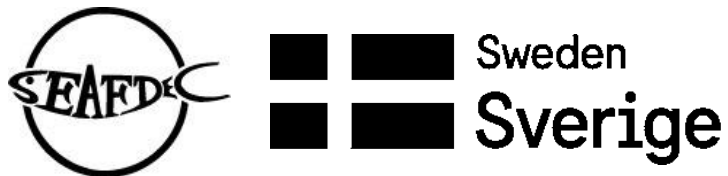


**REPORT OF THE GULF OF THAILAND TECHNICAL MEETING ON MANAGEMENT
OF TRANSBOUNDARY SPECIES: INDO-PACIFIC MACKEREL**

**Bangkok, Thailand
19-20 December 2018**



**The Secretariat
Southeast Asian Fisheries Development Center**

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19-20 December 2018, Bangkok, Thailand

I. Introduction

1. The Gulf of Thailand Technical Meeting on Management of Transboundary Species: Indo-Pacific Mackerel was convened in Bangkok, Thailand from 19-20 December 2018. The Meeting was attended by representatives from Cambodia, Malaysia, Thailand and Viet Nam, resource persons, representative from SEAFDEC/UN Environment/GEF Fisheries *Refugia* Project, officers from SEAFDEC Secretariat, SEAFDEC/Training Department (TD), and members of Regional Fisheries Policy Network (RFPN). The List of Participants appears in **Annex 1**.

II. Opening of the Meeting

2. The SEAFDEC Secretary-General, *Dr. Kom Silapajarn*, welcomed all participants to the Meeting. He appreciated the SEAFDEC-Sweden Project supported in organizing the event to address on the need of the sub-regional cooperation to manage fisheries resources. He referred to the series of technical consultations and the Gulf of Thailand sub-region meetings over the past years; attention in recent years has focused on species such as anchovies, Indo-Pacific mackerel, and blue swimming crab. He informed the Meeting that this Meeting would focus on Indo-Pacific mackerel (*Rastrelliger brachysoma*), which is commercially and widely distributed in the GOT sub-region. He encouraged the views and suggestions from participants for formulation of sub-regional management actions for the sustainable fisheries of *R. brachysoma* in the GOT sub-region. Finally, he then declared the Meeting open. His Opening Remarks appears in **Annex 2**.

III. Introduction, Objectives of the Meeting and Adoption Agenda of the Meeting

3. *Ms. Saisunee Chaksuin*, the Gulf of Thailand Sub-region Coordinator of SEAFDEC-Sweden Project, provided a brief background of the Meeting. She emphasized that Indo-Pacific mackerel is one of important species in the Gulf of Thailand Sub-region that need attention for their sustainable utilization. Through a series of consultation among the countries, it was agreed to build up the available information of Indo-Pacific mackerel and some necessary study is required such as the DNA studies. Therefore, the SEAFDEC-Sweden Project supported the Gulf of Thailand countries to collect the tissue samples of Indo-Pacific mackerel and analysis. The Prospectus of the Meeting as appears in **Annex 3**.

4. She then informed the objectives of the Meeting are to disseminate the result from the DNA studying of Indo-Pacific mackerel in the Gulf of Thailand Sub-region and to obtain ideas and view for further actions/management plan of in the sub-region. After the Agenda was adopted without any amendments. The Agenda is shown in **Annex 4**.

5. Before moving to the next agenda, *Dr. Worawit Wanchana*, Policy and Program Coordinator invited participation countries to nominate representative to be a chairperson of the Meeting. Afterward, the Member countries agreed to invite *Dr. Kamonpan Awaiwanont* to serve as a Chairperson of the Meeting.

IV. Sub-regional Initiatives on Transboundary Species Management

4.1 Gulf of Thailand Sub-region

4.1.1 Anchovy, Indo-Pacific Mackerel, Blue Swimming Crab (AIB) species

6. *Dr. Worawit Wanchana* provided a background of the sub-regional initiative on transboundary species that discussed during the 5th Meeting of GOT sub-region organized in 2015. During that meeting, the Gulf of Thailand countries prioritized the target species namely: Anchovies, Indo-Pacific mackerel, and blue swimming crab (AIB) and suggested to work on the formulation of the management actions including improvement of data collection to support long-term fisheries management. He also recalled that the SEAFDEC-Sweden Project conducted a series of consultation and trainings in order to increase understand of the stock status of the AIB species that includes the Experts Group Meeting on Stock Status and Geographical Distribution of AIB Species and Technical Meeting to Plan for Stock Study on AIB Species in the Gulf of Thailand, respectively.

7. He also reviewed on the status of AIB species which found that the stock status of anchovy was declining in Viet Nam, likely stable in Thailand, while healthy in Malaysia. For Indo-Pacific mackerel, it was declining in Cambodia and Thailand, while likely stable in Malaysia. For blue swimming crab, it was declining in Thailand and Viet Nam while likely stable in Malaysia.

8. He concluded that there were preliminary data on AIB species available in GOT. Malaysia and Thailand have comprehensive set of data used for management of AIB species such as fishing grounds, larvae distribution area and catch and effort, while lack of data/information on AIB species in Cambodia. His presentation as appears in **Annex 5**.

4.1.2 Monitoring, Control and Surveillance Networks

9. *Ms. Pattaratjit Kaewnuratchadasorn*, SEAFDEC-Sweden Project Manager, presented the Monitoring, Control, and Surveillance (MCS) network initiative which is emphasized on the importance of regional and sub-regional cooperation as stated in the document RPOA-Capacity. She referred that SEAFDEC-Sweden Project facilitated the discussion among the Gulf of Thailand countries on development of MCS networks in the GOT since 2017. MCS focused on improved catch data; improved traceability of fish products facilitates trade; improved catch data; improves scientific assessments and recommendations; improved management of transboundary fish stocks, increased long term profits; improved cooperation of surveillance reduce costs for surveillance and increases efficiency of combating illegal fishery. Her presentation as appears in **Annex 6**.

4.2 Resources Mapping of Marine Fisheries Resources

10. *Ms. Siriporn Pangorn*, Fishing Ground Information Scientist of SEAFDEC/TD presented on the usage of The Geographical Information System (GIS) to produce the resource maps related to the resources management. The data and information would be presented in the maps form and data compiled from difference sources such as scientific papers, research works and questionnaire and survey. The resource maps would help for make decision on the fisheries management. In her presentation, she presented example of the GIS thematic maps of the distribution of fish species. Her presentation as appears in **Annex 7**.

11. After her presentation, *Dr. Worawit* emphasized that the GIS is tool to help manager to decide some number of management measure in managing the resources. Moreover, *Mr. Pirochana Saikliang* reminded that the maps presented or when dissemination, it is important to indicate the source of data according to time series, because of the changes occurred time by time.

V. Sub-regional DNA Study on Stock Structure of Indo-Pacific Mackerel (*Rastrelliger brachysoma*)

5.1 Reviews Previous Activities in Relation to the Genetic Study

12. *Dr. Worawit* provided the background of the Sub-regional DNA Study on Stock Structure of Indo-Pacific mackerel. He referred the objective of the study are to identify populations according to

spawning grounds and identify major population contributing to fishery catches in the Upper Gulf of Thailand. He provided that the tissue samples were originally collected from four (4) main spawning grounds included Samut Songkhram province, Prachuab Khiri Khan province, Surat Thani province and Trat province. The sampling was collected every month. The results were found that the genetic Mixed-Stock Analysis (MSA) of Indo-Pacific mackerel in upper Gulf of Thailand. His presentation as appears in **Annex 8**.

13. *Mr. Isara Chanrakkij* inquired on whether the Department of Fisheries of Thailand has collected the data on the hotspots of fish egg and distribution in the Gulf of Thailand. In response, *Ms. Ratanawalee Phoonsawat*, Fisheries Biologist, explained that DOF collected all the fish eggs and larvae by research vessels covered four (4) areas included Samut Songkhram, Prachuab Khiri Khan, Surat Thani and Trat provinces.

5.2 Result of DNA Study on Stock Structure of Indo-Pacific Mackerel

14. *Dr. Akarapong Swatdipong*, lecturer from Kasetsart University, presented the result of DNA study on stock structure of Indo-Pacific mackerel in the Gulf of Thailand, the presentation as appear in **Annex 9**. The study was supported by DOF of Thailand and SEAFDEC-Sweden Project. He informed the Meeting that the analysis results were based on 436 samples, collected from Trat, Samut Songkhram, Prachuab Khiri Khan, Surat Thani, Pattani, Cambodia, Tumpat of Malaysia and Viet Nam.

15. In his presentation, the results of DNA study showed that the Indo-Pacific mackerel populations from four (4) places in Thailand, (Trat, Samut Songkhram, Prachuab Khiri Khan and Surat Thani) are genetically different from each other in moderate levels while the populations from Cambodia, Pattani and Tumpat (Malaysia), and Viet Nam are genetically different to each other in low levels.

16. It was revealed that the mackerel population from Tumpat, Malaysia was genetically close to the mackerel from Pattani which is according to the close geographical distance between the sampling localities. The mackerel populations from Cambodia and Viet Nam (figure 3 in his presentation) cannot be clearly genetically separated.

17. While acknowledging the results of the DNA study, *Mr. Pirochana* suggested to also use data of length frequency of mackerel of each country, would provide a clear picture of the fish migration around Cambodia and Thailand. In addition, *Dr. Tanuspong* also suggested collecting data by seasons.

18. While noting the significant of data and information of the hotspot of fish eggs and larvae, *Ms. Ratanawalee* confirmed that Thailand conducted the study of fish egg and larvae in the Gulf of Thailand.

19. *Ms. Pattaratjit* stated that the SEAFDEC-Sweden Project provided several activities (consultations, trainings) to improve understanding of the stock status of the Indo-Pacific mackerel for the development the management plan. She hoped based on the results would provide steps towards to continue such plan. She also mentioned that another on-going Fisheries *Refugia* project which also has the same focus would use these results for continuation of the initiative.

VI. Relevant Technical Information

6.1 Suitable Areas for Fish Larvae according to Sea Surface Temperature and Chlorophyll-A

20. *Dr. Methae Kaewnern*, resource person from Kasetsart University of Thailand, presented the information of concentration of chlorophyll-a which collected from MODIS data by NASA

in format of Satellite imagery (Aqua+Terra Satellite) daily. He mentioned that the other factor may be related suitability of the larvae is sea surface temperature, which also can be downloaded from MODIS in order to determine the suitability area of fish larvae. According to the study, the presence of larvae closely related to the availability of chlorophyll-a, and the range of temperature.

21. He further presented that the area of the fish larvae distribution followed the three categories of suitability included most suitable area, moderate suitable area and low suitable area. The prediction by DOF Thailand about area closure of the year 2018 has similarity to the distribution of larvae regarding to this analysis.

22. He concluded that plankton is one of other factor related to migration of fish. This is based on the study of stomach content to confirm species of plankton. The conclusion was the good environment condition for larvae is during December, when the chlorophyll-a density is high and the water temperature is optimum. His presentation as appear in **Annex 10**.

23. *Dr. Somboon Siriraksophon* inquired about the optimum temperature range is much narrowed. *Dr. Methee* explained, based on the scatter plot analysis, the fish larvae with high density found in depth temperature range. If the temperature increased more than optimum, the larvae may be moving down to find the optimum temperature.

6.2 A Preliminary Investigation of Marine Larvae Transport in the Gulf of Thailand Using Numerical Model

24. *Dr. Tanuspong Pokavanich*, resource person from Kasetsart University, presented model of water transport in the Gulf of Thailand. The water movement in the GOT dominated by monsoon, density changes, and the general of wind which is changing in term of space of the areas.

25. He continued presented that the study of the hydrodynamics, water flow and circulation of the GOT using numerical modeling. However, more field observation data is needed to validate the Gulf-scale model. The marine larvae dispersal can be investigated using numerical modeling technique providing information of the spawning ground and data to validate the model. The preliminary results showed that strong variation of seasonal patterns of the larval dispersal and clearly indicate the cross-(country) boundaries of the larvae transport in the GOT. His presentation as appear in **Annex 11**.

26. *Ms. Saisunee* inquiries that this model used the single value of seafloor roughness in represent of the GOT area is this reliable with the current status of the GOT, that referred to the possibility of the change of water movement in the GOT due to the installation of artificial reef which along the GOT coastal areas. *Dr. Tanuspong* explained that the single value of seafloor roughness was considering as average scale of the whole GOT. The artificial reefs are not cause to affect the water movement in the whole GOT.

27. In the discussion, the Meeting agreed that for larval dispersal can be investigated using numerical modeling technique providing knowledge of the spawning ground and data to validate the model and the preliminary results show that strong variation of seasonal patterns of the larval dispersal and clearly indicate the cross-(country) boundaries of the larvae transport in the GOT.

VII. Discussion on DNA Study Result and Relevant Physio-Biological Information and Recommendations

28. The Meeting took note the results of DNA study, however, some sampling site such as Tumpat in Malaysia, that is very close to Pattani, Thailand, the Meeting was asked if possible to add one station further distance from Tumpat. In response, Malaysia delegate explained that the current

site is a part of fishing ground representative for collecting sample, which difficult to find the mackerel at other sites.

29. According to **MSA (Mixed-Stock Analysis)**, the mackerel taken from Trat fishing area has been contributed by genetic resources from four countries included Cambodia, Malaysia, Thailand and Viet Nam. In order to understand the migration of populations in the GOT the use of numerical modelling technique could be a good choice for considering. Nevertheless, it needs to validate the model.

30. The **possible factor that influence migratory and movements of populations** as explained by *Dr. Methée* included the availability of chlorophyll-a, the suitable temperature. The other migratory routes influenced by tidal current, water movement generated by monsoon and wind direction. The broodstock movement in the areas of GOT was studied since decades ago and indicated the migratory route of major mackerel population, originating from lower GOT and nursing in the inner GOT until to maturity, and then migrating to its natal spawning ground. The current study however describe a number of mackerel populations and their possible routes of migration to the Trat fishing ground, the area close to border between Thailand and Cambodia that has not been largely previously studied for the mackerel.

31. The element that required for resource mapping for management propose should be comprised of spawning ground, nursing ground and fishing ground. For the spawning ground, the identification of egg and larval hotspots is further required. This should be part of restricted areas during the spawning season by closed season regulation. The information on juvenile appearance and distribution would be use to protect nursing ground by prohibiting the use of fishing gears with small mesh size. However, the mackerel in larval and juvenile stages are morphologically similar to other small pelagic fishes and difficult for species identification. Thus, technical information for the identification would be needed. As the Trat fishing ground is adjacent Cambodia and also Viet Nam, the future study of MSA in Cambodian and Viet Nameese waters for mackerel resource mapping was mentioned.

VIII. Development of Sub-regional Plan for Managing Transboundary Species of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region

8.1 Fishing Effort (and catch) Control System in Thailand: A Case of Pelagic Fish

32. *Dr. Pavarot Noranarttragoon*, resource person from the Department of Fisheries (DOF), Thailand, firstly provided information on the current legal framework for fisheries management approved by Thailand cabinet namely: 1) the Royal Ordinance on Fisheries 2015, 2) the Royal Ordinance on Fisheries (No.2) 2017 and 3) Marine Fisheries Management Plan of Thailand 2015-2019 (FMP). The Royal Ordinance on Fisheries had three (3) important sections included Section 24: using the reference point for as the basis for determination for Maximum Sustainable Yield (MSY) and approach the issuance of fishing license, Section 30, this reference point from best scientific methods and Section 36 the following specified contents including the maximum allowable catch in fishing license.

33. He explained that the MSY in Thailand use as reference point for fishing license issuance which categorized into three groups of species are demersal fish, pelagic fish, and anchovy. Thailand also set the Total allowable catch (TAC) determination and catch allocation base on MSY. After careful consideration, DOF allocated to the group of vessel under approved by national committee.

34. He also presented the opportunities and challenges four (4) points included; 1) Current management system, DOF already have legal framework, tools, and facilities to implement full output control, like Individual Transferable Quota (ITQ) 2) Individual catch transfer implemented 3) In the

regional are tropical multi-species fishery very hard to set TAC 4) Species-specific TAC and 5) Catch target might be achieved without catch because of some fishermen discard small fish in the sea. His presentation as appear in **Annex 12**.

