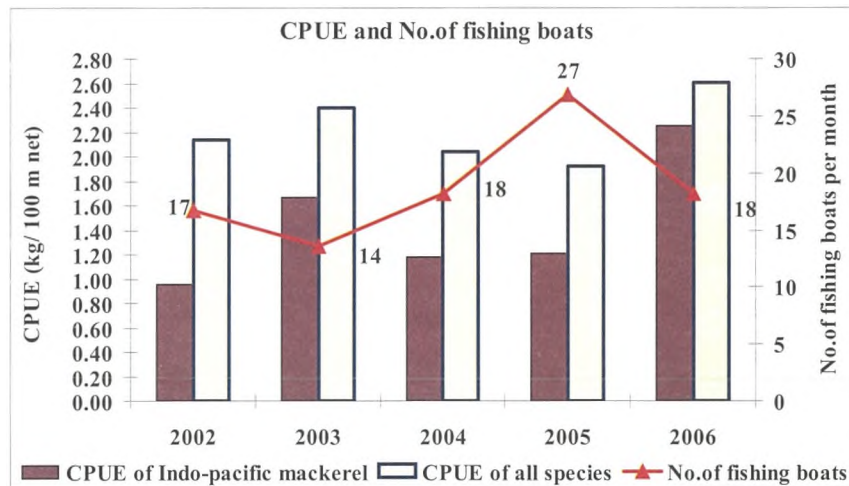


Fig. 26 CPUE and number of fishing boats of Indo-pacific mackerel gill net in Pakklong Sub-district

#### 4.4 Species composition and size composition

Species composition of catch from the Indo-pacific mackerel gill net comprised mostly the Indo-pacific mackerel. In 2002, the composition was: 44.86% Indo-pacific mackerel, 26.84% other pelagic fish, 13.33% demersal fish, 6.00% others, 5.72% crab, 3.03% squid and 0.23% shrimp. In 2003, the composition was: 69.58% Indo-pacific mackerel, 17.23% demersal fish, 10.48% other pelagic fish, and 2.71% others. In 2004, the composition was: 57.92% Indo-pacific mackerel, 29.92% other pelagic fish, 7.91% others and 4.25% demersal fish. In 2005, 63.08% Indo-pacific mackerel, 18.04% demersal fish, 16.42% other pelagic fish, 2.25% others, 0.10% crab, 0.09% squid and 0.02% shrimp; and in 2006 86.64% Indo-pacific mackerel, 4.53% others, 4.32% other pelagic fish, 4.12% demersal fish and 0.39% crab, respectively. (Fig. 27 and Table 14)

The average total length of the Indo-pacific mackerel were 16.22-20.61 cm. The average total length in 2002, 2003, 2004, 2005 and 2006 were 17.63, 17.52, 17.72, 17.40, and 17.63 cm, respectively (Table 14). A comparison between the average total length and the first maturity size of *Rastrelliger brachysoma* at 18.49 cm (Ratana, 2001) is shown in Fig. 28, which indicated that the Indo-pacific mackerel catch from Pakklong Sub-district using 3.5 inch mesh size net was mostly smaller than first maturity size.

Table 14 shows the age ( $t$ ) and total length ( ) of *Rastrelliger brachysoma* from Indo-pacific mackerel gill net by  $L_t = 21.24(1 - e^{-3.72(t+0.0025)})$  (Damri, 1990) equation *Rastrelliger brachysoma* age between 4.6 – 11.3 months old were caught in this area.

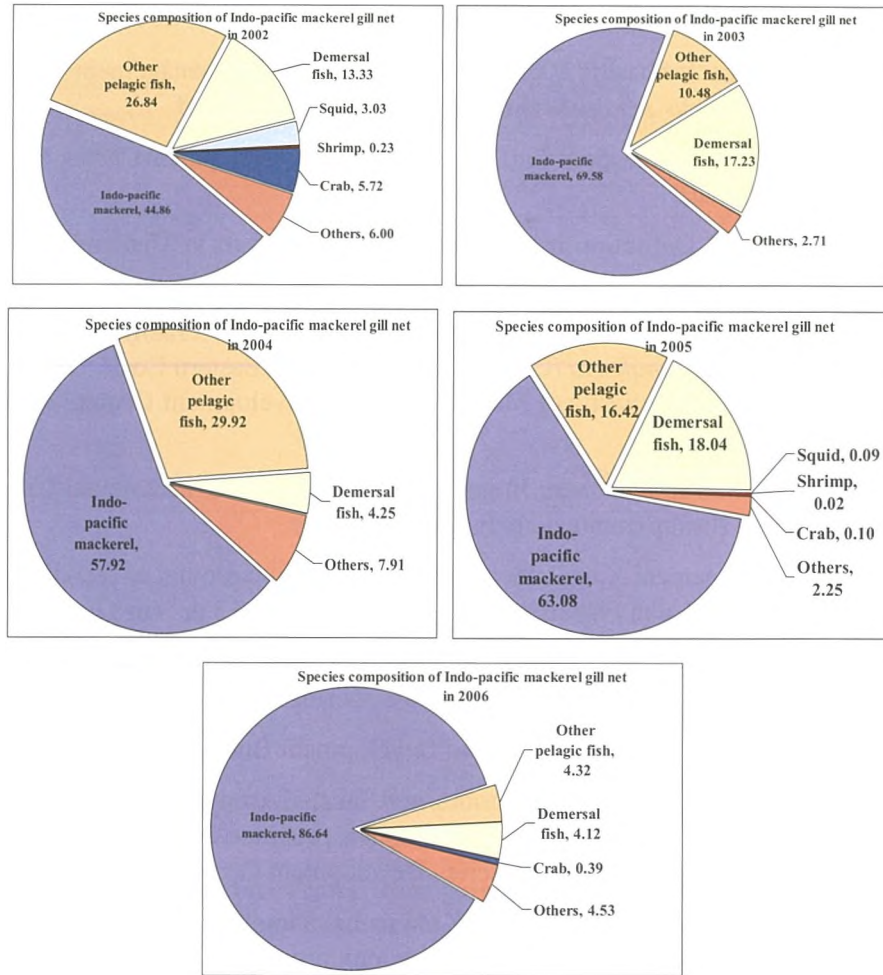


Fig. 27 Species composition of catch from Indo-Pacific mackerel gill net in Pakklong Sub-district

