



**Establishment and Operation of a Regional System of
Fisheries *Refugia* in the South China Sea and Gulf of Thailand**

REPORT

THE SIXTH MEETING OF THAILAND NATIONAL FISHERIES REFUGIA COMMITTEE

BANGKOK, THAILAND

28 OCTOBER 2019

Prepared by
**DEPARTMENT OF FISHERIES
THAILAND**

**SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
TRAINING DEPARTMENT**



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REPORT OF THE MEETING

1. The sixth meeting of Thailand national fisheries *refugia* committee for the project entitled “Establishment and Operation of a Regional System of Fisheries *Refugia* in the South China Sea and Gulf of Thailand” was conducted by the Department of Fisheries on 28th October 2019, 09.00 – 12.00 hours, at Department of Fisheries, Bangkok. Dr. Vicharn Ingsrisawang, Deputy Director-General of the Department of Fisheries, acted for the Director-General as the chairman in his absence. Meeting agenda and list of participants are shown in annex 1 and 2, respectively. The meeting minutes are as follows:

AGENDA 1 REPORT OF THE CHAIRMAN

2. **Dr. Vicharn Ingsrisawang**, Deputy Director-General of the Department of Fisheries as the acting chairman, welcomed all the committee and noted that fisheries *refugia* project had been gradually progressing. He expressed his expectation for the integration of fisheries *refugia* management among Thailand and neighboring countries, especially for transboundary species such as Indo-Pacific mackerel. He then introduced the agenda to the meeting.

AGENDA 2 APPROVAL OF REPORT OF THE PREVIOUS MEETING

3. **Ms. Prulai Nootmorn**, Senior Expert in Marine Fisheries, Department of Fisheries, as the committee and secretary, informed the meeting that report of the previous meeting, i.e., the fifth meeting of Thailand national fisheries *refugia* committee on 20th June 2019, had been handed out to each committee for consideration in advance, resulted in some amendments in page 5, 6, 7, 8, and 9. Ms. Prulai then requested the meeting to consider, amend, and approve the revised report which was provided. **Meeting Resolution:** The meeting approved report of the fifth meeting of Thailand national fisheries *refugia* committee on 20th June 2019.

AGENDA 3 MATTERS OF REPORT

3.1 Progress of Project Implementation and Work Plan for Quarter 4 (October-December) of 2019

a) Progress of Project Implementation

5. **Ms. Prulai Nootmorn** reported to the meeting the progress of project implementation by activities and their results, from July 2017 to September 2019, concluded as follows:
 - 1) Four meetings of stakeholder initiation in Chang Strait of Trat Province and Samui Island of Surat Thani Province
 - 2) Results: obtaining initial baseline data of small-scale fisheries, fisher communities, stakeholders, and economical important marine species in the areas. Site-based management boards in Chang Strait and Samui Island were established;
 - 3) Stakeholder consultation workshop in Trat Province
 - 4) Results: fisheries *refugia* project was introduced; programs/projects/activities related to marine resource sustainable development in Trat Province were provided; influences and interests of each stakeholder were analyzed; and priority species in Trat Province were proposed;
 - 5) Stakeholder consultation workshop in Samui Island, Surat Thani Province
 - 6) Results: fisheries *refugia* project was introduced; programs/projects/activities related to marine resource sustainable development in Samui Island were provided; influences and interests of each stakeholder were analyzed; and priority species in Surat Thani Province were proposed;
 - 7) Five meetings of national fisheries *refugia* committee

- 8) Results: progresses of the project implementation were reviewed; executions of project activities were guided and suggested; and quarterly reports were reviewed and approved;
 - 9) Two meetings of national scientific and technical committee
 - 10) Results: progresses of the project implementation were reviewed; technical guidance and recommendations for identification of priority species and fisheries *refugia* sites were provided;
 - 11) Meeting of site-based fisheries *refugia* management board in Trat Province
 - 12) Results: Indo-Pacific mackerel was approved to be priority species for fisheries *refugia* in Trat Province. Guidance was done for the preparation of more technical information and illustrations for issuing the proper site and management measures.
 - 13) Meeting of site-based fisheries *refugia* management board in Surat Thani Province
 - 14) Results: blue swimming crab was approved to be priority species for fisheries *refugia* in Surat Thani Province. Coastal area of Koh Sed in Ban Don Bay was recommended to be fisheries *refugia* site, of which the technical information on fisheries and environments were needed.
 - 15) Six consultation meetings for project implementation
 - 16) Results: Opinions on project implementation were shared; technical information suitable for project implementation was prepared, shared, and reviewed by relevant officers; methods for baseline data collection were discussed and agreed; proper preparation for financial audit was done; and all of the committee's membership and TORs were revised.
 - 17) Revision of the committees
 - 18) Results: all the 4 notifications on appointment of the committees/boards were revised for appropriate and efficient implementation of the project in consistency with its aim and objectives. The revised notifications are as follows:
 - (1) Notification of the Department of Fisheries No. 1130/1/2561 Re: Appointment of Thailand's National Fisheries *Refugia* Committee dated 27th November B.E. 2561 (2018);
 - (2) Notification of the Department of Fisheries No. 1130/2561 Re: Appointment of Thailand's National Scientific and Technical Committee dated 27th November B.E. 2561 (2018);
 - (3) Notification of Trat Province No. 472/2562 Re: Appointment of Site-Based Fisheries *Refugia* Management Board in Trat Province dated 12th March B.E. 2562 (2019); and
 - (4) Notification of Surat Thani Province No. 2079/2562 Re: Appointment of Site-Based Fisheries *Refugia* Management Board in Surat Thani Province dated 20th March B.E. 2562 (2019).
 - (5) Provision of technical data/information supported for well-defined boundaries of fisheries *refugia* sites in Trat and Surat Thani Province
 - 19) Results: Technical information were being under preparation by Eastern Gulf Fisheries Research and Development Center (Rayong), and Central Gulf Fisheries Research and Development Center (Chumphon).
6. **Ms. Prulai** concluded the overall results from project implementations up to date that priority species and study areas for fisheries *refugia* in Trat and Surat Thani Provinces were confirmed and approved as follows:

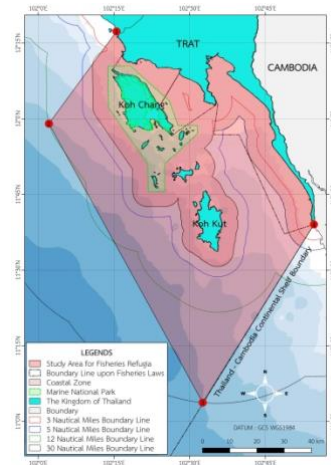
1) Trat Province:

- Priority species: Indo-Pacific mackerel (*Rastrelliger brachysoma*)

- Study area: main fishing area off Trat Province including Koh Chang and Koh Kut;



Indo-Pacific mackerel (*Rastrelliger brachysoma*)

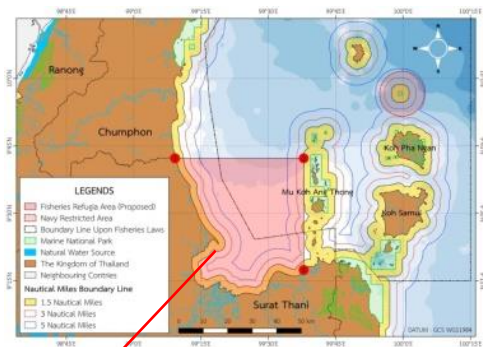


2) Surat Thani Province:

- Priority species: blue swimming crab (*Portunus pelagicus*)
- Study area: main fishing area off Surat Thani Province close to Mu Koh Ang Thong National Marine Park, emphasizing the area around Koh Sed in Ban Don Bay.



Blue swimming crab (*Portunus pelagicus*)



7. **Ms. Praulai** then reported on financing that the overall budget allocation for Thailand was 248,000 US\$, while total expenditure was 60,765 US\$, resulted in the closing balance ending 30th September 2019 at 187,235 US\$.
8. **Mr. Weerasak Yingyuad**, Representative from Project Coordinating Unit, added the information that overall budget was allocated for the duration of 4 years, 2017-2020. However, the project

implementation had been delayed resulted in project extension with no cost. He also noted that budget for consultant was provided in the budget line allocation.

9. **Meeting Resolution:** the meeting acknowledged.

b) **Work Plan for Quarter 4 (October-December) of 2019**

10. **Ms. Prulai** informed the meeting that there were 3 activities planned for Quarter 4 as follows:

- 1) outsourcing for baseline data collection for fisheries, environments, and socio-economics of the fishing communities in Trat and Surat Thani Provinces by Sustainable Development Foundation and Walailak University;
- 2) organizing workshop on “Socio-Economic Study and Value Chain Analysis of Fisheries”, aiming for strengthening knowledge management and sharing information for analysis of the linkage chains among fishers and fishery stakeholders, consequently usable for project evaluation; and
- 3) organizing the meetings of scientific and technical committee, and site-based fisheries *refugia* management boards.

11. **Meeting Resolution:** the meeting acknowledged.

3.2 **Results of the Regional Meeting on Indicators for the Refugia Management and Discussion on Project Follow up, 9th - 11th September 2019**

12. **Mr. Kumpon Loychuen**, Director of the Eastern Gulf Fisheries Research and Development Center (Rayong), Department of Fisheries, reported to the meeting that Ms. Prulai Nootmorn, as national focal point for Thailand, and he himself, as scientific and technical focal point for Thailand, had attended “the Regional Meeting on Indicators for the *Refugia* Management and Discussion on Project Follow up” held by SEAFDEC/UNEP/GEF Project at Pattaya City, Chonburi Province on 9th - 11th September 2019. The meeting aimed to discuss on the regional standardized information and data collection procedures including design and stress reduction and environmental state indicators for managed *refugia*, and to discuss on project outputs.

