

The Gulf of Thailand mixed-trawl Fishery Improvement Project (FIP)

Update Aug 2024

Section 2A Catch

Part A - Total Aggregate Catch

Action Criteria	A1-6	Due Date	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 on stock, (MMSY) and indicators species and publicly available.	Aug 23, 24, 25		The summary report (2024) in the annex 1, Page 11
	2. Fishermen Meeting report and provincial fisheries committee meeting report to be made publicly available.	Dec 22		The summary report in the annex 1, Page 15 (the update after sent 2022)
	3. FMP 2020-2022 evaluation report.	Jan 23		Submitted to peer review
	Output:			
	1. Annual report year (2022-2025) on stock assessment, (MMSY) and indicators species.	Aug 23, 24, 25		The summary report (2024) in the annex 1, Page 11
	2. Fishermen Meeting report and provincial fisheries committee meeting report to publicly available.	Dec 22		The summary report in the annex 1, Page 14 (the update after sent 2022)
	3. Report on FMP evaluation.	Jan 23		Submitted to peer review
Priority	Medium Priority			
Estimated Cost	TBC			
Responsible	1. Department of Fisheries, Marine Fisheries Research & Development Division and Fishery provincial office.			

Parties with lead agency	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	Due Date	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.	Dec 22		Submitted to peer review
	2. Conduct and analysis of changes in catch composition of trawl fishery, classified by vulnerability groups.	Dec 22		Submitted to peer review
	3. Assess the stock status of high-risk species.	Dec 23		The summary report in the annex 1, Page 18
	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.	Dec 22		Submitted to peer review
	2. The report on data/information of changes in the catch composition of each type of trawl fishing.	Dec 22		Submitted to peer review
	3. The report of stock assessment for high-risk species.	Dec 23		The summary report in the annex 1, Page 18

	4. Guidelines/Data/Information for input into the next FMP.	Dec 28		On process
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	Due Date	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.	Dec 23		The summary report in the annex 1, Page 28
	2. Set up data collection program for trawl fisheries monitoring and research vessel.	Dec 22		Submitted to peer review
	3. Conduct the data collection program, especially the composition of the trash fish.	Start Jan 23		The summary update report in the annex 1, Page Page 38
	4. Analyze data and publish annual report on trawl fisheries and research vessel.	Dec 24		On process
	5. Set proposed objectives and TRP for reduction component and juvenile commercial fish.	Dec 25		On process
	6. Conduct workshop with stakeholders to discuss recommendations for input into the next FMP.	Dec 26		On process

	Output:			
	1. Report on catch composition, especially for trash fish including juvenile commercial fish from each type of trawl fisheries and stock assessment.	Dec 24		On Process
	2. Data collection program	Dec 22		Submitted to peer review
	3. Annual report on trawl fisheries and research vessel.	Dec 24		On process
	4. Workshop report recommendation for input into the next FMP.	Dec 26		On process
Priority	High Priority			
Estimated Cost	TBC			
Responsible Parties with lead agency	1. Marine Department of Fisheries, Marine Fisheries Research and Development Division. 2. Thai Sustainable Fisheries Roundtable (TSFR)			
Gaps addressed by the Action	C1-7			

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

Action Criteria	T1-3	Due Date	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.	Mar 23		Submitted to peer review
	2. Workshop to reviews and planning for ETP species recording and trawl interaction.	Aug 23		The summary report in the annex 1, Page 42
	3. Collect Historical data from fisherman at sea observation by DoF.	Dec 23		The summary report in the annex 1, Page 54
	4. Monitor population of marine endangered animal by DMCR.	Dec 23		The summary report in the annex 1, 61
	5. Risk Assessment on trawl fishery and ETP interaction. T2 (As soon as the data available within 5 years)	Dec 26		On process
	6. Consultation with stakeholder to improve current fisheries practice. - 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.	Mar 24		The summary report in the annex 1, Page 80
	Output:			
1. Effective ETP interaction record approach.	Dec 25		On process	

	2. Report on - Updated ETPs of Thailand. - Risk assessment of trawl interaction to ETP species.	Dec 24 Dec 26		On process
	3. Best practice on ETP protection on community area management.	Dec 25		On process
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. 3. Thai Sustainable Fisheries Roundtable (TSFR)			
Gap addressed by the Action	T1-3			

Section 2C – Habitats

Action Criteria	H1-3	Due Date	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)			
	1.1 Inner Gulf of Thailand.	Dec 22		Submitted to peer review
	1.2 Eastern Gulf of Thailand.	Dec 23		The summary report in the annex 1, Page 102 and 112
	1.3 Southern (Lower) Gulf of Thailand.	Dec 24		The funding support has been approved. The research is on process
	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).			
	2.1 Inner Gulf of Thailand.	Dec 22		Submitted to peer review
	2.2 Eastern Gulf of Thailand.	Dec 23		The summary report in the annex 1, Page 102 and 112
	2.3 Southern (Lower) Gulf of Thailand.	Dec 24		The funding support has been approved. The research is on process
	3. Identify and assess the critical habitat effected by trawl fishery. (Apr-May)			
	3.1 Inner Gulf of Thailand.	Dec 22		Submitted to peer review
	3.2 Eastern Gulf of Thailand.	Dec 23		The summary report in the annex 1, Page 102 and 112
	3.3 Southern (Lower) Gulf of Thailand.	Dec 24		The funding support has been approved. The research will

				start Jan 24
	4. Risk Assessment on trawl fishery and habitat interaction.	Dec 25		On process
	5. Workshop to discuss recommendation on mitigation measure for the input into the next FMP.	Dec 26		On process
	Output:			
	1. Report on; Comprehensive environmental data and trawl fishing behaviours (H1).			
	1.1 Inner Gulf of Thailand.	Dec 22		Submitted to peer review
	1.2 Eastern Gulf of Thailand.	Dec 23		The summary report in the annex 1, Page 102 and 112
	1.3 Southern (Lower) Gulf of Thailand	Dec 24		The funding support has been approved. The research will start Jan 24
	2. The result of impacts on main habitat and critical habitat effected by trawl fishery (H2).			
	2.1 Inner Gulf of Thailand.	Dec 22		Submitted to peer review
	2.2 Eastern Gulf of Thailand.	Dec 23		The summary report in the annex 1, Page 63 and 73
	2.3 Southern (Lower) Gulf of Thailand.	Dec 24		The funding support has been approved. The research will start Jan 24
	3. Workshop report recommendation on mitigation measure for the input into the next FMP.	Dec 28		On process
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)
Gap addressed by the Action	H1-3

Section D-Ecosystems

Action Criteria	E1 – 4	Due Date	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.	Jun 23		Submitted to peer review
	2. Find an expert on Ecopath model.	Dec 23		Done
	3. Update Ecopath model by using recent data.	Dec 25		On process
	4. Find key ecological species from Ecopath.	Dec 25		On process
	5. Simulate the model with different scenario [fishing gear/fishing effort].	Dec 25		On process
	6. Workshop to discuss recommendation for input into the next FMP.	Dec 26		On process

	Output:			
	1. Summary historical changes of the impacts from fisheries on the ecosystem.	Jun 23		The summary research in the annex 1 (Page 71)
	2. Reports on; E2 (Dec 25). - Updated Ecopath model. - Key ecological species identified - Simulation result from different scenario and implication for management	Dec 25		On process
	3. Workshop report recommendation for input into the next FMP.	Dec 26		On process
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)			
Gap addressed by the Action	E1-3			

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Completed



On process

ANNEX 1:

Section 2A Catch: (Part A) Total Aggregate Catch

- **Annual Report on Stock Assessment, Multi-Species Maximum Sustainable Yield (MMSY) and Indicator Speceics**

The Maximum Sustainable Yield (MSY) assessment is aims to estimate the biological reference point at which stocks can be harvested without any negative effect on resources and equilibrium with the production of nature in Thai waters. MSY for the Gulf of Thailand and the Andaman Sea was estimated by using Fox surplus production model (Fox, 1970). This model requires statistical data and information on catch, catch rate (CPUE) and fishing effort dt of all fishing operations. The MSY assessment was conducted for three species groups 1) demersal fish that referring to all demersal species including demersal fishes, squids, cuttlefishes and shrimps 2) pelagic fishes; and 3) anchovies. The demersal fish group is directly related to trawl fisheries due to marine resources in this group was caught by pair trawl, otter board trawl, beam trawl, gill net (blue swimming crab gill net, trap, hook, squids falling net, squid lift net and push net.

The MSY assessment was conducted since 2015 for reference point for fisheries management by using Fox surplus production model; Fox, 1970 that can explain by equation below:

$$\frac{y_i}{f_i} = e^{c+d*f_i}$$

$$\ln \frac{y_i}{f_i} = c + d * f_i$$

$$MSY = -\frac{1}{d} e^{c-1}$$

$$F_{MSY} = -\frac{1}{d}$$

when y = catch

f = fishing effort (hour or day)

c and d = constant from linear regression model

MSY = Maximum Sustainable Yield

F_{MSY} = Optimum Fishing effort

Result of Multi-Species Maximum Sustainable Yield (MSY) for Demersal fish in the Gulf of Thailand

The sustainable maximum yield (MSY) assessment in the Gulf of Thailand has been conducted since the year 2015-2021. The results of the annual MSY assessment for demersal fish group in the Gulf of Thailand indicate that the year 2017 had the highest MSY value at 795,869 tons. The second highest value was recorded in 2015 at 794,771 tons, while the lowest value was observed in 2023 with an MSY of 754,615 tons. (table 1)

Table 1 Sustainable Maximum Yield (MSY) Assessment Results by Year using Fox's Surplus Production Model in Thai waters.

year	Gulf of Thailand
2558	794,771
2559	777,855
2560	795,869
2561	785,358
2562	790,985
2563	775,548
2564	766,890
2565	759,129
2566	754,615

Sustainable Maximum Yield (MSY) Assessment Results for Demersal fish Group in 2023

The number of demersal species caught in Thai waters in 2023 from all fishing gears was 703,172 tons. This catch was divided into 551,307 tons from the Gulf of Thailand and 151,864 tons from the Andaman Sea. The quantity of demersal marine species catch used for MSY assessment from the main fishing gears in the Gulf of Thailand was 506,941 tons, which constitutes 91.95% of the total demersal catch from the Gulf of Thailand. (Table 2).

