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REPORT ON THE REGIONAL CAPACITY BUILDING NETWORK (RECAB) 2024: REGIONAL TRAINING COURSE ON BASIC STOCK ASSESSMENT FOR MARINE FISHERY RESOURCES IN THE SOUTHEAST ASIA

17 – 24 September 2024

SEAFDEC/MFRDMD, Kuala Terengganu, Malaysia

Report on the Regional Capacity Building Network (RECAB) 2024: Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia

SEAFDEC/MFRDMD, Kuala Terengganu, Malaysia
17 – 24 September 2024

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TABLE OF CONTENT

ACRONYM

AMS	ASEAN Member States
ASEAN	Association of South East Asian Nations
DOF	Department of Fisheries
FISAT	FAO-ICLARM Stock Assessment Tools
FRI	Fisheries Research Institute
JTF	Japan Trust Fund
LKIM	Lembaga Kemajuan Ikan Malaysia
MFRDMD	Marine Fishery Resources Development and Management Department
MLE	Maximum Likelihood Estimator
MSY	Maximum Sustainable Yield
OSLA	Ordinary Least Square Analysis
RECAB	Regional Capacity Building Network
SEAFDEC	Southeast Asian Fisheries Development Center
SEAFISH	Southeast Asia Fisheries Partnership
SPM	Surplus Production Model
TD	Training Department
VBGF	Von Bertalanffy's Growth Function

**Report on the Regional Capacity Building Network (RECAB) 2024:
Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia
17 – 24 September 2024
SEAFDEC/MFRDMD, Kuala Terengganu, Malaysia**

I. OPENING SESSION

1. The "Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia" under the Regional Capacity Building Network (RECAB), was organized from 17 to 24 September 2024 in Kuala Terengganu, Malaysia. The course was attended by 24 participants, including representatives from SEAFDEC Member Countries, namely Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Viet Nam, resource persons from Malaysia and Thailand; the Chief, Deputy Chief, and officials from SEAFDEC/MFRDMD. The list of participants appears as **Annex 1**.

2. The training course was officiated by the Chief of SEAFDEC/MFRDMD, *Mr. Abd Haris Hilmi Ahmad Arshad*. In his welcoming remarks, he welcomed all participants and expressed his gratitude for their dedication to attend the training. His welcoming remarks appear as **Annex 2**.

3. The Deputy Secretary-General of SEAFDEC and Japanese Trust Fund Manager, *Dr. Tomoko Nakazato*, delivered the opening address, expressing her sincere gratitude to all participants and SEAFDEC/MFRDMD officials who made the training possible. She highlighted that the RECAB initiative aims to establish a network among Member Countries on specific subjects and provide technical assistance through SEAFDEC's Technical Departments. *Dr. Nakazato* also hoped all participants would return to their home countries with valuable knowledge and experiences to support the sustainable development of fisheries through stock assessment works. Her opening address appears as **Annex 3**.

II. INTRODUCTION

4. The Senior Policy Officer from the SEAFDEC Secretariat, *Ms. Pattaratjit Kaewnuratchadasorn*, delivered the 'Introduction to RECAB Program'. She briefly introduced the RECAB program approved by the SEAFDEC Council in 2021. The RECAB is a part of the Japanese Trust Fund (JTF) project "Assistance for Capacity Development in the Region to Address International Fish Trade Related Issues" under the ASEAN-SEAFDEC Strategic Partnership mechanism. The courses offer technical knowledge based on the expertise of the SEAFDEC department and enhance regional cooperation and network among the AMSs on the subject (fisheries and aquaculture). Starting in 2022 until 2024, the course program will be designed and hosted by the Department in collaboration with the SEAFDEC Secretariat. Her presentation appears as **Annex 4**.

5. The Program Coordinator, *Ms. Mazalina Ali*, presented the 'Introduction to the Training Course', in which she introduced the course curriculum and the objectives of the training course (**Annex 5**). The training objectives are to share information on the current status of fisheries of the Member Countries, to equip the participants with the knowledge and skills, to enhance capacity in basic stock assessments, and to foster the network among participants and with SEAFDEC for future communication and cooperation in stock assessment. She also shared the prospectus and agenda (**Annex 6**) and the course timetable (**Annex 7**).

III. COUNTRY PRESENTATION ON THE CURRENT STATUS OF FISHERIES AND STOCK ASSESSMENT METHODS

6. The AMS representatives presented the current status of the fisheries and stock assessment in each AMS in the Southeast Asia region. The presentation included an overview of country marine fisheries, the trend of landing and CPUE by index of efforts for the last 20 years. Besides that, the current and previous stock status and the stock assessment studies conducted, fishery management, problems and constraints as well as suggestions and conclusions. The list of presenters as follows:

Brunei Darussalam by *Mr. Muhammad Azizi Mahali* (**Annex 8**)
Cambodia by *Dr. Chea Tharith* (**Annex 9**)
Indonesia by *Mr. Roy Kurniawan* (**Annex 10**)
Japan by *Ms. Kuwahara Nagisa* (**Annex 11**)
Malaysia by *Mr. Mohd. Hariz Ab. Halim* (**Annex 12**)
Myanmar by *Mr. Min Khaing* (**Annex 13**)
Philippines by *Ms. Sheryll V. Mesa* (**Annex 14**)
Thailand by *Mr. Tossapol Ruangwattanakul* (**Annex 15**)
Viet Nam by *Mr. Cao Van Hung* (**Annex 16**)

IV. FISHERIES BIOLOGY AND BIOSTATISTICS

7. *Dr. Supapong Pattarapongpan*, a resource person from TD, delivered his presentation covering two (2) topics: 'Fisheries Biology' and 'Biostatistics.' He explained that fishery biology is the body of organized knowledge regarding the natural supply of fish commercially exploited and the variation in the supply. He also added that fishery biology combines the main aspects such as biology, genetics, and the life history of various species of fish, which involves the relationship between environment (inc. ecology) and management.

8. He also explains about statistics that can be used in stock assessment. Statistics is the way to manipulate the data mathematically and extract the information from it. Statistics can be divided into two meanings, which are statistical data and statistical methods. There are four categories in statistical data which are nominal scale, ordinal scale, interval scale and ratio scale. While the statistical method is divided into two groups (descriptive and inferential statistics) depending on the availability and condition of data.

9. He concluded that the vital part of fisheries assessment is the data distribution analysis, i.e., a reliable data set. Therefore, selecting the most appropriate method for the data condition and result expectation is very important. His presentation appears as **Annex 17**.

10. He also facilitated the exercise on inferential statistics, which includes testing hypothesis and analysis of variance. Each participant was actively involved and responded positively throughout the exercise, showing great enthusiasm and eagerness to contribute.

11. Resource person from the University of Kasetsart, *Assoc. Prof. Dr. Thanita Darbanandhana* delivered her teaching on Regression Analysis. Regression analyzes the relationship among variables. It helps determine the strength, direction, and nature of the relationship, which can be used for prediction, forecasting, and understanding underlying patterns. Along the presentation, she and *Dr. Supapong* facilitated an exercise to estimate value of a and b by two (2) methods which are Ordinary Least Square Analysis (OLSA) and Maximum Likelihood Estimator-MLE (by Solver in Excel and R program). Her presentation appears as **Annex 18**.

12. *Dr. Thanita* second presentation was on Growth Theory, in which she elaborated on several factors controlling population, which are recruitment, reproduction, natural mortality and fishing mortality. The Growth Model analyzed the relationship between length/weight (x-axis) and age/time (y-axis). She also explained the well-known Von Bertalanffy's Growth Function (VBGF).

13. VBGF is a mathematical model in fisheries science and biology to describe the growth of an organism (e.g., fish, mollusks) over time. It represents how the length of an individual increases with age and is particularly useful for studying fish populations. Her presentation appears as **Annex 19**.

14. *Dr. Thanitha*'s third presentation was on Reproductive Biology (Sex Ratio & Maturity). She explained and coordinated the exercise on fish sex ratio by using the monthly data provided. The output of the analysis shows the number of male fish compared to female fish in a habitat. Her presentation appears as **Annex 20**.

15. The next topic was Basic Sampling Theory; *Dr. Thanitha* explained the purpose of sampling, which represents the fraction of actual data on a particular area or subject. In addition, she described the data sampling anomaly, which includes precision and accuracy.

16. Sampling precision refers to how consistently sample results reflect the actual population value. It indicates the variability in repeated sampling, whereas higher precision means consistent estimates and lower precision means more significant variation between samples. Precision will be increased as sample size increases and variable decreases. Meanwhile, sampling accuracy refers to how close the results of a sample are to the actual population value. It measures the correctness of the sample estimate, indicating how well the sample represents the entire population. Her presentation appears as **Annex 21**.

