

# Surat Thani Blue Swimming Crab Fishery Improvement Project

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## Milestone 31: RBF Workshop Report

### This milestone covers

- (1) RBF Assessment Report with 31 species and score
- (2) RBF Workshop Report July 2016
- (3) Compilation of bycatch from (a) RBF Assessment Report, (b) Documentary Research, and (c) Baseline survey

**Remark:** These documents for Annual Evaluation only, not the final version to send out



# Fisheries Improvement Project for blue swimming crab in Surat Thani province

## Risk Based Framework assessments

### 1 Objectives and scope

Risk Based Framework (RBF) assessments were undertaken to fulfil task 17 of the blue swimming crab (BSC) Fisheries Improvement Project (FIP) action plan. The objectives of the RBF assessments were to: 1) improve existing knowledge of the species caught as bycatch in the BSC fishery; 2) better understand the risk to these species from fishing activities; and 3) identify areas where additional information, detail or clarification is needed (and potentially update the action plan with tasks that will generate this information).

A Productivity Susceptibility Analysis (PSA) was completed for secondary species (no primary or endangered, threatened or protected (ETP) species were identified), and a Consequence Spatial Analysis (CSA) was completed for habitats. PSAs and CSAs were based on information gathered at a stakeholder workshop held in Surat Thani in June 2016, and from online resources including Fishbase, Sealifebase and relevant academic papers. A Scale Intensity Consequence Analysis (SICA) was attempted for ecosystem impacts but there was not sufficient information available at the workshop or in follow up information gathering to complete an assessment.

The results of the PSAs and CSAs are provided in the Excel sheet 'BSC\_RBF assessment results\_July 2016'. Completed assessments are in worksheets with blue tabs, whereas grey tabs indicate that assessments were not attempted (e.g. for primary and ETP species).

### 2 Productivity Susceptibility Analysis

A total of 25 species and a further 17 species groups (e.g. cuttlefish spp.) were identified by fishers during the RBF workshop, caught either in trap or gill net (or both) by the small/medium or large scale fleets.

PSAs were completed for all identified species. The information used to complete the PSA is presented in the Excel file named 'BSC\_PSA species information\_July 2016'. Some information was not available and was estimated using proxy species or the consultant's expert opinion; estimated information is shown in blue text in the spreadsheets, whereas information taken from scientific sources is shown in black text.

All species scored equal to or above 80, indicating a low risk of serious impacts from the fishery. Nevertheless, it should be noted that the assessments were based partially on estimated information and may be prone to error. The catch of these species should be monitored appropriately in the long term.

PSAs were not attempted for the species groups. This was due to uncertainty on the exact species caught and the risk that generic PSAs would be misleading. One possible approach might be to complete PSAs for all possible species in that group (e.g. all 5 species of seahorse known to exist in the Gulf of Thailand), and use the most vulnerable species in the assessment. Alternatively, given the FIP action plan is in the early stages, a data collection survey could be undertaken to identify bycatch to the species level, i.e. task 19 of the BSC FIP action plan, which is also linked to tasks 2.1 and 2.2 of

the BSC National Plan of Action. PSAs could be undertaken again once complete information on bycatch species is known.

### **3 Consequence Spatial Analysis**

Two main habitat types were identified by fishers to fall within fishing areas: mud and sand (coastal margin <25m depth; inner shelf <100m) and artificial reefs. Additional habitats were identified, including seagrass and natural reef, but were reported to be avoided completely by fishers and therefore were not considered in the assessment.

All habitats scored equal to or above 80, indicating they are resilient to serious impacts from the fishery. Nevertheless, changes in the spatial distribution of the fishery should be monitored closely, especially if fishing effort moves into vulnerable areas of seagrass or coral reef. Also, improved knowledge of the encountered habitats, based on scientific surveys, would reduce uncertainty in the habitat impacts of the fishery.

Only main habitats scored?		Consequence score [1-3]										Spatial score [0.5-3]					MSC derived score		Risk category	MSC scoring guidepost						
No		Habitat productivity										Gear-habitat interaction					Consequence score	Gear footprint	Spatial overlap	Enviroment suitability	Spatial score	CSA score	MSC category	MSC guidepost		
Habitat details		Habitat type		Depth (m)		Natural disturbance		Removability of biota		Removability of substratum		Substratum hardness		Substratum rugosity		Seabed slope		Consequence score	Gear footprint	Spatial overlap	Enviroment suitability	Spatial score	CSA score	MSC derived score	Risk category	MSC scoring guidepost
Scoring element	UoA/Gear type	Biome	Sub-biome	Feature	Habitat type	Depth (m)	Regeneration of biota	Natural disturbance	Removability of biota	Removability of substratum	Substratum hardness	Substratum rugosity	Seabed slope	Consequence score	Gear footprint	Spatial overlap	Enviroment suitability	Spatial score	CSA score	MSC derived score	Risk category	MSC scoring guidepost				
1	Gillnet	Coast	Coastal margin	Sediment plains	Small, flat, small erect/encrusting/burrowing	3-20	1	1	1	1	3	3	1	1.44	2	2	3	2.29	2.71	81	Low	≥80				
2	Trap	Coast	Coastal margin	Sediment plains	Small, flat, small erect/encrusting/burrowing	3-20	1	1	1	1	3	3	1	1.44	1	2	3	1.82	2.32	89	Low	≥80				
3	Gillnet	Shelf	Inner shelf	Sediment plains	Small, flat, small erect/encrusting/burrowing	10-40	2	1	1	1	3	3	1	1.67	2	1	3	1.82	2.47	85	Low	≥80				
4	Trap	Shelf	Inner shelf	Sediment plains	Small, flat, small erect/encrusting/burrowing	10-40	2	1	1	1	3	3	1	1.67	1	1	3	1.44	2.30	91	Low	≥80				
5	Trap	Coast	Coastal margin	Large rocky banks (artificial reef)	Large, outcrop, large erect	10-25	1	1	2	1	1	2	1	1.22	1	0.5	1	0.79	1.46	100	Low	≥80				

**Automated MSC scores**

PI	MSC score	Status
1.1.1	FAIL	FAIL
2.1.1	95	Unconditional Pass
2.2.1	FAIL	FAIL
2.3.1	FAIL	FAIL
2.4.1	90	Unconditional Pass









**Surat Thani Blue Swimming Crab  
Fisheries Improvement Plan**

**Risk Based Assessment Workshop**

**Nipa Garden Hotel, 30 June – 1 July 2016**



- DRAFT REPORT -

**July 2016**

Prepared for  
**WWF Thailand**

Prepared by



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## 1 Introduction

Ms Talawat welcomed participants to the workshop and each were invited to provide a short introduction. A list of participants is given in Annex 2.

## 2 Progress update on FIP and action plan tasks

Dr Wakeford provided an overview of the purpose of the workshop and provided a short historical overview:

- Pre-assessment completed in 2012
- Action plan started following pre-assessment in 2013
- Action plan updated in Jan 2014, national action plan also developed.
- In 2015/6 revised action plan
- 2016 workshop to take forward action plan

As part of the introduction a short description of the unit of certification was given to provide the basis of future discussion within the workshop.

## 3 Overview of information gaps and information gathering

An explanation was provided of why it was important to define the geographical area of the fishery, i.e. to define a manageable region for the FIP that is both biologically, economically and relevant and socially and economically.

Dr Wakeford led a discussion on the spatial distribution of BSC using a projected map of the region:

- Some fishers reported a migration of BSC from north to south in the northwest Gulf of Thailand:
  - Jan-Feb north of Chumpon in Phetchaburi
  - Feb-March in the Chumpon region
- Other fishers suggested that crab did not move north-south, but that smaller crab are generally found in shallow water.
- University suggested movement of crab into deeper water in response to temperature (e.g. observed in April this year (2016) - higher water temperatures possibly associated with El Nino effects); changes in salinity are also thought to play a role in crab movement.