Table 2 Catch of Demersal fish group in Thai waters in 2023

Demersal fish	Main fishing gears		Other gears		Total	
	Catch	%	Catch	%	Catch	%
Gulf of Thailand	506,941	91.95	44,366	8.05	551,307	100.00

Demersal fish group in Gulf of Thailand

The data used for assessment covers the years 1971 to 2023. The assessment results reveal that the Maximum Sustainable Yield (MSY) is 754,615 tons. The fishing effort at the MSY level is equivalent to 24.18 million hours. The catch of demersal marine species in the year 2023 amounted to 506,941 tons, a reduction from 436,343 tons in 2022, which is an increase of 70,598 tons. The fishing effort for 2023 is 16.29 million hours, an induction from 1.37 million hours in 2022. The fishing effort in 2023 represents 67.38% of the fishing effort at the MSY level (Figure 1).

Table 3: Summary of Maximum Sustainable Yield (MSY) Assessment Results and Fishing Effort, in 2023

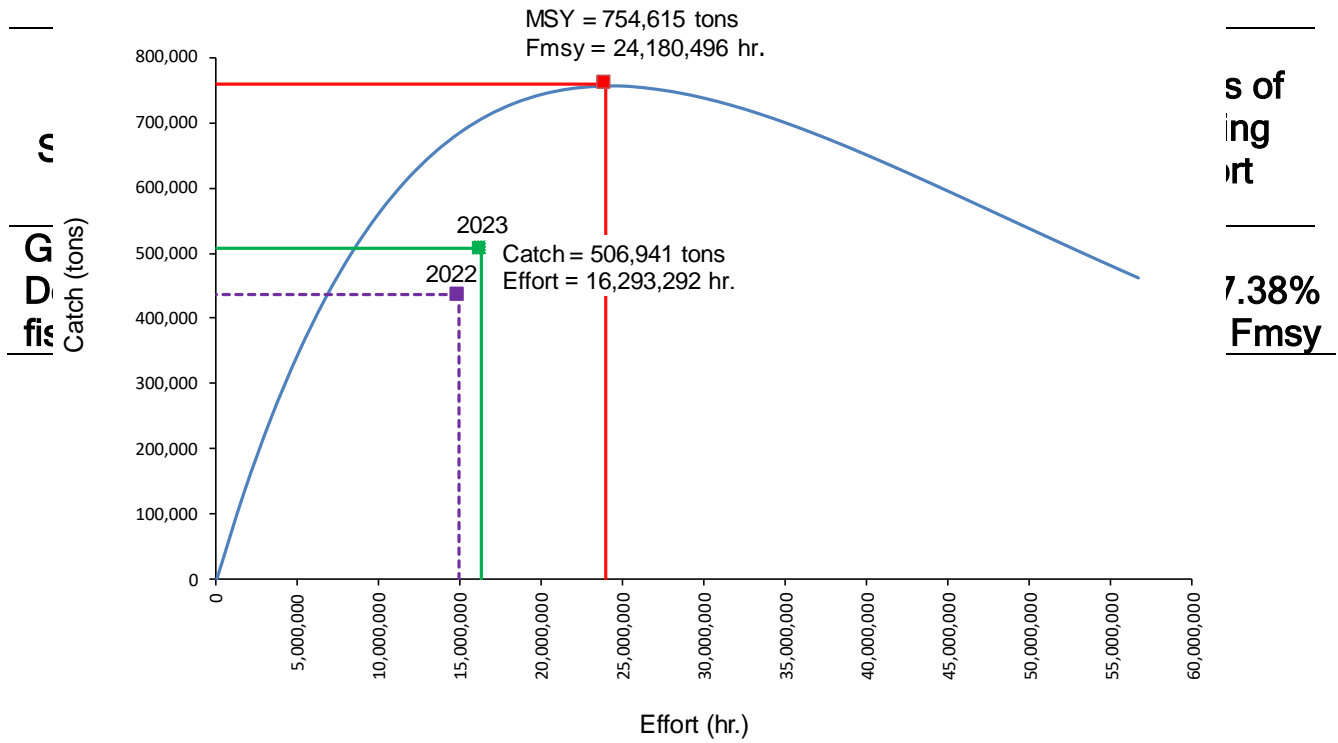


Figure 1 Maximum Sustainable Yield for Demersal group in the Gulf of Thailand in 2023

- **National Fisheries Policy Committee Meeting Report**

The 1/2023 National Fisheries Policy Committee Meeting

On October 26, 2023

The 1/2023 National Fisheries Policy Committee meeting was held at the Burachat Chaiyakorn Conference Room, Ministry of Commerce, chaired by the Deputy Prime Minister and Minister of Commerce (Mr. Phumtham Wechayachai). The key points of the meeting are as follows:

Acknowledgment of the Prime Minister's Orders and the Working Principles and Goals

1) The Prime Minister issued Order No. 253/2023 on October 3, 2023, assigning and delegating authority to the Deputy Prime Minister (Mr. Phumtham Wechayachai) to act as the Chairman of the National Fisheries Policy Committee on behalf of the Prime Minister.

2) For ongoing operations, there is still the Committee for Solving Marine Fisheries Problems (IUU-Fisheries), chaired by the Deputy Prime Minister (Mr. Phumtham Wechayachai). This committee is responsible for negotiating with the European Union to address the economic damages faced by Thailand.

3) The Chairman of the National Fisheries Policy Committee has appointed Mr. Plodprasop Suraswadi as an advisor to the Chairman of the National Fisheries Policy Committee. This appointment aims to ensure that the administrative responsibilities of the Deputy Prime Minister (Mr. Phumtham Wechayachai) in his role as Chairman are carried out smoothly and efficiently.

4) The National Fisheries Policy Committee has the authority and duty to set policies and oversee the management of fisheries as follows:

1. To establish policies for the development of fisheries in Thai waters that align with the quantity of aquatic resources and the fishing capacity, with particular consideration given to reference points.

2. To establish policies for promoting, developing, and addressing issues related to fishing outside Thai waters.

3. To establish policies for the development of aquaculture in the country.

4. To establish policies for the development of the country's fisheries-related industries.

5. To implement measures to ensure the policies under (1), (2), (3), and (4) are achieved.

6. To determine the maximum quantity of aquatic animals that can be fished in Thai waters.

7. To establish guidelines and targets for the development of the country's fisheries in line with the conservation of aquatic resources and the environment.

8. To establish guidelines for managing aquatic resources to maintain a suitable and sustainable fishing environment.

9. To prepare an annual performance report for submission to the Cabinet and to be made known to the public.

10. To undertake any other actions as prescribed by law to be the authority and duty of the Board or as assigned by the Cabinet.

The policies formulated under items (1), (2), (3), and (4) must be submitted to the Cabinet for consideration and approval. Once approved by the Cabinet, all government agencies must implement and oversee these policies accordingly.

- Current Status of Fisheries Management Policies and Plans

The Department of Fisheries is in the process of revising and updating the fisheries management policies and plans. To facilitate this, the department has organized workshops to exchange perspectives and gather feedback for formulating these policies and plans in accordance with Section 19 and Section 23 of the Fisheries Act B.E. 2558 (2015) and its amendments. These policies are divided into four areas:

1. Policies for the development of fisheries within Thai waters.

2. Policies for promoting, developing, and addressing issues related to fishing outside Thai waters.

3. Policies for the development of aquaculture in the country.

4. Policies for the development of the country's fisheries-related industries.

5) The Board has the authority to appoint special committees or subcommittees to perform duties as designated by the Board.

6) The policies under point 4 (1), (2), (3), (4), (5), (6), and (7) must aim to achieve at least the following results:

1. Ensure the conservation, preservation, and prevention of aquatic animals from extinction, allowing for the sustainable use of aquatic resources, maintaining the balance of ecosystems and biodiversity.

2. Prevent the support of illegal fishing activities, including support for personnel, fuel, fishing equipment, or any other supplies.

3. Implement measures to regulate and control fishing activities to comply with international laws and standards.

4. Develop cooperation strategies for fishing activities with other states and international organizations to conserve and manage threats to aquatic resources, migration of aquatic animals, or their habitats, using the precautionary principle.

5. Establish measures to prevent fishing activities from disturbing or hindering natural processes in adequately producing and restoring production capacity to align with nature's maximum production, ensuring sustainable use.

6. Implement measures requiring all relevant government agencies to revise laws, regulations, procedures, and conditions to align with the advancements and developments of international fishing regulations.

7. Develop guidelines to involve fisheries operators and related professions in the conservation and protection of fisheries resources and aquatic resources to maintain suitable conditions for sustainable fishing activities.

7) The guidelines for the management of aquatic resources under point 4 (8) must at least cover the following aspects:

1. Guidelines for promoting conservation measures and sustainable fisheries management.

2. Guidelines for protecting and safeguarding the rights, development, and promotion of the livelihoods of Thai fishers.

3. Guidelines for preventing the overexploitation of aquatic resources.

4. Guidelines for preventing illegal fishing activities.

5. Guidelines for cooperation with international organizations, various countries, and coastal states in disseminating and exchanging information on fish catch statistics and other fisheries-related data.