17. *Dr. Thanita*'s final presentation was on 'Ageing of Fish'. She explained how to determine the age of marine aquatic life by using solid body parts such as otolith, statolith, scale, operculum, shell, cleitrum, vertebrae and spine. Her presentation appears as **Annex 22**.

STUDY TRIP TO KUANTAN LANDING PORT

18. All participants joined the study trip to Kuantan, Pahang, to visit the fish landing port of the Malaysia Fisheries Development Authority (Lembaga Kemajuan Ikan Malaysia - LKIM). During the trip, they observed the landing and sorting process of various fish species, including small pelagic and neritic tuna. The group also interacted with local fishers to gain insights into their fishing practices, gear types, and seasonal challenges.

19. Additionally, the participants attended a briefing by the port authorities, highlighting the port's role in ensuring sustainable fisheries management and compliance with regulations. They also visited several tourist attractions, such as the Kuantan Tower (Menara 188) and the Natural Batik Village, where they enjoyed exploring the local culture and craftsmanship. The travel itinerary of the study trip appears as **Annex 23**.

V. POPULATION DYNAMICS AND STOCK ASSESSMENT

20. The resource person from the Fisheries Research Institute (FRI) Kampung Acheh, Department of Fisheries (DOF) Malaysia, *Mr. Sallehudin Jamon,* delivered his presentation on 'Introduction to Fish Stock Assessment'. He emphasized that stock assessment is the process of collecting and analyzing data on fish populations to determine their size, health, and dynamics with the primary goal of understanding the status of fish populations and their ability to sustain fishing pressure. The fish stock assessment provides the scientific data necessary for effective fisheries management, which involves the application of the data to create regulations and practices aimed at sustainable fishery resources. His presentation appears as **Annex 24**.

21. The resource person from FRI Rantau Abang, DOF Malaysia, *Mr. Sharum Yusof,* presented 'Introduction to Fishing Gear and Fishing Gear Selectivity'. He started by explaining the zoning system, marine fisheries profiles, and landings by fishing gear in Malaysian waters.

22. He elaborated on the classification of fishing gear based on components and specifications of commonly used fishing gear for fisheries operations targeting the selected fish group. He also mentioned that the effectiveness of fishing gear depends on how well one understands a particular fishing system. His presentation appears as **Annex 25**.

23. The resource person, *Mr. Raja Bidin Raja Hassan*, former Chief of MFRDMD, delivered his presentation on 'Introduction to Fisheries Acoustic Survey'. He stated that the fisheries acoustic method is probably the most essential application for measuring fish abundance, particularly in stock assessment of pelagic species. Acoustic technology is widely used to estimate fish abundance by employing sound waves to detect and measure fish abundance in water.

24. Echo sounder devices send sound pulses into the water, which are reflected back to the echoes receiver when encountering fish or other objects. The strength and timing of these fish echoes help determine the number, size, and distribution of fish that can be analyzed quantitively using echo analysis software such as Echoview. This method is highly effective for large-scale surveys, providing accurate and non-invasive assessments crucial for sustainable fisheries management. His presentation appears as **Annex 26**.

25. *Mr. Sallehudin* briefly introduced the 'Demersal Fish Survey.' He highlighted the purpose of fish demersal survey is to assess and monitor the populations and biodiversity of demersal fish species that inhabit the sea floor. He also shared that demersal fish surveys are essential tools for understanding and managing the ecological dynamic of the marine environment, ensuring that both the species that inhabit these areas and the habitats themselves are preserved for future generations. He emphasized that designing suitable methods for fish demersal surveys in the sea involves careful planning to ensure that the data collected is reliable, representative, and informative for fisheries management and ecological studies. Along with the presentation, he facilitated an exercise to deepen the participants' understanding of the topic using FAO-ICLARM Stock Assessment Tools (FISAT II) software. His presentation appears as **Annex 27**.

26. *Mr. Sallehudin*'s final presentation was on 'Introduction to Maximum Sustainable Yield (MSY)'. He explained that for the productivity of a population in the context of fisheries management, it is essential to understand that maximum productivity typically occurs at intermediate or moderate population sizes, which means that at population levels that are not too small or too large, the population tends to achieve the highest level of productivity. He referred to Beverton and Holt (1956), who revealed that the productivity of a fish population is a balance between individual growth and mortality.

27. He also briefly described the MSY. The MSY is a concept in fisheries management that refers to the largest long-term average catch or yield that can be taken from a fish stock under existing environmental conditions without compromising the stock's availability to replenish itself. The MSY refers to a hypothetical equilibrium between the exploited population and the fishing activity. In order to deepen the understanding, Mr. Sallehudin coordinated the exercise on the Surplus Production Model (SPM). His presentation appears as **Annex 28**.

28. Seconded *Mr. Sallehudin*'s efforts, *Dr. Supapong* shared his explanations on SPM by using the TROPFISH R in the R package. His presentation appears as **Annex 29**.

VI. WAY FORWARD AND CLOSING SESSIONS

29. In overall, all participants were actively involved and responded positively throughout the training course, showing great enthusiasm and eagerness to contribute to their engagement beyond participation. They shared thoughtful questions, offered valuable insight, and provided constructive feedback, which enriched the whole training period.

30. *Ms. Pattaratjit* shared that this training course (RECAB 2024) will be the last event. However, the stock assessment activities will be continued under another project such as the USAID Southeast Asia Fisheries Partnership (SEAFish) Project, the GoTFish Project, and the new JTF7 project. Her presentation appears as **Annex 30**.

31. The Secretary General of SEAFDEC, *Dr. Suttinee Limthammahisorn,* delivered her closing remarks. She expressed her sincere gratitude to all those who made this training a great success. She also extended her appreciation to the government of Japan through the JTF for supporting the RECAB program for over three (3) years. She expressed her hope that all

participants will apply the knowledge acquired from this training and hoped for more collaboration among AMSs to enhance and strengthen the capacity of the researchers on stock assessments by providing and sharing crucial scientific information towards the sustainability of fisheries resources in the region. Her closing remarks appear as **Annex 31**.

Annex 1

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Annex 2

Welcoming Remarks

By Mr. Abd Haris Hilmi Ahmad Arshad
Chief of SEAFDEC/MFRDMD

Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia
17 to 24 September 2024
SEAFDEC/MFRDMD, Kuala Terengganu, Malaysia

Very good morning

Dr. Nakazato Tomoko, Deputy Secretary-General of SEAFDEC
and Deputy Chief of SEAFDEC Training Department, Thailand
Dr. Masahito Hirota, Deputy Chief of SEAFDEC/MFRDMD, Terengganu
Dr. Koki Abe, Senior Expert Scientist, SEAFDEC Training Department, Thailand
Ms. Pattaratjit Kaewnuratchadasorn, Senior Policy Officer of SEAFDEC/Secretariat, Thailand
Mr. So Hamaguchi, Secretary to Deputy Secretary General of SEAFDEC, Thailand
Ms. Mazalina Ali, Coordinator of the Training Course and Special Departmental Coordinator of SEAFDEC/MFRDMD, Terengganu

Our resource persons
Assoc. Prof. Dr. Thanita Darbanandhana, Kasersart University, Thailand
Dr. Supapong Pattarapongpan, SEAFDEC/TD, Thailand
Mr. Sallehudin Jamon, The Director of FRI Kg. Acheh, Perak Malaysia

Participants from Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, The Philippines, Thailand and Viet Nam,
and all officers and staffs of MFRDMD.

Distinguished guest,
Ladies and gentlemen,

First of all, I would like to warm welcome to all of you especially to our Deputy Secretary-General of SEAFDEC to MFRDMD, Chendering, Terengganu and welcome to 'Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia'.

As you know that the capture fisheries and aquaculture are important contributors to support the national economy and provide food supply to the world. The capture fisheries have to be managed wisely for sustainability of food resources in future. But the number of experts in managing the fisheries are becoming decrease by the years. So, there is a need to train young researchers and officers on how to manage our fisheries resources.

I would like to congratulate to all participants that have been selected to attend this important training course that is The Regional Capacity Building (RECAB) Network.
Participants should take this opportunity to learn all aspect of fisheries stock assessment during this training course and I hope SEAFDEC will plan to have more training course on fish stock assessment for you in future. Please share your knowledge gained from this training course to your researchers and officers in your country.

I really appreciate the commitments by resource persons who managed to be with us, even they have a tight schedule and also thanks to all participants from member countries for your coming and share your knowledge of fish status assessment.

And last but not less all members of secretariat for their hardworking to make sure this training course become a reality.

I hope you will enjoy during this training course and your stay in Terengganu, and take this opportunity to enjoy with our food, beautiful beaches and also our multispecies of fishes during your visit to a fish landing jetty in Kuantan.

Lastly, I on behalf of MFRDMD, apologize if there are any shortcomings during the training course.