35. *Mr. Le Tran Nguyen Hung* sought the clarification on the criteria to allow the TAC for each fishing vessel and all fishing vessel in Thailand have the fishing logbook. *Dr. Pavarot* explained that the determination on TAC and allocated in three (3) group of fish included; 1) demersal group allocated to trawler and trap; 2) pelagic fish allocated to purse seine and gill net; and 3) anchovy allocated to anchovy purse seine and anchovy falling net. In addition, DOF has CPUE per hour or per day from research. Regarding to the logbook, DOF apply the logbook in commercial vessel which can record 100%, while for the artisanal fisheries, the DOF officers conduct the survey and collect the data every month for catch species composition.

36. *Mr. Buoy Roitana* inquired about the free software on Fishing info and mention to the Surplus production model which is very complicate and difficulty to management single species. *Dr. Pavarot* explained this software developed by Thai DOF and only utilized in the Thailand. He further explained that the different from input data in surplus model input historical catch data while the analytical model input length one year data.

37. *Dr. Somboon* provided more information on establish software in the ASEAN set up the control neritic tuna for stock assessment. The SEAFDEC-Sweden project supported the free software for stock assessment on longtail tuna and kawakawa in the region which can get form SEAFDEC secretariat or download from the website.

38. *Dr. Tanuspong* asked the reasons on statistical catch decrease rapidly. In response, *Dr. Pavarot* explained that the catch decreased during the last three (3) years because in 2014 Thailand announce the close area in the Gulf of Thailand during two (2) month (June and July) until August the fishing vessel can operate in the area. It was found that mostly catch were caught is mature size, however, DOF did not collect the information of environmental factor.

8.2 Plenary Discussion

39. *Dr. Worawit* presented and facilitated discussion on explicitly the summary of the different studies conducted in the GOT by DOF Thailand that can be considered in the formulation of joint management plans, other future studies as well as future planning and policy formulation of the GOT. The following observation and recommendations were agreed by the participants in the Meeting.

- i. The major findings from DNA study on population/stock structure of were enumerated below. However, replication of the study will further validate the results.
- ii. There is genetic similarity or differentiation among the populations which found in the GOT (Cambodia, Malaysia, Thailand and Viet Nam) through Principle Component Analysis (PCA).
 - Thailand populations are genetically different to each other in moderate level.
 - Cambodia, Viet Nam, Malaysia and Thailand (Pattani) population are genetically different to each other in low level.
 - Mixed-Stock Analysis (MSA) in Trat fishing area revealed the resources contributed by GOT countries.
 - Larval dispersal can be analyzed using numerical modeling technique to provide knowledge on the spawning ground and data from field observation is needed to validate the model used.
 - Preliminary results showed strong variation of the seasonal patterns of the larval dispersal clearly indicate the cross- (country) boundaries of the larvae transport in the GOT.

- iii. The key factors that influence migration and population movements
 - Nutrient (e.g. chlorophyll-a) ; more algae, more larvae suitable area
 - Tidal current (diurnal, monsoon) results to larval transport and migration route (s)
 - Fishing activities
 - Sea surface temperature must be between 28.75-30.25° C
- iv. Elements required for resource mapping development for management purposes
 - Nursing ground
 - Spawning ground (hotspot of larvae/egg)
 - Fishing ground
 - Fishing efforts (number of vessels, fishing license, quota, fishing days, CPUE and etc.)

40. The Meeting identified current knowledge/available information of each country about this species such as biology, fishing efforts and management measures and etc. The Meeting also recommended the follow-up actions/needs towards development of the sub-regional transboundary species management plan of Indo-Pacific mackerel at national level and sub-regional level. The details of the Plenary Discussion as appear in **Annex 13**.

IX. Conclusion and Ways forward

41. The Meeting took note of recommendations, follow-up actions and needs towards development of the sub-regional transboundary species management plan from national level and sub-regional level. In order to confirm the procedure of future cooperate management in GOT, the genetic term and fishery term (*i.e.* genetic stock and fishery stock) are needed to be noticed. Therefore, the summary for further improvement and better understanding are placed **Table 1** and **Table 2** as appear in **Annex 14**.

X. Closing of the Meeting

42. *Dr. Kamonpan*, in his capacity as the Chairperson of the Meeting, thanked all participants for the fruitful workshop and requested everyone to call the attention of higher authority for support on the initiatives and declared the Meeting closed.

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OPENING REMARKS

*By Dr. Kom Silapajarn,
SEAFDEC Secretary-General*

Distinguished delegates from Cambodia, Malaysia, Thailand and Viet Nam, experts, representatives from UNEP/GEF/Fisheries *Refugia* Project and officers from SEAFDEC, Members of the Regional Fisheries Policy Network, Ladies and Gentlemen, Good morning!

I would like to welcome all participants to this Technical Meeting on Management of Transboundary Species: Indo-Pacific Mackerel, organized by the SEAFDEC-Sweden Project.

As you may already know the SEAFDEC-Sweden Project have been supported the Member Countries in particular the building up the sub-region cooperation among the Gulf of Thailand Countries with the special focus the fisheries resources and effective ecosystem management in consistence with the Sustainable Development Goal 14: Life below Water. Through the series of Gulf of Thailand Sub-region meetings over past the years, attention in recent years has focused on species such as Anchovies, Indo-Pacific Mackerel and Blue Swimming Crab. At this meeting, we will discuss on one of the targeted species is Indo-Pacific Mackerel (*Rastrelliger brachysoma*), in particular, which is commercially important small pelagic fish, widely distributed in the four countries of the Gulf of Thailand Sub-region. Realizing the population of the Indo-Pacific Mackerel has declined in the Gulf of Thailand sub-region that brought many questions, is it due to overfishing, pollution, loss of habitats, or climate change? Many responsible agencies have tried to look for the answers.

Through the expert discussion among four countries few years ago, and based on available information, in 2018, the SEAFDEC-Sweden Project and countries in collaboration with Kasetsart University, we agreed to conduct the DNA study to understand and confirm if this species has the relationship among Gulf of Thailand sub-region countries, around the coastal provinces of Viet Nam, Cambodia, Thailand and Malaysia.

Ladies and gentlemen, we are pleased to organize this Technical Meeting to disseminate the results of DNA analysis. This Meeting is also important since gathered both scientists and policy makers. I wish to hear the view and suggestion for further consideration. This would be good example of the collaboration among the Gulf of Thailand countries to bring our scientific knowledge, analysis, planning and making the decision for appropriate management measures to ensure the continuing of the productivity of the fisheries resources. It is anticipated that thereafter, the results of the stock structure will be used as inputs to the Gulf of Thailand's monitoring, control and surveillance network for formulation of a sub-regional management actions for the sustainable fisheries of *R. brachysoma* in the Gulf of Thailand Sub-region.

I hope this two-days meeting would have fruitful discussion and give the view for further actions to broaden our perspectives. I would like to express my sincere appreciation for your presence today. Finally, I wish all the best and have a good day.

INTRODUCTION, OBJECTIVES OF THE MEETING AND ADOPTION AGENDA OF THE MEETING

By Ms. Saisunee Chaksuin




GULF OF THAILAND TECHNICAL MEETING ON MANAGEMENT OF TRANSBOUNDARY SPECIES : INDO-PACIFIC MACKEREL

19-20 December 2018, Bangkok, Thailand



SEAFDEC-Sweden Project

VISION





Sustainable use of aquatic resources and reduced vulnerability to climate change, by fishing communities in the ASEAN region

OUTLINE




- Background
- Objectives
- Expected outputs
- Expected outcomes
- Agenda

BACKGROUND

- SEAFDEC-Sweden project supports the Gulf of Thailand countries (Cambodia, Malaysia, Thailand and Viet Nam) to discuss on the transboundary species towards for the sustainable use of fisheries resources.
- Indo-Pacific is one of the target species
- Building upon the available information, and the consultations with the Experts from Cambodia, Malaysia, Thailand and Viet Nam were conducted in 2016-2017.
- The countries agreed on the DNA Study to under the stock structure.

BACKGROUND




In 2017, Inception Meeting for DNA Study on Stock Structure of Indo-Pacific Mackerel (*Rastrelliger brachysoma*) in the Gulf of Thailand

13-14 December 2017, Rayong Province, Thailand




BACKGROUND



□ In 2018, Indo-Pacific Mackerel Tissue Sampling were collected in

- Cambodia
- Malaysia
- Thailand
- Viet Nam


□ DNA Analysis were conducted by Genetic Lab of Kasetsart University in 2018




OBJECTIVES OF THE MEETING 

1. Disseminate the result from the DNA studying of Indo-Pacific mackerel in the Gulf of Thailand Sub-region
2. To obtain ideas and view for further actions/management plan of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region



EXPECTED OUTPUTS 

1. Conclusion of the Indo-Pacific mackerel DNA pattern in the Gulf of Thailand Sub-region
2. Suggestion on action/management plan of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region



EXPECTED OUTCOME 

Management/action plan of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region



TIME TABLE & AGENDA 

19 DECEMBER 2018	
08.30-09.00	Registration
09.00-09.15	Agenda 1: Opening of the Meeting <i>by SEAFDEC Secretary-General</i>
09.15-09.30	Agenda 2: Introduction, Objectives of the Meeting and Adoption Agenda of the Meeting <i>by SEAFDEC-Sweden project</i>
09.30-10.30	Agenda 3: Sub-regional Initiatives on Transboundary Species Management <ul style="list-style-type: none"> 3.1 Gulf of Thailand Sub-region <ul style="list-style-type: none"> 3.1.1 AIB-species <i>by SEAFDEC-Sweden project</i> 3.1.2 MCS Network <i>by SEAFDEC-Sweden project</i> 3.2 Resources Mapping of Marine Fisheries Resources <i>by SEAFDEC/TD</i>
10.30-11.00	Coffee break and group photo

TIME TABLE & AGENDA 

19 DECEMBER 2018	
11.00-12.00	Agenda 4: Sub-regional DNA Study on Stock Structure of Indo-Pacific Mackerel (<i>Rastrelliger brachysoma</i>) 4.1 Reviews Previous Activities <i>by SEAFDEC-Sweden project</i>
12.00-13.30	Lunch
13.30-14.30	Agenda 4: (cont.) 4.2 Result from DNA Study on Stock Structure of Indo-Pacific Mackerel (<i>Rastrelliger brachysoma</i>) <i>by Dr. Akarapong Swaidipong, Faculty of Science, Kasetsart University</i>
14.30-15.00	Coffee break

TIME TABLE & AGENDA 

19 DECEMBER 2018	
15.00-16.00	Agenda 5: Relevant Technical Information 5.1 Suitable Areas for Fish Larvae According to Sea Surface Temperature and Chlorophyll A <i>by Dr. Methee Kaewnern, Faculty of Fisheries, Kasetsart University</i> 5.2 A Preliminary Investigation of Marine larvae Transport in the Gulf of Thailand Using Numerical Model <i>by Dr. Tanuspong Pokavanich, Faculty of Fisheries, Kasetsart University</i>
16.00-17.00	Agenda 6: Discussion on DNA Study Results and Relevant Physio-biological Information and Recommendations
18.00-20.00	Reception Dinner hosted by SEAFDEC-Sweden

TIME TABLE & AGENDA	
20 DECEMBER 2018	
09.00-10.30	Agenda 7: Development of Sub-regional Plan for Managing Transboundary Species of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region 7.1 Fishing Effort (and catch) Control System in Thailand: A case of Pelagic Fish <i>by Dr.Pavarot Noranarttragoon, Department of Fisheries, Thailand</i> 7.2 Plenary Discussion
10.30-11.00	Coffee break
11.00-12.00	Agenda 7: 7.2 Plenary Discussion (cont.)
12.00-13.30	Lunch
13.30-14.30	Agenda 8: Conclusion and Ways forward
14.30-15.00	Agenda 9: Closing of the Meeting



PROSPECTUS

I. Background

Following up with the series of sub-regional activities in collaboration with the Gulf of Thailand countries on technical aspect towards development of coordinated plan for sustainable management of the transboundary species, there is an ongoing initiative on DNA study for understanding the stock structure of Indo-Pacific Mackerel (*Rastelliger brachysoma*) as one of the transboundary species identified by the Gulf of Thailand Countries through the course of activity implementation. It is expected that findings from the DNA study could be used as a basis for formulation of the joint/coordinated plan for management of the Indo-Pacific Mackerel for the Gulf of Thailand Sub-region.

In addition to that of DNA study carried out by the Department of Fisheries Thailand since 2016 in Thailand territorial waters. The SEAFDEC-Sweden project supported the Gulf of Thailand countries to expand the work of such ongoing national initiative of Thailand by incorporating information obtained from Thailand to other countries surrounding the Gulf of Thailand, including Cambodia, Malaysia, and Viet Nam. With that support, DNA tissue samples were collected in Cambodia, Malaysia, and Viet Nam during 2018.

The Meeting aims to disseminate the result from the DNA study conducted the Gulf of Thailand countries as abovementioned. It is envisaged that priority issues and challenges in moving toward joint/coordinated management measures to sustain utilization of the Indo-Pacific Mackerel can be clarified and formulated.

II. Objectives of the Meeting

1. Disseminate the result from the DNA studying of Indo-Pacific mackerel in the Gulf of Thailand Sub-region
2. Discuss on the suggestions and way forward for the development joint/coordinated management plan for Indo-Pacific mackerel in the Gulf of Thailand Sub-region

III. Expected Outputs

1. Conclusion of the Indo-Pacific mackerel DNA pattern in the Gulf of Thailand Sub-region
2. Suggestion on action/management plan of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region

IV. Expected Outcomes

Management/action plan of Indo-Pacific Mackerel in the Gulf of Thailand Sub-region

V. Date and Venue

The Gulf of Thailand Technical Meeting on Management of Transboundary Species: Indo-Pacific Mackerel will be organized from 19-20 December 2018 in Bangkok, Thailand

VI. Expected participants of the Meeting

1. Representatives from the Gulf of Thailand Countries:
 - Two (2) representatives from the Gulf of Thailand countries included Cambodia, Malaysia, Thailand and Viet Nam.
 - SEAFDEC-Sweden Project Focal Point or SEAFDEC National Focal point for the Gulf of Thailand Sub-region.
 - One representative form senior official with experiences and expertise on DNA tissue sample collections.
2. Representative from regional partners and resource persons.

SUB-REGIONAL INITIATIVES ON TRANSBOUNDARY SPECIES MANAGEMENT (ANCHOVY, INDO-PACIFIC MACKEREL, BLUE SWIMMING CRAB (AIB) SPECIES)

By Dr. Worawit Wanchana

Sub-regional Initiatives on Transboundary Species Management in GoT: AIB-Species



Gulf of Thailand Technical Meeting on Management of Transboundary Species:
Indo-Pacific Mackerel
19-20 December 2018

Worawit Wanchana, SEAFDEC Secretariat

Background

- AIB-species were prioritized as the target species for promoting development of management plans for the countries in the GoT → a series of experts consultation → SOP for data collection
- The 5th Meeting of the GoT (2015) suggested
 - Encourage GoT countries to formulate policies by including data collection activities of AIB-species in national policy frameworks to support long-term fisheries management
 - Understand migratory pattern of the AIB-species would facilitate development of a joint management plan for AIB-species
- Experts Group Meeting on Stock Status and Geographical Distribution of AIB Species in the Gulf of Thailand, 22-23 Sept, 2016
- Technical Meeting to Plan for Stock Study on AIB Species in the Gulf of Thailand, 7-8 Feb. 2017




AIB Species in the Gulf of Thailand

A: Anchovies


- Engrasicholina heteroloba*
- E. punctifer*
- E. devisi*
- Stolephorus* spp. (eg. *S. indicus*)
- Etc.