Dr Davies led a discussion on the spatial and seasonal distribution of fishing effort:

- Around 20% of the BSC fleet are large scale vessels based in Don Sak and Surat Thani which operate 10-20 miles offshore; these vessels fish as far south as Songkhla and will land catch there when operating in the southern fishing grounds.
- The rest of the fleet are small or medium scale and operate closer to shore and to the west of the island chain: small scale fishers ( $\leq 10$  m LOA) operate within mainly 3 miles from shore in shallow water (3-5 m); medium scale (10-30 m LOA) partially overlap with small scale inshore but tend to fish in deeper water (20 m+) further offshore.

## 4 Primary/secondary species: information gathering

Dr Davies and Ms Talawat led a data gathering exercise where stakeholders provided information on the range of bycatch species caught within the BSC fishery, i.e. a list of species by vessel/gear type with additional information on the relative frequency of capture, size range and level of retention.

Full details of the information collected is given in Annex 3. This information will be directly relevant to conduct Productivity Susceptibility Analysis (PSA) for each species<sup>1</sup>.

Other general comments included:

- Species with no commercial value are usually discarded (e.g. small crabs that have no eggs).
- Horseshoe crabs – discarded when no eggs, which otherwise make them valuable
- Seahorse – when dead will keep (for export to China), when alive will throw back
- Remoras attach themselves to gillnets but are usually discarded

Both small-scale vessels ( $\leq 10$  m LOA) and medium sized vessels ( $>10$  and  $<30$  m LOA) were reported to catch similar species and are therefore combined in this analysis.

## 5 ETP species

Four main species/groups are currently classified as ETP within Thailand:

**Dugongs:** These are found on seagrass areas around islands but also move between inshore seagrass beds (between islands and mainland); the distribution of dugongs has been estimated and mapped by DMCR.

**Turtles:** Green and hawksbill turtles are found in the Gulf of Thailand. Stakeholders reported that these species tend to be found mainly in coral areas, but not fishing grounds.

**Whales and dolphins:** Stakeholders reported that large whales are sometimes seen (e.g. Bryde's whale), and dolphins regularly swim with boats; however, no whale or dolphin species were reported to interact with fishing gear.

**Sharks and rays:** During the information gathering exercise stakeholders identified several species of shark and ray that are caught in gillnets (e.g. banded bamboo shark). From the information provided, none of these species are considered as ETP (currently the green sawfish is the only elasmobranch that considered a possible ETP species in the BSC fishery, although these are thought to be extinct in Thai waters (see IUCN Redlist); stakeholders gave no indication of this species being present in the bycatch.

## 6 Habitats

To better understand the level of potential impacts of the fishery on main habitat types, the spatial and seasonal distribution of the fishery is required. This was gained through a mapping exercise of the distribution of fishing effort by vessel and gear types. This information will be used to conduct a Consequence Spatial Analysis (CSA) under the MSC Standard.

The distribution of fishing effort was then used to describe the range of habitat types within each area, as defined by the MSC (see table PF9<sup>2</sup>).

### 6.1 Distribution of fishing effort

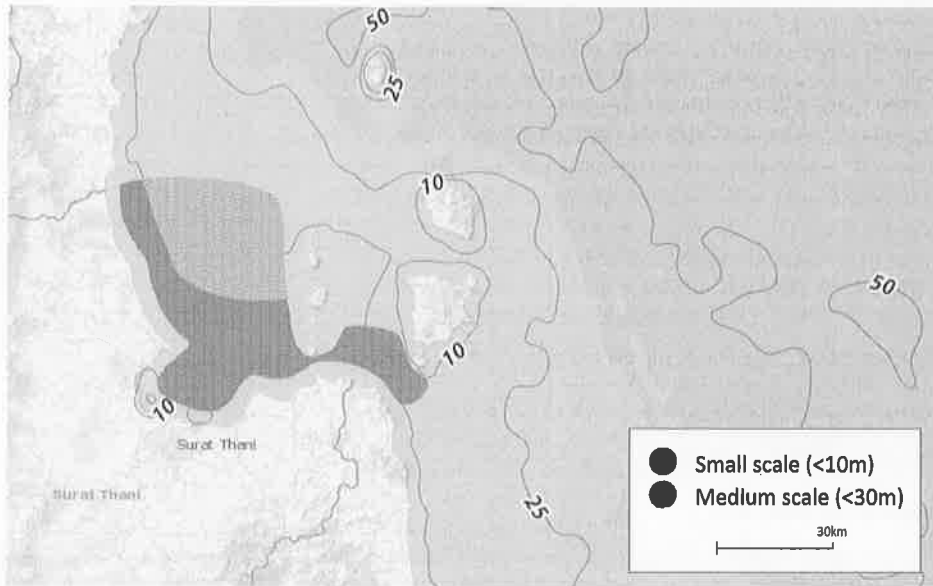
A participatory mapping exercise was undertaken by each stakeholder group to show the distribution of fishing effort within the region.

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<sup>1</sup> Further details of the MSC RBF methodology can be accessed here: <https://www.msc.org/about-us/standards/fisheries-standard/msc-risk-based-framework>

<sup>2</sup> The MSC substratum, geomorphology and biota (SGB) habitat characteristics (page 98): <https://www.msc.org/documents/scheme-documents/fisheries-certification-scheme-documents/fisheries-certification-requirements-version-2.0>

Annex 4 shows outputs from the mapping exercise from each stakeholder group. A summary of these results are presented in the figure below.



**Figure 1: Summary of distribution of fishing effort for small-scale and medium sized vessels**

Small scale vessel (<10 m LOA) fishing grounds range between 3-5 m depth. No fishing occurs within 500-1,000 m from shore (national regulations), and consequently fishing does not occur on seagrass habitats. The furthest extent of fishing grounds is defined either by depth (maximum approx. 10 m) or by distance (fishing trips last 1 day; boats leave in the early hours of the morning and return around midday).

Larger, medium scale vessels (<30 m LOA) fish in deeper waters further from shore, beyond the range of smaller vessels. Fishing grounds for large and small scale vessels overlap partially in shallower areas. Gillnet and traps are used throughout the fishing grounds, although only traps are used on areas of artificial reef (concrete blocks), as gillnets tend to become tangled and damaged.



**Figure 2: Summary of distribution of fishing effort for large vessels**

Large scale vessels (>30 GRT) fish with both traps and gillnets. A large proportion of the fleet is based on Don Sak, with some vessels also based in Surat Thani. Fishing grounds range between approximately 10 to 40 m deep; this maximum depth limit defines the easternmost boundary of fishing grounds. Vessels generally fish 10-20 miles from shore, depending on depth and the availability of crabs (e.g. crabs are reported to move deeper when temperatures are unusually high in shallower waters).

**Comment [RW1]:** We have switched to a different definition of vessel size based on GRT, not length (i.e. > 30 m LOA). Please confirm this is correct.

## 6.2 Distribution of habitat types

A similar participatory exercise was undertaken to map the distribution of different habitat and sediment types, including topography. This information was added to the same maps developed for the distribution of fishing effort above.

Annex 5 shows outputs from the mapping exercise from each stakeholder group. A summary of these results are presented in the figure below. Generally the fishing grounds were reported to consist of fine sediment/mud, with sand in some places. Vulnerable habitat types, such as seagrass and coral (mapped by DMCR), are close to shore and therefore not within fishing grounds. Detailed topography was not known/available, but there are thought to be few significant seafloor features. Small gullies/canyons were reported to occur (no detail on locations/number), and are often associated with high catches of sea urchin.

Artificial reefs exist in some areas (locations mapped by DMCR). These are made using concrete blocks, with the purpose of encouraging marine life to these areas. Artificial reefs are not directly associated with enhancing the productivity of the BSC fishery.



**Figure 3: Summary of distribution of coastal habitat types, based on DMCR online data portal. Fishing grounds are mainly characterised by mud habitat (not shown). Areas shown in green are known seagrass beds.**

## 7 Fisheries management and governance

In addition to the analysis on the potential environmental impact(s) of the BSC fishery within the region, Dr Davies and Ms Talawat led a discussion on the current management and governance of the fishery, which included an update of the recent Royal Ordinance on Fisheries.

