

### 3. Summary rare and endangered marine animals' sightings of trawlers operation.

In 2023, from January to December, there were a total of 49,177 trawler fishing trips reported in the Gulf of Thailand. Among these, rare marine animals were sighted in 28 trips by 7 trawler fishing vessels. The Department of Fisheries records sightings of rare marine animals as reported in the Fishing Logbook into the electronic reporting system of the Department of Fisheries (Thai Flagged Catch Certification System: TFCC). Analyzing the data from the Logbook on the number of rare marine animal sightings, the following information can be summarized on table below:

Fishing Gear	ETP Species				Total (times)
	Turtle	Dolphin	Whale Shark	Whale	
Pair-trawler	1	55	-	1	57
Otter board trawl	7	169	-	-	179
<b>Total</b>	<b>8</b>	<b>224</b>	<b>-</b>	<b>1</b>	<b>233</b>

In 2024, from January to June 2024, there were a total of 19,773 trawler fishing trips reported in the Gulf of Thailand. Among these, rare marine animals were sighted in 21 trips by 8 trawler fishing vessels. The Department of Fisheries records sightings of rare marine animals as reported in the Fishing Logbook into the electronic reporting system of the Department of Fisheries (Thai Flagged Catch Certification System: TFCC). Analyzing the data from the Logbook on the number of rare marine animal sightings, the following information can be summarized:

Fishing Gear	ETP Species				Total (times)
	Turtle	Dolphin	Whale Shark	Whale	
Pair-trawler	2	27	-	2	31
Otter board trawl	2	118	-	-	120
<b>Total</b>	<b>4</b>	<b>145</b>	<b>-</b>	<b>2</b>	<b>151</b>

## Database from the system as reference

No.	Port In. No.	Fishing Gear	Date	latitude (°)	latitude (°)	longitude (°)	longitude (°)	ETP Species
1	6612204863	Otter board trawl	25-05-66	6	44.55	102	05.15	Dolphin
2	6612204863	Otter board trawl	26-05-66	6	49.84	101	52.44	Dolphin
3	6612204863	Otter board trawl	27-05-66	6	52.98	101	58.48	Dolphin
4	6612204863	Otter board trawl	28-05-66	6	45.81	101	49.53	Dolphin
5	6612204863	Otter board trawl	29-05-66	6	47.08	101	52.48	Dolphin
6	6612204863	Otter board trawl	30-05-66	6	55.35	102	22.05	Dolphin
7	6612204863	Otter board trawl	02-06-66	6	57.27	102	20.50	Dolphin
8	6612204863	Otter board trawl	03-06-66	6	57.69	102	12.08	Dolphin
9	6612204863	Otter board trawl	04-06-66	6	59.48	102	20.08	Dolphin
10	6612204863	Otter board trawl	05-06-66	6	59.85	102	17.88	Dolphin
11	6612204863	Otter board trawl	05-06-66	6	53.86	102	12.15	Dolphin
12	6612204863	Otter board trawl	06-06-66	6	58.18	102	18.81	Dolphin
13	6612204863	Otter board trawl	07-06-66	6	44.95	102	07.88	Dolphin
14	6612204863	Otter board trawl	08-06-66	7	01.18	102	11.49	Dolphin
15	6612204863	Otter board trawl	09-06-66	6	58.98	102	08.38	Dolphin
16	6612204863	Otter board trawl	10-06-66	7	02.28	102	17.01	Dolphin
17	6612204863	Otter board trawl	10-06-66	6	53.08	102	27.88	Turtle
18	6612204863	Otter board trawl	11-06-66	7	02.28	102	17.58	Dolphin
19	6612204863	Otter board trawl	12-06-66	7	00.38	102	17.39	Dolphin
20	6612204863	Otter board trawl	12-06-66	6	54.18	102	25.25	Dolphin
21	6612204863	Otter board trawl	13-06-66	7	00.78	102	17.25	Dolphin
22	6612204863	Otter board trawl	14-06-66	7	00.15	102	15.05	Dolphin
23	6612204863	Otter board trawl	14-06-66	6	56.18	102	25.05	Dolphin
24	6612204863	Otter board trawl	15-06-66	6	56.46	102	09.76	Dolphin
25	6612204863	Otter board trawl	16-06-66	6	55.31	102	18.18	Dolphin
26	6612204863	Otter board trawl	17-06-66	6	54.83	102	32.28	Dolphin
27	6612204863	Otter board trawl	18-06-66	6	51.28	102	18.08	Dolphin
28	6612204863	Otter board trawl	19-06-66	6	55.29	102	18.08	Dolphin
29	6612204863	Otter board trawl	20-06-66	6	53.22	102	18.12	Dolphin
30	6612204863	Otter board trawl	20-06-66	6	54.14	102	30.4	Dolphin
31	6612204863	Otter board trawl	21-06-66	6	53.188	102	18.13	Dolphin
32	6612204863	Otter board trawl	21-06-66	6	54.55	102	32.98	Dolphin
33	6612204863	Otter board trawl	22-06-66	6	45.05	102	10.05	Dolphin
34	6612204863	Otter board trawl	22-06-66	6	44.28	102	05.98	Dolphin
35	6612203888	Otter board trawl	27-04-66	6	43.44	101	48.38	Dolphin
36	6612203888	Otter board trawl	28-04-66	6	44.83	101	48.38	Dolphin
37	6612203888	Otter board trawl	29-04-66	6	35.09	101	57.88	Dolphin
38	6612203888	Otter board trawl	30-04-66	6	45.75	101	47.01	Dolphin
39	6612203888	Otter board trawl	05-05-66	6	59.42	101	20.33	Dolphin
40	6612203888	Otter board trawl	06-05-66	6	58.85	101	21.21	Dolphin
41	6612203888	Otter board trawl	06-05-66	6	59.41	101	22.14	Dolphin
42	6612203888	Otter board trawl	07-05-66	6	34.45	101	47.56	Dolphin
43	6612203888	Otter board trawl	08-05-66	6	35.18	101	47.21	Dolphin
44	6612203888	Otter board trawl	10-05-66	6	57.14	101	11.22	Dolphin
45	6612203888	Otter board trawl	11-05-66	6	57.58	101	08.19	Dolphin
46	6612203888	Otter board trawl	12-05-66	6	58.08	101	22.02	Dolphin
47	6612203888	Otter board trawl	14-05-66	6	58.98	102	08.34	Dolphin
48	6612203888	Otter board trawl	14-05-66	6	42.24	102	15.75	Dolphin
49	6612203888	Otter board trawl	15-05-66	6	58.04	102	09.38	Dolphin
50	6612203888	Otter board trawl	16-05-66	6	57.89	102	12.96	Turtle
51	6612203888	Otter board trawl	16-05-66	6	57.89	102	12.96	Dolphin
52	6612203888	Otter board trawl	17-05-66	6	54.42	102	20.75	Turtle
53	6612203888	Otter board trawl	17-05-66	6	54.42	102	20.75	Dolphin
54	6612203888	Otter board trawl	17-05-66	6	57.58	102	35.89	Dolphin
55	6612203888	Otter board trawl	18-05-66	6	54.74	102	22.32	Turtle
56	6612203888	Otter board trawl	19-05-66	7	02.03	102	43.38	Dolphin
57	6612203888	Otter board trawl	20-05-66	7	10.14	102	30.44	Dolphin
58	6612203888	Otter board trawl	21-05-66	6	57.89	102	40.08	Dolphin
59	6612202652	Otter board trawl	23-03-66	6	48.08	102	59.09	Dolphin
60	6612202652	Otter board trawl	24-03-66	6	57.64	102	18.58	Dolphin

61	6612202652	Otter board trawl	25-03-66	6	34.89	102	32.53	Dolphin
62	6612202652	Otter board trawl	26-03-66	6	54.98	102	33.04	Dolphin
63	6612202652	Otter board trawl	27-03-66	6	52.04	102	22.44	Dolphin
64	6612202652	Otter board trawl	28-03-66	6	58.20	102	24.58	Dolphin
65	6612202652	Otter board trawl	29-03-66	6	59.34	102	25.05	Dolphin
66	6612202652	Otter board trawl	30-03-66	6	53.62	102	25.05	Dolphin
67	6612202652	Otter board trawl	31-03-66	6	55.78	102	13.83	Dolphin
68	6612202652	Otter board trawl	01-04-66	6	55.83	102	34.89	Dolphin
69	6612202652	Otter board trawl	02-04-66	6	57.75	102	25.88	Dolphin
70	6612202652	Otter board trawl	03-04-66	7	11.83	102	37.24	Dolphin
71	6612202652	Otter board trawl	03-04-66	7	11.83	102	37.24	Turtle
72	6612202652	Otter board trawl	04-04-66	7	12.89	102	33.78	Dolphin
73	6612202652	Otter board trawl	05-04-66	7	07.78	102	35.39	Dolphin
74	6612202652	Otter board trawl	05-04-66	7	06.49	102	34.75	Dolphin
75	6612202652	Otter board trawl	06-04-66	7	07.18	102	33.44	Dolphin
76	6612202652	Otter board trawl	07-04-66	6	49.81	101	59.14	Dolphin
77	6612202652	Otter board trawl	07-04-66	6	49.68	102	14.04	Dolphin
78	6612202652	Otter board trawl	07-04-66	6	54.71	102	22.71	Dolphin
79	6612202652	Otter board trawl	08-04-66	6	57.89	102	37.08	Dolphin
80	6612202652	Otter board trawl	10-04-66	6	58.34	102	21.38	Dolphin
81	6612202652	Otter board trawl	11-04-66	7	00.95	102	25.38	Dolphin
82	6612202652	Otter board trawl	12-04-66	6	58.09	102	18.98	Dolphin
83	6612202652	Otter board trawl	12-04-66	6	55.25	102	33.88	Dolphin
84	6612202652	Otter board trawl	13-04-66	7	01.18	102	16.58	Dolphin
85	6612202652	Otter board trawl	13-04-66	6	56.06	102	32.08	Dolphin
86	6612202652	Otter board trawl	14-04-66	7	03.48	102	16.49	Dolphin
87	6612202652	Otter board trawl	15-04-66	6	59.49	102	18.08	Dolphin
88	6612202652	Otter board trawl	15-04-66	6	55.44	102	35.64	Dolphin
89	6612202652	Otter board trawl	16-04-66	7	00.18	102	18.08	Dolphin
90	6612200421	Otter board trawl	14-01-66	6	57.20	101	08.34	Dolphin
91	6612200421	Otter board trawl	21-01-66	6	58.91	101	21.67	Dolphin
92	6611200497	Otter board trawl	20-01-66	7	20.53	100	40.49	Dolphin
93	6611200497	Otter board trawl	30-01-66	7	22.00	100	39.67	Dolphin
94	6611200497	Otter board trawl	01-02-66	7	13.30	100	55.10	Dolphin
95	6611200497	Otter board trawl	02-02-66	7	16.50	100	42.50	Dolphin
96	6603200159	Pair-trawler	11-01-66	13	15.245	100	19.128	Dolphin
97	6603200159	Pair-trawler	13-01-66	12	50.411	100	16.250	Dolphin
98	6603200159	Pair-trawler	14-01-66	13	16.50	100	13.852	Dolphin
99	6624201409	Otter board trawl	06-02-66	9	49.80	100	33.20	Dolphin
100	6624201409	Otter board trawl	08-02-66	9	27.30	100	13.70	Dolphin
101	6624201409	Otter board trawl	10-02-66	9	13.70	100	08.65	Turtle
102	6624201409	Otter board trawl	13-02-66	8	40.10	100	04.60	Dolphin
103	6612203713	Pair-trawler	04-05-66	7	12.00	101	45.00	Dolphin
104	6612203713	Pair-trawler	10-05-66	7	29.00	101	38.00	Dolphin
105	6612203713	Pair-trawler	11-05-66	7	28.00	101	37.00	Dolphin
106	6612202959	Pair-trawler	04-03-66	7	31.00	101	35.00	Dolphin
107	6612202258	Pair-trawler	26-03-66	7	41.00	101	43.00	Turtle
108	6612202258	Pair-trawler	30-03-66	7	30.00	101	24.00	Dolphin
109	6612202258	Pair-trawler	30-03-66	7	48.00	101	25.00	Dolphin
110	6612202258	Pair-trawler	05-04-66	7	31.00	101	36.00	Dolphin
111	6612101490	Pair-trawler	28-02-66	7	02.00	102	08.00	Dolphin
112	6612101490	Pair-trawler	28-02-66	7	18.00	102	07.00	Dolphin
113	6612101490	Pair-trawler	02-03-66	7	39.00	101	46.00	Dolphin
114	6612101490	Pair-trawler	05-03-66	7	20.00	102	06.00	Dolphin
115	6612101490	Pair-trawler	06-03-66	7	13.00	102	14.00	Dolphin
116	6612101490	Pair-trawler	06-03-66	7	06.00	102	23.00	Dolphin
117	6612101490	Pair-trawler	10-03-66	7	41.00	101	45.00	Dolphin
118	6612200393	Pair-trawler	14-01-66	7	43.00	102	08.00	Dolphin
119	6612200393	Pair-trawler	16-01-66	7	29.00	101	59.00	Dolphin
120	6612200393	Pair-trawler	20-01-66	7	31.00	102	01.00	Dolphin
121	6612200393	Pair-trawler	21-01-66	7	18.00	102	13.00	Dolphin
122	6611200902	Otter board trawl	13-02-66	7	20.10	101	43.85	Dolphin
123	6611200902	Otter board trawl	01-03-66	7	25.00	101	35.27	Dolphin
124	6611200902	Otter board trawl	02-03-66	7	15.03	101	08.06	Dolphin
125	6612201596	Pair-trawler	10-03-66	7	04.30	102	07.48	Dolphin
126	6612201596	Pair-trawler	10-03-66	7	00.82	102	15.87	Dolphin
127	6612201596	Pair-trawler	11-03-66	7	50.38	102	14.89	Dolphin
128	6612201596	Pair-trawler	14-03-66	7	12.08	101	17.20	Dolphin
129	6612201596	Pair-trawler	15-03-66	7	35.61	101	15.04	Dolphin
130	6612201596	Pair-trawler	18-03-66	7	20.19	101	17.96	Dolphin
131	6628200458	Otter board trawl	17-04-66	6	29.176	101	52.669	Dolphin
132	6612201490	Pair-trawler	10-03-66	7	41.00	101	45.00	Dolphin
133	6612201490	Pair-trawler	06-03-66	7	13.00	102	14.00	Dolphin
134	6612201490	Pair-trawler	06-03-66	7	6.00	102	23.00	Dolphin
135	6612201490	Pair-trawler	02-03-66	7	39.00	101	46.00	Dolphin
136	6612201490	Pair-trawler	05-03-66	7	20.00	102	6.00	Dolphin
137	6612201490	Pair-trawler	28-02-66	7	2.00	102	8.00	Dolphin
138	6612201490	Pair-trawler	28-02-66	7	18.00	102	7.00	Dolphin

## **Monitoring populations of marine endangered animals by DMCR**

The Department of Marine and Coastal Resources, Ministry of Natural Resources and Environment, has a mission to conserve rare marine animals. The status of these rare marine animals is studied and monitored across four groups: sea turtles, dugongs, whales, dolphins, and two types of cartilaginous fish-whale sharks and manta rays. All these species fall under the classification of reserved wildlife and are protected according to the Wildlife Preservation and Protection Act B.E.2562 (2019). This act prohibits hunting, trade, possession, breeding, as well as the acquisition of eggs and carcasses, and various body parts of these animals. Specifically, leatherback turtles, dugongs, Bryde's whales, Omura's whales, and whale sharks are among the reserved wildlife, while other rare marine animals are listed as protected wildlife. Moreover, these rare marine animals are safeguarded under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). All species of sea turtles, dugongs, and Irrawaddy dolphins are categorized under CITES Account number one as Critically Endangered (CR). Other dolphins and whales, including whale sharks, are listed under CITES Account number two. Information regarding sightings, identity classification, and other relevant data are collected, stored in a database system, and analyzed to formulate suitable management and conservation plans.



**Figure 1** Rare marine species in Thailand that is available in this report on the status and distribution.

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

There are five species of sea turtles found distributed in Thailand:

- Green turtle (*Chelonia mydas*)
- Hawksbill turtle (*Eretmochelys imbricata*)
- Olive ridley turtle (*Lepidochelys olivacea*)
- Leatherback turtle (*Dermochelys coriacea*)
- Loggerhead turtle (*Caretta*)

**Dugong** (*Dugong dugon*) is the only species found in Thailand, predominantly inhabiting seagrass areas in both the Gulf of Thailand and Andaman Sea.

**Dolphins and Whales** Currently, 27 species of whales and dolphins have been found in Thailand. This is divided into groups of dolphins and whales that living close to shore (Residence/Nearshore) and populations living off the coast that migrate long distances (Migratory/Offshore). There are dolphin and whale species that are studied in terms of their

status, and population estimation. The spread is limited into 5 species of population near the coast as follow:

- Indo-Pacific Bottlenose dolphin (*Tursiops aduncus*)
- Finless porpoise (*Neophocaena phocaenoides*)
- Indo-Pacific Humpback dolphin (*Sousa chinensis*)
- Irrawaddy dolphin (*Orcaella brevirostris*)
- Bryde's whale (*Balaenoptera edeni*)

As for the group of 22 other species of dolphins and whales, most were reported sightings in nature and very little was found from the survey because it is a population that lives far from the coast and migrates long distances. The species as follow:

- Pantropical spotted dolphin (*Stenella attenuata*)
- Striped dolphin (*Stenella coeruleoalba*)
- Spinner dolphin (*Stenella longirostris*)
- Omura's whale (*Balaenoptera omurai*)
- Blue whale (*Balaenoptera musculus*)
- Fin whale (*Balaenoptera physalus*)
- Humpback whale (*Megaptera novaeangliae*)
- Sperm whale (*Physeter macrocephalus*)
- Pygmy sperm whale (*Kogia breviceps*)
- Dwarf sperm whale (*Kogia sima*)
- Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*)
- Cuvier's beaked whale (*Ziphius cavirostris*)
- Blainville's beaked whale (*Mesoplodon densirostris*)
- Killer whale (*Orcinus orca*)
- Short-finned pilot whale (*Globicephala macrorhynchus*)
- False killer whale (*Pseudorca crassidens*)
- Pygmy killer whale (*Feresa attenuata*)
- Melon-headed whale (*Peponocephala electra*)

- Rough-toothed dolphin (*Steno bredanensis*)
- Fraser's dolphin (*Lagenodelphis hosei*)
- Risso's dolphin (*Grampus griseus*)
- Long-beaked common dolphin (*Delphinus capensis*)

**Cartilaginous fish Group:** There are two species that have been studied in terms of status and distribution and are frequently seen in important dive sites as follow:

- Whale shark (*Rhincodon typus*)
- *Manta rays*

### Rare marine animal's status

- **Sea turtles**

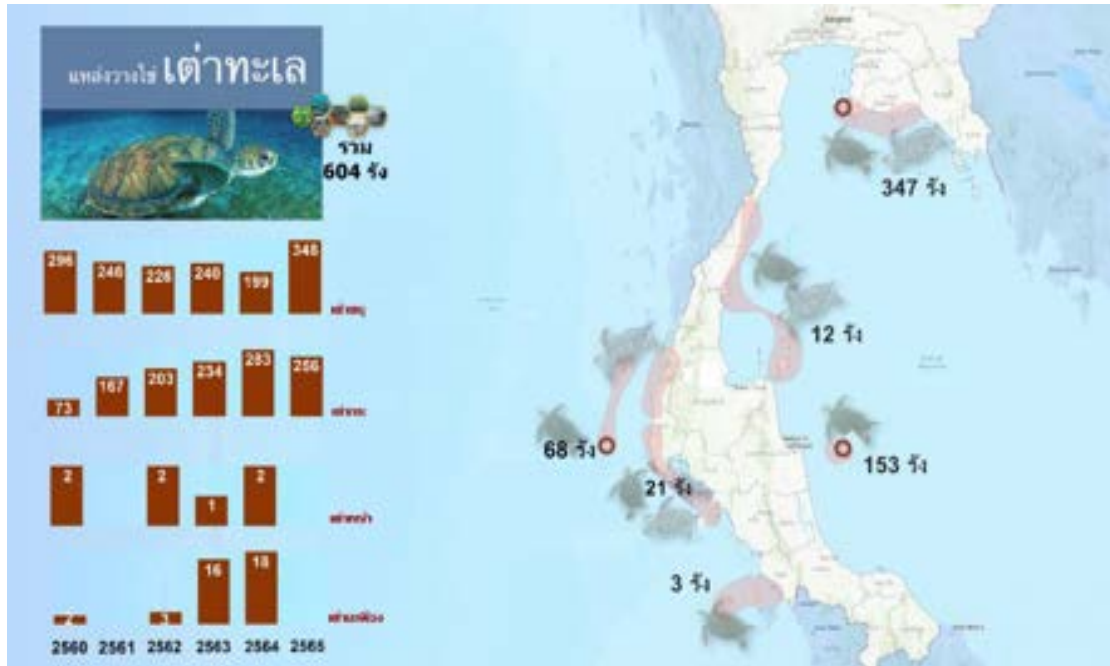
Sea turtle egg-laying information from 2022 (data as of July 2022) indicated the discovery of 604 instances of sea turtle egg-laying. This consisted of 348 green turtle nests and 256 Hawksbill turtle nests. There were no sightings of Olive ridley turtles or leatherback turtles laying eggs. The primary nesting grounds for sea turtles in the Gulf of Thailand were identified at Ko Kram Island, Chonburi province, and Koh Kra Island, Nakhon Si Thammarat province. In the Andaman Sea, nesting areas were observed at the Similan Islands in Phang Nga Province (refer to Figure 2). Comparing the recent egg-laying data with the records of the past five years, it was observed that:

- In 2017, 373 sea turtles were recorded laying eggs (296 Green turtle nests, 73 Hawksbill turtle nests, 2 Olive ridley turtle nests, and 2 Leatherback turtle nests).
- In 2018, 413 sea turtles were recorded laying eggs (246 Green turtle nests, 167 Hawksbill turtle nests; no Olive ridley or Leatherback turtle nests were found).
- In 2019, 434 sea turtles were observed laying eggs (226 Green turtle nests, 203 Hawksbill turtle nests, 2 Olive ridley turtle nests, and 3 Leatherback turtle nests).