With that I end my speech, thank you

Annex 3

OPENING REMARKS

by *Dr. Tomoko Nakazato*
Deputy Secretary-General and Japanese Trust Fund Manager

Regional Capacity Building Network (RECAB) 2024

Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia
17–24 September 2024 at Kuala Terengganu, Malaysia

Chief of MFRDMD, Mr. Haris, Deputy Chief of MFRDMD, Dr. Hirota, experts, and resource persons, Staff of MFRDMD, all participants from SEAFDEC Member Countries, ladies and gentlemen, a very good morning.

It is my great honor to be here today with all of you at the opening session of the "Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia'', which will be held on 17–24 September 2024, in Kuala Terengganu, Malaysia", jointly organized by MFRDMD and Secretariat.

This Training course is conducted as one of the series of training under the "Regional Capacity Building Network" or RECAB, funded by the Japanese Trust Fund (JTF). The RECAB aims to establish the network among the Member Countries on the specific subject and provides technical assistance by SEAFDEC Technical Departments.

As you are aware of the importance of the stock assessment works, SEAFDEC/MFRDMD plays an important role in providing technical assistance to the Member Countries on this matter. For this year, the RECAB focuses on enhancing the capacity of national scientists on the stock assessment for Sustainable Development and Management of Fishery Resources in the region.

I would like to express my sincerest thanks to Chief Haris san, Deputy Chief, Dr. Hirota san, resource persons, and all MFRDMD staff who work to the fullest to make this Training happen.

I would wish to encourage all participants to actively engage in the Training and share your experiences with others, not to hesitate to ask questions, not only to our expert speakers, but also to one another in order to make this a truly interactive and lively Training. I also wish you not only to enjoy important programs but also your free time, talking with your colleagues and friends, enjoying the diverse cultures and the beautiful country.

Lastly, I wish you all the best of luck and I am looking forward to the successful training and hope you will bring back all knowledge and experiences that gain from this Training to support sustainable development in your home countries.

Thank you very much and have a good day.

Annex 4


Regional Capacity Building Network (RECAB) 2024
Regional Training Course on Basic Stock Assessment for Fishery Resources in Southeast Asia
By
SEAFDEC/Marine Fishery Research and Development Department (MFRDMD)
17-24 September 2024, Kuala Terengganu, Malaysia


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AQD
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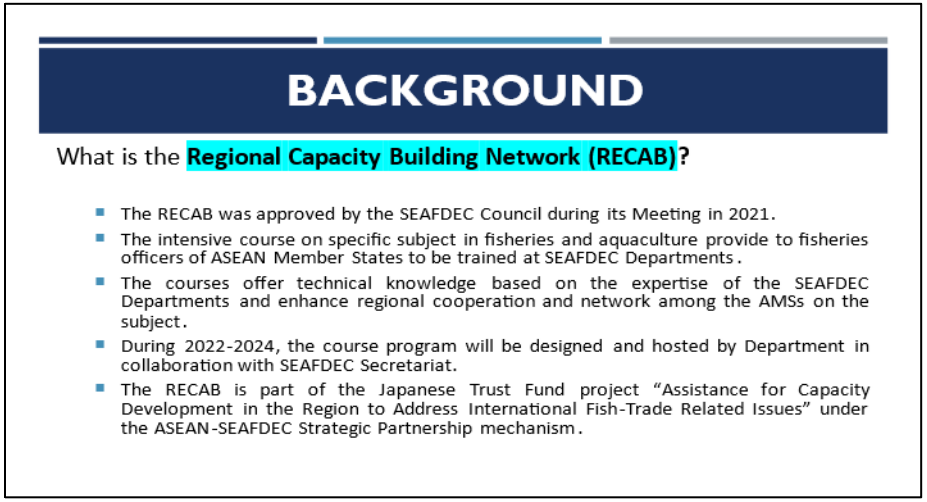
BACKGROUND
What is the Regional Capacity Building Network (RECAB)?
The RECAB was approved by the SEAFDEC Council during its Meeting in 2021.
The intensive course on specific subject in fisheries and aquaculture provide to fisheries officers of ASEAN Member States to be trained at SEAFDEC Departments.
The courses offer technical knowledge based on the expertise of the SEAFDEC Departments and enhance regional cooperation and network among the AMSs on the subject.
During 2022-2024, the course program will be designed and hosted by Department in collaboration with SEAFDEC Secretariat.
The RECAB is part of the Japanese Trust Fund project "Assistance for Capacity Development in the Region to Address International Fish-Trade Related Issues" under the ASEAN-SEAFDEC Strategic Partnership mechanism.


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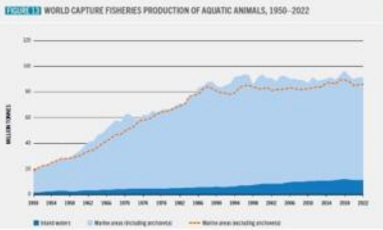
GLOBAL FISH PRODUCTION 2022



In 2022, global capture fisheries production reached 92.3 million tonnes

Source: *FAO The State of World Fisheries and Aquaculture 2024*
https://openknowledge.fao.org/handle/20.500.14283/cd0683en

Southeast Asian countries and Japan are top 25 major producers.

TABLE 6 CAPTURE FISHERIES PRODUCTION OF AQUATIC ANIMALS IN MARINE AREAS BY MAJOR PRODUCER

Country or territory	Production (average per year)				Production				Share in total, 2022 (%)
	1980s	1990s	2000s	2010s	2019	2020	2021	2022	
	(thousand tonnes, live weight equivalent)								
China	3 819	9 963	12 425	13 238	12 154	11 769	11 741	11 819	14.8
Indonesia	1 742	3 030	4 369	5 962	6 513	6 385	6 675	6 843	8.6
Peru (total)	4 136	8 099	8 066	5 130	4 796	5 610	6 508	5 289	6.6
Peru (excluding anchoveta)	*2 504*	*2 541*	*952*	*1 013*	*1 292*	*1 216*	*1 239*	*1 171*	*n/a*
Russian Federation	n/a	3 377	3 201	4 278	4 720	4 792	4 888	4 717	5.9
United States of America	4 531	5 147	4 746	4 882	4 810	4 249	4 286	4 243	5.3
India	1 685	2 602	2 947	3 549	3 672	2 834	3 145	3 597	4.5
Viet Nam	533	943	1 720	2 698	3 294	3 358	3 391	3 443	4.3
Japan	10 592	6 718	4 412	3 485	3 171	3 182	3 174	2 889	3.6
Norway	2 206	2 435	2 519	2 303	2 315	2 472	2 419	2 442	3.1
Chile	4 517	5 948	4 022	2 156	1 975	1 774	1 996	2 226	2.8
Chile (excluding anchoveta)	*4 002*	*4 447*	*2 745*	*1 399*	*1 231*	*1 272*	*1 389*	*1 485*	*n/a*
Mexico	1 206	1 175	1 308	1 431	1 526	1 550	1 618	1 659	2.1
Philippines	1 320	1 677	2 101	1 924	1 673	1 764	1 638	1 595	2.0
Morocco	463	680	971	1 275	1 443	1 360	1 396	1 563	2.0
Iceland	1 434	1 669	1 664	1 199	1 049	1 023	1 155	1 416	1.8
Malaysia	756	1 080	1 306	1 465	1 455	1 381	1 329	1 310	1.6
Thailand	2 076	2 698	2 385	1 460	1 411	1 472	1 300	1 280	1.6
Republic of Korea	2 175	2 253	1 776	1 556	1 412	1 362	1 347	1 247	1.6
Myanmar	496	611	1 098	1 146	1 064	1 087	880	1 010	1.3

Global and Regional Policy Frameworks Addressing on Stock Assessment

14 LIFE BELOW WATER

SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

14.4 By 2020, effectively regulate harvesting, and end overfishing, illegal, unreported and unregulated (IUU) fishing and destructive fishing practices and implement science-based management plans, to restore fish stocks in the shortest time feasible at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, and eliminate subsidies that contribute to IUU fishing, and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the WTO fisheries subsidies negotiation

Global and Regional Policy Frameworks Addressing On Fisheries Management

- UNCLOS, CCRF, IPOA-IUU, IPOA-Capacity
- UN Sustainable Development Goals (SDGs)
- ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region towards 2030

RES&POA-2030
ASEAN-SEAFDEC

Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030

(adopted by AMAF in 2020)

POA#3 "Strengthen national statistical mechanisms for fisheries and aquaculture including data collection disaggregated at species level, and exchange of statistical data; and include collection/compilation of non-routine data and information, *e.g.* from fish consumption surveys, species composition, biological information, as well as local and indigenous knowledge, with the aim of improving the valuation of fisheries including monitoring of their performance;"

POA#4 "Establish reference points, and come up with estimated biomass or capacity level to determine the maximum sustainable yield, allowable biological catch, or allowable effort for marine and inland fisheries;"

POA#4 "Promote the use of simple and practical indicators that had been developed, for planning, monitoring, and evaluation of fisheries in support of achieving sustainability,"

RECAB 2024

Regional Training Course on Basic Stock Assessment for Fishery Resources in Southeast Asia

By

SEAFDEC/Marine Fishery Research and Development Department (MFRDMD)

17-24 September 2024, Kuala Terengganu, Malaysia

LEARNING OBJECTIVES

1. Share information on the current status of fisheries of the SEAFDEC Member Countries and stock assessment methods;
2. Equip participants with knowledge, skills, and enhanced capacity in basic stock assessment models; and
3. Foster the establishment of a network of contacts among participants and with SEAFDEC for future communication and cooperation on stock assessment.