In general, the abundance and availability of BSC in the fishery are thought to vary due to a number of reasons, including:

- High sea surface temperature (SST) drives crab into deeper cooler water further offshore, reducing catches within the inshore region.
- Offshore commercial trawl fishery target large mature crabs in deeper water but increasing risk of entering inshore areas to target shrimp and crab.
- Seasonal rainfall increases nutrient levels in local rivers and estuary leads to increased productivity.

Concern was raised over trends in declining catches and size of crab and the limitations of existing national-level management measures to control fishing activities. Participants considered local fishermen must be more active in local management to reduce fishing effort and rebuild stocks. DoF responded that the fishery is open-access and will always lead to overexploitation and targeting of undersized fish. This also requires an increase in awareness within the fishing community.

Local fishermen indicated that the existing trap mesh size (3.5 cm) is appropriate to retain crabs of the minimum landing size limit (i.e. 10 cm). In addition, retention of berried females is favoured so that the eggs can be retained either in crab banks or holding facilities to be released at a later date. Fishermen expect most female crabs die during hauling, and it is therefore preferable to retain them rather than return to the sea.

**Comment [RW2]:** Check this is correct – either 2.5 cm or 2.5 inches?

**Comment [RW3]:** I'm not sure post-capture mortality (PCM) of berried female crabs has been studied in Thailand? In other geographic regions, crab PCM is considered high, particularly in shallow water (<50 m). However, catch needs to be sorted at-sea rather than on land.

DoF highlighted that the fishery should not target small crab (that can lead to recruitment overfishing and risk of further stock decline). A representative from the processing industry indicated that while catches have been low in 2016, given the high price of crab meat they are encouraged to buy high volumes of crab, including small sizes. They also expressed concern that if supplies are reduced from Thailand, buyers will look elsewhere and stop purchasing.

Some processors explained that they did not purchase crab < 10 cm carapace width. However, local fishermen expressed concern that given all retained crabs will die this is a waste of resources. Clearly there is a need to work together to enforce undersize crab rules and find solution to prevent their capture.

The new Royal Ordinance of Fisheries has increased the trap mesh size from 2.5 cm to 2.5 inches. However, it is not yet clear how well this measure is enforced and whether similar technical measures exist for gill nets (which appear to form the majority of gear used in the fishery).

#### **Crab banks**

More recently, crab banks have been used to re-stock and enhance local crab populations to help off-set large retention of small, undersized crab within the fishery. Fishermen also see crab banks as a potential solution to the impact of local cockle farms, which are increasing within the inshore region. Fishermen requested that additional support be given to the development and maintenance of crab banks in future.

Historically, however, deeds were established for local communities to develop crab banks that would also benefit from them. In practice deeds were given to other groups outside the community and the banks were not always successful.

Dr Wakeford asked whether there was clear evidence that crab banks were successful in enhancing local populations. DoF explained that there were anecdotal reports that higher catches were taken in areas adjacent to crab banks. In addition, the University of Thailand has submitted a proposal to receive funding to study the survival rate of crabs released from crab banks. This 3-year project would look at a range of issues including bycatch and survival rates of juvenile crabs within the Surat Thani region and two other control areas. This information would also help determine the most suitable are to release crab.

**Comment [RW4]:** This suggests selectivity problem. If cannot stop catching and selling small crab, then need management measures that stop them catching them in the first place. Bigger mesh size/spatial planning etc. This will need local support from fishing community.



## **Annex 1: Agenda**

### **Risk Based Framework workshop for the Surat Thani blue swimming crab FIP**

**Nipa Garden Hotel, 30 June – 1 July 2016**

#### **Day 1 - Thursday 30 June**

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09.00 Welcome and introductions

09.10 Progress update on FIP and action plan tasks - MRAG

09.30 Information gaps and introduction to data gathering process – MRAG

#### **10.30 Break**

11.00 Information gathering for primary/secondary/ETP species - MRAG

#### **13.00 Lunch**

14.00 Information gathering for primary/secondary/ETP species - MRAG

#### **15.45 Break**

16.30 Time reserved for any other business/data gathering

17.00 Close of day 1

#### **Day 2 - Friday 01 July**

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09.00 Introduction to RBF methods - MRAG

09.30 Habitats information gathering - MRAG

#### **10.30 Break**

11.00 Habitats information gathering - MRAG

#### **13.00 Lunch**

14.00 Ecosystems - MRAG

15.00 Discussion of P3 Issues (time permitting) - WWF/MRAG

#### **15.30 Break**

16.00 Closing remarks and next steps - WWF

17.00 Close of workshop

## Annex 2: List of participants

No.	Name	Organisation
1	Varln Tanasomwang	Department of fisheries
2	Mr. Kamphon Loychuen	Department of fisheries
3	Mr. Saney Rattanasamneung	Chumphon Coastal Fisheries Research and Development Center, DoF
4	Kritphon Yangvanitsaj	Surat Thanl Coastal Fisheries Research and Development Center, DoF
5	Arkorn Theppanlt	Surat Thanl Coastal Fisheries Research and Development Center, DoF
6	Jeerawat keawpraju	Surat Thanl Coastal Fisheries Research and Development Center, DoF
7	Dr. Thanltha Darbanandan	Faculty of Fisheries, Kasetsart University
8	Dr. Amonsak Sawaddee	Walallak University
9	Jantira Rattanarat	Walallak University
10	Mr.Jroj Sintawanurak	PAKFOOD PUBLIC CO., LTD.
11	Mr.Treerat Chaotawee	PAKFOOD PUBLIC CO., LTD.
12	Tanyakornpak KeawnaJ	PAKFOOD PUBLIC CO., LTD.
13	Jlraphan Jareonkit	PAKFOOD PUBLIC CO., LTD.
14	Mr.Nattapong Malasavat	PAKFOOD PUBLIC CO., LTD.
15	Mr. Suraslt Rahem	VIYACRAB PRODUCTS CO., LTD.
16	Rawadee Jangjan	VIYACRAB PRODUCTS CO., LTD.
17	Sommal Arklm	VIYACRAB PRODUCTS CO., LTD.
18	RaomJlt Slyrat	VIYACRAB PRODUCTS CO., LTD.
19	Mohamad Rensej	VIYACRAB PRODUCTS CO., LTD.
20	Varlt Nopsakun	VIYACRAB PRODUCTS CO., LTD.
21	Atiyut Hanmontree	SICHON DAILY FRESH CO, LTD
22	Pumpllal Pancham	SICHON DAILY FRESH CO, LTD
23	Pramook Taklenkam	Thal Frozen Foods Associatlon
24	Koravlt Yummanon	Thal Frozen Foods Associatlon
25	Watchara Inkorn	Fish market business (Watchara)
26	Sirlrat Tlenchal	Fish market business (Nltl)

No.	Name	Organisation
27	Parisa Tongmala	Fish market business (Niti)
28	Phonpoj Sealee	Fish market business (Poo Andaman)
29	Surachat Sangkhon	Small scale fisheries (Don Sak group)
30	Weeravat Wichaldit	Small scale fisheries (Don Sak group)
31	Preecha Sangkhon	Small scale fisheries (Don Sak group)
32	Rojana Vichaldit	Small scale fisheries (Don Sak group)
33	Leuchal Sangkhon	Small scale fisheries (Don Sak group)
34	Wanpen Kerdsuban	Small scale fisheries (Don Sak group)
35	Apitchaya Buranakun	Small scale fisheries (Phumrlang, Chalya group)
36	Rasee Burananakun	Small scale fisheries (Phumrlang, Chalya group)
37	Nareuphon Klayplchai	Small scale fisheries (Phumrlang, Chalya group)
38	Vilalwan Promnarong	Small scale fisheries (Phumrlang, Chalya group)
39	Wannakorn Promnarong	Small scale fisheries (Phumrlang, Chalya group)
40	Wanlaya Jantong	Small scale fisheries (Phumrlang, Chalya group)
41	Patphan Burananakun	Small scale fisheries (Phumrlang, Chalya group)
42	Sapat Mamal	Small scale fisheries (Phumrlang, Chalya group)
43	Apichat Intongkham	Department of Marine and Coastal Resources
44	Peerasak Pitakvatee	Department of Marine and Coastal Resources
45	Pakawan Talawat	WWF
46	Thanakorn Yimdee	WWF
47	Robert Wakeford	MRAG
48	Tim Davies	MRAG