13. **Mr. Kumpon** concluded that referring to the discussion of the meeting, indicators should reflect on healthy and sustainability in 5 dimensions including 1) ecosystem, 2) economic, 3) social, 4) governance, and 5) climate change issues, which aimed at 3 objectives: 1) to maintain the fish stock and critical habitat, 2) to satisfying fishing community, social needs now and futures, and 3) to put in place on effective management system. He then concluded that under 17 issues or sub-dimensions, there were 44 criteria and 89 indicators needed to consider for effective management of fisheries *refugia* as shown in annex 3.

14. **Mr. Weerasak Yingyuad** added that these indicators were aimed to be guideline for member countries for the consistency of data collections and management evaluations. Each country could choose some indicators for consideration. The table of those indicators would be prepared in the form of regional guidebook and raised for consideration in 2nd Project Steering Committee Meeting next month.

15. **Dr. Vicharn Ingsrisawang** expressed his concern about the large number of indicators provided. He recommended that main indicators and alternative indicators should be determined and taken into consideration once again.

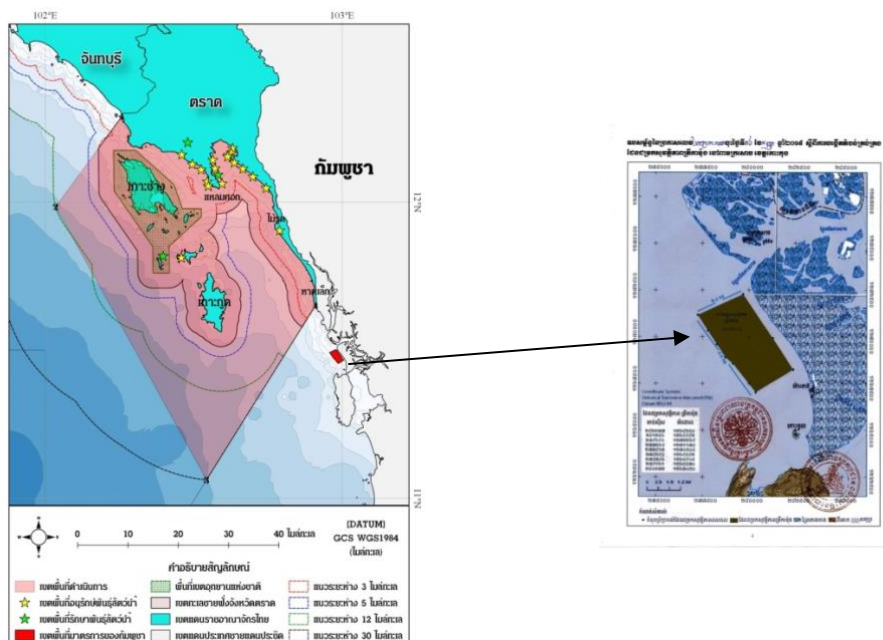
16. **Meeting Resolution:** the meeting acknowledged that there was a recommendation for determination of main indicators and alternative indicators as for the more possible achievement of the fisheries *refugia* project.

3.3 Results of the Technical Consultative Meeting on Drafting of the Regional Action Plan for Management of Transboundary Species, Indo-Pacific Mackerel, in the Gulf of Thailand Sub-region, 12th – 13th September 2019

17. **Mr. Kumpon Loychuen** reported to the meeting that Ms. Prulai Nootmorn and he himself also attended the meeting entitled “Results of the Technical Consultative Meeting on Drafting of the Regional Action Plan for Management of Transboundary Species, Indo-Pacific Mackerel, in the Gulf of Thailand Sub-region” co-organized by SEAFDEC/UNEP/GEF Project and SEAFDEC-Sweden Project, at Pattaya City, Chonburi Province on 12th - 13th September 2019, back to back with the meeting in 3.2. The Meeting was meant to update on the progress of the implementation for Indo-Pacific mackerel studies in the Gulf of Thailand (GoT) sub-region and draft the Regional Action Plan (RAP) for management of Indo-Pacific mackerel and its habitats in the GoT sub-region.
18. **Mr. Kumpon** mentioned about contents of the meeting that the findings of DNA study on Indo-Pacific mackerel around GoT Sub-region: Cambodia, Malaysia, Thailand and Vietnam, were presented showing that Indo-Pacific mackerel is a transboundary species having mixed-stock in the sub-region. It was therefore encouraged for countries to develop a joint management plan comprising MCS network coordination and national management measures for this transboundary species. **Mr. Kumpon** also noted that there was a presentation on the observation of water column condition, seasonal variation, thermocline in GoT which was focused on water circulation relating to seasonal distribution, life cycle, and population measurement of Indo-Pacific mackerel in the sub-region.
19. In reference to the meeting, **Mr. Kumpon** concluded that RAP comprised 5 dimensions: 1) Governance, 2) Social, 3) Economic, 4) Ecosystem, and 5) Climate Change, each of which contained overall objective, specific objectives, knowledge gaps/issues, actions, responsible institutions. Draft RAP appears as annex 4.
20. **Dr. Vicharn Ingsrisawang** expressed his opinion that both indicators and RAP were drafted based on the same dimensions, thus there should be consistency of their components under each of the dimensions. He recommended that components in RAP should be corresponding to those in the indicators.
21. **Mr. Weerasak Yingyuad** responded that he would bring this issue back to the concerned body to be considered.
22. **Meeting Resolution:** the meeting acknowledged that indicators and RAP should be consistent with each other.

3.4 Notification of Fisheries Refugia for Indo-Pacific Mackerel in Koh Kong, Cambodia

23. **Ms. Prulai Nootmorn** informed the meeting that the Ministry of Agriculture, Forestry, and Fisheries of Cambodia had already issued the Proclamation on Creation and Management of Mackerel Fisheries *refugia* in Koh Kong, dated on 16th September 2019, covering the area of 18.63 km² (1,863 ha) at 2-7 m depth. Based on the proclamation, all kinds of fishing and other activities in mackerel fisheries *refugia* in Koh Kong were banned from 1st December to 31st March each year, as it is considered as the spawning season of mackerel in this site; some research activities permitted properly are excepted.



24. **Meeting Resolution:** The meeting acknowledged.

AGENDA 4 MATTERS FOR CONSIDERATION

4.1 Technical Mappings as the fundamentals for Establishment of Fisheries Refugia for Indo-Pacific Mackerel in Trat Province

25. Referring to the first meeting of site-based fisheries *refugia* management board in Trat Province on 4th April 2019, it was requested for the illustrations of coastal ecosystems, coastal sanctuary/conservation areas, commercial and small-scale fishing areas, and distributions of Indo-Pacific mackerel in Trat Province for consideration on the appropriate fisheries *refugia* management of Indo-Pacific mackerel in the area. In this regard, **Mr. Kumpon Loychuen** had prepared those requirements illustrated by mappings as shown in annex 5.

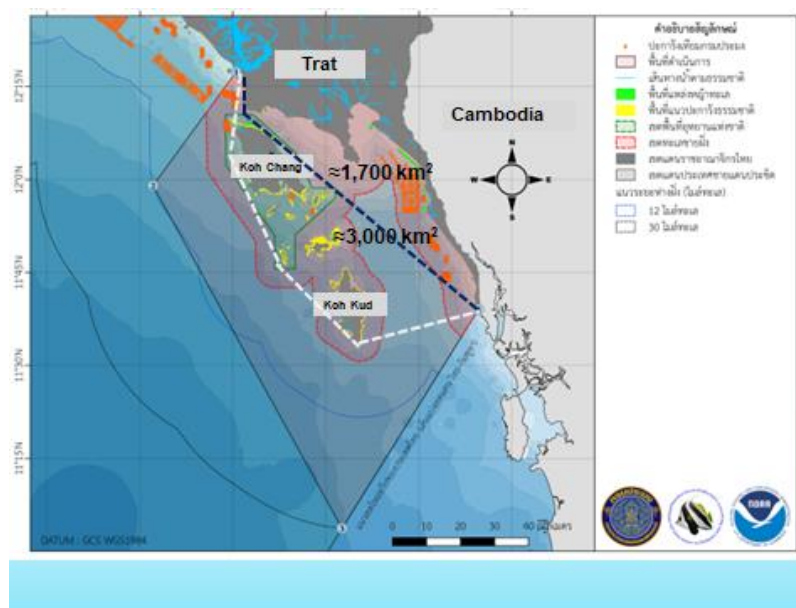
26. **Mr. Kumpon** concluded the fisheries and ecosystem information in Trat Province as follows:

- there were 798 registered fishing boats, > 10 GT, comprising 552 high efficient boats and 246 low efficient boats; while 2,064 non-registered fishing boats, < 10 GT, were recorded;
- fishing gears having high effect on Indo-Pacific mackerel were purse seines, falling nets with light aggregating devices (high composition of juvenile mackerel in their catch), and fish gill nets;
- high fishing season of purse seiners in Trat Province was the period of January-April, while that of falling nets with aggregating devices was January-June;
- fish gill netters fished all year in the areas of Chang Strait, Bann Had Lek and Klong Yai District;
- from study results in 2017-2018, Indo-Pacific mackerel had their peak spawning season during January-April in the area of Chang Strait and Trat Bay; and
- area for baseline study was approximately 6,400 km² covering the main fishing ground and spawning ground of Indo-Pacific mackerel, in which there were 162 km² of mangroves, 10 km² of seagrass beds, 28 km² of coral reefs, and 118 km² of the total of 44 units of artificial reefs.