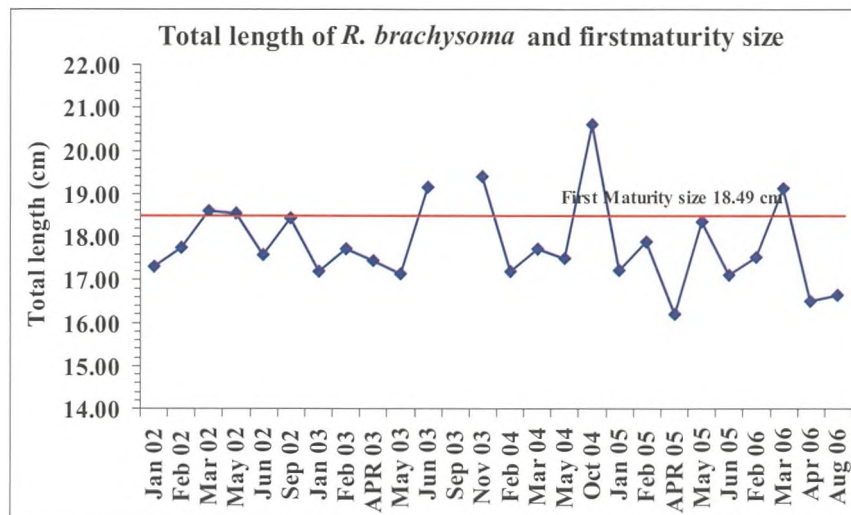


Fig. 28 Average total length of *R. brachysoma* from Indo-Pacific mackerel gill net in Pakklong Sub-district compare to first maturity size



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**Table 1** CPUEs of all species and shrimp of catch from shrimp trammel net in Pakklong Sub-district

Month	No. of fishing boats	CPUE of all species (kg/ 100 m net)	CPUE of shrimp (kg/100 m net)	CPUE of <i>P.merguensis</i> (kg/ 100 m net)	CPUE of other shrimp (kg/ 100 m net)
January 02	18	0.58	0.58	0.11	0.47
August 02	7	0.18	0.09	0.09	0.00
<b>Average</b>	<b>13</b>	<b>0.53</b>	<b>0.52</b>	<b>0.11</b>	<b>0.41</b>
November 02	32	0.18	0.14	0.11	0.03
December 02	18	0.46	0.17	0.16	0.01
January 03	28	0.43	0.18	0.13	0.05
February 03	4	0.59	0.11	0.11	0.00
<b>Average</b>	<b>21</b>	<b>0.36</b>	<b>0.16</b>	<b>0.13</b>	<b>0.03</b>
November 03			No Data		
December 03	63	0.57	0.55	0.45	0.10
January 04	7	0.25	0.12	0.12	0.00
February 04			No Data		
<b>Average</b>	<b>35</b>	<b>0.54</b>	<b>0.51</b>	<b>0.42</b>	<b>0.09</b>
November 04	53	0.86	0.24	0.21	0.03
December 04			No Data		
January 05	21	1.55	0.40	0.16	0.24
February 05			No Data		
<b>Average</b>	<b>37</b>	<b>1.07</b>	<b>0.29</b>	<b>0.20</b>	<b>0.09</b>
November 05	21	3.01	0.47	0.39	0.08
December 05	21	2.91	0.63	0.29	0.34
January 06			No Data		
February 06			No Data		
<b>Average</b>	<b>21</b>	<b>2.95</b>	<b>0.56</b>	<b>0.33</b>	<b>0.23</b>

**Table 2** Species composition of catch from shrimp trammel net in Pakklong Sub-district

Month	Percentage											Crab	fish	Other	Total shrimp
	<i>P. merguensis</i>	<i>P. monodon</i>	<i>P. semisulcatus</i>	<i>P. japonicus</i>	<i>P. latisulcatus</i>	<i>P. longistylus</i>	<i>M. ensis</i>	<i>M. affinis</i>	<i>M. intermedius</i>	Other shrimp					
January 02	18.80	3.17	0.00	0.00	0.00	0.00	0.00	72.11	0.00	5.92	0.00	0.00	0.00	100.00	
August 02	44.52	1.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.01	43.81	0.00	46.18	
November 02	65.16	9.30	0.69	0.20	0.30	0.00	0.00	5.56	0.00	0.00	1.13	17.66	0.00	81.21	
December 02	33.38	0.00	0.59	0.00	0.00	0.00	0.00	1.74	0.00	0.00	0.00	64.29	0.00	35.71	
January 03	28.15	1.04	0.44	0.00	7.41	1.88	0.00	1.81	0.00	0.00	0.00	59.27	0.00	40.73	
February 03	18.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.03	0.00	18.97	
December 03	79.71	0.54	0.00	0.00	0.00	0.00	0.00	16.53	0.00	0.23	0.00	2.99	0.00	97.01	
January 04	50.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.03	0.00	12.34	50.63	
November 04	24.40	2.45	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00	0.00	72.18	0.00	27.82	
January 05	10.39	2.81	0.15	0.00	0.89	0.00	0.00	11.63	0.00	0.15	4.61	68.83	0.54	26.02	
November 05	12.70	0.74	0.16	0.00	0.62	0.00	0.34	0.94	0.00	0.00	1.84	77.39	5.27	15.50	
December 05	10.07	0.00	0.00	0.00	0.15	0.00	0.00	11.43	0.00	0.00	0.00	78.35	0.00	21.65	
<b>Average</b>	<b>26.30</b>	<b>1.49</b>	<b>0.12</b>	<b>0.00</b>	<b>0.66</b>	<b>0.10</b>	<b>0.06</b>	<b>11.25</b>	<b>0.00</b>	<b>0.43</b>	<b>1.20</b>	<b>57.48</b>	<b>0.91</b>	<b>40.41</b>	



**Table 3** Size composition of *P.merguensis* and *M.affinis* from shrimp trammel net in Pakklong Sub-district

Month	Total length of <i>P. merguensis</i> (cm)			Total length of <i>M. affinis</i> (cm)		
	Min - Max	Mode	Mean	Min - Max	Mode	Mean
January 02	14.00 - 19.50	17.75	16.46	10.00 - 19.00	12.75	13.07
August 02	12.00 - 18.50	15.75	15.07		No Data	
<b>Average</b>			<b>15.91</b>			<b>13.07</b>
November 02	12.00 - 20.50	14.75, 15.25	15.33	10.00 - 15.00	12.25	12.17
December 02	13.50 - 19.00	15.25	16.25	10.00 - 14.50	12.25	12.48
January 03	13.50 - 20.50	16.25	16.83	8.50 - 13.50	10.75,11.25,12.25,12.75	11.50
February 03	15.50 - 18.00	17.25	17.00		No Data	
<b>Average</b>			<b>16.08</b>			<b>11.98</b>
November 03				No Data		
December 03	11.50 - 21.00	15.75	16.21	7.00 - 15.00	12.25	12.31
January 04	10.50 - 19.50	16.25, 16.75	15.50		No Data	
February 04				No Data		
<b>Average</b>			<b>16.08</b>			<b>12.31</b>
November 04	12.50 - 23.00	17.25	17.63	7.00 - 15.00	12.25	12.15
December 04				No Data		
January 05	12.50 - 24.00	15.25	16.56	7.00 - 15.00	13.25	12.75
February 05				No Data		
<b>Average</b>			<b>17.50</b>			<b>12.58</b>
November 05	10.00 - 21.00	11.75	12.73	8.50 - 14.00	11.75	11.92
December 05	13.00 - 23.50	16.25	17.74	10.00 - 17.00	12.75, 13.25	12.60
January 06				No Data		
February 06				No Data		
<b>Average</b>			<b>13.69</b>			<b>12.54</b>
<b>Total average</b>			<b>16.15</b>			<b>12.57</b>