- In 2020, a total of 491 sea turtles were recorded laying eggs (240 Green turtle nests, 234 Hawksbill turtle nests, 1 Olive ridley turtle nest, and 16 Leatherback turtle nests).
- In 2021, 502 sea turtle nests were discovered with egg-laying activity (199 Green turtle nests, 283 Hawksbill turtle nests, 2 Olive ridley turtle nests, and 18 Leatherback turtle nests).

Analysis of the data suggests that Green Turtles and Hawksbill turtles are observed laying eggs on both mainland and island beaches in both the Gulf of Thailand and the Andaman Sea. There appears to be an increasing trend in the number of times Hawksbill turtles are observed spawning, while Green turtles show a declining trend. As for Leatherback turtles and Olive ridley turtles, their egg-laying activities were observed solely on mainland beaches in the Andaman Sea. Olive ridley turtles exhibited minimal egg-laying, with only 1 - 2 nests per year, and a tendency towards a decrease in egg-laying activities. On the other hand, between 2020 and 2021, Leatherback turtles exhibited an increasing trend in egg-laying. In 2022, however, no instances of Leatherback turtles laying eggs were reported. This could possibly be attributed to the characteristic behavior of Leatherback Turtles, which tend to return to lay eggs every 3 - 5 years (Shanker et al., 2003).





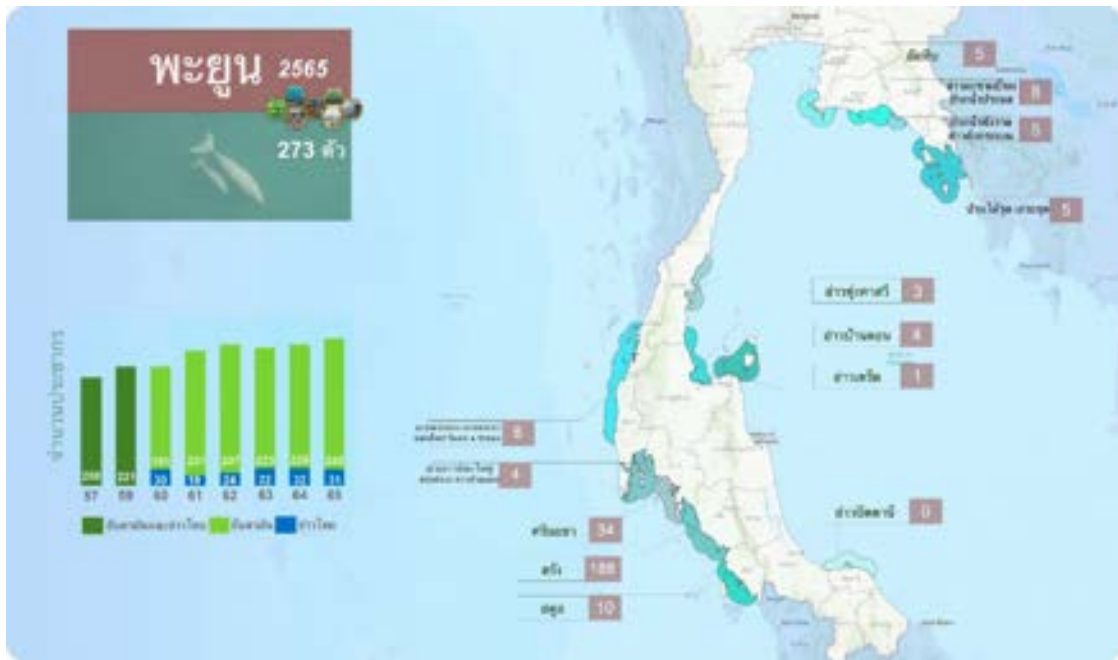
**Figure 2** Statistics on the number of eggs laid by each species of sea turtle over the past 6 years (left picture). Number and spawning areas of Green turtles and Hawksbill turtles in the fiscal year 2022, the dark dots are the main egg-laying areas (right picture).

**Source:** Report on the situation of marine and coastal resources and coastal erosion of the Country in 2022.

- **Dugongs**

Dugongs are distributed in seagrass areas on both the western and eastern coasts of Thailand. Trang Province is the largest dugong population in Thailand. In fiscal year 2022, a survey found 273 dugongs, 31 dugongs found in the Gulf of Thailand area, and in the Andaman Sea 242 were found. When compared to past data, the trend of changes in the dugong population was found in 2 periods. The first period was between 2007 and 2014 and the dugong population tended to decrease. It was found that the number of dugongs on both the Gulf of Thailand and Andaman Sea coasts decreased from 240 to 200 in 2014. For the second period, the dugong population is trending in an increasing direction. In 2016 - 2017, a total of 221 dugongs were found. The increasing in 2018 was to 250 and increasing to 261 in 2019. Although the survey in 2020, the number of dugongs found decreased to 255, but in 2021, the dugong population is estimated to be 261 with 32 dugongs

found on the Gulf of Thailand and 229 on the Andaman side. There is the remark in 2021 that due to the outbreak of coronavirus disease (COVID-19), it was not possible to survey a dugong in the area of Trang Province, the source of the largest dugong population in Thailand. However, the population estimation method is implemented by evaluating the past survey date together with spread area.



**Figure 3** Number of dugongs found per year in Thailand, 2014 - 2022 (left picture), distribution area and number of dugongs in Thailand, fiscal year 2022 (right picture).

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

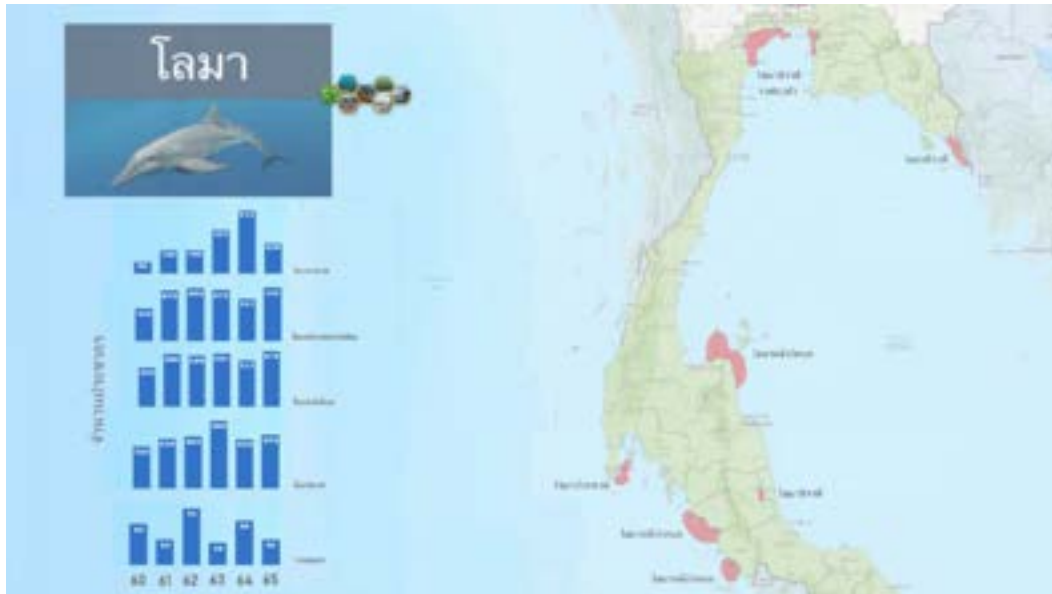
- **Dolphins and whales**

Dolphins and whales are estimated by the population, and the distribution. There are 5 species focus on nearshore populations: Indo-Pacific Bottlenose dolphin, Finless porpoise dolphin, Indo-Pacific Humpback dolphin, Irrawaddy dolphin, and Bryde's whale. In 2022, a survey could be made to assess the population of 2,310 dolphins and whales in important areas (hot spots). The species with the highest number was the Finless porpoise dolphin at 30.5 percent, followed by the Irrawaddy dolphin at 29.4 percent, the Indo-Pacific Humpback

dolphin at 26.7 percent, Indo-Pacific Bottlenose dolphin at 10.8 percent and Bryde's whale at 2.6 percent. When comparing data from the past five years, it was found that the Finless porpoise and Irrawaddy dolphin were the most numerous species, followed by the Indo-Pacific Humpback dolphin, Indo-Pacific Bottlenose dolphin, and Bryde's whale, respectively.

Dolphins and whales in close to shore, despite surveys and reported sightings in both the Gulf of Thailand and Andaman, but there are important areas (hot spots) for each species of dolphin and whale. The Irrawaddy dolphin was found in the area of Trat Bay, the upper Gulf of Thailand, also in Songkhla Lake. The Indo-Pacific Bottlenose dolphin was found around Surin-Similan Island, Phang Nga Province and Maiton Island Phuket Province. Indo-Pacific Humpback dolphins was found some areas and seasons in the Khanom Bay area (Nakhon Si Thammarat Province), Don Sak Bay (Surat Thani Province), Tase bay- Koh Libong (Trang Province), Koh Sarai - Koh Puyu (Satun Province), The Finless porpoise is a species found along the Gulf of Thailand coast from Trat province - Pattani Province, including the Andaman side from Phang Nga Province - Satun Province. The Bryde's whales have an Important area (hotspot) in the upper Gulf of Thailand and was found in certain seasons in the central Gulf of Thailand.

The populations of all five species of dolphins and whales are likely to increase between 2017 and 2020. Dolphin and whale population estimates were highest in 2020 due to a high frequency of surveys due to budget factors and decreased in 2021 due to the outbreak of the coronavirus (COVID-19), which was not possible full field exploration. For offshore populations of dolphins and whales migrate over long distances, most of them are reports of sightings in nature which were not found from the surveys. The status or population information will be based on the data of that type of dolphin and whale at the regional or global level.

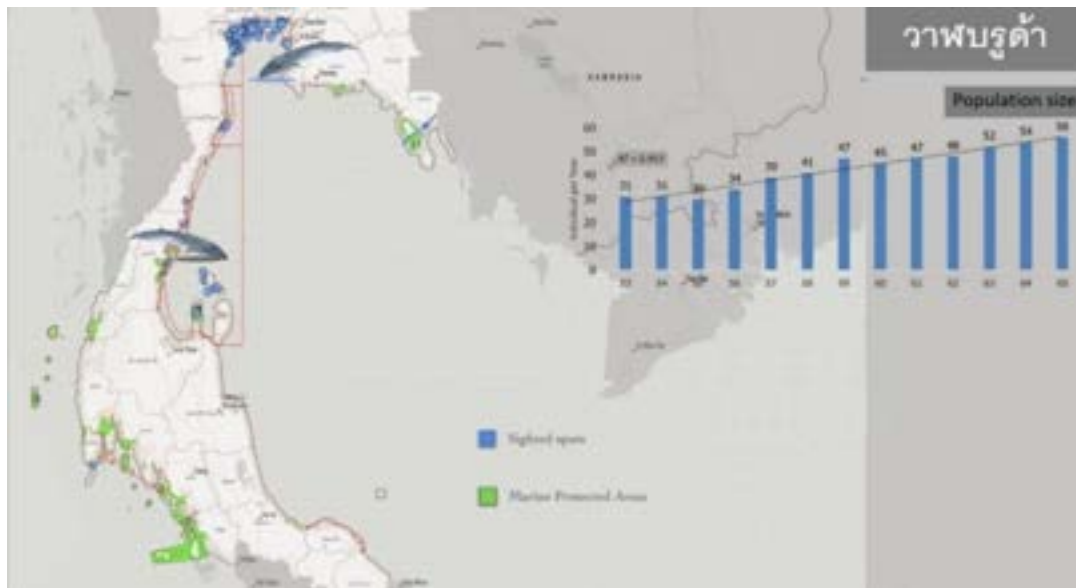


**Figure 4** The number of dolphins and whales nearshore, fiscal year 2017 - 2022 (left picture) and hotspot areas (pink areas) of nearshore dolphins and whales (right picture)

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

For surveying Bryde's whales, the main population found in the Gulf of Thailand, especially the upper Gulf of Thailand in Samut Prakan Province, Bangkok, Samut Sakhon Province, Samut Songkhram Province, and Phetchaburi Province. In addition, some seasons have spread to the central Gulf of Thailand, Chumphon Province, Surat Thani Province.

In the fiscal year 2022, 56 unique can be identified and the trend of Bryde's whale's population in the Gulf of Thailand is increased. From data 2010 – 2022, It was found that the birth rate is approximately 10.09 percent (5 animals/year) and the death rate was approximately 5.08 percent (3 animals/year). On the Andaman Sea side, the Bryde's whales was found in Phang Nga Province and Phuket Province.



**Figure 5** Number of Bryde's whales that have been identified from fiscal year 2010 - 2022 (right picture). Area of distribution of Bryde's whales (left picture)

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

- **Cartilaginous fish**

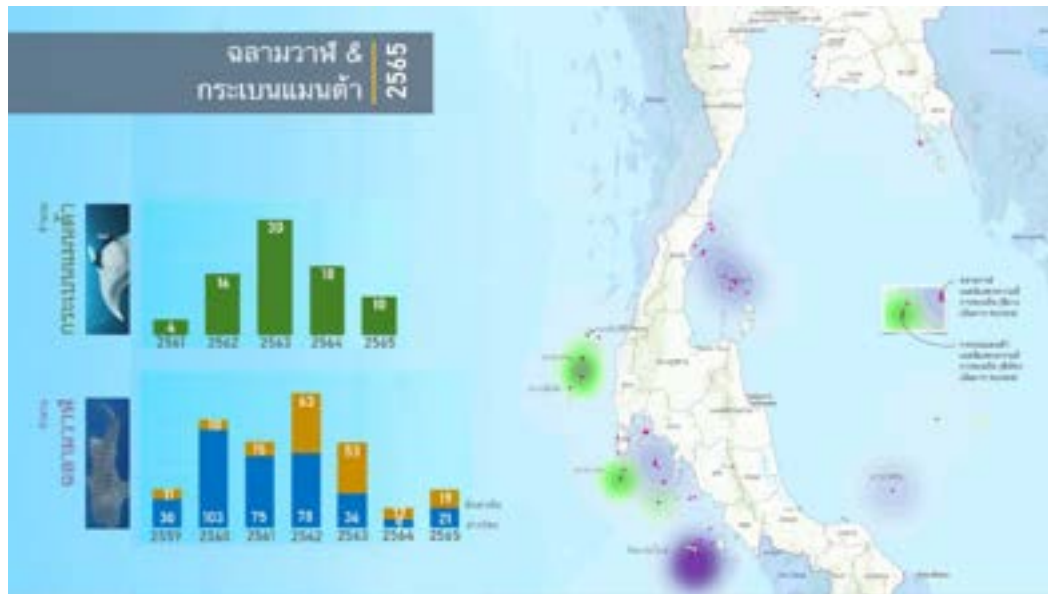
Cartilaginous fish are studied in terms of status, classification of individual identities and distribution. There are two types: whale shark and manta ray. Whale sharks are frequently seen in Thailand's important dive sites. Whale shark surveys rely heavily on a network of divers to report on the whale shark, including collecting information from social media to classify the identity of whale sharks.

In 2022 (information as of July 2022), 40 whale sharks were found, 21 on the Gulf of Thailand side and 19 on the Andaman Sea side. The area where whale sharks are most often found on the Andaman Sea side is “the scuba diving rocket point 8 Mile” in Satun Province, followed by Riseriu Rock in Phang Nga Province and Koh Ha in Krabi Province. For the Gulf of Thailand coast, the province where whale sharks are most frequently found is Surat Thani Province at Hin Bai deep dive site, followed by Kong Hin and Ngam Noi Island in Chumphon Province, respectively. From past data record, it was found that the spread of whale sharks can be found

throughout the year in both the Gulf of Thailand and the Andaman Sea. It has been seen along the coast and on islands in almost every province along the Gulf of Thailand from the eastern Gulf of Thailand (Chonburi Province, Rayong Province, Chanthaburi Province, Trat Province), Upper Gulf of Thailand (Samut Sakhon Province Phetchaburi Province) Central Gulf of Thailand (Prachuap Khiri Khan Province, Chumphon Province, Surat Thani Province), lower Gulf of Thailand (Nakhon Si Thammarat Province, Songkhla Province, Pattani Province Narathiwat Province). For the Andaman Sea, whale sharks can be found along the coast and islands from the upper Andaman (Ranong Province, Phang Nga Province, Phuket Province) to the lower Andaman (Krabi Province, Trang Province, Satun Province).

The trend of changing to the whale shark population is divided into two periods: between 2016 - 2019, there is a trend of the population increasing from 41 to 141 individuals, and in the second period, the whale shark population tends to decrease. In 2020 - 2022, it was founded whale shark populations were 89, 21, and 40, respectively. This is because the whale shark population relies mainly on information gathered from sightings and online media from diving networks and in the second period (2020 - 2022), during the outbreak of the coronavirus (COVID-19), tourists decreased and therefore received less information about whale sharks from data on repeated sightings between 2016 and 2022, there were an average of  $5 \pm 2.9$  repeated whale shark sightings per year.

Manta ray fish are more commonly seen in the Andaman Sea than in the Gulf of Thailand. Although getting proper photos of the belly of the Manta ray fish to classify their unique identity is quite difficult but this can be done in 2021. The data can distinguish the identity of Manta fish. There were 18 Manta ray fish found on the Andaman Sea coast, and in 2022 (information as of July 2022) the identities of 10 Manta ray fish were identified. All information was found on the Andaman Sea coast and mostly often found around Koh Bon in Phang Nga Province.



