

Fisheries *Refugia* Profiles: Trat Province, Thailand



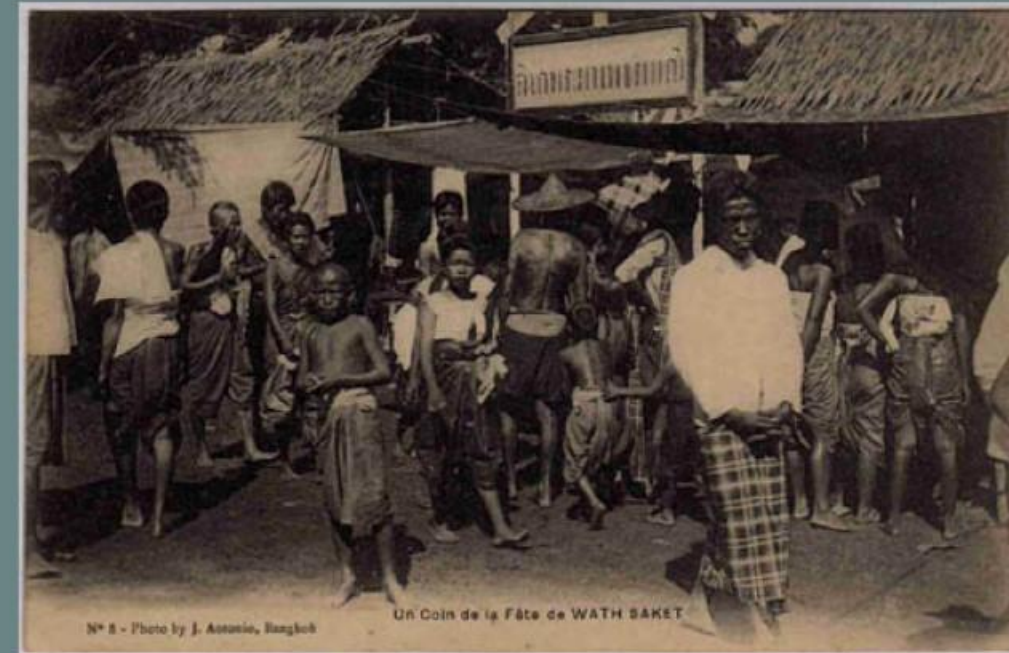
Geophaphy: Trat Province

- Areas: Land = 2,819 km²
Seas = 7,257 km²
Shoreline = 165 km
- Boundaries:
North: Chanthaburi Province and Cambodia
South: the Gulf of Thailand
East: Cambodia (borderd by Banthat Mountains)
West: Chanthaburi Province (boardered by Welu River)
- Main fresh water sources: Trat River, Welu River,
Nam Chieo Canal
- Islands: 52 islands with Koh Chang is the third biggest island of Thailand (after Phuket and Koh Samui)
- Climate: one of the wettest places in Thailand (4,500 mm of rain per year)



History:

- The history of Trat can be traced back to the early 17th century at Ayutthaya Kingdom; it was considered among the trade center cities of Southeast Asia.
- Trat has played an important role in the development of the country's stability and economy due to its strategic location as a checkpoint and buffer city. It was engaged in French-Thai War having Battle of Koh Chang in 1741.
- The population of Trat has long been a mix of Thai, Lao, Chinese, Khmer, and Vietnamese
- Trat is the most important border trade route between Cambodia and Thailand at Ban Hat Lek Border Market



Population:

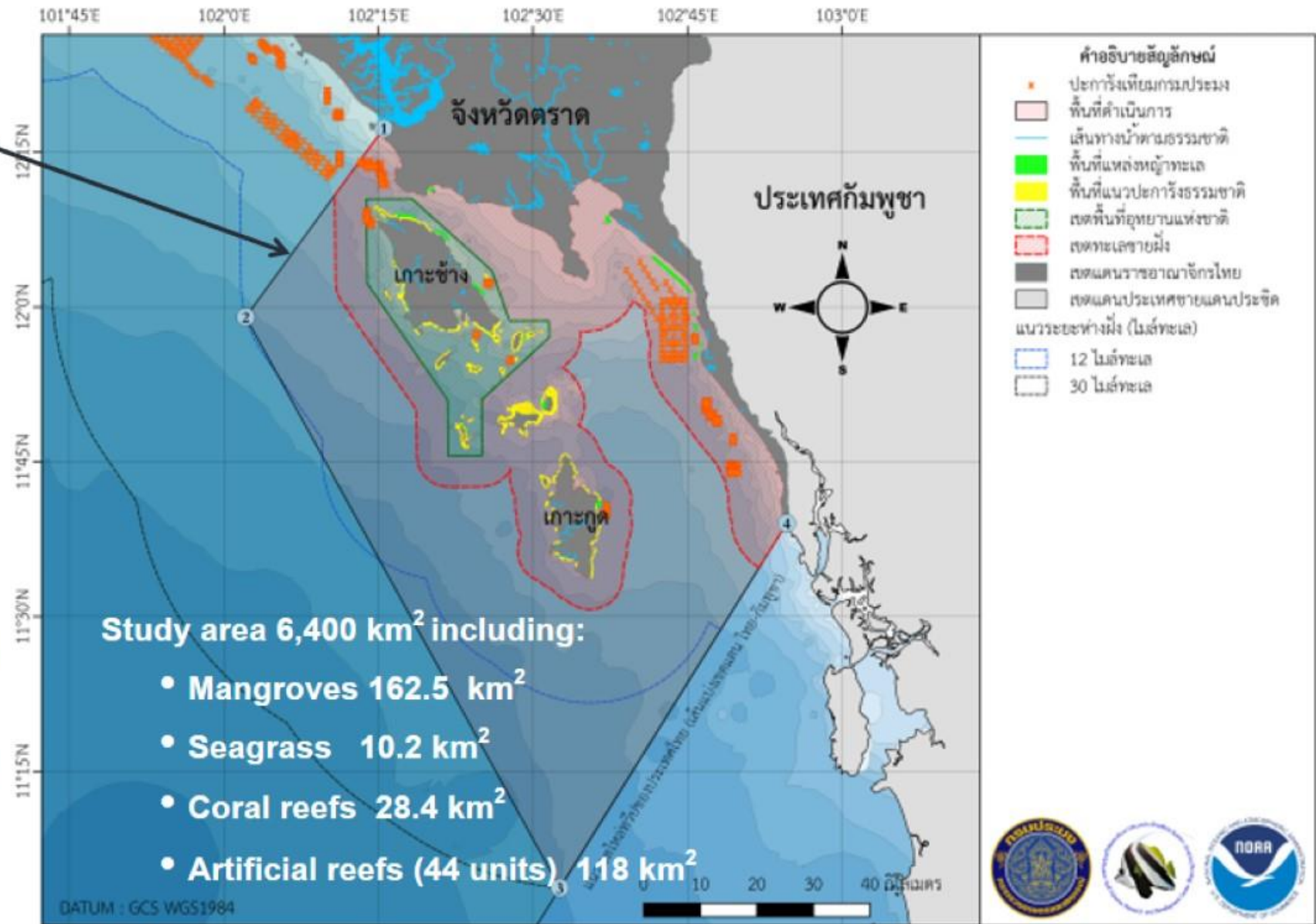
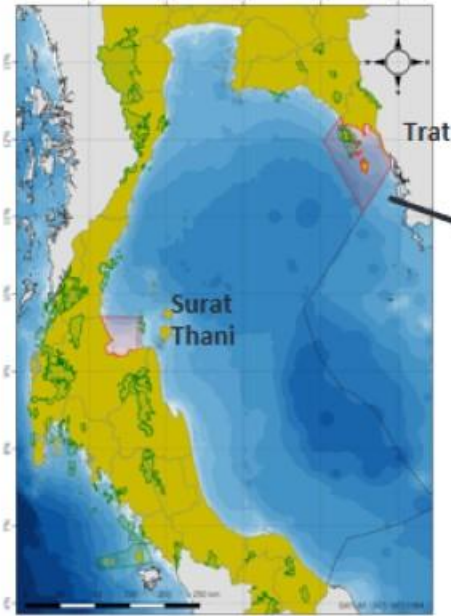
- Total 229,914 (2018)
 - Male 114,334
 - Female 115,580

Socio-economy:

- GDP 39,597 M฿ (2015)
 - GDP in agriculture sector 48%
 - GDP in non-agriculture sector 52%
 - GDP in fisheries sector 13%



Study Area for Fisheries *Refugia* Project



Geographic Location (tentative site for study):

1. 12°17'19.77"N 102°15'30.73"E
2. 11°59'2.55"N 102°2'6.96"E
3. 11°3'44.02"N 102°32'36.03"E
4. 411°39'3.38"N 102°54'38.18"E



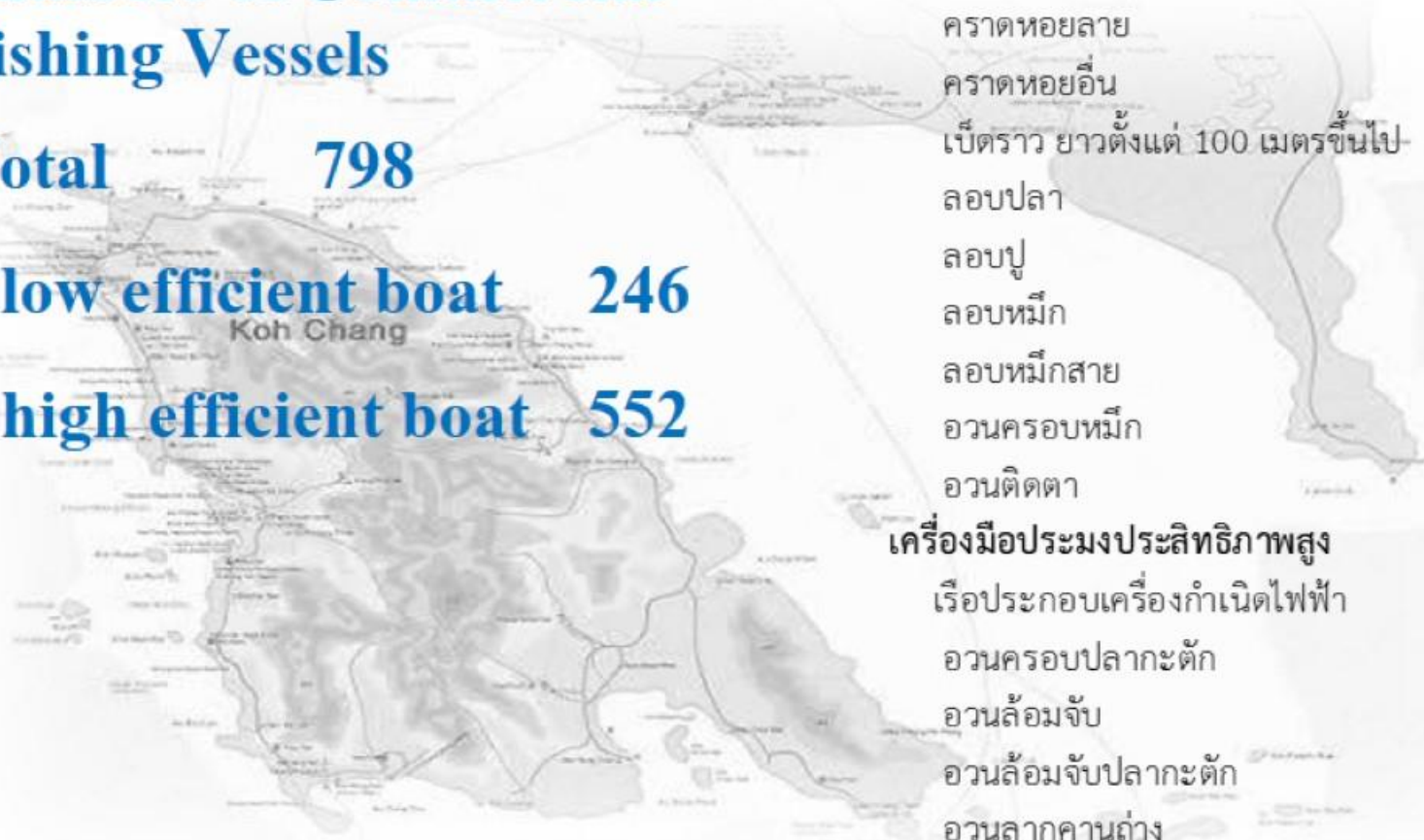
Numbers of Commercial Fishing Vessels



Total 798

• **low efficient boat 246**

• **high efficient boat 552**



เรือประมง	จำนวน (ลำ)
เครื่องมือประมงประสิทธิภาพต่ำ	246
คราดหอยลาย	16
คราดหอยอื่น	4
เบ็ดราว ยาวตั้งแต่ 100 เมตรขึ้นไป	15
ลอบปลา	2
ลอบปู	72
ลอบหมึก	2
ลอบหมึกสาย	9
อวนครอบหมึก	88
อวนติดตา	38
เครื่องมือประมงประสิทธิภาพสูง	552
เรือประกอบเครื่องกำเนิดไฟฟ้า	102
อวนครอบปลากะตัก	208
อวนล้อมจับ	31
อวนล้อมจับปลากะตัก	17
อวนลากคานถ่าง	55
อวนลากคู่	4
อวนลากแผ่นตะเฆ่	135
ผลรวมทั้งหมด	798

low efficient boat
 Short-necked clam dredges
 Other dredges
 Long line than 100 m
 Fish trap
 Crabs trap
 Squids trap
 Octopus Pot
 Squids falling nets
 Gill net

high efficient boat
 Light luring boat
 Anchovy falling nets
 Purse seine
 Anchovy purse sine
 Beam trawls
 Pair trawls
 Otther board trawls

Numbers of Small-Scale Fishing Vessels

➤ **Total 2,197**

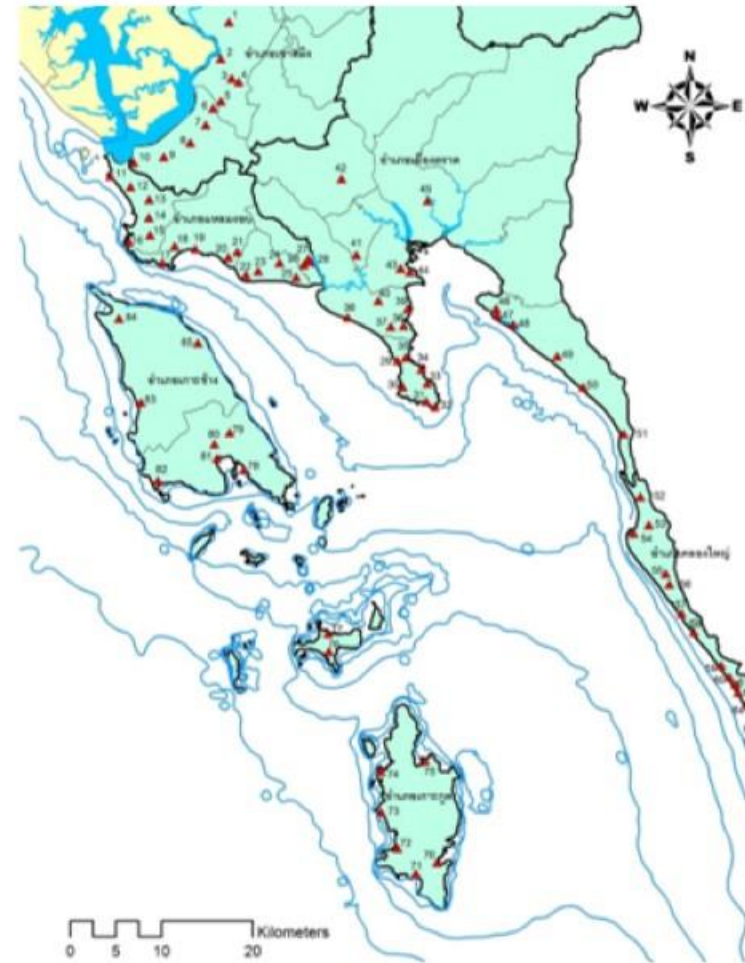


ชนิดเครื่องมือประมง	จำนวน (ลำ)	
อวนติดตา (อวนกุ้ง)	667	Shrimp gill net
อวนติดตา (อวนปู)	390	Crab gill net
ลอบปู	263	Crab trap
อวนลากแผ่นตะเฆ่	115	Otther board trawls
อวนติดตา (ปลาอื่นๆ)	94	Gill net
อวนรุน	94	Push net
อวนติดตา (ปลาทู)	68	Indo pacific mackerel gill net
เบ็ดมือ	64	Hook and line
ลอบหมึก	48	Squids trap
อวนครอบปลากะตัก	47	Anchovy falling nets
เบ็ดราว	38	Long line than 100 m
เรือปั่นไฟ	32	Light luring boat
อวนครอบหมึก	32	Squids falling nets
อวนติดตา (ปลากระบอก)	27	Crab gill net
คราดหอยลาย	13	Short-necked clam dredges
ลอบปลา	12	Fish trap
เครื่องมืออื่นๆ	193	Otter
ผลรวมทั้งหมด	2,197	

Fishing Communities

83 Villages in 21 Sub-districts of 6 Districts

1. Muang District	8 Sub-districts	23 Villages
2. Khlong Yai District	3 Sub-districts	18 Villages
3. Khao Saming District	2 Sub-districts	10 Villages
4. Laem Gnop District	4 Sub-districts	16 Villages
5. Koh Kut District	2 Sub-districts	8 Villages
6. Koh Chang District	2 Sub-districts	8 Villages



Local Fishing Community Organizations



Coastal
Fisheries



Offshore
Fisheries



Fish
Processing



Aquaculture

47 Groups

Existing Fisheries Management Measures in Trat Site

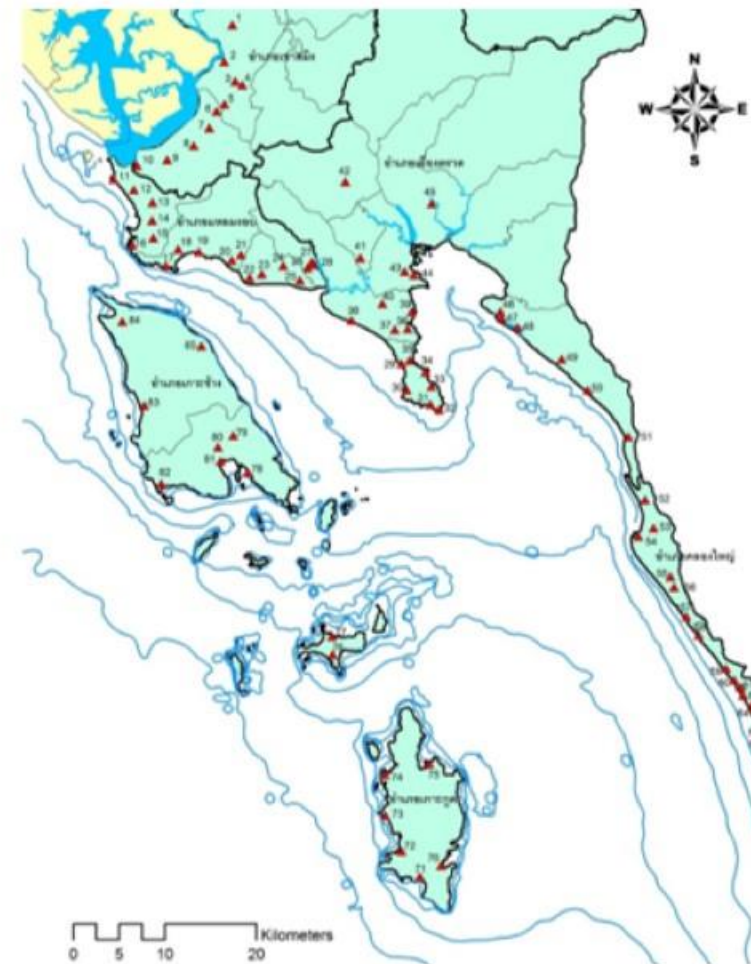
- 1) Determination of fishing gears, fishing methods, and fishing areas prohibited from fishing in coastal seas
- 2) Determination of fishing gears, fishing methods, and fishing areas prohibited from fishing in 15 fishing grounds covering the area of 5,800 rai (9.28 km²)
- 3) Determination of 4 aquatic sanctuaries
- 4) Notification on coastal seas: 3 nm from shoreline (commercial fisheries prohibited)



Usage of *refugia* by threatened and endangered marine species in Trat Site

➤ Appearances of the following endangered species in the past 10 years

- Irrawaddy dolphin (*Orcealla brevirostris*)
- Finless porpoise (*Neophocaena phocinoides*)
- Green turtle (*Chelonia mydas*)
- Hawksbill (*Eretmochelys imbricata*)





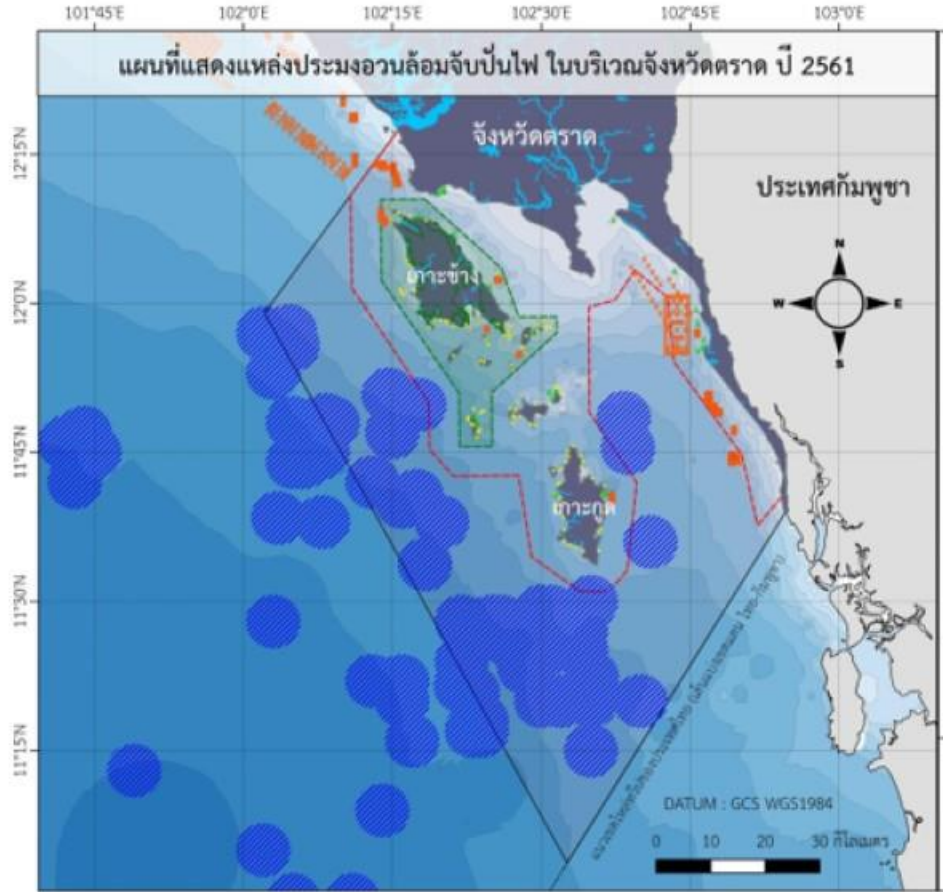
Catches and Species Compositions of the Principal Fishing Gears in Trat Site