27. **Mr. Kumpon** subsequently highlighted that there were 5 existing measures for coastal fisheries management in Trat Province as follows:

- notified coastal seas (5 nm from shoreline);

- notification on 3 aquatic species sanctuaries;
 - notification on determining fishing gears, fishing methods, and fishing areas prohibited from fishing in 15 fishing grounds covering the area of 5,800 rai (9.28 km²);
 - notification on determining fishing gears, fishing methods, and fishing areas prohibited from fishing in 15 fishing grounds (no.2): determining mesh sizes, lengths, and depths of the nets; and
 - determination of fishing gears, fishing methods, and fishing areas prohibited from fishing in coastal seas.
28. **Mr. Kumpon** eventually presented to the meeting the tentative sites and management measures for Indo-Pacific mackerel in Trat Province. He showed 2 options of fisheries *refugia* sites: 1) an area of approximately 1,700 km² having straight boundary line off the coast of Trat Province excluding Koh Chang and Koh Kut, shown by black dash-line in the picture bellow; and 2) an area of approximately 3,000 km² with its boundary stretching over Koh Chang and Koh Kut as shown by white dash-line. For management scheme, **Mr. Kumpon** proposed a prohibition of trawlers, purse seiners, anchovy falling netters, gill netters and entangling netters, of which mesh size less than 2 inches, fishing in fisheries *refugia* site during February-March each year. The meeting was then invited to consider, discuss, and comment on his presentation.



29. **Dr. Vicharn Ingsrisawang** recommended adding the protected area of marine national park to be one of the existing measures for coastal fisheries management in Trat Province
30. Mr. Prathet Sorrak, Inspector-General for the Department of Fisheries, expressed his remark that except only fish gill netters, the trawlers, purse seiners, and falling netters would not much be affected by the proposed measures as they had been already prohibited from fishing in coastal seas which was the majority in the proposed fisheries *refugia* sites.
31. **Asst. Prof. Methee Kaewnern**, Vice-Dean of the Faculty of Fisheries, Kasetsart University, and **Mr. Prathet Sorrak** recommended providing layered mappings which combined the proposed fisheries *refugia* sites with corresponding data as for obtaining obvious illustrations of the benefits and impacts of fisheries *refugia* on resources and fisheries. They also noted that socio-

economic data of all fishers fishing in the area should be taken into consideration for comprehensively related information.

32. **Mr. Weerasak Yingyuad** noted that socio-economics were being studied by outsourcing; he recommended rushing for the results.
33. **Dr. Vicharn Ingsrisawang** recommended taking the declared fisheries *refugia* in Koh Kong into consideration in order to provide the integration of Indo-Pacific mackerel management between Thailand and Cambodia.
34. **Mr. Kowit Kao-ian**, Director of Surat Thani Provincial Fisheries Office, recommended studying for all the life cycle of blue swimming crab in Ban Don Bay to obtain comprehensive information. **Dr. Vicharn** then concluded that resource mappings for blue swimming crab fisheries *refugia* in Surat Thani Province was to be done prior to decision making for its site and measures.
35. **Dr. Vicharn** noted that regarding fisheries *refugia* management process, the project budget could be allocated to the Fisheries Provincial Office for conducting public hearing prior to consideration by the Provincial Fisheries Committee.
36. **LCdr. Sansern Serirak**, Director of Trat Provincial Fisheries Office, explained the process for issuing the fishery management measures that public hearing from all stakeholders in all related sub-districts had to be conducted, then the results were presented to district committee before submitted to the Provincial Governor, and finally raised for consideration at the Provincial Fisheries Committee meeting.
37. **Meeting Resolution:** the committee approved the technical resource mappings in Trat Province and agreed to take socio-economic data into comprehensive consideration for Indo-Pacific fisheries *refugia* management in the area.

AGENDA 5 ANY OTHER BUSINESS

38. **Dr. Vicharn Ingsrisawang** raised a discussion about the Q4-2019 plan for organizing workshop on “Socio-Economic Study and Value Chain Analysis of Fisheries”. It was agreed that the workshop would be beneficial for strengthening the knowledge of socio-economic study and evaluation procedures for relevant officers, however it was recommended consideration mainly for its consistency with the main and alternative indicators previously mentioned.
39. **Dr. Vicharn** recommended the activities for propagation of fisheries *refugia* project which would be beneficial for the awareness and recognition of communities towards fisheries *refugia* in the areas. He urged the Provincial Fisheries Office to develop propagation plan and proposed for implementation budget.
40. **Mr. Weerasak Yingyuad** gave the information that project budget for component 3, information management and dissemination, had been allocated; it could be used for the propagation activities mentioned.
41. **Meeting Resolution:** the meeting acknowledged.

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ANNEX 1

AGENDA

AGENDA 1 REPORT OF THE CHAIRMAN

AGENDA 2 APPROVAL OF REPORT OF THE PREVIOUS MEETING

AGENDA 3 MATTERS OF REPORT

- 3.1 Progress of Project Implementation and Work Plan for Quarter 4 (October-December) of 2019
- 3.2 Results of the Regional Meeting on Indicators for the *Refugia* Management and Discussion on Project Follow up, 9th - 11th September 2019
- 3.3 Results of the Technical Consultative Meeting on Drafting of the Regional Action Plan for Management of Transboundary Species, Indo-Pacific Mackerel, in the Gulf of Thailand Sub-region, 12th – 13th September 2019
- 3.4 Notification of Fisheries *Refugia* for Short Mackerel in Koh Kong, Cambodia

AGENDA 4 MATTERS FOR CONSIDERATION

- 4.1 Technical Mappings as the fundamentals for Establishment of Fisheries *Refugia* for Indo-Pacific Mackerel in Trat Province

AGENDA 5 ANY OTHER BUSINESS

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ANNEX 2**LIST OF PARTICIPANTS****Thailand National Fisheries Refugia Committee**

1.	Mr. Vicharn Ingsrisawang, Ph.D.	Deputy Director-General, Department of Fisheries	Acting Chairman
2.	Asst. Prof. Methee Kaewnern, Ph.D. (Mr.)	Vice-Dean, Faculty of Fisheries, Kasetsart University (represented Dean)	Committee
3.	Mr. Prathet Sorrak	Inspector-General, Department of Fisheries (represented Inspector-General-Head)	Committee
4.	Cdr. Pornchai Singhaboon (Mr.)	Senior Expert in Fishing Gears, Marine Fisheries Research and Development Division, Department of Fisheries (represented Division Director)	Committee
5.	Ms. Pantiya Jai-on	Fisheries Technical Officer, Coastal Aquaculture Research and Development Division, Department of Fisheries (represented Division Director)	
6.	Mr. Supawat Kan-atireklap, Ph.D.	Special Expert in the Research of Resources and Environment in Marine and Coastal Ecosystem, Department of Marine and Coastal Resources	Committee
7.	LCdr. Sansern Serirak	Director, Trat Provincial Fisheries Office, Department of Fisheries	Committee
8.	Mr. Kowit Kao-ian	Director, Surat Thani Provincial Fisheries Office, Department of Fisheries	Committee
9.	Mr. Weerasak Yingyuad	Representative from Project Coordinating Unit	Committee
10.	Ms. Praulai Nootmorn	Senior Expert in Marine Fisheries, Department of Fisheries	Committee and Secretary
11.	Mr. Kumpon Loychuen	Director, Eastern Gulf Fisheries Research and Development Center (Rayong), Department of Fisheries	Committee and Assistant Secretary

Observers

1.	Ms. Nathicha Wichaidit	Dissemination Technical Officer, Office of the Secretary, Department of Fisheries
2.	Ms. Pannalak Srithong	Fisheries Refugia Project Staff, Department of Fisheries
3.	Ms. Jutima Jangjaiboon	Fisheries Refugia Project Staff, Department of Fisheries
4.	Ms. Chanokporn Muenchamnan	Fisheries Refugia Project Staff, Department of Fisheries

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ANNEX 3

INDICATORS FOR THE REFUGIA MANAGEMENT

Dimensions	Sub-dimensions	Criteria	Indicators
1) Ecosystem	Fisheries Resources	Abundance stock / Distribution / Fishing Effort	Biomass Estimation (ton)
			Level of MSY (ton)
			Level of MEY (ton)
			Level of CPUE (Kg/...)
			CPUA (Kg/Area)
			Catch landing (ton or Kg)
		Biological Parameter	Length at first capture (Lc)
			Length at first mature (Lm)
			Sex ratio
			Spawning Potential Ratio
			Length frequency
			Exploitation rate
			GSI (Gonadosomatic Index)
	Species composition / Catch structure	Percentage of dominant species	
		Number of species	
		% Main economic/ commercial species	
		Percentage of Bycatch	
	Habitat (mangrove, coral, seagrass and other critical habitats)	Healthy / condition / Area	Size Coverage (Percent)
			Healthy Index
			Target habitat density (IUCN reference)
Environment (Impact from human ect.)	Pollution	Standard Water Quality (e.g. COD, BOD)	
	Eutrophication	Phytoplankton Abundance	
		Phosphate, Nitrate Concentration (Nutrient loading)	
	Anthropogenic (Human activity)	Coastal reclamation area	
		Level of maritime activity (If appropriated)	

Dimensions	Sub-dimensions	Criteria	Indicators
		Erosion	Level and distribution of sedimentation Loss of area / habitat
2) Social	Livelihoods	Choice of Occupation	Number of option / Occupation / work (Alternative, Permanent work, Subsistence work)
		Fish consumption	Fish consumption per capita per year
		Nutrition	% animal protein (if appropriate)
	Stakeholder Participation (Indigenous People, Gender, etc.)	Participation	Ratio of number of participations (gender and IP)
		Local Organization	Number of organizations,
			Number of Best practices applied
		Networking	Number of networking
			Type / way of direct or indirect communication
	Number of agreement		
	Education (Local knowledge, Local wisdom)	Awareness program (e.g. information center, information education campaign (IEC))	Number of information center or similar
			Number of consultations
			Number of best practices
			Number of awareness program
Capacity building		Number of understanding by stakeholder	
3) Economic	Economic Condition (to community)	Poverty incident	Poverty Index
		Capital accessibility Income	Number of financial accessible
			Income per household
	Fisheries Production, Fishing Efforts	Contribution of target species / Availability	Value of contribution / production
		Effectiveness fishing gear	Level of CPUE

