The Gulf of Thailand mixed-trawl Fishery Improvement Project (FIP)
6 Months Update base on FAP

Section 2A Catch
Part A - Total Aggregate Catch

Action Criteria	A1-6	Update Status	Remark
Objective	To improve the stock assessment and improve the management.		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Update assessment report and publicly available. (A4), Jan 22-Aug 23, Jan 23-Aug 24, Jan 24-Aug 25. 2. Fishermen Meeting report and provincial fisheries committee meeting report to be made publicly available. (A5) (M3.5) 3. FMP 2020-2022 evaluation report. (A6) **Output:** 1. Annual report year (2022-2025) on stock assessment, (MMSY) and indicators species (Provide on Aug every year) (A4) 2. Fishermen Meeting report and provincial fisheries committee meeting report to publicly available. (A5) (M3.5 3. Report on FMP evaluation. (A6)	**Completed** **Completed**	**The meeting report in the annex 1 (Page 13-19)** **The meeting report in the annex 1 (Page 13-19)**

Priority	Medium Priority		
Estimated Cost	TBC		
Responsible Parties with lead agency	1. Department of Fisheries, Marine Fisheries Research and Development Division and Fishery provincial office. 2. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	A4-6 and M 3.5		

Part B - High-risk species/Species groups

Action Criteria	B1 – 6	**Update Status**	**Remark**
Objective	To identify, monitor and assess the high-risk species.		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Identify species and species groups of fish, caught in trawl fishing in the Gulf of Thailand and analysing productivity and sensitivity (PSA) to estimate vulnerability. (1st May21-30thApr22) 2. Conduct and analysis of changes in catch composition of trawl fishery, classified by vulnerability groups. (1st May21-30thApr22) 3. Assess the stock status of high-risk species (1st Aug22-30thJul 23)	**Completed** **Completed**	**The summary report in the annex 1 (Page 20-32)** **The summary analysis in the annex 1 (Page 20-32)**

	Output: 1. The report of analysis for the vulnerability of species/ species groups in catch composition, classified by type of trawl fishing in the Gulf of Thailand. B1 (Dec 22). 2. The report on data/information of changes in the catch composition of each type of trawl fishing B2, B3, B4 (Dec 22). 3. The report of stock assessment for high-risk species. (Dec 23) 4. Guidelines/Data/Information for input into the next FMP (28).	**Completed** **Completed**	**The summary report in the annex 1 (Page 20-32)** **The summary report in the annex 1 (Page 20-32)**
Priority	High Priority		
Estimated Cost	1 million Baht		
Responsible Parties with lead agency	1. Prof. TuantongJutagate, UbonRatchathani University 2. Department of Fisheries, Marine Fisheries Research and Development Division. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	B1-4		

Part C -Reduction component

Action Criteria	C1-7: Reduction component	Update Status	Remark
Objective	To assess reduction component, juvenile commercial fish from trawl fishery and establish TRP.		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Review existing research related to trawl catch composition and stock assessment to set TRP. C1, C2 (Jan -Dec 23) 2. Set up data collection program for trawl fisheries monitoring and research vessel. C3 (Oct - Dec 22) 3. Conduct the data collection program, especially the composition of the trash fish.C3, C4, C5 (Start Jan 2023). 4. Analyze data and publish annual report on trawl fisheries and research vessel C3, C4, C5(Jan 24 - Dec 25). 5. Set proposed objectives and TRP for reduction component and juvenile commercial fish. C1, C2(Jan 24 - Dec 25). 6. Conduct workshop with stakeholders to discuss recommendations for input into the next FMP.C6,C7 (Jan - Dec 26).	**Completed**	**The report in the annex 1 (Page33-42)**

	Output: 1. Report on catch composition, especially for trash fish including juvenile commercial fish from each type of trawl fisheries and stock assessment. 2. Data collection program. 3. Annual report on trawl fisheries and research vessel. 4.Workshop report recommendation for input into the next FMP.	**Completed**	**The report in the annex 1 (Page33-42)**
Priority	High Priority		
Estimated Cost	TBC		
Responsible Parties with lead agency	1. Marine Department of Fisheries, Marine Fisheries Research and Development Division. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	C1-7		

Section 2B – Endangered, threatened and protected species (ETPs)

Action Criteria	T1-3	Update Status	Remark
Objective	To identify and assess ETP species impacted by trawl fishery.		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Review ETP species from IUCN, CITES and National Regulations. T3 (Dec 22 - Mar 23) 2. Workshop to reviews and planning for ETP species recording and trawl interaction. T2 (Jun 23-Aug 23). 3. Collect Historical data from fisherman at sea observation by DoF.(Jan-Dec 23) 4. Monitor population of marine endangered animal by DMCR. (Jan-Dec 23) 5. Risk Assessment on trawl fishery and ETP interaction. T2 (As soon as the data available within 5 years)		

	6. Consultation with stakeholder to improve current fisheries practice. (T1) (Mar 2023 – Mar 2024) - Mitigation protective measures. - Training program by DoF on logbook to record ETP during at sea operation. - Training program by DMCR on life saving, identification, stranded reporting ETPs. **Output:** 1. Effective ETP interaction record approach. (T1) 2. Report on (T2) - Updated ETPs of Thailand. - Risk assessment of trawl interaction to ETP species. Best practice on ETP protection on community area management (T3).		
Priority	High Priority		
Estimated Cost	TBC		
Responsible Parties with lead agency	1. Department of Fisheries, Fish Quarantine and fishing Vessels Inspection Division, Fishing and Fleet Management Division		

	2. Department of Marine and Coastal Resources. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	T1-3		

Section 2C –Habitats

Action Criteria	H1-3	**Update Status**	**Remark**
Objective	To identify and assess critical habitat impacted by trawl fishery		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Collect environmental data of critical habitat (Seagrass, Coral reefs, mangrove and fisheries and marine protected area) and trawl fishing activities, using GIS and VMS (Jun-Dec) - Inner Gulf of Thailand (21-22) - Eastern Gulf of Thailand (22-23) - Southern (Lower) Gulf of Thailand (23-24) 2. Analyze and synthesize data to assess the impact of trawl fishing on critical habitat and marine environments in the Gulf of Thailand, including distribution changes as much as available (Jan-Mar).	**Completed** **Completed**	**The summary report in the annex 1 (Page 43-47)** **The summary report in the annex 1 (Page 43-47)**

	- Inner Gulf of Thailand (21-22) - Eastern Gulf of Thailand (22-23) - Southern (Lower) Gulf of Thailand (23-24) 3. Identify and assess the critical habitat effected by trawl fishery. (Apr-May) - Inner Gulf of Thailand (21-22) - Eastern Gulf of Thailand (22-23) - Southern (Lower) Gulf of Thailand (23-24) 4. Risk Assessment on trawl fishery and habitat interaction. 5. Workshop to discuss recommendation on mitigation measure for the input into the next FMP. **Output:** 1. Report on; Comprehensive environmental data and trawl fishing behaviours(H1). - Inner Gulf of Thailand (Dec 21-22) - Eastern Gulf of Thailand (Dec 22-23) - Southern (Lower) Gulf of Thailand (Dec 23-24)	**Completed** **Completed**	**The summary report in the annex 1 (Page 43-47)** **The summary report in the annex 1 (Page 43-47)**

	2. The result of impacts on main habitat and critical habitat effected by trawl fishery (H2). - Inner Gulf of Thailand (Dec 21-22) - Eastern Gulf of Thailand (Dec 22-23) - Southern (Lower) Gulf of Thailand (Dec 23-24) 3. Workshop report recommendation on mitigation measure for the input into the next FMP H1, H3 (2028).	**Completed**	**The summary report in the annex 1 (Page 43-47)**
Priority	High Priority		
Estimated Cost	15 million Baht		
Responsible Parties with lead agency	1. Prof.ShettapongMeksumpun Department of marine sciences and Prof.SansaneeWangvoralak, Department of Fisheries Management, Faculty of Fisheries, Kasetsart University. 2. Department of Fisheries, Fish Quarantine and fishing Vessels Inspection Division, Fishing and Fleet Management Division. 3. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	H1-3		

Section D-Ecosystems

Action Criteria	E1 – 4	Update Status	Remark
Objective	To identify and assess the impact of fishery to ecosystem		
Action Description and tasks (with timeframes) and expected output	**Action:** 1. Review existing research related to the impacts from fisheries on the ecosystem. (Jan - Jun 23) 2. Find an expert on Ecopath model. (Jul - Dec 23) 3. Update Ecopath model by using recent data. (Jan 24 - Dec 25) 4. Find key ecological species from Ecopath. (Jan 24 - Dec 25) 5. Simulate the model with different scenario [fishing gear/fishing effort] (Jan 24 - Dec 25) 6. Workshop to discuss recommendation for input into the next FMP (Jan - Dec 26) **Output:** 1. Summary historical changes of the impacts from fisheries on the ecosystem. E1 (Jun 23).		

	2. Reports on; E2 (Dec 25). - Updated Ecopath model. - Key ecological species identified - Simulation result from different scenario and implication for management 3. Workshop report recommendation for input into the next FMP. (2028). E3 (Dec 2026)		
Priority	Low Priority		
Estimated Cost	1 million Baht		
Responsible Parties with lead agency	1. Department of Fisheries, Marine Fisheries Research and Development Division 2. Thai Sustainable Fisheries Roundtable (TSFR)		
Gaps addressed by the Action	E1-3		

ANNEX 1:

Section 2A Catch (Part A) - Total aggregate catch:

Fishermen Meeting report and provincial fisheries committee meeting report

Minutes of the 3nd/2022 Committee on National Fisheries Policy Meeting
On Monday 25th July, 2022, at 09: 30 A.M.
At Meeting Room Five Provinces Boundary Forest Preservation Foundation
And long-distance online system, ZOOM program

Participants

1. Deputy Prime Minister — Chairman
2. Deputy Permanent Secretary, Ministry of Agriculture & Cooperative — Vice President
3. Relevant departments

Committee

1. Navy Specialist
2. Assistant Commissioner of the Royal Thai Police
3. Inspector General of the Ministry of Labour
4. Director-General of the Department of Marine and Coastal Resources
5. Director of Bureau of Vessel Registration Standards
6. Inspector General, Department of Provincial Administration
7. Deputy Director General of the Department of International Economic Affairs
8. Fisheries Agricultural Organizations
9. Vice Chairman of the Thai Chamber of Commerce
10. President of the Federation of Thai Industries
11. Thai Oversea Fisheries Association of Thailand
12. National Fisheries Association of Thailand
13. Artisanal fisheries Association of Thailand
14. Thai Frozen Food Association
14. Expert in Natural Resources and Environment
16. Professional Diplomat
17. Director General of the Department of Fisheries, Deputy Director General and Director, Expert Academic Department within the Department of Fisheries
18. Working Group of the Deputy Prime Minister

Objectives of this meeting:

To acknowledge the schedule of the 6th Joint Working Group Meeting between the Thai Government and the European Commission on Anti-IUU and the results of the allocation of commercial fishing licenses for the year 2022 - 2023 and issues to consider the project to remove fishing vessels from the system for sustainable management of fishery resources.

- **Schedule for the 6th Meeting of the Joint Working Group of the Thai Government and the European Commission Against IUU**

The Director-General of the Department of Fisheries reported to the meeting that the European Union has notified a good cooperative mechanism to tackle IUU fishing. However, there are any significant backlogs to monitor progress. The proposed to Department of Fisheries to hold the next meeting, and call for a bilateral meeting between the FAO COFI sessions from 5th - 9th September 2022

The Sub- Committee agreed to hold the meeting during that period and assigned the Department of Fisheries to notify the European Union and prepare a report on progress against IUU fishing in Thailand and submit it within the specified time. Therefore, the chairman approved and assigned the Department of Fisheries to take action.

