Study on the Impact on by catch of ETP Species from the Use of Crab Gillnets and Crab Traps in Bandon Bay, Surat Thani Province, and Nearby Areas

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introduction

Blue swimming crab (*Portunus pelagicus* Linnaeus, 1758) is an important aquatic resource for economic use. It is caught for utilization and is popularly consumed in demand by both domestic and international markets. According to the fishery statistics of Thailand in 2022, a total of 48,530 tons of crabs were caught, with blue swimming crabs accounting for the largest catch, accounting for 81.05 percent or 39,332 tons. When considering the fishing sources, the blue swimming crab catch in the Gulf of Thailand accounted for 81.75 percent and the Andaman sea accounted for 18.25 percent of the total blue swimming crab catch (Fishery Statistics , 2023). The Gulf of Thailand, especially in Ban Don Bay, Surat Thani Province, is an important blue swimming crab fishing ground due to its abundance and relatively high complexity of natural resources and environment (Kanyarat et al. , 2020). Most blue swimming crabs are produced from local fishing vessels using crab gill nets and crab traps, which are fishing gears that are mainly aimed at catching blue swimming crabs. Aquatic animals obtained from blue swimming crab fishing, bycatch species are also found, such as demersal fish, other crabs, lobsters, and squid. In addition, it was found that bycatch species in the ETP Species group are rare marine animals that are in small numbers and are important to the ecosystem (Somsak et al. , 2021). ETP species are animals that are endangered , threatened , or protected , such as seahorses (*Hippocampus kuda*) , which are a group of animals that are very important in maintaining the balance of the marine ecosystem and conserving biodiversity. These animals are at high risk of extinction due to human activities, such as fishing, destruction of the habitat, and activities that cause pollution and various pollutants. Therefore, studying the impacts on bycatch species in the ETP species group from the use of crab gillnets and crab traps, which are currently still relatively few studies, is very important in order to obtain information to be used in the management of aquatic resources in the ETP species group , including blue swimming crab resources, to maximize the benefits and sustainability.

Objective

1. Study the characteristics of fishing gears, patterns and methods of crab gillnets and crab traps during fishing that may affect aquatic animals in the ETP species group.
2. Study the catch rate and catch composition of aquatic animals by using crab traps and crab gillnets in Ban Don Bay area, Surat Thani Province and nearby areas.
3. Study the results of the catch and the size of bycatch in the ETP species group from the use of crab gillnets and crab traps.

Study Guideline

1. Place and duration of the study

This study is a survey that collects data on fishing operations and aquatic resources from fishing vessels that use fishing gear, crab traps and crab gillnets. In Surat Thani Province and nearby areas (Figure 1), data were collected in March 2025.

Figure 1. Data collection location.

2. Method of data collection

2.1 Collect data by observation while fishing vessels are fishing with crab traps and crab gillnets (Observer Onboard). Let the officers observe while the vessel is fishing. By renting a vessel to go out with the fishing vessels to record images and videos, recording 2 time

periods: the period between the beginning of fishing and the period before the end of fishing, as well as recording images of the surrounding area of the fishing area, which was a fishing vessel using 5 crab gillnets vessels, consisting of vessels sizes 0-10 gross tons, 2 vessels Crab gillnets, size 10-29.9 gross tons, 3 vessels and 5 vessels using crab traps, consisting of crab trap vessels with a size of 0-10 gross tons, 2 vessels, Crab trap vessels, size 10-29.9 gross tons, 3 vessels (picture 2).

Figure 2. Fishing vessels used for observation using crab gillnets (a) and (b), and fishing vessels using crab traps (c) (d).

2.2 Inquire about fisheries information by interviewing fishermen about fishing gears, fishing grounds and seasons, the amount of aquatic animals caught (in kilograms), the amount of fishing effort, including the number of fishing days, the number of nets used for fishing, the length of each net, and the number of traps used for fishing.

2.3 Randomly sample aquatic animals, not less than 5 kilograms/boat, and classify the species and group the aquatic animals according to the manual of Carpenter and Niem (1998, 1999 a, b, 2001a, b) as follows: fish group, crab group, shrimp group, squid group, and other aquatic animals, including by- catch aquatic animals in the ETP species group.

Measure the length of the main economic aquatic animals, namely the blue swimming crab and by-caught aquatic animals in the ETP species group, using length recording paper with a class interval of 0.50 centimeters, in centimeters, and weigh in kilograms. For by- caught aquatic animals in the ETP species group, the total length was measured, while for the blue

swimming crab, the carapace width was measured, and for other aquatic animals, the number of individuals was counted and the weight was measured.