### Annex 3: List of bycatch caught within BSC fishery

#### Small and medium-scale fishery

##### Gillnets

	Common name	Species name	Local name	Frequency of capture†	Size range of capture	Released ‡
1	Brownbanded Bamboo Shark	<i>Chiloscyllium punctatum</i>		2	30-80 cm	D/never, P/always
2	Large-scale Tongue Sole			1	10-25 cm	Never
3	Banned mantis Shrimp			1	10-24 cm	Never
4	Ray			1	10-30 cm	Never
5	Croaker					
6	Giant Catfish	<i>Arius thalassinus</i>		2,3	15-40 cm	Never
7	Striped Sea Catfish	<i>Plotosus lineatus</i>		2,3	15-40 cm	Never
8	Silver Silago	<i>Sillago sihama</i>		1,4	15 cm	Never
9	Fourfinger Treadfin	<i>Eleutheronema tetradactylum</i>		3	30 cm	Never
10	Indo-Pacific Spanish Mackerel	<i>Scomberomorus gutt</i>		3,4	5-24 cm	Never
11	Stout-spine Murex	<i>Murex trapa</i>		1	4 cm	Sometime
12	?	വേലിയാ		1,4	10 cm	Sometime
13	?	വേലിയാ		3	10-25 cm	Never
14	Sea Urchin			1	2.5-3 cm	Always
15	Yellow queenfish	<i>Scomberoides lysan</i>		4	20-30 cm	Never
16	Cuttlefish	<i>Sepia</i>		1,2	5-15 cm	Never
17	Tonguefish	<i>Cynoglossus</i>		1	15 cm	Never
18	Sole	<i>Brachirus harmandi</i>		3,4	15 cm	Never
19	Starfish			2	5-20 cm	Always
20	Black Tiger Prawn			4	15-23 cm	Never
21	Banana Shrimp			4	20 cm	Never
22	Bartali Flathead	<i>Platycephalus indicus</i>		1,2	15-40 cm	Never

Comment [RW5]: Please update information in these tables.

Trap

Common name	Species name	Local name	Frequency of capture†	Size range of capture	Released ‡
1 Mud Crab			3	20 cm	Small Always
2 Cuttlefish	<i>Sepia</i>		4	15 cm	Never
3 ?		ปูน้ำจืด	1	3 cm	Never
4 Banded mantis Shrimp			2	5-24 cm	Never
5 Starfish			3	3-20 cm	Always
6 Sea Urchin			3	3 cm	Always
7 <del>XXX</del> Sea cucumber			4	over 2.5 cm	Sometime
8 Giant Catfish	<i>Arius thalassinus</i>		4	10-40 cm	Never
9 Striped Sea Catfish	<i>Plotosus lineatus</i>		4	15-40 cm	Never
10 Horseshoe Crab			4	5-20 cm	Egg Never
11 Auger territella	<i>Territella terebra</i>		2	2-8 cm	Always
12 Spotted scat	<i>Scatophagus argus</i>		3	4-8 cm	Small Always
13 Damsel fish	<i>Dascyllus aruanus</i>		3	4-8 cm	Small Always
14 ?		ปูตาขาว	4	10-12 cm	Never
15 Banana Shrimp	<i>Fenneropenaeus merguensis</i>		4	8 cm	Never
16 Musk crab	<i>Charybdis cruciata</i>		1	8-20 cm	Never
17 Three-spot Swimming Crab	<i>Portunus sanguinolentus</i>		4	8-12 cm	Never
18 ?		ปูหิน	4	8 cm	Always

†1 – Very common (every haul); 2 – common (weekly); 3 – rare (several times a year); 4 – very rare (once a year)

‡ 1 – always; 2 – sometimes; 3 – never

Common name	Species name	Local name	Frequency of capture†	Size range of capture	Released ‡
23 Mud Crab			4	5-20 cm	Never
24 Spiny Rock Crab			1	8 cm	Never
25 Horseshoe Crab			1	5-20 cm	Egg Never
26 Indo-Pacific Mackerel	<i>Rastrelliger brachysoma</i>		2	5-10 cm	Never
27 Spider Crab			1	4 cm	Always
28 ?		ຫຼັງຄາງ	1	1-3 cm	Always
29 ?		ບຸນຄາງ	1	7 cm	Never
30 ?		ຊຸ່ງຄາງ	2	3 cm	Always
31 Jellyfish	Unknown		1	Unknown	Always
32 ?		ບຸນຄາງ	1	3 cm	Never
33 Chacunda Gizzard Shad	<i>Anodontostoma chacunda</i>		1,3	3-8 cm	Never
34 Seahorse	Various		4	6 cm	Live always
35 Lobster			4	12 cm	Never
36 Flathead Lobster			4	5-10 cm	Never

†1 – Very common (every haul); 2 – common (weekly); 3 – rare (several times a year); 4 – very rare (once a year)

‡ 1 – always; 2 – sometimes; 3 – never

Large-scale fishery

Gillnets

	Common name	Species name	Local name	Frequency of capture†	Size range of capture	Released ‡
1	Brownbanded Bamboo Shark	<i>Chiloscyllium punctatum</i>			30 cm	Never
2	Large-scale Tongue Sole				15 cm	Never
3	Banned mantis Shrimp				12-10 cm	Never
4	Ray				15-40 cm	Never
5	Giant Catfish	<i>Arius thalassinus</i>			15-40 cm	Never
6	Striped Sea Catfish	<i>Plotosus lineatus</i>			20-40 cm	Never
7	Indo-Pacific Spanish Mackerel	<i>Scomberomorus gutt</i>			40-100 cm	
8	Stout-spine Murex	<i>Murex trapa</i>			4-5 cm	Sometime
9	Cuttlefish	<i>Sepia</i>			15-30 cm	Never
10	Starfish				10 cm	Always
11	Bartali Flathead	<i>Platycephalus indicus</i>			10-20 cm	Never
12	Mud Crab				12-20 cm	Never
13	Spiny Rock Crab				12 cm	Never
14	?		ปูตาบอง		10-15 cm	Never
15	?		ปูหัวแฉก		10 cm	Never
16	Flathead Lobster				13 cm	Never
17	Brownbanded Bamboo Shark	<i>Chiloscyllium punctatum</i>			30 cm	Never
18	Large-scale Tongue Sole				15 cm	Never

†1 – Very common (every haul); 2 – common (weekly); 3 – rare (several times a year); 4 – very rare (once a year)