TOPICS

- Current Status of Fisheries and Stock Assessment Methods
- Fisheries Biology and Biostatistics
- Population Dynamic and Stock Assessment

Field trip

- commercial fish landing at port in Kuantan, Pahang.

RES&POA-2030
ASEAN-SEAFDEC

THANK YOU

Annex 5

Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia

17-24 September 2024

Prepared by:
Mazalina Ali
Special Departmental Coordinator for SEAFDEC/MFRDMD

Over the years, regional organizations such as SEAFDEC and other international organizations have also supported capacity-building for ASEAN Member States to meet their international commitments such as Sustainable Development Goals (SDGs), WTO Agreement on Fisheries Subsidies, and relevant conventions for food security and the health of the oceans.

This has been guided by the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030, a regional policy framework, that highlights priority actions to improve the assessment of the status of the region's fishery resources and estimate the current level of fish abundance/biomass, and develop guidance on the maximum sustainable yield, allowable biological catch, or allowable effort for marine fisheries in support of achieving sustainability.

The short-term regional capacity development program so-called "**Regional Capacity Building Network (RECAB)**" was approved by the SEAFDEC Council in 2021 and offers an intensive course on specific subjects in fisheries and aquaculture for enhancing the capacity of officers of ASEAN Member States.

For 2024, the RECAB, led by the SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) in collaboration with the SEAFDEC Secretariat organized this regional training; the 'Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia,' here from today until 24 September 2024.

Designed as an introductory session for government fisheries officials, the program will provide a basic understanding of stock assessment techniques, including the principles of fisheries stock assessment.

Participants will engage in statistical evaluations to estimate stock abundance and productivity.

Additionally, participants will explore the effects of fisheries on target populations and learn how to manage fisheries for optimization, including achieving maximum sustainable yield (MSY) and determining appropriate exploitation levels—key objectives in stock assessment.

Through this training, hopefully the participants will gain foundational knowledge and awareness of sustainable fisheries stock management.

The objectives of the Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in Southeast Asia are:

1) To share information on the current status of fisheries of the Member Countries and stock assessment methods;
2) To Equip participants with knowledge, skills, and enhanced capacity in basic stock assessment models; and
3) To foster the establishment of a network of contacts among participants and with SEAFDEC for future communication and cooperation on stock assessment.

There are 6 sessions

Session 1:	Opening Session
Session 2:	Introduction to the RECAB Training
Session 3:	Country Presentation on the Current Status of Fisheries and Stock Assessment Methods
Session 4:	Fisheries Biology and Biostatistics
Session 5:	Population Dynamic and Stock Assessment
Session 6:	Closing Session.

The timetable for this training course is shown, and it is hoped the participants to follow the schedule.

Thank you, terima kasih.

Annex 6

Regional Capacity Building Network (RECAB) 2024: Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17-24 September 2024
SEAFDEC/MFRDMD
Kuala Terengganu, Malaysia

PROVISIONAL PROSPECTUS

I. Background

The Southeast's Asian fisheries make significant contributions to the source of protein food supply for human consumption and contribution to food security. Most Southeast Asian countries are major producers of exporting fish and fish products in international markets. In the region, fishery production generally increased from 45.5 million MT in 2017 to 46.8 million MT in 2019 with an annual average increase rate of 0.65 MT or 1.4 %. However, there was a slight decrease starting 2020 which could be due to the COVID-19 pandemic, while the region's total contribution to the world's total fishery production in 2021 was approximately 21.0 %. (SEAFDEC, 2024). In 2021, the production of Indonesia was 6.7 million MT accounting for approximately 37.3 % of the region's total, followed by Viet Nam with 3.4 million MT (18.9 %), Myanmar with 3.3 million MT (18.4 %), and Philippines with 1.8 million MT (10.0 %). Malaysia and Thailand also produced a considerable volume of aquatic commodities from marine capture fisheries with 1.3 million MT (7.4 %) and 1.3 million MT (7.2 %), respectively. (SEAFDEC, 2024)

Over the years, regional organizations such as SEAFDEC and other international organizations have also supported capacity-building ASEAN members to meet their international commitments such as Sustainable Development Goals (SDGs), WTO Agreement on Fisheries Subsidies, and relevant conventions for food security and the health of the oceans. This has been guided by the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2030, a regional policy framework, that highlights priority actions to improve the assessment of the status of the region's fishery resources and estimate the current level of fish abundance/biomass, and develop guidance on the maximum sustainable yield, allowable biological catch, or allowable effort for marine fisheries in support of achieving sustainability.

SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) was established in 1992 to conduct activities on marine fishery resources focusing on biological studies of commercially important fish species, resource assessment and management, and conservation and management of aquatic species under international concerns, e.g. sharks and marine turtles. MFRDMD also implements activities that support the Member Countries in gathering information on inland capture fisheries and developing indicators to be used for the sustainable development and management of fisheries.

The short-term regional capacity development program so-called "**Regional Capacity Building Network (RECAB)**" was approved by the SEAFDEC Council in 2021 and offers an intensive course on specific subjects in fisheries and aquaculture for enhancing the capacity of officers of ASEAN Member States. The RECAB is under the project "Assistance for Capacity Development in the Region to Address International Fisheries-related Issues"

For 2024, the RECAB, led by the SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) in collaboration with the SEAFDEC Secretariat will organize the 'Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in Southeast Asia,' This training is scheduled to take place in Kuala Terengganu, Malaysia, from 17 to 24 September 2024.

The course curriculum will encompass the fundamental principles of fisheries stock assessment principles, exploring various models used in stock assessment analysis alongside different types of data. This will include statistical evaluations aimed at estimating stock abundance and productivity. Engagement in the training program will furnish participants with fundamental knowledge and raise awareness regarding the sustainable management of fisheries stock. It will serve as an introductory training session for government fisheries officials on basic stock assessment techniques. Participants will also gain insight into the impact of fisheries on the targeted populations. Understanding how to management fisheries towards optimization, such as achieving maximum sustainable yield (MSY) and determining exploitation levels, stands as a crucial objective within the domain of stock assessment.

II. Training Objectives

The objectives of the Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in Southeast Asia are to:

1. Share information on the current status of fisheries of the Member Countries and stock assessment methods;
2. Equip participants with knowledge, skills, and enhanced capacity in basic stock assessment models; and
3. Foster the establishment of a network of contacts among participants and with SEAFDEC for future communication and cooperation on stock assessment.

III. Date and Venue

The Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in Southeast Asia will be held on 17–24 September 2024 at SEAFDEC/MFRDMD, Kuala Terengganu, Malaysia.

IV. Training Sessions

Session 1:	Opening Session
Session 2:	Introduction and Pre-course Assessment
Session 3:	Country Presentation on the Current Status of Fisheries and Stock Assessment Methods
Session 4:	Fisheries Biology and Biostatistics
Session 5:	Population Dynamic and Stock Assessment
Session 6:	Post-course Assessment and Closing Session

In addition, the field trip will be arranged during the training course to observe the commercial fish landing at port in Kuantan, Pahang.

V. Expected Participants

It is expected that the participants of the Training will comprise two (2) of each SEAFDEC Member Country (MCs) i.e. from Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam, with the following requirements:

a. Should have at least a Bachelor's degree
b. Junior researchers/officers (with less than 5 years of service) who are working in related fisheries data collection and stock assessment
c. Proficient in the English language (speaking, reading, writing and communication skills)
d. Preferably someone who has not availed of any Training Fellowship Grants in any of MFRDMD's training courses

e. In good physical and mental condition
f. Preferably one male and one female representative.

Potential participants are expected to:

a. Be familiar with the course outline and requirements before starting the program;
b. Be eager to learn new things as well as enjoy the learning process;
c. Actively participate in the training process;
d. Fulfil all learning tasks, assignments and assessments that are set by the program;
e. Enthusiastically work towards continuing personal learning and development in fisheries;
f. Promote a knowledge sharing and learning culture in his/her institution after completing the program and upon return to home country and;
g. Be a regional network member and form lasting professional relationships with other participants.

VI. Pre and Post-Assessment

The feedback from the participants will be assessed at the beginning and the end of the training in order to monitor whether the course is met the learning objectives and responds to the expectation. The overall course evaluation by the trainees will also be carried out at the end of the training for further improvement of the course.