8) To implement the policies under point 4, the Department of Fisheries shall prepare a fisheries management plan in alignment with these policies for submission to the Board for consideration. The plan shall then be presented to the Cabinet for approval, so that the relevant agencies can follow and implement it accordingly.

Section 2A Catch: (Part B) High-Risk Species/Species groups:

The report of stock assessment for high-risk species.

Summary

The assessment of the stock statuses between 2016 and 2020 of the interested species, i.e. the species with high risks from the trawl fisheries according to the productivity sensibility analysis, was further conducted by using 3 models as yield per recruits' model, spawning potential ratio model and Thompson and Bell's analysis model. All the 3 models are length-based analyses. There were 5 fish species (*Saurida elongate*, *Nemipterus hexodon*, *Priacanthus tayenus*, *Sphyræna jello*, and *Scomberomermus commerson*) had been analyzed and the results are presented below. The results showed that there were trends of overfishing to individual stock, except *P. tayenus*, during the 5 years of monitoring from the yield per recruits' model and consequently lowered the spawning potential ratio to less than 20%, i.e., below the general

limited reference of reproductive ability of the population that guarantee the suitable recruitment. Lastly, the results from Thompson and Bell's analysis model indicated the overfishing situation of the fishing efforts and overfished of the stock, when relating to the level of maximum sustained yield.

List of symbols and abbreviations in the Tables

Symbol and Abbreviation	
L_{∞}	asymptotic length (cm TL)
K	growth parameter (per year)
R_n	goodness of fit test, i.e. how the estimated growth fit to the length frequency distribution
ϕ'	phi-prime value
Z	Total morality coefficients
M	Natural morality coefficients
F	Fishing morality coefficients
a	Annual mortality
L_{50}	Size selectivity at 50% to the fisheries
E_{max}	Exploitation rate which produces maximum yield
$E_{0.1}$	Exploitation rate at which the marginal increase of relative yield-per-recruit is 1/10th of its value at $E=0$

- *Saurida elongata*

Table 1 Growth parameters of *S. elongata* in the Gulf of Thailand as estimated from the length frequency data between 2016 and 2020

Year	Number of samples	Length (cm TL)	L_{∞} (cm TL)	K (per year)	R_n	ϕ'
2016	5,056,290	4-39	40.95	0.32	0.175	2.73
2017	2,344,984	3-36	37.80	0.24	0.179	2.54
2018	2,420,019	2-36	37.80	0.32	0.177	2.66
2019	1,701,662	3-41	43.05	0.59	0.166	3.04
2020	1,912,702	3-30	42.5	0.58	0.135	3.02

Table 2 Mortality parameters of *S. elongata* in the Gulf of Thailand between 2016 and 2020

Year	Z (per year)	a (%)	M (per year)	F (per year)	L ₅₀ (cm TL)
2016	2.51	92%	0.80	1.71	9.41
2017	1.63	80%	0.68	0.95	11.70
2018	1.88	85%	0.82	1.06	7.67
2019	2.73	92%	1.81	0.92	5.90
2020	2.99	95%	1.17	1.82	6.71

Table 3 Current exploitation rate of *S. elongata* in the Gulf of Thailand between 2016 and 2020 and the results from yield per recruits' model showing E_{max} and $E_{0.10}$ and %SPR from the length-based spawning potential model

Year	$E_{current}$	E_{max}	$E_{0.10}$	%SPR
2016	0.68	0.48	0.35	10%
2017	0.58	0.58	0.46	16%
2018	0.56	0.46	0.37	18%
2019	0.34	0.40	0.32	42%
2020	0.60	0.42	0.30	15%

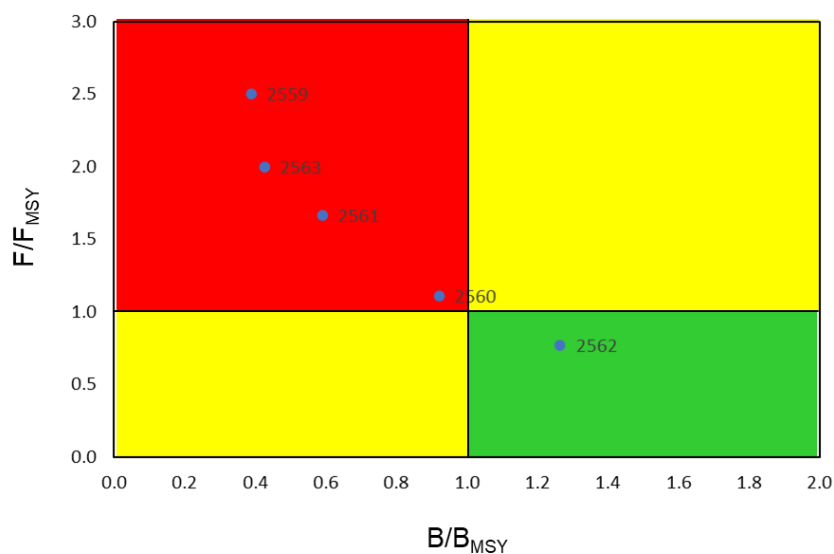


Figure 1 The result from Thompson and Bell Yield Analysis of *S. elongata* in the Gulf of Thailand between 2016 and 2020, as presented in Kobe plot

- *Nemipterus hexodon*

Table 4 Growth parameters of *N. hexodon* in the Gulf of Thailand as estimated from the length frequency data between 2016 and 2020

Year	Number of samples	Length (cm TL)	L_{∞} (cm TL)	K (per year)	R_n	ϕ'
2016	765,818	3-29	30.45	0.82	0.140	2.88
2017	963,083	3-32	33.60	0.68	0.149	2.89
2018	769,753	4-29	30.45	0.61	0.135	2.75
2019	1,068,681	3-28	29.50	0.58	0.101	2.70
2020	652,298	4-29	30.50	0.58	0.101	2.73

Table 5 Mortality parameters of *N. hexodon* in the Gulf of Thailand between 2016 and 2020

Year	Z (per year)	a (%)	M (per year)	F (per year)	L_{50} (cm TL)
2016	2.81	92%	1.61	1.20	9.27
2017	3.27	97%	1.38	1.89	6.24
2018	2.33	88%	1.32	1.01	8.85
2019	2.27	88%	1.29	0.98	10.00
2020	2.08	87%	1.28	0.80	6.46

Table 6 Current exploitation rate of *N. hexodon* in the Gulf of Thailand between 2016 and 2020 and the results from yield per recruits' model showing E_{max} and $E_{0.10}$ and %SPR from the length-based spawning potential model

Year	$E_{current}$	E_{max}	$E_{0.10}$	%SPR
2016	0.43	0.53	0.45	29%
2017	0.57	0.44	0.36	12%
2018	0.43	0.52	0.40	27%
2019	0.43	0.58	0.45	29%
2020	0.38	0.46	0.37	32%

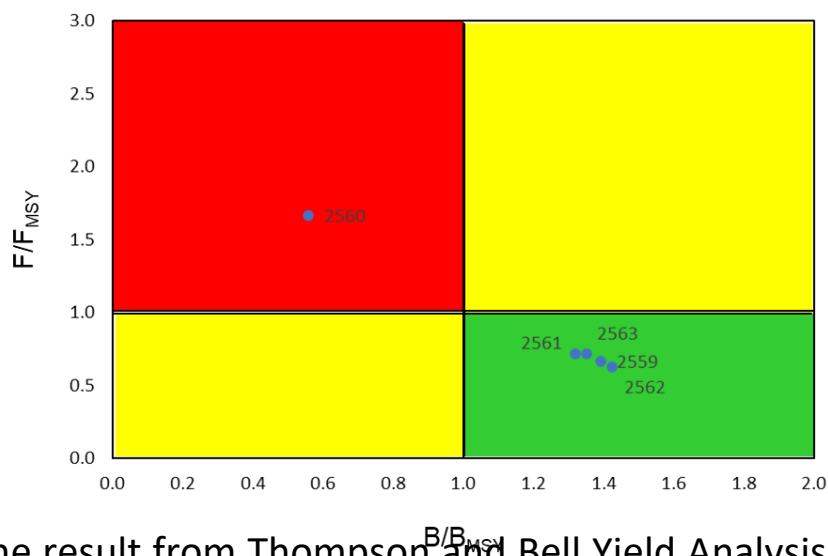


Figure 2 The result from Thompson and Bell Yield Analysis of *N. hexodon* in the Gulf of Thailand between 2016 and 2020, as presented in Kobe plot

- *Priacanthus tayenus*

Table 7 Growth parameters of *P. tayenus* in the Gulf of Thailand as estimated from the length frequency data between 2016 and 2020

Year	Number of samples	Length (cm TL)	L_{∞} (cm TL)	K (per year)	R_n	ϕ'
2016	5,812,356	2-30	31.50	0.68	0.152	2.829
2017	8,729,326	2-29	30.50	0.77	0.123	2.885
2018	5,759,924	2-29	30.50	0.67	0.103	2.795
2019	7,707,585	2-29	30.45	0.62	0.147	2.760
2020	4,050,259	2-31	32.50	0.48	0.130	2.705

Table 8 Mortality parameters of *P. tayenus* in the Gulf of Thailand between 2016 and 2020

Year	Z (per year)	a (%)	M (per year)	F (per year)	L_{50} (cm TL)
2016	3.29	97%	1.41	1.88	4.33
2017	3.59	97%	1.54	2.05	4.35
2018	2.74	93%	1.41	1.33	5.73
2019	2.54	92%	1.34	1.20	4.21
2020	2.23	87%	1.11	1.12	8.75