‡ 1 – always; 2 – sometimes; 3 – never

Trap

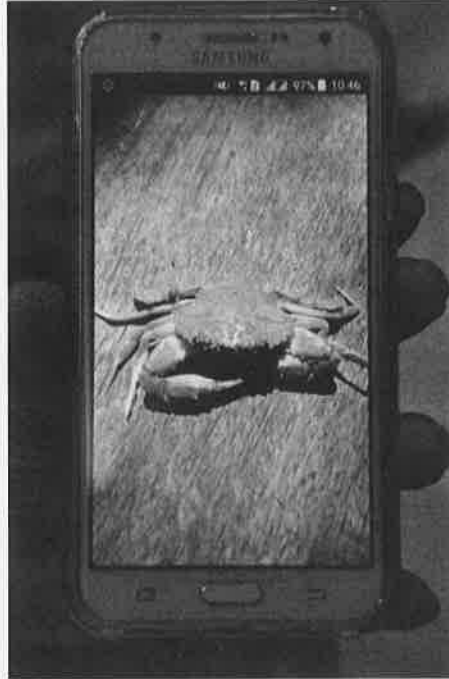
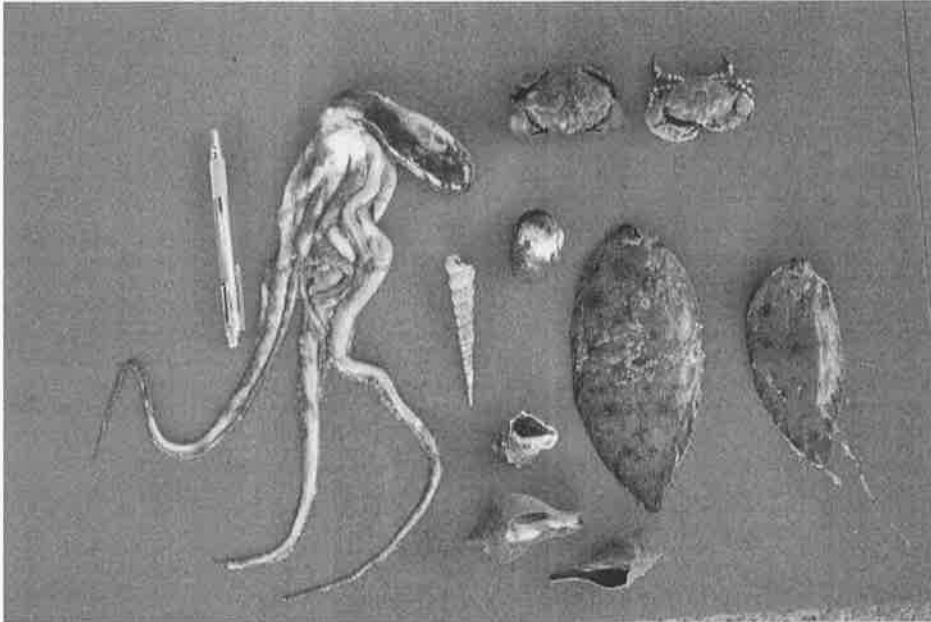
	Common name	Species name	Local name	Frequency of capture†	Size range of capture	Released ‡
1	Threadfin bream				10-20 cm	
2	Grouper	<i>Sepia</i>			10-20 cm	
3	Sea horse				7 cm	
4	?		𐤀𐤃𐤁𐤀𐤃		10-15 cm	
5	Banned mantis Shrimp				10-15 cm	
6	Mud Crab				12 cm	
7	Musk crab	<i>Charybdis cruciata</i>			12 cm	
8	Three-spot Swimming Crab	<i>Portunus sanguinolentus</i>			10 cm	
9	?		𐤀𐤃𐤁𐤀𐤃		10 cm	
10	Cuttlefish	<i>Sepia</i>			10 cm	

†1 – Very common (every haul); 2 – common (weekly); 3 – rare (several times a year); 4 – very rare (once a year)