I: Indo-Pacific mackerel

- Rastrelliger brachysoma*


B: Blue swimming crab

- Portunus pelagicus*




Anchovy Fisheries: Falling Net with Lights

Anchovy Falling/Lift Net with Lights



Anchovy Fisheries: Purse Seine

Anchovy Purse Seine (operating day time)

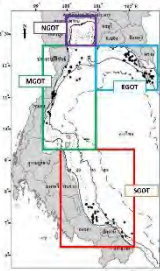
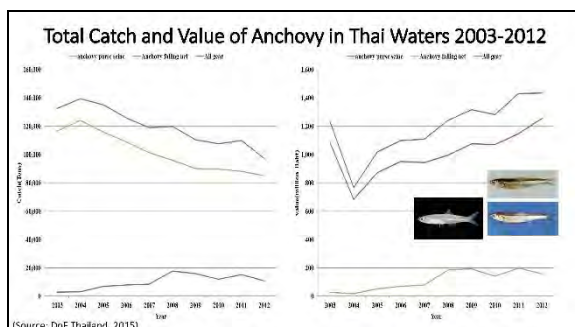


Anchovy: Number of Fishing Vessels and Their Fishing Areas

Fishing gear	10-20 GT	20-60 GT	60-150 GT	>150 GT	Total
Anchovy purse seine	25	53	98	22	198
Anchovy falling net with light luring	78	325	77	1	481
Anchovy lift net	2	12			14

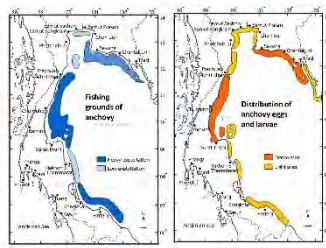
Reference: Fishing licenses as of 31 Aug 16

- SGOT:** the southern part of the Gulf (4 provinces: Narathiwat, Pattani, Songkhla and Nakhon Si Thammarat)
- MGO:** the middle part of Gulf (3 provinces: Sarat Thani, Chumphon, and Prachuap Khiri Khan)
- NGOT:** the northern part of Gulf (5 provinces: Petchaburi, Samut Songkhram, Samut Sakhon, Samut Prakan and Chonburi)
- EGOT:** the eastern part of Gulf (3 provinces: Rayong, Trat and Chanthaburi)

Species Composition of Anchovy Obtained by Fishing Gears

Species Group	Fishing Gear		
	AFNS	ALN	APS
Pelagic fish	95.82	85.75	95.72
Anchovy	63.92	63.22	67.63
<i>E. devisi</i>	11.15	9.68	1.98
<i>E. heteroloba</i>	34.47	30.44	74.09
<i>E. punctifer</i>	30.63	37.68	0.99
<i>Stolephorus</i> spp.	2.42	1.35	0.75
small anchovy	5.25	4.09	9.74
Others pelagic fish	1.90	12.53	8.59
Others	4.18	4.25	4.28



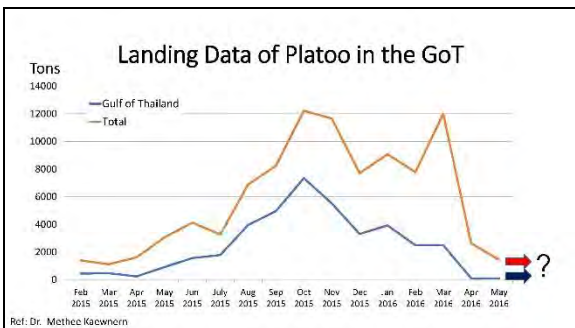
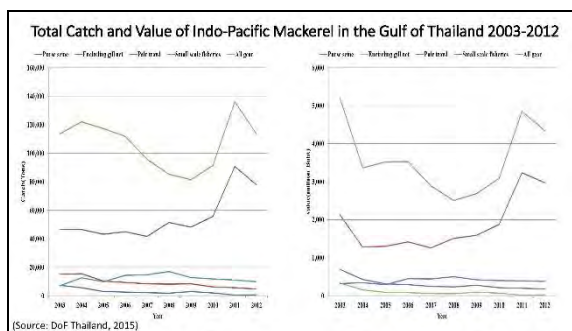
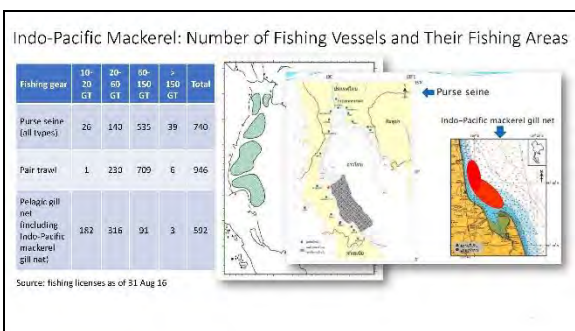
(Source: DoF Thailand, 2015)

Some Biological Information of Anchovy in the Gulf of Thailand

Area/Sub area	Species	Spawning season	Spawning ground
The southern part of the Gulf	<i>E. heteroloba</i> , <i>E. punctifer</i> , <i>E. decais</i> and <i>Stoleteerus</i> spp.	Jan-Mar (Jan 1st-15th)	off Nakhon Si Thammarat to Songkhro, 20-30 m
The middle part of the Gulf	<i>E. heteroloba</i> , <i>E. punctifer</i> , <i>E. decais</i> and <i>Stoleteerus</i> spp.	Feb-Apr (Feb 1st-Apr 1st)	off Prachuap Kiri Khan, Chumphon and off Surat Thani, 10-30 m
The northern part of the Gulf	<i>E. heteroloba</i> , <i>E. punctifer</i> , <i>E. decais</i> and <i>Stoleteerus</i> spp.	Not confirmed	Off Chonburi, 10-30 m
The eastern part of the Gulf	<i>E. heteroloba</i>	Oct-Nov (check with Gov. Surat)	Ice Chang, Ko Kut off Trak, off Chonaburi and off Rayong, 10-20 m

Source: DoF Thailand, 2015

- Existing management measures
- Fishing licenses (based on TAC)
 - Fishing zone
 - Gear restriction
- Recent Research
- Abundance and Distribution of Anchovy Eggs and Larvae in Southern Gulf of Thailand (2001)
 - Stock Assessment of Anchovies (*Encrasicholina devis* (Whitley, 1940), *E. punctifer* Fowler, 1938 and *E. heteroloba* (Ruppell, 1837)) along the Andaman Sea Coast of Thailand (2008)
 - Anchovy Fisheries in the Gulf of Thailand (2008)

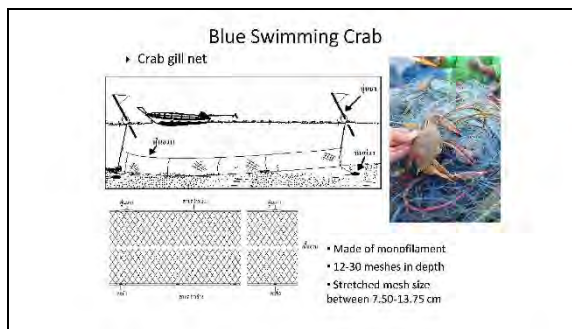


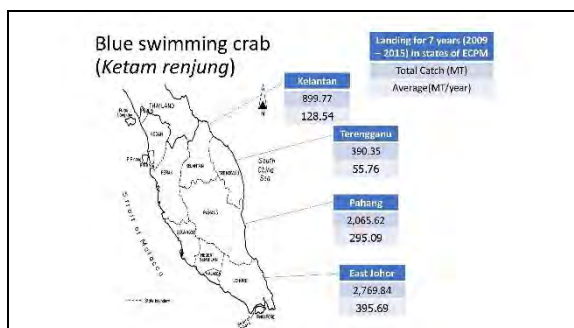
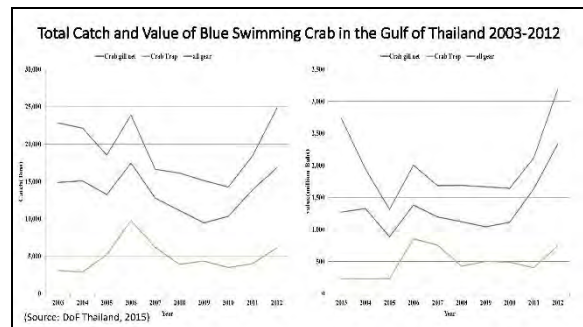
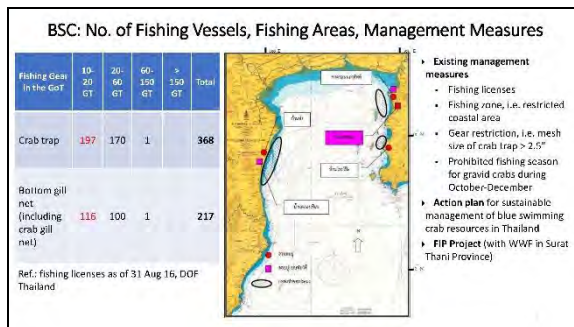
Indo-Pacific Mackerel: Biological Information

- Distribution: along the coastal areas, less than 50 m in depth
- Spawning season: all year round (high peak during Jan-Mar and Jun-Aug)
- Spawning grounds: the middle of the Gulf of Thailand (off Prachuap Kiri Khan, Chumphon and Surat Thani Provinces)
- Life cycle:
 - Gravid fish move from the inner Gulf to spawn in the middle Gulf
 - Fertilized eggs float in the areas of 20-30 m in depth
 - Juveniles move to the inner Gulf

Other available information

- Key Biological Features
- Existing management measures
 - ✓ Closed season
 - ✓ Closed area
 - ✓ Fishing licenses
 - ✓ Fishing zone
 - ✓ Gear restriction





Country Report: Cambodia

Issues	Challenges
Difficulties in obtaining	1) Relevant fisheries information on AIB species from landing sites and ports; 2) Landing data by species
Difficulties in implementing	1) Fisheries management policy 2) Control fishing gears and boats
Current prohibition for catching in general	1) Luring light fishing 2) Paired trawlers 3) Otter-board trawlers operate within 20m deep
Current prohibition for mackerels	Close seasons from 15 Jan to 31 March
Current classification of fishing vessels	1) no engine 2) with engine
Current classification of marine fisheries	small, medium, and large scales

Country Report: Malaysia

Species	Information
Anchovy	1) Common species: <i>Stolephorus commersonii</i> , <i>S. indicus</i> , <i>S. Encrasicholina heteroloba</i> , and <i>Dussumuria etapsoides</i> 2) Important fishing ground: state of Kelantan in east-coast of Peninsular Malaysia 3) Fishing season: May to October
Indo-Pacific Mackerel	1) Major fishing gears: gillnet, drift gillnet, purse seine 2) Major landing areas: States of Kelantan (zone A), Terengganu (zone B), Pahang (zone A), and East Johor (zone B)
Blue swimming crab	1) More common in west coast of Peninsular Malaysia when compared to east coast of Peninsular Malaysia 2) Major fishing gears: crab trap, and non-target for trawl and drift gillnet

Country Report: Thailand

Species	Information
Anchovy	1) Common species: <i>Encrasicholina heteroloba</i> , <i>E. punctifer</i> , <i>E. dens</i> , and <i>Stolephorus</i> spp. 2) Major fishing gears: anchovy falling net with and without luring lights, daytime anchovy purse seine 3) Shown decreasing trend of landing (139,000T in 2004 → 97,000T in 2012) 4) Major fishing grounds: eastern and central GoT 5) Fishing license based on TAC, fishing zones, gear restriction
Indo-Pacific Mackerel	1) Landing: increasing trend for commercial fishing gears (purse seine, encircling gillnet, paired trawl, gillnet) but decreasing for small-scale (data of 2003 to 2012) 2) Major fishing grounds: Central and Southern parts 3) Spawning areas: northern and central parts
Blue swimming crab	1) Major fishing gears: crab gillnet, and collapsible crab trap 2) Fishing boats: 10-20 GT 3) Management measures: restriction in coastal areas, defined fishing zones, and gear restriction, mesh size of trap > 2.5cm, closing season for gravid crabs during Oct. to Dec.

Country Report: Viet Nam

Species	Information
Anchovy	1) Report of the catch in the southern area of Phu Quoc to border of Cambodian water 2) Acoustic survey results indicated overfished or fully-fished 3) Main fishing gears: pelagic paired trawl (challenge to manage)
Indo-Pacific Mackerel	1) Most abundance areas: northern areas in GoT but only few technical information/data is available.
Blue swimming crab	1) Major fishing gears: crab trap, gillnet 2) Major fishing grounds and landing sites: Phu Quoc and Kien Luong Districts 3) Estimated biomass: 7130 tons in 2013 4) Total catch: 7854 tons in 2013

Conclusion

Species	Stock Status			Remarks:
	Declining	Likely Stable	Healthy	
Anchovy	Viet Nam	Thailand	Malaysia	<ul style="list-style-type: none"> Availability of Preliminary data on AIB species in the GoT Thailand conducted stock assessment including MSY estimation since 2015 for AIB species in the GoT → No. of fishing days of the fishing vessels operating in the GoT It is likely that Malaysia and Thailand have comprehensive set of data using for management of AIB species: fishing grounds, larvae distribution area, catch and efforts, etc. No stock status data/information on AIB species available for Cambodia
Indo-Pacific Mackerel	Cambodia	Thailand	Malaysia	
Blue Swimming Crab	Thailand	Viet Nam	Malaysia	

SUB-REGIONAL INITIATIVES ON TRANSBOUNDARY SPECIES MANAGEMENT (MONITORING, CONTROL AND SURVEILLANCE NETWORKS)

By Ms. Pattaratjit Kaewnurachadasorn



SEAFDEC Sweden Sverige

ASEAN Regional Plan of Action for the Management of Fishing Capacity

Objectives

- 1) Enhance the effective, efficient, and equitable and transparent management of fishing capacity for long-term sustainability
- 2) Ensure that fishery managers should endeavor to initially limit fishing capacity at the present level and progressively reduce the fishing effort applied to affected fisheries
- 3) Avoid growth in fishing capacity that undermines the long-term sustainability objectives
- 4) Enhance sub-regional cooperation in managing fishing capacity, specifically with regards to transboundary species or shared species

Section V

6) States should strengthen sub-regional/regional Monitoring, Control and Surveillance (MCS) networks.

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Origin of the MCS initiative

Summary points

- Proposed the creation of a coordinating body
- Establish a technical team from each country, which will comprise researchers, enforcement officers and concerned agencies involved in MCS, will be set up and guided by a moderator to come up with a checklist as needed
- The technical team will then inform the high level Meeting about the scope of the MCS and then finally to form a coordinating body.
- Finally, the coordinating body through the high level Meeting will establish MOU to be followed by Standard Operating Procedure (SOP) and Term of Reference (TOR), afterwards

Sub-regional Consultation on the Development of MCS in the Gulf of Thailand
31 October - 2 November 2017
Chonburi Province, Thailand

SEAFDEC Sweden Sverige

What is MCS?

Monitoring: Collection of data and the measurement and analysis of fisheries related activities such as:

- Catches, Foreign crews, Fishing effort, Licensed vessels

Control: Regulatory conditions under which resources can be harvested such as:

- Management regulations (quota/effort limitations), product certification rules, Port State Measures

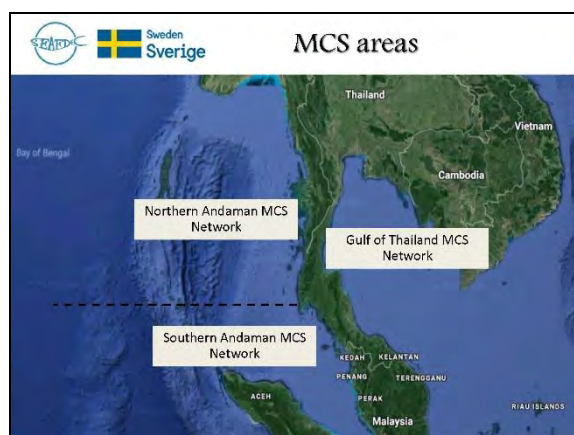
Surveillance: Checking and supervision of fishing related activities (enforcement):

- Port control, VMS systems, Air and Sea surveillance

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MCS initiative

- Improved catch data – improved traceability of fish products facilitates trade.
- Improved catch data – improves scientific assessments and recommendations
- Improved management of transboundary fish stocks, increased profits
- Improved cooperation of surveillance reduce costs for surveillance and increases efficiency of combating illegal fishery



SEAFDEC Sweden Sverige Sub-regional MCS coordination

- Indo-Pacific Mackerel- transboundary species?
- How do we do for the sustainable use of this species?
- What do we know about this species?
- Do we have sufficient scientific information?
- What are requirement to manage this species?