VII. Training Provisions

The training course will be funded by the SEAFDEC/Japanese Trust Fund under the project "Assistance for Capacity Development in the Region to Address International Fisheries-related Issues". The participants will be provided with the following:

a. Round trip international and domestic airfare from the nearest international airport of point of origin to Kuala Terengganu, Malaysia
b. Airport transfer
c. Accommodation
d. Daily subsistence allowance (DSA) for the duration of the course

VIII. Training Requirements

The participants should have the knowledge of the use of Ms. Excel and they are requested to bring their laptop, which will be used during the training session.

As a requirement, the participants from each SEAFDEC Member country will be asked to submit a post-training report to be submitted to SEAFDEC.

IX. Contact Persons

SEAFDEC/MFRDMD
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Course Coordinator
Special Departmental Coordinator
SEAFDEC/MFRDMD
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SEAFDEC Secretariat
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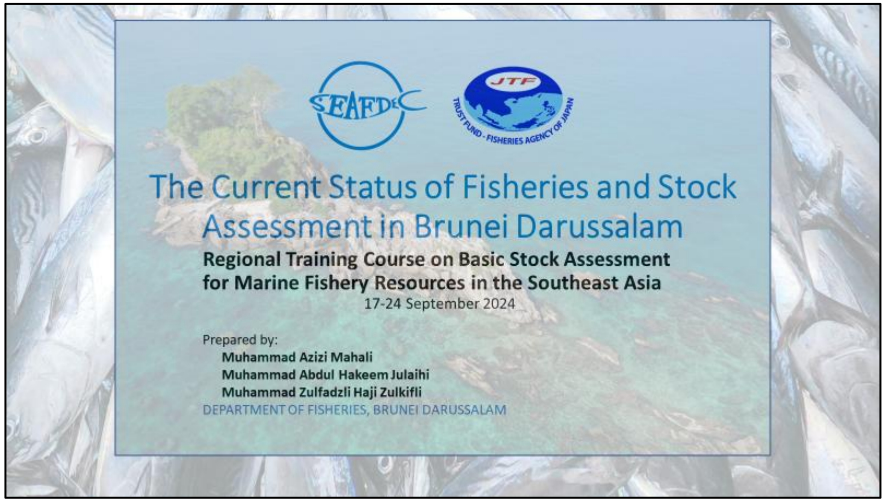
Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17–24 September 2024
SEAFDEC/MFRDMD
Kuala Terengganu, Malaysia

PROVISIONAL TIMETABLE

Time	Activity	Resource Persons
Arrival (16 September 2024, Monday)		
Day 1 (17 September 2024, Tuesday)		
08:30 – 09:00	Registration	
Session 1: Opening Session		
09:00 – 09:30	Opening Session • Welcome Remark • Opening Address	Chief of MFRDMD Deputy SEAFDEC Secretary-General
09:30 – 10:00	Photo session and Morning Break	
Session 2: Introduction and Pre-course Assessment		
10:00 – 10:20	Introduction to the RECAB Program	Ms. Pattaratjit Kaewnuratchadasorn
10:20 – 10:30	Introduction to Training Course	Special Departmental Coordinator for SEAFDEC/MFRDMD
Session 3: Country Presentation on the Current Status of Fisheries and Stock Assessment Methods		
10:30 – 13:00	Country presentation on the current status of fisheries and stock assessment methods (20 min presentation and Q&A) • Brunei Darussalam • Cambodia • Indonesia • Japan • Malaysia • Myanmar	Dr. Supapong Pattarapongpan
13:00 – 14:30	Lunch break	
14:30 – 16:00	Country presentation on the current status of fisheries and stock assessment methods (20 min presentation and Q&A) (Cont.) • Philippines • Thailand • Viet Nam	Dr. Supapong Pattarapongpan

Time	Activity	Resource Persons
16:30 – 17:00	Tea Break	
17:00	Welcome Dinner	
Day 2 (18 September 2024, Wednesday)		
Session 4: Fisheries Biology and Biostatistics		
08:30 – 09:30	Introduction to Fisheries Biology	Dr. Supapong Pattarapongpan
09:30 – 10:30	Overview of Biostatistics	Dr. Supapong Pattarapongpan
10:30 – 11:00	Morning Break	
11:00 – 13:00	Descriptive Statistics	Dr. Supapong Pattarapongpan
13:00 – 14:30	Lunch Break	
14:30 – 15:30	Inferential Statistics 1: Testing Hypothesis	Dr. Supapong Pattarapongpan
15:30 – 16:00	Tea Break	
16:00 – 17:00	Inferential Statistics 1: Analysis of Variance	Dr. Supapong Pattarapongpan
Day 3 (19 September 2024, Thursday)		
08:30 – 10:30	Inferential Statistics 1: Regression Analysis	Assoc. Prof. Dr. Thanita Darbanandhana
10:30 – 11:00	Morning Break	
11:00 – 12:00	Inferential Statistics 1: Regression Analysis (Cont.)	Assoc. Prof. Dr. Thanita Darbanandhana
12:00 – 13:00	Growth Theory	Assoc. Prof. Dr. Thanita Darbanandhana
13:00 – 14:30	Lunch Break	
14:30 – 16:00	Reproductive Biology: Sex Ratio, Maturity etc.	Assoc. Prof. Dr. Thanita Darbanandhana
16:00 – 16:30	Tea Break	
16:30 – 17:30	Sampling Theory	Assoc. Prof. Dr. Thanita Darbanandhana
Day 4 (20 September 2024, Friday)		
All day	Traveling day to Kuantan for study trip	
Day 5 (21 September 2024, Saturday)		
All day	Study trip to commercial fisheries landing port in Kuantan, Pahang and excursion, and back to Kuala Terengganu	

Day 6 (22 September 2024, Sunday)		
Session 5: Population Dynamics and Stock Assessment		
08:30 – 10:30	Introduction to Population Dynamic and Stock Assessment of Fisheries	Mr. Sallehudin Jamon
10:30 – 11:00	Morning Break	
11:00 – 13:00	Introduction to Fishing Gear and Fishing Gear Selectivity	Mr. Sharum Yusof
13:00 – 14:30	Lunch Break	
14:30 – 16:30	Introduction to Fisheries Acoustic Survey	Mr. Raja Bidin Raja Hassan
16:30 – 17:00	Tea Break	
Day 7 (23 September 2024, Monday)		
08:30 – 10:30	Introduction to Demersal Fish Survey	Mr. Sallehudin Jamon
10:30 – 11:00	Morning Break	
11:00 – 13:00	Practical on Basic Stock Assessment and Management of Survey Data	Mr. Sallehudin Jamon
13:00 – 14:30	Lunch Break	
14:30 – 16:30	Introduction to Maximum Sustainable Yield (MSY)	Mr. Sallehudin Jamon
16:30 – 17:00	Tea Break	
Day 8 (24 September 2024, Tuesday)		
08:30 – 10:30	Introduction to MSY (Cont.)	Mr. Sallehudin Jamon
10:30 – 11:00	Morning Break	
11:00 – 13:00	Practical of Data Analysis for Maximum Sustainable Yield (MSY)	Mr. Sallehudin Jamon
13:00 – 14:30	Lunch Break	
Session 6: Post-course Assessment and Closing Session		
14:30 – 16:30	Closing Session	SEAFDEC Secretary-General
16:30 – 17:00	Tea Break	
Departure (25 September 2024, Wednesday)		



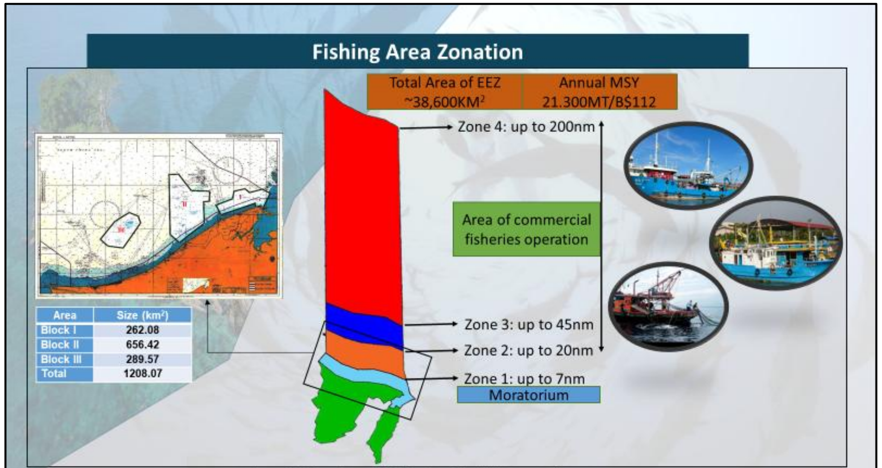


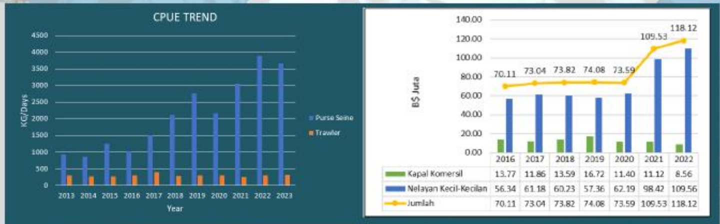
Figure 1: Overview of Fishing Zonation Management