- **Summary of the allocation of commercial fishing licenses for the year 2022 - 2023**

The Director General Department of Fisheries reported to the meeting that after the National Fisheries Policy Committee approved guidelines for issuing licenses and criteria for allocation of commercial fishing licenses for the year 2022 – 2023, the allocation of licenses according to the request for permission has been considered and finished. There are a total of 9,687 vessels have been considered for license allocation.

- **Project to remove fishing vessels from the system for sustainable management of fishery resources**

The Director-General of the Department of Fisheries informed the meeting that from the 3rd meeting 2021 of the National Fisheries Policy Committee has considered ways to remove fishing vessels from the system for sustainable management of fishery resources. There was a resolution approving the removal of 75 white group vessels by the Ministry of Agriculture and Cooperatives, with the Department of Fisheries submitting a letter to the Cabinet to consider approving this project.

In this regard, the working group checks the history and accuracy of non-compliant fishing vessels On July 11th, 2022. The subcommittee on solving illegal fishing problems approved that fishing vessels that have been inspected by the working group will be released from compensation.

The meeting resolved to approve the number of fishing vessels removed from the system for sustainable management of fisheries resources and assigned the Department of Fisheries to proceed further to the Cabinet for further consideration.

- **Other matters**
  - **Propose the results of the committee to coordinate, monitor, and support sustainable fisheries**.

Director General Department of Fisheries has notified the meeting that The Prime Minister has acknowledge the result of the committee as follow.

1) Progress has been made in solving the problem of labor shortages in the fishing sector according to Article 83 of the B.E. 2015 Fisheries Act.
2) The extension project of loan to enhance liquidity of fishery entrepreneurs.
3) Troubleshooting radio possession on Fishing Vessels by the Customs Department.

The chairman has orders as follow:

1) All relevant agencies cooperate in the implementation and provide information for the preparation of the joint working group meeting between the Thai government and the European Commission.

2) As the government has formulated various projects to mitigate the impact on the people, all agencies must take urgent action to help solve the problem for a concrete result.

Minutes of the 4st/2022 Committee on National Fisheries Policy Meeting
On September 30th, 2022, at 10: 30 A.M.
At Meeting Room 301, Command Building 1, Government House
And long-distance online system, ZOOM program

Participants

1. Deputy Prime Minister — Chairman
2. Deputy Permanent Secretary, Ministry of Agriculture & Cooperative — Vice President
3. Relevant departments

Committee

1. Commander-in-Chief of the Navy
2. Assistant Commissioner of the Royal Thai Police
3. Inspector General of the Ministry of Labour
4. Director-General of the Department of Marine and Coastal Resources
5. Director of Marine Resources Conservation
6. Legal expert Bureau of Investigation
7. Deputy Director General of the Department of International Economic Affairs
8. Fisheries Agricultural Organizations
9. Vice Chairman of the Thai Chamber of Commerce
10. President of the Federation of Thai Industries
11. Thai Oversea Fisheries Association of Thailand
12. National Fisheries Association of Thailand
13. Artisanal fisheries Association of Thailand
14. Thai Frozen Food Association
15. Aquatic Animal Processing Expert
16. Expert in Natural Resources and Environment
17. Professional Diplomat
18. Director General of the Department of Fisheries, Deputy Prime Minister, Deputy Director General and Director, Expert Academic Department within the Department of Fisheries
19. Working Group of the Deputy Prime Minister

Objectives of this meeting:

To track the execution of the order, acknowledging the results of the Bilateral Meeting on Combating IUU Fishing between Thailand and the European Union on 7th September 2022 in Rome, Italy ,and considering 1) Measurement to increase efficiency in notifying targets, and prosecuting suspected offenders by the Fisheries Monitoring Center (FMC). 2) Measurement of the National Fisheries Policy Committee on Guidelines for the withdrawal of fishing vessels from the list of illegal fishing vessels.

- **Order tracking**
  - **Report of the 9th SIOFA General Meeting of the Parties**

Director General Department of Fisheries report on the results of the meeting held between 4th -8th July, 2022, in France, participants from 10 member states attended the meeting with the following key points from the meeting:

1) SIOFA approved the minutes of the meeting of the Compliance Committee. Thailand was able to comply with the agreement and measurement for the conservation and management of SIOFA in all measures. There are no outstanding issues.

2) SIOFA has a resolution approving measurement to conserve and manage resources, such as measurement on data management standards, measurement on fishing vessel permits, measurement on the operation of vessels on the IUU Vessel List, and measurement on vessel control to be by the schedule and measurement for collecting shark data.

3) SIOFA endorses the minutes of the scientific committee meetings and the detail that relevant to Thailand is Mauritius and Seychelles case. They claim the Joint Management Area (JMA) over SIOFA on the Saya de Malha Bank. They inform that fishing affects coral reefs/seagrass and the SIOFA disagreed with the proposal because it affected the regulations of SIOFA and SIOFA committee has decided to proceed by the resolution of the Scientific Committee that scientific data must be studied clearly before setting measures. The Director-General emphasized that Thailand has no environmental damage issues as doubt.

The Department of Fisheries is in the process to amend the laws and regulations for Thai fishing vessels to be in line with SIOFA revisions and following up on scientific studies in the Saya de Malha Bank area, seeking alliances from parties on issues related to area management measures and related to trawl

fisheries in Thailand and follow up on improving the SIOFA Bottom Fishing Footprint to match the Footprint of Thailand.

The committee explained to the meeting that from the report of the Department of Fisheries, it was confirmed that Thailand was able to comply with international regulations. This able to raise the standard of operation and management of Thailand to a higher level because Thailand has a baseline data collection that is globally accepted such as collecting data and documenting sensitive areas of the ecosystem or forecasting the number of aquatic animals to be used for management and issuing a fishing license.

The chairman has approved and assigned the Department of Fisheries to consider the process because the government attaches great importance to fisheries and wants to raise the level to international in order to be accepted internationally along with maintaining sustainable aquatic and natural resources.

- **Order from the meeting of the National Policy Committee**

1) **Guidelines and measurement for the development of Thai fisheries to release aquatic animals and products from IUU fishing**: The Department of Fisheries has increased the efficiency of staff in their operations by organizing a workshop for Officers inspecting port state measures, the practice of inspecting vessels, strengthens the competency of aquatic animals fishing vessels inspectors and improve factors of production to prepare for MMPA measures. The chairman assigned the Department of Fisheries to carry out the operation work in an integrated manner for all departments to work together.

- **Results of the Bilateral Meeting on IUU Fishing between Thailand and the European Union on 7th September, 2022, in Rome, Italy**.

The Director-General reported the results of the meeting that the European Union emphasizes rigorous follow-up of countries' post-liberalization from yellow card. For Thailand, the EU needs the country to continue to solve fisheries problems in various dimensions according to scientific principles and in accordance with international principles for the sustainability of fisheries. The meeting has discussed on four main issues, the legal framework, Monitoring Control and Surveillance, vessel management and law enforcement. For investigating the cases, the Assistant Commissioner General of the Royal Thai Police is assigned to carry out after reporting on the progress, the EU is satisfied with law enforcement.

- **Measures to increase efficiency in notifying, inspecting, and prosecuting suspected fishing vessels by the Fisheries Monitoring Center (FMC).**

The Director-General of the Department of Fisheries clarified measures to increase efficiency in notifying targets and inspecting and prosecuting suspected fishing vessels by the Fisheries Monitoring Center (FMC) to the meeting, which was approved by the sub-committee and to be proposed to the National Fisheries Policy Committee in this regard.

The chairman has approved and assigned the relevant agencies, the Royal Thai Navy, the Royal Thai Police, the Department of Marine and Coastal Resources, and the Marine Department; Thai Maritime Enforcement Command Center implements and operates strictly in order to be effective.

- **Measures of the National Fisheries Policy Committee on Guidelines for the withdrawal of fishing vessels from the list of illegal fishing vessels**

The Director-General of the Department of Fisheries reported to the meeting that the subcommittee resolved to propose to the National Fisheries Policy Committee for consideration and proposed to the meeting to consider approving the measure on the guideline for the removal of fishing vessels from the list of fishing vessels engaged in illegal fishing. The resolution of the meeting approved the measure.

Section 2A Catch (Part B) - High-Risk Species/Species groups: Trawl fisheries in the Gulf of Thailand: Vulnerability assessment and trend analysis of the catches

PSA Species / Species group

Catch data for PSA analysis: The study used data from the fish landing sampling surveys around the Gulf of Thailand conducted by 5 Centers under Marine Fisheries Research and Development (MFRDD) between 2016 and 2020, which were pooled at Fisheries Resource Assessment Group of MFRDD. Each landing site were visited once a month and data/information from all the "port-in" trawlers of that day were collected. It is difficult to arrange in advance on which trawler would be the sample. This is due to the unpredictable "port-in" time of the trawlers, in particular the size M trawler and above, which the operation period could be fluctuated from few days to last for 15 days, mostly depends on weather and amount of catches. Collected information included fishing effort, fishing ground and total catch. Then, the catch compositions of each trawler were categorized into groups, taxonomical classified based on FishBase (www.fishbase.org; Froese & Pauly, 2021) for fishes and SeaLifeBase (www.sealifebase.org; Palomares & Pauly, 2021) for other aquatic animals, and then weighed (at 0.1 kg). Only the catches those were identified to genus or species level were further used in the assessment, i.e. Productivity and Susceptibility Analysis.

Productivity and Susceptibility Analysis (PSA)

Productivity Susceptibility Analysis (PSA; Hobday et al., 2011), which is a practical semi-quantitative vulnerability assessment tool (Hordyk and Carruthers, 2018; Lin et al., 2020; Faruque and Matsuda, 2021) was used for assessing the risk of individual stocks from the trawl fisheries in the GoT, according to the trawl type and vessel size. The PSA consists of the attributes of two characters, i.e. productivity and susceptibility attributes. The productivity attributes are employed to determine the recovery rate of the stock from fishing, meanwhile, susceptibility attributes are for determining the extent impact of the fishery to individual stock (Hobday, 2006; Hobday et al., 2011). There were seven productivity attributes and four susceptibility attributes used in this study (Table 1, FAO 2014). For each species, the information for each attribute was from sampling, i.e. contributing in catch and from desk study of relevant scientific publications, in particular from MFRDD

(www.fisheries.go.th/library) as well as from FishBase (www.fishbase.org; Froese and Pauly, 2021) and SeaLifeBase (www.sealifebase.org; Froese and Pauly, 2021) using the search keyword as the common and scientific name of the catches. The obtained information was converted to a rank score (Table 1), where 1 is high productivity or low susceptibility, 2 is medium productivity or susceptibility, and 3 is low productivity or high susceptibility (Hordyk and Carruthers, 2018). A focus group discussion, which is the important step of the PSA, among the researchers, fishery scientists, trawl fishers, member of fish meal group and TSFR was conducted to discuss and make agreement on the rank scores of the catches, based on their experience and ecological knowledge. The total vulnerability (V) or risk score was then calculated by

$$V = \sqrt{(P\text{^}2 + S\text{^}2\ )}$$

where P is the overall productivity score (i.e., arithmetic mean of the productivity attributes) and S is the overall susceptibility score (i.e., geometric mean of the susceptibility attributes). The V score ranges between 1.41 and 4.24; values lower than 2.64 and above 3.18 are considered low- and high- vulnerability, respectively, while values in between indicate medium vulnerability (Hobday et al., 2011; Hordyk and Carruthers, 2018). Data quality of the inputs were checked according to as 1: information is from collected data in the area of interested; 2: information is from literatures, FishBase and SeaLifeBase of other region, 3: as 2 but on the genus or family level; 4: expert opinion and 5: no data, which The mean quality score of P and S was interpreted as high (< 2), medium (2 and <3), or low (3). (Patrick et al., 2010; Lin et al., 2020; Jutagate and Sawusdee, 2022)

Results: Vulnerability analysis

Number of taxa, used in vulnerability analysis, ranged between 65 in beam trawler size L and 256 in pair trawler size L, which the overall V-score ranged between 1.00 and 3. 53 with the mean of 2.55 ± 0.30, and the overall mean of data quality was 2.14 ± 0.41. The high vulnerability taxa, i.e. V-score 3.18, were found in all trawl types and sizes, except the beam trawler size S. There were only 7 taxa classified as high vulnerability included 4 taxa of teleost, namely *Saurida elongata, Plotosus spp., Gymnothorax spp and Sphyraena spp.* as well as 3 taxa of elasmobranch, namely, *Carcharhinus spp. Brevitrygon walga* and *Neotrygon kuhlii*. However, when the considerably high vulnerability taxa, i.e. 3.00 V-score < 3.18, was taken into consideration, the number of taxa in this group was as high as 26

taxa in otter-board trawler size L (**Table 2**). The considerably high vulnerability taxa were not only fishes but also cephalopods, in which the number of teleosts, elasmobranch and cephalopods taxa in this category were 38, 5 and 3 species, respectively.