THANK YOU

SEAFDEC-Sweden Project

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SUB-REGIONAL INITIATIVES ON TRANSBOUNDARY SPECIES MANAGEMENT (RESOURCES MAPPING OF MARINE FISHERIES RESOURCES)

By Ms. Siriporn Pangorn

Contents

- Resource Map: what and why?
- Example of Resource Mapping for Indo-Pacific Mackerel in the Gulf of Thailand (GOT): the existing information from participating countries
- Resource Mapping for Resources Management

Resource Map

What is a natural resource map?

- A natural resource map is a map that shows the expanse of natural resources found on and in the surface of the Earth.
- Natural cover of the worlds, world map of natural vegetation and world map of minerals, fish species distribution map are examples of natural resource maps.

Why we use Resource Map?

- Resource Map helps us make better decision by giving us better insight into the location and distribution of the resources.

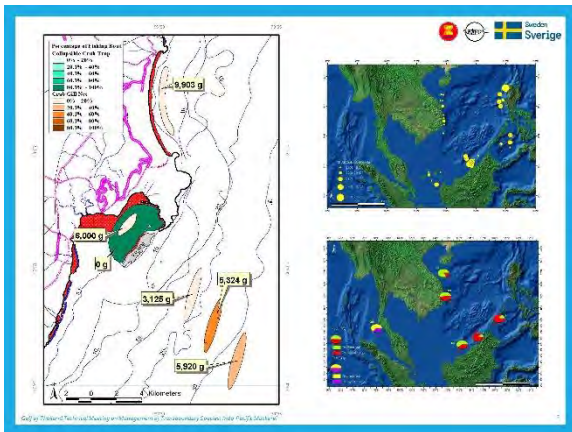
Resource Map

Source of information

- Scientific papers
- Research work
- Resources survey
- Questionnaires survey

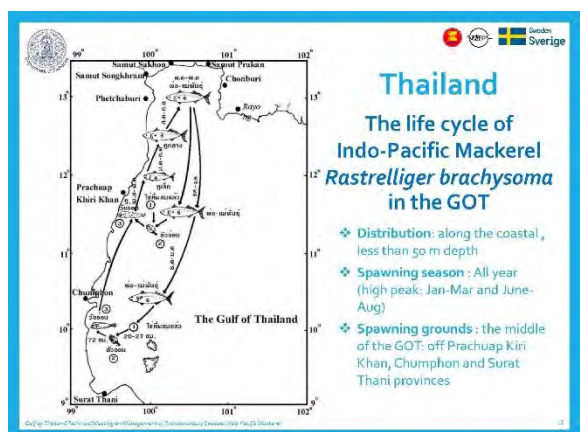
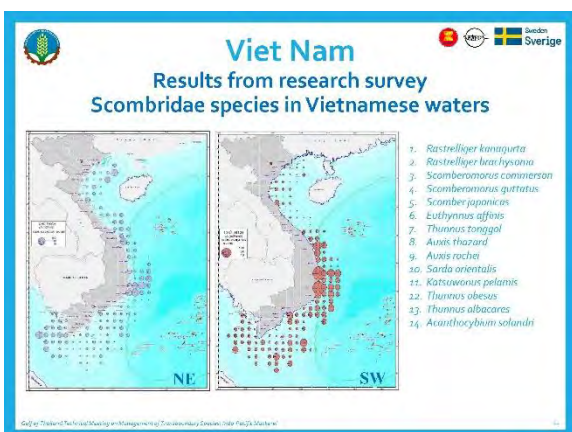
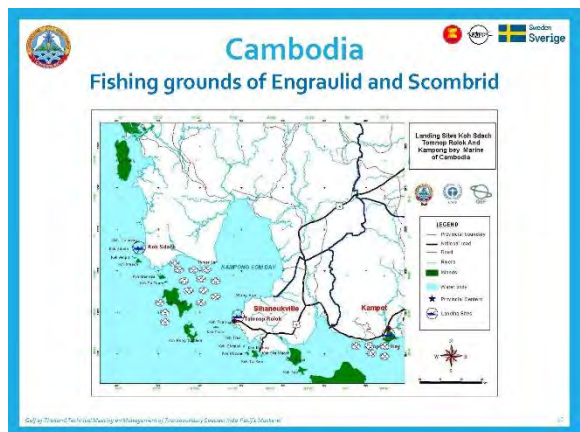
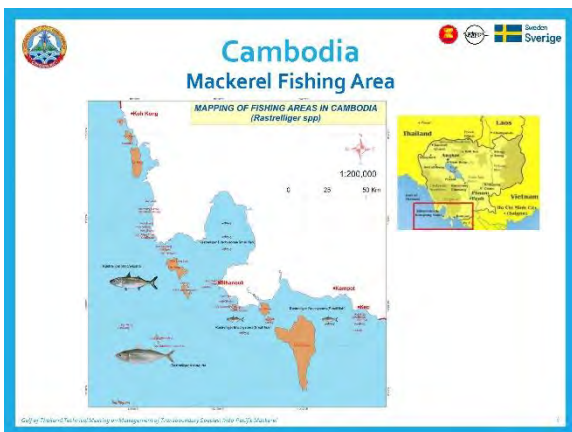
Fishing season in July

Fishing season in August



EXAMPLE OF RESOURCE MAP

The existing information from participating countries



Thailand

The Closed Area in the Central GOT

Duration : 15 Feb-15 May

"to closures of fishing area in the Gulf of Thailand with the aim of conserving spawning and nursery stages of aquatic resources"

Prachuab Kirikhun
Chumphon
Surat Thani
Nakhon Si Thammarat

© IUPAC Technical Working Group on Management of Transboundary Deep-sea Fish Stocks

Thailand

Expansion of the closing area and season in the GOT (2018)
 "to closures of fishing area in the Gulf of Thailand with the aim of conserving spawning and nursery stages of aquatic resources"

Close area 7 NM from shore for some fishing gear 16 May-14 Jun. (5,300 km²)

1. Central GOT 15 Feb.-15 May (27,000 km²)
2. Prachuap Kiri Khan bay 16 May-14 Jun. (2,900 km²)
3. Inner GOT Zone 1 15 Jun.-15 Aug. (2,350 km²)
4. Inner GOT Zone 2 1 Aug.-30 Sept. (1,650 km²)

Total closing area in the GOT (2018) 33,900 km²

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Resource Mapping for Resources management

- Geographic Distribution
- Habitats
- Fish eggs and fish larvae
- Fishing grounds
- Environmental data
- Laws and regulations
- Remote Sensing and GIS Technology

Resource Map helps us make better decision by giving us better insight into the information of the resources.

THAILAND
CAMBODIA
MYANMAR

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THANK YOU

SUB-REGIONAL DNA STUDY ON STOCK STRUCTURE OF INDO-PACIFIC MACKEREL (*RASTRELLIGER BRACHYSOMA*) (REVIEWS PREVIOUS ACTIVITIES IN RELATION TO THE GENETIC STUDY)

By Dr. Worawit Wanchana


Sub-regional DNA Study on Stock Status of Indo-Pacific Mackerel

Gulf of Thailand Technical Meeting on Management of Transboundary Species:
Indo-Pacific Mackerel
19-20 December 2018

Worawit Wanchana, SEAFDEC Secretariat

Contents

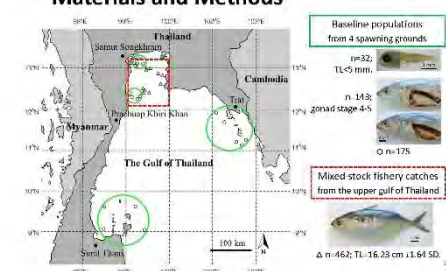
- Population Structure and Genetic Mixed-Stock Analysis of Short Mackerel (*Rastrelliger brachysoma*) Fisheries Catches in the Upper Gulf of Thailand (DoF Thailand since 2015)
- Plan of Activities Towards Development of Joint Management Plan for AIB Species in GoT (TM on Planning for Development of Stock Study for AIB Species in the GoT, Feb. 2017)
 - To assess status of AIB fisheries and its migratory pattern in GoT toward development of "joint management plan" for GoT countries
 - To facilitate the conduct of human resources development activities to enhance technical expertise of the countries with respect to the management of AIB species



Objectives

- identify populations according to spawning grounds
- identify major population contributing to fishery catches in the upper Gulf of Thailand

Materials and Methods

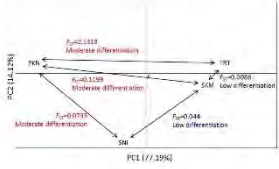


Spawning Ground	n	TL (mm)	Sex Ratio (Q)
Samut Songkhram	19	32	1.22
Prachuap Khiri Khan	143	30	1.15
Trat	175	30	1.15
Surat Thani	175	30	1.15

Mixed stock fishery catches from the upper gulf of Thailand
n = 462, TL = 16.23 cm ± 1.64 SD

Results and Discussion

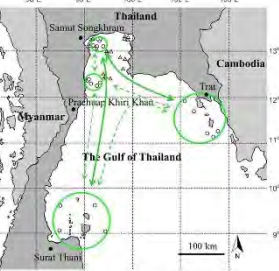
Genetic differentiation (F_{ST}) among baseline populations



SKM = Samut Songkhram
PKN = Prachuap Khiri Khan
TRT = Trat
SNI = Surat Thani

Results and Discussion

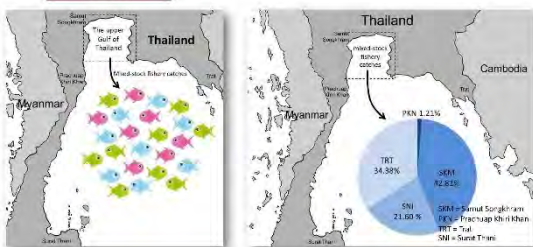
Gene flow based on F_{ST} value



High gene flow
Moderately low gene flow

Results and Discussion

Mixed-Stock Analysis (MSA)

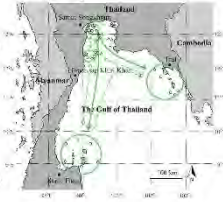


Population	Contribution (%)
TRT	34.38%
SNI	21.60%
SKM	12.21%
PKN	12.81%

SKM = Samut Songkhram
PKN = Prachuap Khiri Khan
TRT = Trat
SNI = Surat Thani

Conclusion of MSA Study for Indo-Pacific Mackerel in GoT (Thai Waters)

- Four populations are identified according to their spawning grounds.
- Samut Songkhram population is the major contributor to fishery catches in the upper gulf of Thailand.
- Trat and Surat Thani populations are the second and third large contributors and also provide gene flow to Samut Songkhram population.
- Prachuap Khiri Khan population is the smallest contributor and has low gene flow to others.
- These information is envision to assist sustainable fishery management in the upper gulf of Thailand.



Plans, Methodologies, Outputs, and Outcomes...

Activities	Outputs	Outcomes
Short-term plan (2 main activities)		
1. Conduct Genetic Mixed-Stock Analysis (2018, completed)		
Step 1: Identify major fishing ground information by countries	Inputs for designing the genetic study on AIB species	Fishing ground mapping for AIB species in GoT
Step 2: Conduct baseline population studies	Determination of number of AIB stocks in GoT	National and joint management plans for AIB species in GoT
Step 3: Conduct MSA	Determination of amount of contribution from other stocks in particular to area of study	National and joint management plans for AIB species in GoT

Plans, Methodologies, Outputs, and Outcomes...

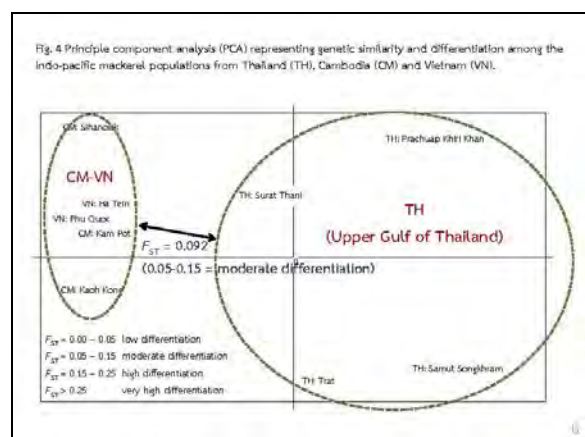
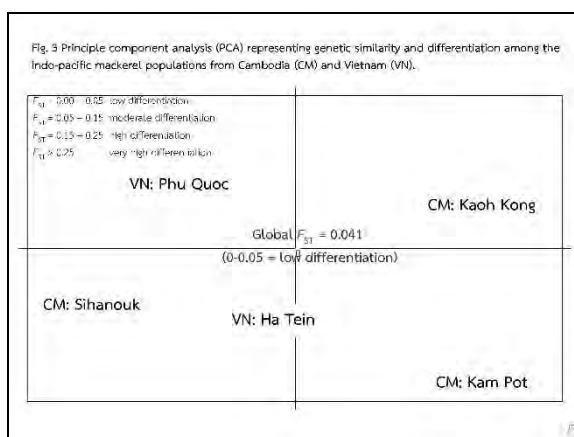
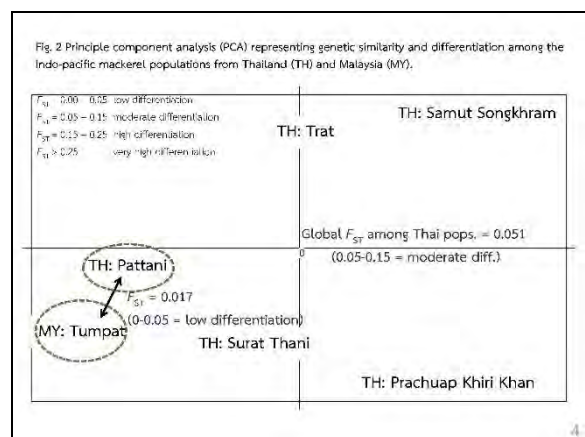
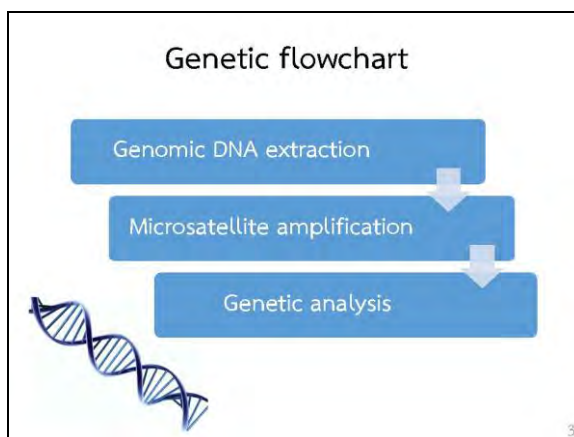
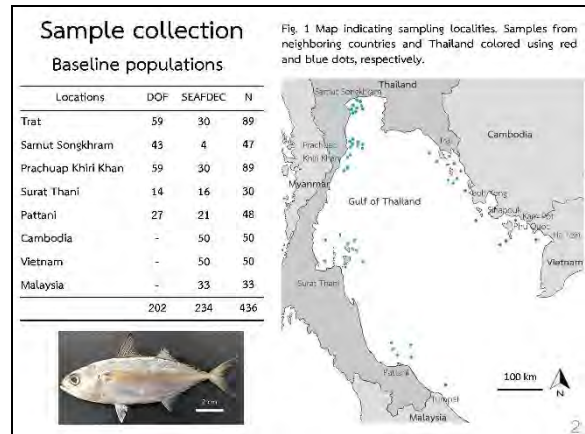
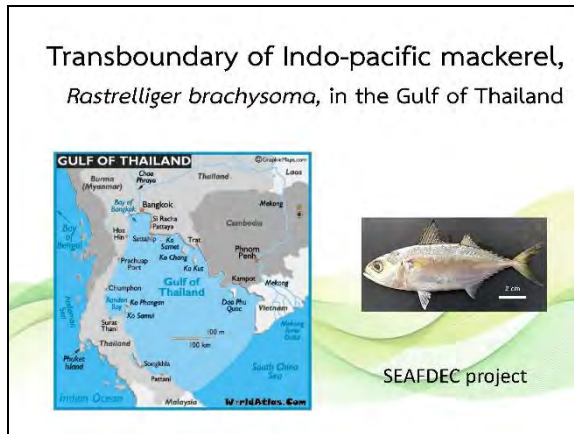
Activities	Outputs	Outcomes
Short-term plan (2 main activities)		
2. Improved Data Collection on AIB Species Using Existing SOP		
Step 1: Name the enumerators for each landing site and study area	Enumerator designated for landing sites in study areas	Harmonized regional data in GoT countries
Step 2: Train the designated enumerators	Enhanced knowledge on biological and environmental data	Improve capacity of enumerators from GoT countries for being trainers in the future
Step 3: Data collection and analysis	Updated information and data on biological and environmental aspects	National and sub-regional management plans for AIB species in GoT
Step 4: Convene meeting to discuss and validate data	Validated data for understanding stocks of AIB species in GoT	National and sub-regional management plans for AIB species in GoT