Figure 2: Muara Fish Landing Complex

	Zone 1	Zone 2	Zone 3	Zone 4a	Zone 4b	Zone 4c
Vessel		Vessel : ≤ 60 GT Wheel House Colour : Orange Engine : < 350 Hp	Vessel : 60.1 – 150 GT Wheel House Colour : Marine Blue Engine : 351 - 600 Hp	Vessel : 150.1 – 250 GT Wheel House Colour : Red Engine : > 600hp	Vessel : 250.1 – 500 GT Wheel House Colour : Purple Engine : > 600hp	Vessel : ≥500.1 GT Wheel House Colour : Celery Green Engine : > 600hp
Gear		**Trawler:** • Code end mesh size not more than 51mm	**Trawler:** • Code end mesh size not more than 51mm			
		Purse seine: • Min mesh size: 30mm • ≤ 400m length	**Purse seine:** • Min mesh size: 30mm • ≤ 600m length	**Purse seine:** • Mesh size from the buoyancy line to a depth of 0.76m: ≥ 76.2 mm (3.0 inches) • Mesh size from a depth of 0.76m to 240m: ≥ 35 mm (1.5 inches) • ≤ 800m length		
		Longline: • ≤ 1000 hooks • ≤ 2km length	**Longline:** • ≤ 2000 hooks • ≤ 4km length	**Longline:** • ≤ 800 hooks • ≤ 30km length		
		Traps ≤ 40 traps	**Traps** ≤ 80 traps			
		Handline ≥ 12 handlines	**Handline** ≥ 12 handlines			

Table 1: Regulation of fishing gears

TRENDS



MARINE RESOURCE SURVEY

Figure 3: Socioeconomic survey and length-weight assessment as part of marine resource survey activities.

- **Data Collected:**
  1. **Landing Data (Kg)**
  2. **Effort Data (No. of Days)**
  3. **CPUE**
  4. **Length-Weight Data**
  5. **Gonad Maturity**
- **Types of sampling performed for length-weight data collection**
  1. **Random vessel landing (commercial)**
  2. **Market/local survey (small scale fisheries)**
  3. **Survey using standardized gear (Fish traps, gill nets, handlines)**

  Types of sampling performed for length-weight data collection
- **Socioeconomic survey among small-scale fishermen.**

RESOURCE SURVEY USING MV SEAFDEC (22ND APRIL - 10TH JUNE 2024)

Purpose of Survey

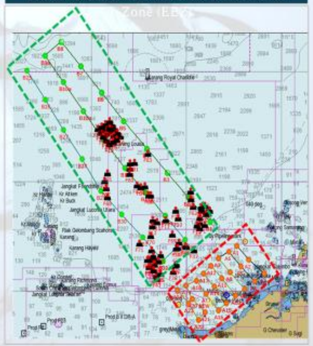
The main activities of the research survey consists of the following:

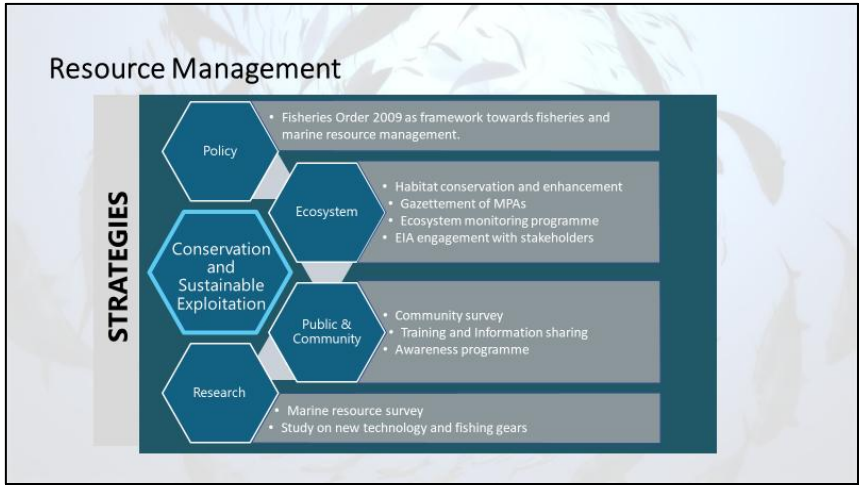
i. Fishing Gear Survey
- Species Composition (Demersal and Pelagic)
- Fishing Gear Catch Composition (Bottom Trawler, Mid Water Trawler, Longline, Fishing Line)
- Catch Effort Data Collection
- Length – Weight Data Collection

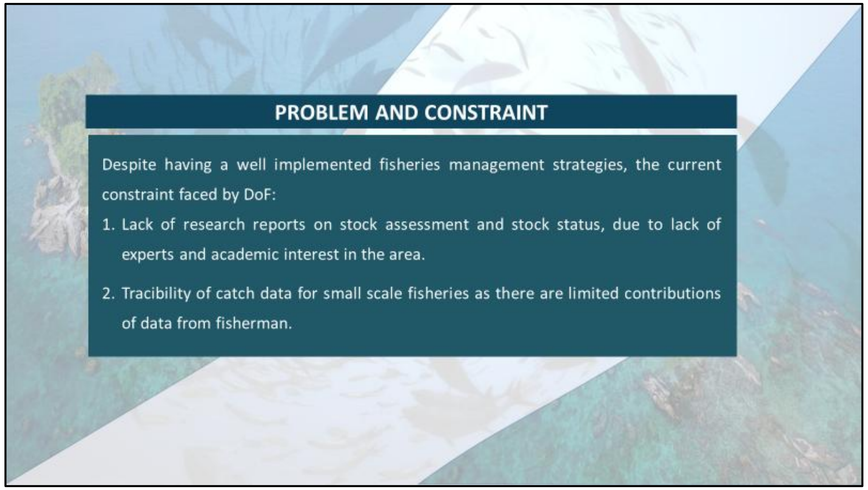
ii. Oceanographic Survey
- Sampling of bottom sediments using Box Core
- CTD measurement (Current, Temperature, Depth, Chlorophyll-a)
- Plankton composition and abundance
- Fish larvae & fish egg collection and identification

3. Acoustic Survey

Survey extends from Zone 2 - Zone 4 of Brunei Darussalam's Exclusive Economic Zone (EEZ)




Resource Management
STRATEGIES
Policy
• Fisheries Order 2009 as framework towards fisheries and marine resource management.
Ecosystem
• Habitat conservation and enhancement
• Gazettement of MPAs
• Ecosystem monitoring programme
• EIA engagement with stakeholders
Conservation and Sustainable Exploitation
Public & Community
• Community survey
• Training and Information sharing
• Awareness programme
Research
• Marine resource survey
• Study on new technology and fishing gears


PROBLEM AND CONSTRAINT
Despite having a well implemented fisheries management strategies, the current constraint faced by DoF:
1. Lack of research reports on stock assessment and stock status, due to lack of experts and academic interest in the area.
2. Tracibility of catch data for small scale fisheries as there are limited contributions of data from fisherman.


WAYFORWARD
• Review of marine fisheries resources exploitation and management strategies through analysis of latest survey data.
• Increase public awareness on current threats to the marine ecosystem and fisheries stock.
• Studies on improving survivability of high value and highly exploited species.
• Studies on alternative fishing gears and technologies.
• Continuous improvement and capacity building in technical aspect.