‡ 1 – always; 2 – sometimes; 3 – never

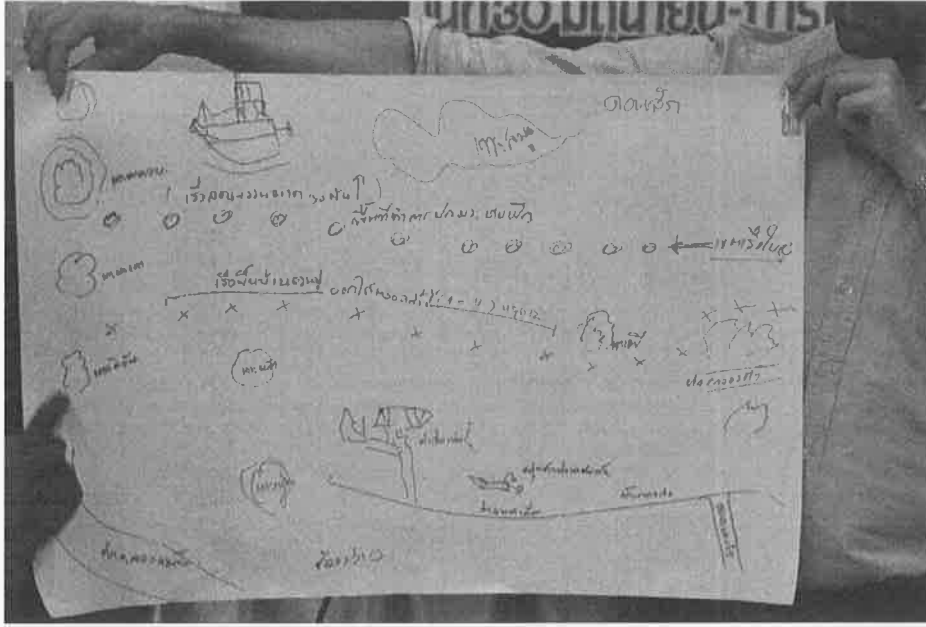


**Annex 4: Examples of bycatch caught in small-scale gillnet fishery**

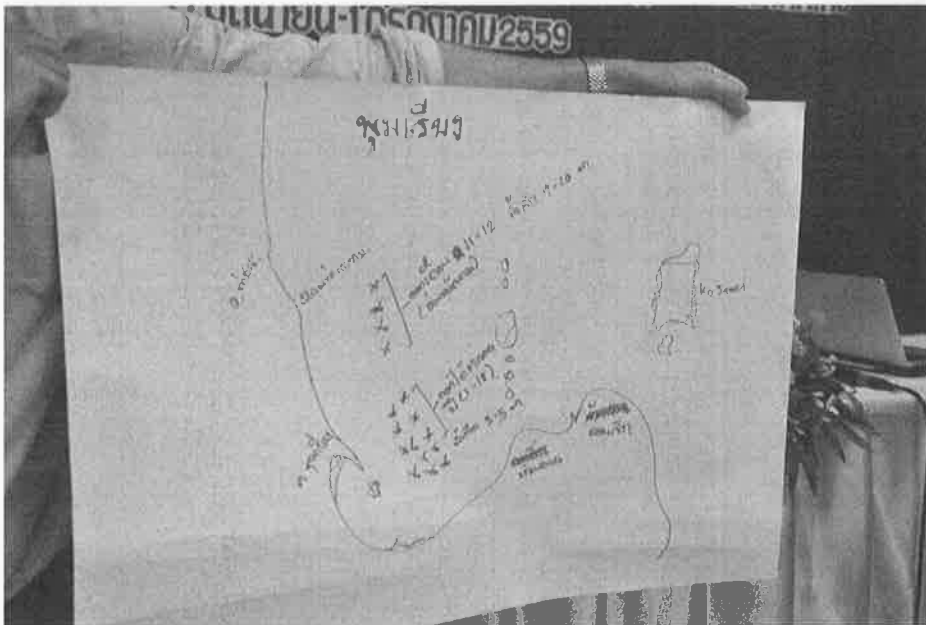


# Annex 5: Participatory mapping of fishing grounds

Group 1



Group 2



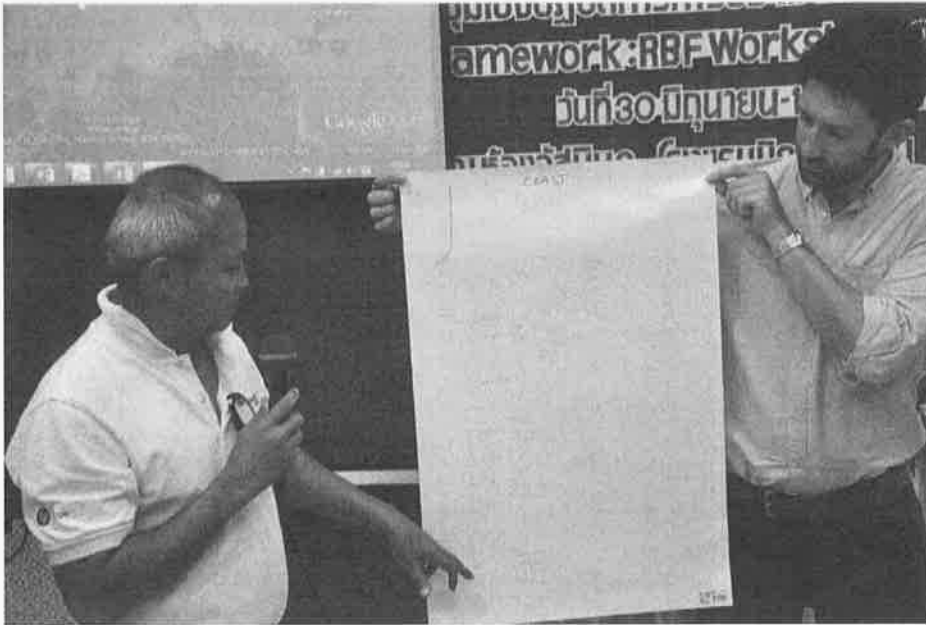
Group 3



Group 4

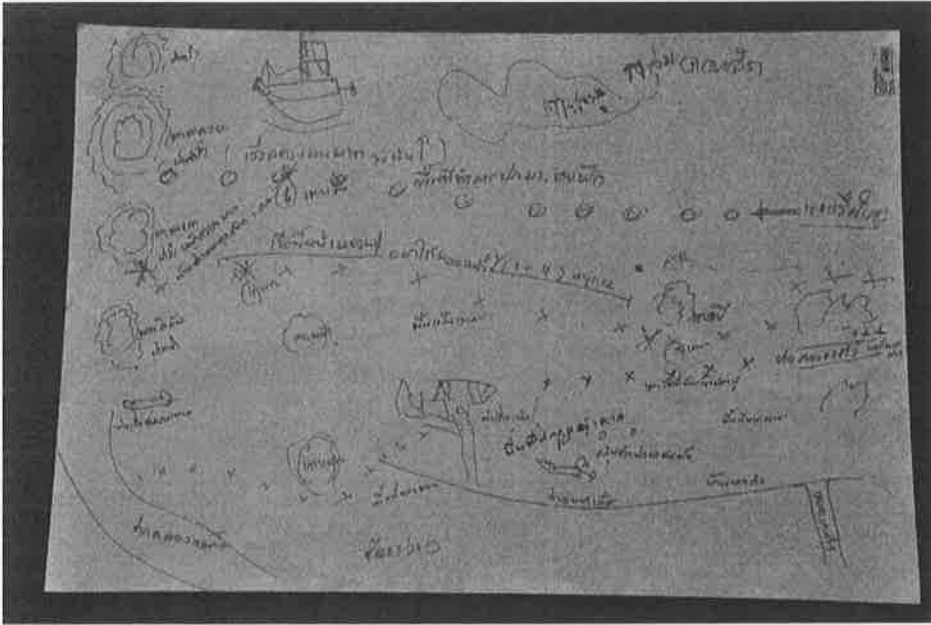


Group 5

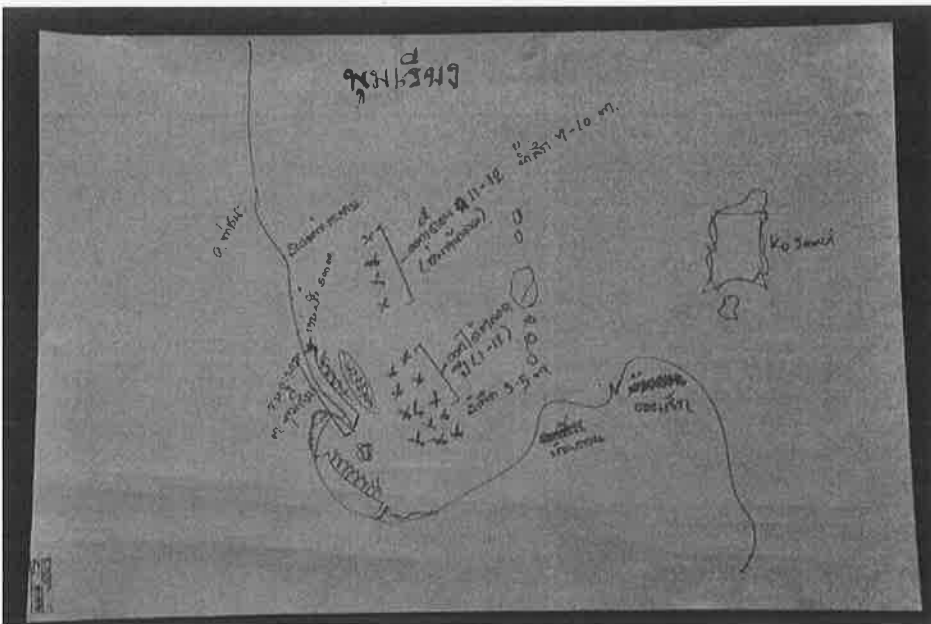


# Annex 5: Participatory mapping of marine habitats

Group 1

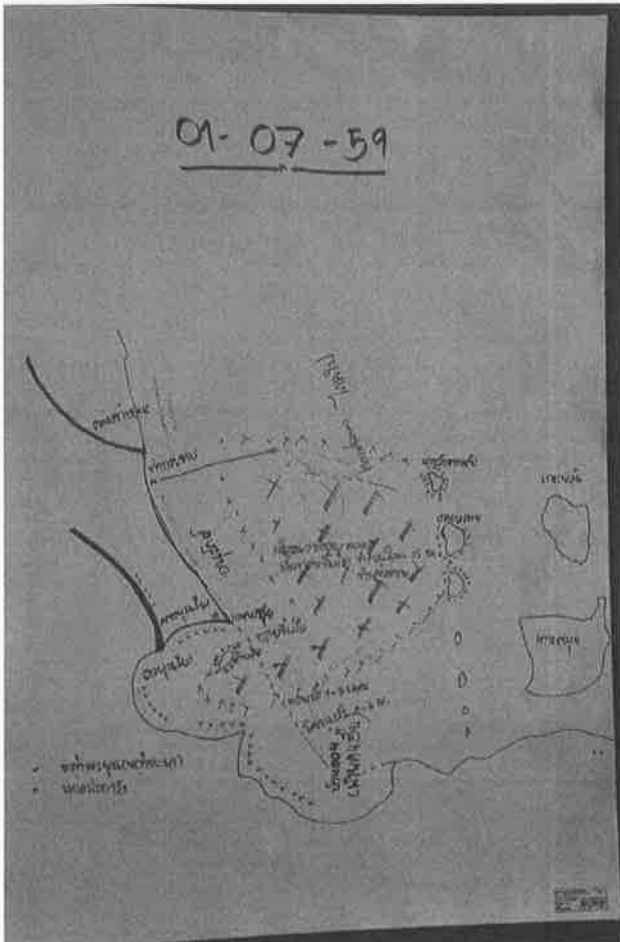


Group 2

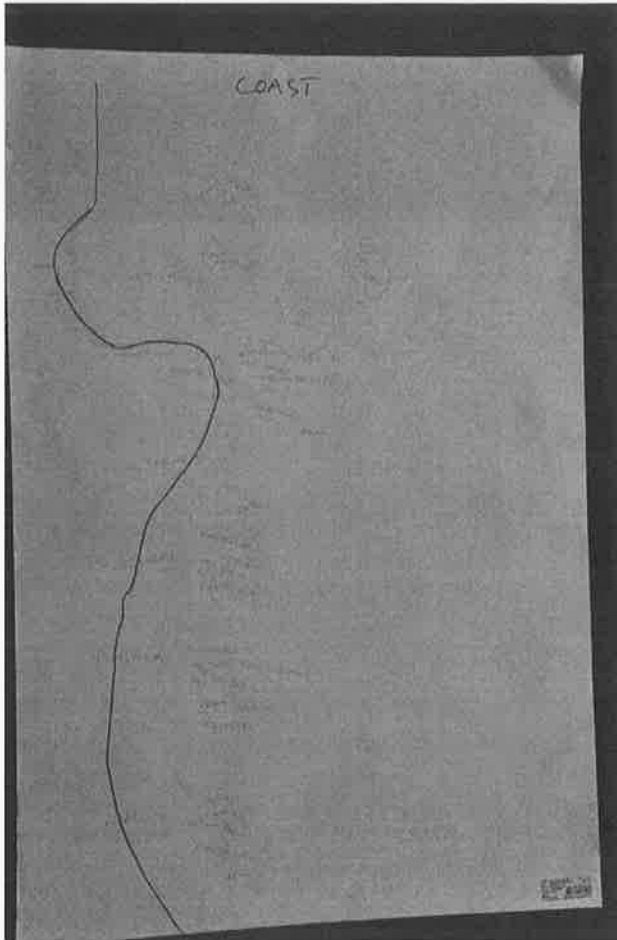




Group 4



Group 5





Scientific Name	Common name	Local Name	FG - RBF	FG - Baseline	RBF WS	Doc Research	Baseline Survey
<i>Acaudina sp.1</i>	Smooth sea cucumber	ปลิงทะเล	Trap	Trap (S)		/	/
<i>Acaudina sp.2</i>	Smooth sea cucumber	ปลิงทะเล	Gillnet	Gillnet (L)		/	/
<i>Alectis indica</i>	Cubbeleafish	โคมงาม	Gillnet	Gillnet(S),(L)			/
<i>Alepes djedaba</i>	Shrimp Scad	โคมงาม	Gillnet	Gillnet(S),(L)			/
<i>Anadara inaequalvis</i>	Barbatia ark, clam	หอยครง	Gillnet	Gillnet (L)		/	/
<i>Anodontostoma chacunda</i>	Chacunda gizzard shad	ตะเพียนน้ำเค็ม	Gillnet		/		
<i>Arachnoides placenta</i>	Sand dollar	เหรียญทะเล	Trap	Trap (S,L)			/
<i>Architectonica pernix</i>	Partridge sundial	หอยวงเวียน	Trap	Trap (S)		/	/
<i>Aurios sp.1</i>	Catfish	ดุกทะเล	Gillnet	Gillnet (S)			/
<i>Aurios sp.2</i>	Catfish	ดุกทะเล	Gillnet	Gillnet (S)			/
<i>Batrachomoeus trispinosus</i>	Three spined Frogfish	คางคก	Trap and Gillnet	Trap (S) Gillnet (S)			/
<i>Bufonaria crumena</i>	Crumena bunker	หอยสังข์ทกบ	Gillnet	Gillnet (L)		/	/
<i>Catappa philargius</i>	Brick-red box crab	ปูถาด	Gillnet		/		
<i>Carangoides sp.</i>	Kingfish	ข้างเหลือง	Gillnet	Gillnet (L)			/
<i>Carsinocarpus rotundicauda</i>	Horse shoe crab	แมงดาถ้วย	Trap and Gillnet	Trap (S) Gillnet(S)			
<i>Charybdis affinis</i>	Smoothshelled swimming crab	ปูกะตอย	Trap and Gillnet	Trap (S,L) Gillnet(S,L)			/
<i>Charybdis feriatus</i>	Musk crab	ปูลาย	Trap		/		/
<i>Charybdis ferriata</i>	Crucifix crab	ปูลาย	Trap and Gillnet	Trap (s) Gillnet(S,L)			/
<i>Charydis hellerii</i>	Spiny swimming	ปูหิน	Trap and Gillnet	Trap (s) Gillnet(S,L)			/
<i>Chiloscyllium punctatum</i>	Brownbanded bamboo shark	ฉลามกบ	Gillnet		/		