Table 9 Current exploitation rate of *P. tayenus* in the Gulf of Thailand between 2016 and 2020 and the results from yield per recruits' model showing E_{max} and $E_{0.10}$ and %SPR from the length-based spawning potential model

Year	$E_{current}$	E_{max}	$E_{0.10}$	%SPR
2016	0.57	0.41	0.31	15%
2017	0.57	0.42	0.35	17%
2018	0.48	0.44	0.36	23%
2019	0.47	0.41	0.31	25%
2020	0.50	0.51	0.42	21%

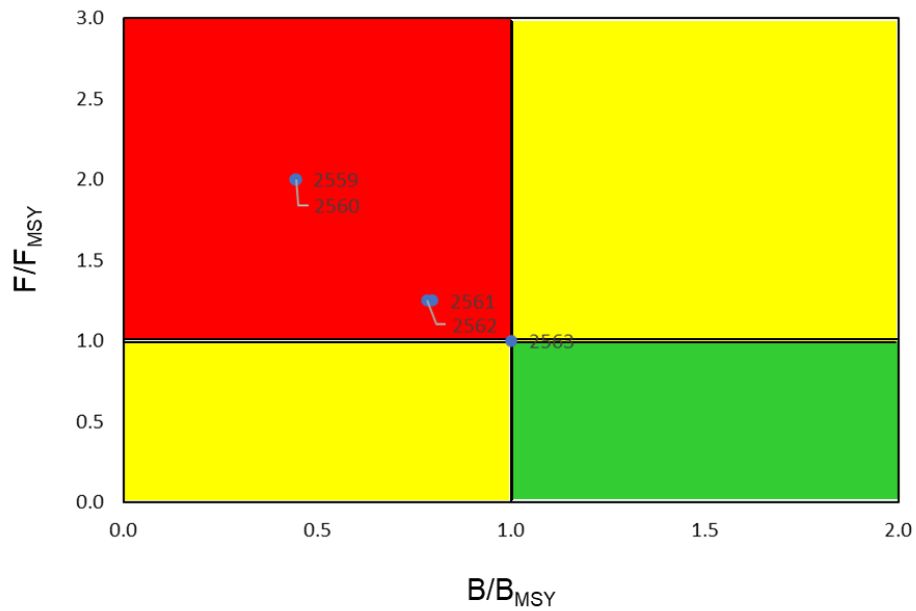


Figure 3 The result from Thompson and Bell Yield Analysis of *P. tayenus* in the Gulf of Thailand between 2016 and 2020, as presented in Kobe plot

- *Sphyraena jello*

Table 10 Growth parameters of *S. jello* in the Gulf of Thailand as estimated from the length frequency data between 2016 and 2020

Year	Number of samples	Length (cm TL)	L_{∞} (cm TL)	K (per year)	R_n	ϕ'
2016	345,448	6 - 66	66.75	0.33	0.134	3.075
2017	398,204	4 - 71	68.10	0.24	0.175	3.047
2018	210,726	5 - 68	65.00	0.33	0.207	3.144
2019	354,561	3 - 86	86.70	0.19	0.141	3.155
2020	466,829	4 - 77	75.00	0.28	0.179	3.197

Table 11 Mortality parameters of *S. jello* in the Gulf of Thailand between 2016 and 2020

Year	Z (per year)	a (%)	M (per year)	F (per year)	L ₅₀ (cm TL)
2016	1.58	79%	0.71	0.87	3.2*
2017	1.37	75%	0.58	0.79	3.5*
2018	1.21	70%	0.72	0.49	3.4*
2019	1.40	75%	0.46	0.94	1.4*
2020	1.36	74%	0.49	0.87	3.4*

Table 12 Current exploitation rate of *S. jello* in the Gulf of Thailand between 2016 and 2020 and the results from yield per recruits' model showing E_{max} and $E_{0.10}$ and %SPR from the length-based spawning potential model

Year	$E_{current}$	E_{max}	$E_{0.10}$	%SPR
2016	0.47	0.38	0.31	11%
2017	0.45	0.36	0.26	8%
2018	0.51	0.37	0.31	24%
2019	0.57	0.35	0.27	3%
2020	0.62	0.35	0.26	6%

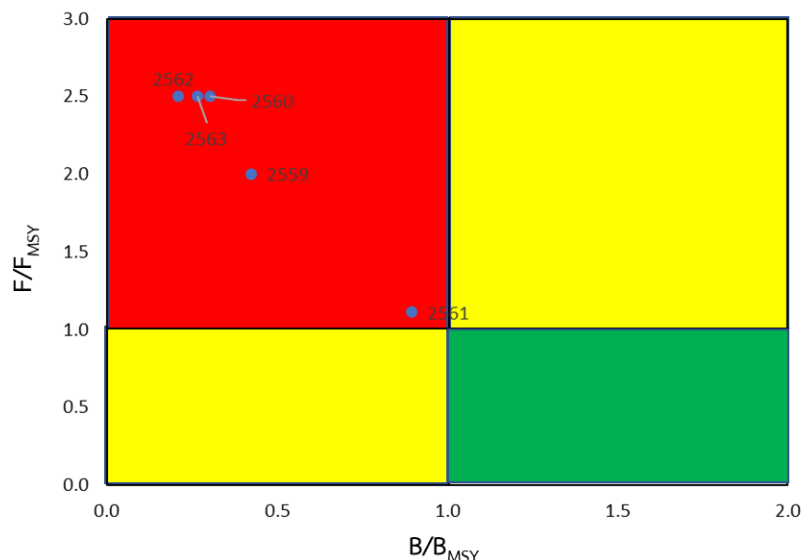


Figure 4 The result from Thompson and Bell Yield Analysis of *S. jello* in the Gulf of Thailand between 2016 and 2020, as presented in Kobe plot

- *Scomberomorus commerson*

Table 13 Growth parameters of *S. commerson* in the Gulf of Thailand as estimated from the length frequency data between 2016 and 2020

Year	Number of samples	Length (cm TL)	L_{∞} (cm TL)	K (per year)	R_n	ϕ'
2016	259,162	5 - 92	93.0	0.42	0.111	3.560
2017	359,447	2 - 85	86.5	0.55	0.118	3.641
2018	304,601	4 - 95	96.5	0.46	0.116	3.632
2019	390,317	3 - 94	95.0	0.42	0.119	3.583
2020	330,678	3 - 87	91.50	0.51	0.106	3.630

Table 14 Mortality parameters of *S. commerson* in the Gulf of Thailand between 2016 and 2020

Year	Z (per year)	a (%)	M (per year)	F (per year)	L_{50} (cm TL)
2016	1.88	85%	0.76	1.12	5.49
2017	1.64	81%	0.93	0.71	2.23
2018	2.14	88%	0.80	1.34	3.40*
2019	2.09	88%	0.76	1.33	3.39
2020	3.54	97%	0.87	2.67	1.67*

Table 15 Current exploitation rate of *S. commerson* in the Gulf of Thailand between 2016 and 2020 and the results from yield per recruits' model showing E_{max} and $E_{0.10}$ and %SPR from the length-based spawning potential model

Year	$E_{current}$	E_{max}	$E_{0.10}$	%SPR
2016	0.60	0.38	0.31	4%
2017	0.44	0.37	0.31	16%
2018	0.63	0.37	0.31	3%
2019	0.64	0.37	0.30	2%
2020	0.75	0.37	0.31	1%

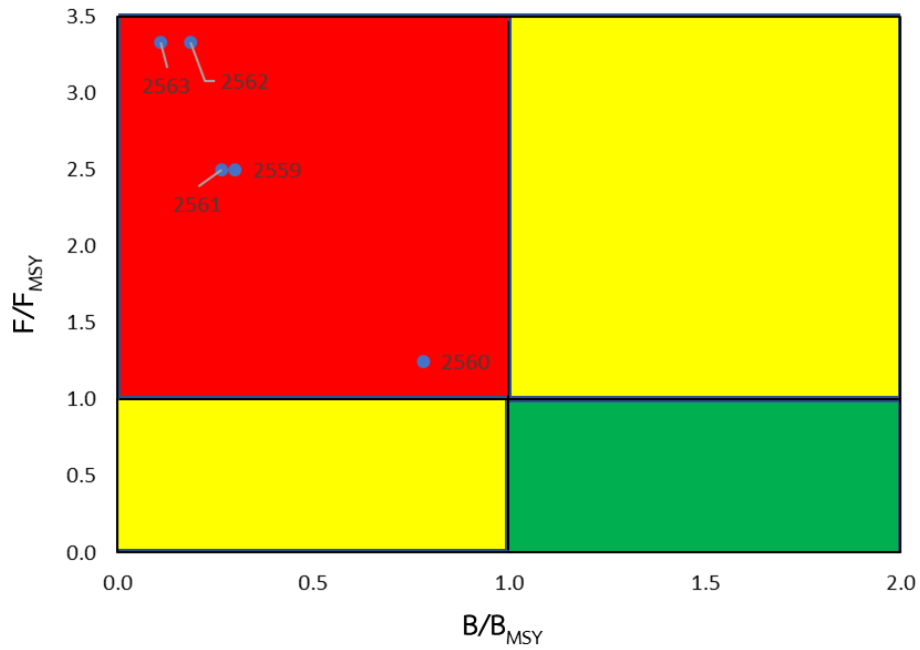


Figure 5 The result from Thompson and Bell Yield Analysis of *S. commerson* in the Gulf of Thailand between 2016 and 2020, as presented in Kobe plot