Figure 3. Measurement of carapace width (CW).

3. Data analysis

3.1 Analysis of fishing ground and seasons from interviews with fishermen, describing them descriptively and showing fishing ground diagrams.

3.2 Analysis of the catch rate is calculated using the following equation:

3.2.1 Catch rate of aquatic animals (kg/100 meters of net) for fishing gear such as gillnets according to the equation as follows:

$$CPUE = \frac{\sum_{i=1}^{n} Catch_i}{\sum_{i=1}^{n} net_i} \times 100$$

when $CPUE$ = Catch rate (kg/100m net)

$Catch_i$ = Catch volume of sample vessel number i (kg)

net_i = Length of net used by sample vessel no. i (m)

i = Sample vessels number 1, 2, 3, ..., n

3.2.2 Catch rate of aquatic animals (kilograms/10 traps) for crab trap according to the equation as follows:

$$CPUE = \frac{\sum_{i=1}^{n} Catch_i}{\sum_{i=1}^{n} trap_i} \times 10$$

when $CPUE$ = Catch rate of aquatic animals (kg/10 traps)

$Catch_i$ = Catch volume of sample vessel number i (kg)

$trap_i$ = i- th sample vessel (trap)

i = Sample vessels number 1, 2, 3, ..., n

3.2.3 Catch rate of aquatic animals (kg/day) of crab gillnets and traps according to the following equation:

$$CPUE = \frac{\sum_{i=1}^{n} Catch_i}{\sum_{i=1}^{n} day_i}$$

when $CPUE$ = Catch rate (kg/day)

$Catch_i$ = Catch volume of sample vessel number i (kg)

day_i = Number of fishing days of sample vessel no. i (days)

i = Sample vessels number 1, 2, 3, ..., n

3.3 Analyze the catch composition of aquatic animals of each gear by calculating the weight of each aquatic animal as a percentage of the total weight of aquatic animals caught.

3.4 Analyze the length of aquatic animals by using length data to find the average, minimum, maximum length and standard deviation in centimeters.

The average length is calculated according to the equation:

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

when $\bar{x}$ = Average length (centimeters)

f_i = i- th interval

x_i = Mid-interval length of class i (cm)

i = Interval lengths 1, 2, 3, ..., n

Then calculate the standard deviation using the following equation:

$$SD = \sqrt{\frac{\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}{\left(\sum_{i=1}^{n} f_i\right) - 1}}$$

when SD = Standard Deviation

$\bar{x}$ = Average length (centimeters)

f_i = i- th interval

x_i = Mid-interval length of class i (cm)