Thank You

The Current Status of Fisheries and Stock Assessment in (*Cambodia*)

Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia

17-24 September 2024

Prepared by:
Dr Chea Tharith
Mr. Ly Seyha
(Marine Fisheries Research and Development Institute)

Overview

- Describe fisheries including boat type, gear type, fishing grounds (with map), fishing season, and other relevant matters for the selected species.
  - At least 80 types of fishing gear are known in practice
  - The current marine fishing gear is being refined and modernized, and emerging fishing gear has not yet been thoroughly studied.
  - Open fishing in all areas, except mackerel, is the closed season from 15 January to 30 March.
  - Marine fishing vessel and classification by length

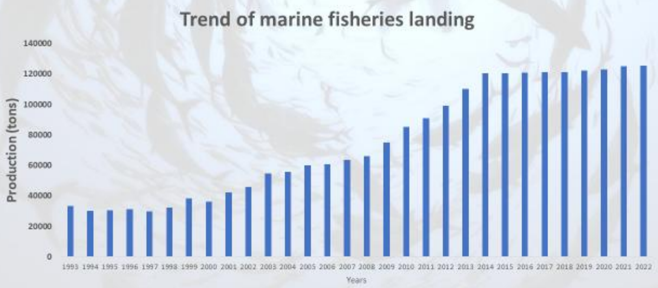
Total length classes (m) of marine fishing vessel

	Koh Kong	Preas Sihanouk	Kampot	Kep	Grand Total
<6	917	34	4	0	955
6 - <12	1777	1563	718	290	4348
12 - <18	720	893	311	304	2228
18 - <24	67	43	6	0	116
≥24	10	0	0	0	10
Grand Total	3491	2533	1039	594	**7657**

- Economical value.
  - estimated catch from June to December 2023, is **83,800.45 MT**. The total estimated catch is by trawlers, for a total of **60.5%,** with small-scale vessels contributing more than 17.5% and other middle-scale gears contributing 29.0%.
  - Using the average reported price (4143 KHR/kg), the total value of the estimated catch for 2023 can be calculated as **347,185,264,350** KHR or **US$ 84,679,333**

Trend and Relevant statistic

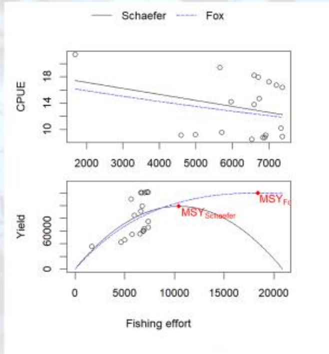
- Trend of landing (20 years)



Trend and Relevant statistic

- Trend of CPUE by number of vessels and/or trips and/or days (20 years)

Year	Effort	Yield	CPUE	Pred Yield
2000	1684	36000	21.38	32,504
2001	4595	42000	9.14	87,353
2002	4982	45850	9.20	94,518
2003	5709	54750	9.59	107,895
2004	6533	55800	8.54	122,930
2005	6843	60000	8.77	128,551
2006	6892	60500	8.78	129,437
2007	6920	63500	9.18	129,944
2008	7367	66000	8.96	138,008
2009	7337	75000	10.22	137,468
2010	5968	85000	14.24	112,635
2011	6596	91000	13.80	124,073
2012	6742	99000	14.68	126,721
2013	5655	110000	19.45	106,905
2014	6596	120250	18.23	124,073
2015	6714	120500	17.95	126,214
2016	7003	120600	17.22	131,444
2018	7552	121100	16.04	141,334



Stock status

- Describe current stock status (including methods) and available parameters and/or equations for stock assessments (LW relations, growth equations r, M etc.).

- The study was conducted to assess the population dynamics of short *R. brachysoma* in four coastal in Cambodia water, based on length-frequency data collected from May to December 2022. The dominant length caught ranges
- from **15-25 cm**. The first cohort, shows a range of **19-20 cm (TL).** The length-weight relationship
- **W = 0.0403* TL$^{2.55}$.** The length at infinity **L∞=25.83 ± 2.91** cm, the growth coefficient estimated
- **K = 0.77/year**. Length at first capture was estimated at **L_{50} = 20.59 cm.** The Total mortality rate **Z= 2.85/year,** the Natural mortality **M = 1.16/year,** the Fishing mortality **(F=Z-M) 1.68/year,** suggest that a greater proportion of mortality caused by fishing. The exploitation rates estimated **E = 0.59** indicating that it has slightly exceeded the optimum exploitation rate (E = 0.5) had occurred. There is an obvious need for consistent monitoring and surveillance of fishing vessels type, size of fishing gear, as well as the fish size and quantity of the catch.

Stock assessments in the past

- Describe briefly any stock assessment conducted in the past.

- Anon (1986-1988) CPUE ranging from **42 to 780 kg/hour** for different vessels, depths, seasons and years
- Senta et al (1973) also compare their data with the results of the Taiwanese research vessel Hai Cheng, which surveyed the Gulf in 1960-1962 recording catches per hour of **98.9kg/hr.** Rescaling the 1970 figure resulted in a catch per hour of **69.4kg/hr**.
- Two fisheries resources carried out by the MV SEAFDEC 2 in 2005 and 2018 provide some indication of the status (Siriraksophon 2008 and Kongpornpratttana 2020) the catch per unit effort (CPUE) of the research vessel in Cambodian waters was **26.3kg/hour.**
- (Vicheth et al 1997) Fishery surveys undertaken from 1983 to 1986 by the Russia a total commercial biomass was estimate **50,000 tons/11,000 km^2**

Fishery Management

- Describe any management measures in place.

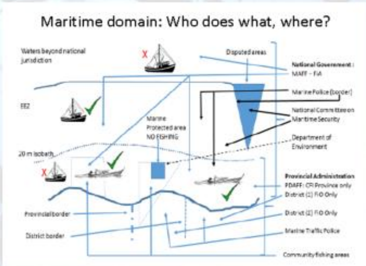
MCS in Cambodia –current situation

Improvements in the Administrative environment:

- Licencing and recording of fishing vessels
- Improved regulation of landing sites
- Improved control of imports and exports
- Strengthening political will

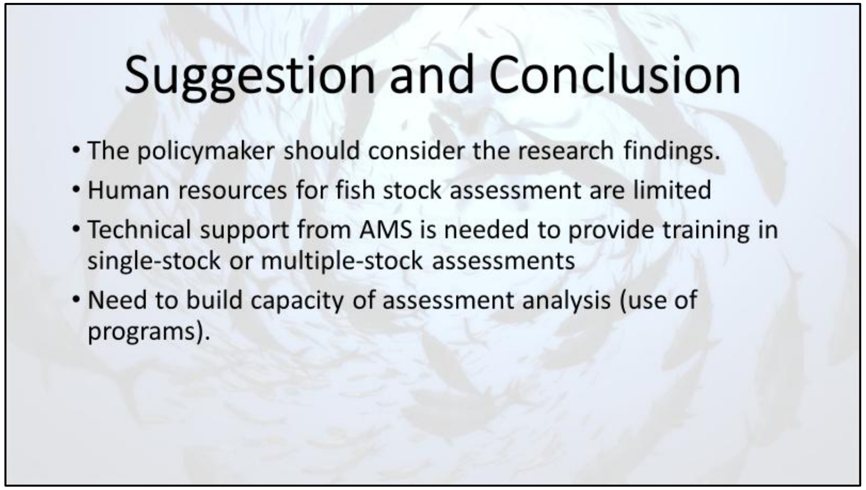
Operational Improvements :

- Lack of infrastructure to undertake ***effective*** operations
- Limited/no supporting technology such as VMS, AIS or other maritime surveillance systems
- Coordination post decentralization still emerging



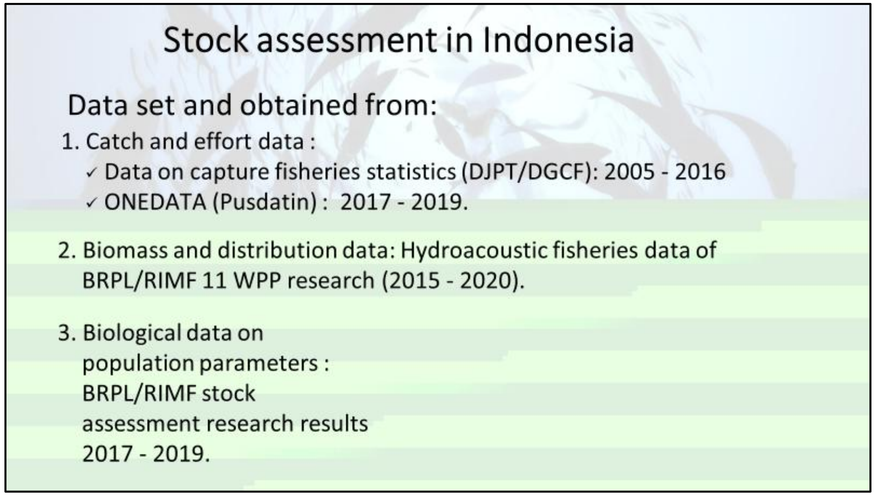
Problem and Constrain

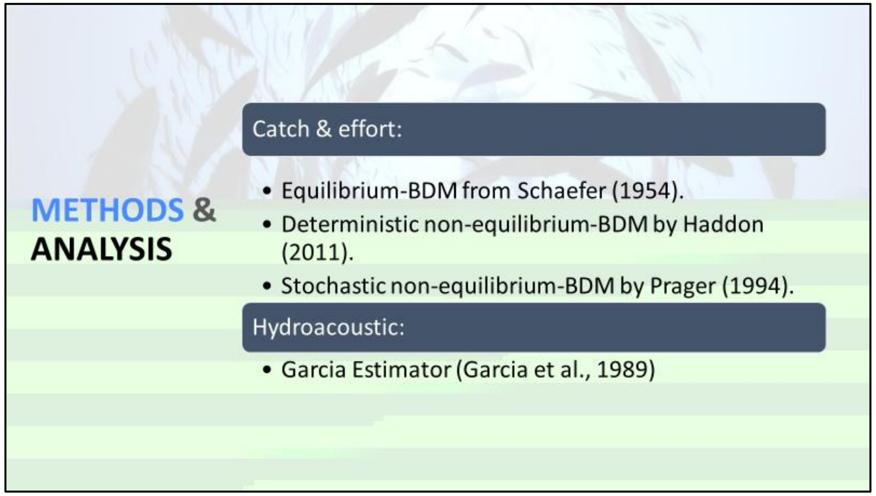
- Describe any problems facing on above issues.
  - Budget constraints
  - Limited of knowledge on multispecies for stock assessment
  - Limited resources, both financial and human
  - Data collection are the lack of manpower to collect fisheries data and information due to limited funds/budget,