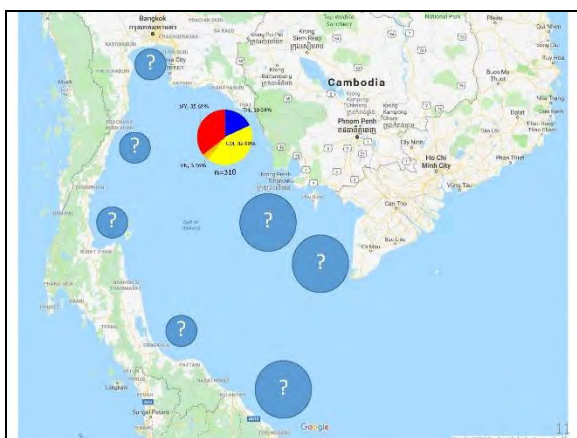
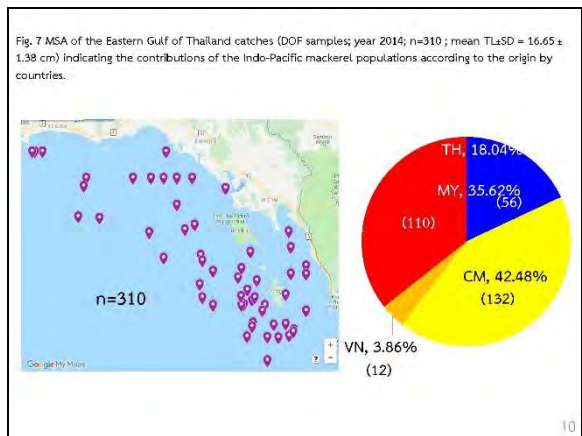
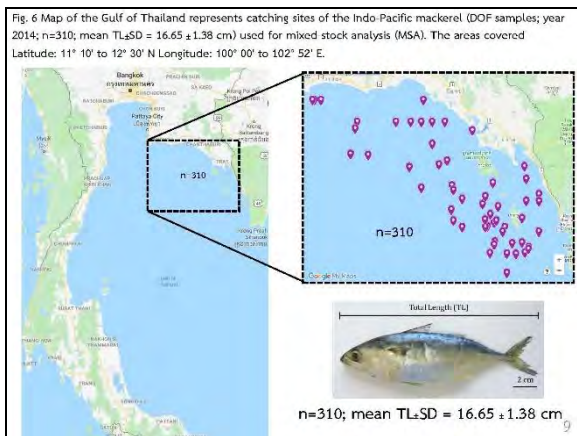
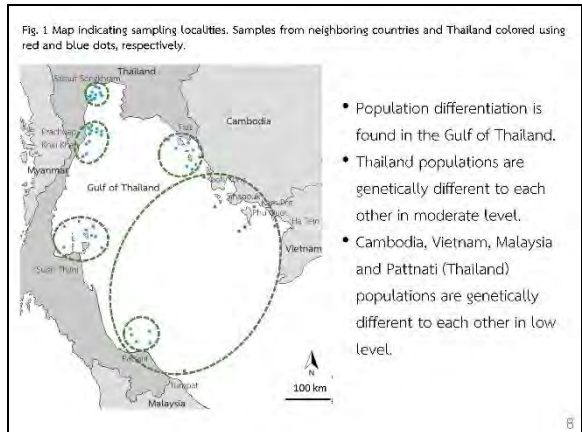
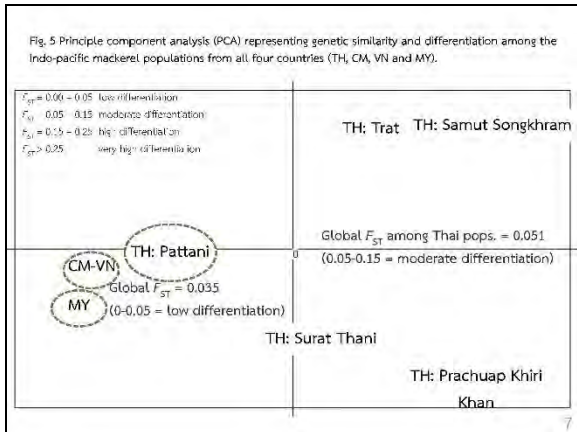
Plans, Methodologies, Outputs, and Outcomes...

Activities	Outputs	Outcomes
Medium and long-term plan		
1. Monitoring change in catch and landing		
Periodic catch and landing survey (depending on the countries)	Updated information on stock status/condition	Effectiveness of the management plans

SUB-REGIONAL DNA STUDY ON STOCK STRUCTURE OF INDO-PACIFIC MACKEREL (*RASTRELLIGER BRACHYSOMA*) (RESULT OF DNA STUDY ON STOCK STRUCTURE OF INDO-PACIFIC MACKEREL)

By Dr. Akarapong Swatdipong





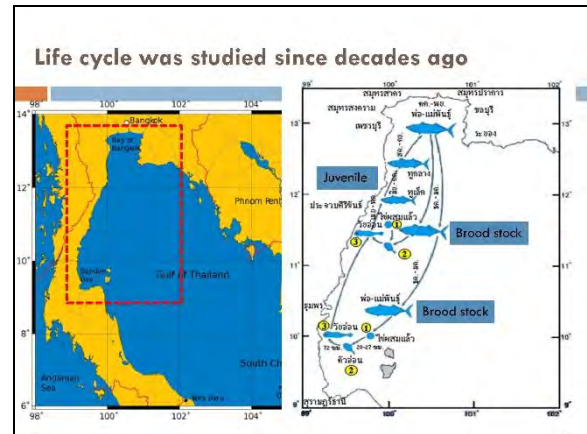
**THANK YOU
FOR YOUR ATTENTION**

RELEVANT TECHNICAL INFORMATION (SUITABLE AREAS FOR FISH LARVAE ACCORDING TO SEA SURFACE TEMPERATURE AND CHLOROPHYLL-A)

By Dr. Methee Kaewnern

Suitable areas for fish larvae
according to sea surface temperature and Chlorophyll-a

Methee Kaewnern
Faculty of Fisheries, Kasetsart University, Thailand

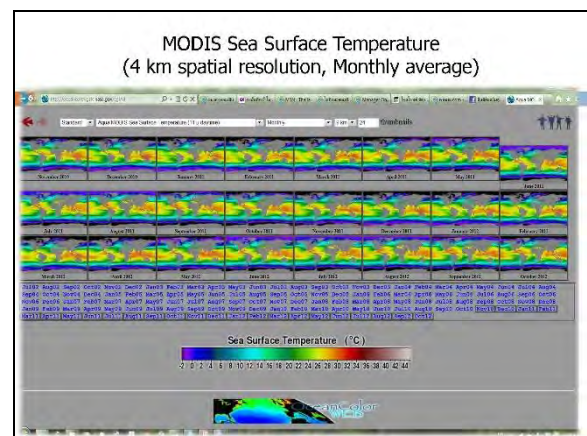
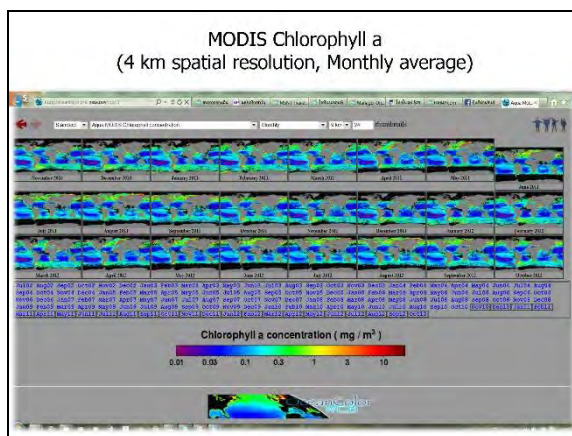


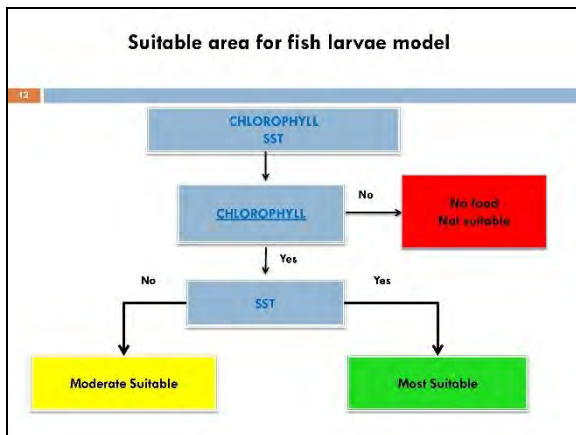
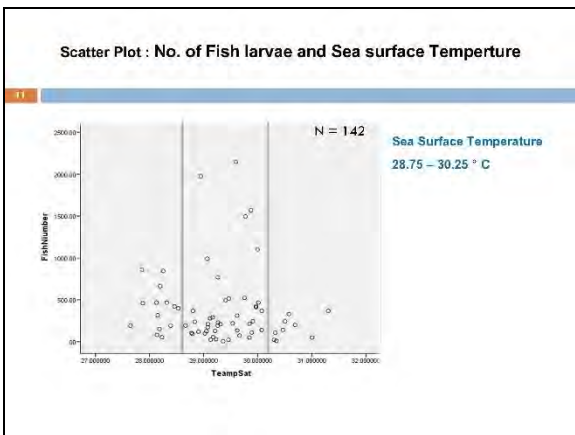
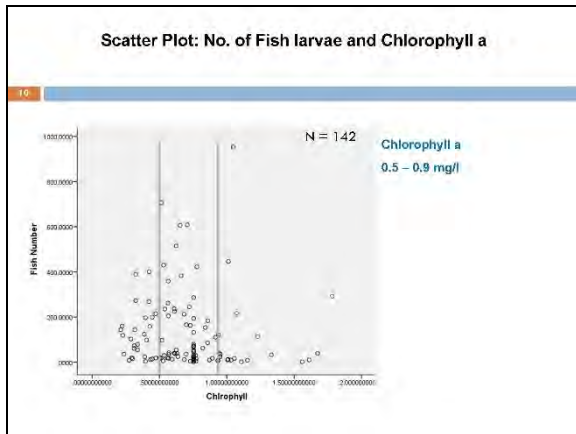
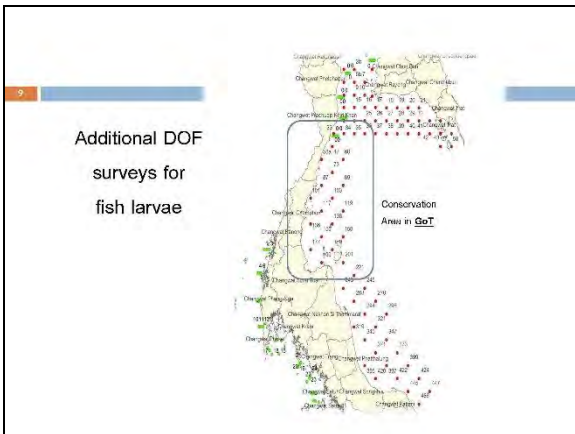
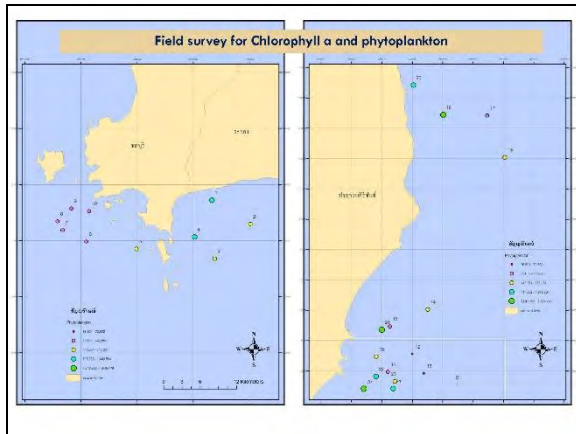
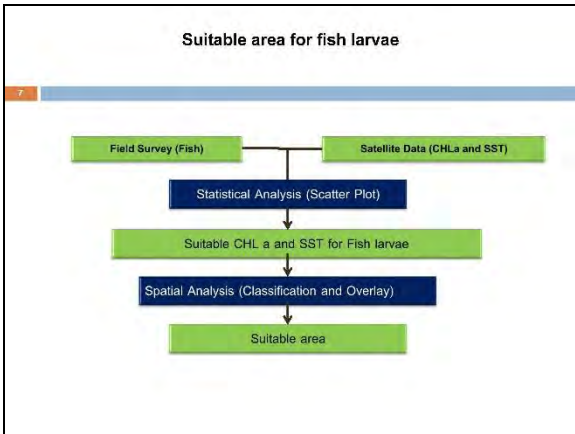
Data collection