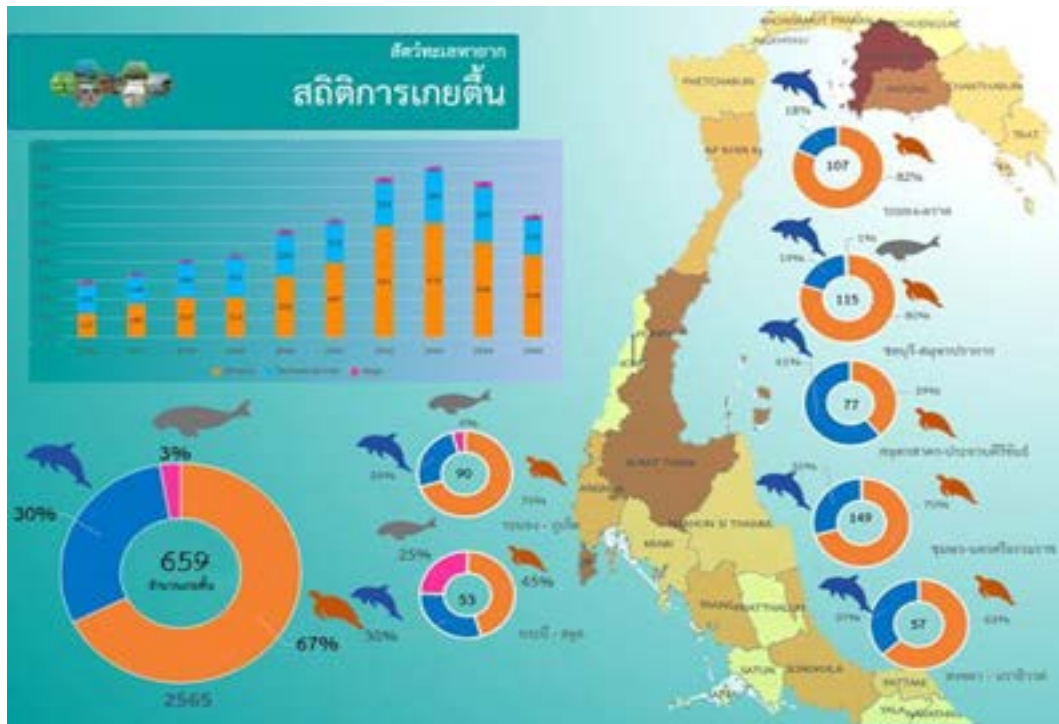
**Figure 6** Number of identifiable whale sharks and manta rays in Thailand, 2016 - 2022 (left picture) and Distribution of whale sharks and manta rays in 2022 (right picture).

**Source:** Report on the situation of marine and coastal resources and coastal erosion of the Country in 2022.

**Rare marine animals stranded.**

The Statistics on stranding of rare marine animals in fiscal year 2022 (data as of September 2022) found 659 stranding, including 438 sea turtles (67 percent), 192 dolphins and whales (30 percent), dugongs 18 (3 percent), also 9 whale sharks and 2 manta rays were stranded. When comparing the statistics of stranding of rare marine animals in 3 main groups: sea turtles, dugongs, dolphins, and whales over the past 10 fiscal years, a total of 5,900 stranded animals were found (representing an average of 590±220 animals per year). From fiscal year 2013 - 2020, there has been a trend of stranding continuously increasing. The highest number of stranding of rare marine animals was found in fiscal year 2020 (905 times) and decreased in fiscal years 2021 - 2022. However, in the future, it is expected that each year, there may be an increased trend of rare marine animals stranding due to quality deterioration environment, including naturally occurring risk factors and human exploitation of marine activities. Moreover, due to advances in communication, it is convenient to report information about stranding

more quickly, and there is increasing awareness of coastal communities as well.



**Figure 7** Stranding of rare marine animals in groups of sea turtles, dugongs, dolphins, and whales from fiscal year 2013-2022 (top left picture), Proportion of stranding of rare marine animals by group, fiscal year 2022 (bottom left picture) and Proportion of stranding of rare marine animals classified according to the area of responsibility of the Marine and Coastal Resources Research Center in fiscal year 2022 (right picture)

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

Stranding condition

Most of the rare marine animals found stranded in the fiscal year 2022 were already dead when the stranding was reported. Dugongs accounted for 89 percent of stranding that resulted in death or carcass. Dolphins and whales accounted for 93 percent of stranding that resulted in death or carcass. Sea turtles accounted 54 percent of stranding that resulted in deaths or carcass. However, 46 percent were stranded alive



for the group of cartilaginous fish. Most of alive condition from stranding are whale sharks with 89 percent and manta rays with 100 percent respectively

### **Stranding of dugongs**

In fiscal year 2022 (data as of September 2022), 18 dugongs were stranded, 16 of which were stranded dead (89 percent). 2 dugongs were stranded alive (11 percent) and able to rescue and release them back into the wild. There were 7 dugongs stranded for unknown reasons due to decomposed carcasses (39 percent), and 11 causes could be identified (61 percent). The number that could be identified was found that the majority of stranding due to illness for 8 dugongs (73 percent). The stranding caused by fishing equipment, including 1 (9 percent) having a crab rope wrapped around its tail, 1 was ill from ate marine garbage (9 percent), and 1 marine accident (9 percent). The rate of stranding due to illness having a trend of increasing from 2021. When considering the stranding statistics of dugongs over the 10 fiscal years, a total of 165 dugongs were stranded representing an average of  $17 \pm 6$  dugongs per year, The stranding in fiscal year 2022 decreased compared to Fiscal year 2021.

### **Stranding of dolphins and whales**

In fiscal year 2022 (data as of September 2022), 192 dolphins and whales were found stranded, 178 stranding with dead or carcass (93 percent), and 14 were stranded alive (7 percent). 7 dolphins and whales were successfully rescued and released back into the wild (50 percent), and 7 died during treatment (50 percent). Stranding of dolphins and whales mostly had an unknown cause due to the decomposed condition of 124 carcasses (65 percent), and the cause could be determined for 68 (35 percent). Most of them were caused by disease 23 (34 percent). 12 were suspected to be from fishing gear (18 percent) and 9 were seriously hit (13 percent). The 6 causes were from fishing gear (9 percent), and 18 from other causes (26 percent) such as, lost direction, marine debris, etc. The cause of stranding from illness tends to decrease while the cause of marine garbage is likely to increase from fiscal year 2021. The

statistics on stranding of dolphins and whales over the past 10 fiscal years found a total of 2,138 dolphins and whales stranded, representing an average of  $214 \pm 49$  per year, with a trend of increasing from 2013 - 2021 and decreasing in 2022.

### **Sea turtle stranding**

In fiscal year 2022 (data as of September 2022), 438 sea turtles were found stranded, of which 237 died or carcass (54 percent) and 201 were stranded alive (46 percent). For the sea turtles stranded, the cause of the majority was unknown due to the decomposed condition of the carcass by 182 cases (42 percent). The 256 causes (58 percent) can identify the cause as follow. The stranding could be determined that the majority were caused by marine trash with 85 cases (33 percent). 81 cases (32 percent) were stranded due to illness. and 37 cases (14 percent) were caused by fishing gear. The fishing gear that most often affects sea turtles is the tools such as nets, hooks, and lures, and also caused by other causes such as boat accidents, illness associated with marine trash and 53 cases lost directions (21 percent). The statistics of sea turtle stranding over the past 10 fiscal years showed a total of 3,597 sea turtles stranded, representing an average of  $360 \pm 175$  sea turtles per year, with a trend of increasing continuously between 2013 - 2020 and beginning to decrease in year 2021 and year 2022.

### **Stranding of cartilaginous fish**

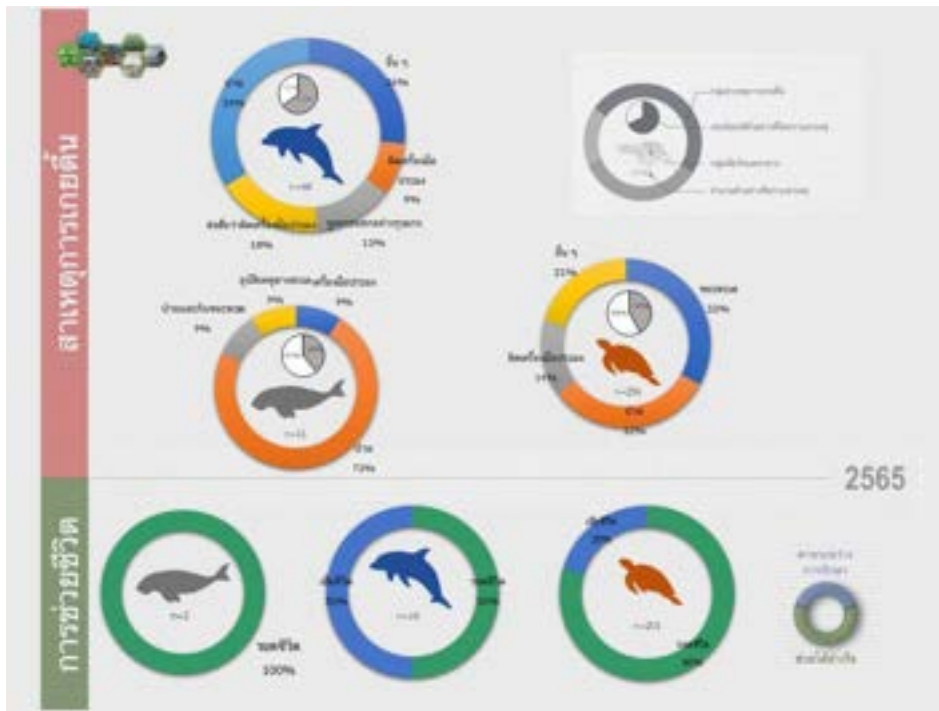
In fiscal year 2022 (information as of September 2022), 9 whale sharks were found stranded, 1 dead (11 percent), and 8 alive (89 percent). All 8 found alive were able to rescue and successfully released back into the wild. The cause of the whale shark's stranding was mostly by fishing gear (8 whale sharks), and the cause is unknown due to the decomposed condition of 1 carcass. The fishing gear that often affects whale sharks is purse seine For 2 cases of Manta ray stingrays, they were found stranded alive. Both were successfully rescued and released back into nature. The cause of the stranding was marine trash in the form of a rope tied around the body.

### **Saving rare marine animals stranded**

Department of Marine and Coastal Resources is giving the first priority to rescuing rare marine animals stranded by setting up a rare Marine animal rescue center which has veterinary personnel marine academic, and medical equipment, total 7 locations covering the entire coastal area of Thailand. The work to rescue rare marine animals operate with the marine and coastal network more than 1,000 people which has completed a training course on basic rare marine animal rescue.

In the data record based on statistics on saving rare marine animals from the past 5 years, fiscal year 2018 – 2022 was found that the groups of sea turtles were stranded alive and received nursing care at a rehabilitation center of the Department of Marine and Coastal Resources with average of survival rate 90 percent while groups of dolphins and whales had an average of survival rate 50 percent and dugongs have an average of survival rate 55 percent.

For fiscal year 2022 (data as of September 2022), 201 stranded alive sea turtles were found, with a survival rate of 80 percent from rescue and medical treatment. In the group of dolphins and whales, there were 14 stranded alive, with a rate of survived by rescued and medical treatment, 50 percent For 2 dugongs found stranding alive, both were able to be rescued (100 percent), including 8 whale sharks and 2 Manta rays stranding alive. All was able to be rescued and released back into nature (100 percent).



**Figure 8** Causes of stranding of rare marine animals in fiscal year 2022 (upper picture) and results of saving rare marine animals' lives in fiscal year 2022 (lower picture)

**Source:** Report on the situation of marine and coastal resources of the Country in 2022.

**Measures and plans for managing marine and coastal resources (short term 1 – 2 years)**

Issues	Operational
1. Marine pollution and marine trash	1) Integrated management of pollution sources: 1.1 The source with a definite origin (Point Sources) include community, industrial plants, hotels, 2.2 The source with an uncertain origin (Non-Point Source) such as agriculture, etc., 2) Integrated waste management from

	the origin source.
2. Marine protected areas and spatial planning	Accelerating the announcement of marine protected areas as well as accelerating the implementation of spatial planning of Thailand's seas.
3. Coastal erosion	Accelerate the solution of coastal erosion problems in an integrated manner at the provincial and area levels.
4. Sustainable marine management through participatory processes	Create a mechanism for participation of communities and local government organizations in managing marine and coastal resources.

### Measures and plans for managing marine and coastal resources (medium term 3 – 5 years)

Measures	Plans
1. Create knowledge and follow up on changes in resource status	Research, monitor changes, evaluate recovery and prepare media
2. Promote participation of citizens and the business sector	Establish a network, provide knowledge, awareness, and support activities create a community agreement
3. Protecting and monitoring marine and coastal resources for sustainable utilization	Inspect and monitor the area, create boundary lines, place mooring buoys, create artificial reefs, prosecute cases, and delimit space utilization areas
4. Restoring marine and coastal resources	Plant coral, seagrass and mangroves, restore sandy beaches and coastal dunes. Rescuing rare marine animals and placement of artificial corals
5. Protecting, monitoring and promoting the reduction of impacts from land and islands	Utilize the mechanisms stipulated in Articles 12 and 13 of the Provincial Marine and Coastal Resources Commission to express opinions on the impact of land activities and

Measures	Plans
	islands, such as garbage, wastewater, and sediment, on marine and coastal resources at the local level through reporting and regional management plans.
6. Announcement of conservation area and protect marine and coastal resources	Establish marine protected areas under the management of the Department of Marine and Coastal Resources, Department of National Parks, Wildlife and Plant Conservation, Department of Fisheries, and the Office of Natural Resources and Environmental Policy and Planning, both by law, community agreement, or any other effective means of conservation.
7. Improving relevant regulations	<ul style="list-style-type: none"> <li>- Prepare guidelines for staff and volunteers</li> <li>- Prepare a seaside city plan and management in the beach cluster system</li> <li>- Inhibiting projects that create impacts on the coast</li> </ul>
8. International cooperation	Support and participate in activities with international cooperation organizations

## Consultation with stakeholder to improve current fisheries practice.

The workshop on the development of guidelines  
for the treatment of rare marine animals during fishing  
At Mae Klong Fisheries Cooperative,  
Mae Klong Subdistrict, Samut Songkhram Province  
On Wednesday, June 19<sup>th</sup>, 2024, from 10:00 AM. to 12:00 PM.

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**Participants:** List of stakeholders sending the representative participated in the workshop

- ⊕ Thai Feed Mill Association (3)
- ⊕ Thai Fisheries Association (2)
- ⊕ Thai Fishmeal Producers Association (1)
- ⊕ Thai Shrimp Association (1)
- ⊕ Department of Fisheries (12)
- ⊕ Speakers (2)
  1. Senior Expert Fisheries Academic, Department of Fisheries
  2. Veterinarian Practitioner, DMCR
- ⊕ Thai Sustainable Fisheries Roundtable Working Group (TSFR) (1)
- ⊕ Trawler Fishermen
  1. President of Prachuap Khiri Khan Fisheries Association (1)
  2. Samut Songkhram Fisheries Association (1)
  3. Samut Songkhram Fisheries Association (Chok Thavorn Sap Vessel)
  4. Samut Songkhram Pair Trawler Fisheries Association (1)
  5. Mae Klong Fisheries Cooperative Ltd. (4)
  6. Wichet Prasob Chok Vessel
  7. Fishing Vessel Operators (7)
  8. Otter Board Trawler Vessel (7)
  9. Pair Trawler Vessel (4)
- ⊕ Online Participants (10)

**Objective:** To present guidelines and manual for the treatment of rare marine animals during fishing and the recording of encounters with rare marine animals, in order to prevent and mitigate impacts on these species for fishing vessels.

**Mr. Piyachoke Sinanan, Senior Expert Fisheries Academic of the Fisheries Inspection and Aquatic Animal Products Division, Department of Fisheries,** presented the guidelines and procedures for fishermen to follow when encountering rare marine animals during fishing activities. He proposed that fishermen should report sightings of rare marine animals to local authorities for inspection and record the encounters in their logbooks. However, while fishermen do not object to reporting and recording sightings of rare marine animals, they raised a concern to the Department of Fisheries. In some cases, fishermen who found and brought rare marine animal carcasses onboard were prosecuted by the Department of Fisheries. This has discouraged fishermen from reporting sightings of rare marine animals.

The Department of Fisheries added that the Fisheries Department Regulation had been issued on Reporting the Rescue of Abandoned, Injured, Sick, or Weak Protected Wildlife, Protected Breeding Wildlife, and Controlled Wildlife, B.E. 2563 (2020) to protect fishermen in these circumstances. However, the fishermen reported that they were unaware of this regulation. They requested that the Department of Fisheries inform fishermen and relevant agencies about it. The fisheries officers acknowledged the fishermen's concerns and will discuss this matter further at the policy level.





**The veterinarian practitioner from the Department of Marine and Coastal Resources** explained to the fishermen the different species of rare marine animals and the initial steps to take when encountering stranded or entangled rare marine animals.



The TSFR working group announced that following this meeting, they would incorporate the feedback into the guidelines for rescuing rare marine animals in collaboration with the Department of Fisheries and the Department of Marine and Coastal Resources. Additionally, they plan to design a method for recording sightings of rare marine animals and pilot this method with five trawlers that wish to participate in the project.



## The Manual how to protect and help rare marine animals during fishing



## Contents

1. Fishing Information
2. Number of vessels/classified by vessel size, types of fishing gears, fishing area.
3. Types of rare marine animals found in Thai waters.
4. How to protect and help rare marine animals during fishing.
  - a. Sea Turtle
  - b. Whales and dolphins
  - c. Whale Shark
5. Recording and reporting rare marine animals

## **Commercial fishing information is classified by type of fishing gear.**

### 1. Fishing gears, trawl nets

There are 3 types of fishing vessels that use trawl nets: Bottom Otter Trawls Vessel or Bottom Single Trawls, Bottom Pair Trawls Vessel, Beam Trawls Vessel. In 2022, there was a total catch of saltwater animals of 504,761 tons, accounting for 50.12 % of the total quantity of saltwater animals. The number of saltwater animals caught from Bottom Pair Trawls was 309,307 tons (61.28 %), followed by the number of saltwater animals caught from Bottom Otter Trawls or bottom single trawls, 183,196 tons (36.29 %). And the number of saltwater animals caught from beam trawls was 12,258 tons (2.43 %).

When considering the amount of catch of saltwater animals classified by fishing source, it was found that the number of saltwater animals caught in the Gulf of Thailand was 373,762 tons (74.05 %) and the number of saltwater animals caught in the Indian Ocean was 130,999 tons (25.95 %). And if we consider the amount of catching saltwater animals classified by group of aquatic animals, it is found that most were catch fish, 253,320 tons (50.19 %), followed by aquatic animals such as fish, 196,706 tons (38.97 %) that most of which are ground fish such as sea bream, sharp-lipped fish, big-eyed fish, white sand fish, etc. Aquatic animals such as squid, 37,343 tons (7.40 %), Shrimp 12,405 tons (2.46 %), Crabs 3,312 tons (0.65 %), Shellfish 1,592 tons (0.31 %), and Other aquatic animals 83 tons (0.02 %).

### Quantity of saltwater animals caught from Trawl Nets in 2022

Quantity : Tons

Fishing Gear	Total		Gulf of Thailand		Andaman	
	Quantity	%	Quantity	%	Quantity	%
Total of Trawl Nets	504,761	100.00	373,762	74.05	130,999	25.95
Bottom Otter Trawls	183,196	36.30	122,074	24.19	61,122	12.11
Bottom Pair Trawls	309,307	61.27	239,430	47.43	69,877	13.84
Beam Trawls	12,258	2.43	12,258	2.43	-	-

## 2. Fishing gears, Surrounding Nets

Fishing vessels that fish with Surrounding Nets consist of 2 types: Surrounding nets fishing vessel and Anchovy Surrounding nets fishing vessel. In 2022, there was a total catch of saltwater animals of 347,999 tons, accounting for 34.55 % of the total quantity of saltwater animals. The number of saltwater animals caught from surrounding nets fishing gear was 286,061 tons (82.20 %), followed by the number of saltwater animals caught from Anchovy surrounding nets fishing gear, which was 61,938 tons (17.80 %).