Focusing on the top ten contributing taxa in catch, as by percentage of weight (**Table 2**), the high vulnerability *S. elongata* were listed in otter-board trawlers sizes S, M and L. There were six (6) out of top ten contributing taxa ranked considerably high or highly vulnerable. The demersal fish *Scolopsis taenioptera*, which were ranked as considerably high vulnerability species, were included in all sizes of otter board trawlers, except the size SS, as well the size S beam trawler. Two (2) pelagic fishes in top ten contributing taxa in pair trawlers, namely, *Encrasicholina heteroloba* and *Selaroides leptolepis* were ranked considerably highly vulnerable. In addition, the loliginid squids *Uroteuthis* spp., which considerably highly vulnerable, were involved in the top ten contributing taxa in catch of otter-board (sizes S, M and L) and pair (size M and L) trawlers.

The graphical PSA results of the substantial high and high vulnerability taxa, by each trawl type, are displayed in **Fig. 1**. It is clearly seen that most of these taxa were highly vulnerable due to their susceptibility to the fisheries, i.e. high rank scores along the vertical axis. The elasmobranches, on the other hands, were highly vulnerable due to their low productivity, high rank scores along the horizontal axis. Elasmobranches also showed higher vulnerable to the trawl fisheries than other groups in every trawl type and size (**Fig. 2**), which Carcharhinus spp. revealed the highest median V-score (3.43), followed by Himantura walga (3.14) and Carcharhinus melanopterus (3.01) (**Fig. 3**).

Table 1 Attributes and scoring thresholds used to determine the vulnerability of taxa, caught by trawl fisheries in the Gulf of Thailand

(A) Productivity attributes and the rank score

Productivity attributes (P)	**Low productivity/ High risk**	**Medium productivity/ Medium risk**	**High productivity/ Low risk**
	Rank score =3	**Rank score =2**	**Rank score =1**

P1: Average age at maturity (years)	> 4	2 - 4	< 2
P2: Average maximum age (years)	>30	10 - 30	< 10
P3: Fecundity (eggs/spawning)	< 1,000	1,000 - 10,000	> 10,000
P4: Average maximum size (cm)	> 150	60 - 150	< 60
P5: Average size at maturity (cm)	> 150	30 - 150	< 30
P6: Reproductive strategy	Live bearer, mouth brooder or significant parental investment	Demersal spawner "Berried"	Broadcast spawner
P7: Mean trophic level	> 3.25	2.5 – 3.25	< 2.5

(B) Susceptibility attributes and the rank score

Productivity attributes (P)	**High susceptibility/ High risk**	**Medium susceptibility / Medium risk**	**Low susceptibility/ Low risk**
	Rank score =3	**Rank score =2**	**Rank score =1**
S1: Contribution to total catch	> 0.2 %	0.04 % - 0.2 %	< 0.04 %
S2: Encounterability	High overlap with trawl fishing gear (20 to 60 m depth)	Medium overlap with trawl fishing gear (10 to 20 m depth)	Low overlap with trawl fishing gear (0 to 10 m, > 70 m depth)
S3: Availability: range of distribution	Limited (western-Pacific)	Spread (Indo-Pacific)	Global
S4: Schooling behavior	Schooling or aggregation	Solitary or schooling or aggregation	Solitary

Table 2 List of high- and considerably high- vulnerability species in the trawl fishery in the Gulf of Thailand by each trawl- type and vessel size with its V- score in parentheses. Species with * indicates that they were among the top ten species caught, in term of weight, by the trawler.

Note: SS (< 10 gross tonnages, GT), S (10 – 29.9 GT), M (30 – 59.9 GT), L (60 – 149.9 GT) and X (> 150 GT).

(a) Otter board trawler

Vessel size	High vulnerability species	Considerably high vulnerability species
SS	*Brevitrygon walga* (3.29), *Saurida elongata* (3.26) and *Plotosus* spp. (3.18)	*Megalops cyprinoides* (3.16), *Apogon* spp (3.13). *Trichiurus lepturus (3.13)*, *Platycephalus indicus**(3.07), *Saurida isarankurai* (3.06), *Gymnothorax* spp. (3.06), *Mugil* spp. (3.02), *Upeneus* spp. (3.00), *Gazza minuta* (3.00), *Nemipterus hexodon* (3.00), *Sillago sihama* (3.00), *Uroteuthis duvaucelii* (3.13), *Uroteuthis chinensis* (3.13) and *Uroteuthis* spp. (3.13)
S	*S. elongata**(3.26), *Plotosus* spp. (3.18), and *Gymnothorax* spp. (3.18)	*Maculabatis gerrardi* (3.17), *B. walga* (3.08), *Chiloscyllium punctatum* (3.06), *Apogon* spp. (3.13), *P. indicus* (3.07), *Sphyraena* spp. (3.04), *Mugil* spp. (3.02), *Lutjanus lutjanus* (3.00), *N. hexodon* (3.00), *S. isarankurai* (3.00), *Scolopsis taenioptera** (3.00), *Atule mate* (3.00), *Selaroides leptolepis* (3.00), *U. chinensis* (3.13), *U. duvaucelii* (3.13) and *Uroteuthis* spp.* (3.13)
M	*S. elongataa**(3.26), *Gymnothorax* spp.(3.18) and *Sphyraena* spp.(3.18)	*M. gerrardi* (3.17), *B. walga* (3.08), *Carcharhinus melanopterus* (3.01), *C. punctatum* (3.06), *Apogon* spp. (3.13),*P. indicus* (3.07), *Terapon jarbua* (3.07), *Plotosus* spp. (3.04), *Mugil* spp.(3.00), *L. lutjanus(3.00)*, *N. hexodon*(3.00), *Nemipterus marginatus* (3.00), *Nemipterus nemurus* (3.00), *Nemipterus*

		tambuloides (3.00), *Pentaprion longimanus* (3.00), *S. isarankurai*(3.00), *S. taenioptera** (3.00), *A. mate*(3.00), *S. leptolepis* (3.00), *U. chinensis* (3.13), *U. duvaucelii* (3.13) and *Uroteuthis* spp.* (3.13)
L	*Carcharhinus* spp.(3.18), *S. elongata**(3.26) and *Sphyraena* spp.(3.18)	*M. gerrardi* (3.17), *C. Punctatum* (3.06), *Lutjanus johnii* (3.16), *Lutjanus sebae*(3.16), *Apogon* spp.(3.13), *Megalaspis cordyla*(3.13), *T.lepturus*(3.13), Soleidae(3.12), *P. indicus*(3.07), *T. jarbua*(3.07), *Chirocentrus dorab*(3.07), *Encrasicholina heteroloba*(3.06), *Gymnothorax* spp.(3.06), *Mugil* spp.(3.02), *L. lutjanus*(3.00), *N. hexodon* (3.00), *N. marginatus* (3.00), *N. tambuloides* (3.00), *P. longimanus**(3.00), *S. isarankurai* (3.00), *S. taenioptera**(3.00), *A. mate* (3.00), *S. leptolepis* (3.00), *U. chinensis**(3.13), *U. duvaucelii**(3.13) and *Uroteuthis* spp.(3.13)

(b) Pair trawler

Vessel size	**High vulnerability species**	**Considerably high vulnerability species**
M	*Plotosus* spp.(3.18) and *S. elongata*(3.26)	*M. gerrardi*(3.10), *Apogon* spp.(3.13), *Scomberomorus commerson* (3.08), *Lutjanus* spp.(3.07), *P. indicus*(3.00), *T. jarbua*(3.07), *C. dorab* (3.07), *Parastromateus niger* (3.06), *E. heteroloba**(3.06), *Mugil* spp.(3.00), *P. longimanus*(3.00), *L. lutjanus* (3.00), *N. hexodon*(3.00), *N. tambuloides* (3.00), *S. taenioptera*(3.00), *S. leptolepis**(3.00), *A. mate* (3.00), *Stolephorus indicus**(3.00), *U. chinensis* (3.13), *U. duvaucelii** (3.13)and *Uroteuthis* spp.* (3.13)

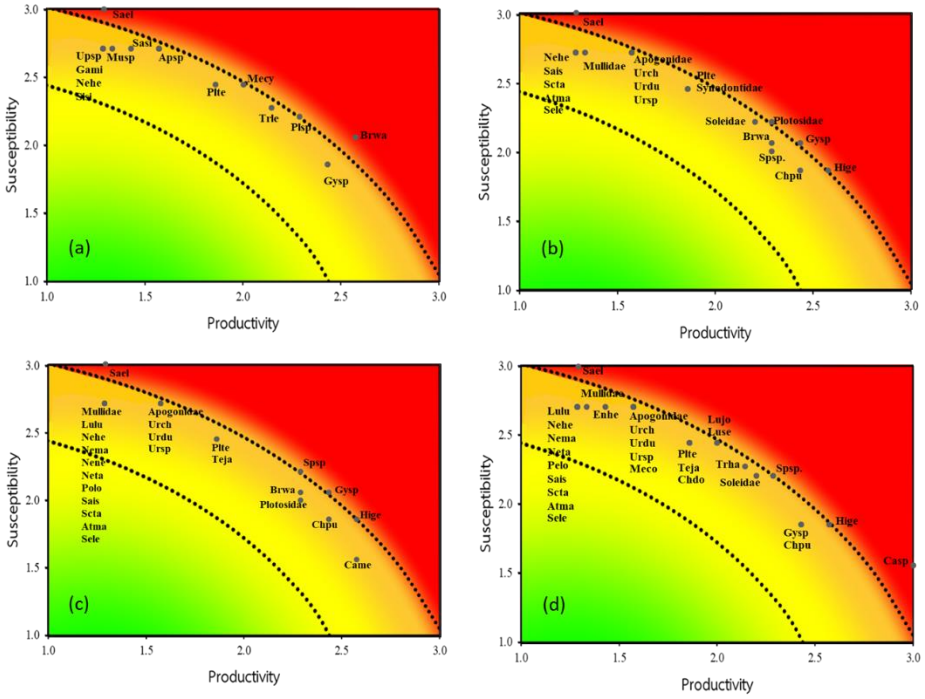
L	*Carcharhinus* spp.(3.38) and *S. elongata* (3.26)	*M. gerrardi*(3.10), *Apogon* spp(3.13)., *M. cordyla*(3.13), *S. commerson*(3.08), *C. dorab*(3.07), *E. heteroloba**(3.06), *P. niger*(3.06), *Gymnothorax* spp.(3.06), *Plotosus* spp.(3.04), *Mugil* spp.(3.00), *L. lutjanus*(3.00), *N. hexodon*(3.00), *N. tambuloides*(3.00), *P. longimanus*(3.00), *S. isarankurai*(3.00), *S. taenioptera*(3.00), *A. mate*(3.00), *S. leptolepis**(3.00), *S. indicus*(3.00), *U. chinensis*(3.13), *U. duvaucelii**(3.13) and *Uroteuthis* spp.(3.13)
XL	*Carcharhinus* spp.(3.53) and *S. elongata* (3.26)	*B. walga* (3.10), *M. cyprinoides* (3.16), *Apogon* spp.(3.13), *M. cordyla*(3.13), *Pampus argenteus*(3.13), *Diagramma pictum*(3.07), *C. dorab*(3.07), *P. niger*(3.06), *Plotosus* spp.(3.04), *L. lutjanus*(3.00), *P. longimanus*(3.00), *Priacanthus macracanthus*(3.00), *A. mate*(3.00), *S. leptolepis**(3.00), *U. chinensis*(3.13), *U. duvaucelii*(3.13) and *Uroteuthis* spp.*(3.13)