Principal Fishing Gears in Trat Site



Light Luring Purse Seines

Fishing Areas



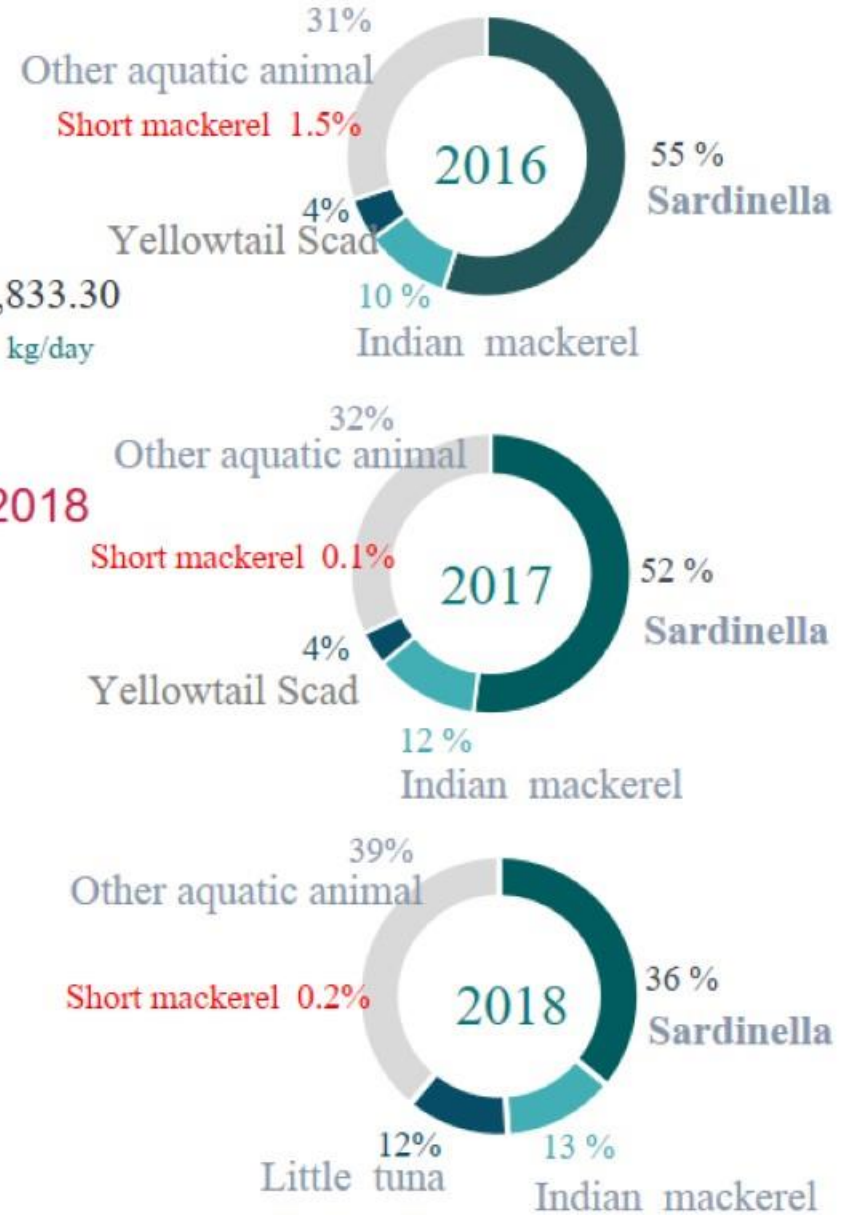
Catch Rates

2016-2018



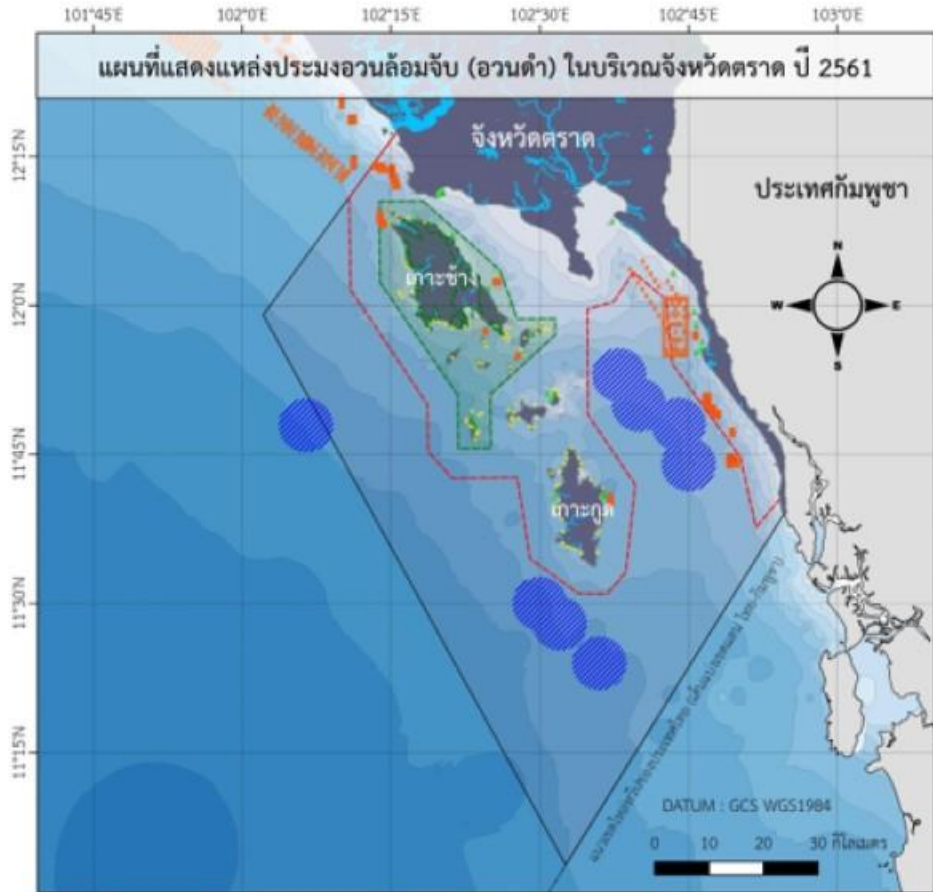
Species Compositions

2016-2018

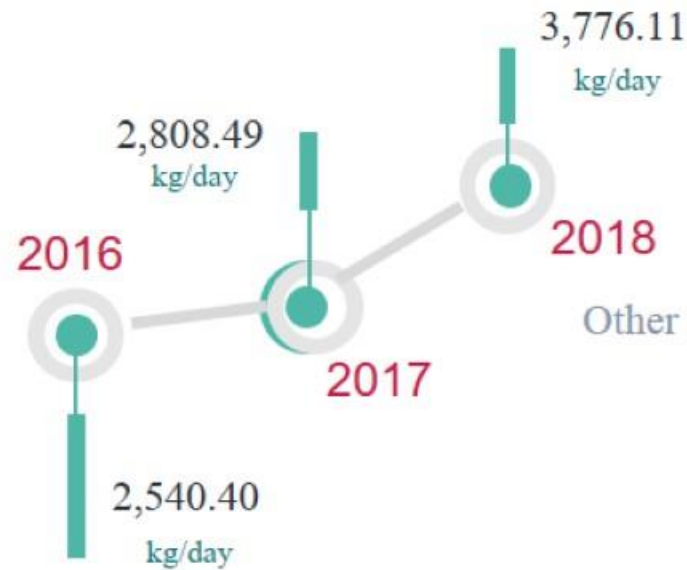


Purse Seines

Fishing Areas



Catch Rates 2016-2018

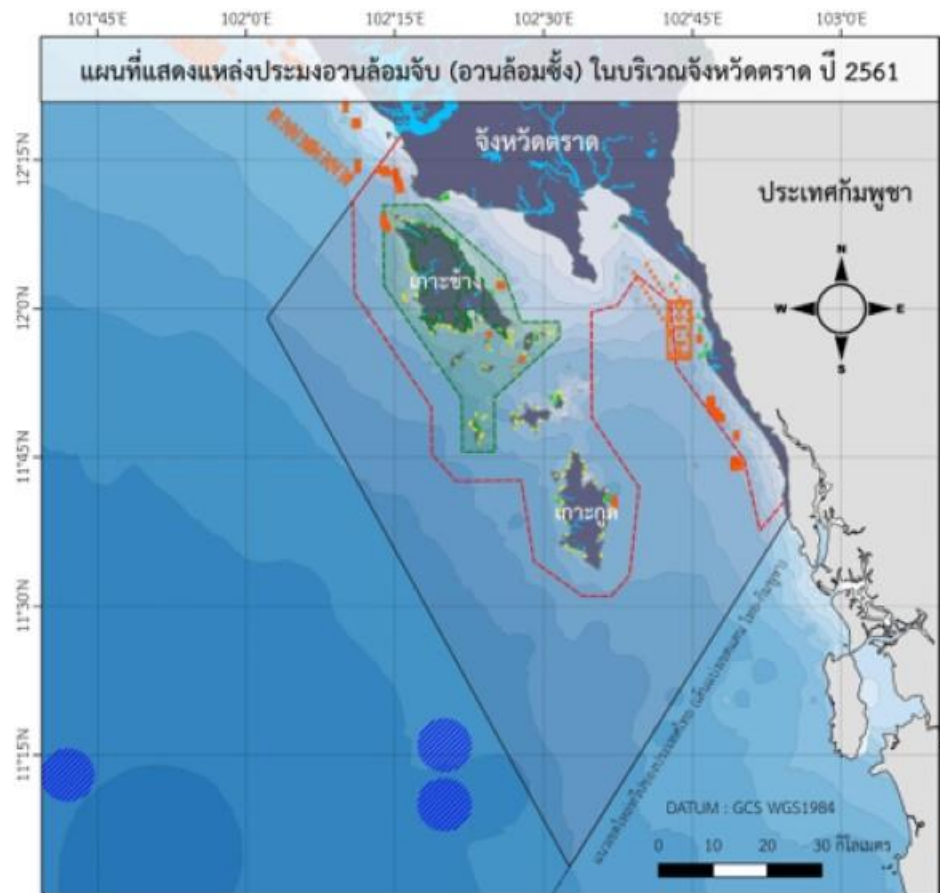


Species Compositions 2016-2018

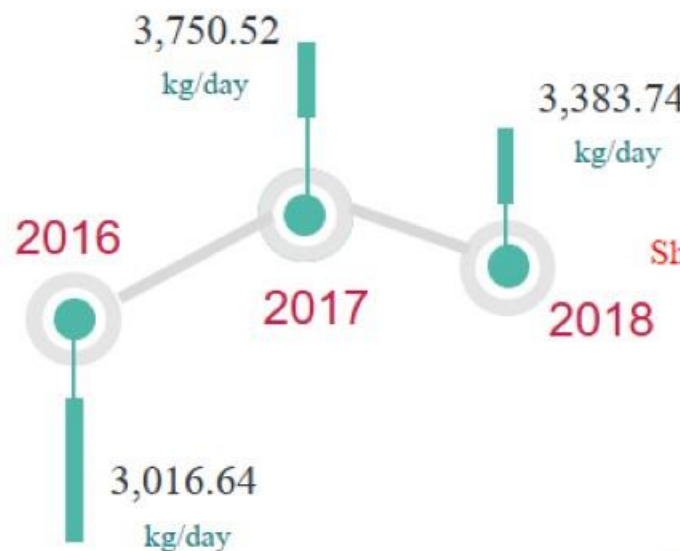


Purse Seines with Fish Aggregating Devices

Fishing Areas



Catch Rates 2016-2018

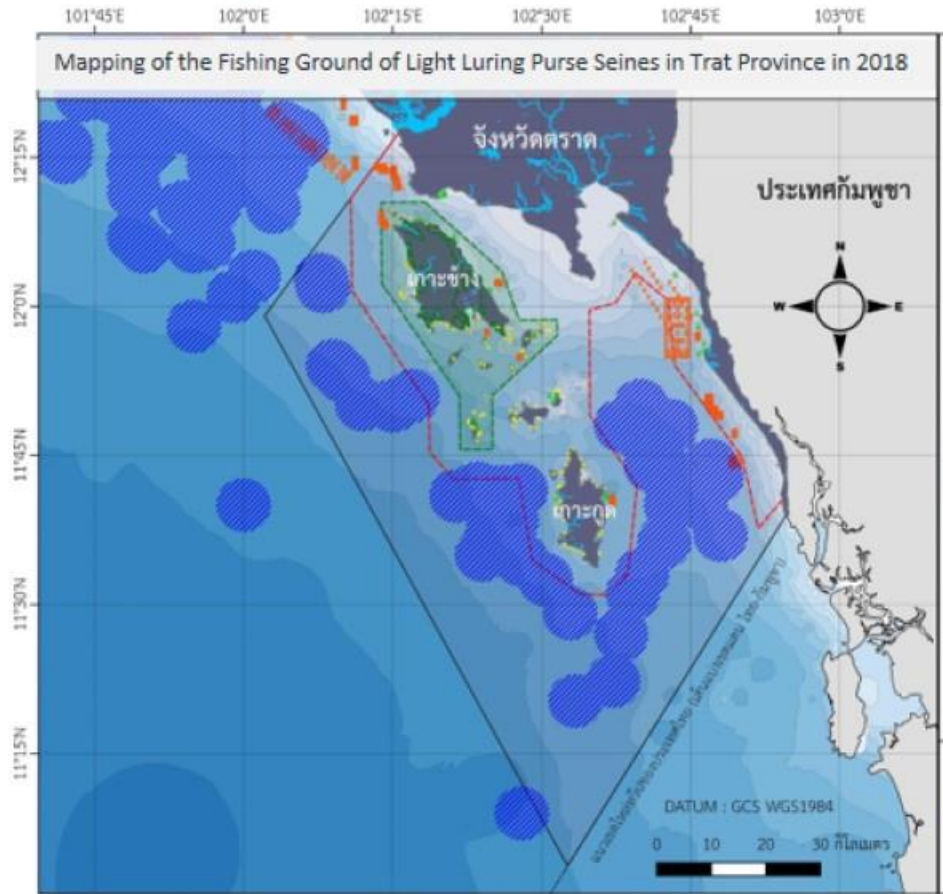


Species Compositions 2016-2018

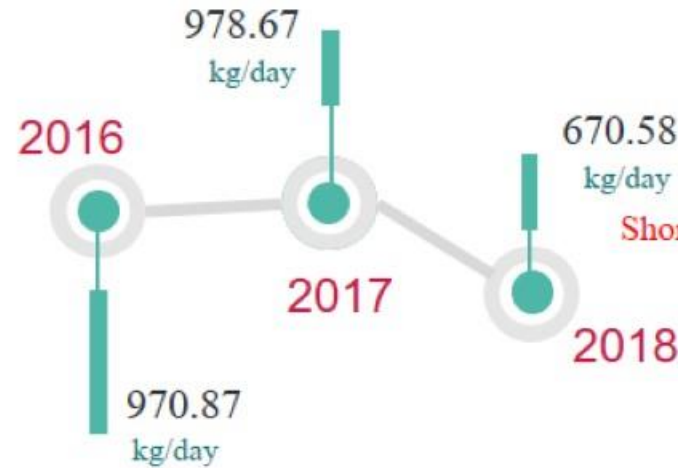


Light Luring Anchovy Falling Nets

Fishing Areas



Catch Rates 2016-2018

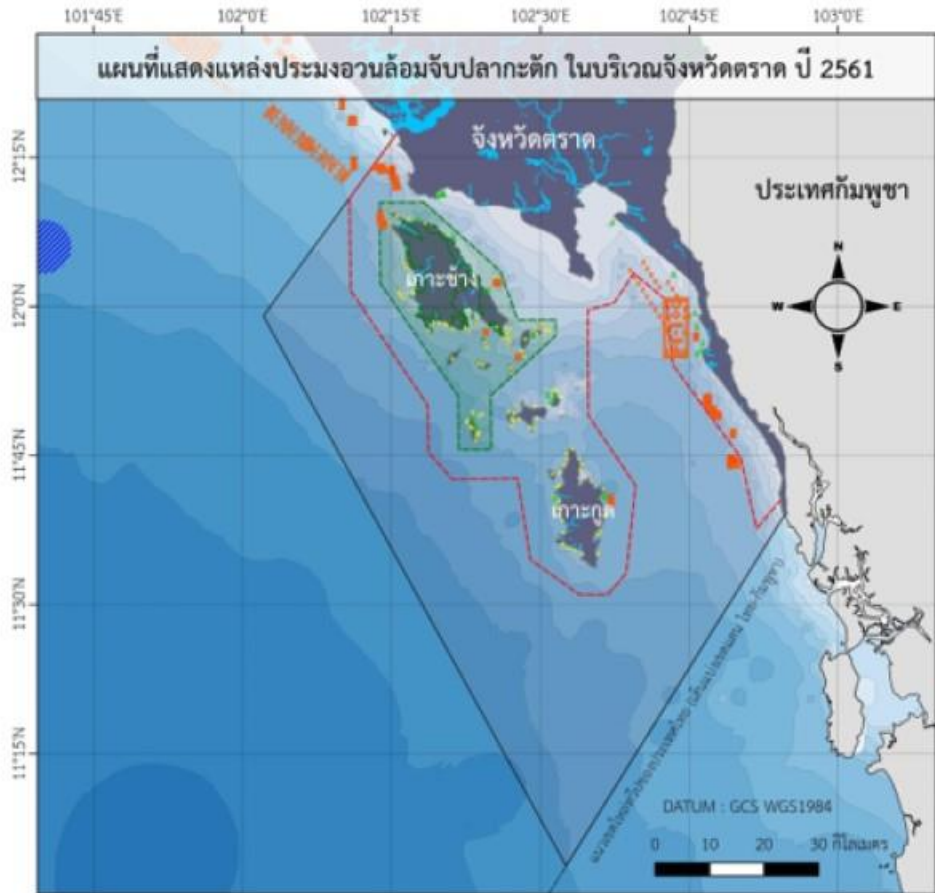


Species Compositions 2016-2018



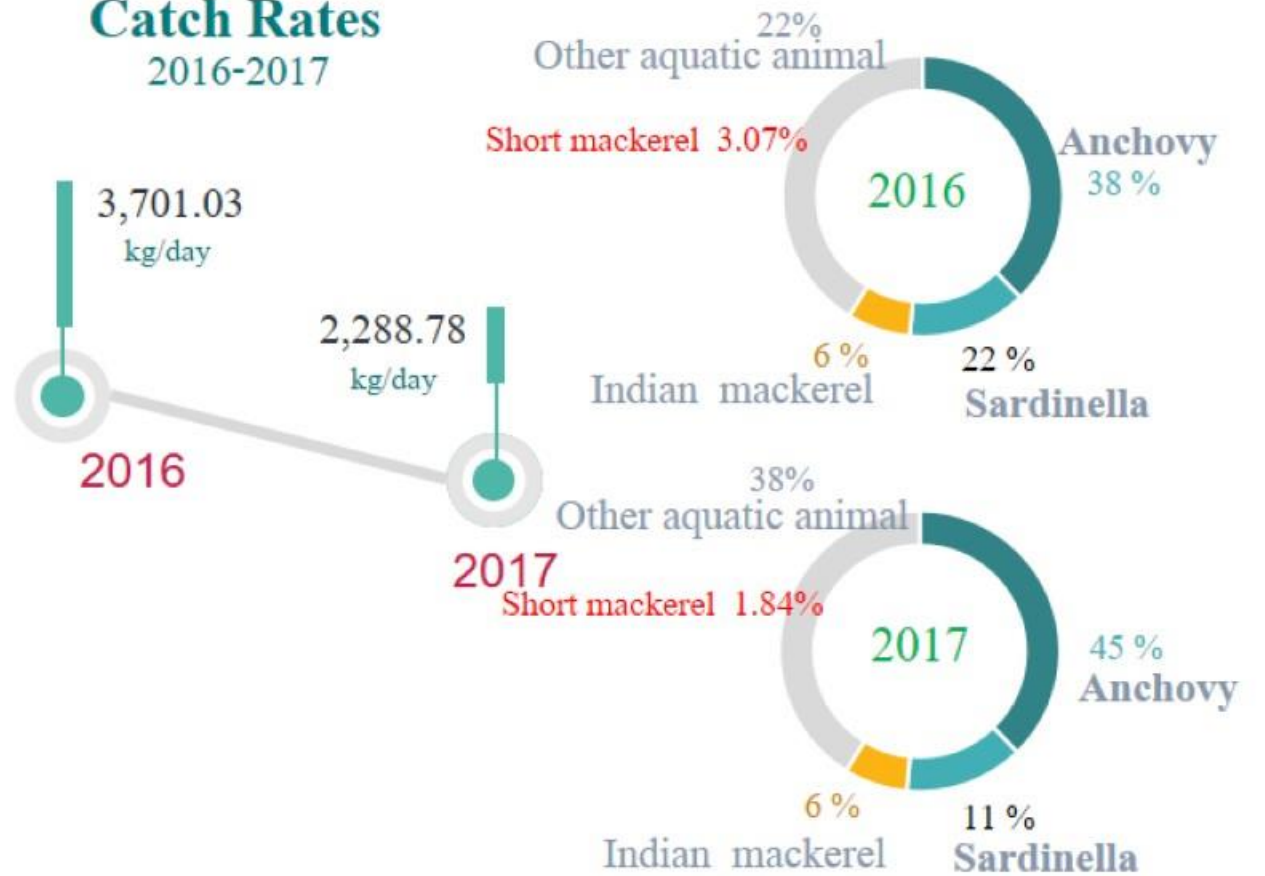
Anchovy Purse Seines

Fishing Areas



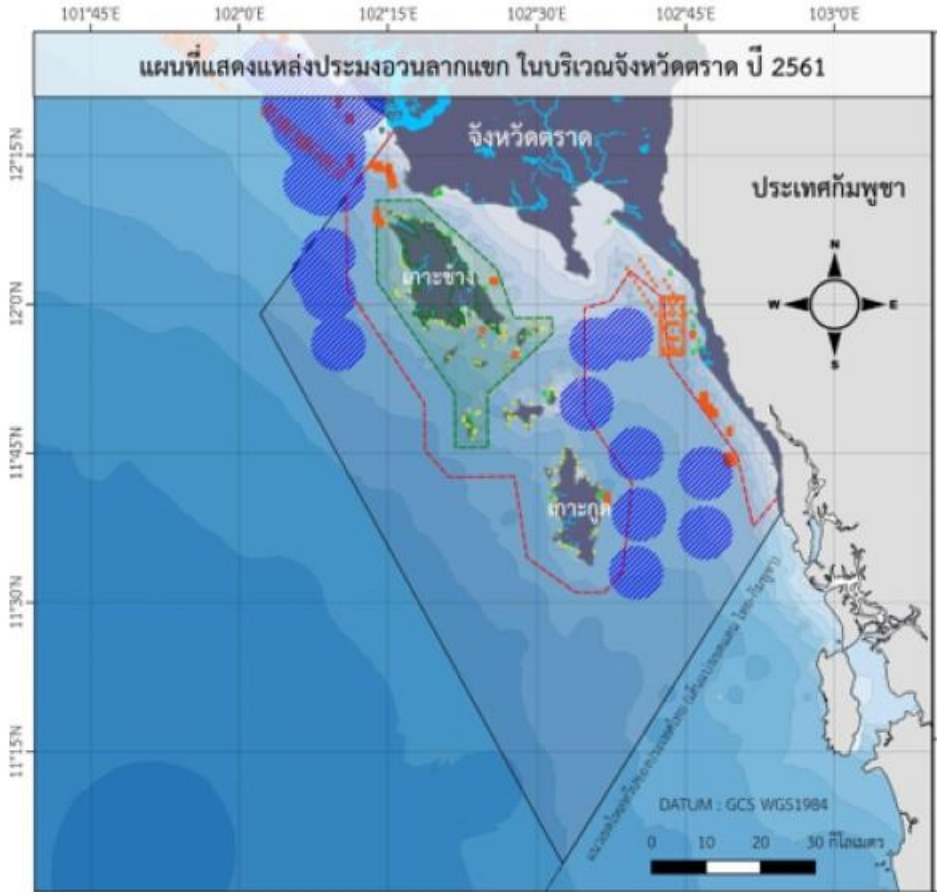
Species Compositions 2016-2017

Catch Rates 2016-2017

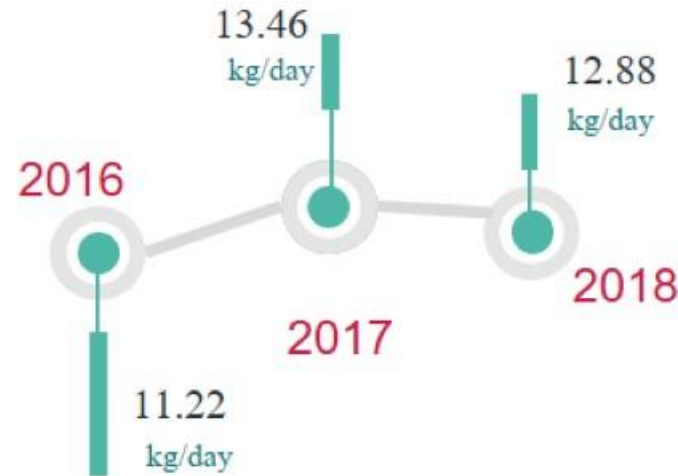


Beam Trawls

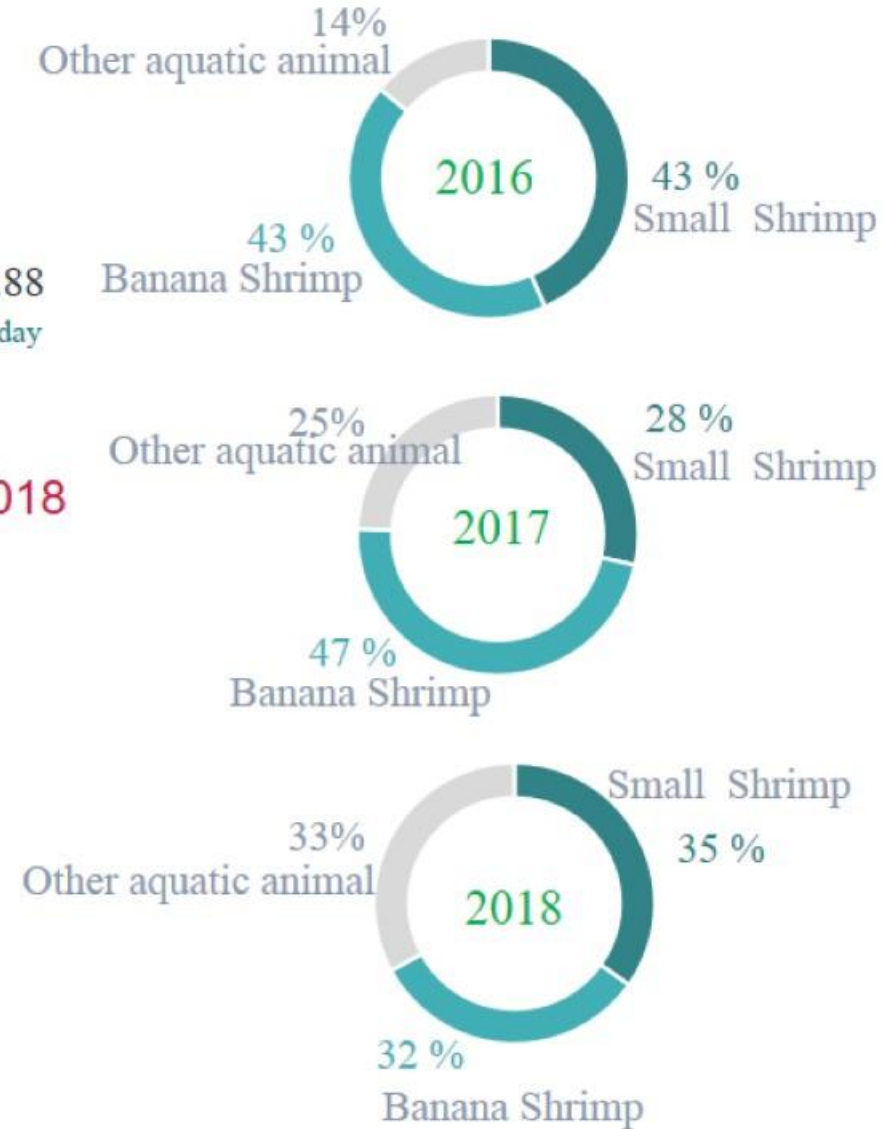
Fishing Areas



Catch Rates 2016-2018

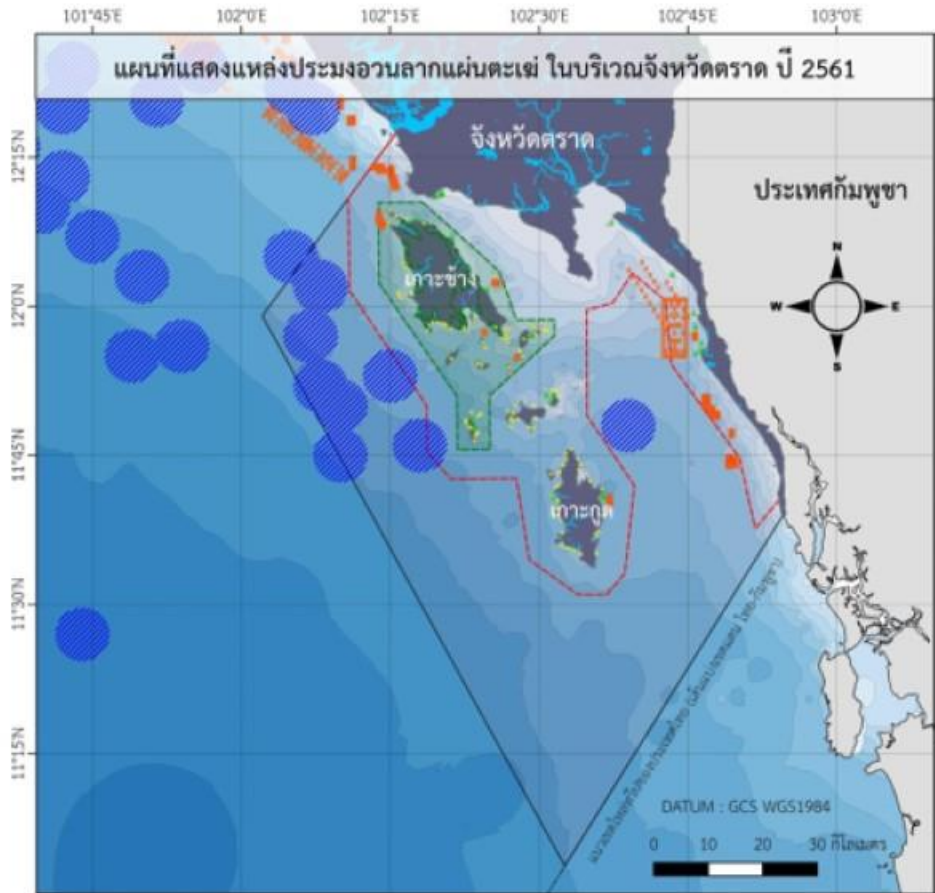


Species Compositions 2016-2018

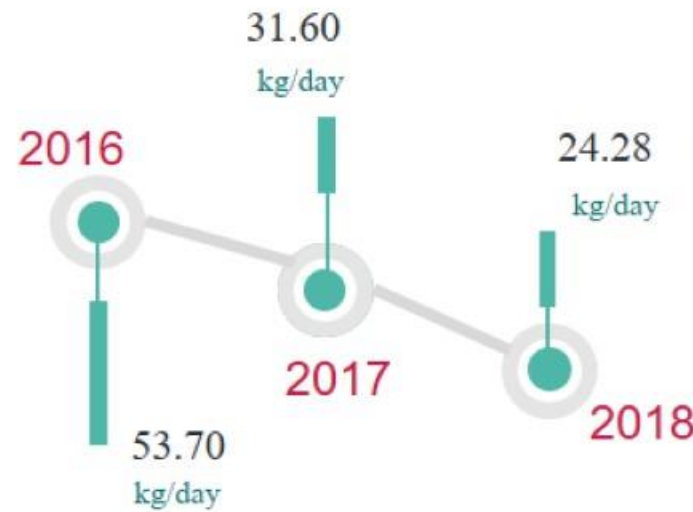


Otter Board Trawls

Fishing Areas



Catch Rates 2016-2018

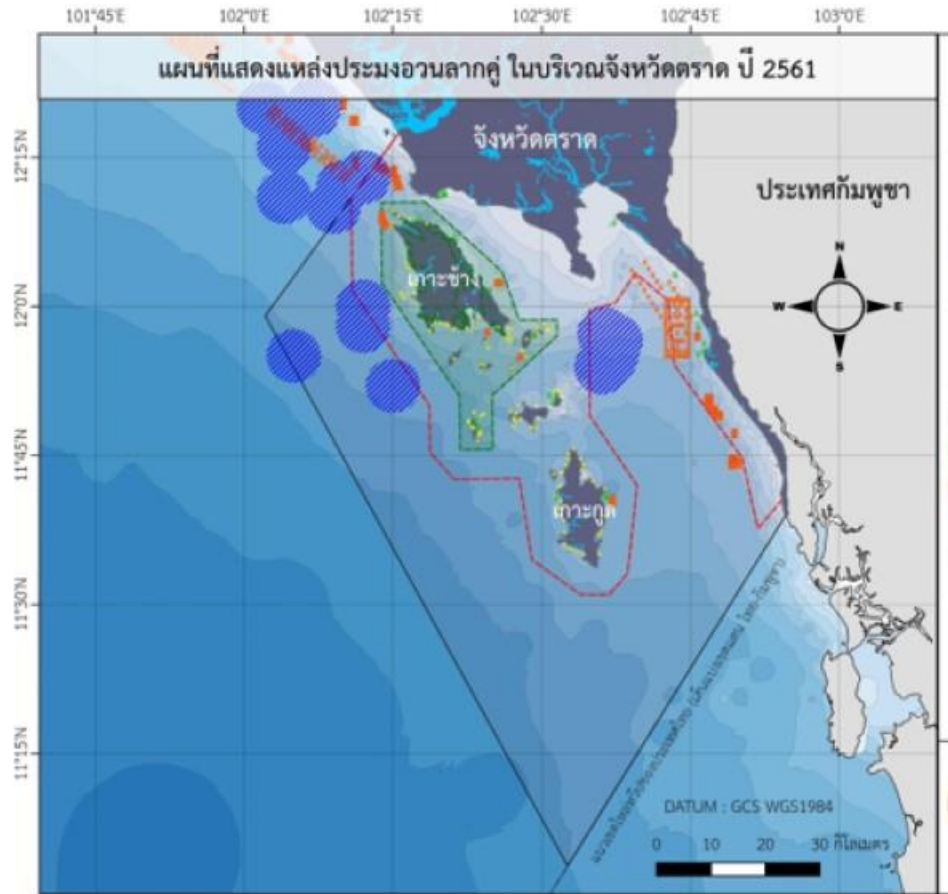


Species Compositions 2016-2018

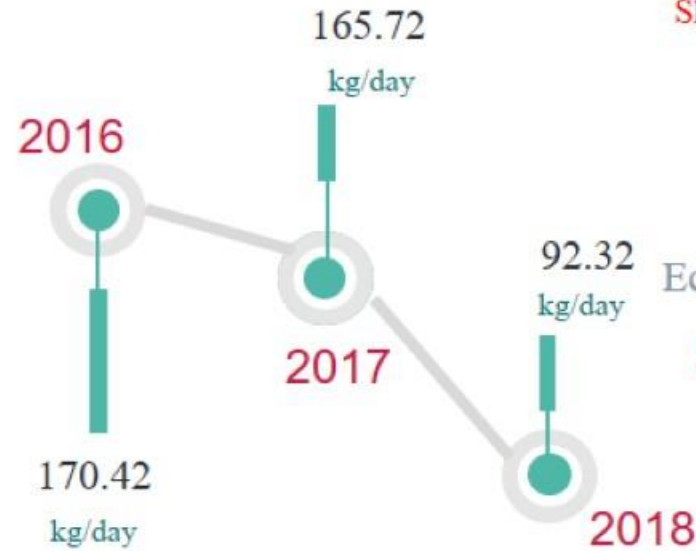