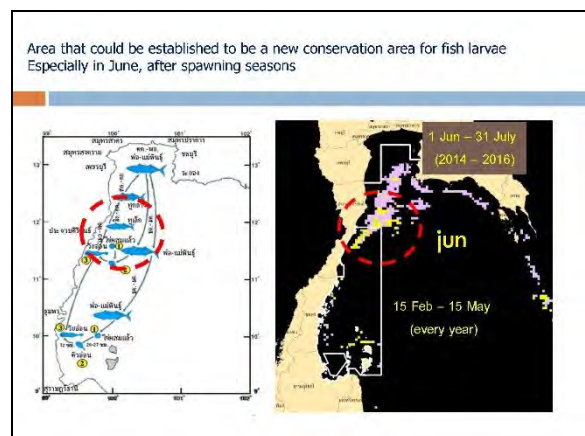
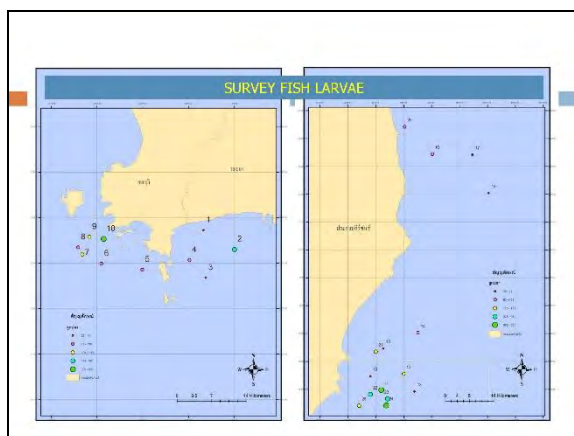
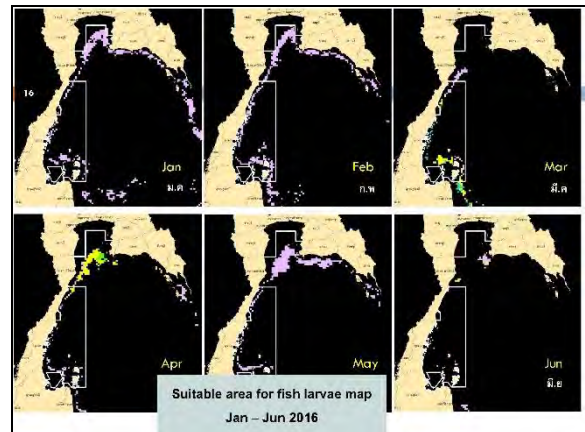
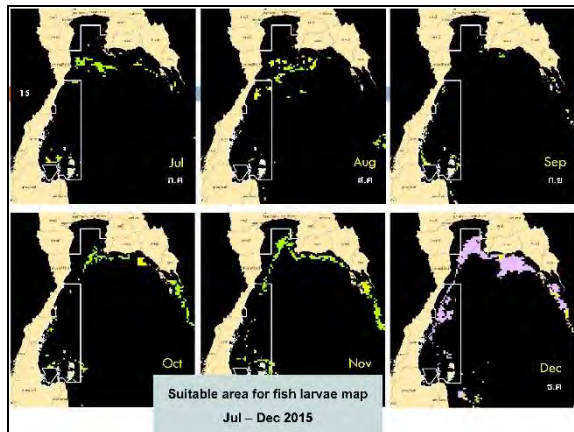
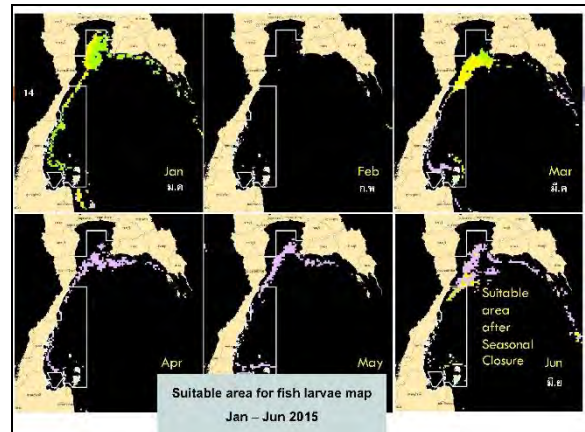
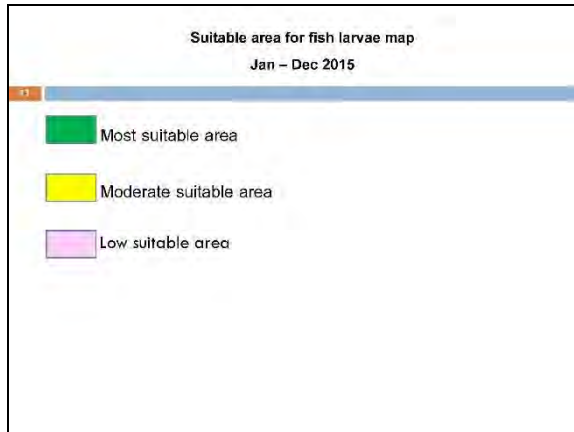
- MODIS data from Ocean Color Products of NASA (Aqua + Terra Satellite) from 2002 -2016
- Field data (Faculty of Fisheries, KU + Department of Fisheries)
- Plankton
- Sea surface, water quality
- Fish larvae

Chlorophyll-a and Sea surface temperature using satellite data

- Investigate suitable area for fish larvae
- Using MODIS data from Ocean Color Products of NASA





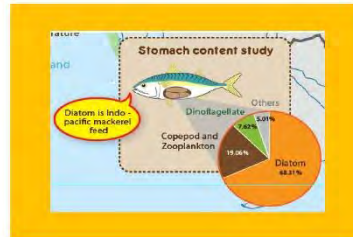


In addition, it showed that Gulf of Thailand could provide a good environment for fish larvae in October and November



Stomach content analysis

Phytoplankton is main feed of Indo-Pacific Mackerel

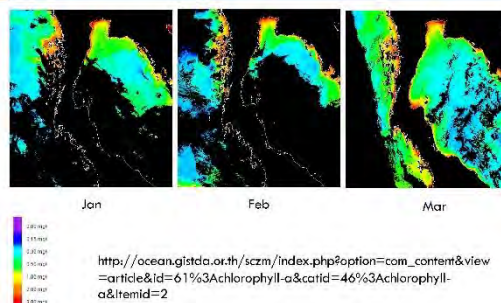


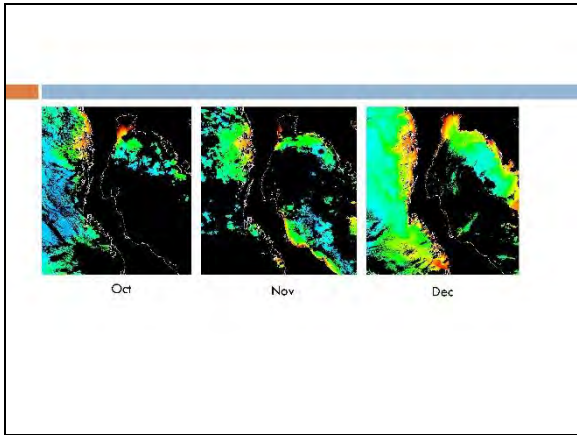
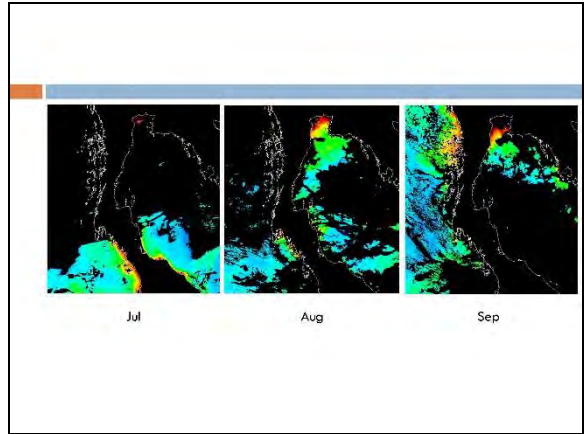
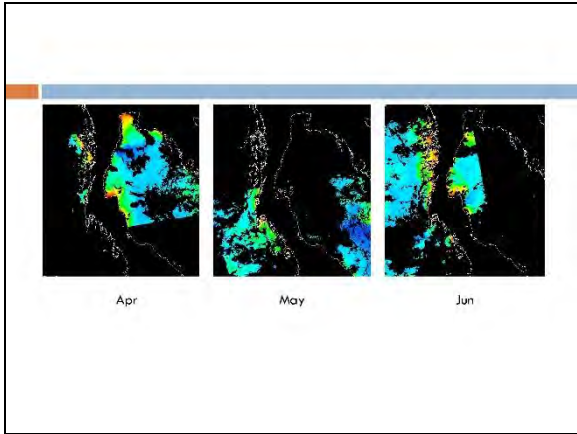
- MODIS data can be used to generate suitable area for fish larvae map.
- An area could be establish as a new conservation area especially in June due to high possibility of fish larvae appearance.
- There was positive correlation between Chl-a concentration extracted from MODIS data and amount of phytoplankton from field survey significantly.
- Meanwhile amount of phytoplankton from field survey has positive relationship with amount of fish egg found from bongo net's samples significantly.

- There was positive correlation between Chl-a concentration extracted from MODIS data and amount of phytoplankton from field survey significantly.
- Meanwhile amount of phytoplankton from field survey has positive relationship with amount of fish egg found from bongo net's samples significantly.



Chlorophyll-a 2017





RELEVANT TECHNICAL INFORMATION (A PRELIMINARY INVESTIGATION OF MARINE LARVAE TRANSPORT IN THE GULF OF THAILAND USING NUMERICAL MODEL)

By Dr. Tanuspong Pokavanich


Larval dispersion pattern

Technical Meeting on Management of Transboundary Species:
Indo-Pacific Mackerel 19-20 December 2018, Bangkok, Thailand

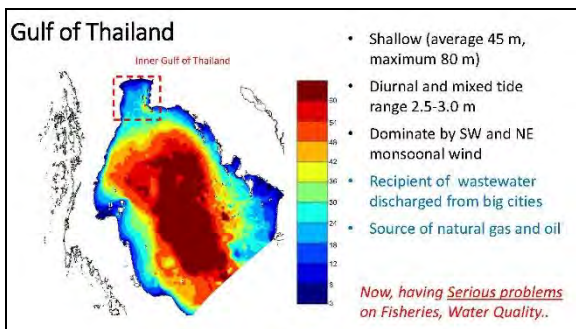
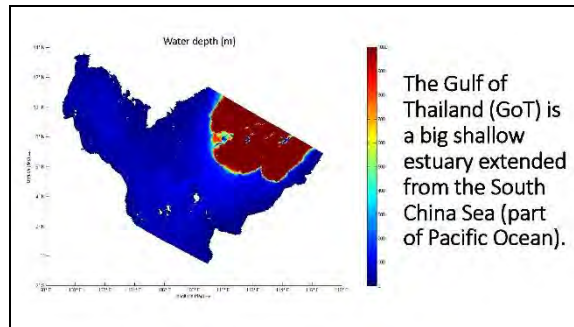
A preliminary investigation of marine larvae transport in the Gulf of Thailand using numerical model

19 Dec 2018

Dr. Tanuspong Pokavanich
Department of Marine Science
Faculty of Fisheries, Kasetsart University



Water circulation pattern

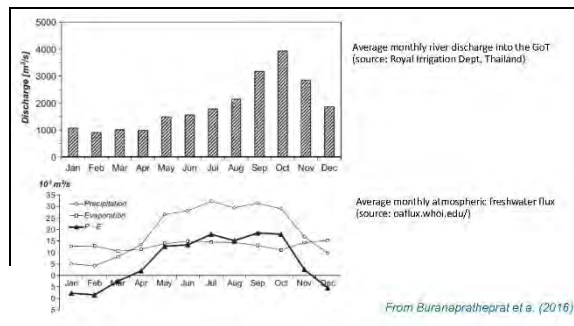
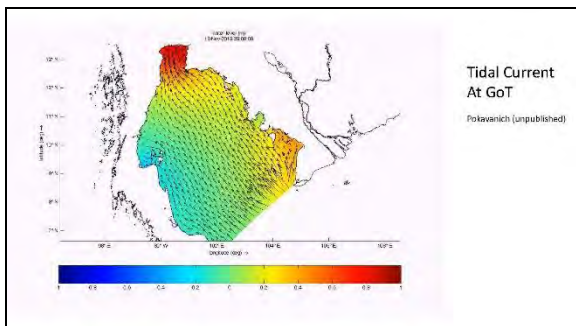
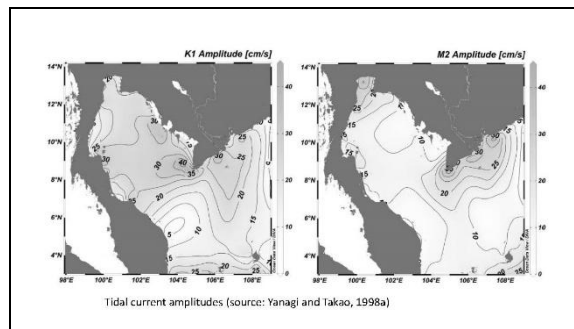
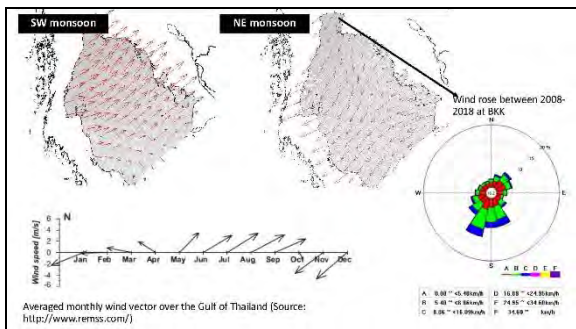


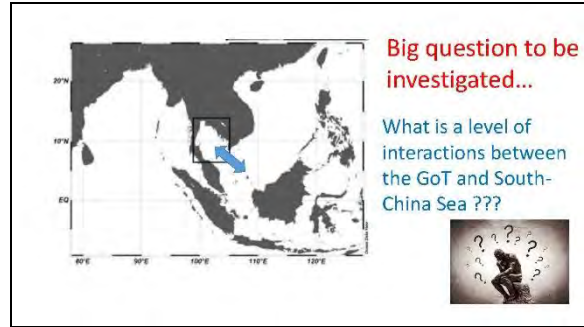
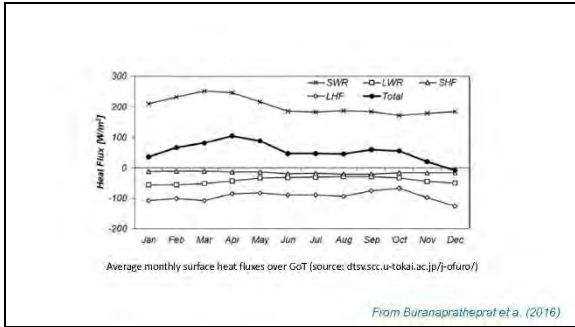
3+1 major factors that move water in the sea

1. Wind driven currents
2. Tidal driven currents
3. Themo-haline (or density driven) currents

+

1. Interactions between seas





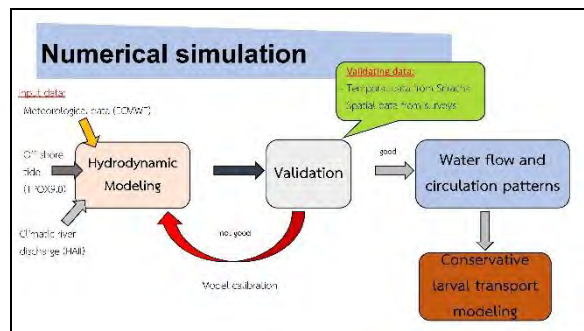
Objectives

1. Preliminary regenerate current and circulation patterns and their seasonal changes using 3D hydrodynamic model
2. Preliminary predict marine larvae transport patterns and their seasonal changes using conservative particle tracking model