(c) Beam trawler

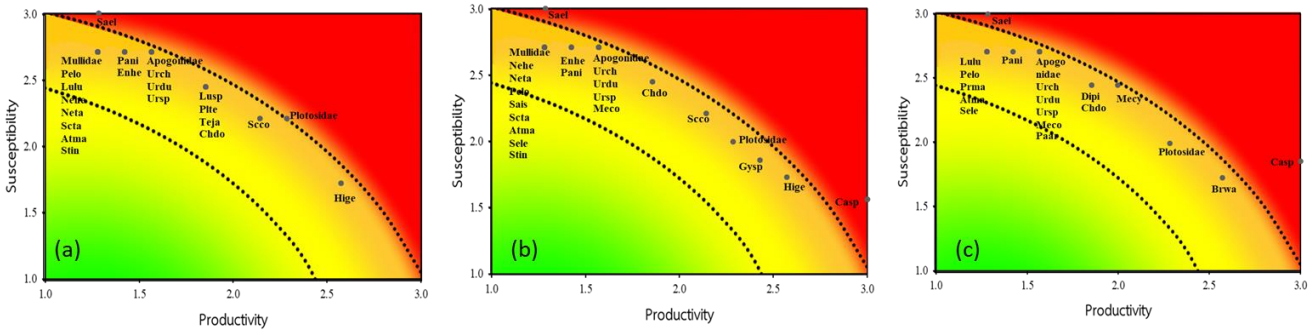
Vessel size	**High vulnerability species**	**Considerably high vulnerability species**
S	None	*M. gerrardi* (3.17), *B. walga* (3.08), *Muraenesox* spp.(3.08) , *Platycephalus* spp.(3.07) , *Pomadasys maculatus* (3.07) , *T. jarbua* (3.07) , *S. elongata* (3.00), *Plotosus* spp.(3.01), *N. hexodon* (3.00) , *Saurida* spp.(3.00) and *S. taenioptera* (3.00)
M	*B. walga* (3.23)	*Brevitrygon imbricate* (3.17), *C. punctatum* (3.06) and *Plotosus* spp. (3.04)
L	*Dasyatis kuhlii* (3.25)	*B. walga* (3.03) and *T. jarbua* (3.07)

Figure 1 Graphical results of the PSA analysis for the trawl fisheries in the Gulf of Thailand by different type and vessel size

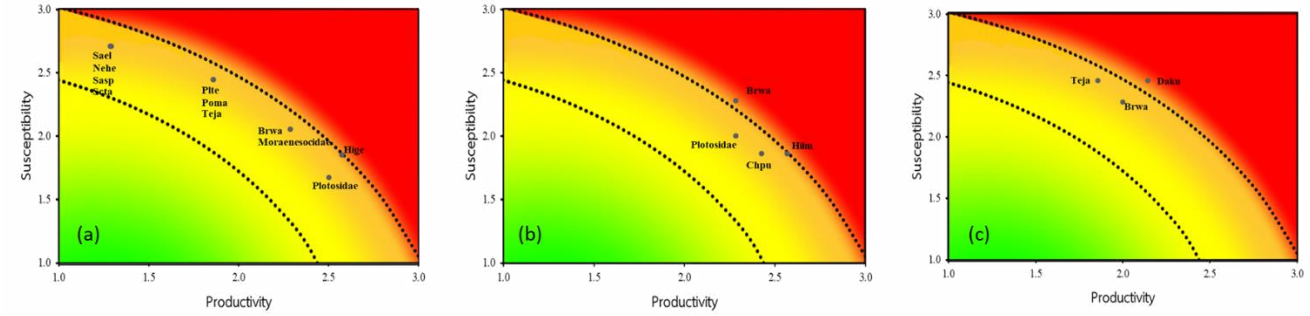
Otter board trawlers (a) vessel size SS; (b) vessel size S; (c) vessel size M and (d) size L



Pair trawlers (a) vessel size M; (b) vessel size L; (c) vessel size XL

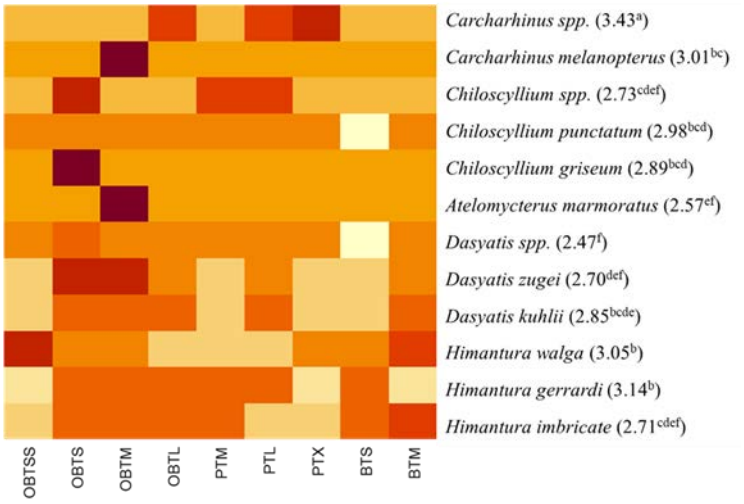


Beam trawlers (a) vessel size S; (b) vessel size M; (c) vessel size L



Note: Brwa: *Brevitrygon walga*, Sael: *Saurida elongata* , Plsp: *Plotosus* spp., Mecy: *Megalops cyprinoides*, Apsp: *Apogon* spp, Gysp: *Gymnothorax* spp., Musp: *Mugil* spp., Trle: *Trichiurus lepturus*, Plin: *Platycephalus indicus,* Sais: *Saurida isarankurai*, Gami: *Gazza minuta*, Nehe: *Nemipterus hexodon,* Sisi: *Sillago sihama*, Urdu: *Uroteuthis duvaucelii,* Urch: *Uroteuthis chinensis*, Ursp: *Uroteuthis* spp. , Mage: *Maculabatis gerrardi*, Chpu: *Chiloscyllium punctatum*, Spsp: *Sphyraena* spp., Lulu: *Lutjanus lutjanus*, Scta: *Scolopsis taenioptera*, Came: *Carcharhinus melanopterus*, Teja: *Terapon jarbua*, Nema: *Nemipterus marginatus*, Nene: *Nemipterus nemurus*, Neta: *Nemipterus tambuloides*, Pelo: *Pentaprion longimanus,* Atma: *Atule mate*, Casp: *Carcharhinus* spp., Lujo: *Lutjanus johnii*, Luse: *Lutjanus sebae,* Meco: *Megalaspis cordyla*, Chdo: *Chirocentrus dorab*, Enhe: *Encrasicholina heteroloba,* Scco: Scomberomorus commerson, Lusp: Lutjanus spp., Pani: Parastromateus niger, Prma: Priacanthus macracanthus, Musp: Muraenesox spp., Plsp: Platycephalus spp., Poma: Pomadasys maculatus,Brim: Brevitrygon imbricate

Figure 2 Risk posed by each trawl type and size to the elasmobranches in the Gulf of Thailand



Trend analysis of the PSA species / species group

Catch data for Trend analysis: The fish landing data, using in trend and variation analyses, were taken from fisheries statistics of Thailand, which annually reported by the Fisheries Statistics Group, Fisheries Development Policy and Planning

Division, DoF and the present data are available from 1985 to 2020. (https://www4.fisheries.go.th/local/index.php/main/site/strategy-stat).

Data analysis: Trends in catch of some high and considerly high vulnerability taxa were examined by Spearman's rank correlation to detect monotonic trends in time series of landings (Conti et al., 2012). The variation, of selected taxa is expressed by coefficient of variation (CV0) in fish landings. Furthermore, to investigate the long term variation, the coefficient of variations of the 1st (linear trend, CV1) and 2nd order polynomials (CV2) were also applied by using time, i.e. years, and fish landings as predictor and response, respectively (Buijse et al. 1991; Jutagate et al., 2012). For short-term variation, i.e. fish landings in n a given year to that in the previous year were examined in form of the index of absolute variation (Ua) and the relative variation (Ur), as for percentile change (Buijse et al. 1991), as

$$U\_a = 100 \times mean|y\_i - y\_(i-1)\ |/y\ \ (\%)$$

$$U\_r = 100 \times 2 \times (((1 - 1/\ 〖10〗\ \hat{}r\ )) / ((1 + 1/\ 〖10〗\ \hat{}r\ )))\ \ (\%)$$

where y = mean of long term fish landings data; yi and yi+1 = fish landings in a given year and previous year, respectively, and r is the mean of absolute difference of log transferred fish landings as calculated by

$$r = \sum\_(i=2)\hat{}n \text{▒}|\ 〖log〗\ \_10\ (y\_i\ /\ y\_(i-1)\ )| / ((n-1)\ )$$

where n = duration of time series data. Significant difference between Ua and Ur was tested by mean of t-test. All statistical tests were conducted by using R (R core team, 2021).

Results: Trends and Variation

Since the annual statistical report present fish landings as both individual species and group of species, 20 high and considerably high vulnerability taxa, which the long-term data series, i.e. between 1985 and 2020, were available and taken into the analyses (Fig. 3). Trend was not found in 2 taxa, i.e. Muraenesox spp. and cephalopod Uroteuthis spp, throughout the considered period. Meanwhile, the landing of remaining 18 taxa showed the monotonic trends, both continuities and discontinuities, in their annual landings time series. The continuously increase over time was found in Sphyraena spp., meanwhile the opposite trend, i.e. continuously decrease, was observed in S. commerson, and Mugil spp. Many types of

discontinuous trends were observed. Trend inversion was observed both in form of "positive-then-negative" (7 taxa) and "negative-then-positive" sub-series (6 taxa). The first trend was included rays and sharks as well as Saurida spp., meanwhile the latter were, for example, Megalapis cordyla and Plotosus spp. The trend breaks, i.e. two positive significant sub-series, were seen only in Lutjanus spp. Trend of anchovies (i.e. mixed Stolephorus spp. and Encrasicholina spp.) was very interesting since it was closed to "positive-then-negative" inversion but the data series of recent year showed the re-increasing and then relatively constant, i.e. no trend.