Dimensions	Sub-dimensions	Criteria	Indicators
	Innovative Fisheries Technology	Cost effectiveness	Cost reduction, time, human power
		Environment friendly (Green technology)	Reduce of fuel consumption
			Reduce bycatch
		Investment	Number of investment (for e.g. fishing fleet, processing, ship builder, management tools / software, etc.)
			New domestic product
		4) Governance	Fisheries management policy (Fishing / User Right, Precautionary approaches/Science-based management, and Synergistic Way/Strategy)
Harvest strategy/ Limit of fishing effort	Fishing close, (area and seasonal closure, Zoning)		
	Number of input control (Number, Mesh size, length of fishing gear, Licensing control, Capacity e.g. Gross tonnage, horsepower, etc.)		
	Number of output control (TAC, Quota, Target species)		
Fisheries management plan/ strategy/ framework	Available / not available		
	Management plan of Fisheries <i>refugia</i> in place		
	Habitat rehabilitation, protection and stock enhancement		
Efficiency fishing gear	Length limit (e.g. crab fishery)		
Stakeholder Cooperation/ Coordination (Regional / National levels)	Management mechanism		Management board/ committee, transboundary committee, RPOA for <i>refugia</i> in place
			Linkage to the existing management/ conservation framework (e.g. MPAs)
Enforcement	Coordination mechanism		Inter-agency coordination in place, Number of joint operations

Dimensions	Sub-dimensions	Criteria	Indicators
		Fishery Law enforcement	Level of enforcement
			Frequency of regular patrol
			Number of violation prosecution
	Capacity Building	Best Practice	Adoption of best practice in place
		Maritime policy and regulation/ International policy	Number of training/ workshops
	Funding (Infrastructure, Enforcement, etc.)	Sustainability	Long term commitment of Government on finance
		Source of funding (incentive, soft loan, donation/CSR)	Number of donors
			Type of funds
		incentive	Type of incentive
			Number of activities
		Number of best practices	
5) Climate Change and Disaster	Fish Stock	Impact to Fish Stock	Availability/levels of knowledge abundance, distribution, genetic diversity, recruitment
			Update information impact to fish stock
	Impact to Habitat	Coral bleaching	Area
			Incident/ frequency
			Recovery Rate
		Destruction of mangrove	Area recovery
			Recovery Rate
		Destruction of sea grass	Area recovery
	Recovery Rate		
	Impact to Environment	Sea level rise	Saline intrusion
			Mean sea level annual
			Coastal Erosion (Area)
		Physical/chemical parameters (T, Salinity, PH, DO)	Level of physical and chemical parameters
Precipitation (rainfall) Ocean acidification		Level of Precipitation pH level	

ANNEX 4

**FINAL DRAFT OF
THE REGIONAL ACTION PLAN FOR MANAGEMENT OF TRANSBOUNDARY SPECIES:
INDO-PACIFIC MACKEREL IN THE GULF OF THAILAND SUB-REGION**

A) GOVERNANCE DIMENSION			
Overall Objective: Regional/sub regional fisheries management mechanism are in place building upon from national regulation and management scheme			
Specific Objectives			
A1. Fisheries Management Mechanism developed and approved (including fisheries management plan and arrangement, the effective of regulation)			
A2.... Data management system are enhanced and considered regional/sub-regional standardization data management system in place			
A3. Standard for assessing fishing effort large, medium and small-scale fishery agreed			
A4. Understandings on national law and management schemes within the sub-regional are communicated and applied			
A5. Impact of unregulated and unreported fishing assessed			
A6. Catch documentation system applied as a tool to improve traceability of the short mackerel fishery			
Knowledge Gaps/Issues	Actions	Ref.	Responsibility
Insufficient catch and landing data	Develop the SOP/technical guidance for data collection (including catch data, biological data)	A2	SEAFDEC University Government agency
	To further develop catch documentation	A2	Fishery research institute
	Harmonization/standardized on data collection and develop database system	A2	
Insufficient biological data collection	Conduct capacity building program for data collection to enumerator and scientist, researchers	A3	SEAFDEC University Government agency
	Conduct time series data collection with standardized method	A3	Fishery research institute
Fishing effort (include commercial and small scale)	Link to the catch documentation include commercial and small-scale fishery (as available)	A4	Government and Private sector
	Regular monitor data collection on fishing effort capture production (include commercial and small scale)	A4	
Fisheries Management Mechanism (including fisheries management plan and arrangement, the effective of regulation)	Develop fisheries management plan for short mackerel at national and sub-regional level	A1	SEAFDEC University Government agency Fishery research institute All stakeholder (fishers, others)
	Establish regional cooperation on monitoring, control and surveillance	A1	Existing national MCS partners/network

	Raise awareness of both small-scale fishers and commercial-scale fishers <ul style="list-style-type: none"> ○ Policy and regulations ○ Management measures ○ Sustainable utilization ○ Involvement the participation, considering gender sensitivity 	A1	SEAFDEC University Government agency Fishery research institute All stakeholder
	Promote stakeholder consultation among researchers, managers and stakeholders using EAFM	A1	SEAFDEC University Government agency Fishery research institute All stakeholder International organizations (FAO, NOAA, etc)
	Conduct habitat rehabilitation and stock enhancement programs	A1	SEAFDEC University Government agency Fishery research institute All stakeholder
Understanding national law and regulations	Comparative review of national law and regulations	A5	Government and resource person
	Disseminate knowledge and information on the conservation and management of Indo-pacific mackerel to fisheries communities and students	A5	Government Other stakeholders
Flexibility of regulation to respond to science advise	Encourage periodic evaluation of policy and regulation	A1	Government
Management schemes/arrangements including transboundary aspects.	Develop management schemes/arrangements at sub-regional area including transboundary aspects	A1	SEAFDEC University Government agency Fishery research institute All stakeholders
	Support establishment of regional cooperation/management mechanism (non-legal binding and scientific advisory committee)	A1	
Illegal, Unregulated and Unreported Fishing	Assessing the impact of Illegal, Unregulated and Unreported Fishing	A6	Government and resource person
	Strengthen the Monitoring, Control and Surveillance network against the illegal fishing (none legal binding)	A6	Inter-agencies coordination
Traceability system for fish and fishery product (using electronic logbook, etc)	Develop the catch documentation that suitable for traceability system e.g. electronic logbook, etc	A6	Government and resource person

B) SOCIAL DIMENSION			
Overall Objective: Social responsibility and involvement in fisheries management achieved			
Specific Objectives			
B1. Understanding the social condition of people involving in fishery at local and national level.			
B2. Increase participation and involvement of stakeholder in various level.			
B3. Resolve conflict on land and resource use			
B4. Build awareness and capacity in all level			
Knowledge Gaps/Issues	Actions	Ref.	Responsibility
Social and economic at local and national level	Conduct a baseline survey based on available information on social and economic at local and national level (S)	B1	Government University
Traditional fishing (indigenous knowledge and social responsibility)	Improve and disseminate the best practice to other (indigenous people)	B1	Government
People engagement in fishery activity (include small scale fishery and large scale/commercial fishery, processing)	Conduct stakeholder analysis for understanding the important and influence of stakeholder in various level	B2	Government University
People engagement in policy making (fisherfolk organization, academy, private sector,	Promote Public Private Partnership	B2	Government
	Promote multi stakeholder engagement in policy making	B2	Government and relevant stakeholder
Social structure (community small scale and large scale, gender, migrant labor, and fisher)	Encourage gender equality based on understanding of social structure in community	B2	Government and relevant stakeholder
Conflict on land and resource use	Promote stakeholder consultation	B3	Government and relevant stakeholder
	Promote marine spatial planning and coastal zone management	B3	Government Resource person Relevant stakeholder
Awareness	Distribute brochures or any media (e.g. digital media) to promote fisheries management and regulations Capacity building and experts exchange Fishing gear technology for eco-friendly (Reduce bycatch, cost and expenditures)	B4	SEAFDEC Government Relevant stakeholder

C) ECONOMIC DIMENSION

Overall Objective: Equal distribution of economic benefit, economic return and employment opportunities

Specific Objectives:

- C1. Ensure the national government and private sector commitment for long-term funding and support.
 C2. Understanding the structure and ownership of asset within fishing industry (large, medium and small scale).
 C3. Maximized economic benefit return for management response and reduced unequal distribution.