Pair Trawls

Fishing Areas



Catch Rates 2016-2018

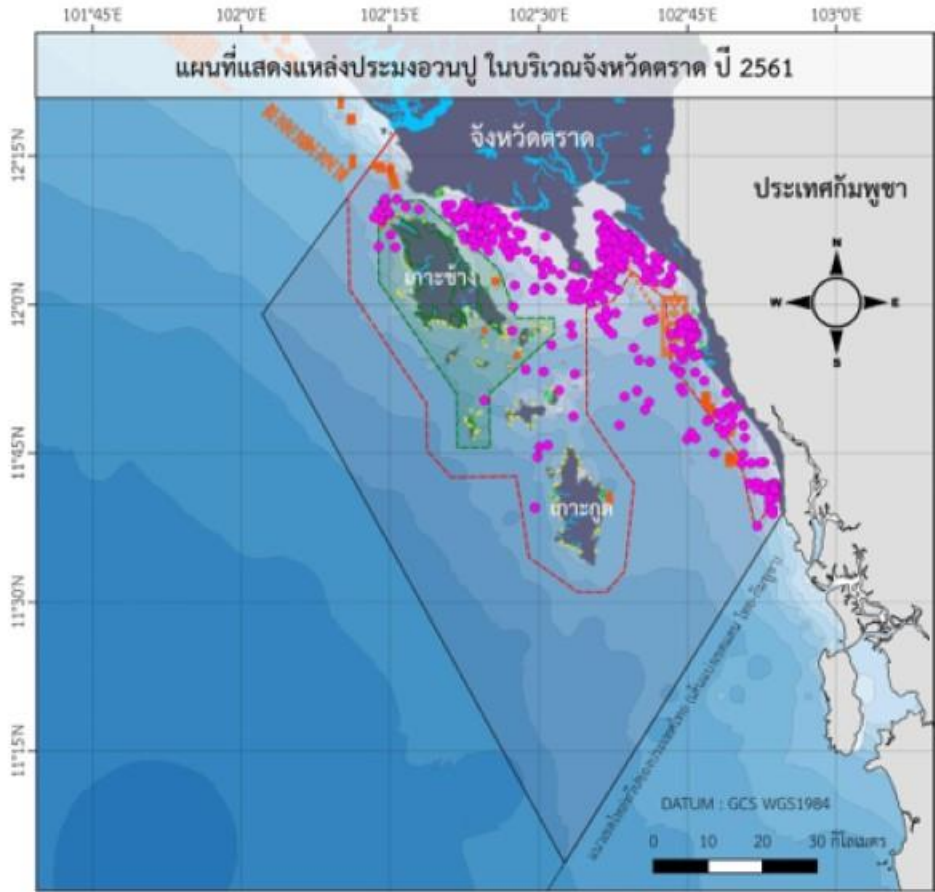


Species Compositions 2016-2018

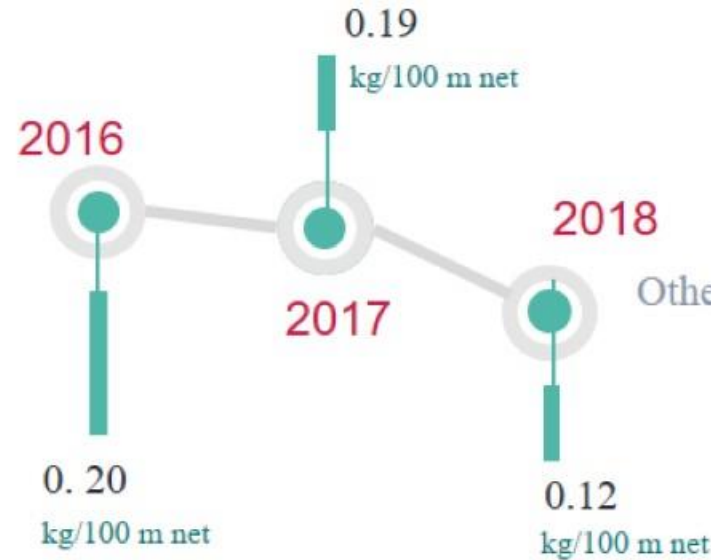


Crab Gill Nets

Fishing Areas



Catch Rates 2016-2018

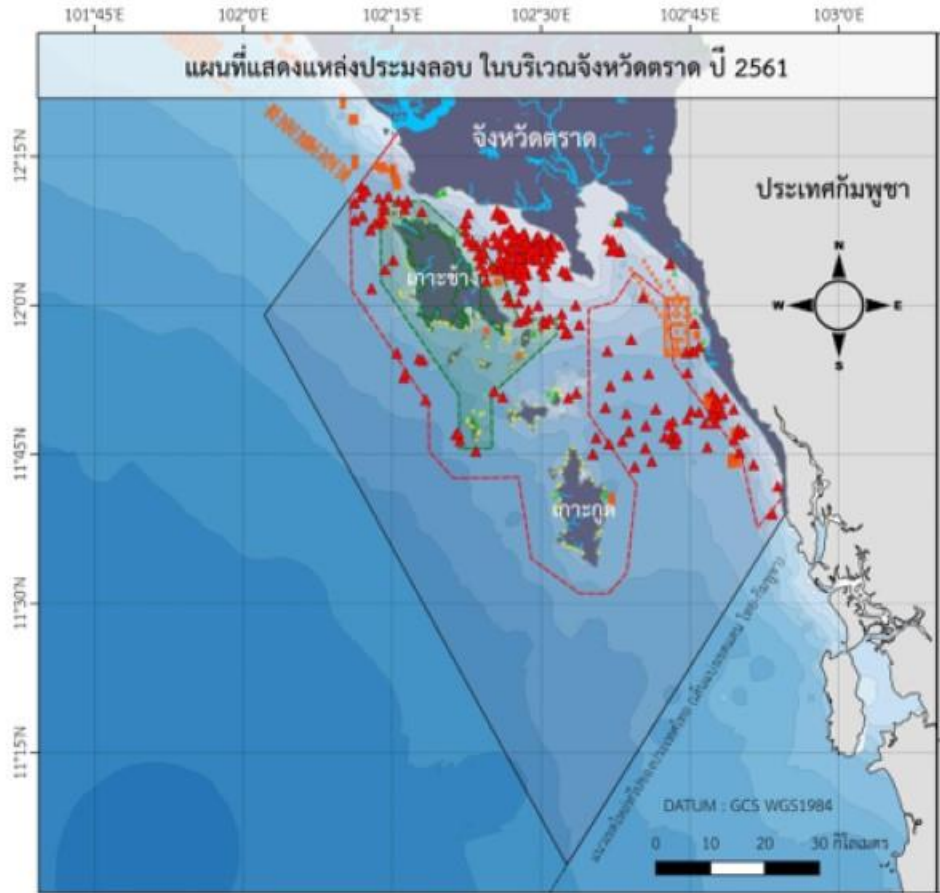


Species Compositions 2016-2018

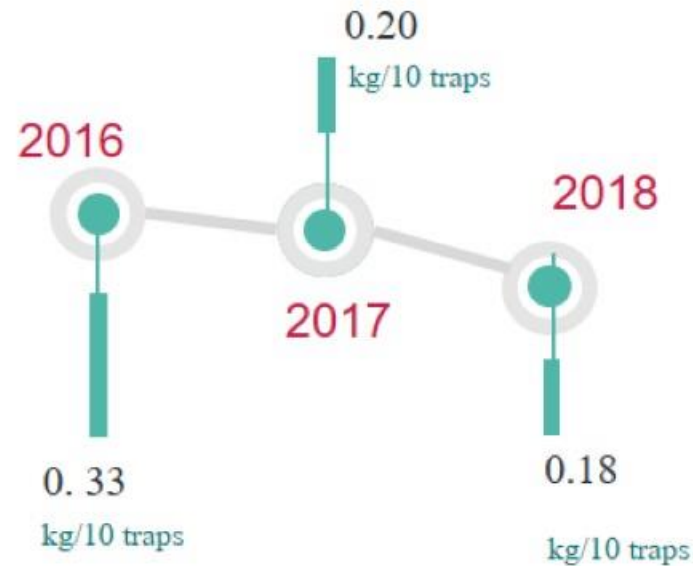


Crab Traps

Fishing Areas



Catch Rates 2016-2018

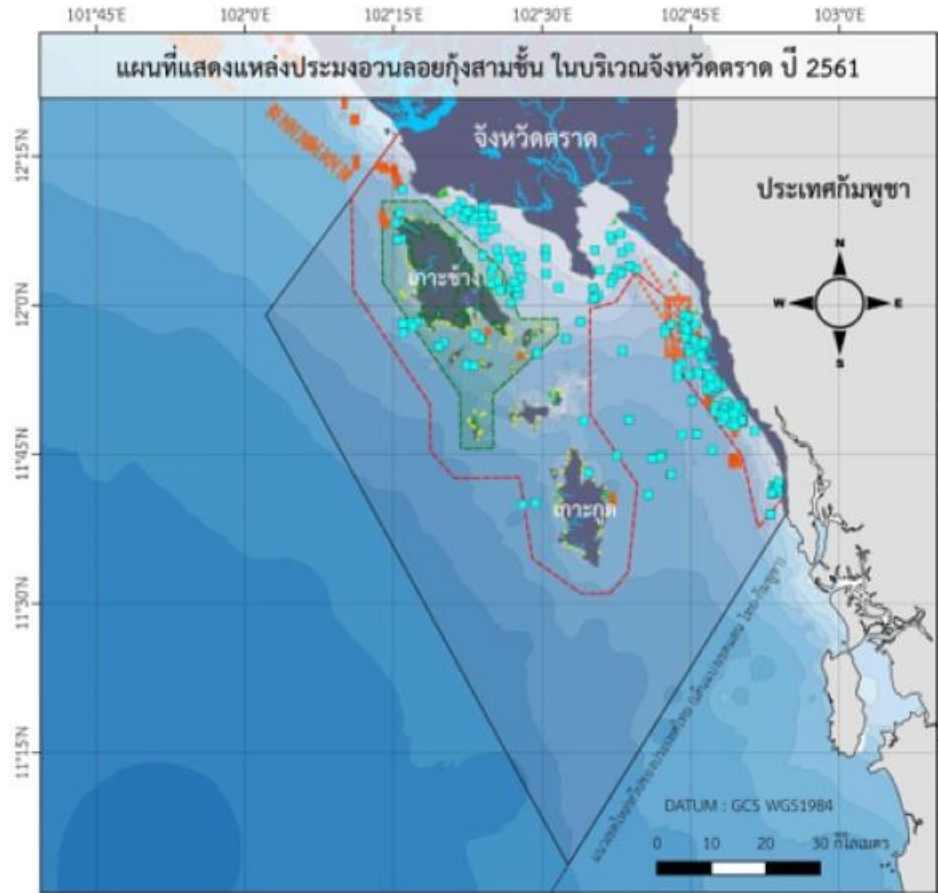


Species Compositions 2016-2018

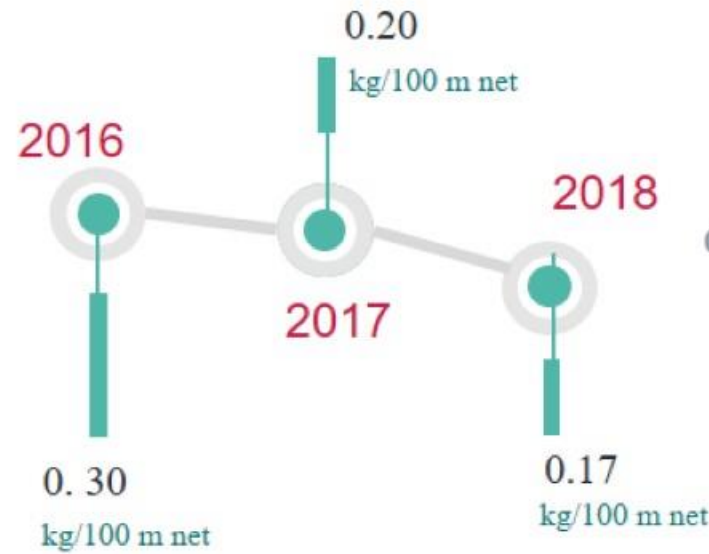


Shrimp Gill Nets/Trammel Nets

Fishing Areas



Catch Rates 2016-2018

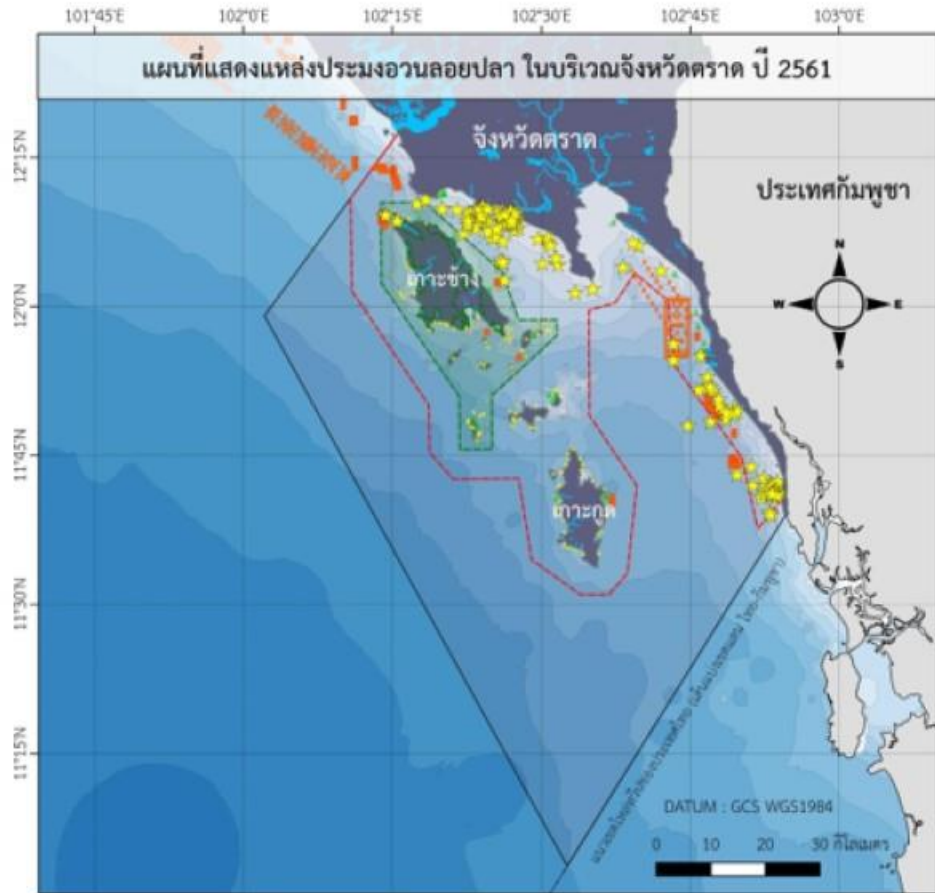


Species Compositions 2016-2018



Short Mackerel Gill Nets

Fishing Areas



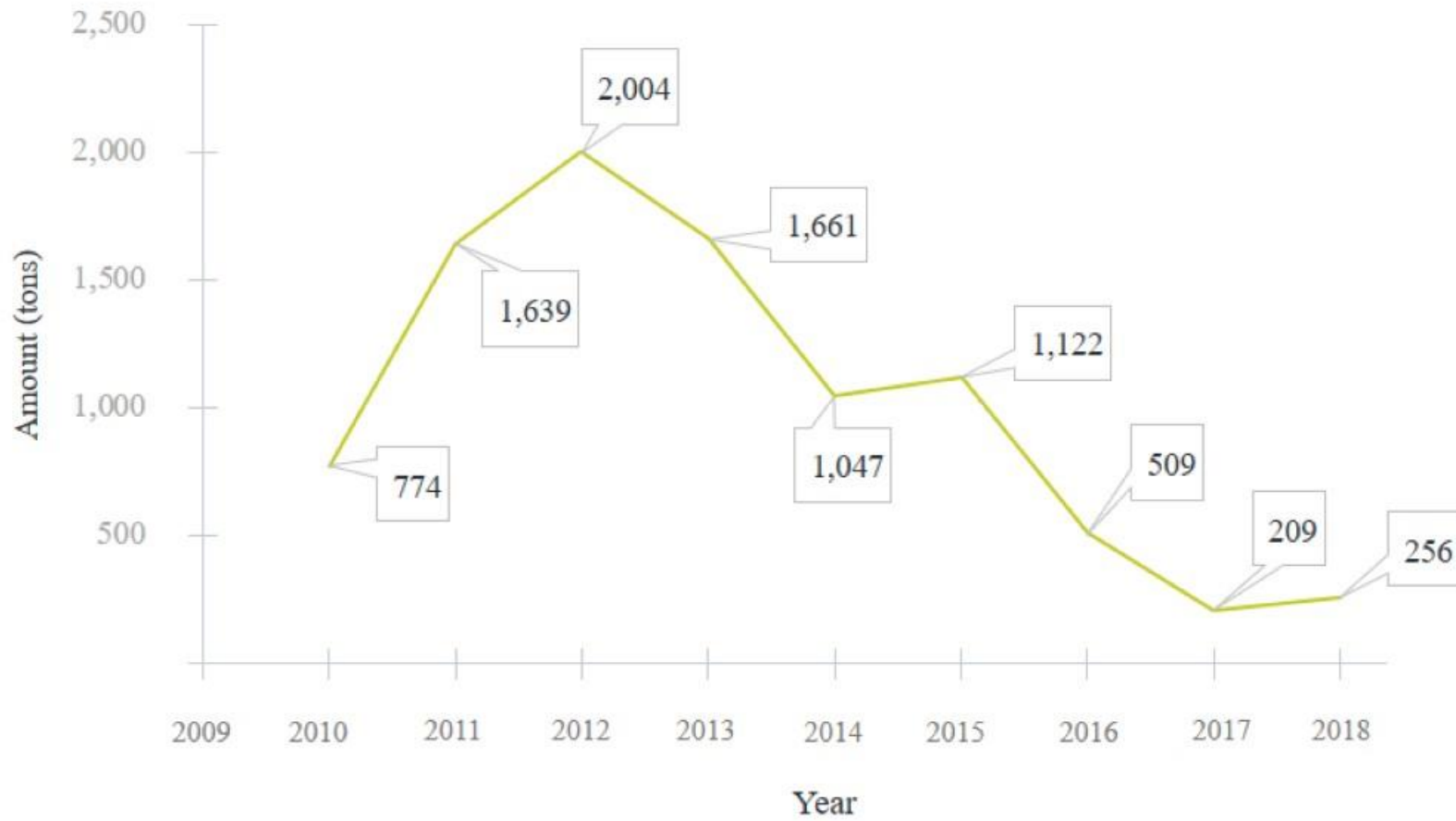
Catch Rates 2016-2018



Species Compositions 2016-2018



Landings of short mackerel (tons) at the fishing ports in Trat Site





Priority Species Information



Common Name: Short mackerel, Indo-Pacific mackerel

Scientific Name: *Rastrelliger brachysoma* (Bleeker, 1851)

Thai Local Name: Pla Thu (Pla = Fish)

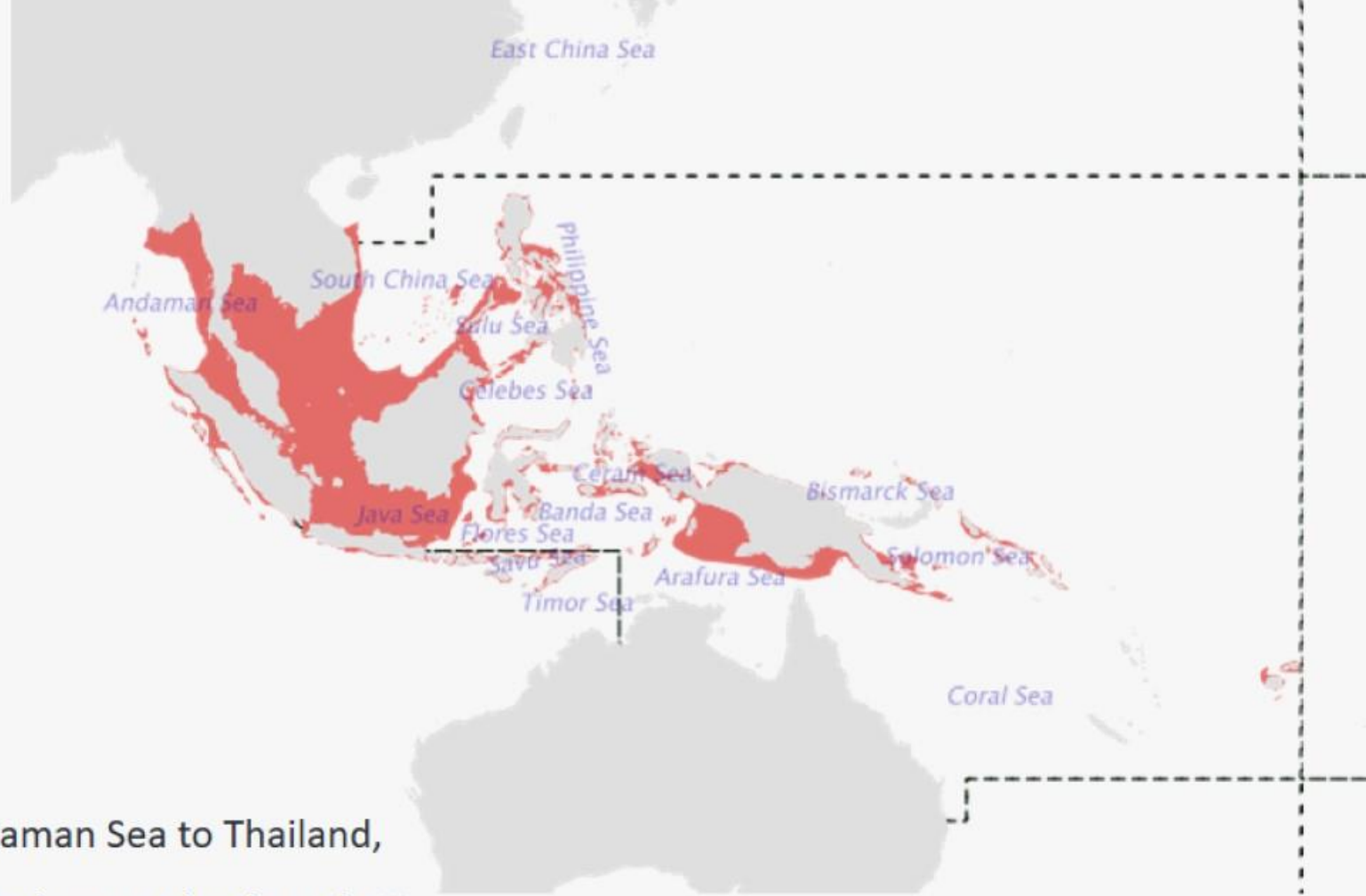
Morphology: Body very deep; head equal to or less than body depth; gill rakers very long, visible when mouth is opened; snout pointed; silver body colour; colour of spinous dorsal fin yellowish with a black edge, pectoral and pelvic fins dusky, other fins yellowish