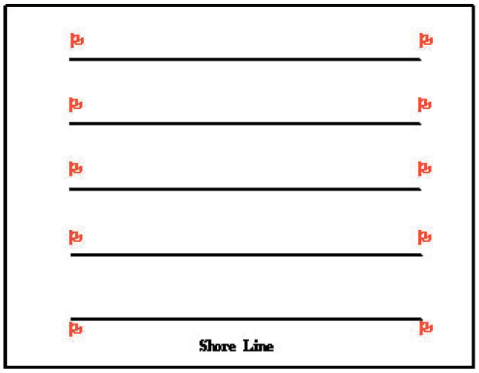
i = Interval lengths 1, 2, 3, ..., n

Study results

1. Characteristics of fishing gears, pattern and methods of crab gillnet and crab traps.

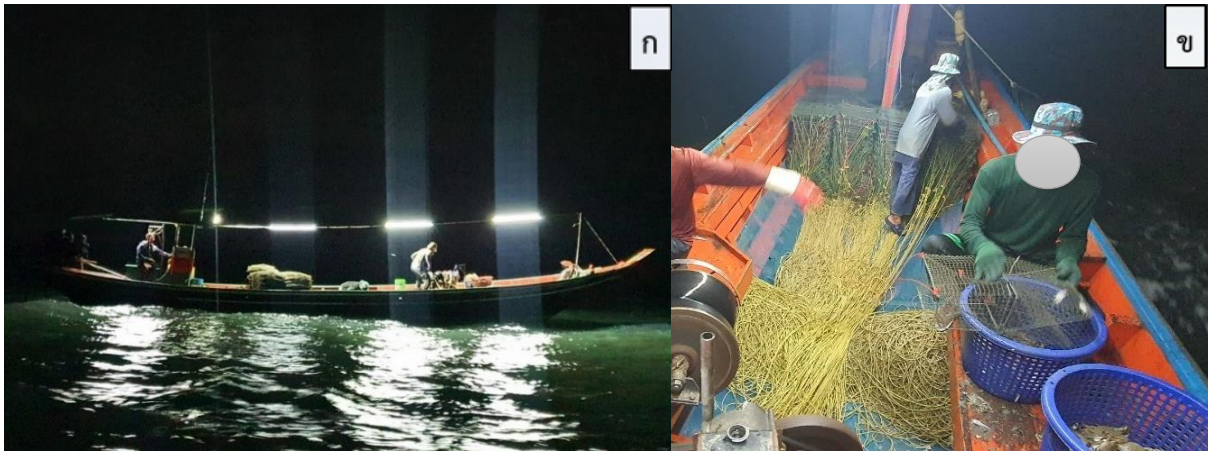
1.1 Crab gill net, the net material is nylon, size 20 and 25 , net mesh size 3.0 - 3.5 inches, depth 15 - 20 meshes. Each fisherman uses 15 - 30 packages of nets, 3 gillnets per package. The length of the nets used is between 2,700 - 7,200 meters per trip. The vessels used are long-tail vessels with a vessel length between 8.4 -10 meters (Figure 4a) . The nets are laid out in a rectangular shape covering an area parallel to the shoreline. Each row of nets is parallel to the other and each row of nets is not connected. The distance between rows is approximately 20 - 100 meters. At the end of each row of nets, there is a buoy. Most of the fishermen fish at night , leaving their nets out for 5-9 hours before retrieving them. It requires 2 laborers to fish. There are fishing grounds in front of Koh Set, Laem Sui, Ban Don Bay and Koh Prap, Surat Thani. The water depth is 5-30 meters. You can fish all year round. The fishing grounds are 2-8 nautical miles. You can fish 1 trip per day. There are 20 trips per month.

Picture 4. Fishing boat with crab gillnet (a) and characteristics of the crab gillnet (b).

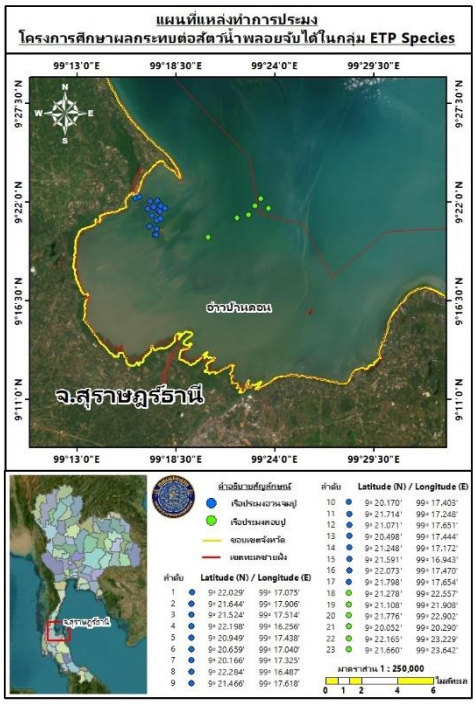


Picture 5 : The positioning of the crab gillnet.

1.2 Crab traps, Crab traps are traps with a square steel frame. The net is covered with polyethylene. The trap frame is made of 0.40 cm. diameter steel wire, bent into a rectangular box 35 cm wide, 55 cm. long and 20 cm. high. The mesh size is 2.5 inches for the whole trap. There is a bait bag in the middle of the trap. Fish are used as bait. Each fisherman uses 350-1,800 traps. The vessels that fishermen leave traps at night and leave the traps for 3 - 7 hours and then retrieve them. There are both single and straight traps. Fishermen use many traps in rows of 50 - 100 traps, with a distance between rows of 20 - 50 meters. Use a long-tailed vessel with a length of 9.75 - 15.4 m. and use 2 people for fishing. There are fishing grounds in the area of Chaiya District, Surat Thani Province.



Picture 6 Fishing boat, crab trap tool (a) and characteristics of the crab trap tool (b)