Knowledge Gaps/Issues	Actions	Ref.	Responsibility
Funding	To ensure the national government commitment for long-term funding and support	C1	Government Private sector Funding agency/donor
	Explore various potential donor	C1	
	Promote capital access through micro finance scheme	C1	
	Promote corporate social responsibility	C1	
Structure and ownership of asset within the fishing industry (large and small scale)	Review structure and ownership of asset within the fishing industry (large, medium and small scale) for management responses	C2	Government Resource person
Benefit and economic return and unequal distribution	Assess benefit and economic return throughout the value chain	C3	Government Resource person
Increase of cost (fuel and other inputs)	To ensure the fuel and other input exist for local fishermen	C3	Government
Fisheries employment revenue	To create the alternative work	C3	Government Private Sector Relevant stakeholder
	Require the contract among people engage in fishing	C3	

D) ECOSYSTEM DIMENSION			
<p>Overall Objective: Maintain healthy ecosystem for the wellbeing of short mackerel resources</p> <p>Specific Objectives</p> <p>D1. Understand current status and improve the knowledge of short mackerel resources for scientific based management</p> <p>D2. Understand various habitats of short mackerel throughout its life cycle</p>			
Knowledge Gaps/Issues	Actions	Ref.	Responsibility
Migratory route	Update, further define and confirm the migratory route at national, sub-regional or regional area	D2	Fisheries Agencies, National Research Institutions, Regional Institutions
	Conduct tagging program, e-DNA, DNA	D1	Fisheries Agencies, Research Institutions
Spawning and nursery grounds (including dispersion and distribution of fish larvae)	Conduct comprehensive larvae survey (e.g ichthyoplankton)	D1	Fisheries Agencies, Research Institutions
	Study on critical habitats	D2	Fisheries Agencies, Research Institutions,
Seasonal changes	Conduct comprehensive larvae survey (e.g ichthyoplankton)	D1	Fisheries Agencies, Research Institutions, SEAFDEC
	Conduct reproductive biology study	D1	Fisheries Agencies, Research Institutions, SEAFDEC
Physical and chemical oceanographic conditions and ocean circulation	Conduct oceanography survey	D2	Fisheries Agencies, Research Institutions, SEAFDEC
	Develop oceanographic modelling	D2	Fisheries Agencies, Research Institutions, IOC/WESTPAC
	Conduct satellite imagery (GIS, remote sensing) analysis	D2	Fisheries Agencies, Research Institutions
Stock structure	Conduct DNA study, otolith, tagging, etc.	D1	Fisheries Agencies, Research Institutions, SEAFDEC
Stock status at national and regional of <i>R. brachysoma</i> (distribution and abundance)	Conduct stock assessment at national, sub-regional or regional level	D1	Fisheries Agencies, Research Institutions, SEAFDEC
	Share data, information and findings from scientific research to relevant stakeholders	D1	Fisheries Agencies, Research Institutions, SEAFDEC

	Standardized data collection for regional stock assessment	D1	Fisheries Agencies, Research Institutions, SEAFDEC
	Develop modeling for stock assessment	D1	Fisheries Agencies, Research Institutions, SEAFDEC, FAO
Species Identification	Provide capacity building on species identification of small size (juvenile) and larval fishes	D1	Fisheries Agencies, Research Institutions, SEAFDEC
Status and Trends	Investigate the trend of short mackerel catch at national, sub-regional levels	D1	Fisheries Agencies, Research Institutions, SEAFDEC
Population dynamics (Growth parameters, mortalities etc.	Conduct survey on fisheries biology	D1	Fisheries Agencies, Research Institutions
Impact of fishing effort on stock structure (Multi-fishing gears to harvest)	Conduct study on impact of fishing effort on stock structure (Multi-fishing gears to harvest) to improve the fishery management	D1	Fisheries Agencies, Research Institutions, SEAFDEC
	Enhance Fishing gear technology for eco-friendly (Reduce bycatch, cost and expenditures)	D2	Fisheries Agencies, Research Institutions, SEAFDEC
Stock assessment and distributions for transboundary species	Enhance the cooperation for information sharing among the bordering countries	D1	Fisheries Agencies, SEAFDEC
Capacity building and experts exchange	Training, workshop, conference and experts exchange	D1,2	Fisheries Agencies, Research Institutions, SEAFDEC, FAO, UNEP-GEF

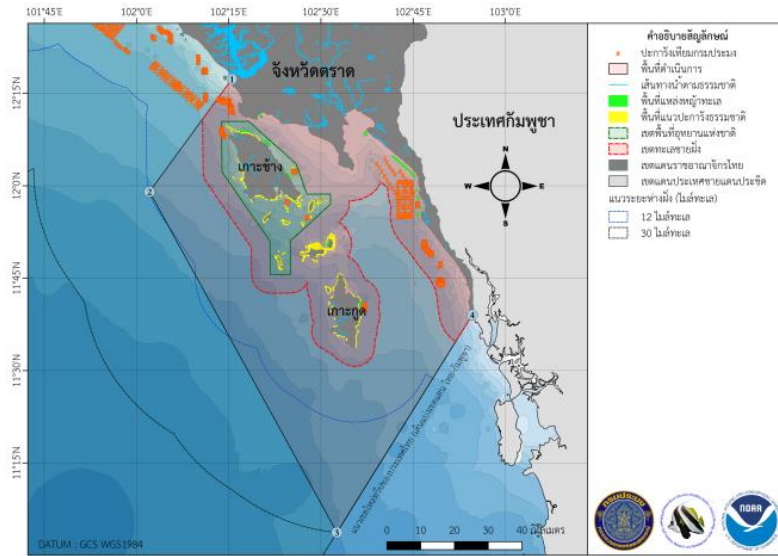
E) CLIMATE CHANGE			
Overall Objective: Adaptive management based on understanding the impact of climate change and disaster			
Specific Objectives: E1. adaptive management measures in place in response to the impact of climate change and disaster to short mackerel fisheries and habitats E2. mitigation and precautionary measures adopted to compensate the effects of climate change			
Knowledge Gaps/Issues	Actions	Ref.	Responsibility
Impact of climate change to fish migration route	Assess the impact of climate change/disaster/anthropogenic activities to fish migration route, habitat and behavior	E1	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
	Study effect of environmental changes on the migratory pattern and spawning patterns based on climate change	E1	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
	Share information from the findings of scientific research to both fisheries managers and fishers	E2	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
Sensitivity of species on critical habitats and environment impact to ecosystem (pollution, climate change, etc)	Conduct study on sensitivity of species on environment change (pollution, climate change, etc) to support the management response	E1	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
	Study on the critical habitats (spawning and grounds)	E1	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
	Study effect of environmental changes on the migratory pattern and spawning patterns	E1	Fisheries and Environmental Agencies, Research Institutions,

			SEAFDEC, UNEP-GEF, UNDP, FAO
	Data sharing (assign focal person to share information)	E1	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO
Capacity building and experts exchange	Training, workshop, conference and experts exchange on CC impacts	E1 E2	Fisheries and Environmental Agencies, Research Institutions, SEAFDEC, UNEP-GEF, UNDP, FAO

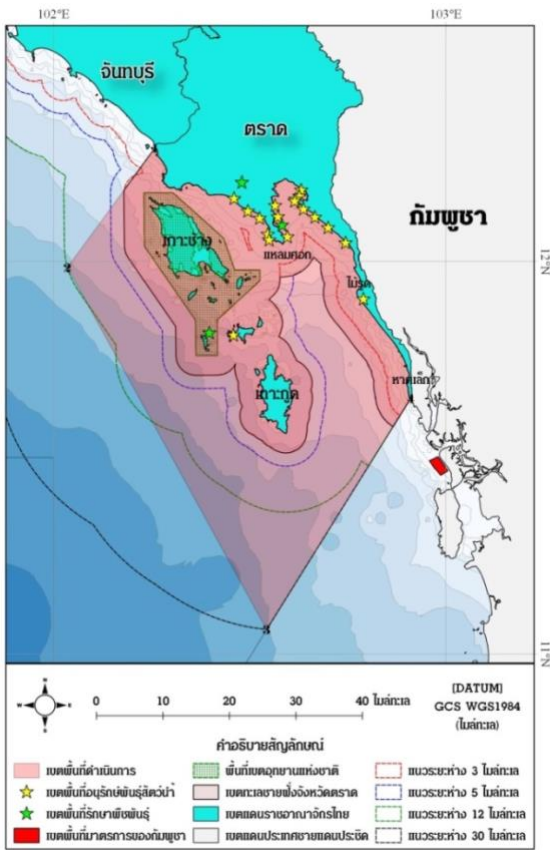
ANNEX 5

TECHNICAL MAPPINGS AS THE FUNDAMENTALS FOR ESTABLISHMENT OF FISHERIES REFUGIA FOR INDO-PACIFIC MACKEREL IN TRAT PROVINCE

Coastal Resources and Artificial Reefs



Notified Aquatic Species Conservation Areas ()



Numbers of Small-Scale and Commercial Fishing Boats in 2019 (2,862 Boats)

จำนวนเรือจากการสำรวจรวม 3 ฝ่าย เรือต่ำกว่า 10 ตันกรอส

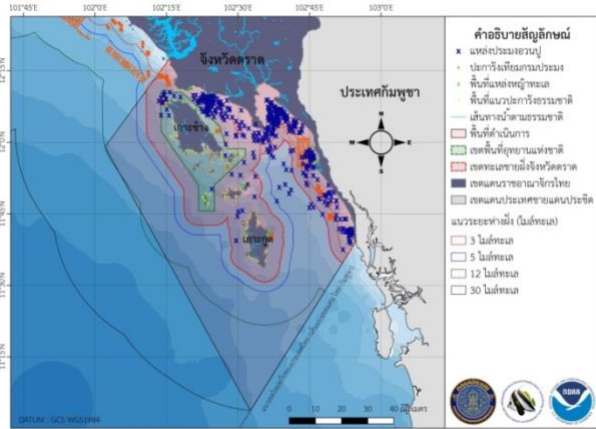
ชนิดเรือ	จำนวน ลำ
ดอนปู่	133
ดอนหมึก	43
อวนครอบปลากะตัก	39
อวนครอบหมึก	3
อวนโหดหมึก	22
อวนติดตา (ปลากะตัก)	10
อวนติดตา (ปลา)	44
อวนติดตา (ปลาอินทรี)	23
อวนติดตา (อวน)	413
อวนติดตา (อวน)	267
อวนรุน	57
อวนลากแผ่นตะเ婆	98
อื่นๆ	912
รวมทั้งหมด	2,862