Variations in the fish landings of the high and considerably high vulnerability species/ group of species, which available in the fisheries statistics of Thailand, are presented in **Table 3**. For long-term variation, the modes of coefficient of variations were 30% for CV0 and 10% for CV1 and CV2. The plots between CV0 to CV1 and CV2 show that all the co-ordinates were below the bisectrix line (**Fig. 3**), confirming there was significant trends on fish landings of our selected taxa. Meanwhile, the inter-annual, i.e. short-term, variations showed positive skewed for both absolute, Ua, and relative, Ur, variations, which the modes were respectively 20% and 10%. Mean values of Ur (24.8 %± 12.3 %) was a slightly higher than Ua (24.1 %± 11.9 %), but not significant difference (t-test, P-value = 0.85)

Figure 3 Trend in fish landings of high and considerably high PSA species /species groups

fish	n1	r1	trends	n2	r2
Scomberomorus commerson	36	-0.51		0	n.a.
Chirocentrus dorab	14	0.85		22	-0.61
Megalapis cordyla	20	-0.58		16	0.89
Selar spp. & *Selaroides* spp.	25	-0.60		11	0.72
Stolephorus spp.*	*	*		*	*
Mugil spp.	36	-0.69		0	n.a.
Parastromateus niger	31	-0.64		5	0.90
Sphyraena spp.	36	0.89		0	n.a.
Nemipterus spp.	18	0.95		18	-0.70
Scolopsis taeniopterus	25	-0.73		11	0.63
Saurida spp.	17	0.91		19	-0.85
Trichiurus lepturus	18	0.44		18	-0.66
Lutjanus spp.	23	0.58		13	0.95
Priacanthus spp.	20	0.89		16	-0.81
Sillago spp.	36	-0.52		0	n.a.
Plotosus spp.	24	-0.61		12	0.97
Rays	20	0.51		16	-0.80
Sharks	19	0.52		17	-0.87
Muraenesox spp.	36	0.11		0	n.a.
Uroteuthis spp.	36	-0.01		0	n.a.

Table 3 Coefficient of variation (%) for zero (CV0), first (CV1)- and second (CV2)-order polynomials, and indices (%) for absolute (Ua) and relative (Ur) short-time variations in fish landings high and considerably high vulnerability species/ group of species from trawl fisheries in the Gulf of Thailand

Species/ group of species	CV0	CV1	CV2	Ua	Ur
Scomberomorus commerson	37.02	10.75	14.15	17.26	16.43
Chirocentrus dorab	42.24	11.53	21.03	22.85	21.53
Megalapis cordyla	70.20	6.69	40.46	35.02	37.24
Selar spp. (and *Selaroides* spp.)	23.13	0.23	10.88	13.48	12.88
Stolephorus spp.	17.80	2.70	11.29	10.01	10.74
Mugil spp.	25.92	18.48	19.03	15.81	15.66
Parastromateus niger	45.50	2.82	20.73	21.68	20.80
Sphyraena spp.	57.26	50.25	50.56	20.40	19.08
Nemipterus spp.	47.95	6.28	38.41	15.68	17.35
Scolopsis taeniopterus	159.89	115.31	141.99	36.24	39.00
Saurida spp.	61.07	9.82	47.66	25.02	24.40
Trichiurus lepturus	50.99	11.20	26.00	27.87	60.50
Lutjanus spp.	52.52	4.02	17.92	29.99	31.16
Priacanthus spp.	65.55	14.35	53.90	16.32	16.88
Sillago spp.	75.95	14.53	31.19	29.14	30.97
Plotosus spp.	133.32	37.08	40.24	63.71	40.36
Rays	57.13	27.38	35.96	24.91	22.60
Sharks	78.05	25.67	48.61	25.65	28.21
Muraenesox spp.	32.25	1.47	31.19	20.81	20.05
Uroteuthis spp	10.65	1.47	1.53	10.34	9.88

Other work in progress

1. We did analyze the difference in catch composition by trawl type and vessel size, which the manuscript are under developing as "Trawl fisheries in the Gulf of Thailand II: Spatio-temporal variations in catch composition"
2. The length frequency data of high and considerably high PSA species are cleaned and will be further used as input for stock assessment (will be finished and reported to ARDA in May 2023)

Section 2A Catch (Part C) - Reduction Component

Data collection program for trawlers and research vessel

The Department of Fisheries has been collecting data from fishing trawlers monthly since 2016 to the present. The data collection has been gather from 3 types of fishing tools, Otter board trawl, Beam trawls and Pair trawls on a monthly basis. The samples from collecting data of all 3 tools is not less than 50 samples per month and the sample collection has operated by 8 Marine Fisheries Research and Development Centers as follow.

1) Marine Fisheries Research and Development Center at Rayong province.
2) Marine Fisheries Research and Development Center at Samut Prakan province.
3) Marine Fisheries Research and Development Center at Chumphon province.
4) Marine Fisheries Research and Development Center at Songkhla province.
5) Marine Fisheries Research and Development Center at Narathiwat province.
6) Marine Fisheries Research and Development Center at Ranong province.
7) Marine Fisheries Research and Development Center at Phuket province.
8) Marine Fisheries Research and Development Center at Satun province.

The data collected includes Fishing Effort (Table 1) and Aquatic Composition (Table 2). The data has been classified into 7 fisheries statistical areas (Figure 1) as follow.

1) Eastern Gulf of Thailand.
2) Upper Gulf of Thailand.
3) Central Gulf of Thailand.
4) Lower Gulf of Thailand.
5) In the middle of the Gulf of Thailand.
6) Upper Andaman.
7) Lower Andaman.

Data Collection Method

The data were collected from fishing trawlers docked in fishing rafts and fishing piers along the coast of the Gulf of Thailand and the Andaman Sea. The sampling was done by randomly sampling each type of trawl fishing vessel that landed aquatic animals at the sampling site. The samples are collected every month and the collecting details are as follows:

1) Interviewing for information related to Fishing Grounds, Fishing Effort (Number of fishing day, Number of times laying down fishing nets, Number of hours for trawled fishing) along with the amount of fish caught.
2) Sampling and classification of aquatic animals.
   2.1 Economic aquatic animal: This group is the aquatic animal used for consumption and trading in the market. The sampling will record the weight of every species by dividing into the following sub-groups such as Demersal fish, Pelagic fish, Cephalopods, Shrimps, Crabs, Shells and Miscellaneous group.
   2.2 Trash Fish: This group is divided into small economic aquatic animals and original trash fish. The sampling will record the total weight and sampling 3 - 5 kilograms of Trash Fish per vessel to classify and weigh each species.
3) Economic aquatic animal and small economic aquatic animals were sampled and measured in centimeters. The fish group was measured as total body length. Cephalopods were measured as mantle length. Shrimp, shrimp/mantis shrimp were measured as total length from tip to tail and crab groups measure carapace width. The aquatic animals measured in size as follow.
   3.1 Demersal Fish 10 species.
   3.2 Pelagic Fish 11 species.
   3.3 Shrimp 5 species.
   3.4 Cephalopods 5 species.
   3.5 Crab 1 specie.
   3.6 Shell 1 specie.
   3.7 Mantis shrimp 1 specie.
4) The information gathered from item 1-3 to record in the form as in table 1 and 2

Table 1 Fishing Effort data recorded from a sampling of trawling vessel.

Column	Column Name	Record Description	
A	Sample Vessel Code	Agency Code Record +YYYY+MM+nnn by	
		Agency Code	EM Marine Fisheries Research and Development Center at Rayong province.
			UM Marine Fisheries Research and Development Center at Samut Prakan province.
			CM Marine Fisheries Research and Development Center at Chumphon province.
			SM Marine Fisheries Research and Development Center at Songkhla province.
			NM Marine Fisheries Research and Development Center at Narathiwat province
			AP Marine Fisheries Research and Development Center at Phuket province.
			AS Marine Fisheries Research and Development Center at Satun province.
			RN Marine Fisheries Research and Development Center at Ranong province.
		YYYY	Year of sampling, enter the year of the Christian era (AD) in the amount of 4 digits.
		MM	Sample collection month, 2 digits. Use numbers from 01, 02, ..., 12 to refer to the months of January, February and December respectively.
		nnn	The order of the sample for each month, 3 digits.

Column	Column Name	Record Description	
		For example, EM201901001 means the sample vessel of the Fisheries Research and Development Center, Eastern Gulf of Thailand (Rayong) in January 2019, the No 1.	
B	Date	Sampling date	
C	Month	The sampling month uses numbers 1, 2, 3,..., 12.	
D	Year (A.D.)	Sampling year (AD) 4 digits	
E	Place	The Sampling place, for example, the name of the pier, fish raft or fish bridge, etc.	
F	Sub-district	The sampling sub-district	
G	District	Sampling District	
H	Province	Sampling Province	
I	Name of Vessel	Sampled Vessel Name	
J	Vessel Registration	Register of sampling Vessel, consists of 9 digits and recorded consecutively without spaces.	
K	Marking	Marking of a fishing vessel, appearing on both sides of the external prow.	
L	Vessel Length (M.)	Sampled Vessel Length in meters	
M	Ton gross	Ton gross size of the sampled vessels	
N	Engine size (HP)	Engine size (Unit is horse power)	
O	Tools	Type of fishing gear recorded by using English abbreviations as follows	
		BT	Beam Trawls (Use a steel beam to help spread the net entry)
		OBT	Otter Board Trawl (Use otter board to help spread the net entry)
		PT	Pair trawls (Two boats were used to haul the nets and stretch the mouths of the nets.)
P	Tool characteristics	Characteristics of nets that have changed	
Q	Approximate length (m)	Approximate length of the trawl in meters	
R	Net size (cm)	The size of the bottom of the bag net in centimeters	

Column	Column Name	Record Description
S	Number of sailing	Number of days from leaving until return to the port.
T	Number of fishing days	The total number of days trawled on that trip
U	Day hauling (days)	Number of days of daylight trawling
V	Daily (times)	The number of times the net was dragged during the day (Unit is time/day)
W	Daytime (hours)	Number of hours trawled during daylight hours (The unit is hours/times)
X	Total daylight hours (hours/trip)	Total number of hours of daylight trawl in that trip (U x V x W). The Unit is hours/trip.
Y	Night drag (night)	Number of days trawling at night
Z	Per night (times)	The number of times the net was dragged at night (The unit is times/night)
AA	Night per time (hours)	Number of hours trawled at night (The unit is hours/times)
AB	Total night (hours/trip)	Sum of the total hours of night drag on that trip (Y x Z x AA). The unit is hours/trip.
AC	Fishing grounds	Specify the area, place or source of fishing.
AD	From Latitude (Degree)	Latitude that began the fishing of that voyage (The unit is degrees north)
AE	From Latitude (Linpa)	Latitude that began the fishing of that voyage (The unit is lipda north)
AF	From longitude (Degree)	Longitude that began the fishing of that voyage (The unit is degree east)
AG	From longitude (Lipda)	Longitude that began the fishing of that voyage. (The unit is Linpa east)
AH	To latitude (Degree)	The latitude that ends the fishing of that voyage (The unit is degree north)
AI	To latitude (Lipda)	The latitude that ends the fishing of that voyage (The unit is Linpa north)
AJ	To longitude (Degree)	The longitude that ends the fishing of that voyage (The unit is degree east)

Column	Column Name	Record Description
AK	To longitude (Lipda)	The longitude that ends the fishing of that voyage (The unit is Linpa east)
AL	Minimum water depth (m.)	Minimum water depth in the fishing area (In meters)
AM	Maximum water depth (m.)	Maximum water depth in the fishing area (In meters)
AN	Statistical area	Statistical areas for fishing sites in Thai Waters consists of zones 1-5 in the Gulf of Thailand and 6-7 in the Andaman Sea. In case of fishing more than one statistical area, each agency shall consider specifying only one statistical area of the sample vessel by considering the areas with the most fisheries.
AO	Total catch (kg.)	Total fish catch which is the sum of economic aquatic animals and trash fish in kilograms
AP	Economic aquatic animals (kg.)	Economic aquatic animals catch in kilograms
AQ	Trash Fish (kg.)	Amount of trash fish caught in kilograms
AR	Note	Record observations from interviews or encounters for the examiner or data analyst to know more details.