Hydrodynamic Modeling

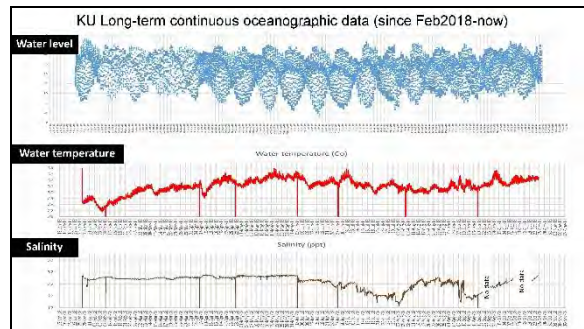
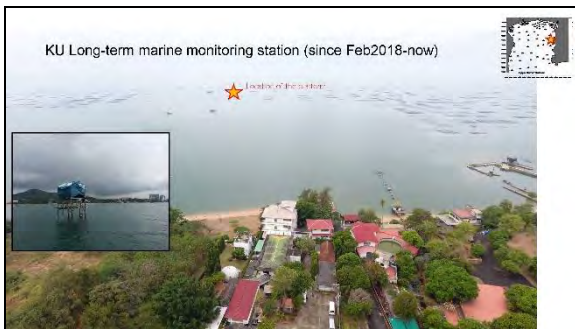
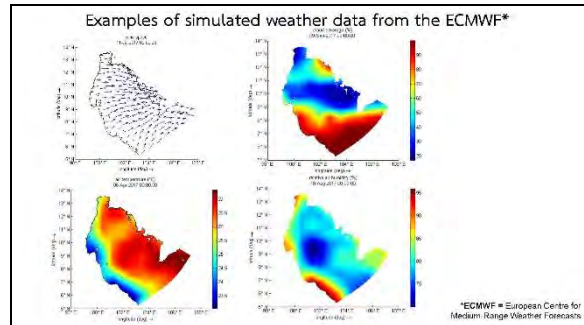
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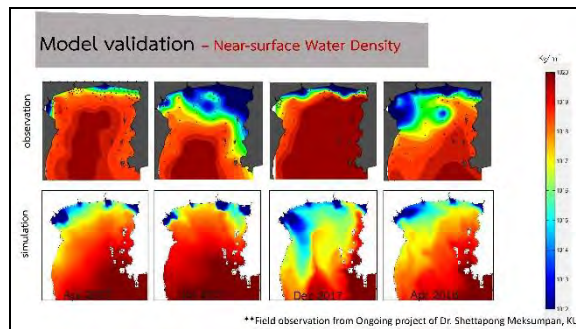
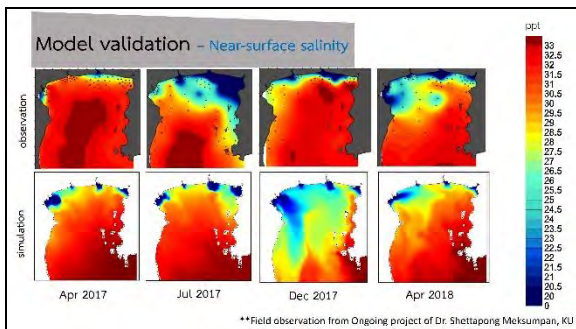
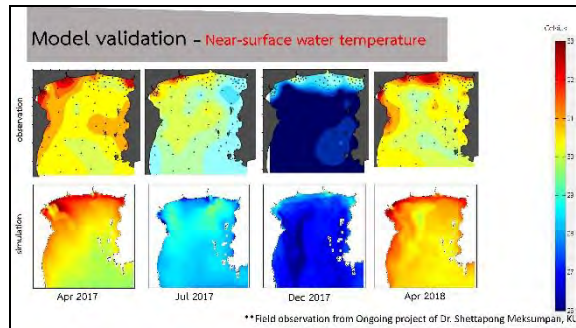
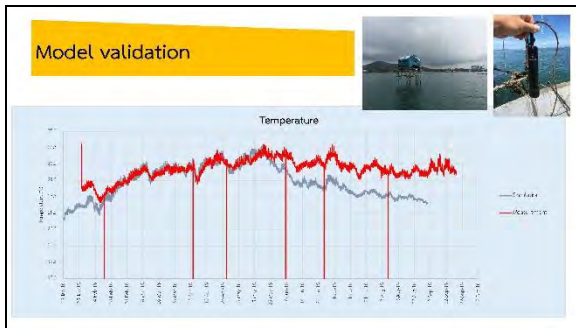
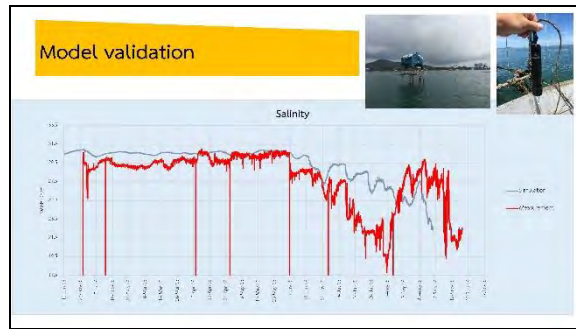
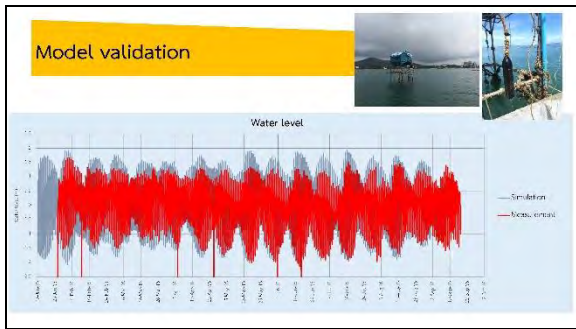
Larval transport modeling



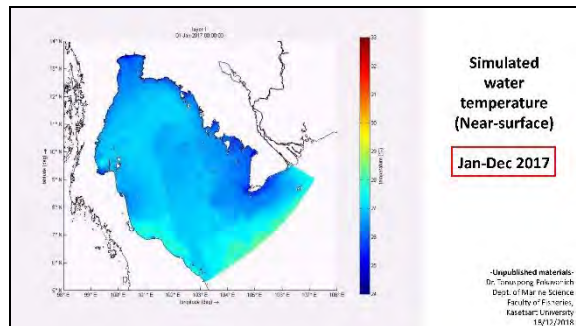
Numerical model setup

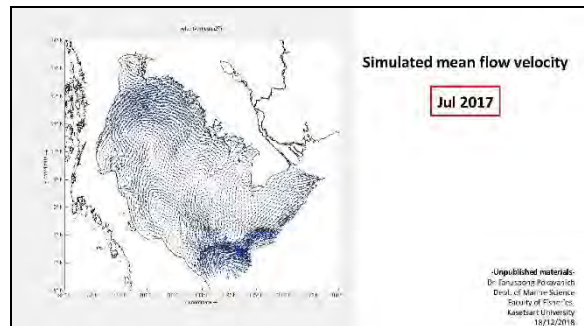
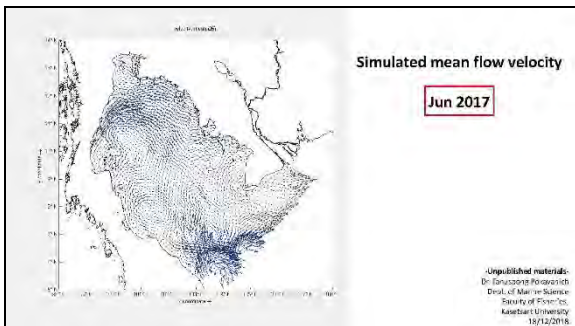
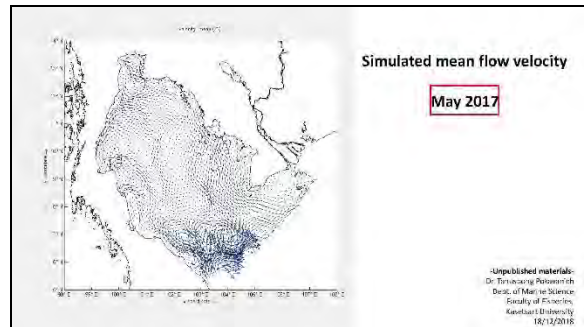
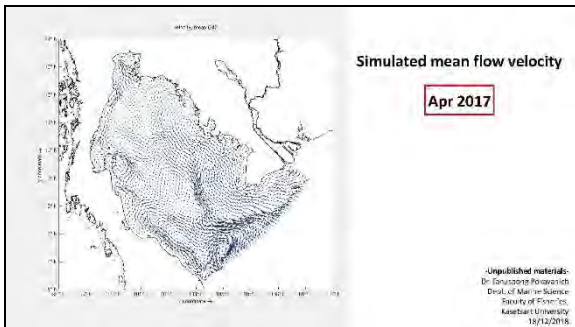
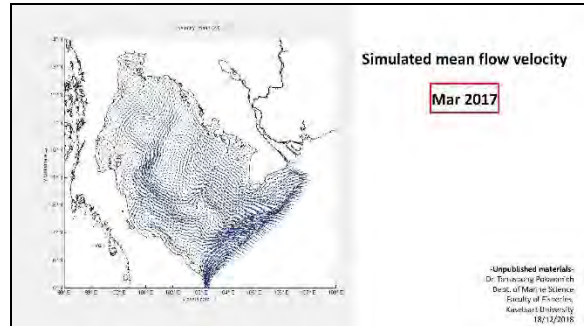
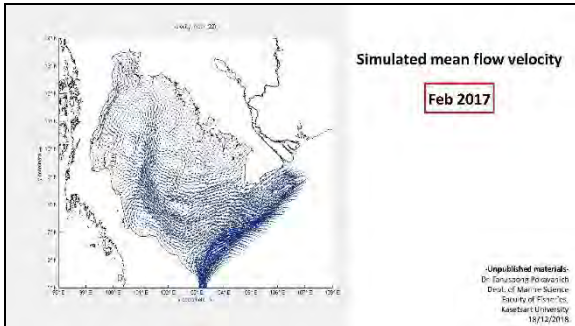
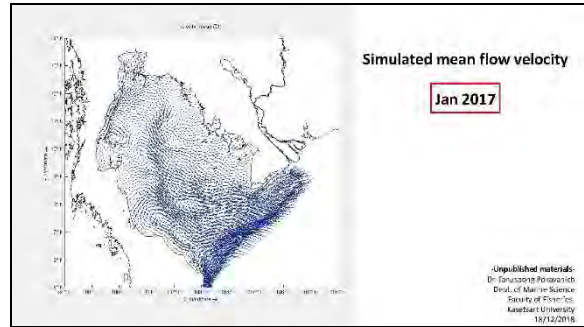
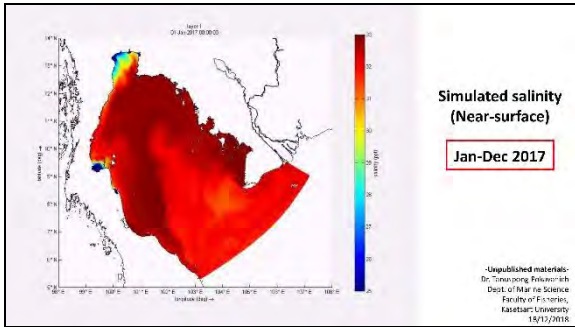
Item	InnerGoT (3D)
Sim. Period	1 Apr 2017 to 1 Sep 2018
Mesh	Curvilinear grid in spherical coordinate
No. vertical layer	10 layers
Time step	5 minute
Initial condition	Uniformly rested water at 31 ppt, 25 C° (3 years spinned up)
Bottom roughness	Cheyzy 80
Hor. eddy viscosity	10.0 m ² /s
Hor. diffusivity	20 m ² /s
Offshore boundary condition	TPXOS.0: Global Inverse Tide Model
Wind & Air pressure data, Air tem, Relative humidity, Cloud cover data	6 hourly ECMWF-ERA Interim –spatial and temporal varying data
Precipitation	12 hourly ECMWF-ERA Interim –spatial and temporal varying data

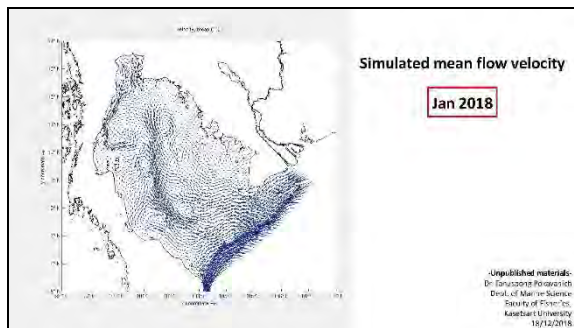
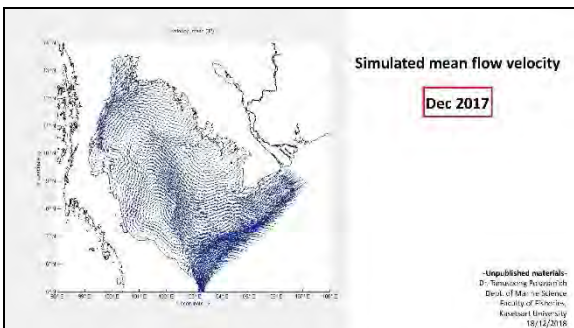
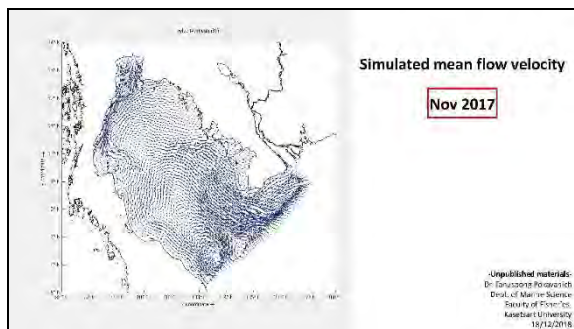
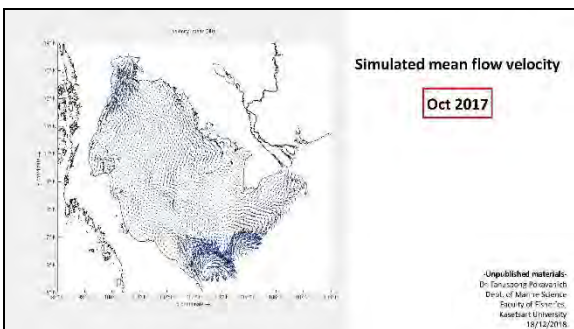
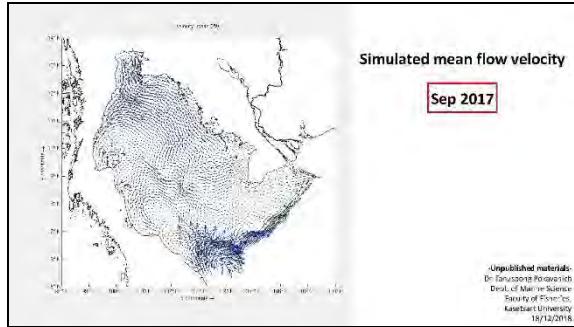
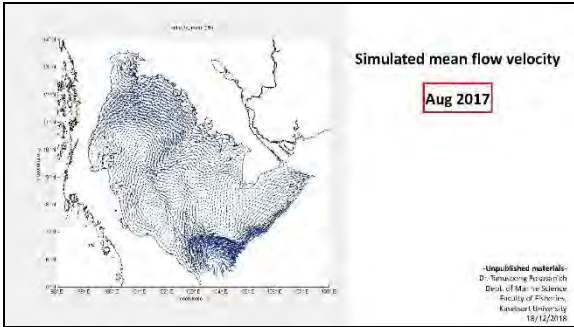




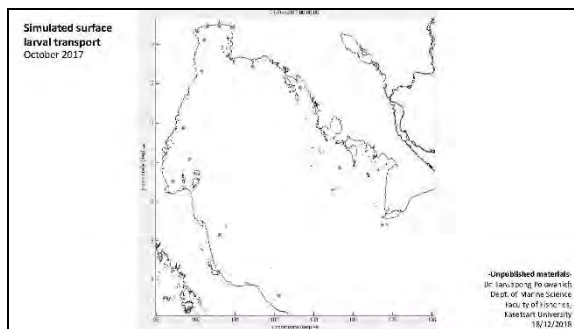
1. Preliminary hydrodynamic simulation results
(Validated only at the Inner-Gulf of Thailand)

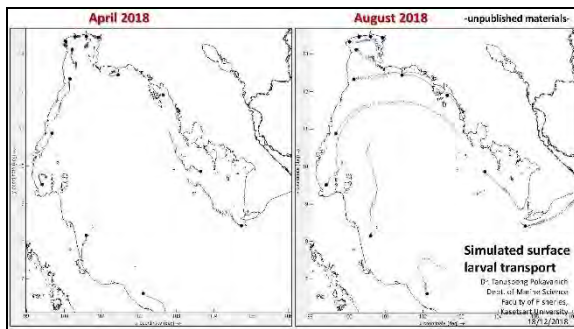
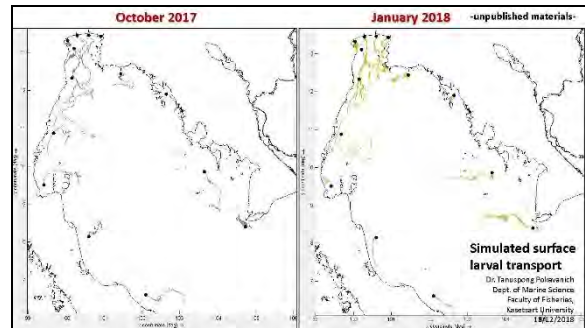
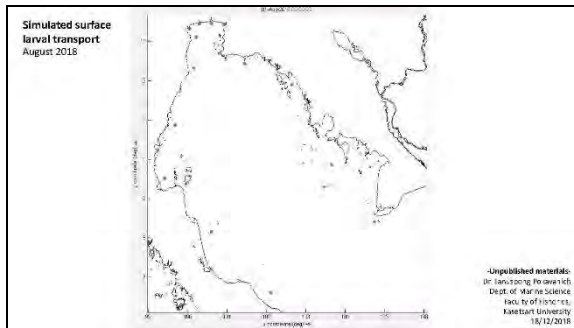
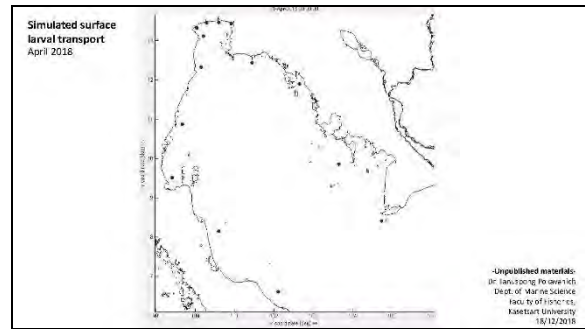
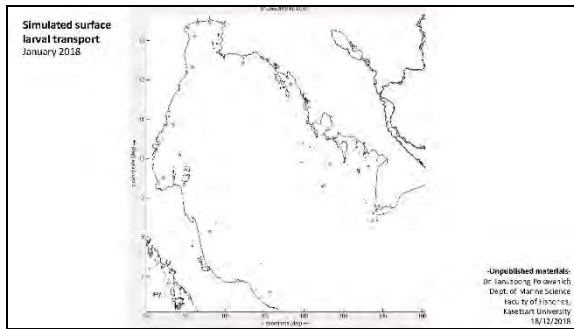






2. Preliminary conservative larval dispersal simulation
(Not yet validated)





Concluding Remarks

- We are able to study in details the hydrodynamics, water flow and circulation of the GoT using numerical modeling. However, more field observation data is needed to validate the gulf-scale model.
- The marine indo-pacific mackerel larvae dispersal can be investigate using numerical modeling technique providing a knowledge of the spawning ground and data to validate the model.
- Preliminary results show that strong variation of seasonal patterns of the larval dispersal and clearly indicate the cross- (country) boundaries of the larvae transport in the GoT.