Length at First Maturity (L_{50}/L_m): 16.98 cm

Size: $L_\infty = 22.23$ cm, common length = 16-18 cm

MSY: 112,416 tons

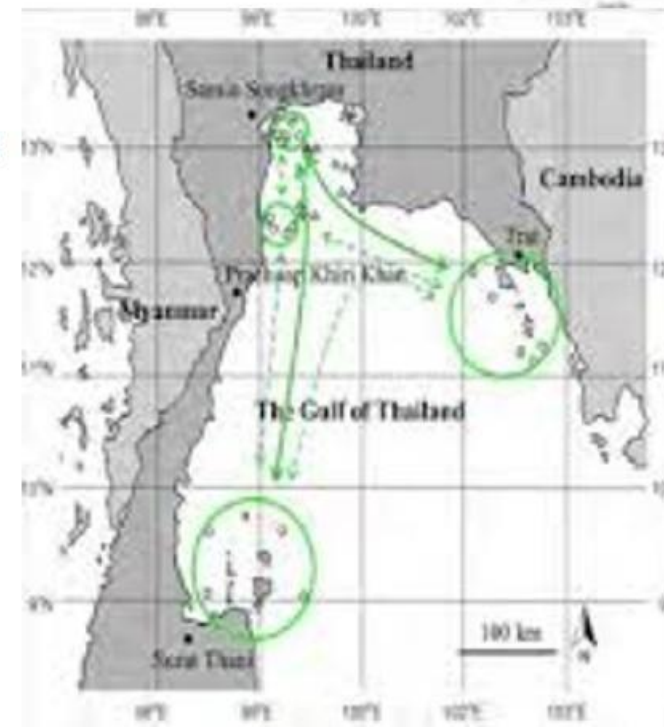
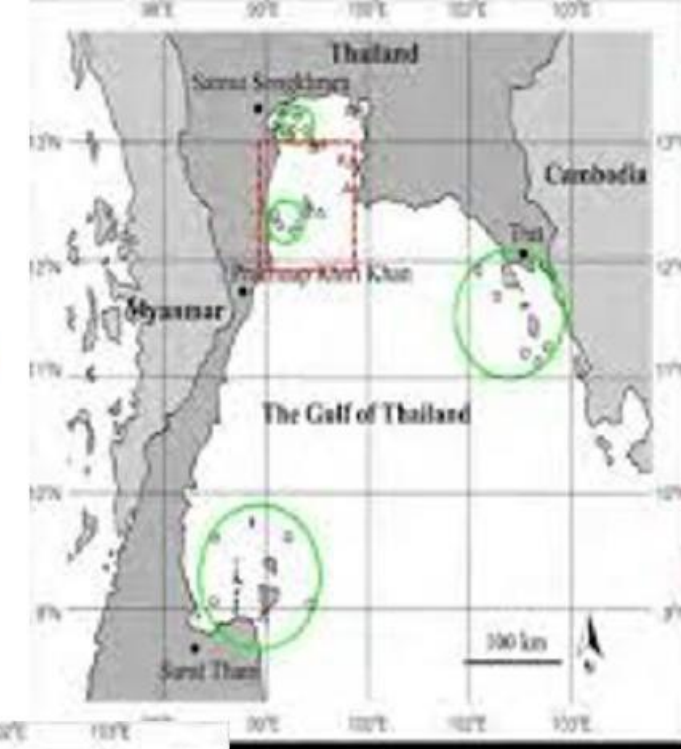




Distribution: Indo-Pacific Region; from Andaman Sea to Thailand, Indonesia, Papua New Guinea, Philippines, Solomon Islands and Fiji, at water temperature of 20-30°C and water depth of 15-200 m

Populations of Short Mackerel in the Gulf of Thailand

- There are possibly 4 different populations in the Gulf of Thailand, namely, **Trat**, Samut Songkram, Prachuap Kiri Khan, and Surat Thani
- Stocks were found migrate among the 4 populations:
 - **Trat** – Samut Songkhram
 - **Trat** – Prachuap Khiri Khan
 - Surat Thani – Samut Songkhram
 - Surat Thani – Prachuap Khiri Khan



Occurrences of Short Mackerel in Trat Site



Juvenile



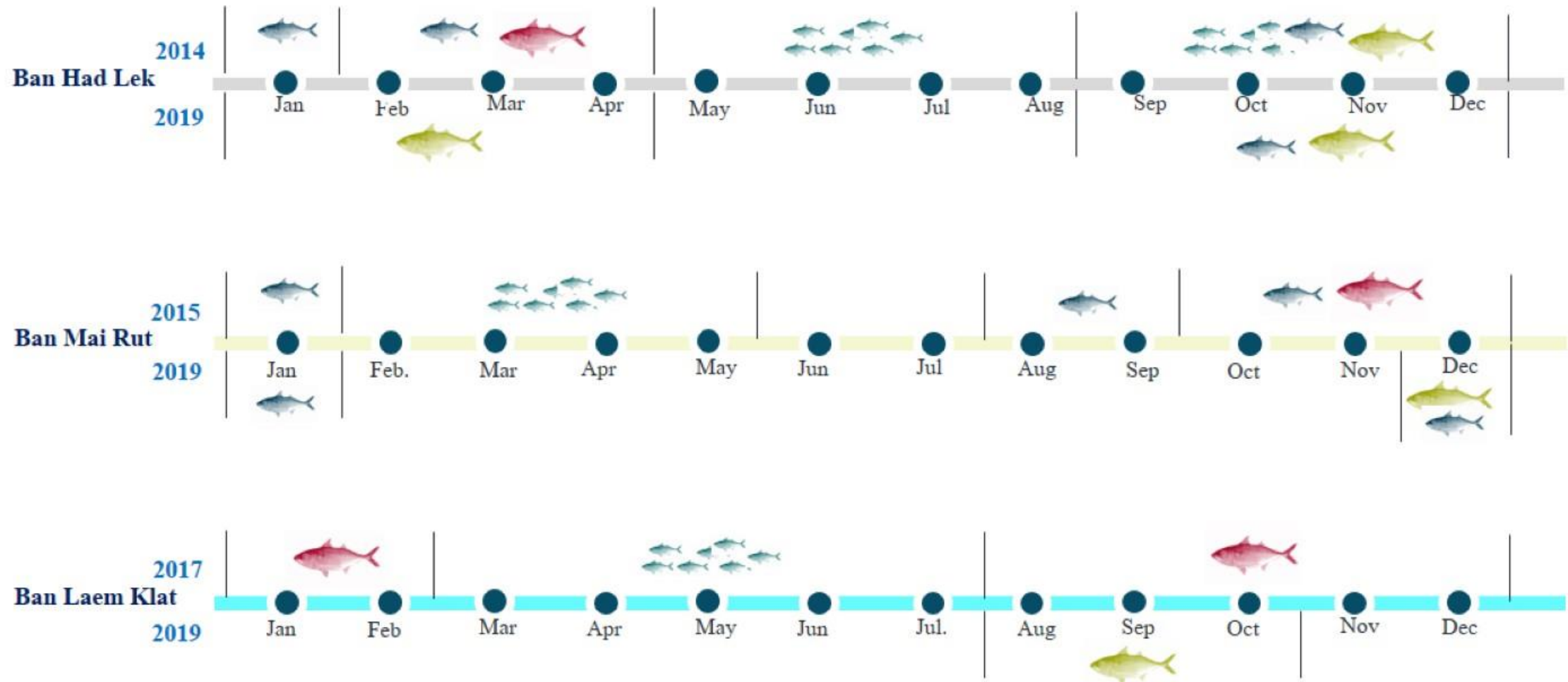
13-15 cm
(25-25 fish/kg)



16-18 cm
(15-17 fish/kg)



Mature fish with eggs



Occurrences of Short Mackerel in Trat Site



Juvenile



13-15 cm
(25-25 fish/kg)



16-18 cm
(15-17 fish/kg)

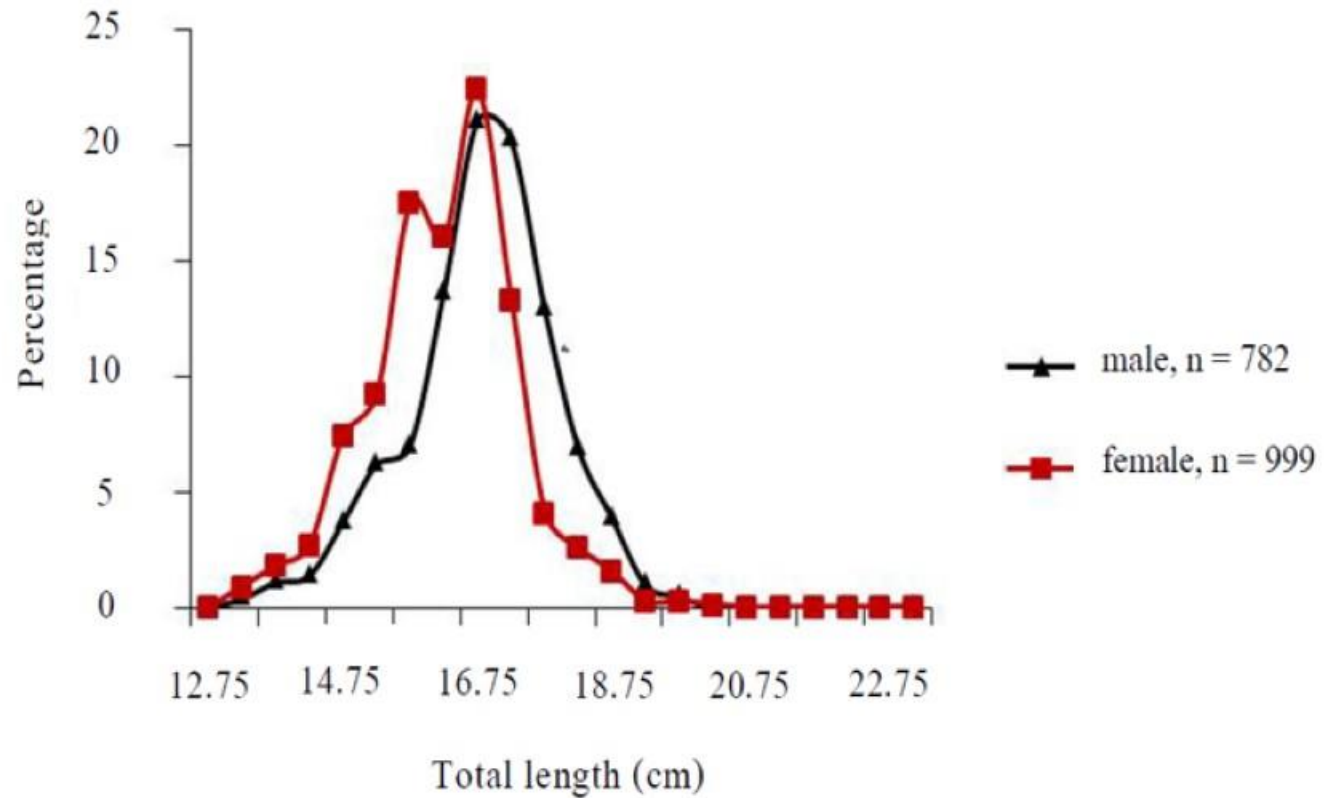


Mature fish with eggs



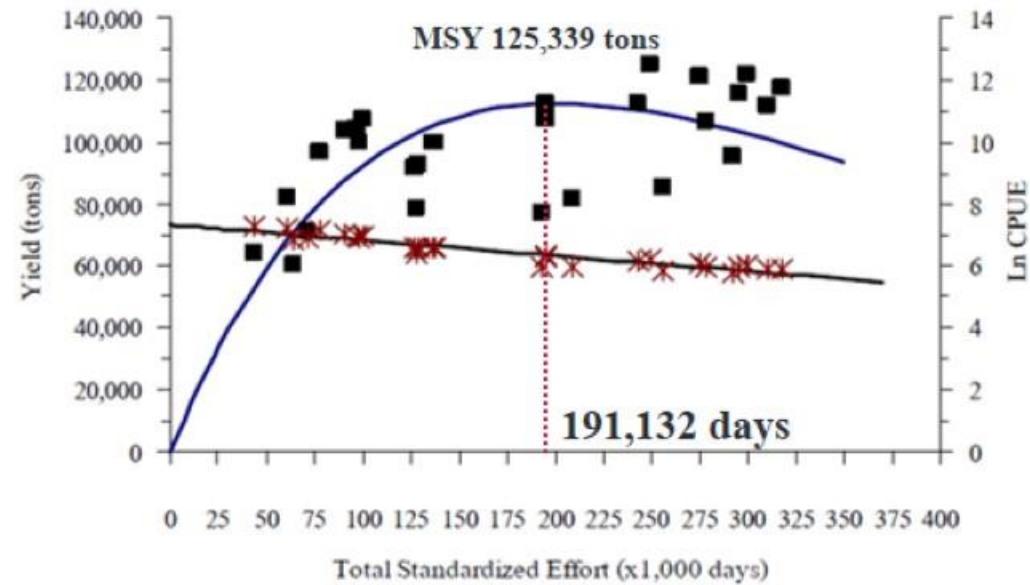


Size Frequency of Short Mackerel in the Eastern Gulf of Thailand





Total standard fishing efforts vs total catches and CPUEs for short mackerel gill net fisheries in Thai Waters