**Table 4** Total length and age of *P.merguensis* from shrimp trammel net in Pakklong Sub-district

Month	Total length of <i>P. merguensis</i> (cm)	Fraction of year	Age of <i>P. merguensis</i> (months)	% smaller than first	% bigger than first
				maturity size	maturity size
January 02	16.46	0.73	8.7	7.69	92.31
August 02	15.07	0.63	7.5	35.29	64.71
November 02	15.33	0.65	7.7	20.78	79.22
December 02	16.25	0.71	8.5	4.62	95.38
January 03	16.83	0.75	9.1	6.12	93.88
February 03	17.00	0.77	9.2	0.00	100.00
December 03	16.21	0.71	8.5	5.80	94.20
January 04	15.50	0.66	7.9	31.25	68.75
November 04	17.63	0.82	9.8	3.60	96.40
January 05	16.56	0.73	8.8	8.06	91.94
November 05	12.73	0.49	5.9	88.11	11.89
December 05	17.74	0.83	10.0	3.70	96.30
<b>Average</b>	<b>16.15</b>	<b>0.70</b>	<b>8.4</b>	<b>22.95</b>	<b>77.05</b>

**Table 5** Number of fishing boats, CPUEs of all species and squids, fishing effort of squid cast net with light luring in Pakklong Sub-district

Month	No. of fishing boats	CPUE of all species (kg/trip)	CPUE of squid (kg/trip)	CPUE of all species (kg/haul)	CPUE of squid (kg/haul)	Fishing Effort per month (days)
Jan 02				No Data		
Feb 02	5	46.85	46.67	15.62	15.56	113
Mar 02	17	37.25	36.20	5.40	5.25	340
Apr 02	12	20.00	19.37	3.33	3.23	230
May 02	15	35.64	35.56	7.29	7.27	287
Jun 02	5	29.67	26.33	7.42	6.58	78
Jul 02				No Data		
Aug 02	12	44.29	42.90	7.75	7.51	240
Sep 02	12	56.43	56.43	8.59	8.59	240
Oct 02	9	45.00	45.00	7.76	7.76	180
Nov 02	9	52.00	52.00	10.83	10.83	180
Dec 02	2	8.30	8.30	2.08	2.08	40
<b>Average</b>		<b>41.10</b>	<b>39.70</b>	<b>7.09</b>	<b>6.83</b>	<b>193</b>
Jan 03	41	57.08		No Data		144
Feb 03	68	110.94	62.84	8.41	4.76	374
Mar 03	95	65.25	65.25	12.14	12.14	732
Apr 03	103	60.23	60.23	7.71	7.71	1082
May 03	89	37.91		No Data		258
Jun 03	69	31.88	31.88	3.75	3.75	345
Jul 03	79	39.57	35.31	9.05	8.08	442
Aug 03	69	25.77	25.77	5.22	5.22	338
Sep 03	69	54.70	54.70	11.71	11.71	987
Oct 03	102	62.71	62.71	15.90	15.90	520
Nov 03	7	46.19		No Data		21
Dec 03	20	49.41		No Data		34
<b>Average</b>		<b>56.64</b>	<b>52.87</b>	<b>10.70</b>	<b>9.99</b>	<b>440</b>
Jan 04	20	98.46	95.62	18.09	17.57	26
Feb 04	5	91.58	74.15	17.39	14.08	19
Mar 04	64	65.56	44.29	17.37	11.73	250
Apr 04	53	36.23	35.45	7.86	7.69	223
May 04	13	5.00	5.00	1.67	1.67	49
Jun 04				No Data		
Jul 04	25	123.80	53.01	28.14	12.05	195
Aug 04	68	59.25	46.25	8.78	6.85	381
Sep 04	41	91.76	55.71	16.06	9.75	172
Oct 04	64	49.67	36.27	11.99	8.76	154
Nov 04	32	33.10	31.84	8.27	7.96	96
Dec 04				No Data		
<b>Average</b>		<b>55.51</b>	<b>36.97</b>	<b>13.86</b>	<b>9.23</b>	<b>157</b>
Jan 05				No Data		
Feb 05	89	28.33	27.05	5.96	5.69	227
Mar 05	99	55.29	53.66	9.76	9.47	574
Apr 05	109	19.10	18.80	4.15	4.09	164
May 05	47	43.29	39.00	7.77	7.00	172
Jun 05	68	34.70	31.33	6.94	6.27	476
Jul 05	65	10.00	10.00	2.50	2.50	206
Aug 05	61	23.75	23.75	6.33	6.33	305
Sep 05	73	35.67	33.83	6.29	5.97	219
Oct 05	No Data	38.38	24.00	10.23	6.40	No Data
Nov 05				No Data		
Dec 05				No Data		
<b>Average</b>		<b>34.74</b>	<b>33.04</b>	<b>7.12</b>	<b>6.77</b>	<b>293</b>
Jan 06	109	28.17	23.56	5.63	4.71	109
Feb 06				No Data		
Mar 06	89	107.27	80.80	15.73	11.85	356
Apr 06	92	124.49	38.32	24.29	7.48	594
May 06	58	20.50	12.80	4.88	3.05	167
Jun 06	109			No Data		109
Jul 06				No Data		
Aug 06	No Data	63.60	36.20	13.25	7.54	No Data
Sep 06				No Data		
<b>Average</b>		<b>88.48</b>	<b>41.80</b>	<b>14.72</b>	<b>6.95</b>	<b>267</b>

**Table 6** Species composition of squid cast net with light luring in Pakklong Sub-district

Month	Percentage			
	<i>L. duvaucelli</i>	Other squids	Pelagic fish	Others
Jan 02			No Data	
Feb 02	99.61	0.39		
Mar 02	97.19	0.13	2.68	
Apr 02	96.86	3.14		
May 02	99.76	0.06	0.07	0.11
Jun 02	88.76		11.24	
Jul 02				
Aug 02	96.88		3.12	
Sep 02	100			
Oct 02	100			
Nov 02	100			
Dec 02	100			
<b>Average</b>	<b>98.58</b>	<b>0.24</b>	<b>1.17</b>	<b>0.01</b>
Jan 03			No Data	
Feb 03	56.64		43.36	
Mar 03	100			
Apr 03	100			
May 03			No Data	
Jun 03	100			
Jul 03	89.23	10.77		
Aug 03	100			
Sep 03	100			
Oct 03	100			
Nov 03			No Data	
Dec 03			No Data	
<b>Average</b>	<b>93.35</b>	<b>0.63</b>	<b>6.02</b>	<b>0.00</b>
Jan 04	97.12	0.41	2.47	
Feb 04	80.97	0.51	18.52	
Mar 04	67.56	0.06	32.38	
Apr 04	97.84		2.16	
May 04	100			
Jun 04			No Data	
Jul 04	42.82	0.64	56.54	
Aug 04	78.06		21.94	
Sep 04	60.72	0.03	39.25	
Oct 04	73.03		26.97	
Nov 04	96.2		3.8	
Dec 04			No Data	
<b>Average</b>	<b>66.60</b>	<b>0.24</b>	<b>33.16</b>	<b>0.00</b>
Jan 05			No Data	
Feb 05	95.49	0.53	3.98	
Mar 05	97.06	0.32	2.62	
Apr 05	98.43	1.57		
May 05	90.1	2.31	7.59	
Jun 05	90.29	0.83	8.88	
Jul 05	100	0	0	
Aug 05	100	0	0	
Sep 05	94.86	0	5.14	
Oct 05	62.54	2.61	34.85	
Nov 05			No Data	
Dec 05			No Data	
<b>Average</b>	<b>95.10</b>	<b>0.60</b>	<b>4.30</b>	<b>0.00</b>
Jan 06	83.64	1.14	15.11	0.11
Feb 06			No Data	
Mar 06	75.32	0.27	24.41	
Apr 06	30.78	0.2	69.02	
May 06	62.44		36.9	0.66
Jun 06			No Data	
Jul 06			No Data	
Aug 06	56.92		43.08	
Sep 06			No Data	
<b>Average</b>	<b>47.25</b>	<b>0.24</b>	<b>52.49</b>	<b>0.02</b>