ข้อมูลใบอนุญาตทำการประมงพาณิชย์ จังหวัดตราด รอบปีการประมง 2561-2562

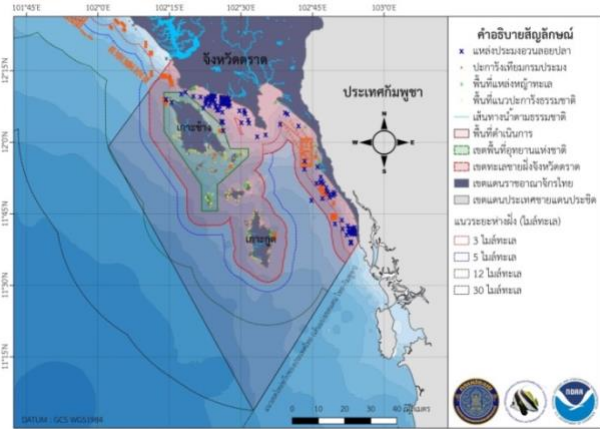
ผลรวมทั้งหมด 798 ลำ

เรือประมง	จำนวนราย	เรือประมง	จำนวนราย
คราดหอยลาย	16	เรือประกอบเครื่องกำเนิดไฟฟ้า	102
คราดหอยอื่น	4	อวนครอบปลากะตัก	208
เบ็ดราว	16	อวนล้อมจับ	31
ดอนปลา	2	อวนล้อมจับปลากะตัก	17
ดอนปู่	72	อวนลากคานอ้าง	55
ดอนหมึก	2	อวนลากคู่	4
ดอนหมึกสาย	9	อวนลากแผ่นตะเ婆	135
อวนครอบหมึก	88	เครื่องมือประมงอิเล็กทรอนิกส์	562
อวนติดตา	38		
เครื่องมือประมงอิเล็กทรอนิกส์	248		

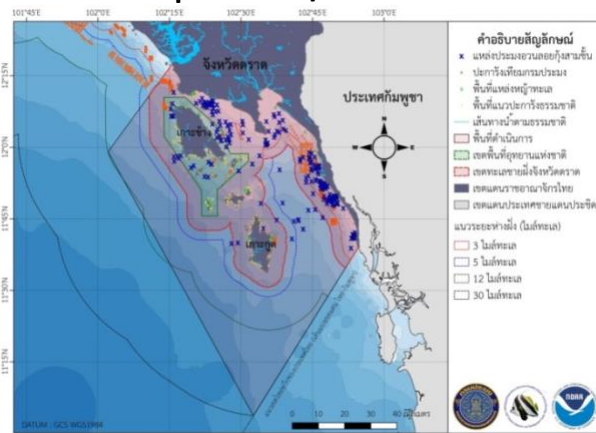
Small-Scale Fishing Area of Crab Gill Nets



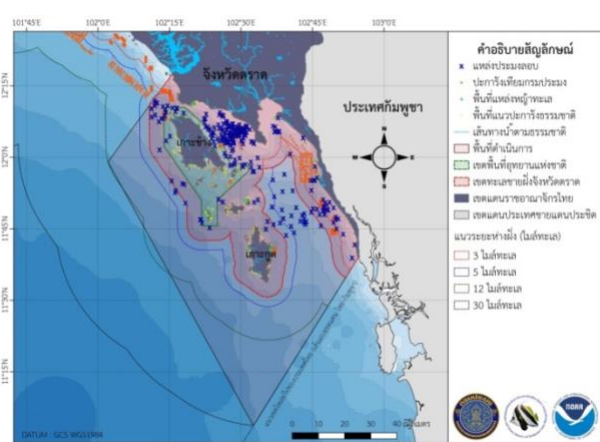
Small-Scale Fishing Area of Fish Gill Nets



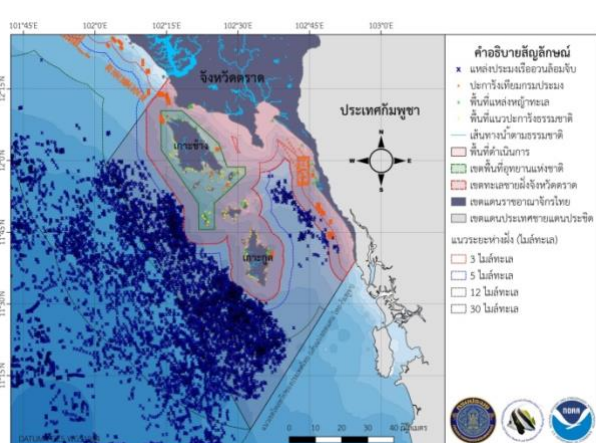
Small-Scale Fishing Area of Shrimp Gill Nets/Tremmel Nets



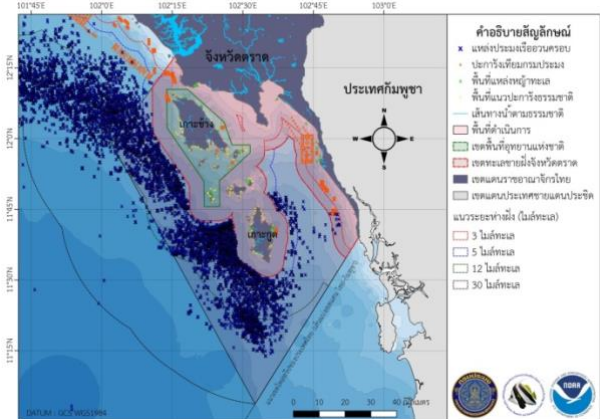
Small-Scale Fishing Area of Traps



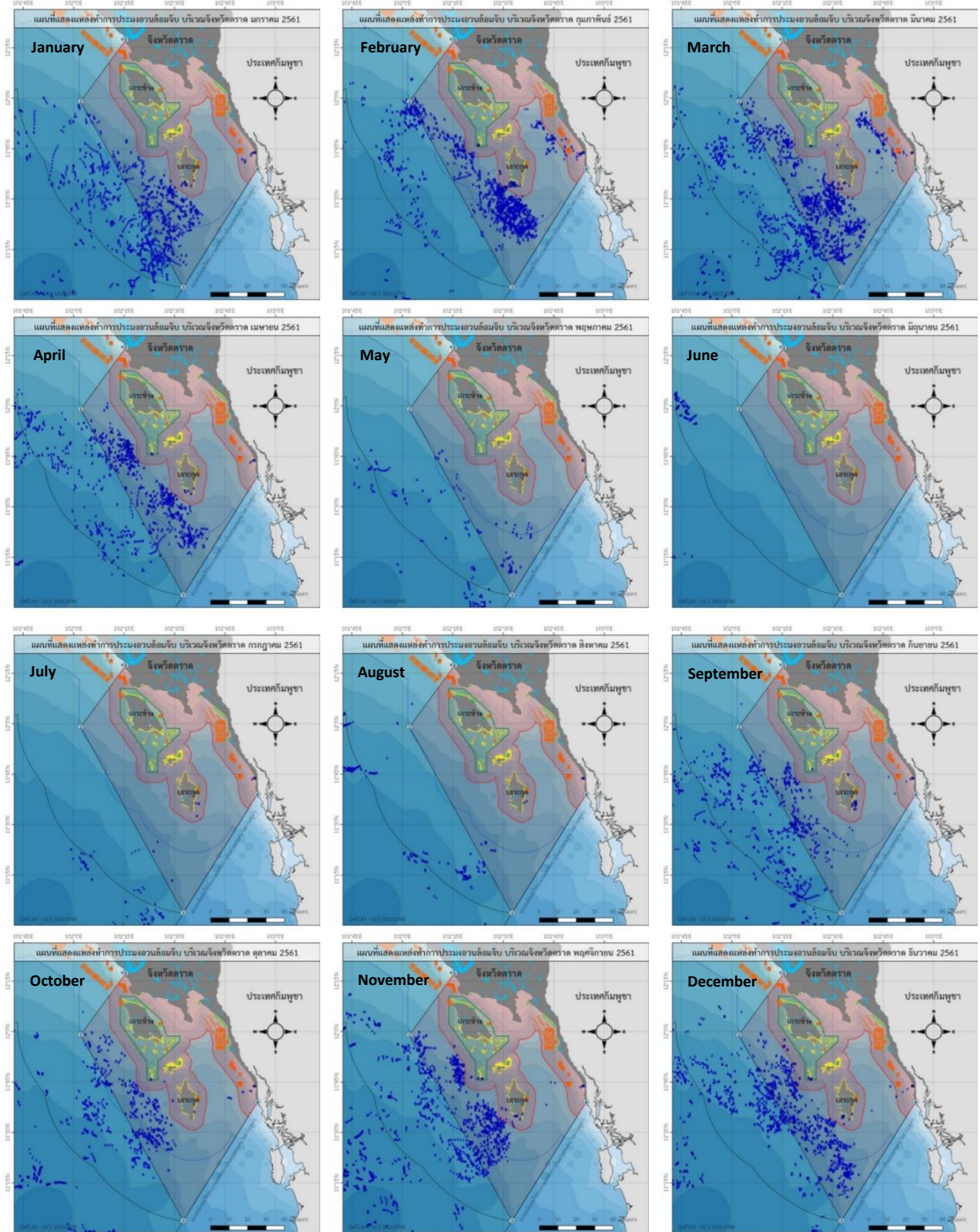
Commercial Fishing Area (Purse Seines)