When considering the amount of catch of saltwater animals classified by fishing source, it was found that the number of saltwater animals caught in the Gulf of Thailand was 244,670 tons (70.31 %) and the number of saltwater animals caught in the Indian Ocean was 103,329 tons (29.69 %). And if we consider the amount of catching saltwater animals classified by group of aquatic animals, it is found that most of them are fish, 287,810 tons (82.70 percent), which are mostly surface fish such as anchovies, greenback fish, mackerel, black pomfret, indian mackerel, etc. Followed by by-catch fish, 55,530 tons (15.96 %), aquatic animals such as squid, 4,649 tons (1.34 %). The rest is shrimp and other aquatic animals, 10 tons (0.002 %).

## Quantity of saltwater animals caught from Surrounding Nets in 2022

Quantity : Tons

Fishing Gear	Total		Gulf of Thailand		Andaman	
	Quantity	%	Quantity	%	Quantity	%
Total of Trawl Nets	347,999	100.00	244,670	70.31	103,329	29.69
Surrounding nets	286,061	82.20	186,419	53.57	99,642	28.63
Anchovy Surrounding nets	61,938	17.80	58,251	16.74	3,687	1.06

### 3. Fishing gears, Trap

There are 4 types of fishing vessels that use trap fishing gear: Squid trap vessel, Octopus trap vessel, Fish trap vessel, and Crab trap vessel. In 2022, there was a total catch of saltwater animals of 11,368 tons, accounting for 1.13 % of the total amount of saltwater animals. It is the amount of catch of saltwater animals from fish trap, 4,465 tons (39.28 %), followed by the number of saltwater animals caught from octopus trap, 3,823 tons (33.63 %). The number of saltwater animals caught from crab trap was 2,497 tons (21.97 %), and the number of saltwater animals caught from squid trap was 583 tons (5.13 %).

When considering the amount of catch of saltwater animals classified by fishing source, it was found that the number of saltwater animals caught in the Gulf of Thailand was 10,569 tons (92.97 %), and the number of saltwater animals caught in the Indian Ocean was 799 tons (7.03 %). And if we consider the amount of catching saltwater animals by group of aquatic animals, it is found that most were aquatic animals such as squid, 4,406 tons (38.75 %), followed by fish with 4,293 tons (37.77 %), most of which are ground fish such as sea bream, grouper, red snapper, white sea bream, etc. Aquatic animals such as crabs 2,497 tons (21.97 %) and catch fish 172 tons (1.51 %).

## Quantity of saltwater animals caught from Trap in 2022

Quantity : Tons

Fishing Gear	Total		Gulf of Thailand		Andaman	
	Quantity	%	Quantity	%	Quantity	%
Total of Traps	11,368	100.00	10,569	92.97	799	7.03
Squid Trap	583	5.13	336	2.96	247	2.17
Octopus Trap	3,823	33.63	3,820	33.60	3	0.03
Fish Trap	4,465	39.28	3,973	34.95	492	4.33
Crab Trap	2,497	21.96	2,440	21.46	57	0.50

## 4. Fishing gear, Gillnets/ Trammel nets and Entangling nets

Amount of catch of saltwater animals by fishing vessels using fishing gear of the following types: Gillnets/Trammel nets/Entangling nets. In 2022, there will be a total of 25,579 tons, accounting for 2.54 % of the total amount of saltwater animals. When considering the catch of saltwater animals classified by fishing source, it was found that the number of saltwater animals caught in the Gulf of Thailand was 25,493 tons (99.66 %), and the number of saltwater animals caught in the Indian Ocean was 86 tons (0.34 %). And if we consider the amount of catching saltwater animals by group of aquatic animals, it is found that most of them are fish, 23,677 tons (92.56 %), followed by duck fish, 929 tons (3.63 %), crabs 894 tons (3.50 %), Shrimp 51 tons (0.20 %), shellfish 21 tons (0.08 %), and squid 7 tons (0.03 %).

## Quantity of saltwater animals caught from Gillnets/ Trammel nets and Entangling nets in 2022

Quantity : Tons

Fishing Gear	Total		Gulf of Thailand		Andaman	
	Quantity	%	Quantity	%	Quantity	%
Gillnets/ Trammel nets and Entangling nets	25,579	100.00	25,493	99.66	86	0.34

## Data on sightings of rare marine animals by trawl fishing vessels in 2023

Information on sightings of rare marine animals is collected from logbooks recorded in the Department of Fisheries' electronic reporting system database (Thai Flagged Catch Certification System: TFCC). In 2022, there were 24,280 fishing trips by trawl vessels, indicating rare marine animals were seen on 42 trips from a total of 17 trawlers. The information can be summarized as follows:

Fishing Gear	Rare marine animals				Total (Times)
	Turtles	Dolphin	Whale Shark	Whale	
Bottom Pair Trawls	1	29	1	2	33
Bottom Otter Trawls	1	10	-	1	12
<b>Total</b>	<b>2</b>	<b>39</b>	<b>1</b>	<b>3</b>	<b>45</b>

Number of vessels/classified by vessel size, type of fishing gear, fishing areas.

### Types of Rare marine animals found in Thai waters

Wild Animal Preservation and Protection Act 2019 on 29 May 2019, it has been announced that 3 types of marine mammals include: Dugong or water pig (*Dugong dugon*), Bryde's Whale (*Balaenoptera edeni*), and Omura's whale (*Balaenoptera omurai*). They are a protected wild animal in the group of wild mammals. Another 21 species of whales and dolphins have been declared protected species in the mammalian wildlife category. According to the Ministerial Regulation, certain types of wild animals are protected wild animals, B.E. 2003. There are another 5 species of marine mammals that are not yet listed as protected or protected wildlife under Thai law: blue whales, humpback whales, Blaineville whales, minke whales, and Risso's dolphins. List of marine mammals found in Thai waters

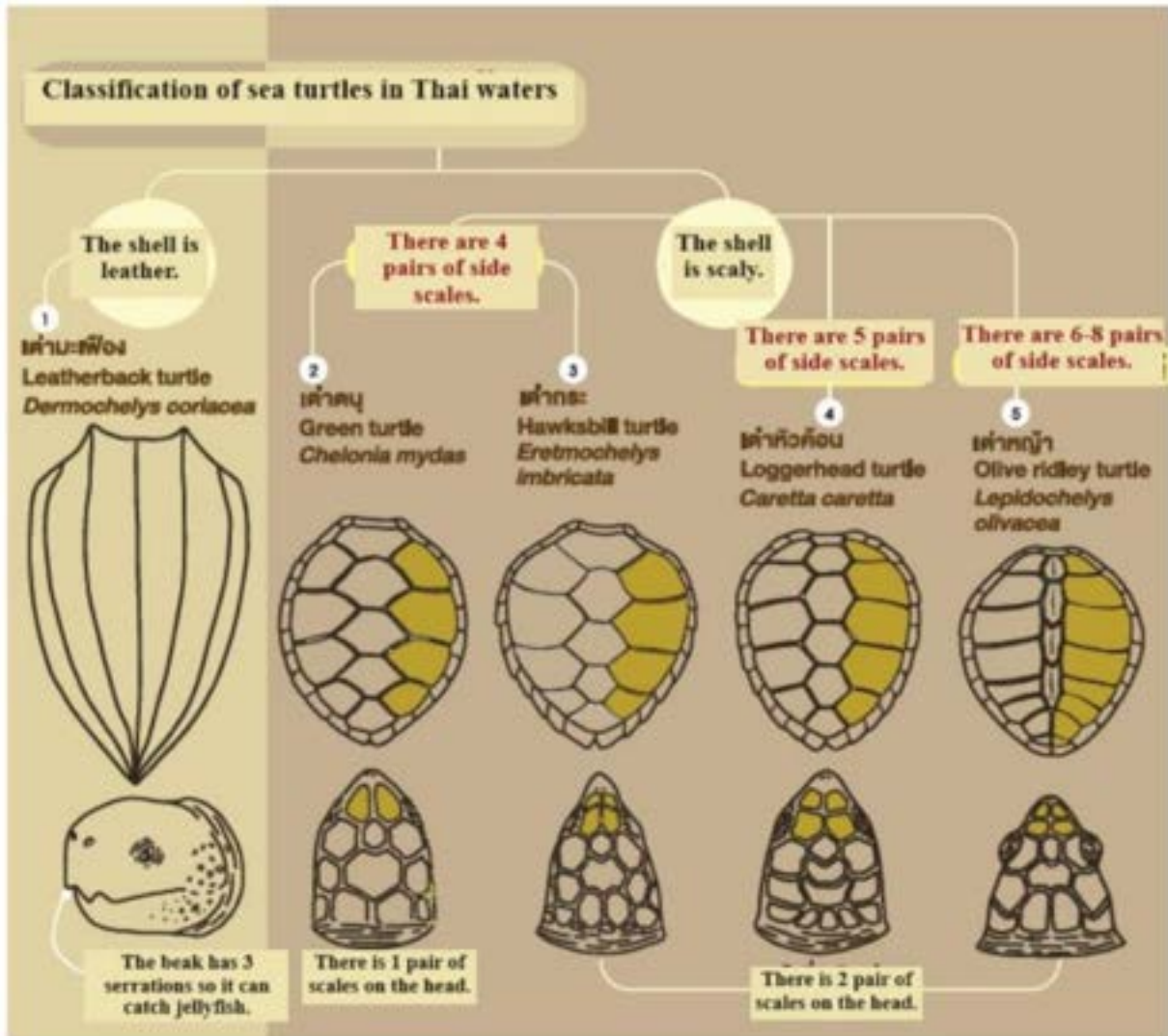
The Department of Marine and Coastal Resources (2014) has prepared a manual for classifying marine mammals and sea turtles in Thailand which found a total of 29 types of marine mammals. There are 28 types of dolphins and whales and 1 type of dugong found as follows:

1. Dugong, (Dugong dugon)
2. Bryde's whale (*Balaenoptera edeni*)
3. Omura's whale (*Balaenoptera omurai*)
4. Blue whale (*Balaenoptera musculus*)
5. Fin whale (*Balaenoptera physalus*)
6. Humpback Whale (*Megaptera novaeangliae*)
7. Sperm whale (*Physeter macrocephalus*)
8. Pygmy Sperm whale (*Kogia breviceps*)
9. Dwarf Sperm whale (*Kogia sima*)
10. Cuvier's Beaked whale (*Ziphius cavirostris*)
11. Blainville's Beaked whale (*Mesoplodon densirostris*)
12. Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*)
13. Killer whale (*Orcinus orca*)
14. False killer whale (*Pseudorca crassidens*)
15. Pygmy killer whale (*Feresa attenuata*)
16. Short-finned pilot whale (*Globicephala macrorhynchus*)
17. Melon-headed whale (*Peponocephala electra*)
18. Indo-Pacific humpback dolphin (*Sousa chinensis*)
19. Indo-Pacific bottlenose dolphin (*Tursiops aduncus*)
20. Rough-toothed dolphin (*Steno bredanensis*)
21. Long-beaked common dolphin (*Delphinus capensis*)
22. Spinner dolphin (*Stenella longirostris*)
23. Striped dolphin (*Stenella coeruleoalba*)
24. Pantropical spotted dolphin (*Stenella attenuata*)
25. Fraser's dolphin (*Lagenodelphis hosei*)
26. Risso's dolphin (*Grampus griseus*)
27. Irrawaddy dolphin (*Orcaella brevirostris*)
28. Finless porpoise (*Neophocaena phocaenoides*)
29. Common Minke whale (*Balaenoptera acutorostrata*)



List of sea turtles found in Thai waters. There are 5 types of sea turtles found in Thai waters as follows:

1. Green turtle (*Chelonia mydas*)
2. Hawksbill turtle (*Eretmochelys imbricata*)
3. Olive Ridley Turtle (*Lepidochelys olivacea*)
4. Loggerhead Turtle (*Caretta caretta*)
5. Leatherback Turtle (*Dermochelys coriacea*)



List of rare and endangered marine animals, some types of cartilaginous fish

Cartilaginous fish that have been declared as Wildlife conservation, Protected wildlife and are being proposed to be listed as protected wildlife include 14 species as follows:

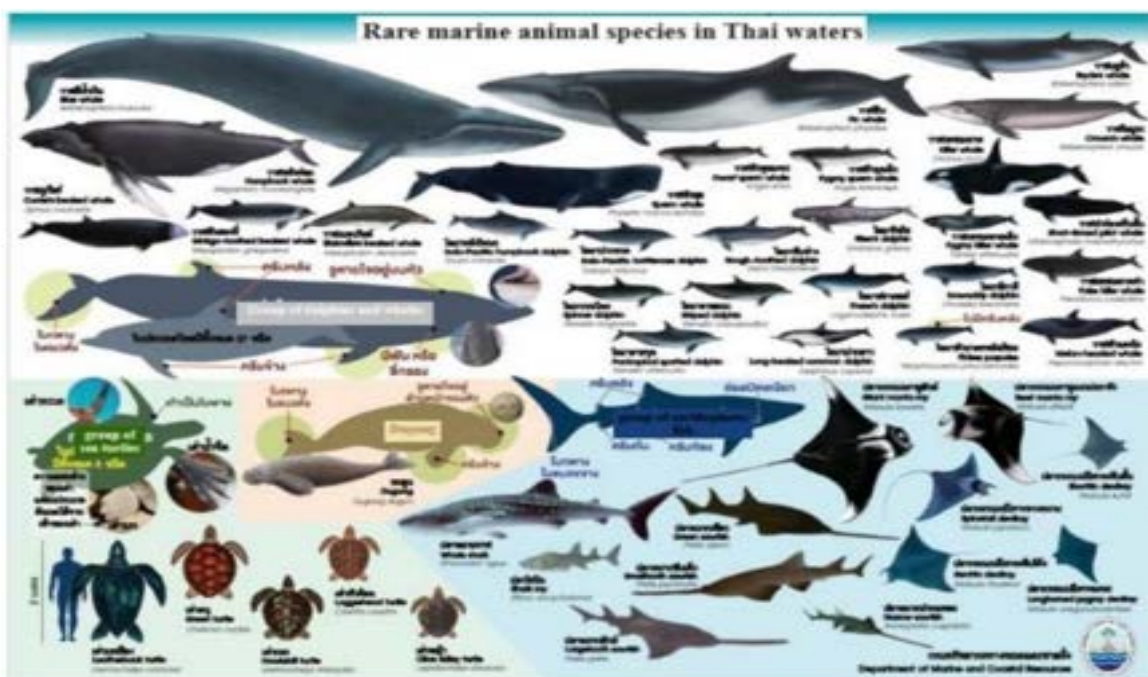
1. Whale shark\*1 (Rhincodon typus)
2. Giant manta ray\*2 (Mobula birostris)
3. Reef manta ray\*2 (Mobula alfredi)
4. Longhorned pygmy devil ray\*2 (Mobula eregoodoo)
5. Shortfin devil ray\*2 (Mobula kuhlii)
6. Giant devil ray\*2 (Mobula mobular)
7. Bentfin deveil ray\*2 (Mobula thurstoni)
8. Chilean devil ray\*3 (Mobula tarapacana)
9. Bowmouth guitarfish\*2 (Rhina ancylostoma)
10. Largetooth sawfish\*2 (Pristis pristis)
11. Green sawfish\*2 (Pristis zijsron)
12. Narrow sawfish\*2 (Anoxypristis cuspidata)
13. Smalltooth sawfish\*2, Not found in Thai waters (Pristis pectinata)
14. Leopard shark / Zebra shark\*3 (Stegostoma tigrinum)

\*Notes:

1 Wildlife conservation

2 Protected wildlife

3 Currently in the process of proposing to be listed as protected wildlife



## How to protect and help rare marine animals during fishing

Rare marine animals found in the Gulf of Thailand fishing areas consist of 3 groups of marine animals. There are Sea turtles, whales and dolphins, and whale sharks, all of which are classified as Wildlife conservation and Protected wildlife.

### Guidelines for prevention

- Determine the extent of use in the habitat.
- Manage marine waste.
- Restoration of spawning grounds.
- Designate areas to protect rare marine animals.
- Responsible fishing.
- Training on saving lives of rare marine animals and rare marine animal rescue centers



Reference: Department of Marine and Coastal Resources

## Helping sea animals

### 1.(Sea turtles)

Basic methods for rescuing sea turtles in the case that they are found inside the nets of a fishing vessel or if a sea turtle is found stuck in a net in the middle of the sea, do the following:

1) Reduce vessel speed, specify speed (normal - stop), notify the vessel operator to record the date and coordinates found and inform other vessels nearby to avoid fishing in that area.

2) Navigate the vessel so that the position of the vessel is next to the turtle.

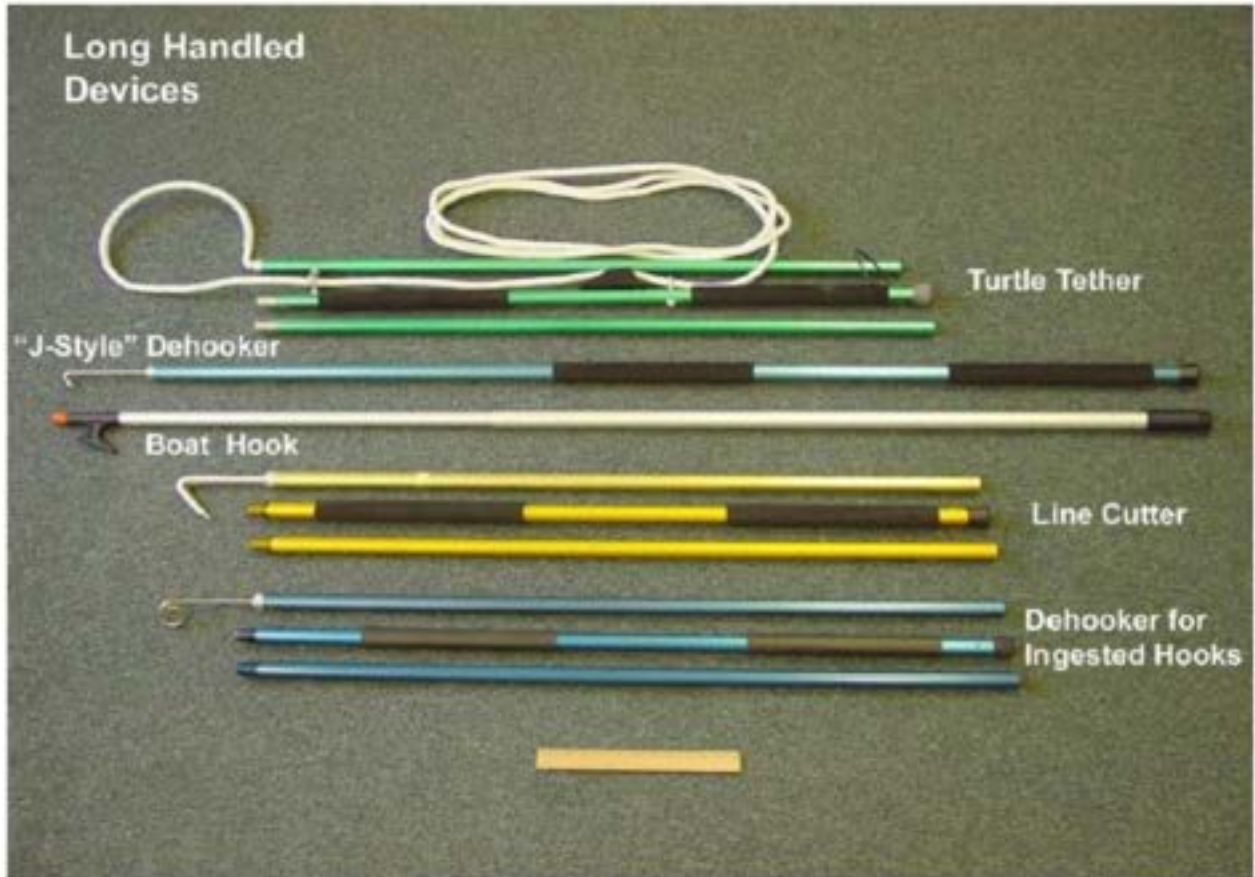
3) Recover the net slowly, avoiding dragging or pulling hard or using hooks or other blunt instruments to pull the turtle closer to the vessel.