**Table 7** Total catch and size composition of catch from squid cast net with light luring in Pakklong Sub-district

Month	All species total catch (tons)	Squid total catch (tons)	Mantle length (cm)		
			Min - Max	Mode	Average
Jan 02			No Data		
Feb 02	5.31	5.29	3.50 - 13.50	9.75	9.36
Mar 02	12.66	12.31	5.00 - 17.50	11.25	10.66
Apr 02	4.59	4.45	4.50 - 21.00	7.75	9.31
May 02	10.22	10.19	6.50 - 20.00	10.75	11.2
Jun 02	2.32	2.06	4.50 - 12.50	5.75	7.86
Jul 02			No Data		
Aug 02	10.63	10.30	1.50 - 19.50	5.25	6.58
Sep 02	13.54	13.54	3.00 - 18.50	4.75	8.84
Oct 02	8.10	8.10	4.00 - 20.00	9.75	10.86
Nov 02	9.36	9.36	7.00 - 19.50	10.75	11.03
Dec 02	0.33	0.33	6.50 - 21.00	10.75	13.81
<b>Average (Sum)</b>	<b>(77.07)</b>	<b>(75.94)</b>			<b>9.11</b>
Jan 03	8.22		No Data		
Feb 03	41.49	23.50	5.00 - 19.00	9.25	9.67
Mar 03	47.76	47.76	4.00 - 20.00	6.25	9.67
Apr 03	65.17	65.17	5.00 - 22.50	10.75	11.98
May 03	9.78		No Data		
Jun 03	11.00	11.00	7.00 - 14.50	7.75	10.42
Jul 03	17.49	15.61	4.00 - 14.50	8.25	7.98
Aug 03	8.71	8.71	3.50 - 16.00	7.75	7.75
Sep 03	53.99	53.99	5.00 - 18.00	9.25	9.55
Oct 03	32.61	32.61	3.50 - 19.00	8.25	8.6
Nov 03	0.97		No Data		
Dec 03	1.68		No Data		
<b>Average (Sum)</b>	<b>(298.89)</b>	<b>(279.01)</b>			<b>9.45</b>
Jan 04	2.56	2.49	3.50 - 19.50	10.75	10.18
Feb 04	1.74	1.41	4.00 - 20.00	7.25	8.07
Mar 04	16.39	11.07	6.00 - 22.00	7.25	11.34
Apr 04	8.08	7.90	6.00 - 19.00	11.75	13.81
May 04	0.25	0.25	7.00 - 22.00	9.75	11.66
Jun 04			No Data		
Jul 04	24.14	10.34	4.50 - 16.00	11.25	11.01
Aug 04	22.57	17.62	3.50 - 15.50	12.75	9.94
Sep 04	15.78	9.58	3.50 - 23.00	10.75	10.19
Oct 04	7.65	5.59	3.50 - 21.50	10.75	9.33
Nov 04	3.18	3.06	3.00 - 18.00	8.75	8.96
Dec 04			No Data		
<b>Average (Sum)</b>	<b>(102.34)</b>	<b>(69.30)</b>			<b>9.97</b>
Jan 05			No Data		
Feb 05	6.43	6.14	4.00 - 22.00	11.25	11.37
Mar 05	31.74	30.80	4.50 - 21.00	8.75	9.59
Apr 05	3.13	3.08	4.00 - 19.00	6.25	8.52
May 05	7.45	6.71	4.50 - 40.00	7.75	7.99
Jun 05	16.52	14.91	4.00 - 19.50	7.75	9.26
Jul 05	2.06	2.06	7.00 - 17.50	11.25	12.28
Aug 05	7.24	7.24	4.50 - 21.50	11.25	11.38
Sep 05	7.81	7.41	4.50 - 20.00	8.75	8.77
Oct 05		No Data	4.00 - 21.00	9.25	9.21
Nov 05			No Data		
Dec 05			No Data		
<b>Average (Sum)</b>	<b>(82.38)</b>	<b>(78.36)</b>			<b>9.24</b>
Jan 06	3.07	2.57	5.00 - 17.50	9.75	10.53
Feb 06			No Data		
Mar 06	38.19	28.76	4.00 - 18.50	8.25	8.07
Apr 06	73.94	22.76	4.50 - 21.00	9.75	10.68
May 06	3.42	2.14	4.50 - 22.00	7.75	10.07
Jun 06			No Data		
Jul 06			No Data		
Aug 06		No Data	5.00 - 21.00	9.75	10.39
Sep 06			No Data		
<b>Average</b>					<b>10.52</b>



**Table 8** Age and percentage of *L. duvaucelli* smaller than first maturity size from squid cast net with light luring in Pakklong Sub-district