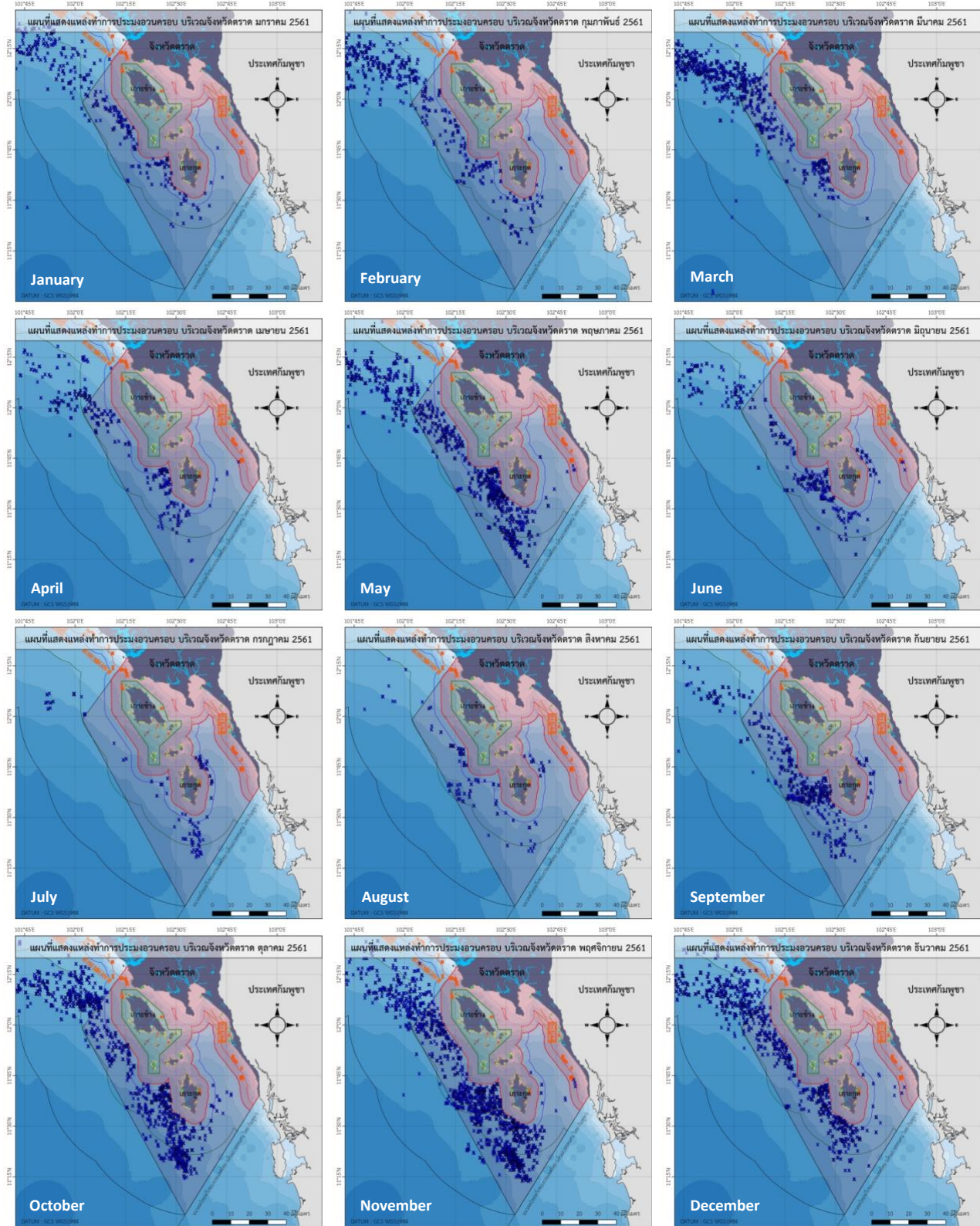
Commercial Fishing Area (Falling Nets with aggregating devices)



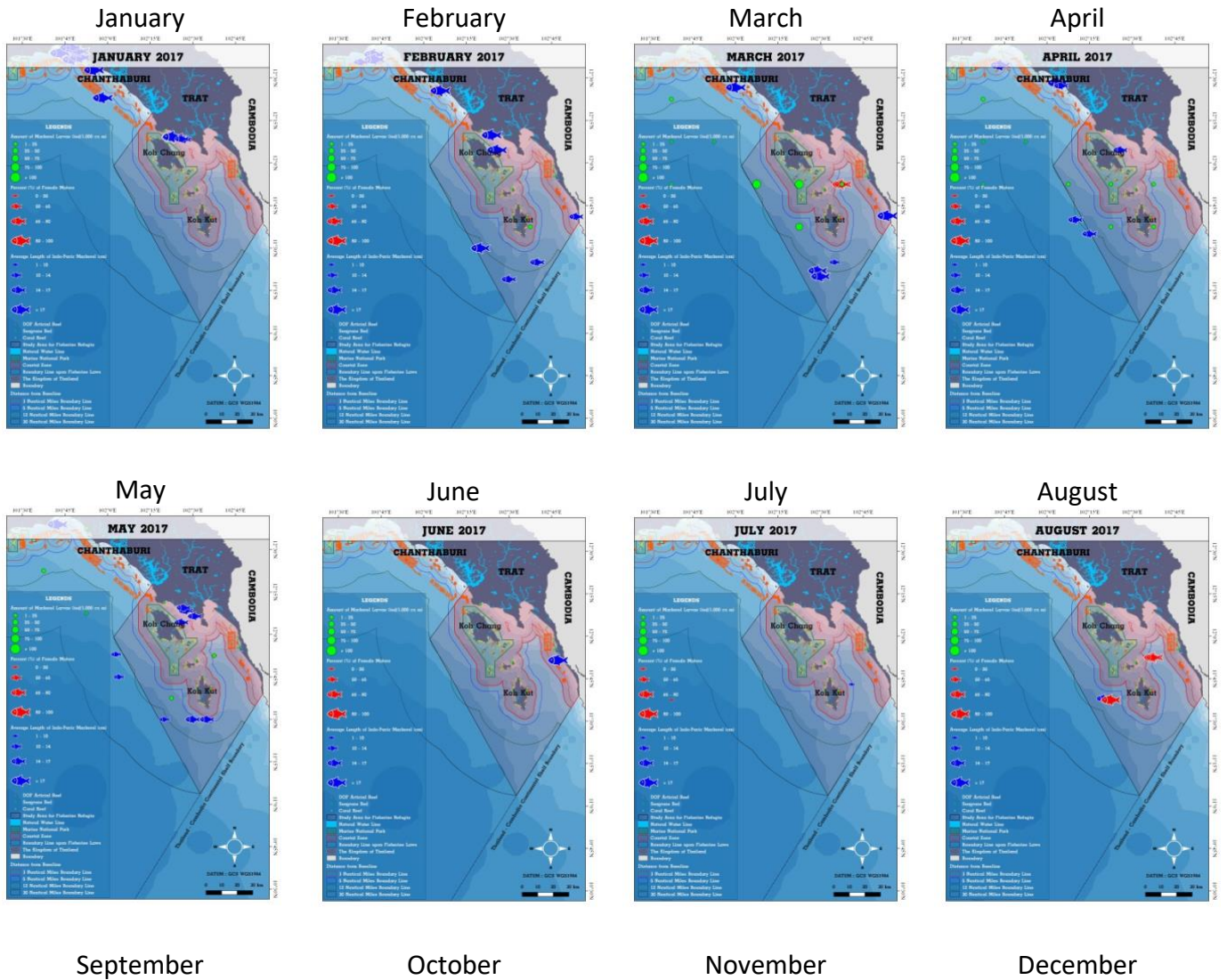
Purse Seine Fishing Areas, monthly in 2018