4) Evaluate the turtle's size to determine how to help as follows:

➤ If the turtle is enough size to be lifted into a vessel, use a large swing or pulley. Avoid tugging at the net, which can injure the turtle. When retrieving the turtle, place it on a cushioned material on the floor of the vessel, such as a car tire.



- If the turtle is too large to carry on the vessel, use a leash to tether the turtle near the vessel. (if it can be done)



Equipment for controlling sea turtles in the water



How to restrain a large sea turtle



Lifting large sea turtles onto boats

## 5. Evaluate symptoms and check for external wounds.

➤ The turtle is normal, healthy, and has no injuries. Remove the turtle from the net or cut off the pieces of the net. Quickly release it into the sea in the area.

- If the nets are entangled in your turtle, carefully cut the nets off using a knife or scissors. Be careful not to let the turtle be cut by a knife or scissors.

- If a hook is found, Use wire cutters. Cut off the tip of the hook. If you cannot cut it, cut it to a length of at least 30 centimeters and inform the staff. while waiting or being delivered to

officials Keep the turtle in the shade. Cover the shell with a damp cloth to always keep it moist. Be careful not to cover head. and do not expose to the sun

➤ A turtle that is weak or unconscious Place the turtle on the backing plate and raise the backing plate so that the back of the turtle is 15-30 degrees to allow the water the turtle choked to flow out and place the turtle in the shade. Maintain a cool body temperature, avoid exposure to the sun, and keep the face and eyes moisturized. After that, check for response every three hours by touching the eyelids and corners of the eyes. The turtle is revived, within 24 hours, the turtle should be released only at the back of the boat.



Positioning the turtle



Monitoring the turtle's response

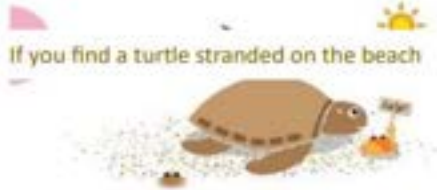
Currently, the stranding rate of sea turtles is very high, 80 percent of which are caused by pieces of rope and nets floating in the sea. If we encounter it, we can help save lives as follows:

# how to help sea turtles

## วิธีช่วยเหลื่อเต่าทะเลเบื้องต้น

For the general public and tourists

If you find a turtle stranded on the beach



ในประเทศไทยพบเต่าทะเลได้ 5 ชนิด ได้แก่ เต่ามะเฟือง เต่าตนุ เต่ากระ เต่าหญ้า และเต่าหัวมีด ทุกชนิดถูกจัดเป็นสัตว์ทะเลหายากและใกล้สูญพันธุ์ทั้งสิ้น

Use your fingers to gently touch the eyelids. To see if the turtle is still alive.



Check to see if there are any wounds.

If no wounds are found and the turtle still has strength, release the area found.

If there are severe injuries or the turtle shows signs of weakness, please notify the relevant agencies for treatment.



แจ้งกรมประมง โทร. 0-2554-2000



If found caught in a net or fishing line  
Either on the beach or in the sea



Do not use your hands to remove rope or scraps of the net because it takes a long time and causes the turtle to stay out of the water for too long.



The tangled line should be cut before releasing it back into the sea.

Throw away scraps of rope and nets in the trash.



If the turtle's condition is not good, while waiting for the staff to come pick it up and take it for treatment.



Put the turtle under the shade. Do not expose to direct sunlight.



Cover the head or shell with a damp cloth to maintain humidity.



First aid involves using medicine that people use for wounds.

Fresh wounds use betadine. Canker sores use purple medicine



ถ้าต้อง ครอบหรือปิดการพาของเต่าทะเล



## 2. Whales and Dolphins

Basic methods for helping whales and dolphins in cases where they are found inside the nets of fishing boats are as follows:

1. When seen while sailing, notify the ship's operator to note the date and coordinates and report it to other ships. nearby to avoid fishing in that area.

2. If whales and dolphins are found inside the net.

- Stop the boat and observe the behavior of dolphins or whales in the nets.
- Open the front of the net and pull it up to create a gap large enough for the dolphin or whale to swim out or press the buoy at the head underwater to create a gap that allows the dolphin or whale to swim out. But if it is found that a dolphin or whale that has been tangled in the net is still alive, remove or cut the net while the animal is in the water, trying to raise its head so the animal can breathe. Use a sharp tool to cut the net rope as soon as possible. and avoid using loud noises While cutting, keep the sharp part away from the animal. After that, examine the external wound.



ที่มา: กรมทรัพยากรทางทะเลและชายฝั่ง

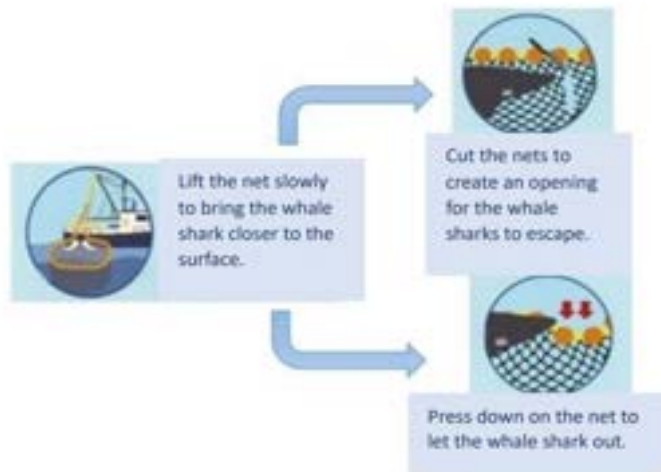
## 3. Whale shark

How to help whale sharks In the case of seeing something inside a fishing boat's net, do the following:

1. When seen while sailing, notify the ship's operator to note the date and coordinates and report it to other ships. nearby to avoid fishing in that area.

2. If a whale shark is found stuck in the net.

- If the whale shark is near the surface of the water, lift the net. The weight of the animals may cause the nets to break. The animal can swim out on its own or the crew can help by cutting the net about 1 - 2 meters and pushing the head of the fish out of the net.
- Lift the net slowly to bring the whale shark closer to the surface, close to the boat and push the fish over the net. Do not use a rope to tie the fish's tail and lift it up.



ที่มา: กรมประมง

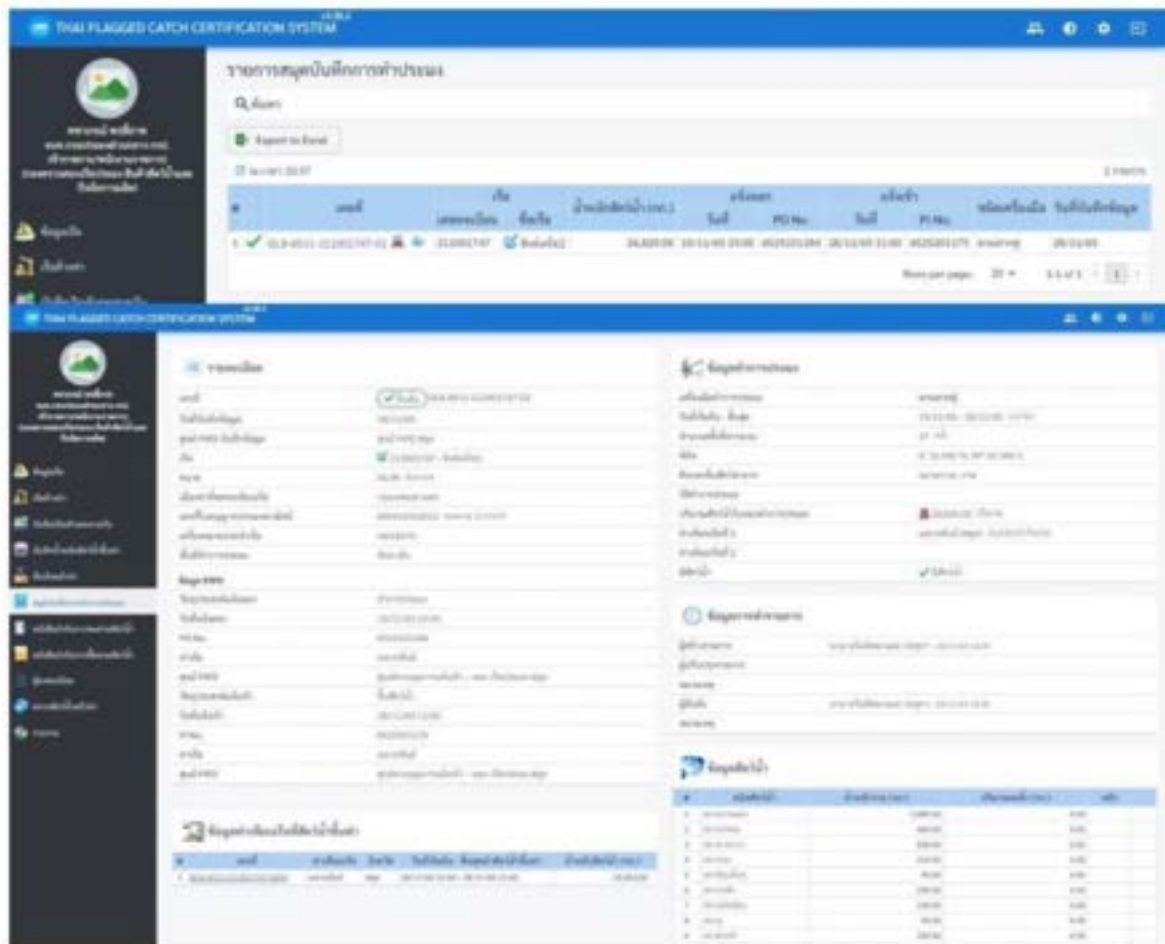
### Recording and reporting rare marine animals.

Recording rare marine animal species, time and location where they were found. (According to the fishing logbook form).

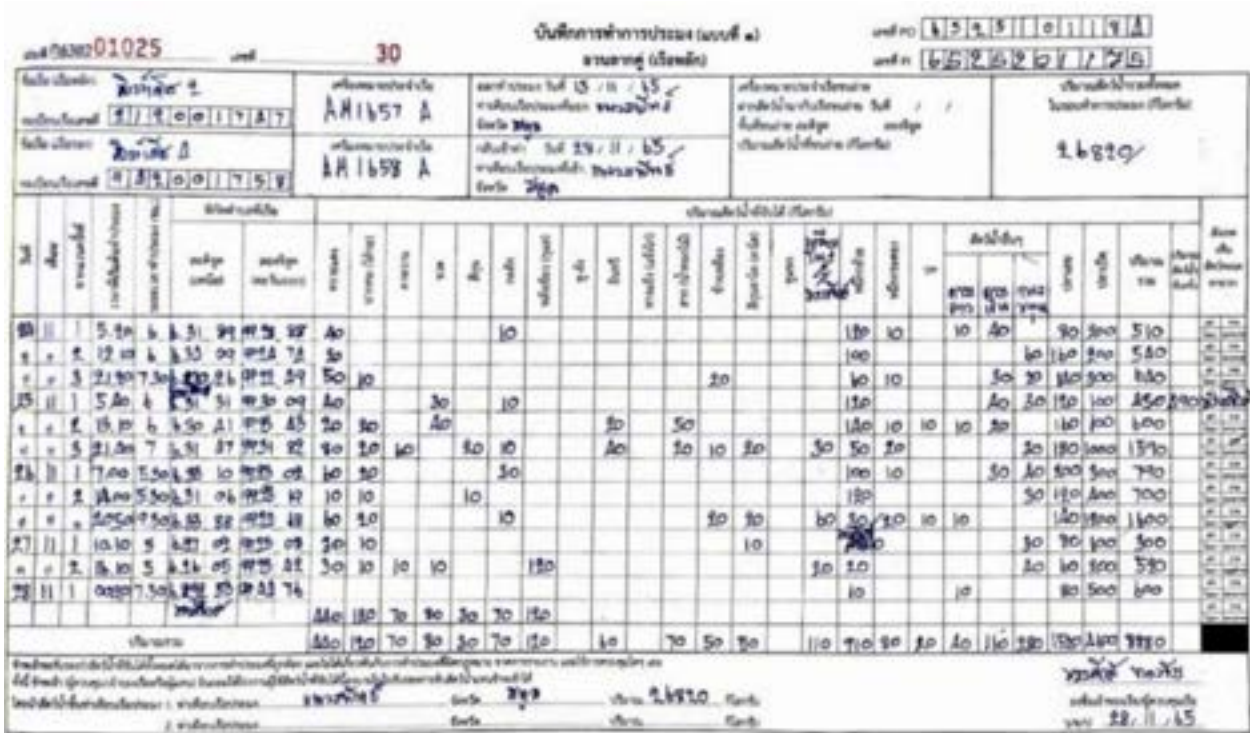
Classification of rare marine animals, recording details to describe rare marine animals found as much as possible. Especially the physical characteristics that can be seen outside or photographed, such as size, length, distinctive characteristics of each species such as color, dorsal fin, head shape, fishing tools or things attached to rare marine animals, and recording of injuries observed such as Cracked shells, weakened, or damaged positions on the legs or tail.

Methods for collecting data on sightings of rare marine animals. The Department of Fisheries records information from the fishing diary into the TFCC system on the website. <https://tfcc.fisheries.go.th/tds/>

Example of data recording.



Example of a fishing logbook.



The logbook form includes the following sections:

- Header:** Vessel ID (01025), date (30), and other administrative numbers.
- Vessel Information:** Name (AH1657 A), engine details, and location (16890).
- Main Data Table:** A grid with columns for date, time, location, and various fishing metrics (e.g., effort, catch, gear used).
- Summary:** Total values for various metrics at the bottom of the table.
- Footer:** Additional notes and dates.

Report incidents in the case of injured or stranded marine animals.

Phetchaburi province to Chachoengsao province

034-497074

089-6358264

093-9935616

Chonburi Province to Trat Province area

038-661693

063-4034555

090-9595402

Area of Prachuap Khiri Khan Province to Surat Thani Province

077-510213-4

081-6857329

081-0856284

Ranong Province to Satun Province area

076-391128

086-6721448

Nakhon Si Thammarat Province to Narathiwat Province area

074-307079

094-4493514, 081-8326225

## **Section 2C –Habitats**

### **(Research 1) Effects of trawl fishing on biological resources and marine environment in Eastern Gulf of Thailand.**

The impacts on the marine and coastal environment from trawl fishing are considered as an important problem that cause the degradation of marine ecosystems around the world, including in Thailand. Key marine and coastal ecosystems that are often directly or indirectly affected by trawl fishing include seagrass, coral reefs, and ecosystems within the water column and sea bottom. In this case, the ecosystems that are often directly affected by fishing, especially trawl, are the ecosystems within the water column and sea bottom through the disturbance of seafloor, the diffusion of sediment and various solutions from the sediment into the water column. Meanwhile, seagrass and coral reefs are ecosystems that are indirectly affected by trawl fishing in the form of dispersed sediment, blocking of light from increased seawater turbidity. Also, include the concentration of various solutions caused by the sweep area of the fishing gear, especially the concentration of nutrients in seawater that may affect the abundance of phytoplankton and seaweed. This will result in the degradation of seagrass and coral reefs. The natural restoration may not help to maintain the ecosystem as a habitat for aquatic animals (Dawes et al., 1997).

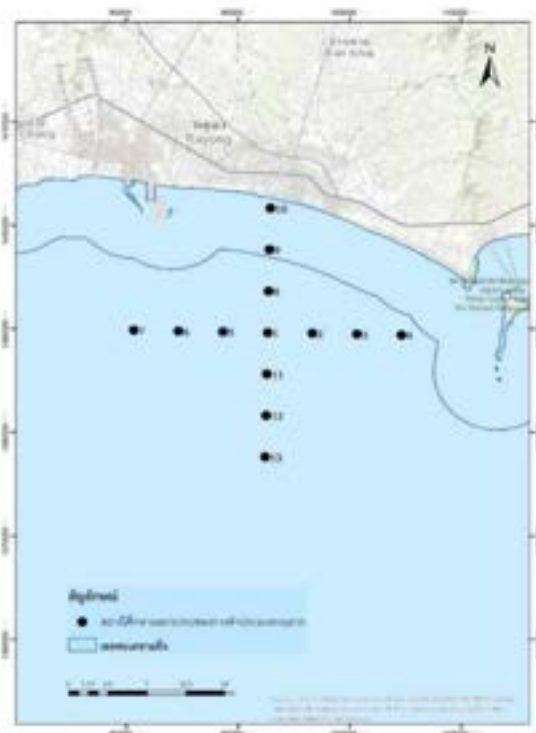
The impacts from trawl fishing can also be considered as a cause of loss of marine ecosystems and restoration funds. However, the past studies shown that marine environmental data has not been linked to the impacts from trawl fishing. Therefore, this study of the effects of trawl fishing on biological resources and marine environment in Gulf of Thailand (Eastern part) aims to study the impact of trawl fishing on the quality of seawater and sediment in the Gulf of Thailand and impacts of trawl fishing on marine resources in the Gulf of Thailand. The result from the study will be used as a guideline for developing trawl fisheries in the Gulf of Thailand in accordance to international standard for sustainability practices.

## Objective

To study the impact of trawl fishing on sediment, water mass, and fishery resources in the Gulf of Thailand.

## Research methods

The study of the impacts of trawl fishing on biological resources and marine environment in eastern Gulf of Thailand was conducted by defining the study area based on the results of commercial trawl fishing areas analysis. Information regarding the time period and areas prohibited for fishing according to the Department of Fisheries announcement, the fishing patterns of trawlers, and the data from the fishing vessel tracking system (VMS) were used for analysis. Sampling in the target area was done using “Variable Radius Plot Sampling” starting from the densest trawl area and then set up sampling stations in 4 directions, 3 stations in each direction, with a distance of 4 kilometers between stations, totaling 13 stations to cover areas with trawl fishing and coastal areas without trawl fishing as a control (Figure 1). The time periods for data survey were October 2022 and December 2022.



**Figure 1:** Surveyed station to assess the impact of trawl fishing on water quality, sediment quality, and fishery resources in the eastern Gulf of Thailand

Factors studied for the water quality are general water quality (temperature, dissolved oxygen (DO), and pH of water), Nutrient concentration (dissolved inorganic nitrogen (DIN), silicate-silicon ( $\text{Si(OH)}_4\text{-Si}$ ) and orthophosphate-phosphorus ( $\text{PO}_4^{3-}\text{-P}$ )), chlorophyll *a* content and total suspended solids (TSS) . The study was conducted at 3 depth of water levels: the surface, the middle, and the bottom. For sediment quality, the factors studied are sediment particle size (grain size), acid volatile sulfide; AVS, total organic matter; TOM, pore-water nutrient, heavy metal content in sediment (Cd, Pb, Cu, Zn) and  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  of sediment.

The impact of trawl fishing in the eastern Gulf of Thailand is analyzed using above-mentioned data in order to assess the impact of trawl fishing on the marine environment and biological resources of the Gulf of Thailand. The knowledge integration of physical oceanography, chemical oceanography, and marine biology was also used in the analysis to assess the impacts both directly and indirectly on resources in the eastern Gulf of Thailand.

## Research results

**General water quality:** Water depth 8.7-29.1 m, transparency 4.7-19.5 m, temperature 28.1-30.3 °C, salinity 28.7-31.3 psu, pH 7.9-8.2, DO 5.5-7.7 mg/l.

**Nutrient concentration:** DIN 0.79-3.37  $\mu\text{M}$ ,  $\text{Si(OH)}_4\text{-Si}$  8.19-75.75  $\mu\text{M}$ , and  $\text{PO}_4^{3-}\text{-P}$  0.20-2.27  $\mu\text{M}$ .