Table 2 Recording of aquatic animal composition from a random sampling of trawl vessel.

Column	Column Name	Record Description
A	Sample Vessel Code	Sample Vessel Code from "the Effort Worksheet"
B	Place	Sampling locations (According to the Effort worksheet)
C	Sub-district	Sampled sub-district (According to the Effort Worksheet)
D	District	Sampling District (According to the Effort Worksheet)
E	Province	Sampling Province (According to the Effort Worksheet)
F	Tools	Type of fishing gear, recorded by using the English abbreviation according to the Effort worksheet.
G	Aquatic Animals	Sampled of aquatic animals species, consumption fish or trash fish.
H	Group of random species	Identify the sampled aquatic species of each sampled vessel ID. Because the aquatic animals obtained from the trawl are separated by species and size before storage. Therefore, it is necessary to cover all types of fish groups and sizes by specifying the sampled aquatic animals of each sampling vessel code.
I	Weight of group type (kg)	The total weight of aquatic animals of each group species, randomly assigned according to column H (in kg.)
J	Weight randomly from the group (grams)	Total sampled fish weight from each randomized species group (in grams)
K	Aquatic species	Identifiable aquatic species by recording the names of aquatic animals according to the practice of each agency or the understanding of the data recorder.

Column	Column Name	Record Description
		Each agency may have a database of species and scientific names used within its own agency.
L	Scientific name	The scientific name of the aquatic species that can be classified. Species can be converted to scientific names using commands in Excel using the agency's list of species.
M	Statistical Department name	Thai common name
N	No. (Statistics Department)	The order number of fish used for catch composition assessments (using three digits), except for trash fish and other aquatic animals (Using 4-digit numbers)
O	weight, measure length/count (grams)	Total weight of aquatic species measured by length in grams (For agencies that count the number of aquatic animals that do not measure length, they will enter the weight of the aquatic animals counted in this box.)
P	Weight not measured/counted (grams)	Weight of aquatic animals not measured by length or not counting in grams.
Q	Total weight of random (species) (grams)	The total weight of aquatic animals measured and not measured in length. (sum of columns O and P), in grams
R	Weight Raised (Kg)	Distribute the random weight of each species proportionally to the weight of the species group I (Raise Weight) to obtain the total weight of each species in each random species group.
S	number of units measured/counted	The number of characters measuring length or count the number according to the column O
T	Length frequency	Length frequency recorded by using freqtext
U	Raised Length	Distribution of the number of aquatic animals measured by using the length weight (column O) and raise weight (column R), using Freqtext to obtain the

Column	Column Name	Record Description
		total number of individuals of each species in each randomized species group.
V	Note	Record observations from aquatic animal sampling for auditors or data analysts to know more details

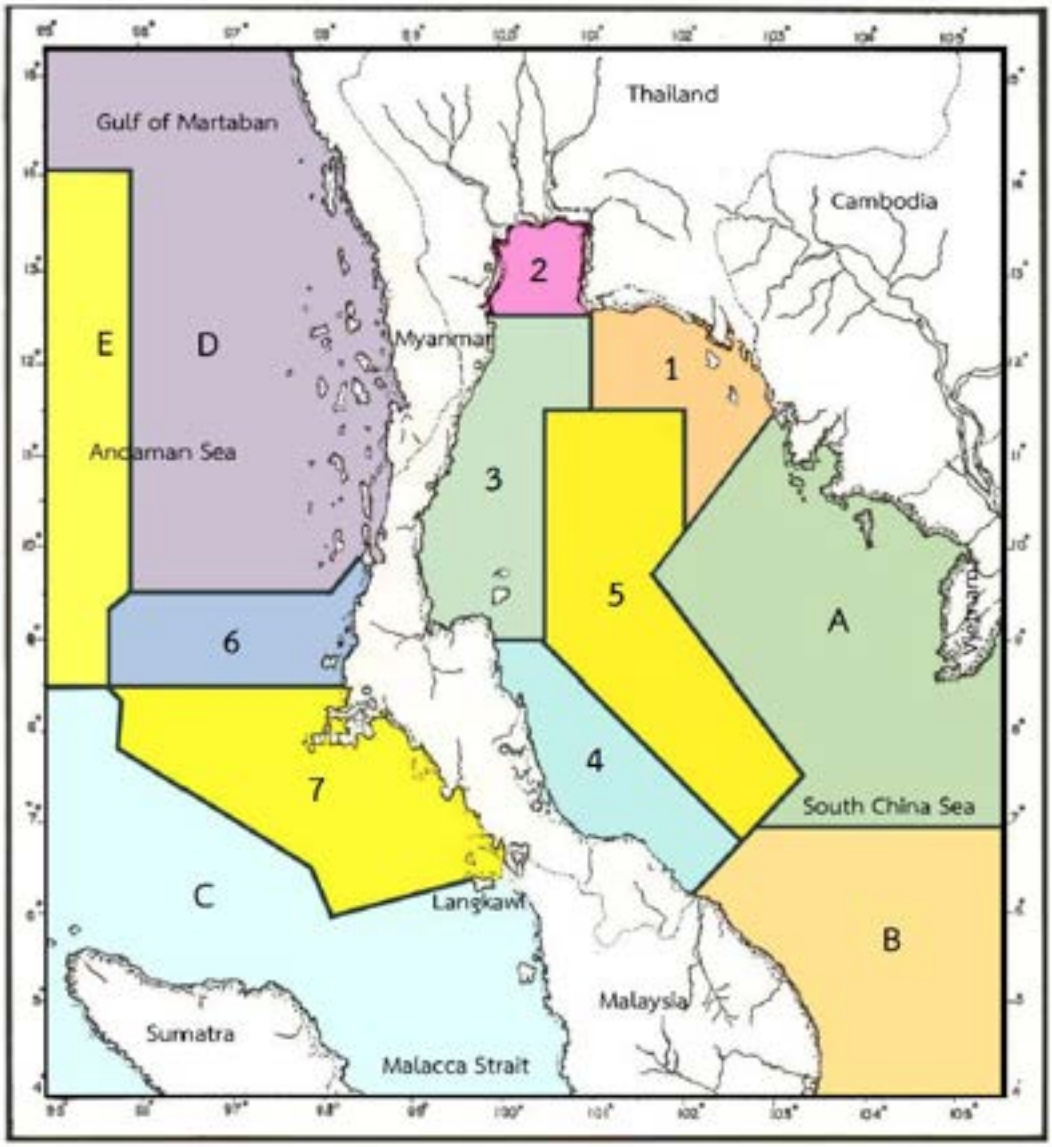


Figure 1 Map showing fisheries statistical zoning.

The Department of Fisheries conducts aquatic animal resource surveys with five marine fishery survey vessels: Fisheries1, Fisheries 2, Fisheries 4, Fisheries 9 and Fisheries 16 of the Marine Fisheries Research and Development Division. Department of Fisheries conducted surveys using otter board trawl, bottom net size 4.0 cm, in 86 survey stations. The survey station divided into 64 stations (9 sub-district) in the Gulf of Thailand

(Covering an area of 115,270 square kilometres) and 22 stations (4 sub-district) in the Andaman Sea (Covering an area of 60,327 square kilometres). Aquatic resource surveys by survey are conducted a total of 19 survey trips per year.

The survey was conducted by random trawling method within the area of each station for 1 hour at a speed of 2.5-3 nautical miles per hour. After the trawling is completed, aquatic animals will be separated according to the type of utilization, which is divided into 2 groups, namely, economic aquatic animals. and trash fish group. The trash fish group is classified as small economic aquatic animals and the true trash fish. After that, aquatic animals in different groups were classified by species for weighing. For the species that are of economic importance, the length will be further measured. The data obtained from the surveys will be used to analyze the composition of aquatic animals as a percentage of total aquatic animals caught. Catch per unit effort (CPUE) of each station has a unit in kilograms per hour. Stock density is measured in kilograms per square kilometer area and to find the average length of aquatic animals that are economically important

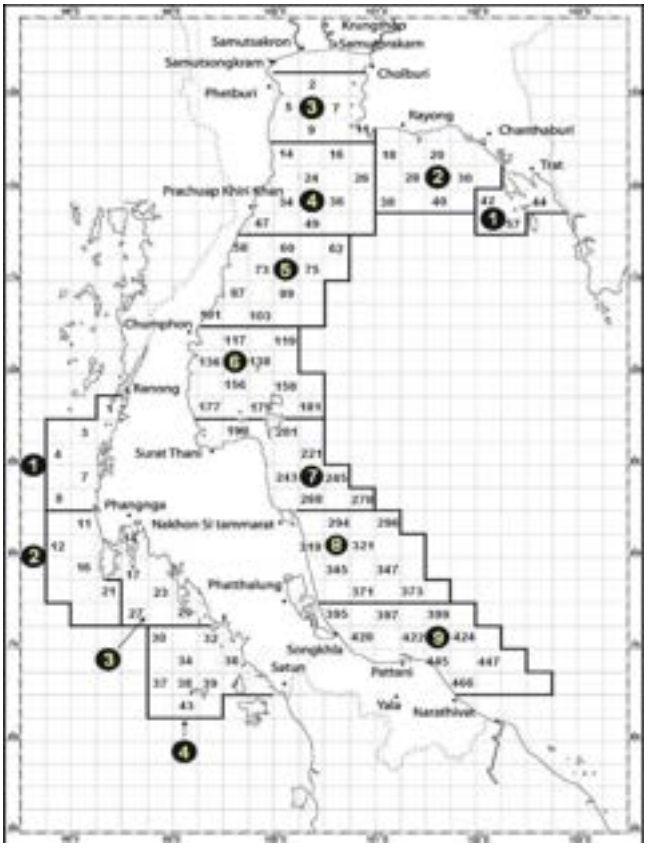


Figure 2 Map showing the demarcation of marine fishery survey stations.

Section 2C –Habitats

(Research 1) Effects of trawl fishing on biological resources and marine environment in inner the Gulf of Thailand (Dec 21-22).

The impact on the marine environment from trawl fishing is a problem that affects to the degradation of marine ecosystems. The marine ecosystems that are often indirectly and directly affected by trawl fishing include seagrass, coral reefs, ecosystems within the water mass and the water floor. For seagrass and coral reefs, it is often an ecosystem that is indirectly affected by trawl fishing in terms of sediment deposition and dispersion and blocking light from rising seawater turbidity. At the same time, the ecosystems that are most often directly affected by trawl fishing are ecosystems within the water mass and water floor through sediment disturbances, the diffusion of sediments and solutions. Consequently, natural restorations may not be able to sustain ecosystems that can continue to serve as habitats for aquatic species (Dawes et al., 1997). Therefore, research to restore ecosystems such as seagrass and coral reefs must have been developed and implemented (Short et al., 2002).

The scope of the research is to study the effects of trawl fishing on sedimentary ground, water mass and fishery resources in the Gulf of Thailand. The fishing area is the inner Gulf of Thailand where commercial trawlers enter to fish during the year 2021-22. The objective is to obtain clear and complete technical knowledge on the level of impacts of trawl fishing in important fisheries with specific fishing area characteristics.