Month	Average mantle length (cm)	Fraction of year	Age (months)	Smaller than first maturity size (%)	Bigger than first maturity size (%)
Jan 02				No Data	
Feb 02	9.36	0.26	3.1	31.24	68.76
Mar 02	10.66	0.31	3.7	11.38	88.62
Apr 02	9.31	0.26	3.1	56.95	43.05
May 02	11.2	0.33	4.0	5.43	94.57
Jun 02	7.86	0.21	2.5	54.05	45.95
Jul 02				No Data	
Aug 02	6.58	0.17	2.1	87.82	12.18
Sep 02	8.84	0.24	2.9	40.13	59.87
Oct 02	10.86	0.32	3.8	24.94	75.06
Nov 02	11.03	0.32	3.9	15.47	84.53
Dec 02	13.81	0.44	5.3	2.50	97.50
<b>Average</b>	<b>9.11</b>	<b>0.25</b>	<b>3.0</b>	<b>44.46</b>	<b>55.54</b>
Jan 03				No Data	
Feb 03	9.67	0.27	3.3	23.43	76.57
Mar 03	9.67	0.27	3.3	44.50	55.50
Apr 03	11.98	0.36	4.3	12.38	87.62
May 03				No Data	
Jun 03	10.42	0.30	3.6	22.14	77.86
Jul 03	7.98	0.22	2.6	47.92	52.08
Aug 03	7.75	0.21	2.5	67.91	32.09
Sep 03	9.55	0.27	3.2	22.36	77.64
Oct 03	8.6	0.24	2.8	39.03	60.97
Nov 03				No Data	
Dec 03				No Data	
<b>Average</b>	<b>9.45</b>	<b>0.27</b>	<b>3.2</b>	<b>31.94</b>	<b>68.06</b>
Jan 04	10.18	0.29	3.5	28.27	71.73
Feb 04	8.07	0.22	2.6	61.82	38.18
Mar 04	11.34	0.34	4.0	23.39	76.61
Apr 04	13.81	0.44	5.3	6.59	93.41
May 04	11.66	0.35	4.2	11.63	88.37
Jun 04				No Data	
Jul 04	11.01	0.32	3.9	13.42	86.58
Aug 04	9.94	0.28	3.4	31.79	68.21
Sep 04	10.19	0.29	3.5	25.83	74.17
Oct 04	9.33	0.26	3.1	44.25	55.75
Nov 04	8.96	0.25	3.0	41.48	58.52
Dec 04				No Data	
<b>Average</b>	<b>9.97</b>	<b>0.28</b>	<b>3.4</b>	<b>38.00</b>	<b>62.00</b>
Jan 05				No Data	
Feb 05	11.37	0.34	4.0	11.90	88.10
Mar 05	9.59	0.27	3.2	34.15	65.85
Apr 05	8.52	0.23	2.8	58.10	41.90
May 05	7.99	0.22	2.6	83.13	16.87
Jun 05	9.26	0.26	3.1	53.54	46.46
Jul 05	12.28	0.37	4.5	17.65	82.35
Aug 05	11.38	0.34	4.0	27.58	72.42
Sep 05	8.77	0.24	2.9	46.38	53.62
Oct 05	9.21	0.26	3.1	42.11	57.89
Nov 05				No Data	
Dec 05				No Data	
<b>Average</b>	<b>9.24</b>	<b>0.26</b>	<b>3.1</b>	<b>50.36</b>	<b>49.64</b>
Jan 06	10.53	0.30	3.7	7.58	92.42
Feb 06				No Data	
Mar 06	8.07	0.22	2.6	64.15	35.85
Apr 06	10.68	0.31	3.7	19.11	80.89
May 06	10.07	0.29	3.4	38.15	61.85
Jun 06				No Data	
Jul 06				No Data	
Aug 06	10.39	0.30	3.6	26.90	73.10
Sep 06				No Data	
<b>Average</b>	<b>10.52</b>	<b>0.30</b>	<b>3.6</b>	<b>41.63</b>	<b>58.37</b>

**Table 9** Number of fishing boats, CPUEs of all species and Blue swimming crab and operation days per month of collapsible crab trap fisheries in Pakklong Sub-district

Month	No. of fishing boats	All species CPUE (kg/10 traps)	Blue swimming crab	
			CPUE (kg/10 traps)	Operation days per month (days)
Jan 02			No Data	
Feb 02	20	0.60	0.58	15.45
Mar 02	19	0.58	0.56	21.42
Apr 02	21	0.88	0.88	24.14
May 02	19	0.41	0.40	22.79
Jun 02	18	0.83	0.83	22.50
Jul 02	19	0.75	0.75	21.16
Aug 02	21	0.55	0.55	22.19
Sep 02	21		No Data	21.67
Oct 02	25	0.41	0.37	20.40
Nov 02	23	0.56	0.53	16.52
Dec 02	24	0.56	0.52	19.96
<b>Average</b>		<b>0.59</b>	<b>0.57</b>	<b>20.67</b>
Jan 03	11	0.24	0.20	17.82
Feb 03	26	0.24	0.22	18.00
Mar 03	26	0.53	0.45	30.00
Apr 03	26	0.85	0.84	30.00
May 03	13	0.62	0.59	27.23
Jun 03	13	0.48	0.48	29.23
Jul 03	13	0.56	0.56	29.77
Aug 03	13	0.65	0.65	25.23
Sep 03	10	0.40	0.40	23.70
Oct 03	26	0.52	0.45	26.50
Nov 03	20		No Data	5.35
Dec 03	26	0.30	0.12	27.50
<b>Average</b>		<b>0.52</b>	<b>0.47</b>	<b>24.34</b>
Jan 04	19	0.37	0.30	10.20
Feb 04	19	0.27	0.22	13.40
Mar 04	13	0.58	0.58	12.25
Apr 04	10	1.07	1.07	28.33
May 04	13	1.03	1.03	28.75
Jun 04	13	0.30	0.30	27.00
Jul 04	20	1.06	1.05	21.25
Aug 04	26	0.39	0.39	30.25
Sep 04	26	0.62	0.62	27.00
Oct 04	26	0.70	0.68	30.75
Nov 04	26	0.47	0.45	29.75
Dec 04	26	0.32	0.31	28.25
<b>Average</b>		<b>0.65</b>	<b>0.63</b>	<b>24.64</b>
Jan 05	26	0.56	0.50	24.50
Feb 05	26	0.42	0.37	27.00
Mar 05	26	0.58	0.49	29.50
Apr 05	26	0.48	0.46	29.50
May 05	26	0.34	0.32	30.50
Jun 05	26	0.49	0.46	29.27
Jul 05	26		No Data	30.77
Aug 05	26	0.60	0.54	29.77
Sep 05	26	1.08	1.05	29.50
Oct 05	26	0.83	0.79	17.77
Nov 05	26	0.73	0.64	26.08
Dec 05	24	0.33	0.28	16.92
<b>Average</b>		<b>0.61</b>	<b>0.56</b>	<b>26.82</b>
Jan 06	17	0.45	0.33	22.82
Feb 06	14	0.41	0.32	26.50
Mar 06	16	0.52	0.43	30.19
Apr 06	26	0.93	0.90	29.15
May 06	26	0.71	0.70	29.65
Jun 06	23	0.77	0.62	29.87
Jul 06	22	0.39	0.32	25.32
Aug 06	22	0.59	0.53	24.32
Sep 06	26	0.67	0.65	25.85
<b>Average</b>		<b>0.62</b>	<b>0.55</b>	<b>27.20</b>