**Chlorophyll *a*:** 0.13-5.74  $\mu\text{g/l}$ .

**Total suspended solids content:** 0.60-15.15 mg/l.

**General characteristics of sediments:** Most of sediment sample was mud mixed with shellfish fraction, the surface layer of the sediment is brown with gray and black color in the deeper layers., An indistinct

oxidized layer was observed at the sediment surface (0-1 cm) and there was no obvious sulfide odor.

**Sediment particle size:** Composition of sediment particle smaller than 63 microns at the sediment surface (0-1 cm) was 2.26-64.03% of the dry weight.

**Acid volatile sulfide of the sediment:** The concentration of acid volatile sulfide in the sediment at the surface level (0 -1 cm) was nd-0.039 mg/g dry weight.

**Water content of the sediment:** The water content of the sediment at the surface level (0-1 cm) was 16.99-69.76% of the wet weight.

**Total organic matter of the sediment:** TOM of the sediment at the surface level (0-1 cm) was 1.56-11.00% of the dry weight.

**Pore-water nutrients:** The concentration of inorganic nitrogen in the pore-water at the surface sediment (0-1 cm) is between 123.25-1,229.01  $\mu\text{M}$  ,  $\text{Si}(\text{OH})_4$ -Si 44.05-482.46  $\mu\text{M}$ , and  $\text{PO}_4^{3-}$ -P 17.86-124.95  $\mu\text{M}$ .

**Heavy metals in sediment:** The concentration of cadmium in the surface sediment (0-1 cm) is between 0.589-4.507 ppm, lead 4.782-160.691 ppm, copper 8.019-71.181 ppm, and zinc 24.462-97.867 ppm.

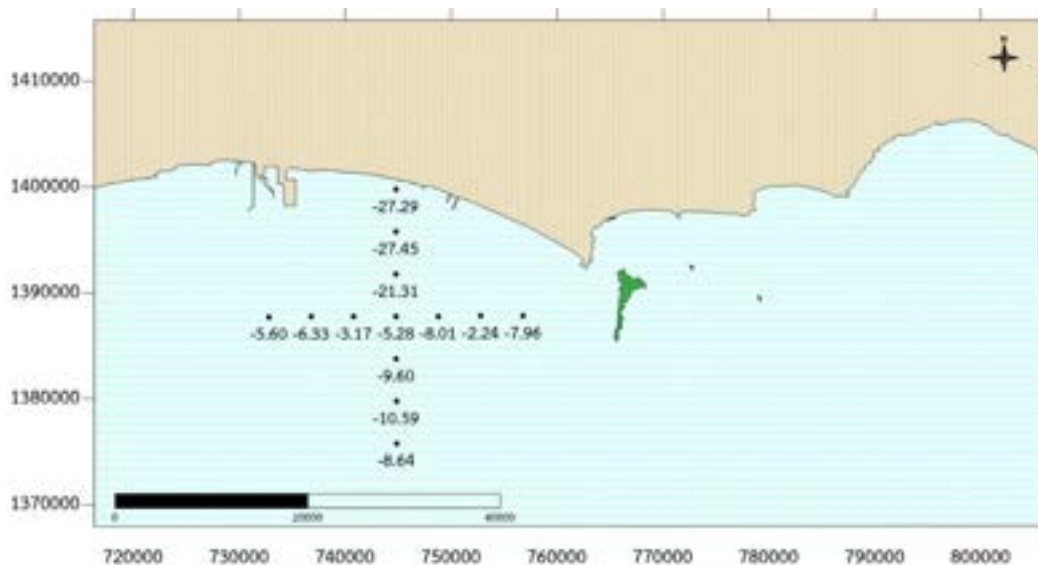
**Aquatic animal resources:** Total of 12 phylum of benthic organisms were found: Phylum Cnidaria, Phylum Platyhelminthes, Phylum Nemertea, Phylum Mollusca, Phylum Annelida, Phylum Echiura, Phylum Sipuncula, Phylum Arthropoda, Phylum Nematoda, Phylum Echinodermata, Phylum Chaetognatha, and Phylum Chordata. Species of the Phylum Annelida was found to be the most abundance, followed Phylum Arthropoda. Total density of marine benthic organisms was varied among sampling stations and study areas.

**Stable isotope in the sediments:** The lowest value of  $\delta^{13}\text{C}$  in the surface sediment (0-1 cm) was -27.45 ‰ (station 9) and the highest value was -2.24 ‰ (station 3). In general, sediment in coastal areas come from two sources: from terrestrial which flown to the sea by the, and from marine biogenous sediment. In the Gulf of Thailand, end member of  $\delta^{13}\text{C}_{\text{marine}}$  and  $\delta^{13}\text{C}_{\text{terrestrial}}$  were about -21.00 ‰ and -27.00 ‰, respectively. In the present study, it was found that the source of sediment in near-shore areas is mainly influenced by terrestrial (-27.45



‰ in station 9). Meanwhile, the source of sediment in areas further away from shore is from the sea. For the stable isotopes  $\delta^{15}\text{N}$ , the lowest value was -7.03 ‰ and the highest value was 4.80 ‰.

**Stable isotopes in aquatic animals:** Stable isotope of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  of 5 aquatic animals (splendid squid, blue swimming crab, scallop, purple-spotted bigeye fish, and sea bream fish) obtained from trawl fishing in the eastern Gulf of Thailand was analyzed. The study area is divided into 4 sub-areas: the upper west side (Zone 1), the upper east side (Zone 2), the lower west side (Zone 3), and the lower east side (Zone 4). The stable isotope  $\delta^{13}\text{C}$  of each species were similar.  $\delta^{13}\text{C}$  of the same species were similar among areas.  $\delta^{15}\text{N}$  clearly reflected the differences of trophic level between species. The lowest values of  $\delta^{15}\text{N}$  was found in scallops while the highest was found in squid. This indicated that splendid squid is the top consumer in the present study, followed by purple-spotted bigeye fish, sea bream fish, blue swimming crab, and scallop, respectively.



**Figure 2:** Stable isotope values  $\delta^{13}\text{C}$  (‰) in sediment samples at a depth of 0-1 cm in the eastern Gulf of Thailand, October 2022.



**Figure 3:** Stable isotope values of  $\delta^{15}\text{N}$  (‰) in aquatic animal in the eastern Gulf of Thailand

**The impact of trawl fishing on aquatic environmental quality:**

Field survey was conducted in February 2023 to collect environmental samples for trawl fishing impacts assessment. The studied variables are general water quality (water depth, transparency, temperature, salinity, pH, DO), total suspended solids content, nutrients concentration, and sediment particle size. The total 16 sampling station was divided into 6 and 10 stations where samples are collected before and after the trawler passed by, respectively. An interesting finding was that the total suspended solids content at the water surface before and after the trawlers passed by were similar, while the distinct changes of TSS content between pre- and post-trawling were observed at the bottom level. The range of TSS content at the bottom level after the trawler passed by was 2.75-12.68 mg/l ( $7.56 \pm 5.51$  mg/l) which was clearly higher than that before the trawl passed by (1.85-8.40 mg/, median value  $2.58 \pm 3.06$  mg/) with the statistically significant difference at the

significance level of 0.05; p-value=0.039. TSS content at the bottom level tended to be 2-5 times higher than that at the water surface as a result of the dispersion of the sediment. This is corresponded with transparency of water which is found to be lower after the trawl passed by (pre-trawling  $11.9 \pm 1.8$  m and post-trawling  $9.6 \pm 2.9$  m) with the statistically significant difference at the significance level of 0.05; p-value=0.039.

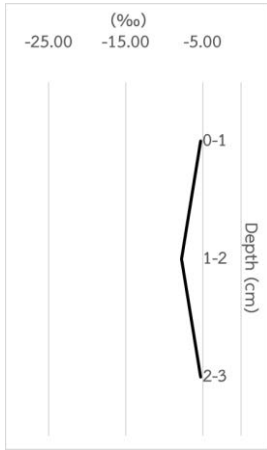
The stable isotope  $\delta^{13}\text{C}$  in the sediment (0-3 cm) was found to be varied by increasing depth. (Figure 4).

Group 1: Stations with decreasing stable isotope values  $\delta^{13}\text{C}$  with increasing depth are station 4 and station 8.

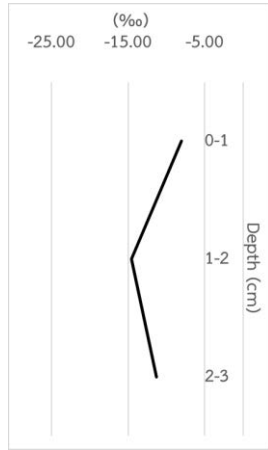
Group 2: Station with relatively constant stable isotope value  $\delta^{13}\text{C}$  with increasing depth is station 13.

Group 3: Stations with trendless stable isotope values  $\delta^{13}\text{C}$  changing are stations 1-3, stations 5-7, and stations 9-12.

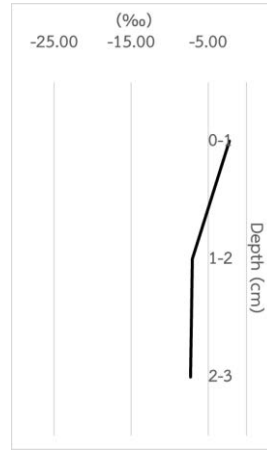
In general, stable isotope values of  $\delta^{13}\text{C}$  in natural sediment is decreased with increasing depth (group 1) due to the decomposition of organic matter in the sediment. In cases where sediment have been disturbed by human activities, changes in the stable isotope values of  $\delta^{13}\text{C}$  can be found increasing with increasing depth (not found in this study) or changes without trend (group 3), such as trawl fishing activities that cause the sediment to be unnaturally reversed from the bottom layer to the top. Meanwhile, the constant stable isotope values of  $\delta^{13}\text{C}$  in sediment with increasing depth in group 2, could be attributed to the high sedimentation rate which surface sediment has not much been altered by the decomposition process.



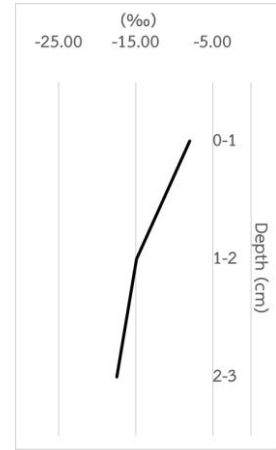
Station No. 1



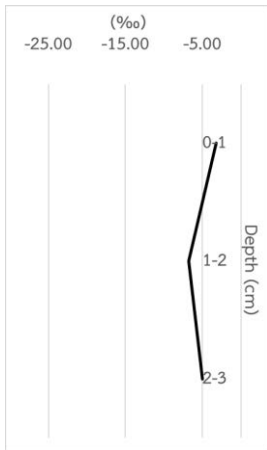
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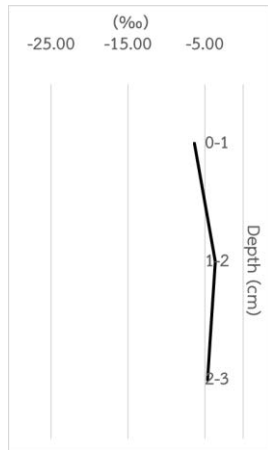
Station No. 3



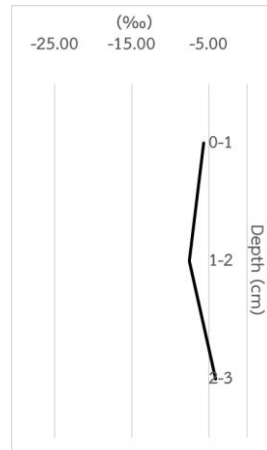
Station No. 4



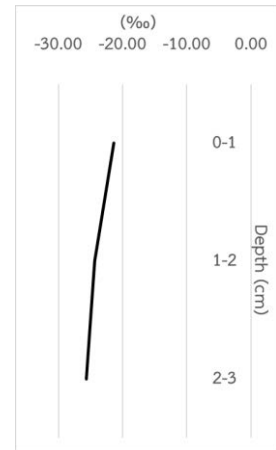
Station No. 5



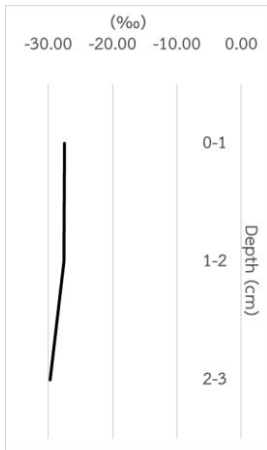
Station No. 6



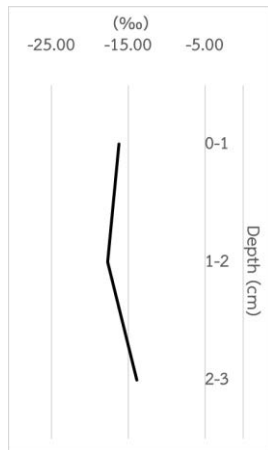
Station No. 7



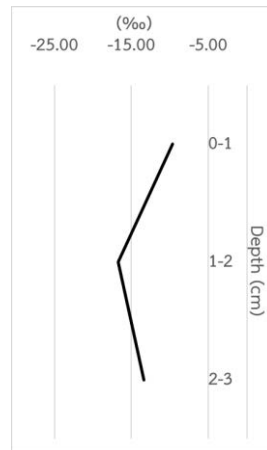
Station No. 8



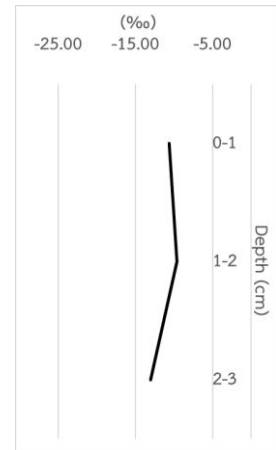
Station No. 9



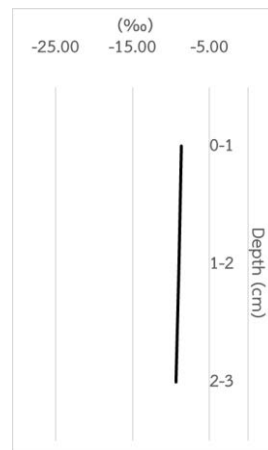
Station No. 10



Station No. 11



Station No. 12



Station No. 13

**Figure 4:** Stable isotope values of  $\delta^{13}\text{C}$  (‰) in sediment in the eastern Gulf of Thailand (0-3 cm)

## Conclusion

1. General water quality, nutrient concentration, and sediment quality (AVS and TOM) in most study areas remained within normal limits based on the water quality standards of Thai seawaters (seawater quality for aquaculture according to the announcement of the National Environment Board 2021)

2. The accumulation of AVS in the surface sediment (0-1 cm) was low. TOM in surface sediment (0-1 cm) was low in some areas, especially the area close to the shore (station 9-10). Meanwhile, areas farther from shore (station 11-12) had higher TOM in surface sediment.

3. The source of the organic substances in the sediment in this study was confirmed by stable isotopes of  $\delta^{13}\text{C}$  in the sediment. The stable isotope values  $\delta^{13}\text{C}$  of the sediments in the nearshore area (stations 9-10) clearly reflect the source of organic substances coming from land which was flushed into the sea from the Rayong River. Meanwhile,  $\delta^{13}\text{C}$  in sediment further from shore, indicated organic matter originates mainly from marine life with little coastal influence.

4. The amount of heavy metals in the sediment (Cd, Pb, Cu, Zn) was found to be higher than that in the coastal sediment quality criteria specified in the Pollution Control Department's announcement, 2021.

5. Trawl fishing clearly affects the TSS, transparency, and the stable isotope value  $\delta^{13}\text{C}$  in the sediment. The TSS was increased and water transparency was decreased after the trawler fishing passed by. Including the discovery of unnatural changes with depth of the stable isotope value  $\delta^{13}\text{C}$  in the sediment as a result of the fishing method which the nets are positioned at sea bottom and in contact with the sea floor. This causes the sediment to be turnover, disturbed, and dispersed into the water column.

### **Suggestions**

1. Guidelines for solving the problem of pollutant contamination in the coastal area of Rayong Province (study area) should be carried out under the development of an eco-industrial city, including the prevention of pollution problems, together with the restoration the environment according to the principles of sustainable utilization management of natural resources and the environment. Focusing on the delivery of natural resources and a good environment to the next generation with the concept of bio-economy, circular economy, and green economy development which places the importance on the application of scientific knowledge, modern technology, and creativity in order to create additional economic value along with maintaining a balance between conservation and utilization of the natural resource and biodiversity.

2. Research and development of appropriate trawl fishing methods with minimal impact on the sea bottom ecosystem will lead to sustainable use of fishery resources further.

## **Section 2C – Habitats**

### **(Research 2) Analysis of trawl fishing ground in the eastern Gulf of Thailand:**

In the group of fishing equipment, trawling is a challenging tool for proper fisheries management planning. It's estimated that trawl fishing equipment can catch a variety of aquatic animals, including cartilaginous fish, bony fish, shrimp, crabs, mollusks, and echinoderms. Collectively, there are more than 800 species in trawl fisheries across Asia (FAO, 2014) and more than 360 species in the Gulf of Thailand (Pornsinsin et al., 2018). This creates the need to find a comprehensive management approach to achieve fisheries balance in all types of catches, both for the main economic species and low-value aquatic animals (by-catch) which the proportions vary according to the gears type and fishing location of the trawl. For example, trawlers in the Gulf of Thailand, the by-catch can reach approximately to 60-70% from the Pair Trawl, 30-40% and 0.5 -1% from the Otter Board Trawl and Beam Trawl, respectively (Pornsinsin et al., 2018; Ahmed et al., 2007)

The impact of trawl fishing on the fishing grounds environment can be divided into four issues (Jones, 1992): 1. Scraping and plowing, which occur from various components of the trawl such as ropes, chains, buoys, and the nets to touch the sea floor by scraping or plowing along the sea floor, 2. Dispersion of sediment will affect the turbidity of the seawater and cause the physical, chemical, and biological composition of the sediment to change. Palanques et al. (2001) reported that small-sized sediment will disperse and begin to aggregate after 1 hour of trawling. In addition, a study of water turbidity found high values in the lower water areas which has changed from the first hour to 2 -5 days after trawling 3. Destroy benthic animals that are not the target group, which results from scraping and plowing, such as the breaking of corals and sponges or causing the shells of bivalves to crack. This includes the impact on the abundance of benthic animals on trawl fishing routes and the stressful of aquatic animals in the area. This continues to affect the diversity of species and ecosystems in the area (Smith, 2000; Izaskun et

al., 2019; Saygu et al., 2020), and 4. The waste deposition process, including disturbing the natural nutrient cycling process and trawling. This results in a decrease in the amount of organic matter (Bhagirathan et al., 2008).

Vessel Monitoring System (VMS) is a system that combines the technology of the Internet, GPS, and Global Service Mobile (GSM) into a Vessel Positioning System (VPS) to help locate fishing vessels. It is a vessel tracking system developed in Thailand by the Department of Fisheries in collaboration with the National Electronics and Computer Technology Center (Department of Fisheries, 2011). In addition, if data from the fishing vessel tracking system is applied together with information from the fishing information recording system by the Port-In Port-Out Control Center (PIPO), it can be useful in assessing the impacts of trawl fishing.

### **Objective**

To study the pattern of trawl fishing in the eastern Gulf of Thailand and to prepare a map of trawl fishing sites in the eastern Gulf of Thailand for use in determining measures for further management of trawl fishing, in case found an impact on important aquatic animal habitats (Critical Habitat).

### **Research methods**

The data used in this study consists of 2 types of data: primary data and secondary data. The Important of secondary data used to calculate the transit area and catch volume comes from the Port-In Port-Out (PIPO) database and the Department of Fisheries fishing Vessel Tracking system data from 1st January 2021 – 31st December 2022. In addition, data collected using In-depth interviews to collect data on fishing patterns of Pair Trawl, Otter Board Trawl, and Beam Trawl from operators or vessel owners with experience in fishing to study factors affecting vessel speed during trawl fishing and calculating the trawl swep area for mapping the trawl fishing in the eastern Gulf of Thailand.