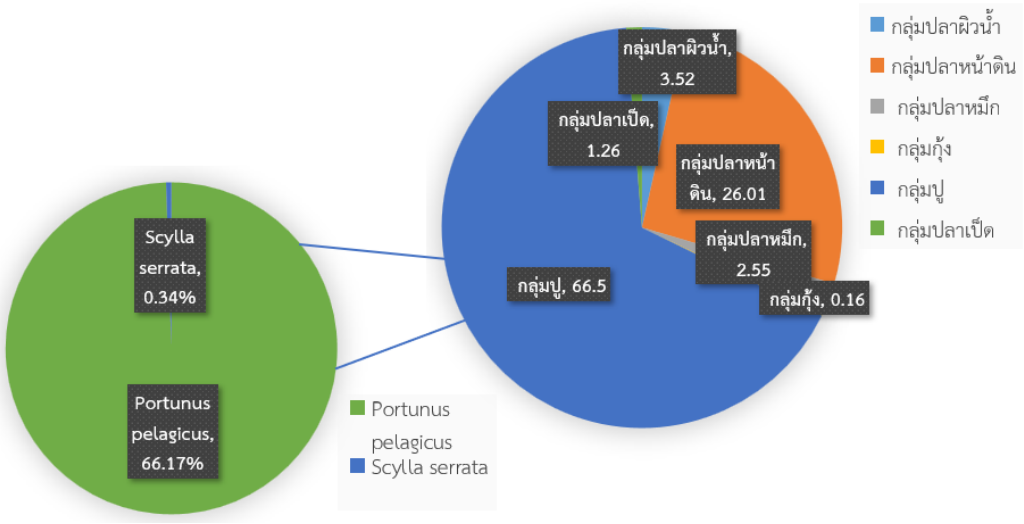


Picture 7 Fishing grounds, crab traps and crab nets in Ban Don Bay and nearby areas.

2. Catch rate and catch composition of aquatic animals from the use of crab gillnets and crab traps in Ban Don Bay, Surat Thani Province and nearby areas.

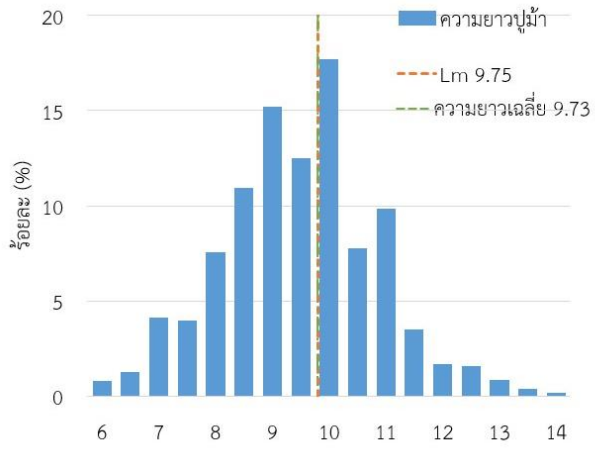
2.1 Crab gillnets

The crab gill net has a total catch rate of 0.219 kilograms/100 meters of net length , with the total catch rate of each vessel being in the range of 0.103 - 0.419 kilograms/ 100 meters of length. The highest percentage of aquatic animals caught was crabs, at 66.50 percent of the total catch, followed by demersal fish, pelagic fish, squid, trash fish, and shrimp at 26.01, 3.52, 2.55, 1.26, and 0.16 percent, respectively. The catch rate of crabs was 0. 146. Kilograms/100 meters of net length. Found 2 types of crabs that were commonly found: Blue swimming crab (*Portunus pelagicus*) 66.17 percent and mud crab (*Scylla serrata*) 0.34 percent respectively (Picture 8)



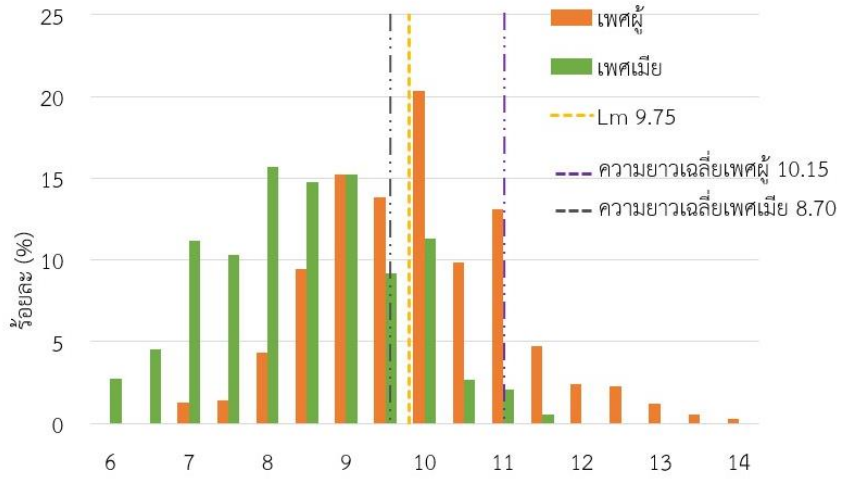
Picture 8 Catch Composition of aquatic animals (percentage of total catch) from fishing vessels using crab gillnets

The length of 1,129 blue swimming crabs was divided into 81.18 percent male and 18.82 percent female. The size range was 6.00 - 14.00 centimeters, with an average of 9.73 ± 1.38 centimeters. The size at first reproduction was 9.75. Centimetre (Figure 9)



Picture 9 Length of blue swimming crabs from crab gillnet.