The picture shows the study area selected by considering the data on fishing behavior and fishing patterns of trawling vessel, including prohibited fishing areas to analyze fishing areas together with the use of data from the fishing Vessel Monitoring System (VMS).

The sampling in the study area is using "Variable Radius Plot Sampling" which sampling from the center of the study area with the highest concentration of trawl fishing and then set out

sampling stations in 4 directions, 3 points in each direction.

The distance between the points are 4 Km and the totaling sampling are 13 stations (as can be seen from the picture). The sampling and analysis methods are 1) Water quality analysis sampling 2) Sediment quality analysis sampling 3) Study on the impact of trawl fishing on marine resources and 4) Impact analysis of trawl fishing in the inner Gulf of Thailand (Study area).

For water quality analysis sampling, the aim is to analyze physical and chemical properties from general water quality (water depth, water transparency, temperature, salinity, PH, and dissolved oxygen), total suspended solids and the Nutrient content in water. The study found characteristics colors of various water quality in the study area, clear green, green with brown sediment, bright green color (conditions of "Red Tide" from plankton type Noctiluca Scintillans or reddish brown color caused by the abundance of plankton type Ceratium Sp.

The aim of sediment quality analysis sampling is to analyze physical and chemical properties from water content (WC), and Total Organic Matter (TOM). The study in the area found that the sediment texture is soft liquid mud with blackish gray color and the soil surface had a vague Oxidized Layer without clear sulfide odor. In some area, sea worms have been found or yellow-brown sediment, indicating the presence of Benthic Diatoms. Moreover, important economic clams, such as striped clams, are also found in the area where fine soil texture is gray and black.

The impact of trawl fishing on marine resources conducts the study by random sampling of marine benthic species in the target area, also collecting samples of aquatic animals obtained from trawl fishing in each target area for analyzing the data together with comprehensive environmental data and trawl fishing behaviors. The study will have the information to help for more understanding and confirm the food chain of bio-resources in the Gulf of Thailand. The study found that the areas without trawl fishing (stations No. 9-10), the density of marine benthic species is higher than areas with trawl fishing. Similarly, the abundance of benthic resources was found to be high in areas without trawl fishing. High abundance of 11 species was found while the lowest abundance (1-2 species) was found in trawl fishing areas.

The impact analysis of trawl fishing in the inner Gulf of Thailand. This will conduct by bringing the data from the above studies to analyze the effects of trawl fishing on the marine environment as well as biological resources of the Gulf of Thailand and use the results as an information to develop a sustainable trawl fishing model that meets international standards in the future.

For effects of trawl fishing on water quality, considering from general water quality (water depth, water transparency, temperature, salinity, PH, and dissolved oxygen), total suspended solids and the nutrient content in water, this can be concluded that the water transparency in the study area is within the normal range (not less than 0.3 m), which is suitable for the habitat and growth of aquatic animals. The water temperature was found within the normal range (30.7-31.0 PSU) which changes according to the air temperature during the survey period. Salinity is in the normal range (30.8-31.0 PSU). The PH value has relatively little change in area. Dissolved oxygen content in some stations has relatively low content, sometimes the value is lower than the standard for aquaculture (4.0 milligrams per liter) of the Pollution Control Department (2006) that has been set. The total suspended solids (after the trawling), it was found that the total suspended solids in the water at the water surface increased significantly after the trawling. This increase as a result of trawl fishing in which the net is drawn close to the bottom of the water, causing to stir the sediment to diffuse up in the water mass. This can harmful to the respiratory system of aquatic animals and obstructs the functioning of the gum cavity. In addition, suspended solids that rise up in the water mass can block light from entering the water over time. This might limit the photosynthetic activity of plankton and might cause the amount of natural food in the water source to decrease, although for a short period of time, but can spread over a fairly wide area. The Nutrient content in water. The study focus on the content of Nitrite- Nitrate, Silicate-Silicon, Ammonium-Nitrogen and Orthophosphate-Phosphorus. From the study, it can be demonstrated that the nutrient content in the water at the surface and bottom levels changes significantly after trawling, as this can be seen in the Orthophosphate-Phosphorus content at the water surface and the bottom of the water, which was found to increase after trawling. The increase in nutrient content in the water after trawling is caused by the trawl passing at the soil level and causing sediment diffusion at the surface. This result in the diffusion of nutrients in the water from the gap between the soil to the water mass. In this regard, an increase in the

nutrient content of an appropriate amount of water will benefit primary producers of water sources. On the other hand, the excessive increase of nutrients may also have a negative impact on the ecosystem.

From the study on the sediment quality, it was found that the Tha Chin River (at the end of the river) has amount of dissolved nutrients and the amount of organic matter in the sediment quite high quantity. Therefore, there is a necessity to monitor pollution problems, including the management of the affected area for healing and returning to normal condition, that are likely to increase in the future. There is a remark that the ecological process in which the environment naturally heals itself may be inadequate and timely. Therefore, human enforcement is required by applying management techniques such as river delta sediment dredging, increasing the efficiency of wastewater treatment before discharging to water sources that will help drain the water mass as well as reduce the natural treatment burden. In long term management, all sectors should coordinate in order to find ways to deal with problems at the root cause by applying the model, based on the Precautionary approach, Polluter pay principle or the Common but differentiated responsibility, to explore activities that are the actual sources of pollution and lead to the determination of suitable and effective solutions to manage problems at the pollution source. This will lead to the management of sustainable use of resources and ecosystems.

For the impact of trawl fishing on marine resources, the study suggest that trawl fishing activities can also affect marine resources especially marine benthic. This is because such activities can alter the physical and chemical properties of the sediment, affecting marine resources. There are also some researches to support with the study that the direct impact of trawl fishing on the environment and ecosystems is the reducing biodiversity and ecosystems of bottom-water resources, as a result of changes in the water surface caused by trawl fishing that destroys the soil by landfilling or turning the top of the soil., Auster and Langton (1999). Studies by Thrush et al. (1998), Sainsbury et al. (1997), and Smith et al. (1985) found that the otter board trawls fishing affects the destruction of marine resources on the water floor. Similarly, a study by Kaiser and Spencer (1996) found that Beam trawls fishing resulted in a 50% reduction in the abundance of bottom marine resources in the hydroid and coral populations. However, trawl fishermen are of the view that trawling will cause changes in the structure of the seafloor, which is "beneficial" in

terms of high productivity of seafloor species that benefit the fish that consume ground animals for food. Including the view that trawl fishing is a "Farming at sea" or "shoveling" and this is a hot topic of debate in recent years (Van Denderen, 2015).

Trawl fishing is an activity that creates jobs and generates income for the community as well as the country. However, at the same time, it is classified as an activity that affects the quality of the aquatic environment and aquatic animals, especially on the bottom ecosystem and benthos resources. The development of suitable trawl fishing plan and policy with minimal impact on the bottom water ecosystem will lead to sustainable utilization of fishery resources in the future.

Section 2C – Habitats

(Research 2) Analysis of trawl fishing ground in the inner Gulf of Thailand:

Trawl fishing is an important fishery in Thailand with approximately 45% of the total catch from the sea comes from trawl fishing (Department of Fisheries, 2021). The groups of aquatic animals caught by trawl fishery are divided into 2 main groups. Those that are used for human consumption and aquatic animals used to make animal feed, also known as by-catch. For the fishing gears, trawlers can be classified into 3 types: Otter board trawl, Beam trawls and Pair trawls (Department of Fisheries, 2021). All three gears, the Department of Fisheries are classified as highly efficient gears that require a license for commercial fishing. After the issuance of the Royal Fisheries Act in 2015, the law stipulates that commercial fishing vessels of 30 tons or more. The Vessel Monitoring System (VMS) must be installed, the fishing logbook must be submitted and the fishing vessels must be report the enter and exit (Port-In, Port-out) to the PIPO Center. This is a part of the Monitoring, Control and Surveillance (MCS) and traceability system to tackle Illegal, Unreported and Unregulated Fishing (IUU). The application of data from the Vessel Monitoring System (VMS) and the data from the fisheries record system (Fishing Info) by the Vessel Control Center can be used to analyze each type of trawl fishing area. Similarly example, Skaar et al. (2011) used fishing vessel tracking data to assess drag areas in the Barents Sea, or Martin et al. (2014) attempted to use fish data on fishing vessel tracking data for the management of the fishing fleet in the Mediterranean Sea. Analysis of areas with intensive trawl fishing will be useful in further assessing both physical and biological impacts for each area. In addition, mapping of fishing grounds and trawler fishing maps can be made. This will be very useful to further formulate measures for fishery management according to each area.

The scope of the research is to initiate a map of trawl fishing grounds and study trawl fishing patterns in the inner Gulf of Thailand during 2021-2022.

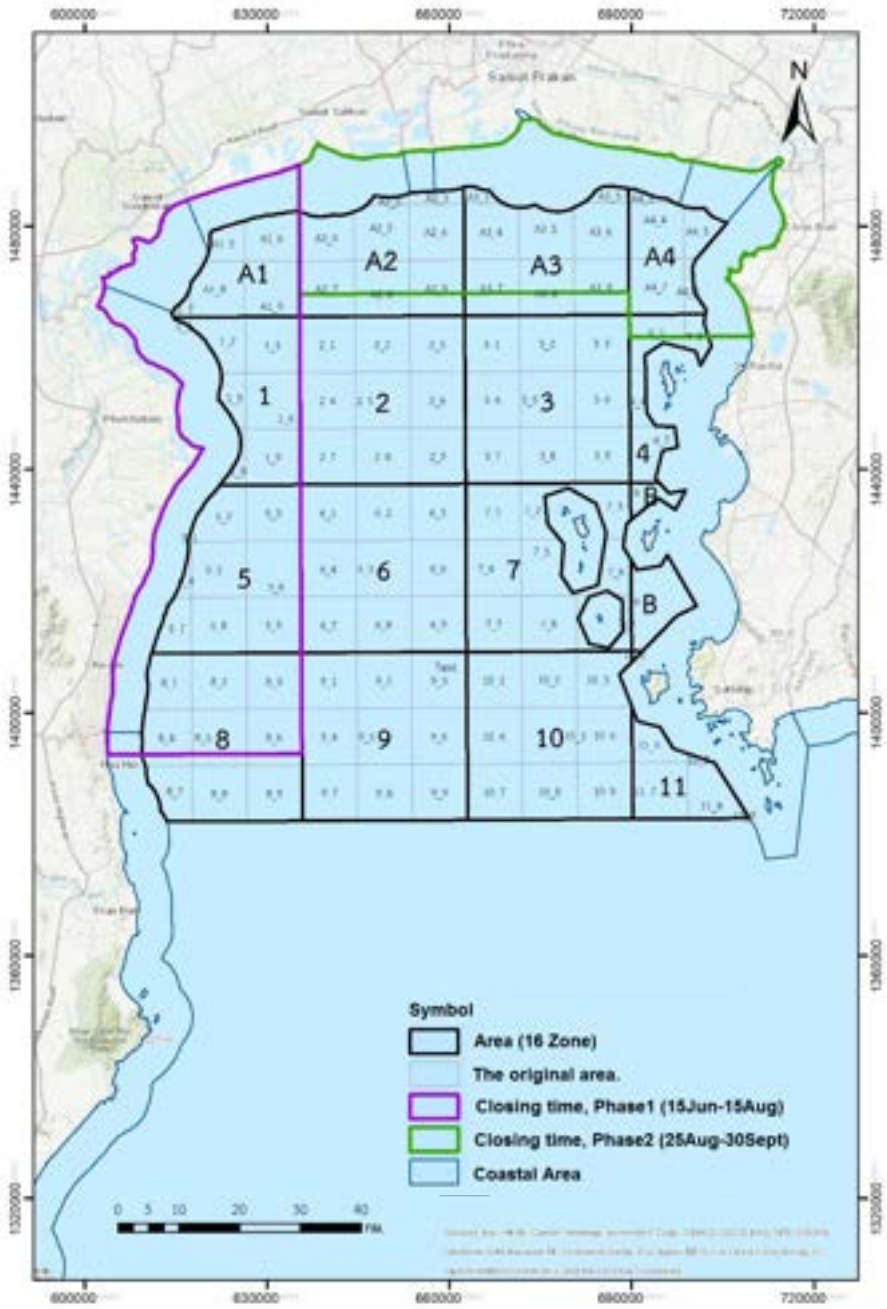
The research has collected the data by using the methodology as follow.