**Table 10** Species composition of collapsible crab trap fisheries in Pakklong Sub-district

Month	Percentage									
	Blue swimming crab	3 spots swimming crab	Crucifix crab	Ridged swimming crab	Sentinel crab	Other crab	Fish	Shrimp	Mantis shrimp	Others
Jan 02	No Data									
Feb 02	96.57		3.43							
Mar 02	97.06		2.94							
Apr 02	100.00									
May 02	97.32					2.03	0.28	0.37		
Jun 02	100.00									
Jul 02	98.88		1.12							
Aug 02	100.00									
Sep 02	No Data									
Oct 02	88.44		0.94							10.62
Nov 02	96.00	4.00								
Dec 02	92.59	5.19	2.22							
<b>Average</b>	<b>97.02</b>	<b>0.65</b>	<b>1.04</b>			<b>0.21</b>	<b>0.03</b>	<b>0.04</b>		<b>1.01</b>
Jan 03	84.44	8.89	6.67							
Feb 03	94.09		5.45			0.46				
Mar 03	85.98	2.52	3.62				7.88			
Apr 03	98.99		1.01							
May 03	95.10	4.49				0.41				
Jun 03	100.00									
Jul 03	100.00									
Aug 03	100.00									
Sep 03	100.00									
Oct 03	85.88					14.12				
Nov 03	No Data									
Dec 03	40.00			60.00						
<b>Average</b>	<b>95.34</b>	<b>0.76</b>	<b>0.76</b>	<b>1.96</b>		<b>1.02</b>	<b>0.16</b>			
Jan 04	79.59	18.37				2.04				
Feb 04	81.58		5.79	5.26		0.79				6.58
Mar 04	99.25					0.75				
Apr 04	100.00									
May 04	100.00									
Jun 04	100.00									
Jul 04	98.65						1.35			
Aug 04	100.00									
Sep 04	100.00									
Oct 04	97.38			0.14		0.50	1.26			0.72
Nov 04	95.84		4.16							
Dec 04	98.29		0.55	1.16						
<b>Average</b>	<b>97.29</b>	<b>0.96</b>	<b>0.49</b>	<b>0.26</b>	<b>0.00</b>	<b>0.27</b>	<b>0.35</b>			<b>0.37</b>
Jan 05	89.49	0.94	0.77	7.77		0.52				0.51
Feb 05	86.81	0.73	7.90	3.80			0.76			
Mar 05	84.76	0.30	8.70	5.31			0.42			0.51
Apr 05	95.54	3.34	0.05	1.07						
May 05	94.77	0.66		3.65			0.92			
Jun 05	93.14	2.71		3.98		0.17				
Jul 05	No Data									
Aug 05	89.42		0.81	9.77						
Sep 05	97.02			1.45		1.53				
Oct 05	96.01			1.26		2.58	0.15			
Nov 05	88.46	1.23	0.57	6.81	0.38	1.61	0.94			
Dec 05	82.87	5.30	2.18	3.74			4.98	0.93		
<b>Average</b>	<b>91.98</b>	<b>0.88</b>	<b>1.65</b>	<b>3.96</b>	<b>0.04</b>	<b>0.96</b>	<b>0.40</b>	<b>0.03</b>		<b>0.10</b>
Jan 06	72.87			24.26		1.35	0.82			0.70
Feb 06	78.42	1.22	2.41	14.52			2.12			1.31
Mar 06	83.55	0.31	1.67	14.47						
Apr 06	97.11	0.73		1.32		0.54	0.12			0.18
May 06	98.55			0.47			0.98			
Jun 06	80.40			19.60						
Jul 06	81.38	1.44	1.60	10.85		0.48	4.25			
Aug 06	89.60			1.40		8.97	0.03			
Sep 06	96.26		0.54	3.20						
<b>Average</b>	<b>89.76</b>	<b>0.37</b>	<b>0.50</b>	<b>7.66</b>		<b>0.91</b>	<b>0.57</b>			<b>0.23</b>