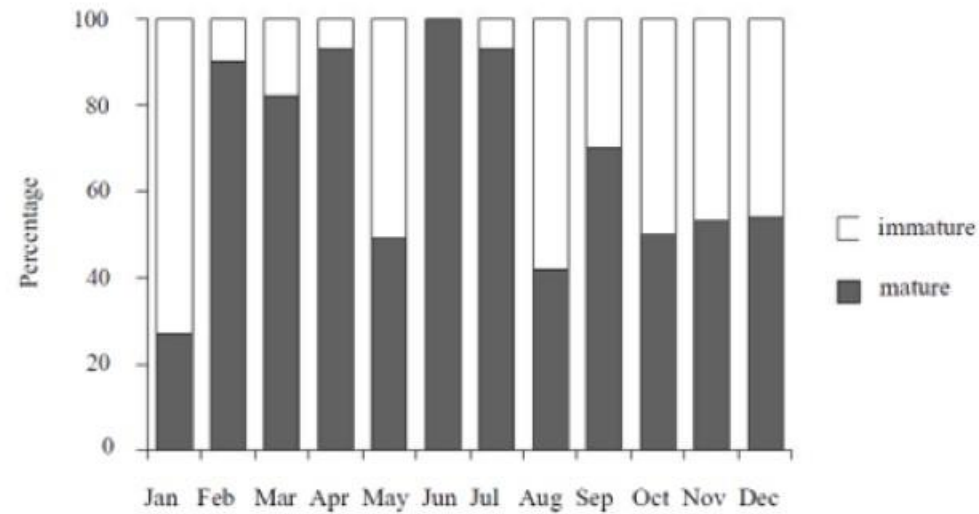


ภาพที่ 8 แสดงความสัมพันธ์ระหว่างปริมาณแรงงานประมงมาตรฐาน (จำนวนวันทำประมงของเครื่องมืออวนล้อมติดปลา) กับปริมาณการจับปลาทั้งหมด (เมตริกตัน) และอัตราการจับต่อหน่วยการลงแรงประมง (กิโลกรัม/วัน) ของการประมงปลา ระหว่างปี 2515 - 2552 ตามวิธีการของ Fox

Figure 8 Relationship between total standard fishing effort (#day of mackerel encircling gill net) and total catch and CPUE (kgs/day) of Indo-Pacific mackerel fisheries, 1982 - 2009 by Fox's model

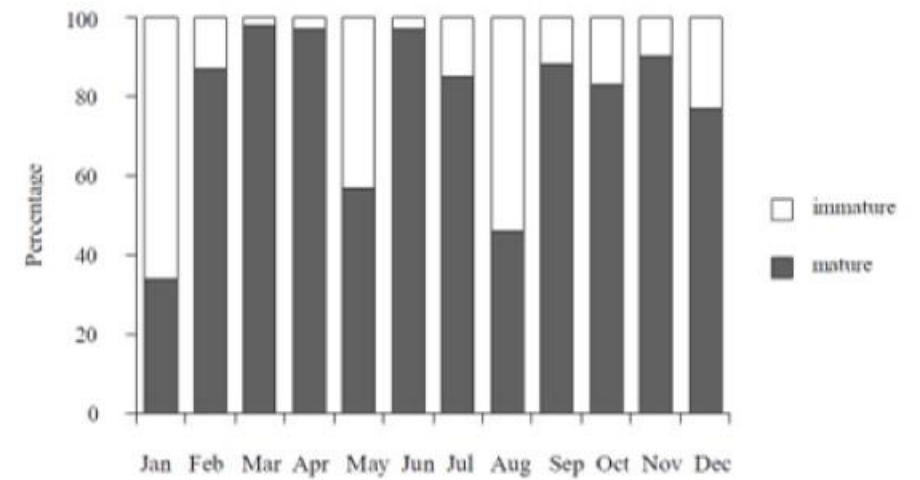


Annual Maturation of Short Mackerel in Trat Site



ภาพที่ 5 ร้อยละของระยะเจริญพันธุ์ของปลา (Rastrelliger brachysoma) เพศผู้บริเวณจังหวัดตราด ปี 2552

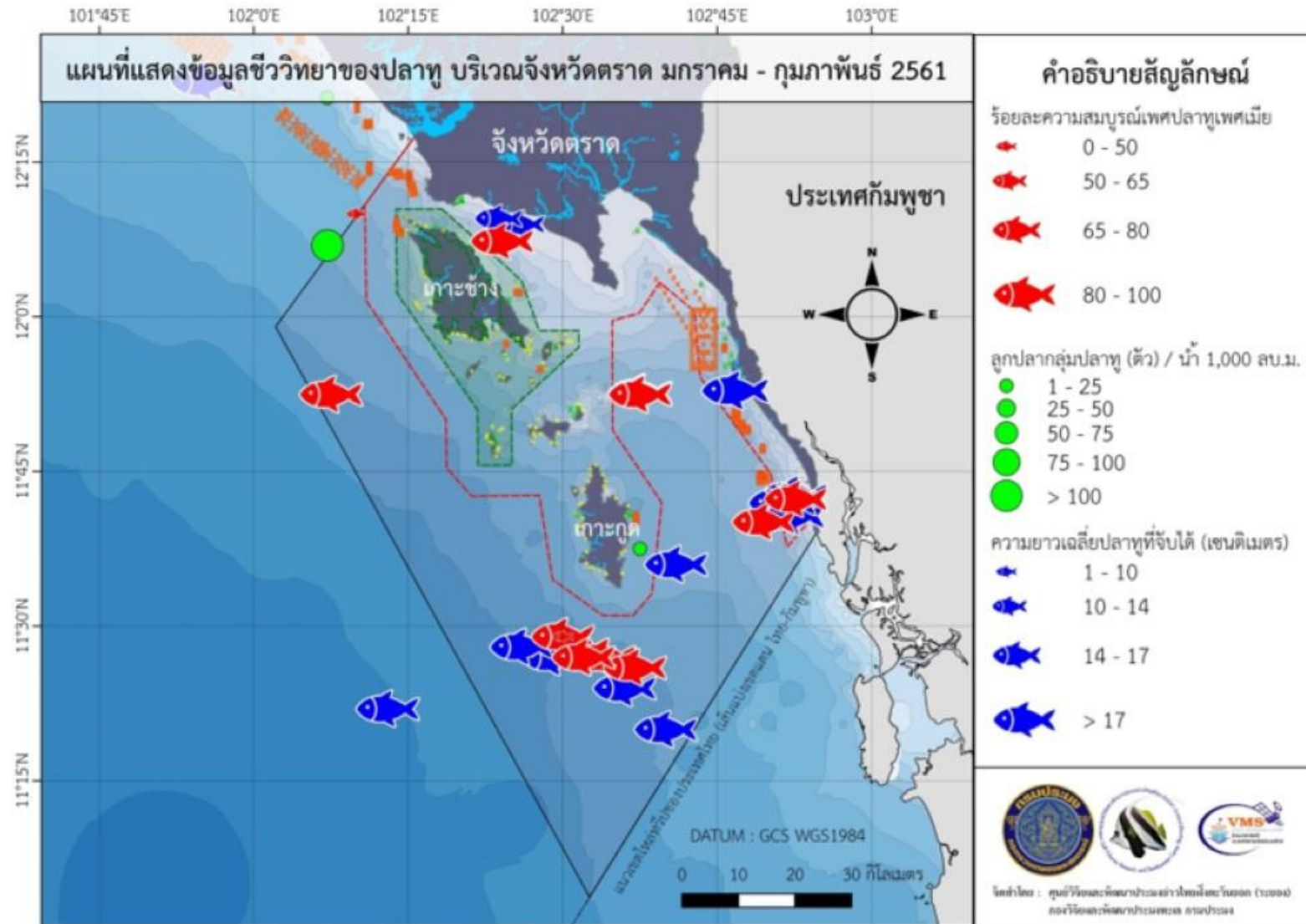
Figure 5 Percentage of male mature of Indo-Pacific mackerel (*Rastrelliger brachysoma*) in Trat Province, 2009



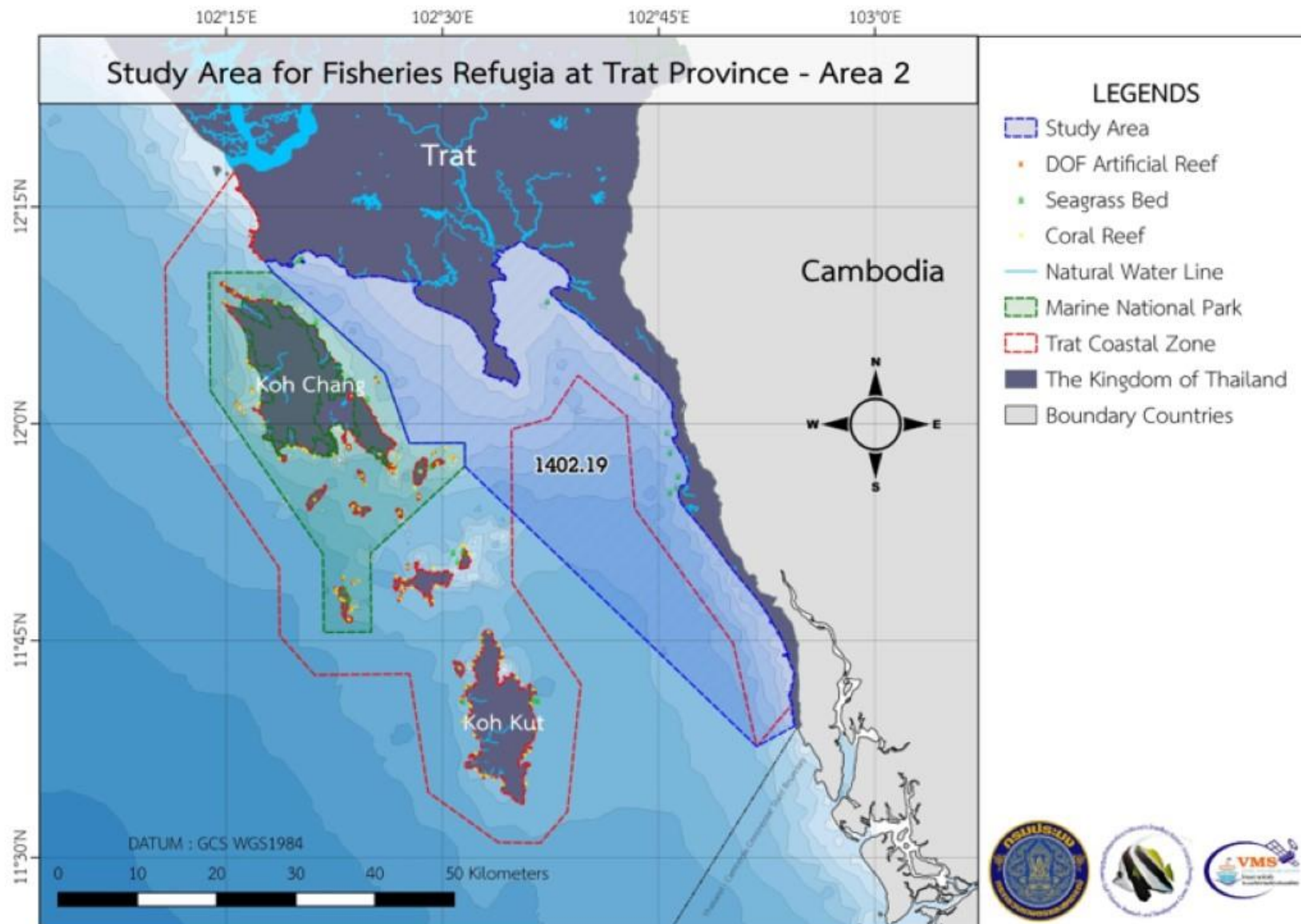
ภาพที่ 6 ร้อยละของระยะเจริญพันธุ์ของปลา (Rastrelliger brachysoma) เพศเมียบริเวณจังหวัดตราด ปี 2552

Figure 6 Percentage of female mature of Indo-Pacific mackerel (*Rastrelliger brachysoma*) in Trat Province, 2009

Distributions of larval, juvenile, adult, mature, and fully mature short mackerel in Trat Site during peak spawning period: January – February 2018

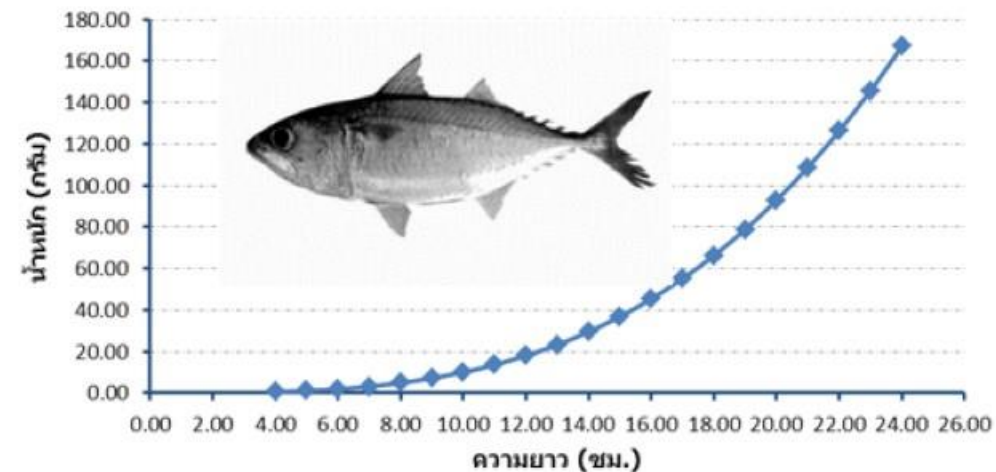
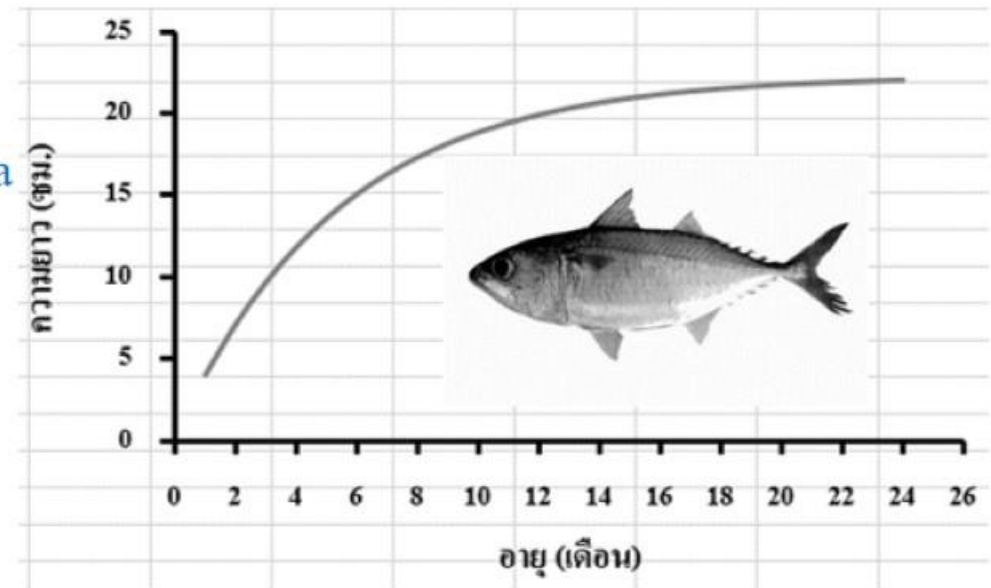


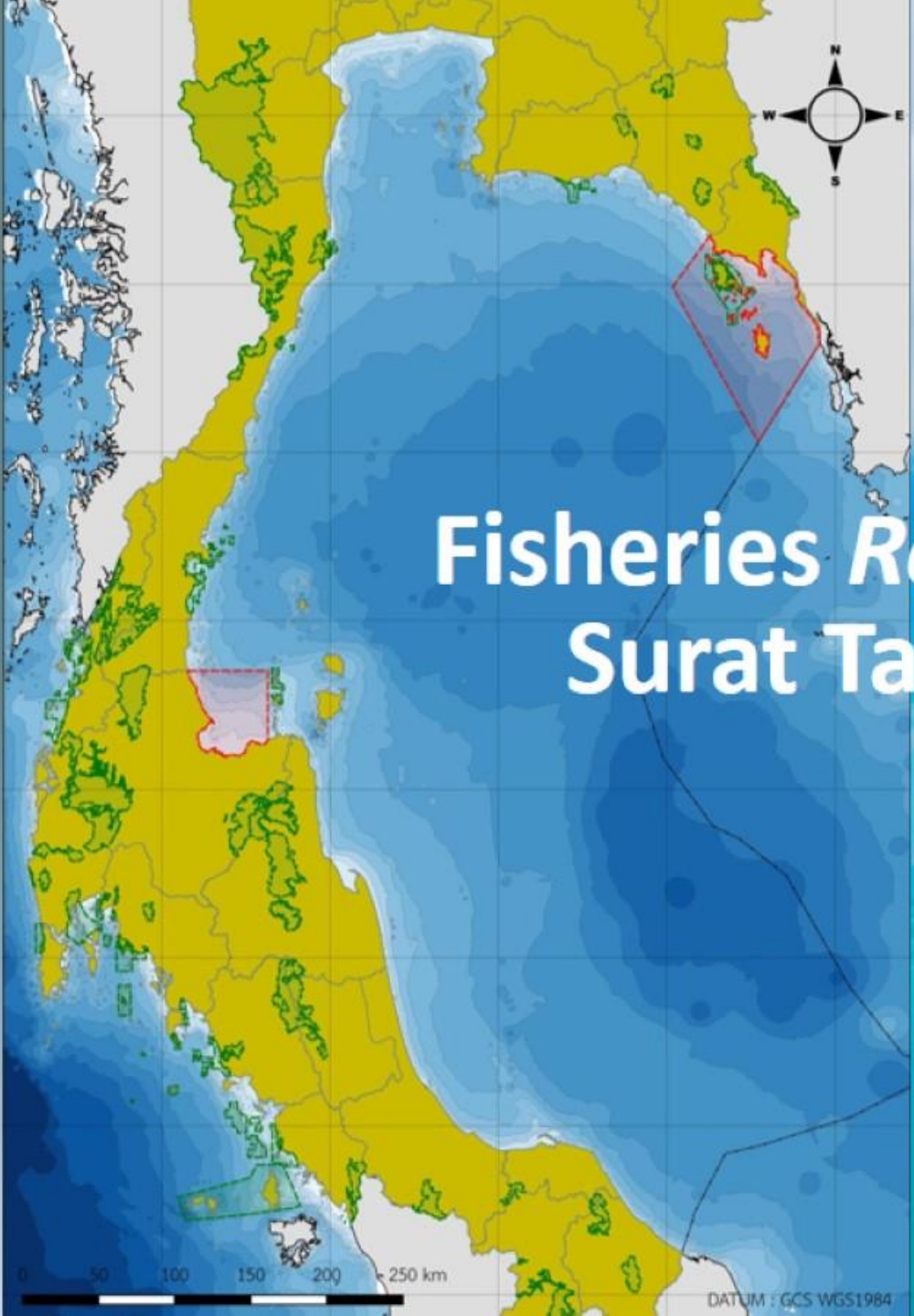
Tentative actual fisheries *refugia* boundary, prepared for community forums in Trat Site



Estimated population of short mackerel while implementing fisheries *refugia* management

- 1 — **256,000 kg** landing of short mackerel (in 2018)
- 2 — **25,600 kg** landing of short mackerel in 10 % of fishing area and 2 month (Jan-Feb)
average weight 73 g/fish (17 cm)
- 3 — equal to a number of **350,685 fish**
- 4 — which was **175,342 female fish**
- 5 — **17,534,246,575.34 eggs** by 100,000 spawners
- 6 — **175,342,465 larvae** hatch rate = 1%
- 7 — survive to marketable size **1,753,424 fish** survival rate = 1%
- 8 — **= 127,100 kg** weight of survival/year