1) Review trawl fishing patterns from academic reports, journals, research reports and in-depth interviews. The data collection of the fishing patterns consisting of fishing area, characteristic of fishing gear used, speed (including factors affecting the speed used in fishing) and 15 fisherman's representative in the vessel controller or vessel owners with knowledge of trawl fishing for each gear, pair trawls, otter board trawls and beam trawls. The results of the analysis will be used as part of the basic data for analyzing fishing pattern and mapping trawl fishing grounds, using geographic information systems.

2) Collecting spatial data to create maps and databases, consisting of Measures Area of Department of Fisheries, Fishery licensed area of the Department of Fisheries and trawl fishing information (from VMS, Fishing Electronic Fishing Log-book, and Port-in Port out)

3) For fishing areas and development of a trawl fishing database system in the Gulf of Thailand, the information used includes oceanographic data collection such as water temperature/depth and a survey of the demersal population of economic important.

For initiate a map of trawl fishing grounds to track changes in fishing and clearly track the swept area. In this study, the inner Gulf of Thailand was divided into 5 × 5 nautical mile grid plots (25 square nautical miles or 85.748 square kilometers) based on minutes of latitude and longitude and in accordance with the survey area currently operated by the Department of Fisheries. The number of grids can be divided is a total of 136 grids, with 21 grids overlapping the coastal/sea area. which commercial fishing vessel cannot go fishing. This leaves only 115 grids (representing an area of 8,171.27 square kilometers) where commercial fishing vessels have the authorize to fish. For greater clarity in the analysis, the grid area of 5 x 5 nautical miles has been adjusted to an area of 15 x 15 nautical miles (1 zone equals 9 grids), which divides the Gulf of Thailand into 16 districts in total (see the map below)



The trawl fishing ground in the Inner Gulf of Thailand. The study found that most of them are located in the central bay area (Zones A2, A3, 2, 3, 6, 7, 9 and 10). Especially the 2 and 3 zones are the areas with a very high swept area ratio with a proportion of more than 3 times. For aquatic animal fish caught, the demersal Fish has found in a high proportion in zones 8 and 11. The pelagic fish are more common in the coastal and mid-western regions (zones 1, 6, 2, 8, and 9). Cephalopods mostly found in upper area (A4) and Lower East (Regions 7, 10, 11 and B). For By-catch, it is

predominantly found in the upper shore and mid-gulf (zones 2, 3, 6, 7, 9 and 10). This mean that the area has been swept in the year, which can be inferred that the upper coastal area is a rich source because despite measures "Closing area in the Inner Gulf of Thailand", but still has a higher swept than other areas.

For trawl fishing patterns, the inner Gulf of Thailand covers an area of approximately 10,000 square kilometers. The area where trawl fishing can be accessed is 8,171.268 square kilometers, (representing 81.70 percent). The rest of the area will be coastal areas where commercial fishing vessels are unable to fish. From the calculation of the trawl swept area in the upper Gulf of Thailand in 2020-21, the volume is between 22,704.98- 23,478.46 sq.km. In 2021, the number of fishing vessels entering the inner Gulf of Thailand decreased by 10.05 percent, resulting in a 3.29 percent decrease in the amount of swept area in 2021. Considering the types of trawl vessels, it was found that the number of all types of trawl vessels decreased in the same way. The number of pair trawls decreased the most, at 13.65 percent, followed by beam trawls (6.19 percent) and otter board trawls (4.20 percent). If considering the quantity of the swept area, it was found that both the otter board trawl and beam trawl had the swept area in 2021, decreasing by 48.92 and 34.02 percent respectively. However, Pair trawl had 10.45 percent increase in the swept area. The results of the study show that the decline in the number of vessels did not contribute to the decline in trawl fishing, especially in pair trawl

For the quantity of fish caught, the data has been collected from report in the logbook to analyze together with the vessel position, obtained from the transmission of the fishing vessel tracking system (VMS) to identify the swept area of trawl fishing. The catch from trawl fisheries in the Inner Gulf of Thailand in 2020-2021 amounts between 43,980.50-50,076.31 tons, with the pair trawl fishing gear is the main fishing tool in the inner Gulf of Thailand with the proportion of the catch between 86.09-86.37%. Followed by the beam trawl (11.12-11.54%) and the otter board trawl (2.38-2.51%) respectively. The quantity of aquatic animals caught per area can reflect the abundance of aquatic animals in each area. It was found that the area with the highest amount of aquatic animals caught per area is the upper area of the inner Gulf of Thailand, especially in the above coastal zone. For the species of aquatic animals caught, it can be divided to economic fish and by-catch fish. The study found that the quantity of economic fish is 45.9-50.4% (Mostly demersal Fish 15.3-15.7%,

Pelagic Fish 13.6-17.4%, Cephalopods 11.1-11.7% and Shrimp, Crab, Shell about 5%. For by-catch fish, the it was found 49.6-54.1%.

The study has suggested that the fish that has a possibility for high-risk, especially Saurida sp which are found mainly in the western coastal areas (zone 8) and the lower central coast of the inner Gulf of Thailand (zone 6, 7, 9, and 10) requires in-depth study and monitoring of the biology of the fish in the area whether it is a breeding or nursery area at any time. Including the additional research on catch rate tends to increase or decrease in the past 5 years, this information will be used a data for the assessment of surveillance in determining measures for continuous care and able to set targeted spatial management measures for greater efficiency.

Also, in the case of the inner and central Gulf of Thailand where the close area measures have led to the displacement of fishing areas. This could be a good way to allow enclosed areas to recuperate (Zone A1-A4). At the same time, outside the closed area may be affected by increased fishing, especially zone 2 and 3. However, the aquatic animals caught from both fishery zones was also at a high level. Consequently, it is still unable to determine the appropriate level of fishing for the size of the area that should be at a level that will not cause degradation of resources. Continued studies over a period of time to use the data to help assess the annual catch rate per area will lead to the determination of fish catch per area indicators and the quota approach ensures that trawl fishing does not affect habitats and ecosystems, which is a targeted management.

Finally, an increase in the catch rates of the three types of fishing gear, Otter board trawl, Beam trawls and Pair trawls, may reflect that fishery resources in the Inner Gulf are not deteriorating, or an increase in catch rates may reflect efficiency of fishery resource management over the past few years. If there is a follow-up or ongoing research, these indicators may be used to further inform the resource situation and implement the area-based fisheries management of Thailand

ANNEX 2: Meeting summary with key satkeholders

Meeting with the President of the National Fisheries Association of Thailand to clarify the fishery action plan (FAP)


On Tuesday, November 15th, 2022, from 10:00 A.M. - 12:00 P.M. at the National Fisheries Association of Thailand meeting room, representatives on behalf of the Thai Sustainable Fisheries Roundtable (TSFR) and Asst.Prof.Dr.Kungwan Juntarashote, Project Advisor, attended a meeting with the President of the National Fisheries Association of Thailand, Mr.Mongkol Sukcharoenkana.

The objective of the meeting is to update the progress of the Gulf of Thailand Trawl Fishery Improvement Plan (FIP) and explain the activities on Fishery Action Plan (FAP) to consider the approval before proceeding to prepare a formal report and submit to the MarinTrust. At the end of the meet, the president has agreed to cooperate and approve the activities on the fishery Action Plan (FAP) and have conversation to TSFR working team that the Action Plan can answer the question of maintaining sustainable resources and a guideline for effective joint practice in the future.


International Seminar 16th Asia Pacific Roundtable on Sustainable Consumption and Production

On Wednesday, November 23rd, 2022, from 1: 30 PM to 4: 30 PM, at Pathumwan Princess Hotel, Bangkok, TSFR working group representatives were invited to attend a seminar on the 16th Asia Pacific Roundtable on Sustainable Consumption and Production (16th APRSCP 2022: Carbon Neutral Event): "Bridging Net Zero Transition by SCP and Circular Economy" with the objective of presenting the overview of the project (FIP in the Gulf of Thailand) on how to develop trawl fisheries in the Gulf of Thailand towards sustainability in accordance with international standards.

On the day of the meeting, the Thai Fishmeal Producers Association of Thailand also jointed to present in the topic, the Road to Sustainability Consumption and Production of Thai Fishmeal Industry and aquaculture supply chain leading to the certification scheme process. In addition, there are also other speaker participated to share the knowledge in seminars on other topics as Towards climate neutrality in Thai livestock industry, measures for greenhouse gas emission mitigation in feed production, US soy supply chain is efficient, sustainable and reliable, and Agri-food Supply Chain Management: CPF's Implementation for Sustainability.

Follow-up meeting for update Guidelines for the Development of Sustainable Trawl Fishery in the Gulf of Thailand according to International Standard

On Thursday, December 1st, 2022, at the Department of Fisheries, the Deputy Director General of the Department of Fisheries had called a meeting. The participants include the representative from TSFR, project advisors, and the director/officers from the divisions of Department of Fisheries. The objective is to update the current status of the project and follow up the result of the researches in order to be ready for reporting Agricultural Research Development Agency (ARDA) for 6 months' update.

TSFR having an Interview on the Radio Channel Topic "How can Thai Fishery be Sustainable"

On Friday, December 16th, 2022, from 2:35 P.M. - 3:00 P.M., the TSFR representative and Project Manager for the Gulf of Thailand Trawl Fishery Improvement Plan (FIP) Mr.Vorapong Iamtrakul was having an interview on the radio channel which drive the leads to the sustainability of the country, on the topic "How can Thai fishery be sustainable"

In the interview, the information has been provided on the reason of establishment of the Thai Sustainable Fisheries Roundtable (TSFR), the link of the supply chain between the Thai Feed Mill industry and how the association cope with Illegal, Unreported, and Unregulated Fishing (IUU Fishing), Including the details of the Fishery Improvement Plan (FIP) that the project is currently in the implementation stage and Fishery Action Plan (FAP) has already been approved by the MarinTrust, a globally recognized standard for the sustainability of fishmeal and fish oil and Thailand is the first country in the world who coordinate with MarinTrust to develop Multi-Species assessment methodology as MarinTrust consider Thailand is a country with good information available, both the public and private sectors, and

the resources of many species of aquatic animals (Multi-Species) available. Therefore, Thailand is suitable to participate in the development of this standard.

At the end of the meeting, Mr. Vorapong has emphasized that TSFR working group, the Department of Fisheries, and all stakeholders, highly expected that participation in activities under the FIP project will be an important way to restore aquatic resources, raising awareness, increase responsible fishing, and Develop trawl fishery standards that promote quality of sustainable products throughout the supply chain.

SupportInformation :
https://drive.google.com/file/d/18WnhfD4xYdbbSVX2VoKPyT0HbfR9Gt1x/view ,
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