Section 2A Catch (Part C): Reduction component

Review of existing research related to trawl fisheries in the Gulf of Thailand and resource assessment for establishing Total Reference Points (TRP)

A review of research related to trawl fishing in the Gulf of Thailand, conducted by the Marine Fisheries Research and Development Division over the past 10 years from 2012 to present, found a total of 20 studies related to trawl fishing or associated catch from trawl fisheries. Additional research on laws related to trawl fishing in the Gulf of Thailand was also conducted. The content can be divided into 8 main topics:

1. CPUE and Species Composition from Trawl Fisheries in the Gulf of Thailand

1. CPUE varies by trawl type, with pair trawls having the highest CPUE, followed by medium-sized otter board trawls, beam trawls, and small otter board trawls respectively. CPUE also varies by area and season. Average CPUE are as follows:
 - Small otter board trawls: 11.40-27.86 kg/hr ·
 - Medium otter board trawls: 20.61-38.15 kg/hr ·
 - Pair trawls: 79.68-241.22 kg/hr ·
 - Beam trawls: 19.72-28.92 kg/hr
2. Catch composition:
 - Economic species: Comprise 50% to 95% of the total catch, depending on trawl type. Beam trawls have the highest proportion of economic species (92-96%).
 - Trash fish: Comprise 5% to 50% of the total catch. Pair trawls typically have a higher proportion of trash fish compared to other board trawl types.
3. Main economic species groups:
 - Demersal fish: Highest proportion, about 20-63% of all economic species
 - Squid: About 2-25%, depending on trawl type and fishing area

Pelagic fish: About 0-30%, found mostly in pair trawls

Shrimp: Proportions vary greatly, from 0.3% in pair trawls to 85% in beam trawls

Crab: About 0.2-16%, found mostly in beam trawls

These proportions vary by trawl type, fishing area, and season.

4. Important economic species found in trawl fishing include: ·

- Threadfin bream (*Nemipterus* spp.): Found mostly in otter board trawls and pair trawls
- Lizardfish (*Saurida elongata*): Found in all trawl types ·
- Squid (*Loligo* spp.): An important economic species in all trawl types ·
- Banana prawn (*Penaeus merguensis*): Found mostly in small otter board trawls and beam trawls
- Metapenaeus shrimp (*Metapenaeus* spp.): Found mostly in small otter board trawls and beam trawls
- Blue swimming crab: Found mostly in beam trawls

Other economically important species include goatfish, croaker, and bigeye.

5. Trends in changes: From various studies over different periods, important trends were observed:

- Declining CPUE: Compared to past studies, overall CPUE show a declining trend, especially for pair trawls
- Increasing proportion of trash fish: Reports indicate an increasing trend in the proportion of trash fish in catches, especially in pair trawls
- Changes in species composition: Reports indicate changes in the composition of caught species, such as a decrease in large species and an increase in small species

6. Differences by area and season: CPUE and species composition differ by area and season

- Area: CPUE and species composition differ between the inner Gulf of Thailand, the eastern Gulf of Thailand, and the upper Gulf of Thailand ·

- Season: Reports indicate that catch rates during the southwest monsoon and northeast monsoon seasons are higher than during monsoon transition periods
- Water depth: Each type of fishing vessel operates at different depths, affecting the species and quantity of fish caught

2. Trawl Fishing Grounds and Seasons in the Gulf of Thailand

Trawl fishing grounds in the Gulf of Thailand

1. Otter Board Trawls

Small-sized

- Area: Near coastal areas throughout the Gulf of Thailand
- Water depth: 7-50 meters
- Key areas: ·
 - Eastern Gulf of Thailand: Trat to Rayong provinces ·
 - Upper Gulf of Thailand: Chonburi to Prachuap Khiri Khan provinces ·
 - Central Gulf of Thailand: Prachuap Khiri Khan to Surat Thani provinces ·
 - Lower Gulf of Thailand: Nakhon Si Thammarat to Songkhla provinces

Medium and Large-sized

- Area: Further offshore than small-sized trawls, covering a wider area
- Water depth: 9-80 meters
- Key areas: ·
 - Eastern Gulf of Thailand: Trat to Rayong provinces ·
 - Upper Gulf of Thailand: Chonburi to Prachuap Khiri Khan provinces ·
 - Central Gulf of Thailand: Prachuap Khiri Khan to Surat Thani provinces ·
 - Lower Gulf of Thailand: Nakhon Si Thammarat to Pattani provinces

2. Pair Trawls

- Area: Throughout the Gulf of Thailand, including mid-gulf areas
- Water depth: 6-70 meters

- Key areas: ·
 - Eastern Gulf of Thailand: Around Kood Island and Chang Island, Trat province ·
 - Upper Gulf of Thailand: Chonburi to Prachuap Khiri Khan provinces ·
 - Central Gulf of Thailand: Prachuap Khiri Khan to Surat Thani provinces ·
 - Lower Gulf of Thailand: Nakhon Si Thammarat to Pattani provinces

3. Beam Trawls

- Area: Mostly in the inner Gulf of Thailand and parts of Prachuap Khiri Khan province
- Water depth: 10-24 meters
- Key areas: ·
 - Near major river mouths: Mae Klong, Tha Chin, Chao Phraya, Bang Pakong ·
 - Upper Gulf of Thailand: Samut Sakhon to Phetchaburi provinces ·
 - Parts of Prachuap Khiri Khan province

Interrelation of Fishing Grounds

1. Overlapping areas: ·
 - All types of trawls have overlapping fishing areas in many locations, especially in shallow coastal waters ·
 - The area around Prachuap Khiri Khan province and nearby areas is a point where fishing from all types of trawls overlaps
2. Area division by vessel size: ·
 - Small otter board trawls and beam trawls often operate in shallower coastal waters ·
 - Medium/large otter board trawls and pair trawls can operate in areas further offshore and in deeper waters
3. Seasonal changes:
 - During the northeast monsoon season, there is a movement of vessels from the western Gulf of Thailand to fish more in the eastern Gulf of Thailand ·
 - Fishing is intense during the open season (after May 15)

4. Legal restrictions and conservation: ·

- There is a gulf closure measure for marine fisheries resources conservation from February 15 to May 15 every year, which affects fishing in some areas ·
- Fishing vessels must operate outside the coastal area (beyond 3 nautical miles)

5. Relationship with marine resources: ·

- Fishing grounds are related to the distribution of economic marine species such as shrimp, threadfin bream, blue swimming crab, and squid ·
- Some areas are spawning and nursery grounds for marine resources, which may be affected by trawl fishing

This summary demonstrates the complexity and interrelation of trawl fishing grounds in the Gulf of Thailand, including overlapping fishing areas between different fishing gear, area division by vessel size, seasonal changes, legal restrictions and conservation measures, as well as the relationship with marine resources in the area.

3. Sizes of Economically Important Species Caught by Trawl Fisheries

From studies on the sizes of economically important marine species caught by trawl fisheries in Thai waters, particularly in the Gulf of Thailand, various species were examined, including banana shrimp, cuttlefish, Indo-Pacific mackerel, Indian mackerel, pony fish, threadfin bream, lizardfish, and blue swimming crab. The fishing gear used includes otter board trawls, pair trawls, and beam trawls. The studies focused on average length, length range, and comparison of caught sizes with size at first maturity, as well as comparing sizes caught at different times. Details are as follows:

1. Banana shrimp (*Penaeus merguensis*): ·
 - Average length: 15.68±0.41 cm ·
 - 59.40% were larger than the first maturity size
2. Tiger shrimp (*P. monodon*): ·
 - Average length: 20.24±1.04 cm ·
 - 92.83% were larger than the first maturity size
3. Jinga shrimp (*M. affinis*): ·

- Average length: 10.66±0.16 cm ·
 - 83.28% were smaller than the first maturity size
4. Greasyback shrimp (*M. ensis*): ·
- Average length: 9.99±0.37 cm ·
 - 80.05% were smaller than the first maturity size
5. Japanese scad (*Decapterus maruadsi*): ·
- Size at first maturity: Males 14.31 cm, Females 13.19 cm ·
 - Smallest size with eggs: 10.50 cm ·
 - The size at first maturity has decreased compared to previous studies
6. Blue swimming crab: ·
- Pair trawl: 97.38% were larger than the first maturity size
 - Otter board trawl: 100% were larger than the first maturity size
 - Beam trawl: 46.61% were larger than the first maturity size
7. Ornate threadfin bream (*Nemipterus hexodon*): ·
- Average length from small otter trawls: 14.22 cm ·
 - Average length from medium otter trawls: 15.82 cm ·
 - Average length from pair trawls: 17.80 cm
8. Needle cuttlefish (*Sepia aculeata*): ·
- Males: Size at first maturity 71.9 mm ·
 - Females: Size at first maturity 94.4 mm
9. Recurve cuttlefish (*Sepia recurvirostra*): ·
- Males: Size at first maturity 66.2 mm ·
 - Females: Size at first maturity 84.2 mm

From this data, it's evident that some marine species, such as tiger shrimp and blue swimming crab caught by otter board trawls, are mostly larger than their size at first maturity. However, other species, such as both types of *Metapenaeus* shrimp, are mostly smaller than their size at first maturity, which could potentially impact the long-term populations of these aquatic species.