## Research results

The study of trawl fishing in the eastern Gulf of Thailand covers fishing zone 1 and 2 of the vessels survey of the Department of Fisheries and fishing area 1 according to the zoning division of commercial fishing statistics of the Fisheries Department. The areas in which commercial trawlers can go fishing are totals 23,304.83 square kilometers, estimate from the speed during fishing of trawl vessels in the eastern Gulf of Thailand. In the Year 2022, fishing vessels face the problem of high oil prices due to the war situation between Russia and Ukraine. Therefore, this is one of the factors affecting the use of speed in fishing. In addition, besides to the factors of tides (base on the season), horsepower, gear reduction, and propeller size (engine size), the results of the statistical test found that the movement speeds of the pair trawl, beam trawl, and otter board trawl between 2021 and 2022 are significantly different at the significance level of 0.05. The median speed of pair trawl, beam trawl, and otter board trawl in 2022 being less than the median speed of vessel movement in 2021 (Table 1). Therefore, in estimating the speed during fishing this time, the analysis separated between 2021 and 2022. In 2022, Beam Trawl and Otter Board Trawl vessels size 60-<150 GT, and the Pair Trawl vessel has a speed reduction while fishing, especially the 30-<60 GT, Pair Trawl vessels have a reduced speed during the off-monsoon season (Between February and May) continues into the southwest monsoon period (Table 2). While many vessels use the method of refraining from fishing, the number of fishing vessel trips that go out to fishing with Port-In Port-Out notifications in the eastern Gulf of Thailand in 2022 is 5,349 trips, decreased from Year 2021 with a total of 6,746 trips or a decrease of 18.35 percent, affecting the amount of swept area and the quantity of aquatic animals caught in 2022 also decreased (18.61% and 13.21%, respectively).

**Table 1:** The average movement speeds of Beam Trawl, Otter Board Trawl, and Pair Trawl between 2021 and 2022.

Vessel speed information	Beam Trawl	Otter Board Trawl	Pair Trawl
Year 2021	2.06 ± 0.82	2.32 ± 0.27	2.38 ± 0.59
Year 2022	1.99 ± 0.83	2.26 ± 0.26	2.23 ± 0.53

**Table 2:** Overview of vessel speeds while fishing in the eastern Gulf of Thailand, classified by type of equipment.

Vessel size	Season	Fishing time	Vessel speed while fishing (knots)						
			Beam Trawl		Otter Board Trawl		Pair Trawl		
			Year 2021	Year 2022	Year 2021	Year 2022	Year 2021	Year 2022	
30 - <60 GT	Outside the monsoon season (dry season)	Day	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	2.01-3.00	1.51-3.00	
		Night	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	2.01-3.00	1.51-3.00	
	Southwest monsoon	Day	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	2.01-3.00	1.51-3.00	
		Night	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	2.01-3.00	1.51-3.00	
	Northeast Monsoon	Day	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	1.51-3.00	2.01-3.00	
		Night	1.51-2.50	1.51-2.50	2.00-2.49	2.00-2.49	2.01-3.00	2.01-3.00	
	<b>Overview of size 30 - &lt;60 GT</b>			<b>1.51-2.50</b>	<b>1.51-2.50</b>	<b>2.00-2.49</b>	<b>2.00-2.49</b>	<b>1.51-3.00</b>	<b>1.51-3.00</b>
	60 - <150 GT	Outside the monsoon season (dry season)	Day	1.51-4.00	1.51-2.50	2.00-2.99	2.00-2.49	2.01-3.50	2.01-3.00
Night			1.51-4.00	1.51-4.00	2.00-2.49	2.00-2.49	2.01-3.00	2.01-3.00	
Southwest monsoon		Day	1.51-2.50	1.51-4.00	2.00-2.49	2.00-2.49	2.01-3.00	2.01-3.00	
		Night	1.51-2.50	2.51-4.00	2.00-2.49	2.00-2.49	2.01-3.00	2.01-3.00	
Northeast Monsoon		Day	1.51-4.00	1.51-4.00	2.00-2.49	2.00-2.49	2.01-3.00	2.01-3.00	
		Night	1.51-	1.51-	2.00-	2.00-	2.01-	2.01-	

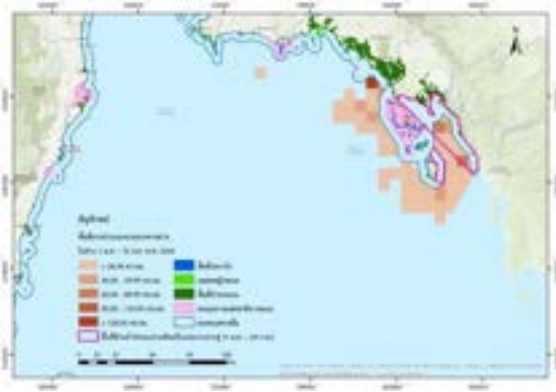
	4.00	2.50	2.49	2.49	3.00	3.00
<b>Overview of size 60 - &lt;150 GT</b>	<b>1.51-4.00</b>	<b>1.51-4.00</b>	<b>2.00-2.99</b>	<b>2.00-2.49</b>	<b>2.01-3.50</b>	<b>2.01-3.00</b>

**Note:** Northeast Monsoon (October-January); Outside the monsoon season (February-May); southwest monsoon (June-September)

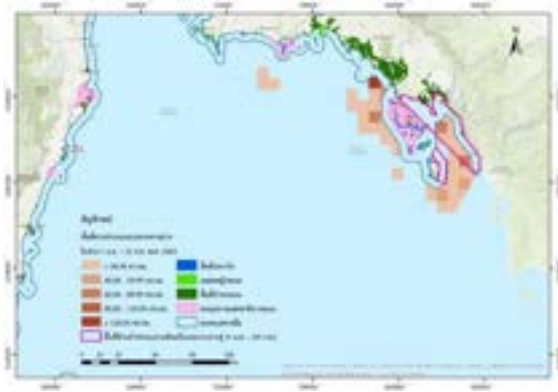
The average sweep area during the study (2021-2022) is 35,175.80 squarekilometers per year (Table 3), representing 1.51 times the total area that can used for fishing, which has less fishing density than the inner Gulf of Thailand (Area that can use for fishing is 8,171.268 square kilometers, the average sweep area is 23,091.72 square kilometers per year, equivalent to 2.82 times the total area that can used for fishing). Pair Trawl vessels are still the main influence on fishing in the eastern Gulf of Thailand as well as the inner Gulf of Thailand, followed by Otter Board Trawl and Beam Trawl but in the inner Gulf of Thailand, Beam Trawl vessels have more sweep area than Otter Board Trawl vessels or have more fishing than Otter Board Trawl vessels (Table 3 and Figure 1).

**Table 3:** Sweep area of fishing vessels in the eastern Gulf of Thailand

Year	Sweep area (sq.km.)				%			
	Beam Trawl	Otter Board Trawl	Pair Trawl	All types	Beam Trawl	Otter Board Trawl	Pair Trawl	All types
2021	827.7	11,055.33	26,902.	38,785.	2.13%	28.50%	69.36%	100.00%
2022	829.0	8,948.19	21,788.	31,566.	2.63%	28.35%	69.03%	100.00%
+/-	1.37	(- 2,107)	(- 5,113)	(- 7,219)	0.17%	(- 19%)	(- 19%)	(- 18.61%)
average	828.4	10,001.76	24,345.	35,175.	2.36%	28.43%	69.21%	100.00%

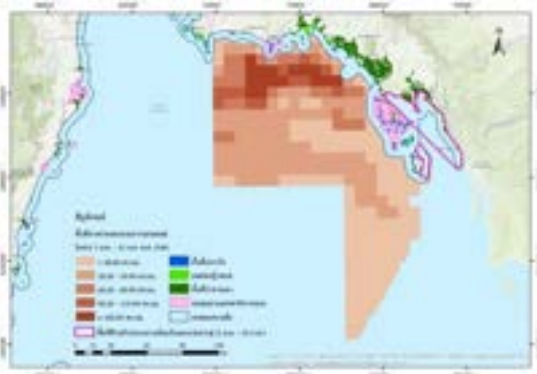


Year 2021

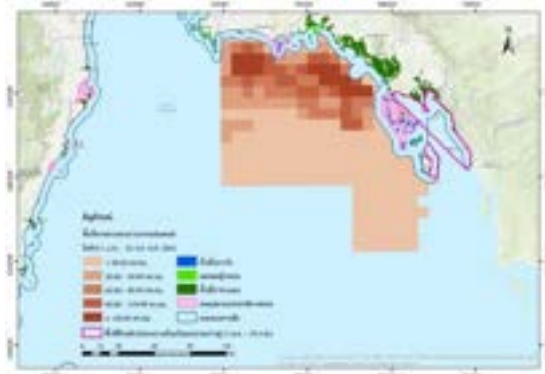


Year 2022

Beam Trawl

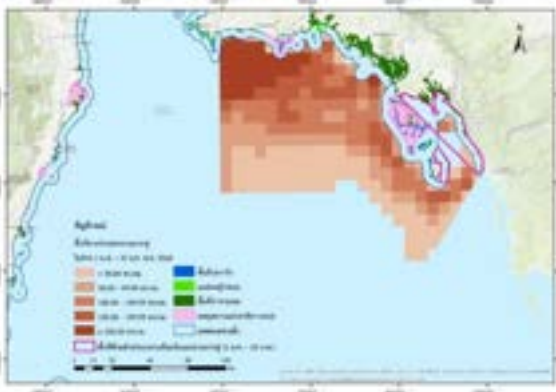


Year 2021

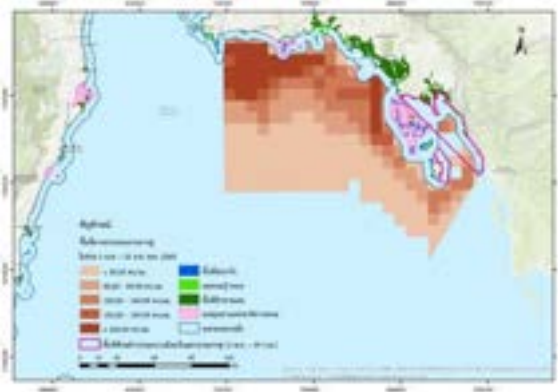


Year 2022

Otter Board Trawl



Year 2021



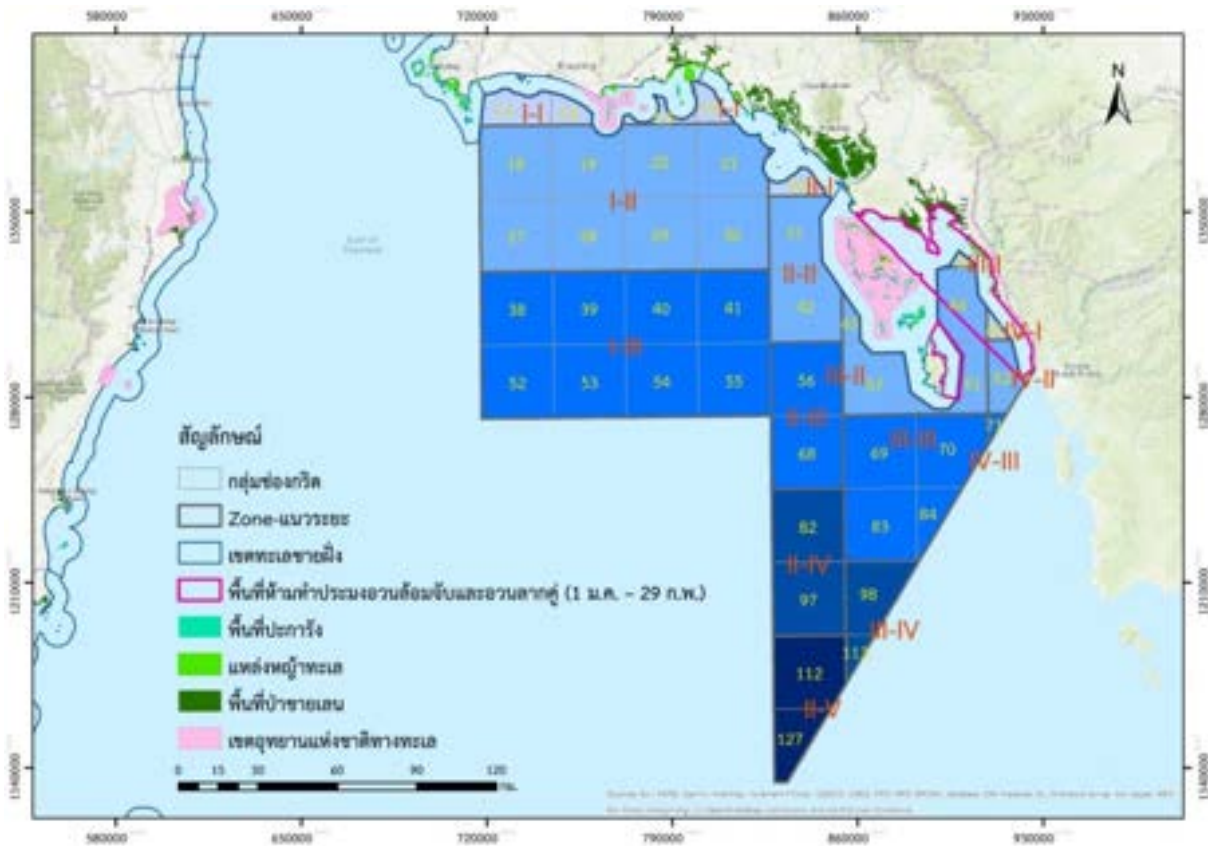
Year 2022

Pair Trawl

**Figure 1** Sweep area of the trawl in the eastern Gulf of Thailand

To clearer picture in this study, the fishing area in the eastern Gulf of Thailand was divided into 4 zones, perpendicular to the coastal edge and classified in each zone according to the distance from shore 15-30 nautical miles, using the line of latitude in dividing the area from the shoreline into 5 distance (I being the distance closest to the coastal, and V being the distance farthest from the coastal). This results in a total of 15 sub-areas (Figure 2)

The results of the study found that, overall, the proportion of fishing vessel sweep area is mostly in Zone I-II (52.79-57.42 percent), However, if considered separately by type of fishing gear, **the proportion of the Beam Trawl sweep area is mainly along the II line of almost all zones (Zone II-II, Zone III-II and Zone IV-II) and in the I line of Zone II (Zone II - I).** This means that the area mentioned above is an important fishing area for the Beam Trawl. Furthermore, the importance fishing area for the Otter Board Trawl is along II and III line of Zones I and II (Zone I-II, Zone I-III, Zone II-II, and Zone II-III) while the important fishing areas of Pair Trawl will be in I, II, and III line of Zone I, Zone II, and Zone III (Zone II, Zone I-II, Zone I-III, Zone II-II, Zone III-II, and Zone III-III).



**Figure 2** The area division according to zones and distance from coastal in the study area of the eastern Gulf of Thailand

When considering the amount of swep area, the number of aquatic animals caught, and the rate of aquatic animals caught per swep area together (Table 4-6) from the data year 2021-2022, the overall picture divided by zones found that the Zone I area has a high amount of swep area (23,189.92-29,537.19 square kilometers), and the number of aquatic animals caught (29,941.63-37,209.05 tons) is the most, followed by Zone II (swep area 5,217.26-5,232,81 square kilometer and Quantity of Aquatic animals caught 7,631.69-7,743.75 tons). **The areas with a highest rate of aquatic animals caught per swep area is Zone IV (1,935.10-2,578.40 kilograms per square kilometer or 1.93-2.57 tons per square kilometer), followed by Zone III (1,890.55-2,567.27 kilograms per square kilometer or 1.89-2.56 tons per square kilometer) both areas are near islands and bays that have protected areas where commercial fishing vessels are prohibited.**

In addition, in the overall picture of the distance from shore (commercial area) was found that the line II is the line with the highest swep area (23,594.02-25,682.53 square kilometers) and the number of aquatic animals caught (32,913.02-34,450.68 tons) is the most, followed by the line III (sweep area 4,218.03-8,902.46 square kilometer and Quantity of Aquatic animals caught 7,343.17-12,516.30 tons). However, the area with a highest rate of aquatic animals caught per sweep area is the line III (1,405.94-1,740.90 kilograms per square kilometer or 1.40-1.74 tons per square kilometer), followed line I (1,365.77-1,439.20 kilograms per square kilometer or 1.36-1.43 tons per square kilometer), **When considering the quantity of aquatic animals caught, classified by area and distance from shore together, it was found that areas near the Chang Islands line and surrounding protected areas will have a greater abundance of aquatic animals than areas further from coastal and islands. These are Zone II-I, Zone II-II, Zone II-III, Zone III-I, Zone III-II, Zone III-III, Zone IV-II, and Zone IV-III.**

**Table 4:** Sweep area of fishing vessels in each zone and distance from coastal

Unit: square kilometer

Line	Zone					% Zone				
	I	II	III	IV	รวม	I	II	III	IV	Total
<b>2021</b>	<b>29,537.19</b>	<b>5,217.26</b>	<b>3,501.02</b>	<b>529.86</b>	<b>38,785.33</b>	<b>76.16%</b>	<b>13.45%</b>	<b>9.03%</b>	<b>1.37%</b>	<b>100.00%</b>
I	3,012.92	736.95	46.26	0.36	3,796.49	7.77%	1.90%	0.12%	0.00%	9.79%
II	20,476.64	2,974.18	1,751.31	480.40	25,682.53	52.79%	7.67%	4.52%	1.24%	66.22%
III	6,047.63	1,125.38	1,680.35	49.10	8,902.46	15.59%	2.90%	4.33%	0.13%	22.95%
IV		355.99	23.10		379.09		0.92%	0.06%		0.98%
V		24.76			24.76		0.06%			0.06%
<b>2022</b>	<b>23,189.52</b>	<b>5,232.81</b>	<b>2,571.83</b>	<b>572.10</b>	<b>31,566.26</b>	<b>73.46%</b>	<b>16.58%</b>	<b>8.15%</b>	<b>1.81%</b>	<b>100.00%</b>

Line Distance	Zone					% Zone				
	I	II	III	IV	รวม	I	II	III	IV	Total
I	2,442.25	1,094.19	150.80	1.34	3,688.58	7.74%	3.47%	0.48%	0.00%	11.69%
II	18,126.31	3,582.43	1,349.15	536.12	23,594.02	57.42%	11.35%	4.27%	1.70%	74.74%
III	2,620.96	490.55	1,071.88	34.63	4,218.03	8.30%	1.55%	3.40%	0.11%	13.36%
IV		65.64	0.0		65.64		0.21%	0.0%		0.21%
V		0.0			0.0		0.0%			

**Table 5:** Quantity of aquatic animals caught in each zone and distance from coastal

Line of distance	Number of aquatic animals captured (tons)					Percentage				
	Zone					I	II	III	IV	รวม
	I	II	III	IV	รวม					
<b>Year 2021</b>	<b>37,209.05</b>	<b>7,743.75</b>	<b>6,618.87</b>	<b>1,025.33</b>	<b>52,597.00</b>	<b>70.74%</b>	<b>14.72%</b>	<b>12.58%</b>	<b>1.95%</b>	<b>100.00%</b>
I	3,994.27	1,130.83	59.55	0.49	5,185.14	7.59%	2.15%	0.11%	0.00%	9.86%
II	24,771.93	4,616.53	4,116.26	945.97	34,450.68	47.10%	8.78%	7.83%	1.80%	65.50%
III	8,442.85	1,579.02	2,415.56	78.87	12,516.30	16.05%	3.00%	4.59%	0.15%	23.80%
IV		388.98	27.50		416.49		0.74%	0.05%		0.79%
V		28.39			28.39		0.05%			0.05%
<b>Year 2022</b>	<b>29,941.63</b>	<b>7,631.69</b>	<b>6,602.59</b>	<b>1,475.10</b>	<b>45,651.01</b>	<b>65.59%</b>	<b>16.72%</b>	<b>14.46%</b>	<b>3.23%</b>	<b>100.00%</b>
I	3,140.15	1,602.90	564.14	1.42	5,308.60	6.88%	3.51%	1.24%	0.00%	11.63%
II	22,774.87	5,211.66	3,586.40	1,340.09	32,913.02	49.89%	11.42%	7.86%	2.94%	72.10%
III	4,026.61	730.91	2,452.06	133.59	7,343.17	8.82%	1.60%	5.37%	0.29%	16.09%
IV		86.22	0.00		86.22		0.19%	0.00%		0.19%
V		0.00					0.00%			