<i>Clibanarius infraspinus</i>	Hermit crab	ปูเสฉวน	Gillnet	Gillnet(s)			/
<i>Cyaneidae</i>	Jellyfish	แมงกระพรุน	Gillnet	Gillnet (L)			/
<i>Cynoglossus arel</i>	Largescale tonguesole	ลิ้นหมา	Gillnet		/		/
<i>Cynogrossus arel</i>	Sole	ลิ้นหมา	Gillnet	Gillnet (L)			/
<i>Cynogrossus sp.</i>	Sole	ลิ้นหมา	Gillnet	Gillnet (L)			/
<i>Cynogrossus trulla</i>	Macau Sole	ลิ้นหมา	Gillnet	Gillnet (L)			/



<i>Dascyllus aruanus</i>	Whitetail dascyllus	สลิดหินมัลลาย	Trap		/	
<i>Diadumenidae</i>	Sea anemone	ดอกไม้ทะเล	Trap	Gillnet (S,L)		/
<i>Diogenes sp.</i>	Hermit crab	ปูเสฉวน	Trap (S) Gillnet (L)	Trap (S) Gillnet (L)		/
<i>Doclea canifera</i>	spider crab	ปูแมงมุม	Gillnet	Gillnet (L)		/
<i>Doclea sp.</i>	spider crab	ปูแมงมุม	Trap and Gillnet	Trap (S) Gillnet (S,L)		/
<i>Dorippe quadridens</i>	Sumo crab	ปูเป็ดม	Gillnet	Gillnet (S,L)		/
<i>Drepane punctata</i>	Spotted sicklefish	ใบโพธิ์จุด	Gillnet	Gillnet (S),(L)		/
<i>Eleutheronema tetradactylum</i>	Fourfinger treadfin	กวางสี่เส้น	Gillnet		/	/
<i>Ephippus orbit</i>	Orbfish	ปลาจระเม็ดขาว	Gillnet	Gillnet (S)		/
<i>Eubleekeria spendens</i>	Spined Ponyfish	สลิดหิน	Gillnet	Gillnet (L)		/
<i>Eucrater alcocki</i>	Rectangular crab	ปูใบ	Gillnet	Gillnet (L)		/
<i>Fenneropenaeus merguensis</i>	Banana shrimp	กุ้งเขี้ยว	Gillnet		/	/
<i>Fenneropenaeus merguensis</i>	Banana shrimp	กุ้งเขี้ยว	Trap		/	/
<i>Galene bispinosa</i>	square-shelled crab	ปูแขนทิด	Gillnet	Gillnet (L)		/
<i>Harpiosquilla harpex</i>	Robber Harpiosuillid mantis shrimp	กั้งตึกแดน	Trap and Gillnet	Trap (s) Gillnet (L)		/
<i>Harpiosquilla raphidae</i>	Robber Harpiosuillid mantis shrimp	กั้งตึกแดน	Trap and Gillnet	Trap (L) Gillnet (L)		/
<i>Hemifusus sp.</i>	Spiral melongena	หอยโมพี	Trap and Gillnet	Trap (S) Gillnet (S,L)		/
<i>Hippocampus sp.</i>	Sea horse	ม้าน้ำ	Gillnet	Gillnet (S),(L)		/
<i>holothuria martensii</i>	Sea cucumber	ปลิงทะเล	Gillnet	Gillnet (L)		/
<i>Johnius amblycephalus</i>	Goatee Croaker	จวด	Gillnet	Gillnet (S),(L)		/
<i>Laevistrombus canarium</i>	Dog conch, wing shell	หอยชักตีน	Trap	Trap (S)		/
<i>Lagocephalus lunaris</i>	Green Puffer	ปักเป้า		Trap (S)		/
<i>Luidia sp.</i>	Sea star	ดาวทะเล	Trap and Gillnet	Trap (s) Gillnet (S,L)		/
<i>Lutjanus russelli</i>	Russel snapper	กะพง	Gillnet	Gillnet (S),(L)		/
<i>Lutjanus sp.</i>	Snapper	กะพง	Gillnet	Gillnet (S)		/