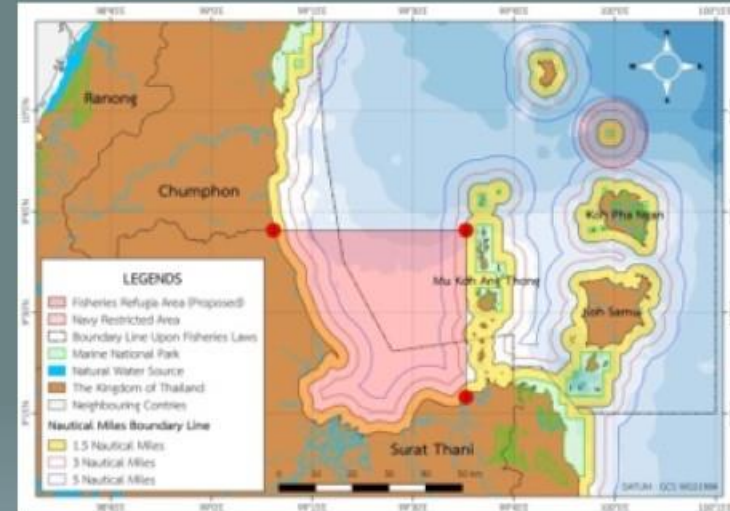
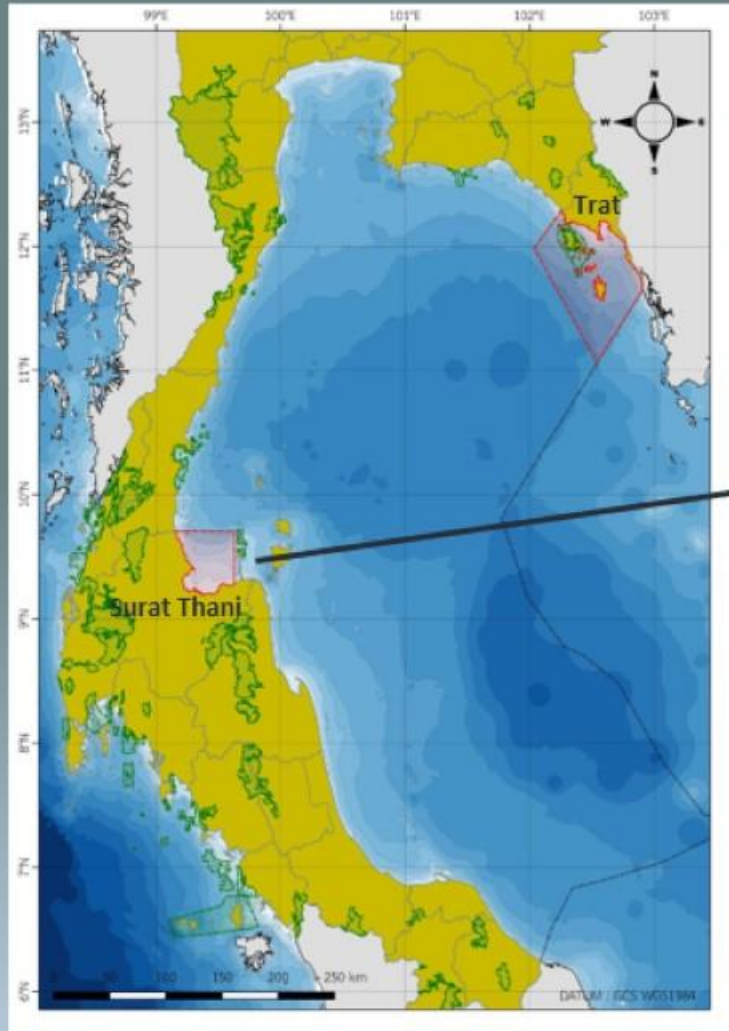


Fisheries *Refugia* Profiles: Surat Tani, Thailand



DATUM : GCS WGS1984

Site Name (2): Surat Thani



Geographic Location (tentative site for study):

1. 9°42'15.00"N 99°9'12.00"E
2. 9°42'15.00"N 99°37'52.16"E
3. 9°17'25.47"N 99°37'52.16"E

Geophaphy: Surat Tani Province

- **Areas:**
 - Land = 12,892 km² (the Largest of the southern provinces of Thailand)
 - Islands = 419 km²
 - Shoreline = 157 km
- **Boundaries:**
 - North: Ranong and Chumphon Provinces, and the Gulf of Thailand
 - South: Krabi and Nakhon Si Thammarat Provinces
 - East: Nakhon Si Thammarat Province and the Gulf of Thailand
 - West: Phang Nga Province
- **Main fresh water sources:** the Tapi River and the Phum Duang River
- **Islands:** 108 islands (the most in the GoT) ; Koh Samui is the second biggest island of Thailand (after Phuket), and Mu Koh Ang Thong is a Marine National Park
- **Climate:** tropical climate with fairly stable temperatures throughout the year at the average of 27°C, having rainfall around 1,850 mm per year



History:

- It can be traced back to the prehistoric times when Semang (Sakai) and original Malays lived in **Surat Thani**.
- In the 13th century, the city became a part of the Srivijaya Empire which ruled over the Malay Peninsula as well as parts of Java.
- When the empire collapsed, it was divided into 3 main areas: Chaiya, Thathong, and Kiri Rat, which were ruled by Nakhon Si Thammarat under King Rama IV.
- These 3 areas were eventually combined under just the name Chaiya, which was later changed to **Surat Thani**
- **Surat Thani** means “city of the good people”. It is also known as “the city of a hundred islands” as there are many big and small islands in the Gulf of Thailand lay off the coast of the province.



Population:

- Total 1,063,501 (2018)
Density 83/km²

Economy:

- GDP 191,177 M฿ (2015)
 - GDP in agriculture sector 26%
 - GDP in non-agriculture sector 74%
- Economic Composition
 - Vending
 - Hotel and tourism
 - Agriculture
 - Fisheries

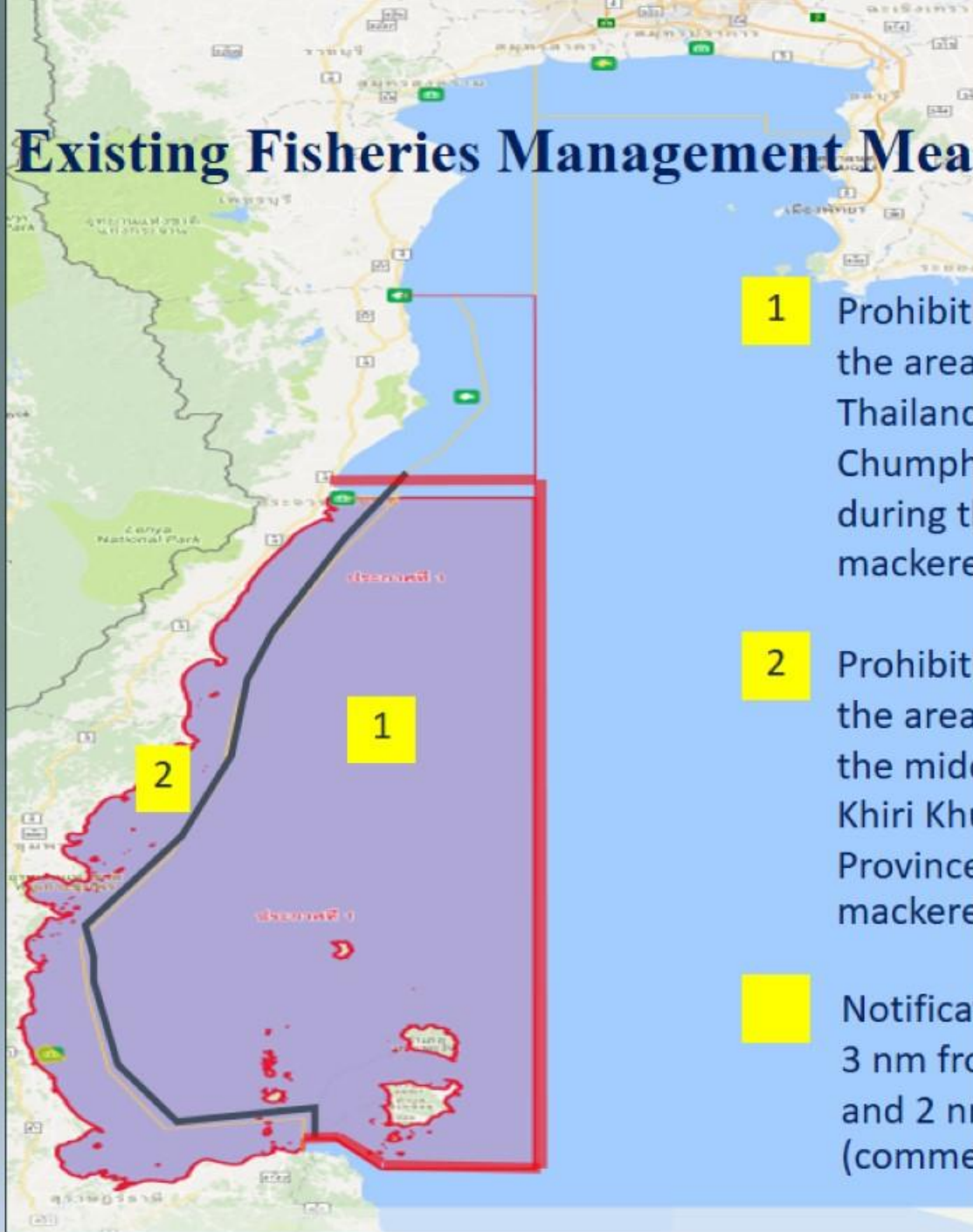


Main Fishing Gears in Surat Thani Site

- Otter trawl
- Pair trawl
- Beam trawl
- Purse seine
- Anchovy purse seine
- Gill net
- Crab trap
- Crab gill net



Existing Fisheries Management Measures in Surat Thani Site



1 Prohibition of some fishing gears fishing in the area of 27,000 km² in the middle Gulf of Thailand, off Prachuab Khiri Khun, Chumphon, and Surat Thani Provinces, during the spawning season of short mackerel, 15 February – 15 May each year

2 Prohibition of some fishing gears fishing in the area of 5,300 km² along 7 nm off shore in the middle Gulf of Thailand, off Prachuab Khiri Khun, Chumphon, and Surat Thani Provinces during the nursery period of short mackerel, 16 May – 14 June each year

3 Notification on coastal seas:
3 nm from shoreline of mainland;
and 2 nm from shoreline of islands
(commercial fisheries prohibited)

Some Information of
Blue Swimming Crab Resources, Fisheries,
and Ecosystem in Surat Thani Site

Blue Swimming Crab



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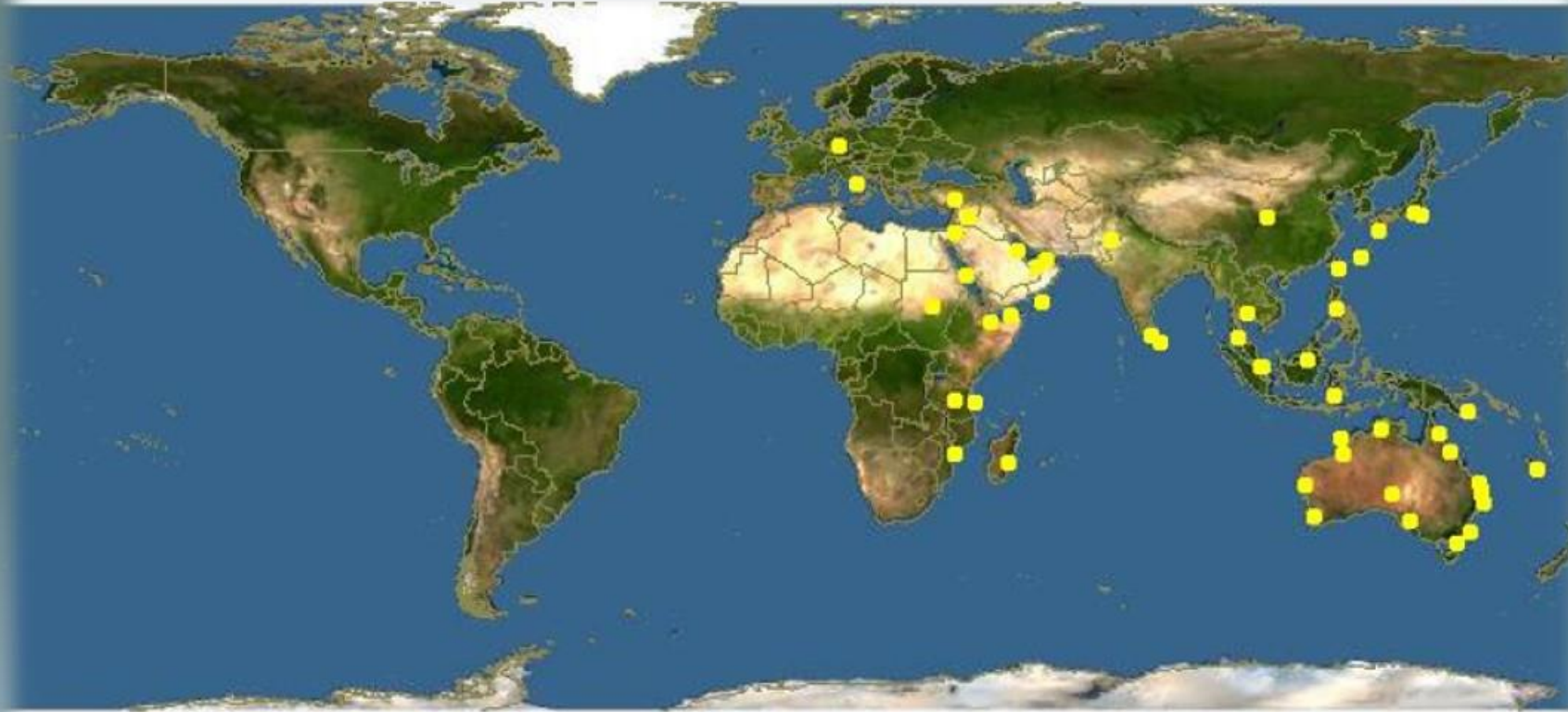
Common Name: Blue Swimming Crab

Scientific Name: *Portunus pelagicus*, Linnaeus (1758)

Thai Local Name: Pu Ma (Pu = Crab)

Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Distribution of Blue Swimming Crab



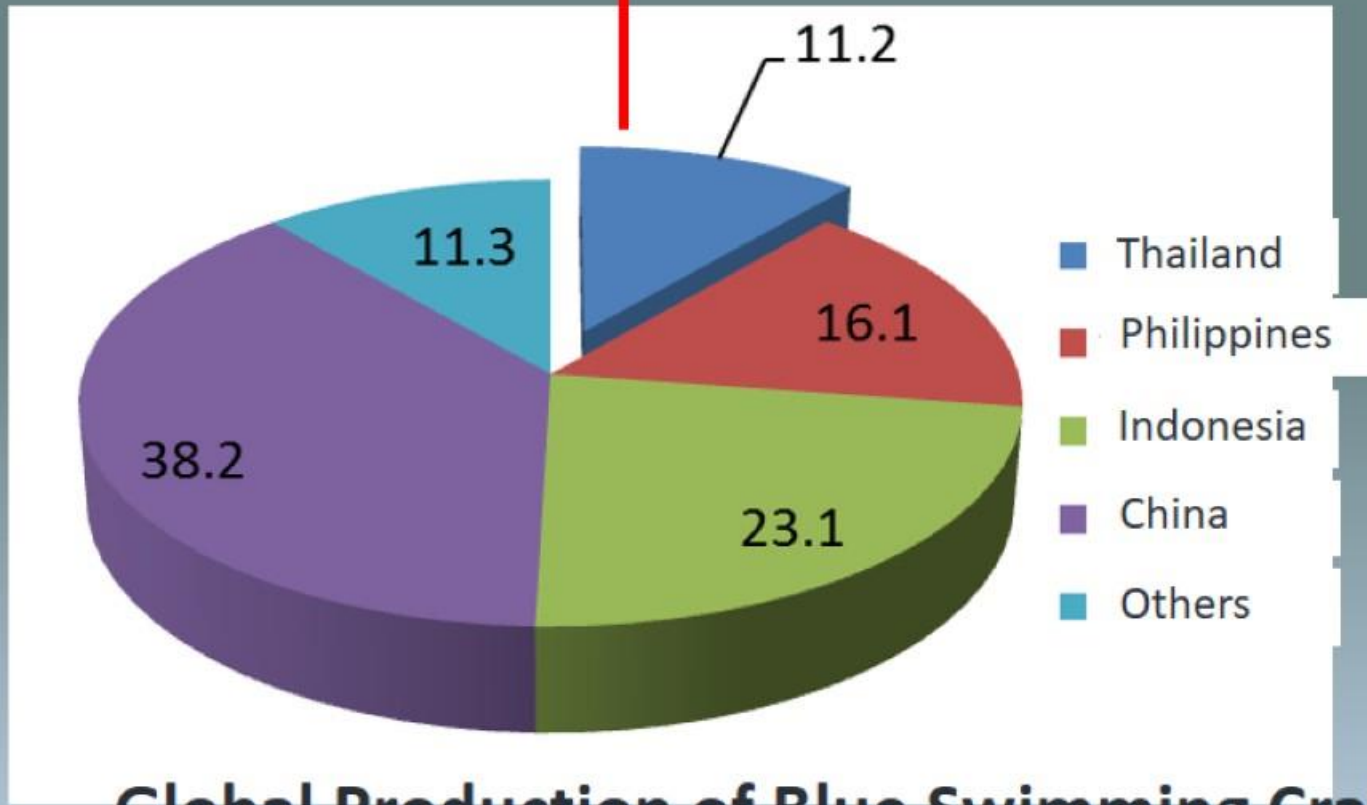
Coastal areas of the tropical and temperate zones, as well as estuary along Africa, Indian Ocean, Indo-Pacific, and Australia

Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Production of Blue Swimming Crab



Quantity: 20,000 tons, Value: 3,200 million bahts

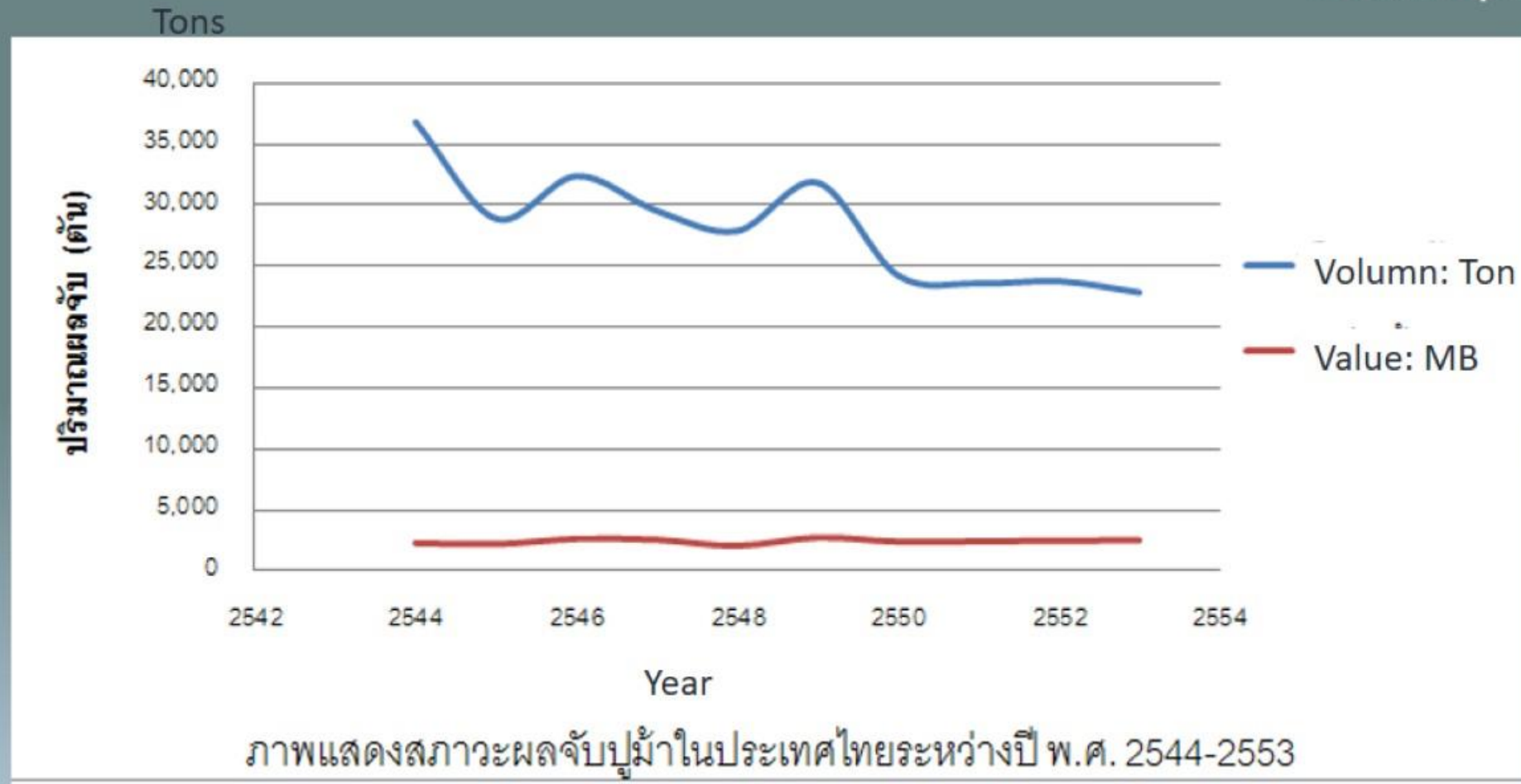


Global Production of Blue Swimming Crab

(cited from FAO)

Production of Blue Swimming Crab in Thailand During 2001-2010)

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Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Fishing Gears for Blue Swimming Crab

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Gill Net

Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Fishing Gears for Blue Swimming Crab