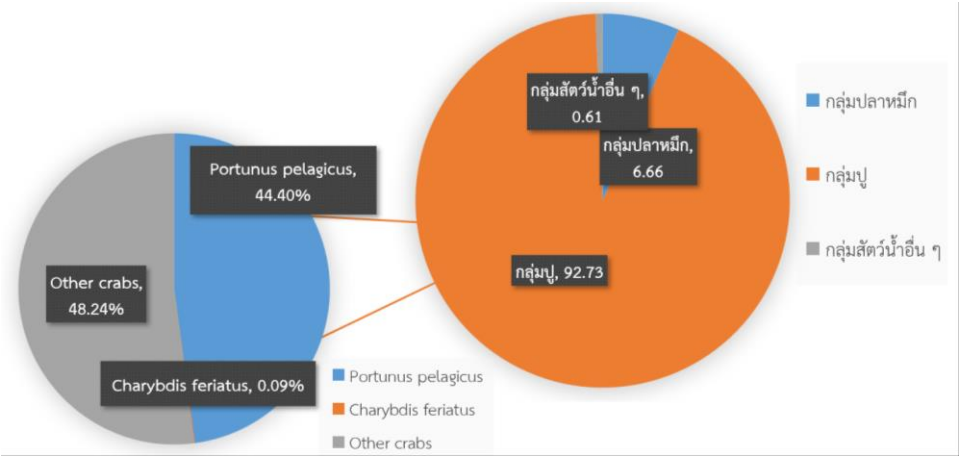
Considering the gender of the blue swimming crabs, there were 804 male crabs, with the size range of 7.00 . - 14.00 cm. average 10.15 ± 1. 22 Centimeters , first reproductive size 9.75 centimeters. 325 Female crabs's size range is 6.00. - 1 1.50 centimeters, Average 8.70 ± 1. 19 Centimeters , first reproductive size 9.75 Centimetre (Picture 10)



Picture 10 Comparison of the length of the male and female blue swimming crabs, using crab gillnets

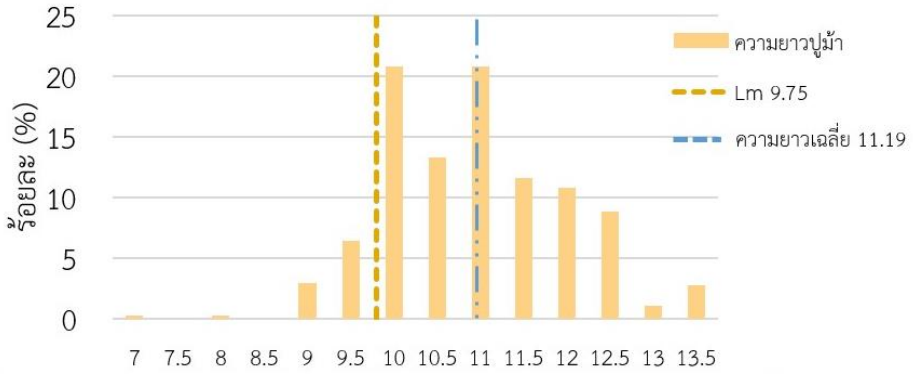
2.1 Crab traps

2.2.1 Crab trap fishing gear from small-scale fishing vessels has a total catch rate of 0.266 kg./10 traps, with a total catch rate of each vessel in the range of 0. 122 - 0.426 kg/ 10 traps. The highest percentage of crabs was found, at 92.73 percent of all catches, followed by squid and other aquatic animals at 6.66 and 0.61 percent, respectively. Crabs had a catch rate of 0.246 Kilogram/10 traps found 3 types of crabs: Trash Crab (Trash crabs) 48.24 percent, blue swimming crabs 44.40 percent and crucifix crabs 0.09 percent, respectively (Picture 11).