<i>Lysiosquilla scabricauda</i>	Banded mantis shrimp	กั้งตึกแดน	Gillnet, Trap	/	/	/
<i>Macrobrachium rosenbergii</i>	Giant freshwater prawn	กั้งก้ามกราม	Trap and Gillnet			/
<i>Macroplathalmus</i> sp.	Sentinel crab	ปูก้ามหกฟ้า	Gillnet	Gillnet (S,L)		/
<i>Magalaysis Coidyla</i>	Torpedo scad	แซงไก่	Gillnet	Gillnet (L)		/
<i>Matuta Planipes</i>	Flower moon crab	ปูกระดุม	Trap	Trap (s) Gillnet(S,L)		/
<i>Matuta Victor</i>	Common moon crab	ปูหนุมาน	Trap and Gillnet	Trap (s) Gillnet(S,L)		/
<i>Melo melo</i>	Indian volute, Bailer shell	หอยลำโพง	Gillnet	Gillnet (L)		/
<i>Modiolus prolivis</i>	Horse mussel	หอยกะพง	Gillnet	Gillnet (S)		/
<i>Muraenesax cinereus</i>	Muraenesax cinereus	ยอดจาก	Gillnet	Gillnet (L)		/
<i>Murex trapa</i>	Short-spine murex	หอยสังข์หนาม	Gillnet		/	/
<i>Myomenippe hardwickii</i>	Thunder crab	ปูใบ้	Trap	Trap (s) Gillnet(S,L)		/
<i>Natica vitellus</i>	Calf moon	หอยจันทร์ลายเสือ	Trap	Gillnet (L)		/
<i>Nemipterus</i> sp.	Threadfin bream	ทรายแดง	Gillnet	Gillnet(S),(L)		/
<i>Netuma thalassina</i>	Giant catfish	ริวกีว	Gillnet		/	/
<i>Netuma thalassina</i>	Giant catfish	ริวกีว	Trap		/	/
<i>Nrachirus orientalis</i>	Oriental sole	ลันควายดำ	Trap and Gillnet	Trap (S) Gillnet(S,L)		/
<i>Nuchequula gerrioides</i>	Decorate ponyfish	ปลาแป้นจมูกสั้น	Gillnet	Gillnet (L)		/
<i>Octopus</i> sp.	Octopus	หมึกสาย	Trap	Trap(S)		/
<i>Olatosquilla nepa</i>	Mantis shrimp	กั้งตึกแดน	Trap and Gillnet	Trap (s) Gillnet(L)		/
<i>Ophiocnemis marmorata</i>	Brittle star	ดาวประาะ	Gillnet	Gillnet (S)		/
<i>Otholithes uber</i>	Tigertooth Croaker	จวด	Gillnet	Gillnet (L)		/
<i>Pampus Chinensis</i>	Chineaser Silver Pomfret	จาระเม็ด	Gillnet	Gillnet (L)		/
<i>Paphia undulata</i>	Clams	หอยลาย	gillnet	Gillnet (L)		/
<i>Paramonacanthus choirocephalus</i>	Leather-jacket fish	วัวหนัง	Trap and Gillnet	Trap (L) Gillnet(L)		/
<i>Parexcoetus brachypterus</i>	Sailfin Flyingfish	นกกระจอก	Gillnet	Gillnet (L)		/
<i>Penaeus silasi</i>	False white prawn	กั้งขาวหางแดง	Gillnet	Gillnet (S)		/
<i>Penaeus monodon</i>	Black tiger prawn	กั้งกลาดำ	Gillnet		/	/



<i>Penaeus semisulcatus</i>	Green tiger prawn	กุ้งกุลาลาย	Gillnet	Gillnet (S)	/	/
<i>Photoligo</i> sp.	Squid	หมึกกล้วย	Gillnet	Gillnet(S,L)	/	/
<i>Phyllophorella kohkutiensis</i>	Sea cucumber	ปลิงทะเล	Trap and Gillnet	Trap(S) Gillnet (L)	/	/
<i>Pilumnidea</i>	Crab	ปูแม่น้ำ	Gillnet	Gillnet (L)	/	/
<i>Platycephalus indicus</i>	Bartail flathead	หางควาย	Gillnet	Gillnet(S),(L)	/	/
<i>Plotosus lineatus</i>	Striped eel catfish	ดุกทะเล	Gillnet	/	/	/
<i>Plotosus lineatus</i>	Striped eel catfish	ดุกทะเล	Trap	/	/	/
<i>Podophthalmus vigil</i>	Long-eyed swimming crab	ปูตายาว	Gillnet	/	/	/
<i>Podophthalmus vigil</i>	Long-eyed swimming crab	ปูตายาว	Trap	/	/	/
<i>Pomadyss kaakan</i>	Javelin grunter	สร้อยนกเขา	Gillnet	Gillnet (L)	/	/
<i>Portunus sanguinolentus</i>	Three-spot swimming crab	ปูดาว	Trap	/	/	/
<i>Prnahia anea</i>	Donkey Croaker	จวด	Gillnet	Gillnet (L)	/	/
<i>Psuedociaenasoldado</i>	Caroun Croaker	จวด	Gillnet	Gillnet(S),(L)	/	/
<i>Pugilina cochilidium</i>	Spiral melongena	หอยโมพี	Trap and Gillnet	Trap (S) Gillnet(S)	/	/
<i>Rastrelliger brachysoma</i>	Indo-Pacific (short) mackerel	ทู	Gillnet	/	/	/
<i>Sardinella gibbosa</i>	Gold Stripe Sardinella	หลังเขียว	Gillnet	Gillnet (L)	/	/
<i>Scatophagus argus</i>	Spotted scat	ตะกรับ	Trap	/	/	/
<i>Scomberoides lysan</i>	Yellow (doublespotted) queenfish	สีเสียด	Gillnet	/	/	/
<i>Scomberomorus commerson</i>	Spanish Mackerel	อินทรี	Gillnet	Gillnet (L)	/	/
<i>Scomberomorus guttatus</i>	Indo-Pacific spanish mackerel	อินทรีจุด	Gillnet	/	/	/
<i>Scylla serrata</i>	Mud crab	ปูทะเล	Trap	/	/	/
<i>Scylla serrata</i>	Mud crab	ปูทะเล	Gillnet	/	/	/
<i>Sea pen</i>	Sea pens	ปากกาทะเล	Trap	Trap(S)	/	/
<i>Sea Star (in process)</i>	Sea star	ดาวทะเล	Trap and Gillnet	Trap (s) Gillnet(S,L)	/	/
<i>Secutor hanedaii</i>	Haneda,s ponyfish	สลัดหิน	Gillnet	Gillnet (L)	/	/
<i>Semicassis bisulcatum</i>	Granular ark	หอยกระต่าย	Gillnet	Gillnet (L)	/	/
<i>Sepia pharanopsis</i>	Cuttle Fish	หมึกกระดอง	Gillnet	Gillnet (L)	/	/
<i>Sepia2</i>	Cuttle Fish	หมึกกระดอง	Trap and Gillnet	Trap (L) Gillnet(L)	/	/
<i>Siganus caniculatus</i>	White spotted	สลัดหินจุดขาว	Trap and Gillnet	Trap (S) Gillnet(S,L)	/	/
<i>Sillago sihama</i>	Silver sillago	ช่อนทรายแก้ว	Gillnet	/	/	/
<i>Sphyaena frosteri</i>	Bigeyes baracuda	น้ำดอกไม้	Gillnet	Gillnet (L)	/	/
<i>Sphyaena jello</i>	Pickhandle baracuda	น้ำดอกไม้	Gillnet	Gillnet (S)	/	/
<i>Strongylura strongylura</i>	Black spot longtom	กระตังเหวดำ	Gillnet	Gillnet (S)	/	/





<i>Tachypleus gigas</i>	Horse shoe crab	แมงดาจาน	Trap and Gillnet	Trap (S) Gillnet(S,L)			
<i>Takifugu oblongus</i>	Lattice blassop	บึกเป้าซีลอน	Trap and Gillnet	Trap (S) Gillnet(S,L)			/
<i>Temnopleurus toreumaticus</i>	Sea urchin	เม่นทะเล	Trap and Gillnet	Trap (s) Gillnet(S,L)		/	/
<i>Terapon jabua</i>		ข้างตะเภา	Trap and Gillnet	Trap (S) Gillnet(L)			/
<i>Thalamita crenata</i>	Spiny rock crab	ปูหิน	Gillnet		/		
<i>Thenus indicus</i>	Shovel-nose lobster	กั้งกระดาน	Gillnet	Gillnet (L)			/
<i>Thryssa harmitonii</i>	Harmitoms Thryssa	กเรา	Gillnet	Gillnet (L)			/
<i>Triacanthus neuhofii</i>	Silver Tripodfish	วีว	Trap	Trap(S)			/
<i>Uca perplexa</i>	Perplexing fiddler crab	ปูก้ามขาว	Gillnet		/		
<i>Uca perplexa</i>	Perplexing fiddler crab	ปูก้ามขาว	Trap		/		
<i>Upeanus sundicus</i>	Ocherband Goatfish	แพะ	Trap and Gillnet	Trap (S) Gillnet(L)			/