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Collapsible Crab Trap

Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

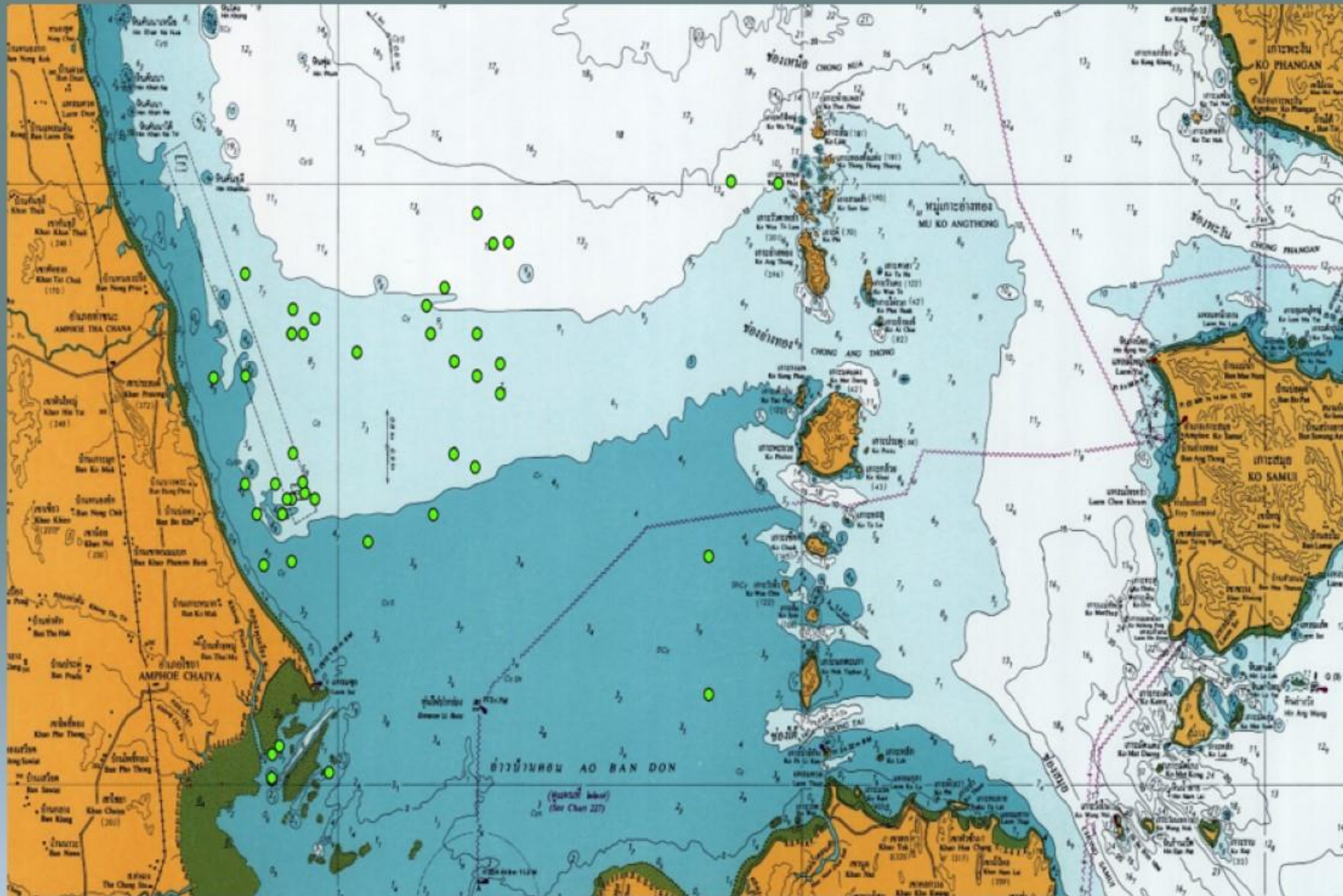
Collapsible Crab Trap

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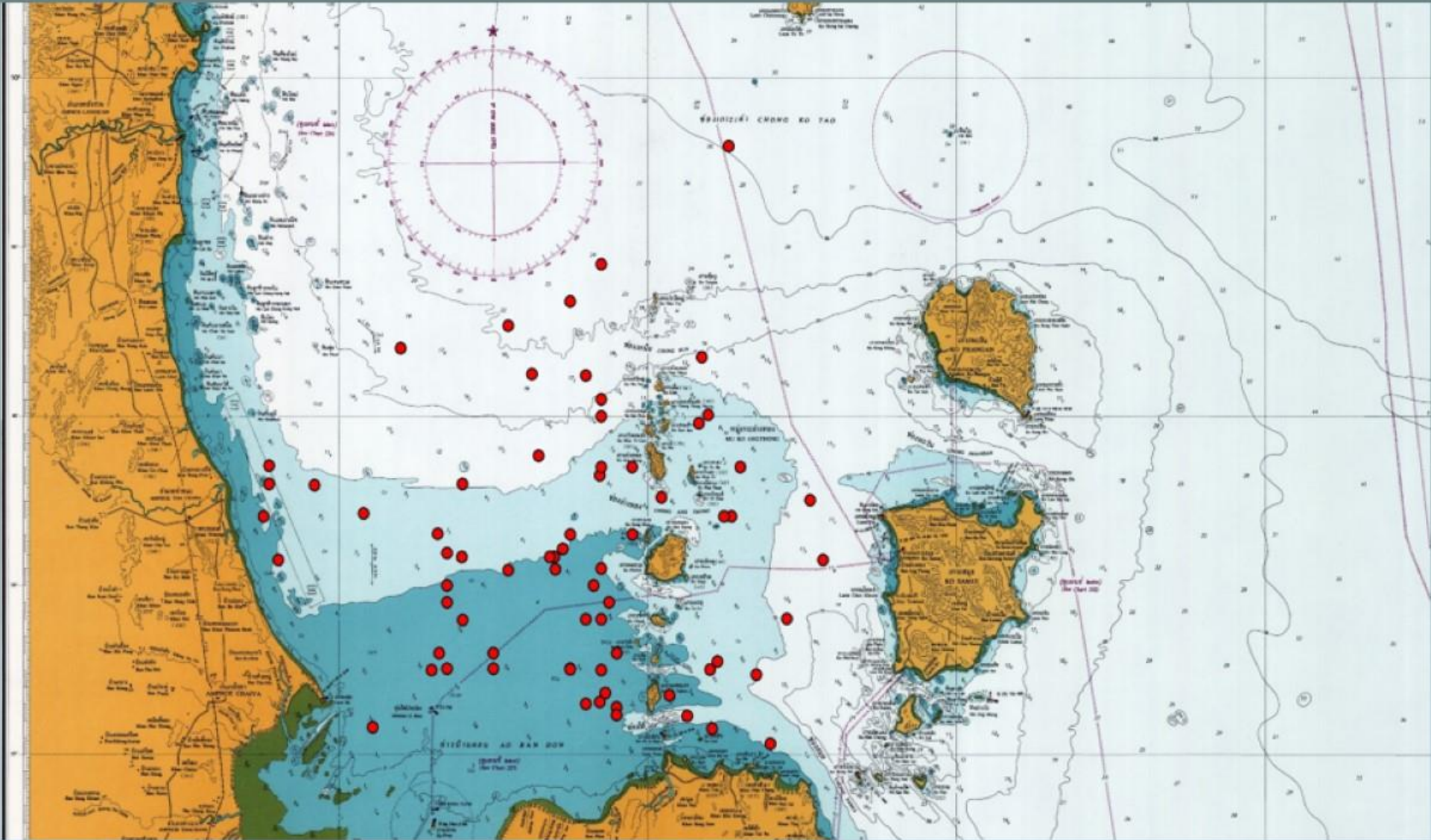
Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Fishing Grounds of Crab Gill Net Fisheries



Source: Middle Gulf Fisheries Research and Development Center (Chumphon)

Fishing Grounds of Crab Trap Fisheries



Source: Middle Gulf Fisheries Research and Development Center (Chumphon)

Catching Sizes of Blue Swimming Crab in Thailand

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Size decreased



1987

Avg. Carapace length: 14 cm



2007

Avg. Carapace length: 8 cm

Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Mating Behavior



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❖ After female molting

❖ 8-10 hr coupling



❖ 1-2 hr mating

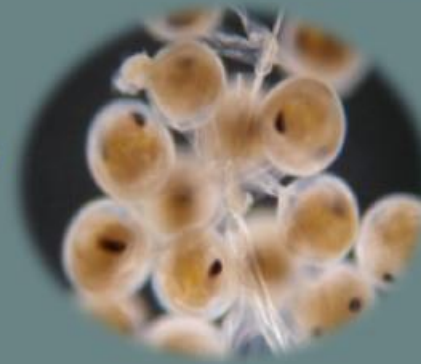
Life Cycle of Blue Swimming Crab



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998,292 eggs

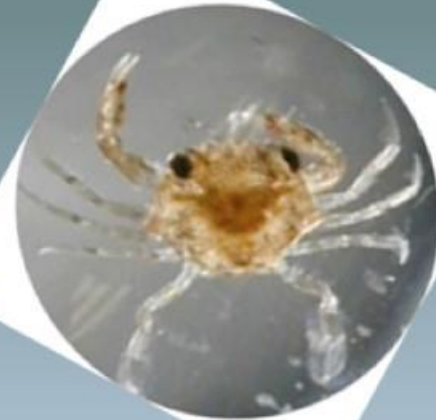
berried crab



65 % hatched



648,890 larvae



20,765 first crabs

3.2% survived



160 mature crabs

0.77 % survived

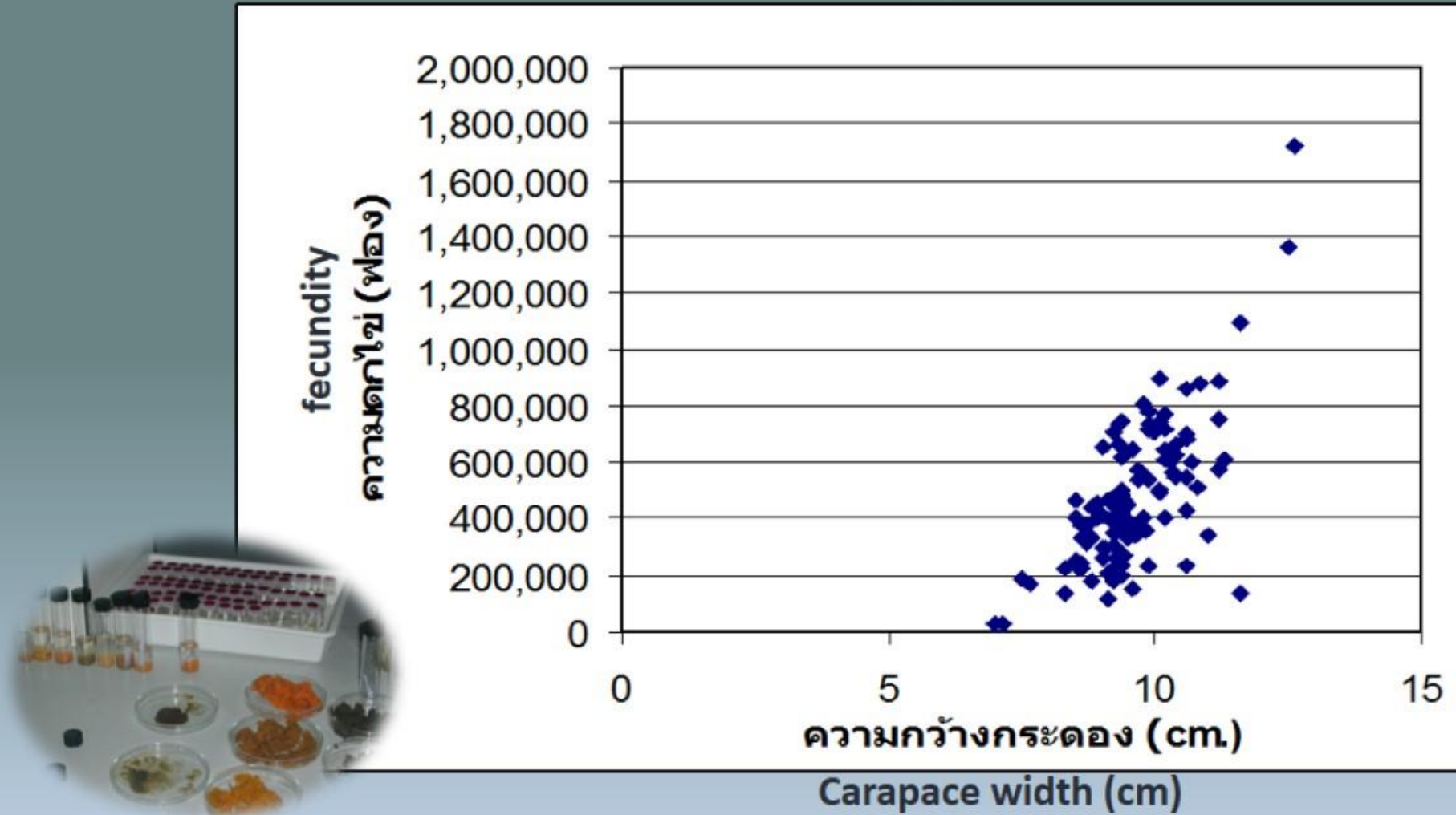
Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Fecundity of Blue Swimming Crab



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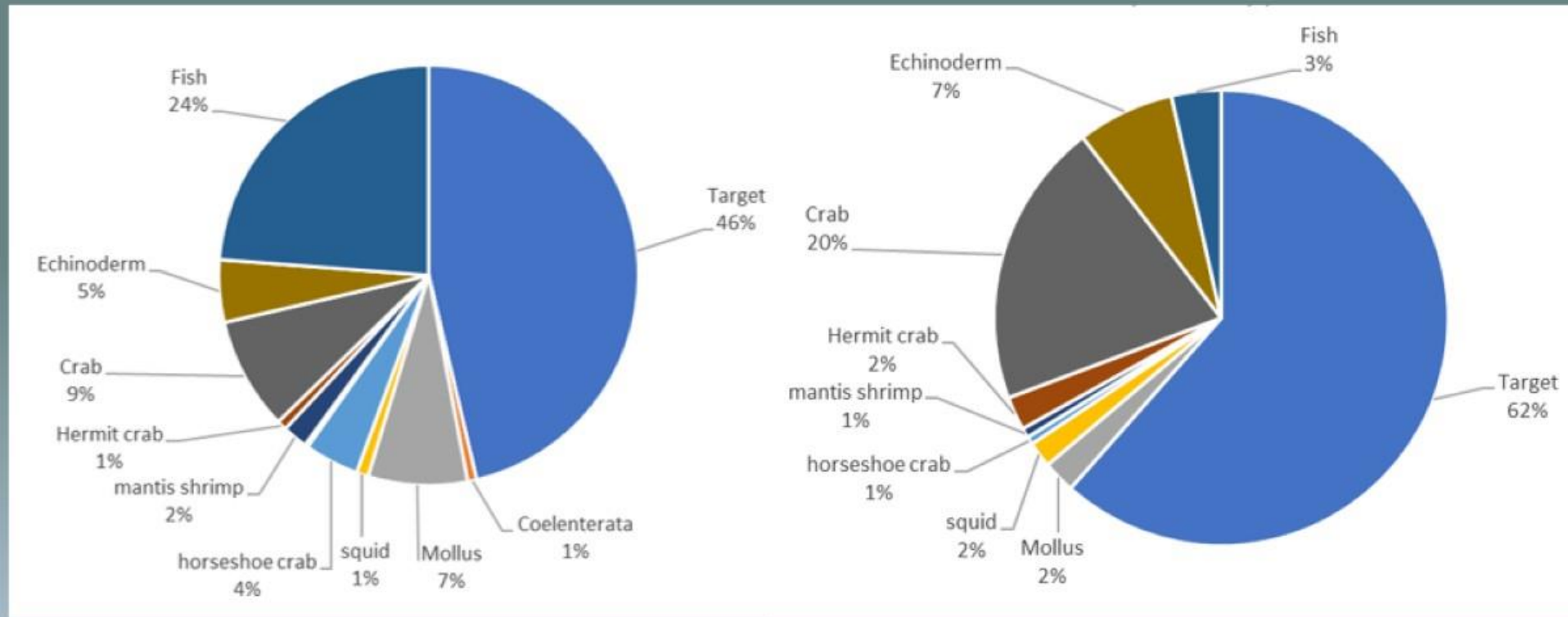
Fecundity: 229,538-2,850,061 eggs



Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Catch Composition by Weight

สัดส่วนองค์ประกอบชนิดเชิงน้ำหนักตัวจากเครื่องมืออวนและลอบ



Crab Gill Net

Crab Trap

Catch Composition (%) of Crab Gill Net Fisheries in Surat Thani Site in 2018

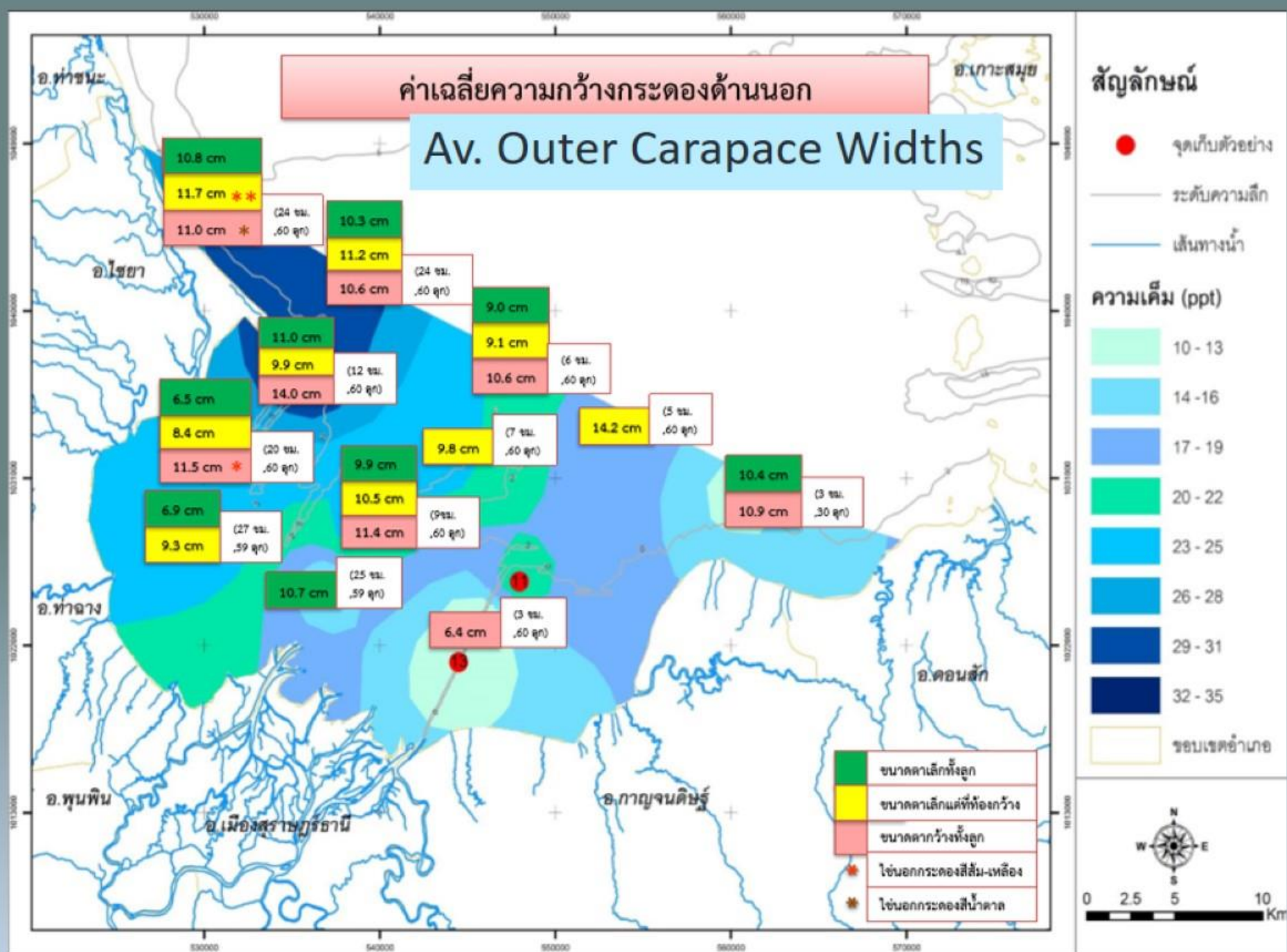
สัตว์น้ำ	Jan	Feb	March	April	May	June	July	Aug.
กลุ่มกุ้ง	3.49	0.00	0.00	0.18	0.00	0.00	0.45	4.68
กลุ่มกุ้ง	0.00	0.28	0.00	0.00	0.00	0.00	0.90	0.00
กลุ่มปลา	36.51	4.30	0.00	0.00	0.00	0.00	11.96	0.07
กลุ่มปู								
- <i>Portunus pelagicus</i>	53.81	92.15	97.94	98.14	98.40	98.67	84.81	93.63
- <i>Charybdis feriatus</i>	0.00	3.27	1.67	1.68	1.60	0.38	1.07	0.86
- other crab	6.19	0.00	0.40	0.00	0.00	0.95	0.21	0.77
กลุ่มหมึก	0.00	0.00	0.00	0.00	0.00	0.00	0.60	0.00
กลุ่มหอย	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
สัตว์น้ำอื่นๆ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ผลรวม	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
อัตราการจับ (กก./อวน 100 เมตร)	0.12	0.46	0.29	0.63	0.19	0.19	0.41	0.27

Source: Middle Gulf Fisheries Research and Development Center (Chumphon)

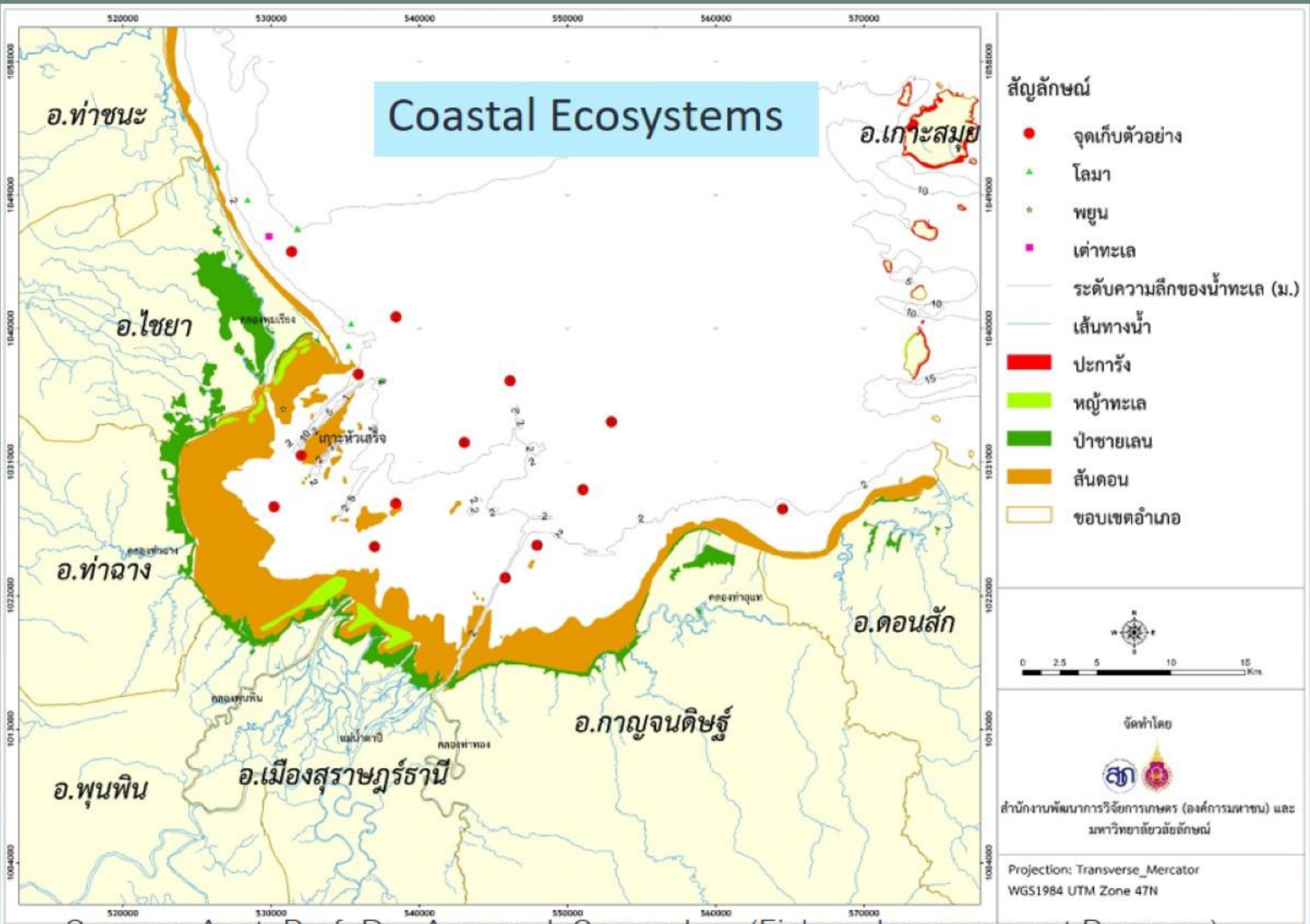
Catch Composition (%) of Crab Trap Fisheries in Surat Thani Site in 2018

สัตว์น้ำ	Jan	Feb	March	April	May	June	July	Aug.
กลุ่มกั้ง	0.00	0.83	0.00	0.00	0.28	0.00	0.00	0.00
กลุ่มปู								
Portunus pelagicus	93.00	87.73	62.86	84.16	91.19	73.84	94.89	100.00
Charybdis feriatus	6.42	9.84	25.16	15.68	8.50	4.90	3.88	0.00
other crab	0.58	0.99	11.98	0.16	0.02	21.25	0.00	0.00
กลุ่มหมึก	0.00	0.61	0.00	0.00	0.00	0.00	1.23	0.00
ผลรวม	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
อัตราการจับ (กก./สอบ 10 ลูก)	0.130	0.104	0.144	0.127	0.172	0.263	0.219	0.242