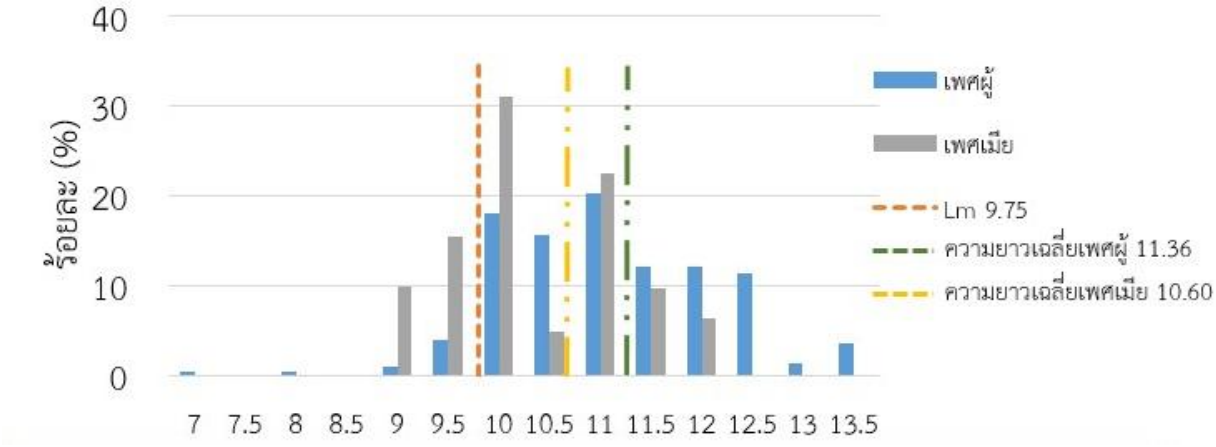
Picture 11 Catch Composition of aquatic animal species (percentage of total aquatic animal catch) from fishing vessels using crab traps from small-scale fishing vessels

The length of the crabs from crab traps from small-scale fishing vessels, blue swimming crabs, total of 386 crabs. It was divided into 82.14 percent male and 17.86 percent female. The size was in the range of 7.00 - 13.50 Centimeter, average 11.19 ± 1.06 Centimeters, first reproductive size 9.75 Centimetre (Picture 12)



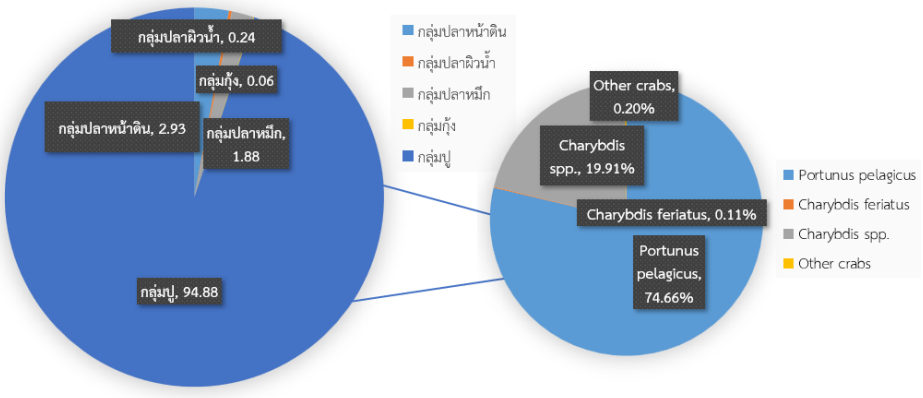
Picture 12 The length of the blue swimming crab from crab traps from small-scale fishing vessels

When considering the gender of the crab, it was found that 302 male crabs have a size in the range of 7.00 - 13.50 cm, average 11.36 ± 1.05 cm, first reproductive size 9.75 Centimeters and 84 female crabs, the size is in the range of 9.00-12.00 Centimeter, average 10.60 ± 1.19 Centimeters, first reproductive size 9.75 Centimetre (Picture 13)



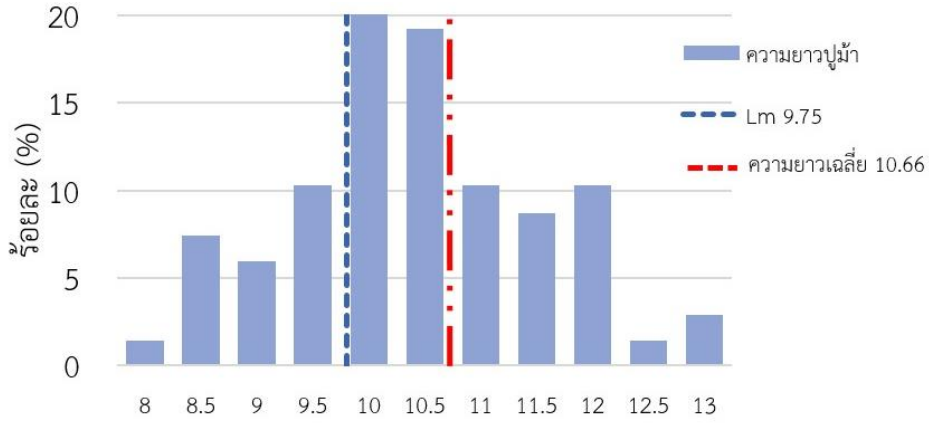
Picture 13 Comparison of the length of blue swimming crabs by sex from crab traps from small-scale fishing.