**Table 11** Size composition and age of crab from collapsible crab trap fisheries in Pakklong Sub-district

Month	Male crab (cm)				Female crab (cm)			
	Min-Max	Mode	Average	Age (months)	Min-Max	Mode	Average	Age (months)
Jan 02	No Data							
Feb 02	6.00 - 13.50	11.25	10.10	5.3	6.50 - 14.00	11.25	10.57	5.7
Mar 02	8.00 - 13.00	11.25	10.66	5.8	7.00 - 14.00	11.25	10.77	5.9
Apr 02	6.00 - 10.50	8.25	8.30	3.9	6.50 - 13.00	8.75	9.06	4.4
May 02	5.00 - 11.00	8.75	8.64	4.1	6.00 - 10.50	9.25	8.79	4.2
Jun 02	4.00 - 10.00	7.25	7.52	3.3	7.00 - 11.00	8.75	8.83	4.3
Jul 02	7.50 - 12.00	9.25	9.35	4.7	6.00 - 11.50	9.75	9.45	4.7
Aug 02	7.00 - 12.00	9.25	9.07	4.4	7.00 - 11.50	9.75	9.40	4.7
Sep 02	No Data							
Oct 02	8.00 - 14.00	12.75	11.47	6.6	7.50 - 14.00	11.75	11.09	6.2
Nov 02	7.50 - 12.50	9.25	9.90	5.1	7.50 - 12.50	10.25	10.16	5.3
Dec 02	6.50 - 11.50	8.25	8.65	4.1	6.00 - 12.50	8.25	8.80	4.2
<b>Average</b>	<b>9.09</b>				<b>9.43</b>			
Jan 03	6.50 - 11.50	9.75	8.75	4.2	6.50 - 12.00	9.25	9.19	4.5
Feb 03	6.00 - 14.00	9.25	9.37	4.7	7.00 - 13.50	8.25	9.53	4.8
Mar 03	5.50 - 13.50	7.75	8.54	4.0	6.00 - 13.00	8.25	9.08	4.5
Apr 03	7.00 - 13.50	10.25	9.74	5.0	7.00 - 14.00	8.75	10.07	5.3
May 03	4.50 - 10.00	7.25	7.10	3.1	4.50 - 10.50	7.75	7.80	3.5
Jun 03	6.00 - 11.00	8.75	8.22	3.8	5.50 - 11.00	8.25	8.00	3.7
Jul 03	6.00 - 11.00	9.25	9.00	4.4	5.50 - 12.00	9.75	8.92	4.3
Aug 03	7.00 - 12.00	10.75	10.28	5.5	7.50 - 13.00	9.75	10.25	5.4
Sep 03	6.50 - 10.00	8.25	8.00	3.7	6.00 - 11.00	9.25	8.85	4.3
Oct 03	6.50 - 12.00	8.25	8.92	4.3	6.50 - 12.50	8.25	9.10	4.5
Nov 03	No Data							
Dec 03	6.50 - 11.50	8.25	8.55	4.1	6.50 - 11.50	8.25	8.50	4.0
<b>Average</b>	<b>8.81</b>				<b>8.90</b>			
Jan 04	6.50 - 13.00	8.75	9.36	4.7	6.50 - 16.00	8.25	9.46	4.8
Feb 04	7.00 - 13.00	7.75	9.55	4.8	7.50 - 13.00	8.25	10.01	5.2
Mar 04	6.50 - 13.00	8.25	8.93	4.3	7.50 - 13.00	8.75	9.60	4.9
Apr 04	6.50 - 12.50	8.75	8.96	4.4	6.50 - 14.00	9.75	9.11	4.5
May 04	6.50 - 13.00	8.75	9.12	4.5	4.50 - 14.00	8.25	8.65	4.1
Jun 04	6.00 - 11.00	7.75	7.73	3.5	6.00 - 15.00	7.75	7.98	3.6
Jul 04	6.50 - 12.50	8.25	9.39	4.7	7.00 - 14.50	10.25	9.95	5.2
Aug 04	8.00 - 11.00	8.25	9.00	4.4	7.50 - 12.00	9.25	9.48	4.8
Sep 04	No Data							
Oct 04	5.50 - 12.00	8.75	8.27	3.8	5.50 - 13.00	8.25	8.49	4.0
Nov 04	5.00 - 12.00	7.75	7.72	3.5	5.00 - 16.00	8.25	8.96	4.4
Dec 04	6.50 - 11.50	7.75	8.44	4.0	6.00 - 12.00	8.25	8.87	4.3
<b>Average</b>	<b>8.67</b>				<b>8.88</b>			
Jan 05	5.50 - 14.00	7.75	8.44	4.0	6.00 - 12.50	8.75	9.02	4.4
Feb 05	6.00 - 13.00	9.25	9.41	4.7	6.00 - 13.00	8.75	9.47	4.8
Mar 05	6.00 - 14.00	8.75	9.70	5.0	6.00 - 13.50	10.25	9.76	5.0
Apr 05	6.50 - 12.00	8.25	8.49	4.0	6.50 - 12.50	8.75	8.72	4.2
May 05	6.50 - 11.00	9.25	8.60	4.1	5.50 - 12.00	9.25	8.60	4.1
Jun 05	5.50 - 11.50	7.75	7.99	3.7	6.00 - 11.50	7.25	8.18	3.8
Jul 05	No Data							
Aug 05	5.50 - 11.00	8.25	8.47	4.0	6.50 - 12.00	8.75	9.11	4.5
Sep 05	6.00 - 10.00	7.75	8.38	3.9	5.50 - 12.00	8.75	8.92	4.3
Oct 05	6.00 - 10.50	8.25	8.25	3.8	5.50 - 11.50	8.25	8.60	4.1
Nov 05	5.50 - 12.50	7.75	7.97	3.6	5.50 - 13.00	7.75	8.16	3.8
Dec 05	5.00 - 13.50	7.75	7.76	3.5	5.50 - 12.50	8.25	8.20	3.8
<b>Average</b>	<b>8.46</b>				<b>8.73</b>			
Jan 06	6.00 - 12.50	7.75	8.09	3.7	6.50 - 12.00	7.75	8.30	3.9
Feb 06	5.00 - 12.50	7.25	8.31	3.9	3.50 - 12.00	8.75	8.19	3.8
Mar 06	4.50 - 10.50	8.75	8.58	4.1	4.50 - 11.50	9.25	8.64	4.1
Apr 06	6.50 - 12.50	7.25	8.63	4.1	5.50 - 11.50	9.25	8.48	4.0
May 06	5.50 - 12.50	8.75	8.30	3.9	5.50 - 12.50	7.75	8.18	3.8
Jun 06	7.50 - 10.50	9.25	9.25	4.6	7.50 - 10.50	8.75	8.97	4.4
Jul 06	5.50 - 13.50	7.75	8.34	3.9	6.00 - 12.50	8.25	8.52	4.0
Aug 06	6.00 - 12.00	7.75	8.29	3.9	7.00 - 11.50	8.75	8.71	4.2
Sep 06	5.00 - 12.00	8.75	8.31	3.9	5.00 - 11.50	8.75	8.27	3.9
<b>Average</b>	<b>8.40</b>				<b>8.39</b>			



**Table 12** Total catch of Blue swimming crab from collapsible crab trap fisheries in Pakklong Sub-district

Month	CPUE of Blue swimming crab (kg/trip)	Fishing day (days/month)	Fishing effort (days/month)	Total catch of Blue swimming crab (tons/month)
Jan 02			No Data	
Feb 02	10.06	15.45	309	3.11
Mar 02	10.35	21.42	407	4.21
Apr 02	11.63	24.14	507	5.90
May 02	6.90	22.79	433	2.99
Jun 02	12.00	22.50	405	4.86
Jul 02	12.86	21.16	402	5.17
Aug 02	9.10	22.19	466	4.24
Sep 02	No Data	21.67	455	No Data
Oct 02	7.08	20.40	510	3.61
Nov 02	9.60	16.52	380	3.65
Dec 02	8.33	19.96	479	3.99
<b>Average (Sum)</b>	<b>9.60</b>	<b>20.67</b>	<b>432</b>	<b>(41.72)</b>
Jan 03	3.80	17.82	196	0.74
Feb 03	4.14	18.00	468	1.94
Mar 03	7.80	30.00	780	6.08
Apr 03	16.33	30.00	780	12.74
May 03	11.65	27.23	354	4.12
Jun 03	7.25	29.23	380	2.76
Jul 03	8.00	29.77	387	3.10
Aug 03	13.00	25.23	328	4.26
Sep 03	6.00	23.70	237	1.42
Oct 03	7.30	26.50	689	5.03
Nov 03	No Data	5.35	107	No Data
Dec 03	3.00	27.50	715	2.15
<b>Average (Sum)</b>	<b>8.49</b>	<b>24.34</b>	<b>452</b>	<b>(44.34)</b>
Jan 04	6.50	10.20	194	1.26
Feb 04	5.17	13.40	255	1.32
Mar 04	11.00	12.25	159	1.75
Apr 04	24.30	28.33	283	6.88
May 04	26.00	28.75	374	9.72
Jun 04	7.94	27.00	351	2.79
Jul 04	27.50	21.25	425	11.69
Aug 04	7.25	30.25	787	5.71
Sep 04	14.00	27.00	702	9.83
Oct 04	19.43	30.75	800	15.54
Nov 04	8.80	29.75	774	6.81
Dec 04	4.89	28.25	735	3.59
<b>Average (Sum)</b>	<b>14.44</b>	<b>24.64</b>	<b>487</b>	<b>(76.89)</b>
Jan 05	12.21	24.50	637	7.78
Feb 05	9.52	27.00	702	6.68
Mar 05	12.57	29.50	767	9.64
Apr 05	11.04	29.50	767	8.47
May 05	8.61	30.50	793	6.83
Jun 05	11.31	29.27	761	8.61
Jul 05	No Data	30.77	800	No Data
Aug 05	13.95	29.77	774	10.80
Sep 05	26.89	29.50	767	20.62
Oct 05	17.95	17.77	462	8.29
Nov 05	11.69	26.08	678	7.93
Dec 05	6.65	16.92	406	2.70
<b>Average (Sum)</b>	<b>13.54</b>	<b>26.82</b>	<b>693</b>	<b>(98.34)</b>
Jan 06	8.47	22.82	388	3.29
Feb 06	6.58	26.50	371	2.44
Mar 06	10.44	30.19	483	5.04
Apr 06	22.96	29.15	758	17.40
May 06	18.51	29.65	771	14.27
Jun 06	8.04	29.87	687	5.52
Jul 06	5.10	25.32	557	2.84
Aug 06	11.32	24.32	535	6.06
Sep 06	15.79	25.85	672	10.61
<b>Average</b>	<b>12.96</b>	<b>27.20</b>	<b>580</b>	