4. Overview of Fishery Resource Assessment in the Gulf of Thailand

The study by Thongsila and Sinanun (2013) on banana shrimp in the eastern Gulf of Thailand used data from push nets and otter board

trawls in Rayong, Chanthaburi, and Trat provinces from January to December 2009. The findings were:

1. Banana shrimp mortality rates:
 - Natural mortality coefficient: 2.54 per year
 - Fishing mortality coefficient: 4.00 per year
 - Exploitation ratio: 0.61
2. Sustainable yield for banana shrimp:
 - Maximum Sustainable Yield (MSY): 123.78 tons
 - Fishing effort at MSY: 1.50 times the 2009 level
 - Maximum Sustainable Economic Yield: 18.88 million baht
 - Fishing effort at Maximum Economic Yield: 0.95 times the 2009 level

The study by Tossapornpitakkul et al. (2013) on ponyfish found:

1. Fish caught by trawls:
 - Length at first capture: 1.25 centimeters
 - Number of fish entering the fishery: 31,427,533,326 individuals
2. Sustainable yield for ponyfish:
 - Maximum Sustainable Yield (MSY): 13,411.27 tons
 - Maximum Sustainable Economic Yield: 53.65 million baht
 - Current fishing effort is less than the optimal fishing effort

Both studies indicate that fishing effort could be increased. However, they recommend maintaining the current level of fishing effort for long-term sustainability.

5. Losses and Preservation of Catch from Trawl Fishing

Poolsawat, 2017 found that squid is the main income source, accounting for 67.57% of total revenue of pair trawl. Specifically, cuttlefish generates 57.32% of total revenue.: Highest Post-harvest losses observed in Indo-Pacific mackerel was 1,350.44 baht per trip. Main cause were poor preservation, leading to loss of freshness in fish caught early in the trip, resulting in significantly lower selling prices.

Financial losses from catching small-sized fish before maturity (Sinanun et al., 2020):

- Beam trawls cause the highest losses: 7,877.10 baht per trip or 787,710 baht per year
- Otter board trawls cause the second-highest losses: 7,078.46 baht per trip or 424,707.60 baht per year
- Three-layered shrimp gillnets cause the least losses: 397.54 baht per trip or 71,557.20 baht per year

1. Implications:

- These data highlight the importance of developing more efficient fish preservation methods
- There is a need to consider improving fishing gear to reduce the capture of small-sized fish before maturity
- Such improvements could help reduce losses and promote long-term sustainability of fishery resources

2. Recommendations:

- Develop better preservation techniques, especially for species like Indo-Pacific mackerel
- Modify fishing gear to reduce the capture of immature fish
- Implement measures to minimize losses from catching small-sized fish
- Focus on sustainable fishing practices to ensure long-term viability of fishery resources

This information underscores the need for improved catch handling and preservation methods, as well as the importance of selective fishing practices to reduce the capture of immature fish. These measures could significantly reduce losses and contribute to the long-term sustainability of fishery resources in the Gulf of Thailand.

6. Determination of Appropriate Codend Mesh Sizes for Trawls

The study of appropriate codend mesh sizes for trawls has been ongoing for decades, with research continuously refining our understanding of optimal sizes for sustainable fishing practices. Early studies by Meemeskul (1979) and Sinoda et al. (1979) reached similar conclusions, suggesting that the appropriate codend mesh size for demersal fish in the Gulf of Thailand and the South China Sea should be between 4.5 and 5.5 centimeters. This finding was further supported by

Sinoda et al. (1987), who specifically recommended a 5.0-centimeter mesh size. More recent experimental work by Taweeep (2008) provided quantitative evidence of the impact of different mesh sizes on fish escape rates. The study found that using codend mesh sizes of 4.0 and 6.0 centimeters resulted in escape rates of 28.84% and 42.49% respectively. These results clearly demonstrate that increasing the mesh size allows a greater proportion of smaller aquatic animals to escape, potentially contributing to more sustainable fishing practices.

The significant impact of mesh size on fishery productivity was highlighted in a report by the Demersal Fisheries Working Group (1995). They projected that increasing the codend mesh size from 2.5 to 5.5 centimeters could potentially boost demersal fish production from 77,838 tons to 157,025 tons. This substantial increase is attributed to allowing smaller fish to escape, grow, and eventually re-enter the fishery at a larger, more valuable size.

However, when it comes to actual implementation and legal requirements, there is considerable variation among different countries. For instance, Malaysia mandates a mesh size of 3.8 centimeters, while Australia, known for its stringent conservation measures, requires a much larger mesh size of 9.0 centimeters. Legal requirements in other countries fall within this range, with Brunei stipulating 4.0 centimeters and Myanmar setting the bar at 6.25 centimeters.

7. Fishery Resource Data from the Department of Fisheries' Research Vessels

1. Survey of fishery resources in the inner Gulf of Thailand to Prachuap Khiri Khan province, 2003-2005: ·
 - CPUE increased from 2003 to 2005 ·
 - 2003: 9.297 kg/hr ·
 - 2004: 12.522 kg/hr (increased by 34.69%) ·
 - 2005: 12.485 kg/hr (increased by 34.29%)
2. Main composition of caught marine sources: ·
 - 2003: Squid (41.724%), Demersal fish (36.968%) ·
 - 2004-2005: Demersal fish (43.196% and 42.571%), Squid (38.412% and 37.036%)

3. Changes in size of marine fisheries resources:

12 species with continuously increasing average length:

- Pelagic fish group:
 - *Alepes kleinii* ·
 - Black-banded trevally (*A. djedaba*) ·
 - *Carangoides malabaricus*
- Demersal fish group: ·
 - *Saurida micropectoralis* ·
 - Unicorn leatherjacket filefish (*Aluterus monoceros*) ·
 - Vermiculated spinefoot (*Siganus oramin*) ·
 - Terapon fish (Teraponidae) ·
 - Groupers (Serranidae)
- True trash fish group: ·
 - *Leiognathus brevirostris*

10 species with continuously decreasing average length:

- Pelagic fish group: ·
 - Black pomfret (*Parastromateus niger*) ·
 - Short mackerel (*Rastrelliger brachysoma*) ·
 - Anchovy group (*Thryssa* spp.)
- Demersal fish group: ·
 - Areolate grouper (*Epinephelus areolatus*) ·
 - Purple-spotted bigeye (*Priacanthus tayenus*) ·
 - Sulphur goatfish (*Upeneus sulphureus*) ·
 - One-stripe threadfin bream (*Scolopsis taeniopterus*) ·
 - Tongue sole group (Cynoglossidae) ·
 - Flathead fish group (Platycephalidae) ·
 - Threadfin bream group (Nemipteridae)

4. Survey in Prachuap Khiri Khan province area, 2013-2014: ·

- CPUE varied by month: ·
 - January: 10.52 kg/hr ·
 - March: 18.14 kg/hr ·
 - May: 11.70 kg/hr ·
 - July: 9.88 kg/hr ·
 - August: 15.18 kg/hr ·

- Main composition of caught fisheries resources was mostly squid and demersal fish, with proportions varying each month. This data shows the variability of fisheries resources in different areas and time periods.

8. Fishery Laws Related to Trawl Fisheries

Fishery laws in Thailand have established several regulations to manage trawl fishing activities in the Gulf of Thailand, aiming to protect marine resources and ecosystems while balancing the needs of fishing communities. One key regulation sets the minimum mesh size for trawl cod ends at 4 centimeters or larger, which helps to reduce the capture of juvenile fish and allows smaller marine organisms to escape.

In Chonburi province, a notable restriction has been implemented on beam trawls. This decision was made in response to the area's unique environment, characterized by a muddy seabed rich in aquatic resources. The extensive use of beam trawls in this region was causing severe damage to the seabed ecosystem and depleting aquatic resources. As a result, authorities have prohibited beam trawling in Chonburi province to protect this sensitive marine habitat.

The laws also address the use of trawls and push nets in specific coastal areas. Restrictions have been placed on these fishing methods in parts of several provinces, including Nakhon Si Thammarat, Chonburi, Prachuap Khiri Khan, Chumphon, Narathiwat, and Trat. These area-specific regulations serve dual purposes: first, they help preserve certain coastal zones as nursery grounds for juvenile aquatic animals, supporting the replenishment of fish stocks. Second, they maintain accessible fishing grounds for small-scale local fishermen who lack the capacity to operate far from the shore.

Data collection program for trawl fisheries monitoring and research vessel

In 2023, the Department of Fisheries has been actively collecting data from three types of trawl fishing gears: Otter board trawls, Beam trawls, and Pair trawls on a monthly basis. This data collection effort is carried out by eight Marine Fisheries Research and Development Centers located as follows:

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

Between January and December, a total of 527 samples were collected from the Gulf of Thailand, comprising Beam trawl (88 samples), Otter board trawl (325 samples), and Pair trawl (114 samples (Table 1). The CPUE were 121.707, 23.030 and 16.717 for Pair trawl, Otter board trawl, and Beam trawl respectively (Table1).

This comprehensive data collection initiative holds great significance for enhancing fisheries monitoring and supporting scientific research. The Department of Fisheries underscores the importance of accurate data collection for the sustainable management of trawl fisheries.

The Department of Fisheries conducts comprehensive fisheries resource surveys employing five dedicated marine fisheries research survey vessels: namely, Pramong 1, Pramong 2, Pramong 9, and Pramong 16, all under the Marine Fisheries Research and Development Division. These surveys are conducted using the otter board trawl method, utilizing a cod end net size of 4.0 cm, across a total of 64 survey stations in the Gulf of Thailand (Figure 1). From January to December, the Department of Fisheries successfully executed a total of 237 hauls through 15 survey trips (Table 2).

The data collection will continue until the end of 2023. Subsequently, the analysis of the data and the writing of the report will proceed. The report is expected to be completed by end of 2024.