2.2.2 Crab trap from commercial fishing vessels has a total catch rate of 0.223 Kilograms/10 traps, with a total catch rate of each vessel in the range of 0.207 – 0.239 Kilograms/10 traps found the highest percentage of crabs, 94.88% of all aquatic animal catches, followed by demersal fish, squid, pelagic fish, and shrimp, 2.93%, 1.88%, 0.24%, and 0.06%, respectively. The crab catch rate was 0.212 Kilograms/10 traps and found 4 types of crabs in total: Blue swimming crab (*Portunus pelagicus*), White claw crab (Charybdis spp.) , trash crab and crucifix crabs (*Charybdis feriatus*) 74.66%, 19.91%, 0.20% and 0.11% respectively (Picture 14)



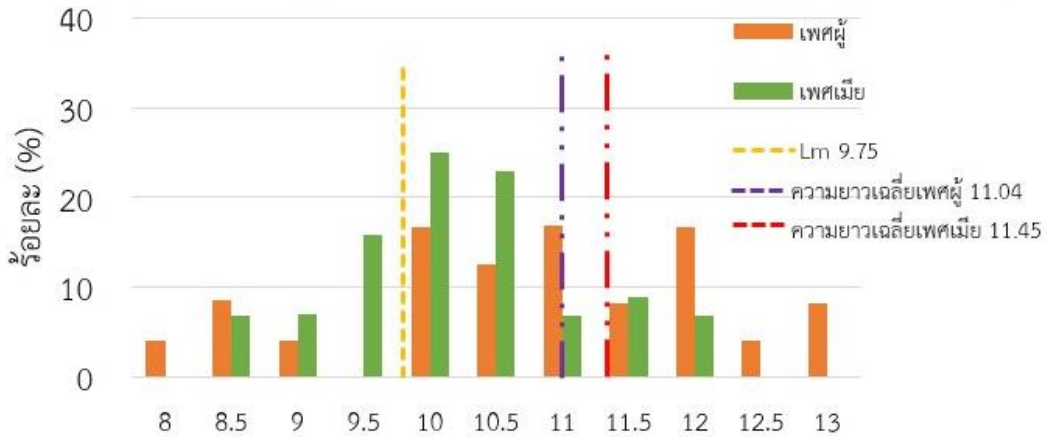
Picture 14 Catch Composition of aquatic animal species (percentage of total aquatic animal catch) from fishing vessels using crab traps from commercial fishing vessels.

The length of the crabs from crab traps from commercial fishing vessels, total of 632 blue swimming crabs. It was divided into males 59.16 percent and females 40.84 percent. The size was in the range of 8.00-13.00 centimeters, with an average of 10.66 ± 1.12 centimeters. The size at first reproductive was 9.75 Centimetre (Picture 15)



Picture 15 The length of the blue swimming crab from crab traps from commercial fishing vessels

222 male crabs were found with sizes ranging from 8.00 - 13.00 cm., average 11.04 ± 1.35 Centimeters, first reproductive size 9.75 Centimeters and 410 female crabs, the size range is 8.50 - 12.00 cm., average 11.45 ± 0.91 Centimeters, first reproductive size 9.75 Centimetre (Picture 16)



Picture 16 Comparison of the length of blue swimming crabs by sex from crab traps from commercial fishing.

3. Catches and sizes of bycatch in the ETP species group from crab gillnets and crab traps.

This study did not find any ETP species in the composition of aquatic animals caught from crab gillnets and crab traps. However, from the interview with small-scale fishermen, it

was found that seahorses, which are aquatic animals in the group ETP species were frequently found in the composition of aquatic animals caught by gillnets during June to October on some fishing vessels. The vessels that were found had between 1-4 seahorses caught, and the fishermen had various methods of handling them such as release them back into the sea or send them to the Shrimp Breeding Research and Development Center to breed them and release them into the wild.

From the survey of FISHERIES REFUGIA PROFILE FOR THAILAND: SURAT THANI (Ratana Munprasit et al., 2020) found that In addition to seahorses, the distribution of ETP species in dolphins, sea turtles, and dugongs was also found in Ban Don Bay and nearby areas. This is consistent with information provided by fishermen that dugongs, green turtles and dolphins have been seen in fishing ground, **but the fishing gear used, namely crab gillnets and crab traps, have no impact on this ETP species group.**

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Annex

Catch Composition details from field research.