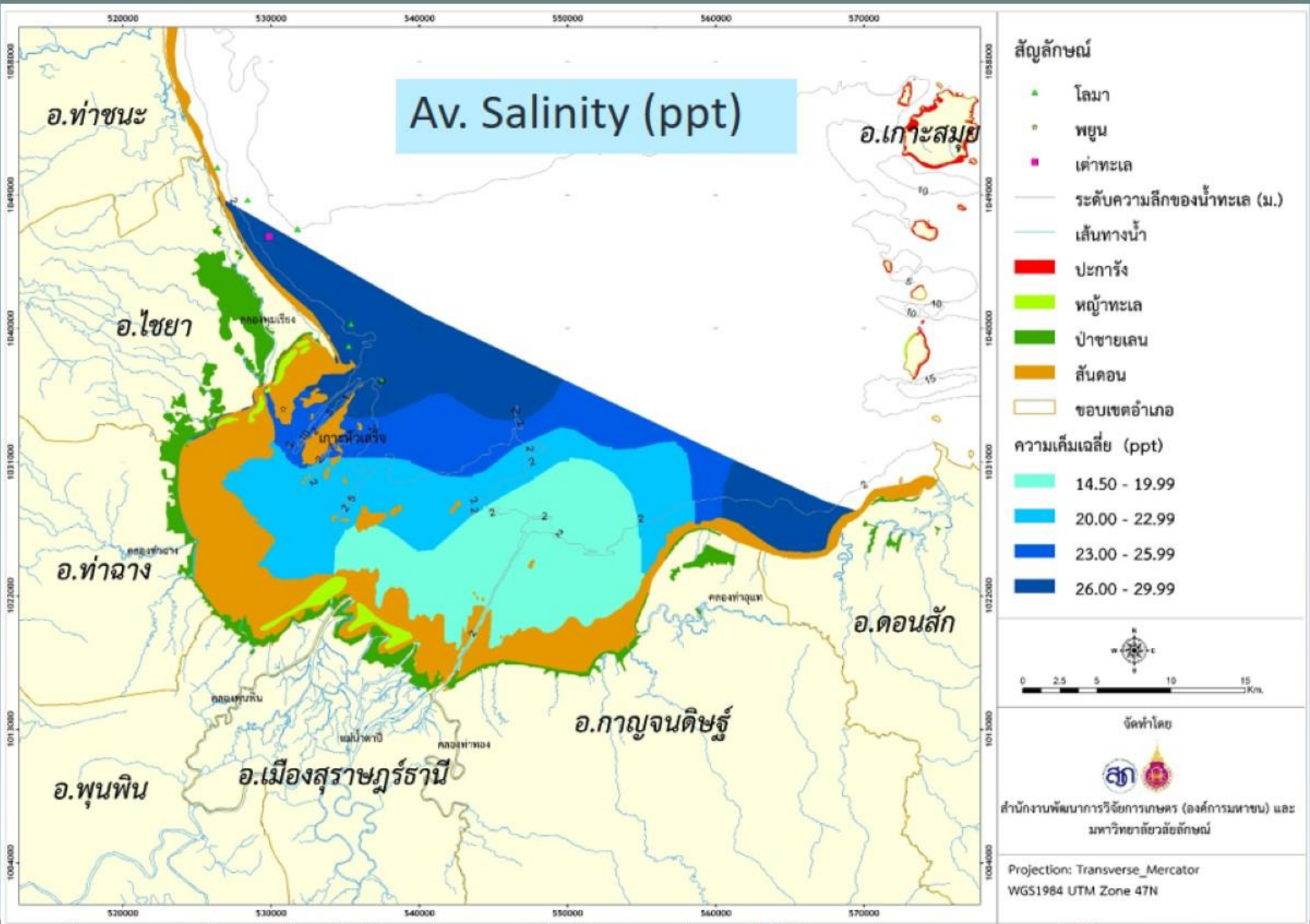
Source: Middle Gulf Fisheries Research and Development Center (Chumphon)



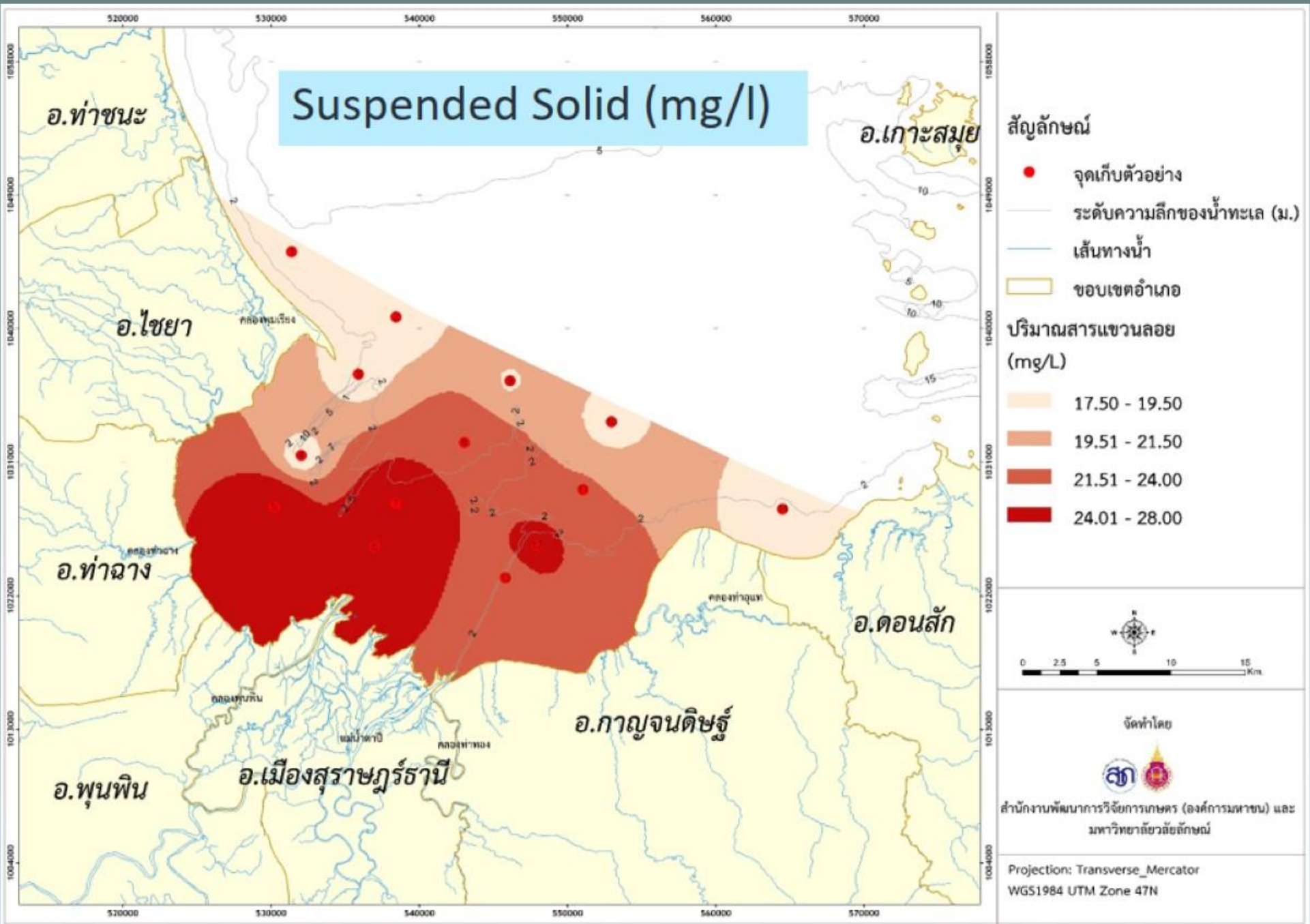
Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)



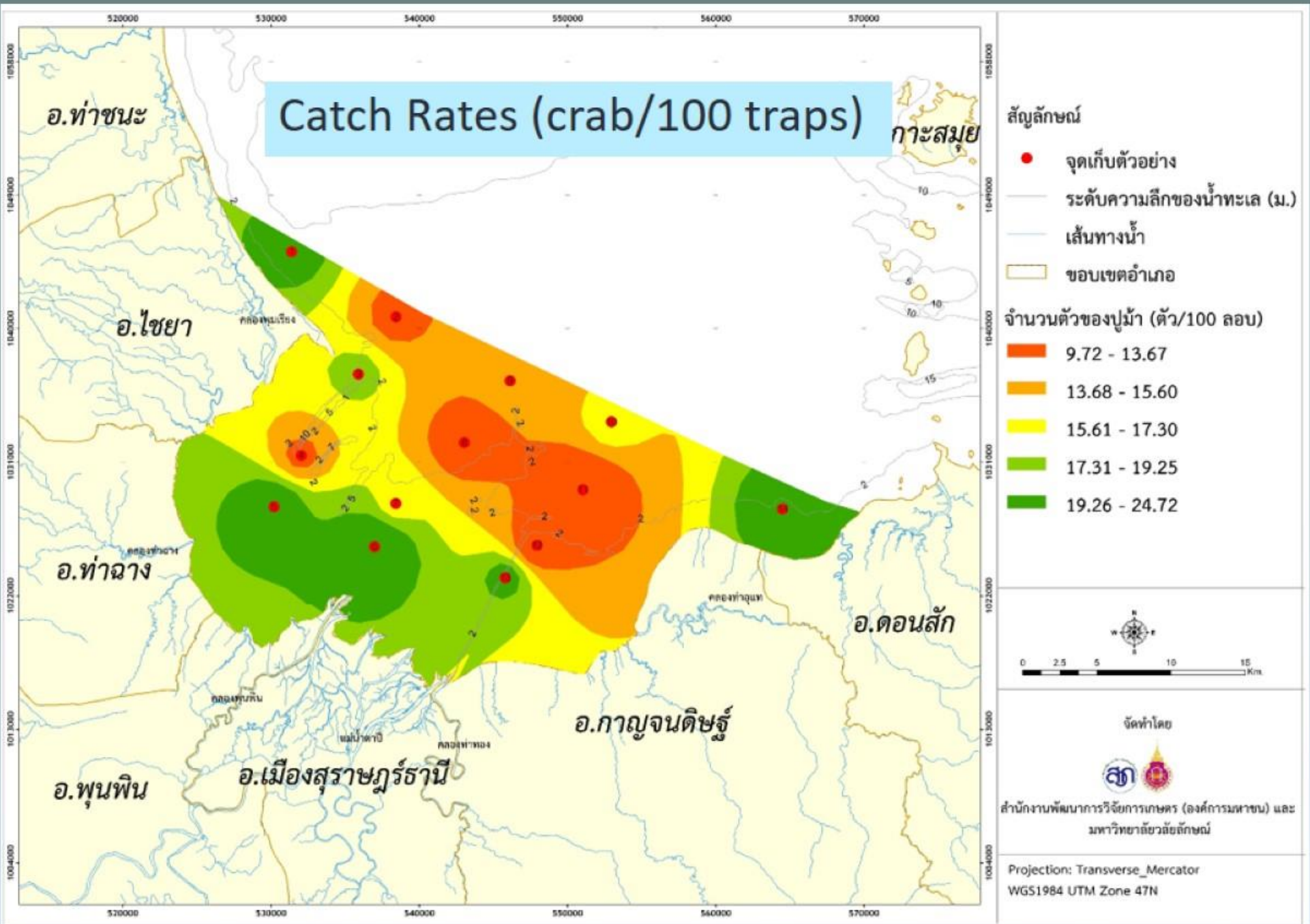
Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)



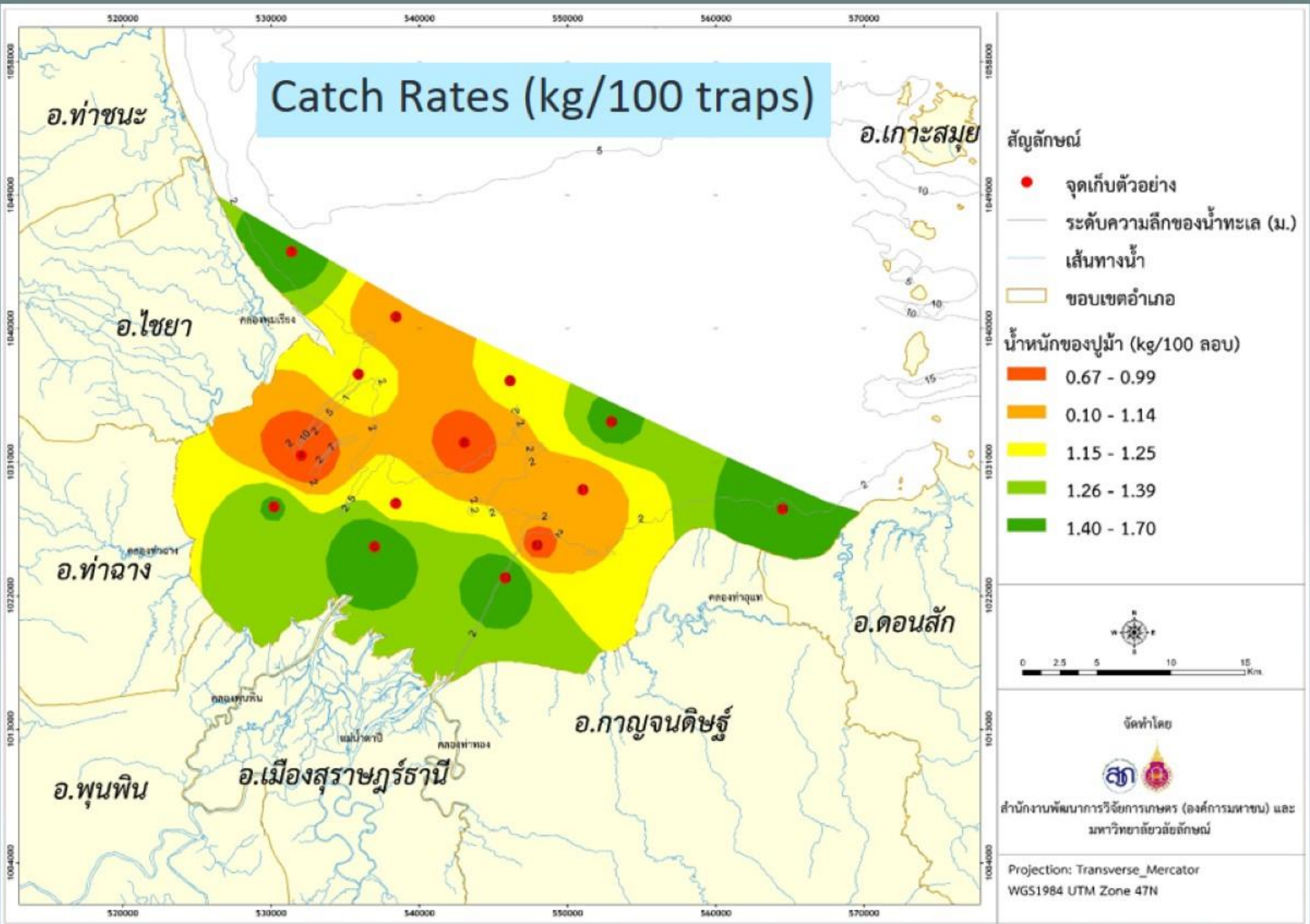
Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

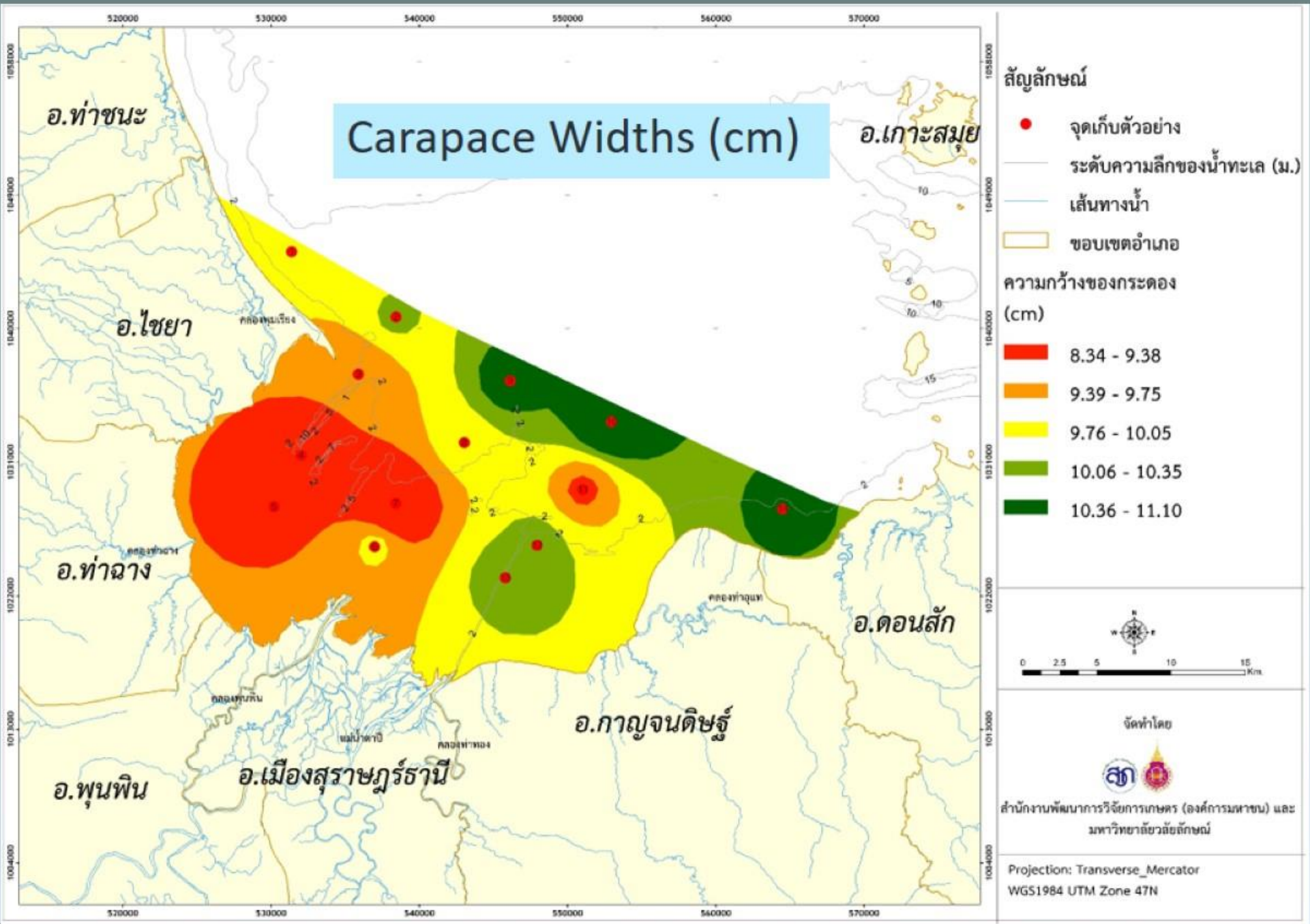


Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

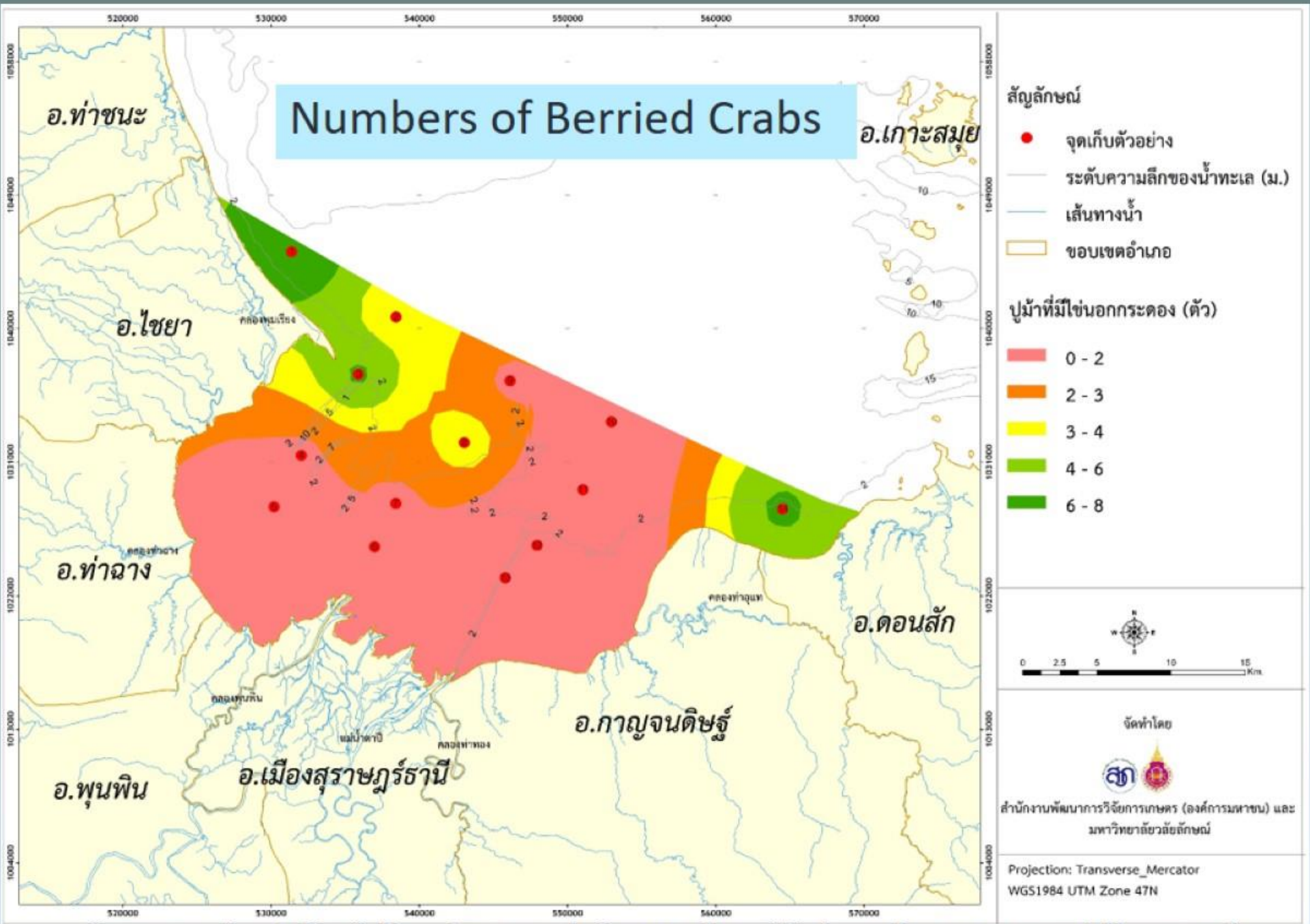


Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)





Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)



Source: Asst. Prof. Dr. Amonsak Sawusdee (Fishery Improvement Program)

Thank You



A grayscale map of Southeast Asia and surrounding regions, including parts of China, Burma, Vietnam, Laos, Thailand, Philippines, Malaysia, and Indonesia. The text 'Thank You' is overlaid in a large, teal font. A faint 'PIXTO' watermark is visible in the center of the map.

Thank You