😊 Thank you very much for your kind attention. 🧑‍🤝‍🧑

*No one can whistle a symphony.
It takes a whole orchestra to play it.*

Hilbert Lissak

Dr. Tanusong Pokavanich (MEN) NICE TO MEET YOU!!

Department of Marine Science
Faculty of Fisheries, Kasetsart University

Education

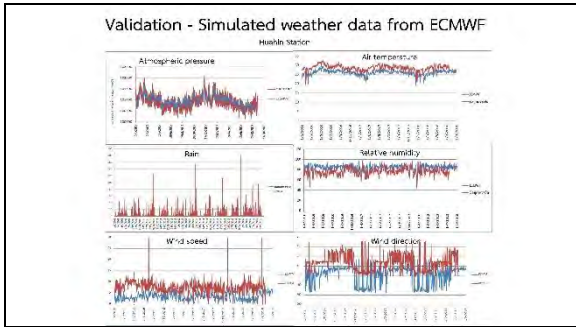
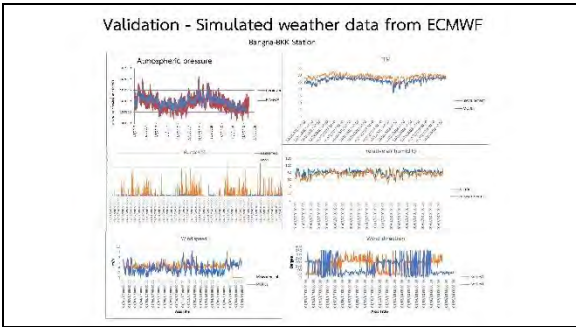
- D. Eng., Environmental, Informatics, Toyo Institute of Technology - Japan
- M. Eng., Water Engineering and Management, Asian Institute of Technology - Thailand
- B. Eng., Civil Engineering, Sirindhorn International Institute of Technology - Thammasat University - Thailand

Field of Expertise

- ✓ Coastal and estuarine processes
- ✓ Numerical modeling
- ✓ Hydrographic survey
- ✓ Coastal Engineering

Experience

- ✓ 1.5 yrs as Post-doc in ToyoTech, Japan
- ✓ 5 yrs as Assoc. Research Scientist in K.S.P, Kuwait
- ✓ 1 yr as lecturer in Kasetsart U, Thailand




DEVELOPMENT OF SUB-REGIONAL PLAN FOR MANAGING TRANSBOUNDARY SPECIES OF INDO-PACIFIC MACKEREL IN THE GULF OF THAILAND SUB-REGION (FISHING EFFORT (AND CATCH) CONTROL SYSTEM IN THAILAND: A CASE OF PELAGIC FISH)

By Dr. Pavarot Noranartragoon

Fishing effort (and catch) control system in Thailand: A case of pelagic fish

Pavarot Noranartragoon, Ph.D.
Fisheries Biologist, Head of Fisheries Resource Assessment Group
Marine Fisheries Research and Development Division
Department of Fisheries

20 December 2018



Outline

- Legal framework for fisheries resource management
- MSY assessment
- TAC determination and catch allocation
- Fishing effort control
- Constraints, opportunities and challenges for Indo-Pacific mackerel management

Legal framework

- Royal Ordinance on Fisheries 2015
- Royal Ordinance on Fisheries (No. 2) 2017
- Marine Fisheries Management Plan of Thailand 2015-2019 (FMP)
- National Plan of Action to prevent, deter, and eliminate IUU Fishing (NPOA-IUU)

❖ Approved by the Cabinet in November, 2015
❖ Published in the Thai Royal Gazette in December, 2015

Legal framework: Royal Ordinance on Fisheries

Section 24 The Fisheries Management Plan shall at least cover
(1) an approach to the issuance of fishing licenses in line with the fishing capacity and the maximum sustainable yield, using **reference points** as the basis for determination

Section 30 ... the parties concerned shall take into account the natural productivity as determined by **best scientific methods** in order to identify the **reference points** which will allow fisheries undertakings to take place in a sustainable manner...

Section 36 ... the following contents shall be specified on fishing license:

- the number and type of fishing gears authorized,
- areas in which fishing operations are to be undertaken,
- **the maximum allowable catch**,
- the number of fishing day

in alignment with the fishing capacity and the maximum sustainable yield for the purposes of sustainable fisheries

Legal framework: Fisheries Management Plan

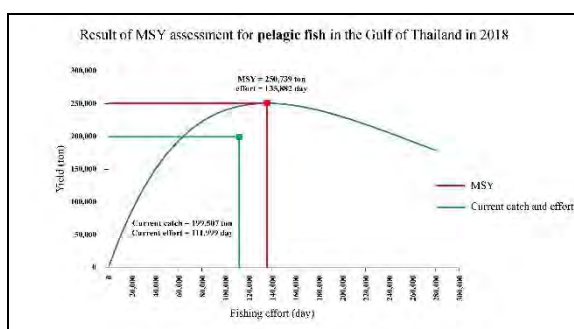


Goals:

1. Reform Thailand's marine fisheries into a limited access regime where the fishing effort is commensurate with the maximum sustainable yield (MSY);
2. Prevent, deter and eliminate IUU fishing;
3. Increase benefits for and reduce conflicts among major stakeholders;
4. Improve the marine environment; and
5. Strengthen capacity to sustainably manage the fisheries

Maximum sustainable yield (MSY)


- Currently, MSY is used as the reference point for fishing license issuance
- MSY assessment is conducted for three groups of species, i.e. demersal fish, pelagic fish, and anchovy, both in the Gulf of Thailand and Andaman Sea
- For pelagic fish in the Gulf of Thailand, 25-year catch statistical data was used for calculation
- Single species assessment for Indo-Pacific mackerel



Result of MSY assessment for Indo-Pacific mackerel in the Gulf of Thailand

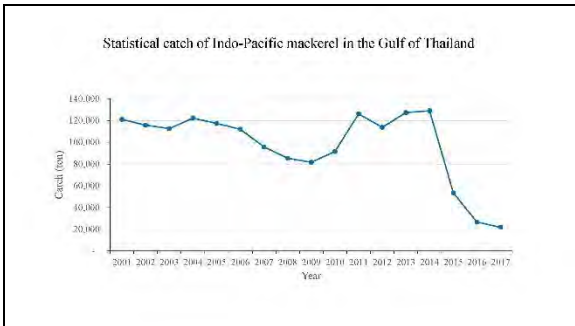
Year	Assessment method	MSY (ton)	Effort at MSY (day)	2016 Effort	Catch (ton)	F-factor	Status
2017	Surplus production model	96,455	78,680	237,679	24,328 (2016)	-	Over 66%
2017	Analytical model	26,228	-	-	24,328 (2016)	3.0	Under 200%
2018	Analytical model	24,064	-	-	19,531 (2017)	2.4	Under 140%

SPIC Software



Pass

Fail



Total allowable catch (TAC) determination and catch allocation

MSY (ton)	TAC (ton)	Catch allocation (ton)			Total allocation
		Allocated to artisanal vessels	Allocated to commercial vessels using low efficiency gear	Allocated to commercial vessels using high efficiency gear	
250,739	238,202 (95% of MSY)	6,854	21,795	197,569	226,018

1,122 Artisanal vessels : No control of fishing day
 917 Commercial vessels using low efficiency gear : No control of fishing day
 631 Commercial vessels using high efficiency gear : 240 day/year

Commercial fishing license

หมายเลขใบอนุญาต: [Redacted]

เครื่องหมายประจำเรือ: [Redacted]

ชื่อเอกสาร: Commercial fishing license

ประเภทใบอนุญาต: [Redacted]

เลขที่ใบอนุญาต: R161770310129

วันที่ออก: 09/02/2561

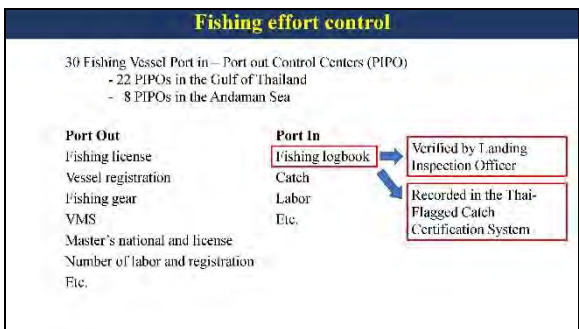
มีผลใช้บังคับถึง: 09/02/2561

หมดอายุ: 09/02/2561

พื้นที่ประมง: Gulf of Thailand

จำนวนวันประมงต่อปี: 240 วัน/ปี

TAC: 728,440.00



Logbook (type 2)

Port Out

ชื่อเรือ: [Redacted]

วันที่ออกใบ: [Redacted]

พื้นที่ประมง: [Redacted]

ชนิดของเครื่องมือประมง: [Redacted]

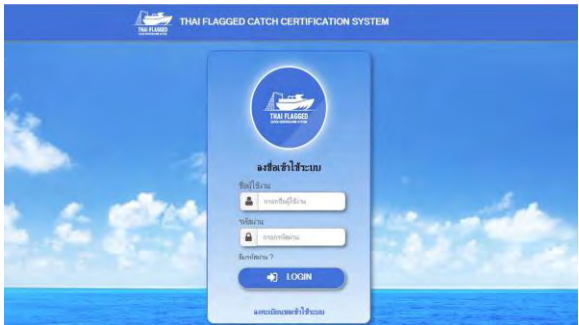
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ชนิดของเครื่องมือประมง: [Redacted]

ชนิดของสัตว์น้ำ: [Redacted]



- ### Constraints
- Although amount of catch allocation is specified in each fishing license, catch is not controlled.
 - In stead of catch, fishing effort is controlled.
 - Thai-Flagged Catch Certification System is designed for traceability system. Recording process may be delayed

- ### Opportunities and challenges
- Current management system
 - Individual catch transfer implemented
 - Tropical multi-species fishery
 - Species-specific TAC
 - Catch target might be achieved without catch → Discard

**DEVELOPMENT OF SUB-REGIONAL PLAN FOR MANAGING TRANSBOUNDARY SPECIES
OF INDO-PACIFIC MACKEREL IN THE GULF OF THAILAND SUB-REGION
(PLENARY DISCUSSION)**

By Dr. Worawit Wanchana

Discussion for Conclusion

1. Major findings from DNA study on population/stock structure of Indo-Pacific mackerel
 - Population differentiation is found in the Gulf of Thailand
 - Thailand populations are genetically different to each other in moderate level
 - Cambodia, Viet Nam, Malaysia and Pattani populations are genetically different to each other in low level
 - Mixed-stock analysis in Trat fishing areas revealed resources of Indo-Pacific mackerel are sharing among the GOT countries
 - Indo-Pacific mackerel larval dispersal can be investigated using numerical modeling technique providing knowledge of the spawning ground and data to validate the model
 - Preliminary results show that strong variation of seasonal patterns of the larval dispersal and clearly indicate the cross-(country) boundaries of the larvae transport in the Gulf of Thailand
2. Key factors that influence migration and population movements
 - Nutrient (e.g. chlorophyll-a)
 - Tidal current (diurnal, monsoon) → larval transport, migration route (s)
 - Fishing activities
 - Sea surface temperature
3. Elements required for resource mapping development for management purpose
 - Nursery ground
 - Spawning ground (hotspot of larvae/egg)
 - Fishing ground
 - Fishing efforts (no. of vessels, fishing license, quota, fishing days, CPUE, etc.)

CONCLUSION AND WAYS FORWARD

By *Dr. Worawit Wanchana*

1. What do we know/have and don't about this species ?

Topics	C	M	T	V
Biology				
- Size at first maturity	*	Y	Y	Y
- Size range of capture (depending on fishing gear)	*	Y	Y	
- Spawning ground (hotspot for larvae)			Y	
- Eggs and larvae abundance			Y	
- Migration routes (life cycle)			Y	
Fishing efforts and management measures				
- No. of fishing vessels catching IPM			Y	*
- Fishing ground of each fishing gear catching IPM		Y	Y	
- Fishing gear restriction			Y	
- Fishing season closure	Y		Y	
Other important factors influencing the movement/migration of eggs, larvae, pre-mature, post-mature				
- Simulated mean flow velocity (not validate)			Y	
- Simulated larvae transport (not validated)			Y	
- Tidal current (diurnal, monsoon season- validated)	Y	Y	Y	Y
- Chlorophyll-A	Y	Y	Y	Y
- Sea surface temperature	Y	Y	Y	Y

2. Recommendations, follow-up actions/needs towards development of the sub-regional transboundary species management plan: Indo-Pacific mackerel

National level

Recommendations	Follow-up actions/needs
Cambodia	
1. Carry out research	Study on biology throughout the coastline
2. Closing area	Establish closing area near Thai and Viet Nam borders based on the research results
3. Unclear transboundary	Carry out genetic and fishery stock structure to

resource of IPM between Cambodia and Viet Nam	understand...
Viet Nam	
1. Fishing vessel	know no. of fishing vessels catching IPM
2. Landing of IPM by type of fishing gear	- know total landing of IPM - species differentiation between <i>R. brachysoma</i> and <i>R. kanagurta</i> of small size (consult Dr. Sommai)
3. Spawning ground	Hotspot of eggs and larvae and logbook (refer to survey result conducted by MV SEAFDEC 2)
4. Stock assessment	Carry out survey to understand
5. Life cycle and closing area (s)	- Larvae species identification techniques - Juvenile species identification techniques
Malaysia	
	(same as Cambodia and Viet Nam)
Fishing gear specification among the GOT countries	Conduct training on fishing gear specification
Thailand	
Increase no of specimen for Surat Thani	(in addition to that 30 samples)
MSA for Pattani population	
Integration or information for policy formulation	

Sub-regional level

Recommendations	Follow-up actions/needs
MSA study in Cambodia, Malaysia, and Viet Nam	Fishery <i>refugia</i> project to be consulted with RSWG for accommodating in their work plan of activity (Cambodia and Viet Nam)
Monitor the change of tidal, sea surface temperature	Consult with the countries the possibility to install data logger in safe place of the participating countries, or to have collaboration research with academic
Monitor larvae transport	(same as above)
Simulation of chlorophyll-a, current, temperature, etc.	To coordinate and collaborate with the countries (Fishery <i>refugia</i> project)
Biological and physical study in the GOT	To follow-up with SWG physical oceanography and larvae expert (JTF project)
Stock assessment	- To conduct stock assessment through existing SWG (ASEAN-SEAFDEC) - Procedures: (1) conduct population stock in the GOT; (2) total landing; (3) MSA; and (4) prioritization of the most important genetic stock
Establishment of database	- All important data/information for management - Establish IPM specialist group