Table 1 Sampling number of trawl fishing vessels from January to December 2023

Month	Pair trawl		Otter board trawl		Beam trawl	
	sampling number	CPUE (kg./hr.)	sampling number	CPUE (kg./hr.)	sampling number	CPUE (kg./hr.)
1	13	95.873	39	13.635	7	15.608
2	5	132.762	30	23.256	8	19.879
3	9	92.740	43	21.552	9	13.536
4	6	146.466	24	29.293	8	15.800
5	7	121.838	26	20.159	11	13.922
6	11	139.271	31	26.109	13	17.714
7	15	113.824	25	25.816	11	13.043
8	9	131.558	28	23.058	3	12.739
9	8	121.613	25	21.178	7	19.337
10	9	136.988	14	30.999	4	32.217
11	14	131.016	19	32.219	3	22.866
12	8	116.848	21	20.257	4	14.168
Total	114	121.707	325	23.030	88	16.717

Table 2 Number of fisheries resources survey stations from January to December 2023 in the Gulf of Thailand

Center	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EMDEC	9		9		9						9	
UMDEC	11		11		11		11					
CMDEC		22	22			22		22				
SMDEC			23					23	23			
total	20	22	65		20	22	11	45	23		9	

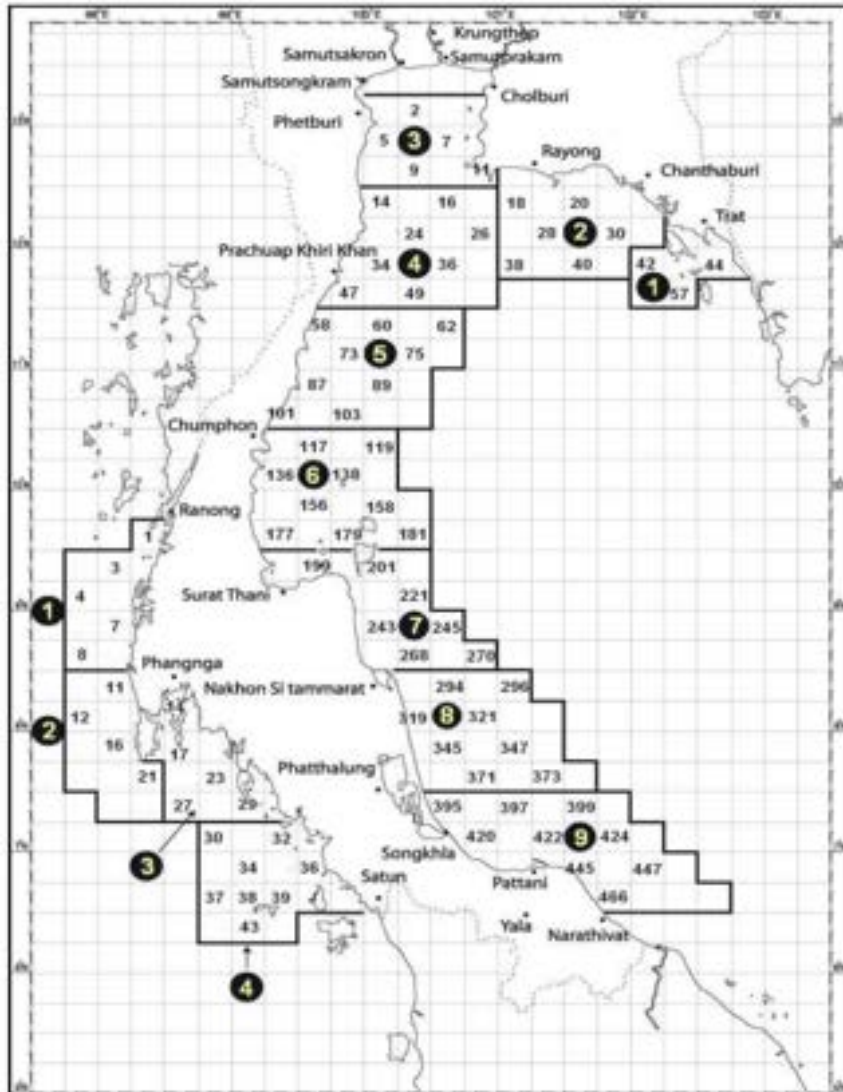


Figure 1 Marine fisheries research survey stations

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

- **Workshop to reviews and planning for ETP species recording and trawl interaction.**

Summary workshop

**“Good fishing practices to reduce the impact
on Endangered, Threatened and Protected species (ETPs) into
sustainable fishery standards”**

**Mae Klong Fishery Cooperative Limited, Mueang District, Samut
Songkhram Province**

25th September 2023, 10.30-17.00 PM

List of stakeholders sending the representative participated in the workshop

- 1) Thai Feed Mill Association (5 People)
- 2) National Fisheries Association of Thailand (2 People)
- 3) Thai Frozen Foods Association (2 People)
- 4) Thai Fishmeal Producer Association (1 person)
- 5) Thai Shrimp Association (1 Person)
- 6) Department of Marine and Coastal Resources (2 People)
- 7) Department of Fisheries (12 People)
- 8) Presenter (6 People)
- 9) TSFR Consultant (1 Person)
- 10) TSFR Working team (2 People)
- 11) Fisherman, Trawl Gears (31 People)
- 12) Online (19 People)

Objective:

1. To exchange experiences encountering rare marine animals during fishing in fishing Vessels (Trawl Gear).
2. To introduce sustainable fishing standard requirements in terms of environmental impact reduction.
3. To prepare a manual on good fishing practices to reduce the impact on rare marine animals in the Gulf of Thailand.

Fishery Improvement Project (FIP) in the Gulf of Thailand is a private sector initiative to evaluate and create Fishery Action Plan (FAP) to manage the Gulf of Thailand trawl fishery to become certified to MarinTrust standards, an international organization for certifying the sustainability of marine raw materials, Fishmeal. The Fishery Action Plan (FAP), 2022 has already been approved by the main agency, the Department of Fisheries, Stakeholders throughout the supply chain of Thai fisheries products and MarinTrust. Currently, the FAP is on the process of implementing the work specified in the action plan.

This workshop is a part of the Gulf of Thailand Trawl fishery management Plan (Fishery Action Plan; FAP) in the activities regarding workshop to reviews and planning for Endangered, threatened and protected species (ETPs) recording and trawl interaction. The working team chose the area where trawl fishing is the main tool, mainly the inner Gulf of Thailand area and some southern parts, also selecting representatives of fishermen from Samut Sakhon Province, Samut Prakan Province, Prachuap Khiri Khan Province, Ban Laem District Fishermen's Association and Songkhla Province, etc. Various suggestions from the workshop will be used to prepare a report and to create a manual for trawl fishing.

Opening speech at the workshop

President of the Thai Feed Mill Association, Mr. Pornsil Patcharintanakul opened the meeting on behalf of Thai Feed Mill Association and the working group of 8 associations as business operators throughout the supply chain from participating in Fishery Improvement Project (FIP) in the Gulf of Thailand. The operation of the project linked with foreign countries, which has now been accepted very well. This success would be difficult to achieve without the cooperation of all sectors, such as the Department of Fisheries, the Department of Marine and Coastal Resources, and researchers, who have always cooperated well for more than 10 years. Collaboration throughout the supply chain is an important factor and we will continue to develop Thai fisheries for more complete and better fisheries system to meet

international standards so that the children and grandchildren of fishermen can use resources sustainably

Managing Director of Thai Frozen Foods Association Mr. Anucha Techanitisawad added on the opening that carrying out activities under the FIP project will be beneficial in explaining to trading partners who are keeping an eye on sustainable fisheries that Thailand places great importance on this issue, management of ETP species, and the Thai Frozen Foods Association is pleased to continue supporting this FIP project together with the working group of 8 associations.

Professor Kungwan Juntarashote, TSFR Consultant and Department of Fisheries Expert added on the opening that carrying out the FIP project and organizing this workshop activities, every department is involved together throughout the supply chain, starting from the capture process (fisherman), using fish as raw material to produce feed for shrimp and brought for consumption. Therefore, if any part is damaged, the supply chain will also be damaged so a careful planning is necessary. At present, it can be seen that there are many regulations at the international level in the form of recommendations and agreements, most of which are designed to benefit from the resources from the sea. However, few mentioned the importance of equal access to marine resources and there is only one concern about marine life but there is no mention of survival from fishing, both matters should be considered together. Professor Kungwan suggests that every party involve including governments, academics and key stakeholders should change the perspective by allowing the government sector to manage aquatic animal resources in the way that the fishermen survive and everyone must find a way to adjust to the changing trend of the world that views aquatic animal as global resources. Therefore, resources must be used without affecting the ecosystem and the well-being of the next generation



Presenting by Department of Marine and Coastal Resources and Department of Fisheries

Presenting on Endangered, Threatened and Protected species (ETPs) and basic rescue when ETPs are found stranded or stuck in fishing gear by Marine and Coastal Resources Research Center of the Upper Gulf of Thailand, Department of Marine and Coastal Resources.



Presenting on recording sightings of Endangered, Threatened and Protected species (ETPs) by Fish Quarantine and Fishing Vessels Inspection Division, Department of Fisheries.



Brainstorming session.

President of National Fisheries Association of Thailand explained that the reason why trawler fishermen do not keep records when they find Endangered, Threatened and Protected species (ETPs) because it had previously been affected by an NGO complaining that ETPs such as dugongs had been found caught in fishing trawlers. However, the dugong's habitat depends on the coastline and trawl fishing boats which are commercial fishing cannot enter the coastline to fish. In addition, trawl fishermen know which marine animals need to be conserved and if it is accidentally caught, it will be immediately released into the sea. Because such sea creatures cannot be sold, fishermen definitely do not catch them.