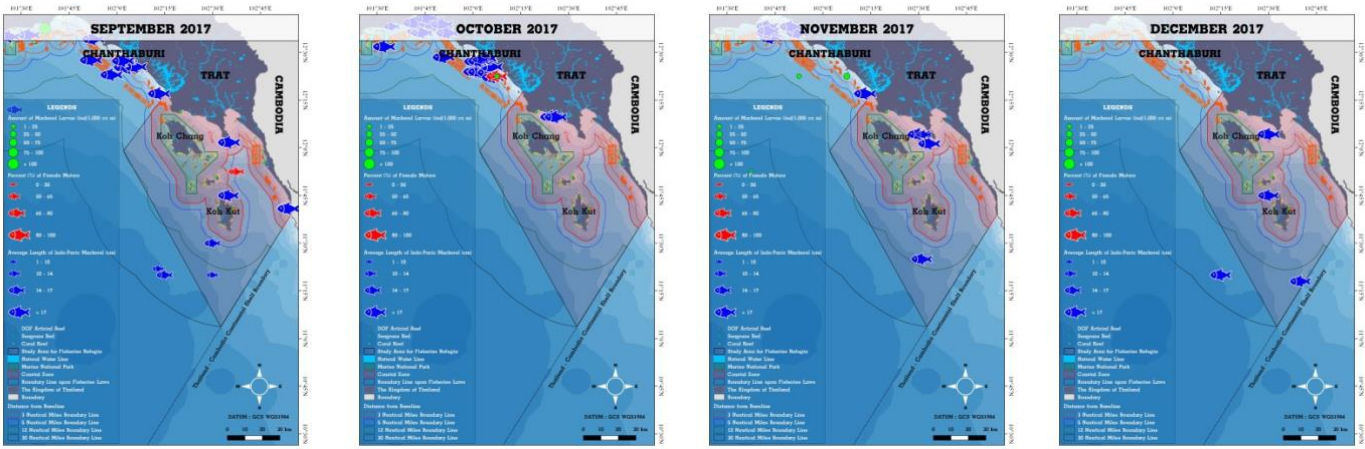


Falling Net Fishing Areas, monthly in 2018

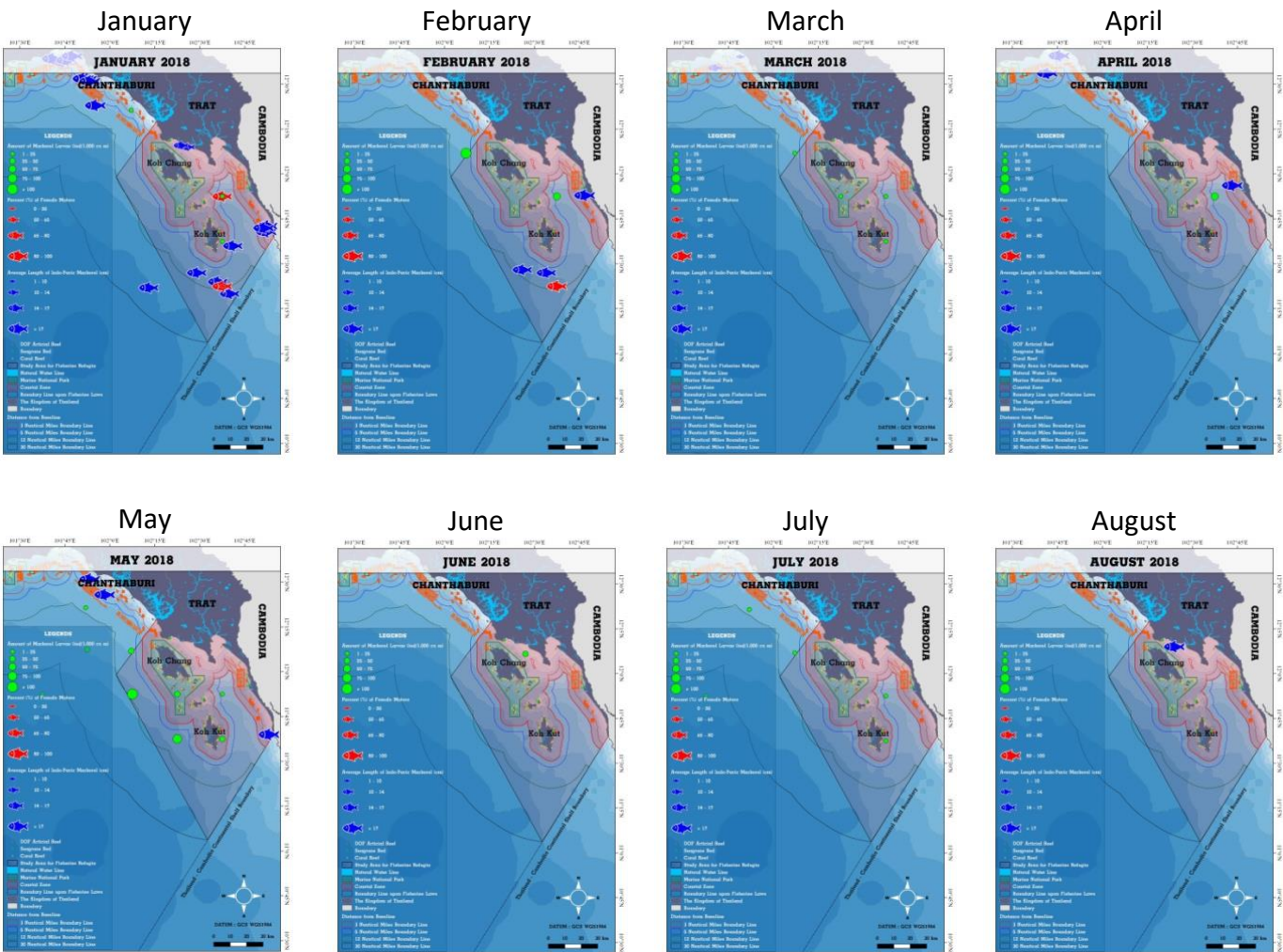


Distributions of Indo-Pacific Mackerel (Larvae, Adults, and Mature fish) in the waters off Trat Province in 2017





Distributions of Indo-Pacific Mackerel (Larvae, Adults, and Mature fish) in the waters off Trat Province in 2018

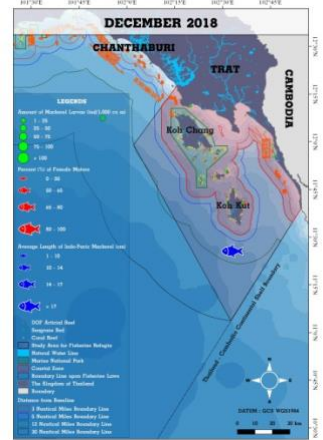
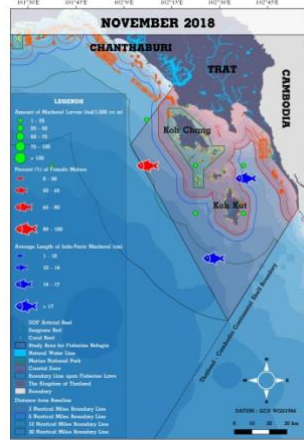
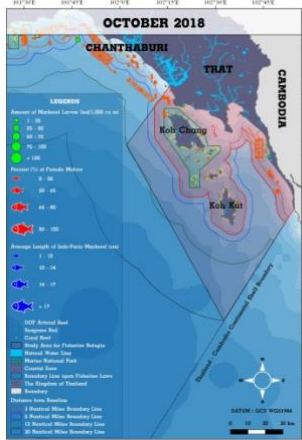
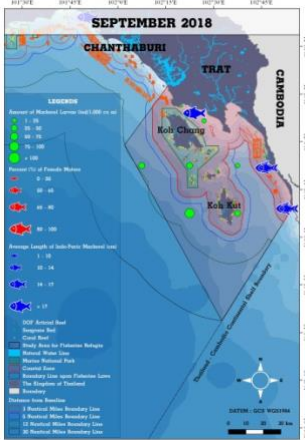


September

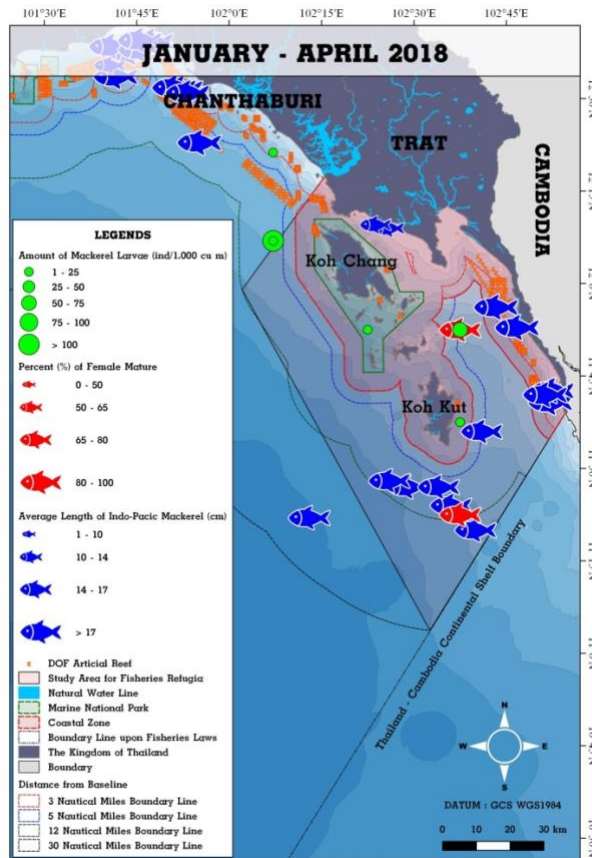
October

November

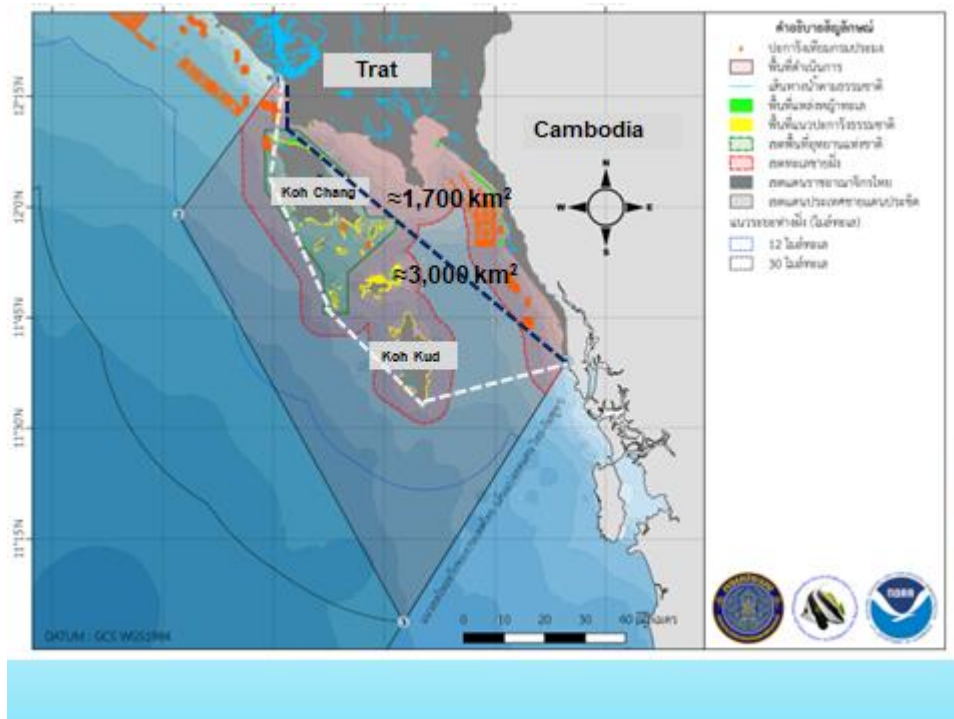
December



Distribution of Indo-Pacific Mackerel in the Spawning Peak Period: January-April



Proposed Fisheries Refugia Sites in Trat Province



ANNEX 6

MEETING ATMOSPHERE