Small-scale fishing vessels, crab gillnets

head	(ทั้งหมด)	
researchGroup3	สัตว์น้ำ (ชื่อวิทยาศาสตร์)	ผลรวม ของ น้ำหนัก raise (กก) 2
1 กลุ่มปลาผิวน้ำ	Alepes djedaba	0.05%
	Atule mate	0.13%
	Eleutheronema tetradactylum	0.24%
	Ilisha megaloptera	0.02%
	Megalaspis cordyla	0.02%
	Pampus chinensis	0.03%
	Parastromateus niger	1.12%
	Rachycentron canadum	1.44%
	Rastrelliger brachysoma	0.28%
	Sardinella fimbriata	0.02%
	Thryssa hamiltonii	0.16%
2 กลุ่มปลาหน้าดิน	Aurigequula fasciata	0.11%
	Brevitrygon heterura	3.43%
	Cociella crocodilus	0.38%
	Drepane punctata	3.13%
	Gerres oblongus	0.07%
	Lutjanus fulviflamma	0.05%
	Lutjanus johnii	0.53%
	Maculabatis gerrardi	0.88%
	Neotrygon caeruleopunctata	2.73%
	Psettodes erumei	2.78%
	Scatophagus argus	0.06%
	Sillago sihama	1.91%
	Terapon jarbua	0.20%
	Upeeus sulphureus	0.01%
	Cynoglossus lingua	0.75%
	Johnius spp.	5.19%
	Brachirus orientalis	1.15%
	Arius spp.	2.46%
	Leiognathus equulus	0.21%
3 กลุ่มปลาหมึก	Sepia aculeata	2.55%
4 กลุ่มกุ้ง	Metapenaeus affinis	0.02%
	Penaeus merguiensis	0.10%
	Penaeus monodon	0.04%
5 กลุ่มปู	Portunus pelagicus	66.17%
	Scylla serrata	0.34%
9 กลุ่มปลาเป็ด	Eubleekeria splendens	0.03%
	Horseshoe crab	0.90%
	Murex trapa	0.33%
ผลรวมทั้งหมด		100.00%

Small-scale vessels, Crab traps.

head	(หลายรายการ)	
researchGroup2	**สัตว์น้ำ (ชื่อวิทยาศาสตร์)**	**ผลรวม ของ น้ำหนัก raise (กก) 2**
4 กลุ่มปลาหมึก	Sepia aculeata	6.46%
	Sepiella inermis	0.19%
4 กลุ่มปลาหมึก ผลรวม		**6.66%**
6 กลุ่มปู	Portunus pelagicus	44.40%
6 กลุ่มปู ผลรวม		**44.40%**
7 กลุ่มสัตว์น้ำอื่น ๆ	Miyakea spp.	0.61%
7 กลุ่มสัตว์น้ำอื่น ๆ ผลรวม		**0.61%**
9 กลุ่มปลาเป็ด	Brittle star	0.00%
	Charybdis feriatus	0.09%
	Trash crabs	48.24%
9 กลุ่มปลาเป็ด ผลรวม		**48.33%**
ผลรวมทั้งหมด		**100.00%**

Commercial vessels, Crab traps.

researchGroup2	**สัตว์น้ำ (ชื่อวิทยาศาสตร์)**	**ผลรวม ของ น้ำหนัก raise (กก) 2**
2 กลุ่มปลาหน้าดิน	Cociella crocodilus	0.11%
	Paraplagusia blochii	0.62%
	Psettodes erumei	0.68%
	Sillago sihama	0.03%
	Arius spp.	0.11%
	Johnius spp.	1.00%
	Cynoglossus lingua	0.37%
2 กลุ่มปลาหน้าดิน ผลรวม		**2.93%**
3 กลุ่มปลาผิวน้ำ	Ellochelon vaigiensis	0.21%
	Hemiramphidae	0.04%
3 กลุ่มปลาผิวน้ำ ผลรวม		**0.24%**
4 กลุ่มปลาหมึก	Sepia aculeata	1.49%
	Sepiella inermis	0.39%
4 กลุ่มปลาหมึก ผลรวม		**1.88%**
5 กลุ่มกุ้ง	Penaeus merguiensis	0.06%
5 กลุ่มกุ้ง ผลรวม		**0.06%**
6 กลุ่มปู	Portunus pelagicus	74.66%
6 กลุ่มปู ผลรวม		**74.66%**
9 กลุ่มปลาเป็ด	Charybdis feriatus	0.11%
	Charybdis spp.	19.91%
	Trash crabs	0.20%
9 กลุ่มปลาเป็ด ผลรวม		**20.22%**
ผลรวมทั้งหมด		**100.00%**