**Table 13** Number of fishing boats, CPUEs of all species and Indo-pacific mackerel from Indo-pacific mackerel gill net fisheries in Pakklong Sub-district

Month	No. fishing boats per month	CPUE of all species (kg/trip)	CPUE of Indo-pacific mackerel (kg/trip)	CPUE of all species (kg/100 m net)	CPUE of Indo-pacific mackerel (kg/100 m net)
Jan 02	22	25.75	20.85	3.58	2.90
Feb 02	11	30.05	0.81	3.34	0.09
Mar 02	6	60.00	24.43	8.57	3.49
May 02	11	6.35	2.74	0.34	0.14
Jun 02	34	19.08	9.06	1.76	0.84
Sep 02	17	25.83	7.56	1.79	0.52
<b>Average</b>	<b>17</b>	<b>23.77</b>	<b>10.66</b>	<b>2.14</b>	<b>0.96</b>
Jan 03	6	8.30	5.70	0.83	0.57
Feb 03	17	39.33	36.67	4.40	4.10
APR 03	6	120.00	100.00	6.00	5.00
May 03	45	32.88	19.34	2.09	1.23
Jun 03	11	11.50	9.89	1.40	1.21
Sep 03	6	20.00	3.60	1.11	0.20
Nov 03	6	18.00	3.00	0.87	0.14
<b>Average</b>	<b>14</b>	<b>33.55</b>	<b>23.34</b>	<b>2.40</b>	<b>1.67</b>
Feb 04	6	16.80	5.00	1.31	0.39
Mar 04	50	28.50	19.57	2.24	1.54
May 04	6	7.00	3.00	0.70	0.30
Oct 04	11	22.23	2.00	2.04	0.18
<b>Average</b>	<b>18</b>	<b>24.98</b>	<b>14.47</b>	<b>2.04</b>	<b>1.18</b>
Jan 05	39	26.27	16.95	2.36	1.52
Feb 05	22	38.78	32.04	5.10	4.22
APR 05	34	15.62	7.08	1.33	0.60
May 05	28	18.80	10.00	1.20	0.64
Jun 05	11	15.56	6.30	0.93	0.38
<b>Average</b>	<b>27</b>	<b>23.24</b>	<b>14.66</b>	<b>1.92</b>	<b>1.21</b>
Feb 06	28	96.00	91.40	4.76	4.53
Mar 06	22	25.68	17.20	1.36	0.91
Apr 06	6	5.00	3.88	0.25	0.20
Aug 06	17	13.56	4.93	0.90	0.33
<b>Average</b>	<b>18</b>	<b>48.34</b>	<b>41.88</b>	<b>2.61</b>	<b>2.26</b>

**Table 14** Species composition of catch, total length and age of Indo-pacific mackerel from Indo-pacific mackerel gill net in Pakklong Sub-district

Month	Percentage							Total length (cm)			Age (months)
	Indo-pacific	Other pelagic fish	Demersal	Squid	Shrimp	Crab	Others	Min-Max	Mode	Average	
Jan 02	80.95	4.45	11.54	0.64	0.38	0.42	1.62	15.00 -	17.25	17.30	5.4
Feb 02	2.70	90.11	2.35				4.84	17.50 -	17.75	17.75	5.8
Mar 02	40.72	38.47	1.63				19.18	17.00 -	18.75	18.62	6.7
May 02	42.44	18.97	15.46	4.89		11.01	7.23	17.00 -	18.75	18.55	6.6
Jun 02	47.46	23.91	25.00	3.56	0.07		0.00	14.00 -	17.75	17.58	5.6
Sep 02	29.25	43.64	23.99				3.12	14.50 -	21.75	18.44	6.5
<b>Average</b>	<b>44.86</b>	<b>26.84</b>	<b>13.33</b>	<b>3.03</b>	<b>0.23</b>	<b>5.72</b>	<b>6.00</b>			<b>17.63</b>	<b>5.7</b>
Jan 03	68.67	13.18	16.83				1.32	15.50 -	16.75	17.20	5.3
Feb 03	93.22	1.37	4.96				0.45	16.00 -	17.25	17.72	5.8
APR 03	83.33	2.19	11.99				2.49	16.00 -	16.75	17.46	5.5
May 03	58.84	29.57	10.54				1.05	15.00 -	17.75	17.14	5.3
Jun 03	86.15	5.87	6.96				1.02	17.00 -	18.75	19.17	7.5
Sep 03	18.04	0.00	69.33				12.63	No Data			
Nov 03	16.50	83.50	0.00				0.00	17.50 -	19.25	19.42	7.9
<b>Average</b>	<b>69.58</b>	<b>10.48</b>	<b>17.23</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>2.71</b>			<b>17.52</b>	<b>5.6</b>
Feb 04	29.76	70.24	0.00				0.00	15.00 -	17.75	17.20	5.3
Mar 04	68.65	21.68	4.99				4.68	16.00 -	17.25	17.72	5.8
May 04	42.86	57.14	0.00				0.00	14.50 -	18.75	17.50	5.6
Oct 04	9.00	52.00	12.00				27.00	19.00 -	19.25	20.61	11.3
<b>Average</b>	<b>57.92</b>	<b>29.92</b>	<b>4.25</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>7.91</b>			<b>17.72</b>	<b>5.8</b>
Jan 05	64.54	11.84	20.90	0.09	0.02	0.10	2.51	13.50 -	17.75	17.24	5.4
Feb 05	82.62	10.78	6.60				0.00	14.50 -	18.25	17.90	5.9
APR 05	45.32	10.64	44.04				0.00	10.00 -	19.25	16.22	4.6
May 05	53.18	18.87	20.24				7.71	15.00 -	18.75	18.36	6.4
Jun 05	40.46	29.95	28.50				1.09	15.00 -	16.75	17.11	5.3
<b>Average</b>	<b>63.08</b>	<b>16.42</b>	<b>18.04</b>	<b>0.09</b>	<b>0.02</b>	<b>0.10</b>	<b>2.25</b>			<b>17.40</b>	<b>5.5</b>
Feb 06	95.21	0.50	4.13				0.16	16.00 -	17.75	17.52	5.6
Mar 06	66.95	23.02	3.67				0.39	17.50 -	18.75	19.14	7.4
Apr 06	77.60	16.20					6.20	12.00 -	17.25	16.52	4.8
Aug 06	36.35	9.29	28.56				25.80	15.00 -	16.25	16.65	4.9
<b>Average</b>	<b>86.64</b>	<b>4.32</b>	<b>4.12</b>	<b>0.00</b>	<b>0.00</b>	<b>0.39</b>	<b>4.53</b>			<b>17.63</b>	<b>5.7</b>