President of the Samutsakhon Fisheries Association provided the information that as an operator of a Bryde's whale viewing tour boat, it gives him the experience of encountering a group of ETPs. For reporting the discovery of ETPs, Trawl fishermen can record truthfully but it must not affect the fishermen and should be encouraged to help inform and record information. This will support the Department of Marine and Coastal Resources to increase the accuracy of the data on ETPs found and death rate. As the result, the bio-abundance index will be more accurate. The president has encouraged the participant in the workshop that reporting the discovery of ETPs does not affect the trawl fishermen in any way. This will also create awareness and makes you know how many ETPs there are. The president also provides the information that most trawl fishing vessels use a speed of 2-3 knots, which ETPs swim faster and avoid them quickly. Therefore, the chance of accidentally getting caught in a fishing net may be influenced by other factors, such as sea animals being sick.

The Department of Fisheries working group has joined in exchanging information with trawl fishermen and inquire about the discovery and recording of ETPs during fishing as follows:

The project manager from Thai Frozen Foods Association has shared the information that in terms of assessment for international standard, the importance of ecological impacts is clearly stated in the ecological assessment criteria. The entrepreneurs or fisherman must be able to inform how many types of ETPs live in each fishing area. This information may be overlaid with the fishing area information to indicate how much the fishing area affects the habitat of ETPs.

Fishery experts from Fish Quarantine and Fishing Vessels Inspection Division, Department of Fisheries has clarified that the Department of Fisheries has publicized coordinate with the Port In Port Out (PIPO) center regarding requesting cooperation from fishermen to continuously record the sightings of ETPs in a logbook. However, it has not been as successful as it should be. This may come from fishermen fearing that if they report their records, they may face consequences or penalties which is not true. The objective of the Department of Fisheries is to record ETPs encounters without specifying the number of individuals while fishing, while the boat is running or the boat is moored. The Department of Fisheries will use this information to create maps to see the distribution and density of ETPs. If there is regular reporting of information on ETPs encounters, even if it is accidentally attached to fishing gear and/or death, but the amount is less than the data on ETPs found. It makes believe that those ETPs is still some density. Therefore, recording data from fishermen is very important for reporting the abundance and distribution of ETPs.

Comments from trawl fishermen

1. Finding ETPs

- ETPs that are often encountered – Dolphins, risk of getting caught in nets – Low, Death rate from fishing – Low
- ETPs that are rarely found - Sea turtles.

Noted sea turtles: The risk of getting caught in nets - very low. There is no procedure to prevent getting caught. Survival rates are moderate if caught in nets. Turtles and whale sharks are also

sometimes found when fishing. However, fishermen try to avoid fishing in areas where ETP species are found.

2. Reporting sightings of ETPs:

Most fishermen know about ETPs and be aware of basic legal protection and had experience of seeing ETPs while going fishing over a period of 10 years, but did not report the sighting of ETPs in the fishing Logbook. This is because there is still not enough understanding of the benefits of data reporting and worried about asking for additional information from the officers as there may be a misunderstanding that a fisherman is the one causing injury or death to ETPs and may be punished. This also Includes report of ETPs stranded. Fishermen see that it was not clear how they should proceed or how they needed to provide evidence in their logbook. In order to be clear and not to create obligations or receive legal penalties. After receiving clarification from the responsible agencies, both the Department of Marine and Coastal Resources and the Department of Fisheries, fishermen consider that such information is important and necessary in order to create a database of ETPs in Thailand and also saw that organizing activities/workshop like this time is an important part that should be in place for creating mutual understanding between officials and those involved at all levels and creating confidence in reporting information for ETPs to fishermen more clearly.

3. Guidelines to prevent impacts on ETPs during fishing.

From the presenting session previously on ETPs by Department of Marine and Coastal Resources and Department of Fisheries, this makes fishermen interested in the conservation of ETPs for what are the long-term positive or negative effects which relates to the relationships of living systems. The TSFR project consultant provided a case study example of Cod fisheries in foreign countries that the government has established measures to reduce cod fishing but found that the resource status has not recovered as expected. This results from a ban on the capture of another aquatic animal that is a predator the cod fish. The example case shows that the increase or decrease in the quantity of

aquatic animals depends on the ecological chain. A representative from Department of Marine and Coastal Resources added information that some ETPs are important predators in the ecological food chain. Therefore, their numbers are small but necessary to maintain natural ecological balance. The reason why there are so few rare marine animals is because they have a low reproduction rate, that is, they can reproduce and give birth only once a year, 1-2 animal at a time. Therefore, it is necessary to create understanding among those who use marine resources in order to be aware. The importance of conserving ETPs for the sake of proper natural balance.

The member from Thai Fishmeal Producer Association added that he had previously proposed a method to prevent dolphins from getting caught in the nets. From experience, the behavior of dolphins often approaches group of fish, and this might cost the caught in the net. Therefore, it is proposed that the Department of Fisheries allow fishing vessels to use red netting to cover their nets to prevent dolphins from coming closer. This will reduce the chance of getting caught in the nets. However, it was found that this method is still not possible due to the interpretation of the Fisheries Act that the use of such nets may violate the law in terms of modifying fishing gear.

President of the Prachuap Khiri Khan Fisheries Association and advisor of the Department of Marine and Coastal Resources added that most fishermen concern about the impact of being prosecuted. This is because fishermen see that fishing laws have high penalties so that the penalties should be adjusted to suit each case of action. The fishermen would like the Department of Fisheries to coordinate with the Port In Port Out center in order to provide an understanding to the fishermen. In the case of reporting the discovery of ETPs, this does not mean a wrongdoing or has an impact on fishermen. This will help benefit the development of the country's fisheries system for the better mentoring ETPs.







Collect Historical data from fisherman at sea observation by Department of Fisheries

1. Laws, regulations and policies related to Rare marine animals

Rare marine animals in Thai sea consist of three groups of marine animals: sea turtles, dugong, dolphins, and whales (Whales and Dolphins). All of these are classified as reserved wildlife and protected according to the Wildlife Preservation and Protection Act B.E.2562 (2019) regarding prohibition of hunting, trade, possession, and breeding, including occupying eggs and carcasses as well as various parts of those animals. In addition, these rare marine animals are protected according to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). All species of sea turtles, Dugong, and Irrawaddy dolphins are listed on CITES Account No.1 as Critically Endangered (CR). Other dolphins and whales, including whale sharks, are listed on CITES Account No.2.

Thailand has enforced laws in managing fishery resources, which have both direct and indirect effects on fisheries resource management and conservation. The objective is to make sustainable use of aquatic animal resources, including marine mammal resources. Laws and measures regarding the management of marine mammals in Thailand include:

1) Wildlife animal conservation and protection Act, 2019, which lists dugongs, Bryde's whales and Omura's whales as protected wildlife. and listed 21 other types of whales and dolphins as protected wildlife.

2) Royal Ordinance on Fisheries 2015 and Royal Ordinance on Fisheries (No. 2) 2017 (revised edition), which has amended the Fisheries Act 1947 to be in line with international principles of fisheries resource management and the changing fishing situation. As for the conservation of dugongs, whales and dolphins, there has been an announcement from

the Ministry of Agriculture and Cooperatives regarding the designation of aquatic mammals, Rare or endangered aquatic animals that are prohibited from catching or taking on fishing vessels, 2016.

3) Act on the Promotion of Marine and Coastal Resources Management B.E. 2558 (2015), according to Section 3, stipulates that the word “Marine and coastal resources” includes marine animals. Therefore, marine mammals are also protected under the Act whereas Section 17, Section 20, Section 22 and Section 23 of the said law Established for the protection of marine and coastal resources. It gives the authority to determine measures for the conservation, rehabilitation and utilization of resources. This includes the declaration of protected areas, which results in marine mammal habitats being protected to preserve the natural integrity of the area.

4) The National Parks Act 2019 is a law that affects the protection of the habitats of marine mammals living in marine national park and a zone adjacent to the coastline where fishing is prohibited. Currently, there are 24 national parks covering the marine areas of the Gulf of Thailand and the Andaman Sea, and 2 more areas that are being declared as national parks, representing a total marine area of more than 4,000 square kilometers.

5) Enhancement and conservation of National Environmental Quality Act, 1992 is a law that can be used as a tool to prevent or restrain the implementation of projects or activities that may have an impact on the environment. This affects the protection of marine mammal habitats in the area of environmental protection measures in a specified place and period of time.

2. Department of Fisheries data recording system on rare marine animal sightings

The Department of Fisheries has made a mandatory for all sightings of rare marine animals to be recorded in the fishing logbook while fishermen are out fishing. There are 4 species of rare marine animals that are listed in the fishing logbook: turtles, dolphins, whales, and whale sharks, as shown (Figure 1). If they see rare marine animals in the area where they will be fishing or while fishing to refrain from fishing in those areas and must move the fishing area to an area that does not have rare marine animals in that area.

The image shows a Thai fishing logbook form. At the top, there are fields for vessel name, date, and location. Below this is a table with multiple columns for recording data. A magnifying glass is positioned over a cell in the table, highlighting a specific entry. To the right of the main table is a legend box with Thai text and symbols.

Figure 1: Example of a fishing logbook with the area to full in rare marine animals (on the right).

The Department of fisheries will record sightings of rare marine animals that were reported in the Fishing Logbook (Figure 2) into the Department of Fisheries' electronic reporting system (Thai Flagged Catch Certification System: TFCC). This will be done by the Department of Fisheries officials will inspect and import such information into the system. When the information has been recorded successfully, the system will display information on sightings of rare and endangered marine animals, as shown in Figure 3.

LR	TM
1	0048/วท
1	0048/วท
1	0048/วท

Figure 2: Fishing logbook showing rare and endangered marine species sightings.

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Figure 3: Data on sightings of rare marine animals in the TFCC system.