**Table 6:** Ratio of aquatic animals caught per sweep area of trawlers fishing in the eastern Gulf of Thailand classified by area and distance from coastal

Line	Ratio of aquatic animals caught per area towed through (kilograms per square kilometer)				
	Distance	Zone I	Zone II	Zone III	Zone IV
<b>2021</b>	<b>1,259.74</b>	<b>1,484.26</b>	<b>1,890.55</b>	<b>1,935.10</b>	<b>1,356.11</b>
I	1,325.71	1,534.47	1,287.29	1,361.11	1,365.77
II	1,209.77	1,552.20	2,350.39	1,969.13	1,341.41
III	1,396.06	1,403.10	1,437.53	1,606.31	1,405.94
IV		1,092.67	1,190.48		1,098.66
V		1,146.61			1,146.61
<b>2022</b>	<b>1,291.17</b>	<b>1,458.43</b>	<b>2,567.27</b>	<b>2,578.40</b>	<b>1,446.20</b>
I	1,285.76	1,464.92	3,740.98	1,059.70	1,439.20
II	1,256.45	1,454.78	2,658.27	2,499.61	1,394.97
III	1,536.31	1,489.98	2,287.63	3,857.64	1,740.90
IV		1,313.53	0.00		1,313.53
V		0.00			0.00

### The elements of aquatic animals caught by trawlers

In studying the accordance of the composition of aquatic animals caught in each zone, the proportion of by-catch fish to aquatic animals consumed, the ratio of aquatic animals caught per sweep area, and the rate of aquatic animals caught per fishing area. The study results indicate that the highest by-catch fish mostly caught is in Zone IV, areas near Chang Island, which has a ratio of by-catch fish and aquatic animals for consumption (1.41), a ratio of aquatic animals caught per sweep area (2,269.07 kilograms per square kilometer) and the rate of aquatic

animals caught per fishing area (3,089.92 kilograms per square kilometer). Followed by Zone I and II areas that are important areas for Pair Trawl and Otter Board Trawl fishing in the group of aquatic animals for consumption. **The composition of aquatic animals caught in each zone, the rate of aquatic animals caught per sweep area and the rate of aquatic animals caught per fishing area. The data shows the consistent and indicates that the Pelagic fishes are most likely to be caught in Zone III (near the Chang Islands). Squid and shell groups are caught the most in Zone I, and the group of crabs, shrimp, and crayfish are caught the most in Zone IV (near the Chang Islands),** except for the Demersal fish group. Indicators for the composition of aquatic animals caught in each zone, the rate of aquatic animals caught per sweep area, and the rate of aquatic animals caught per fishing area may not be consistent as in the case of other groups of aquatic animals. If in the case of considering the composition of aquatic animals caught in the proportion of demersal fish, it is more than 50 percent of fish were found in all 4 areas (Zone I-IV). Rate of aquatic animals caught per sweep area indicates the demersal fish group was caught in greater numbers in zone III (671.41 kilograms per square kilometer) while the ratio of fish caught per fishing area indicates that the Demersal fish group are abundant in zone I (790.28 kilograms per square kilometer) and Zone IV (767.22 kilograms per square kilometer).

In addition, when considering the abundance or fishing grounds of aquatic animal groups along the distance of the coast from the aquatic animal elements caught in each zone, the proportion of catch-fish fish to aquatic animals for consumption, Rate of Aquatic animals caught per sweep area and rate of aquatic animals caught per fishing area, the results indicate that pelagic fish, squid, crabs, shrimp, and crayfish are mostly caught closer to the coast (line I-II) and begin to decline farther from the coast, except for the Demersal fish group. The proportion of catches was greater in the distances away from the coast (from stages III-IV), but the rate of aquatic animals caught per fishing area indicates

that the abundance of Demersal Aquatic animals is more abundant along coast distances I and II than along coast distances III, IV, and V. The proportion of by-catch fish is greater in areas near the coast (within the commercial area) and proportion of catch fish will decrease when fishing farther from coastal. **These data indicate that areas near the coastal are important resources especially pelagic fish, squid, crabs, shrimp and crayfish.**

Among the pelagic fish caught by trawlers in the eastern Gulf of Thailand that are classified in the fishing logbook for the period 2021-2022, there are a total of 25 species. First, 5 species of Pelagic fish are most commonly caught are *Stolephorus* spp., *Clupeidae* sp., *Selaroides* sp., *R. brachysoma* and *R. kanagurta*. **The catching rate of aquatic animals per swep area in the overall of pelagic fish decreased from 2021 by 11.77 kilograms per square kilometer. Among the 25 Pelagic fish species, 12 species had a decrease in catch per swep area in 2022, with *Stolephorus* spp. having a decrease of 17.71 kilograms per square kilometer. Monitoring the situation of fish resources of *Stolephorus* spp. may need to continue to monitor how this decline continues or this is just a change in the resources according to the life cycle. The squid, crab, shrimp, and crayfish groups had a decrease in the rate of fish caught per swep area in 2022 from 2021, as same as the pelagic fish group (reduced 0.65, 1.49, 3.13 and 0.46 respectively)**

**For the Demersal fish group, which is the main aquatic animal of the trawl fishery, the study in the eastern Gulf of Thailand found a total of 30 species of demersal fish that are classified in the fishing logbook, except for other fish (which are unclassified). Demersal fish that caught in large quantities during 2021-2022 and have an influence on trawl fishing in the eastern Gulf of Thailand are *Mullidae* sp., *Sphyræna* spp, *Leiognathidae* sp., *Priacanthus* spp., *Nemipterus* spp. and *Saurida* spp. Among the 30 demersal fish species, 15 species had a decrease in catch per swep area in 2022, especially *Priacanthus* spp., *Saurida* spp. which decreased to 23.64 and 3.15 Kilograms per square kilometer, respectively.**

### **Suggestions obtained from the study are as follows:**

1) The catch rate per sweep area of many aquatic species is higher in the vicinity of coastal areas and areas near islands; it shows that the conservation of these areas is important to help protect nursery areas and habitats for aquatic animals to have a better chance of survival before entering to the fishing grounds.

2) The use of speed while fishing affects the amount of sweep area and the number of aquatic animals caught, including the rate of aquatic animals caught per sweep area. As the factor effects of the use of speed while fishing by engines, machinery used and the season is an important factor for all gear types of trawlers, Oil prices are also an important factor that drives decisions about trawl fishing (stop/reduce/increase). Monitoring of trawl fishing using the sweep area and the quantity of aquatic animals caught should therefore be continuous to create an indicator for predicting or monitoring the situation of utilization the resources used for benefits from trawlers, including determining management measures more accurately.

3) High-risk fish groups such as *Saurida* spp., and relatively high-risk aquatic animal groups such as *Stolephorus* spp., *Priacanthus* spp., Squid groups (such as *Sepiida* sp., *Octopoda* sp., *Sepioteuthis* sp.) Shrimp groups (such as *Fenneropenaeus* sp., *Metapenaeus* sp.) and crab groups (such as *Portunus pelagicus*) groups had a decrease in the ratio of fish caught per sweep area, especially *Stolephorus* spp., *Priacanthus* spp., and *Saurida* spp. are of high economic importance. The combined analysis of biological data helps to reveal qualitative information, such as the size of aquatic animals caught in the area. This will help to analyze the data more clearly and make the determination of fishery management measures effective.

**ANNEX 2:****Summary Report of the stakeholders' meeting for the Sustainable Fisheries Improvement Project (FIP) in trawl fishing in the Gulf of Thailand**

**On Tuesday, April 23<sup>th</sup>, 2024, from 9:00 AM. to 1:00 PM.  
at Kuladam Conference Room, 7th Floor, Chulabhorn Building,  
Department of Fisheries**

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**Participants:****☞ Department of Fisheries**

1. Director of the Marine Fisheries Research and Development Division
2. Director of the Fisheries Commodity Standard System and Traceability Division
3. Fisheries Commodity Standard System and Traceability Division
4. Fisheries Commodity Standard System and Traceability Division
5. Fisheries Commodity Standard System and Traceability Division
6. Fisheries Commodity Standard System and Traceability Division
7. Fisheries Commodity Standard System and Traceability Division
8. Marine Fisheries Research and Development Division
9. Marine Fisheries Research and Development Division

**☞ Department of Marine and Coastal Resources****☞ Thai Feed Mill Association****☞ Samut Prakan Fisheries Association****☞ Thai Overseas Fisheries Association****☞ Southeast Asian Fisheries Development Center (SEAFDEC)****☞ Thai Union Feedmill Public Company Limited****☞ Research team from Kasetsart University****☞ Speakers****☞ Project consultants****☞ Thai Sustainable Fisheries Roundtable Working Group (TSFR)****☞ List of online participants**

**Objectives of the Meeting:**

- To present the progress of the Gulf of Thailand Trawl Fisheries Development Project towards sustainability in accordance with international standard practices during the implementation of the Fishery Action Plan (FAP).
- To present research findings, supported the funding by the Agricultural Research Development Agency (ARDA), over the past three years and to propose policies for the management of the Gulf of Thailand trawl fisheries that align with the research findings, as well as to gather feedback from stakeholders to inform the Department of Fisheries and related agencies in future management considerations.

**Opening Remarks by Mr. Pornsil PatcharinTanakul President of the Thai Feed Mill Association:**

Throughout the implementation of the Gulf of Thailand Trawl Fisheries Improvement Project (FIP), the TSFR working group has consistently presented and reported progress to the standard assessors. This ongoing reporting has enabled MarinTrust, the international organization responsible for certifying the sustainability of marine production, to recognize the project's advancements and approve the continuation of the Gulf of Thailand Trawl Fisheries Improvement Project (FIP) in accordance with the Fishery Action Plan (FAP). This endeavor requires the cooperation of all sectors.

Currently, more members from the fishmeal production industry, a key business sector, are seeking standard assessments, even though this may necessitate adjustments or increased investments. This is to meet the goals and ensure efficient and effective certification under international standards amidst increasing commercial competition. I extend my gratitude to the Department of Fisheries, the Agricultural Research Development Agency (Public Organization) (ARDA) for their financial support, the specialized faculty members, and the research

team who have continued their collaborative efforts to maximize the project's efficiency and success. Their contributions are pivotal in achieving beneficial developments for the fisheries sector and the broader industry.

**Additional Remarks to the Meeting by Ms. Krisana Chankaeo, Director of the Fisheries Commodity Standard System and Traceability Division, on behalf of the Department of Fisheries:**

On behalf of the Department of Fisheries, we are pleased to cooperate and collaborate with the TSFR working group. For instance, the Department has been actively involved in the Blue Swimming Crab Fishery Improvement Project (FIP). Regarding the Gulf of Thailand Trawl Fisheries Improvement Project, the Department of Fisheries is glad to acknowledge the progress and provide necessary assistance.

**Summary of stakeholder feedback on research finding and policy recommendations on the management of Gulf of Thailand trawl fisheries, aligned with research findings, to provide information for consideration of the Department of Fisheries and relevant agencies in developing future management strategies.**

**1. At the research study feedback session during the meeting,**

The head of the Samut Sakorn Fisheries Association, posed a question regarding the impacts of water and sediment dispersion. In response, Prof.Dr.Shettapong Meksumpun commented that physically, water and sediment dispersion affects the respiratory systems of aquatic animals. According to assessors from MarinTrust, the critical concern lies in how trawl fishing impacts habitats such as coral reefs, seagrass beds, and mangrove forests. An observed issue is sediment covering seagrass, leading to its gradual decline. Chemically, there has been an observed increase in dispersion activities, particularly notable within the Gulf of Thailand. Recently, this phenomenon has expanded beyond traditional areas to include Bang Saen, Ang Sila, Pattaya, Koh Samet, and the

southern islands of Ang Thong. Some of these activities may originate from coastal activities, necessitating comprehensive studies.

The head of the Samut Sakorn Fisheries Association, believes that it is essential to conduct a comprehensive study, including various factors, to determine the percentage impact on biological resources and the environment. Only then can a clear and definitive summary be made. He also suggests that in the case study of Project Phase 3 by Assoc. Prof. Dr. Sansanee Wangvoralak, the increased quantity of by-catch fish may be linked to the practice of purchasing high-quality fish (fish for human consumption) beforehand.

The president of the Samut Prakan Fisheries Association, provided his opinion: In Sub-project 2 studied by Prof. Dr. Shettapong, the depth of water during fishing operations should be analyzed as a contributing factor. It was found that increased drag nets caused more sediment accumulation than usual, a concern for fishermen who prefer minimal disturbance. The study area's shoreline is designated as inaccessible to dragging fishing vessels. Professor Dr. Shettapong Meksumpun commented that the research team's objective is to gather data from coastal areas. They aim to use non-trawled zones as comparative controls against areas with light and heavy trawling to provide comprehensive coverage of all seabed conditions. This will help them determine how trawling activities affect areas differently depending on the intensity of trawling. In Sub-project 3, researched by Assoc. Prof. Dr. Sansanee, the method of calculating upper sweep length was proposed, deviating from the conventional lower sweep calculation method. Assoc. Prof. Dr. Sansanee explained that this upper sweep calculation method is derived from FAO standards for fishing gear, based on previously granted lower sweep lengths from fishing vessels. Research teams have consulted with SEAFDEC experts on trawl fishing gear to refine their data analysis.



The president of the Trawl Fishing Vessel Association of Songkhla, expressed his appreciation to the TSFR team and the researchers for the valuable data benefiting fishermen. However, he emphasized the importance for the project to also focus on issues directly relevant to fishermen. He believes this should be prioritized alongside resource conservation and environmental protection efforts, especially considering recent government and fisheries department regulations. These include prohibitions on seasonal fishing, expansion of trawling areas, and potentially increased enforcement measures. He emphasized the need for fishermen, who are vital to the economy, to fully understand these regulations. The association acknowledges the responsibility of responsible fishing practices but seeks clarity on how fishermen can best comply with these regulations. Professor Dr. Shettapong Meksumpun commented that the research team's objective in this study is to assist fishermen by finding solutions to issues such as exports and sustainable resource utilization. Their approach involves collaborating with fishermen rather than imposing regulations, for instance, by clearly defining fishing areas. Assoc.Prof. Dr.Kungwan Juntarashote added that the academic work conducted in this project aims not for personal gain but to seek the best scientific truths. This knowledge will be used in fisheries management to ensure sustainable resource utilization and uphold responsible fishing practices.

The president of the Kantang Fisheries Association, expressed concerns about the use of research data, particularly regarding seagrass in Trang province. He highlighted issues where trawl fishing activities have adversely affected seagrass beds, leading to governmental conservation regulations. Although trawl fishermen have relocated from designated areas, damaged seagrass persists, raising caution about the precise application of data and the effectiveness of problem-solving approaches. Professor Dr. Shettapong Meksumpun responded that the utilization of research data depends significantly on the intentions of those utilizing it. For the projects research study, it presents an overview without specifying that trawl-induced sedimentation alone affects

seagrass beds. The research team aims to present factual insights derived from data collected within the study area.

Mr. Pornsil PatcharinTanakul, the president of the Thai Animal Feed Producers Association, shared his understanding of fishermen's concerns regarding policy discussions that could potentially impact trawl fishing. He acknowledged that policymaking is a necessary undertaking for every country and involves extensive considerations in practice. Insufficient or lacking research data could lead to misunderstandings among stakeholders. Therefore, he emphasized the importance of collaborative research efforts aimed at establishing scientifically sound findings based on thorough studies, even if it requires considerable time. This approach aims to address fishermen's concerns by working together to identify and solve issues. The project's objective is collaborative development. If there are any resulting impacts, they should be managed comprehensively, including within the business sector. Mr. Pornsil stressed the need for fishermen to have a clear understanding of these processes.

Assoc. Prof. Dr. Kungwan Juntarashote expressed his opinion: "I support Mr. Phansin's views. The project's operation is a knowledge development initiative aimed at sustainable fisheries, emphasizing not only marine life but also the livelihoods of fishermen. Therefore, policy-making should prioritize the survival of fishermen. Fishermen should not worry because before any policy is formulated, there must always be meetings and discussions with them to seek approval to ensure that no one suffers losses.

The chairman of the trawler fishing association in Songkhla, commented: "There are no objections to the research. Fishermen have no objections and appreciate the research team's thorough study. We are happy to fully support the project and gladly collaborate with the project team.

**2. Policy recommendations for the management of trawl fisheries in the Gulf of Thailand, aligned with research findings, provide data to the Department of Fisheries and related agencies for future management considerations. Presented by Assoc.Prof. Dr.Kungwan Juntarashote, representing the faculty and TSFR working group**

**2.1 Thailand should implement zoning for trawl fisheries in the Gulf of Thailand, allowing each group of vessels to fish in designated areas. This approach aims to manage resource access and reduce environmental impacts:** Research indicates that during bay openings, nearshore Zone 6 experiences high catches of marine animals, including by-catch, possibly due to trawlers congregating in one area. Therefore, efficient zoning based on vessel capabilities is recommended: small trawlers should operate nearshore where fishing efficiency is lower, medium-sized trawlers should fish in the mid-bay areas, and highly efficient medium-sized trawlers should operate farthest from the coast to optimize fishing efforts while minimizing environmental impacts.

**2.2 Establishing clear standards for trawl fishing gear:** Setting standards for trawl fishing gear should be universally accepted and adhered to by all stakeholders. In the future, the Department of Fisheries should invite experts in fishing gear, including trawler fishermen, researchers, and relevant stakeholders from all sectors, to collectively discuss and establish standardized formats and sizes for each type of trawl. This collaborative effort aims to ensure unified decision-making and consensus on accepted standards for trawl fishing gear among all parties involved.

**2.3 Establishment of a unit to verify academic articles from abroad that may contain inaccurate information regarding fisheries in Thailand:** The Department of Fisheries should monitor academic articles that are publicly published and may contain analyses or data that are incorrect in the context of Thailand's fisheries. They should take steps to

provide clarification through documented processes or articles that provide accurate information, to prevent misunderstandings about the actual situation.

**Chairperson's closing remarks:**

Mr. Amnuay Kongprom, Director of the Marine Fisheries Research and Development Division, speaking on behalf of the Research Project Manager, Mr. Banchat Sukkaew, in this research endeavor, aims to utilize the study's findings for standard evaluation. This initiative allows the Fisheries Department to employ the research results in formulating measures and managing marine resources sustainably. The resources of marine fauna and flora from trawling activities contribute to sustainability. We extend our gratitude to the research team and all participants for their insightful contributions, which have instilled confidence and credibility in various proposals. The Fisheries Department welcomes feedback from fishermen. If opportunities arise to implement today's proposals, particularly in expanding or defining trawling zones and net mesh sizes, we are eager to present them to the Director-General of the Fisheries Department. This aligns with ongoing departmental efforts towards sustainable fisheries management for the collective benefit.



**The picture of stakeholders' meeting for the Sustainable Fisheries Improvement Project (FIP) in trawl fishing in the Gulf of Thailand, at the Kuladam Room, 7th floor, Chulabhorn Building, Department of Fisheries.**



**The picture of stakeholders' meeting for the Sustainable Fisheries Improvement Project (FIP) in trawl fishing in the Gulf of Thailand, at the Kuladam Room, 7th floor, Chulabhorn Building, Department of Fisheries.**