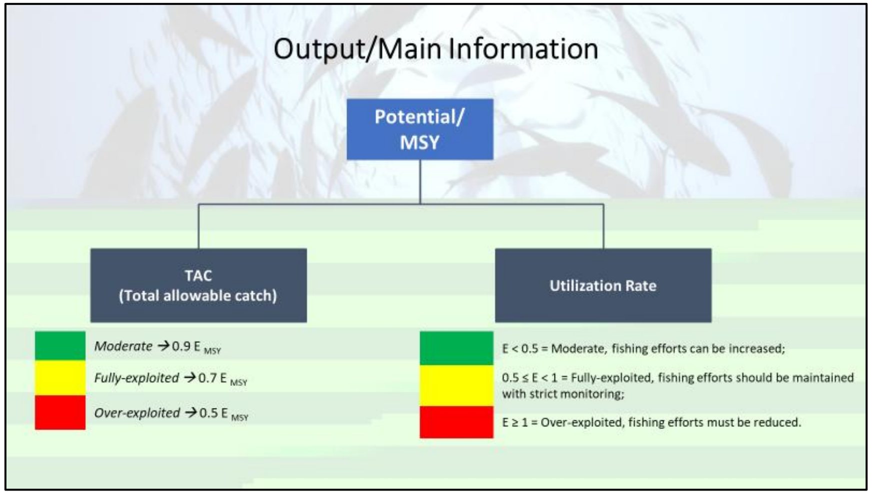

Suggestion and Conclusion
• The policymaker should consider the research findings.
• Human resources for fish stock assessment are limited
• Technical support from AMS is needed to provide training in single-stock or multiple-stock assessments
• Need to build capacity of assessment analysis (use of programs).


Thank You

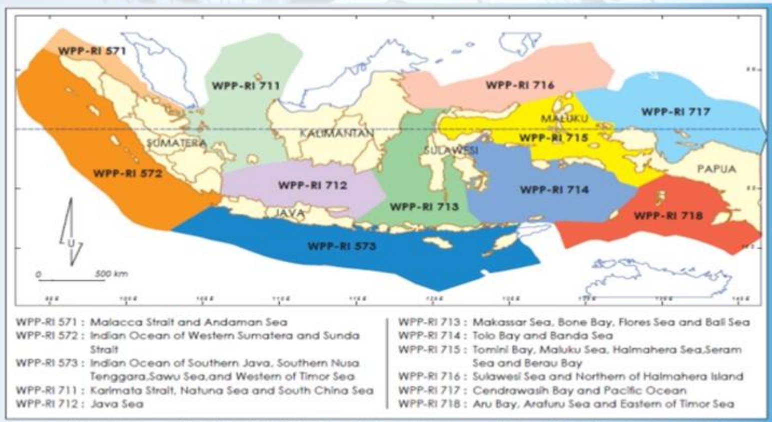

The Current Status of Fisheries and Stock Assessment in Indonesia
Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17 - 24 September 2024
Prepared by:
Herlisman1) and Roy Kurniawan2)
1) Human Resource Development and Extension Agency, MMAF
2) Center for Fishery Research-National Research and Innovation Agency


Stock assessment in Indonesia
Data set and obtained from:
1. Catch and effort data :
✓ Data on capture fisheries statistics (DJPT/DGCF): 2005 - 2016
✓ ONEDATA (Pusdatin) : 2017 - 2019.
2. Biomass and distribution data: Hydroacoustic fisheries data of BRPL/RIMF 11 WPP research (2015 - 2020).
3. Biological data on population parameters : BRPL/RIMF stock assessment research results 2017 - 2019.


METHODS & ANALYSIS
Catch & effort:
• Equilibrium-BDM from Schaefer (1954).
• Deterministic non-equilibrium-BDM by Haddon (2011).
• Stochastic non-equilibrium-BDM by Prager (1994).
Hydroacoustic:
• Garcia Estimator (Garcia et al., 1989)


Output/Main Information
Potential/ MSY
TAC (Total allowable catch)
Utilization Rate
Moderate → 0.9 E MSY
Fully-exploited → 0.7 E MSY
Over-exploited → 0.5 E MSY
E < 0.5 = Moderate, fishing efforts can be increased;
0.5 ≤ E < 1 = Fully-exploited, fishing efforts should be maintained with strict monitoring;
E ≥ 1 = Over-exploited, fishing efforts must be reduced.

Map of Indonesia's fisheries management areas



Source: Ministerial Decree No. PER.01/MEN/2009 about Fisheries Manegement Area of Republic of Indonesia, 21 January 2010

Results of Potential Estimation, TAC, Utilization Rate, and Stock Health Indicators 2021

Fish Group	WPPNRI 571 (Malacca Strait and Andaman Sea)			WPPNRI 572 (Indian Ocean of Western Sumatra and Sunda Strait).			WPPNRI 573 (Indian Ocean of Southern Java, Southern Nusa Tenggara, Savu Sea, and Western of Timor Sea)		
	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate
Small Pelagic Fish	157,151	141,436	0.3	479,503	431,553	0.2	624,366	437,056	0.6
Large Pelagic Fish	75,095	37,548	1.4	438,877	219,439	1.1	354,215	247,950	0.9
Demersal Fish	230,000	115,000	1.2	204,500	143,150	0.9	299,600	269,640	0.2
Reef Fish	34,518	31,066	0.4	33,429	16,715	1.1	23,725	11,863	2.5
Penaeid Shrimp	47,610	23,805	1.6	35,560	17,780	1.5	8,514	4,257	1.2
Lobster	477	239	1.4	2,722	1,361	1.6	1,563	782	2.0
Crab	10,870	5,435	1.5	6,787	6,108	0.1	585	410	0.7
Swimming Crab	2,906	2,034	0.8	2,533	1,267	1.6	3,750	2,625	0.6
Squid	32,511	22,758	0.7	26,039	23,435	0.4	22,124	11,062	1.1
Total	591,138			1,229,950			1,338,442		

*Large Pelagic Fish other than Tuna and Skipjack
Utilization Rate (E):
E < 0.5 = Moderate, fishing efforts can be increased;
0.5 ≤ E < 1 = Fully-exploited, fishing efforts should be maintained with strict monitoring;
E ≥ 1 = Over-exploited, fishing efforts must be reduced.
Source: Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number 19/KEPMEN-KP/2022.

Results of Potential Estimation, TAC, Utilization Rate, and Stock Health Indicators 2021

Fish Group	WPPNRI 711 (Karimata Strait, Natuna Sea, and North Natuna Sea)			WPPNRI 712 (Jawa Sea)			WPPNRI 713 (Makassar Strait, Bone Bay, Flores Sea, and Bali Sea)		
	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate
Small Pelagic Fish	536,917	375,842	0.9	275,486	247,937	0.4	284,302	142,151	1.0
Large Pelagic Fish	163,744	114,621	0.7	145,863	72,932	1.3	162,506	113,754	0.8
Demersal Fish	289,300	202,510	0.8	358,832	179,416	1.1	374,500	337,050	0.3
Reef Fish	197,580	138,306	0.5	71,526	57,221	0.8	167,403	83,702	1.3
Penaeid Shrimp	71,810	50,267	0.6	83,820	58,674	0.8	56,835	39,785	0.8
Lobster	1,467	734	1.1	1,481	1,037	0.5	765	383	1.3
Crab	3,388	1,694	1.9	7,360	5,152	0.9	6,213	4,349	0.7
Swimming Crab	9,804	4,902	1.2	23,508	16,456	0.7	9,253	4,627	1.5
Squid	32,369	22,658	0.5	66,609	46,626	0.9	11,370	5,685	1.2
Total	1,306,379			1,034,485			1,073,147		

*Large Pelagic Fish other than Tuna and Skipjack
Utilization Rate (E):
E < 0.5 = Moderate, fishing efforts can be increased;
0.5 ≤ E < 1 = Fully-exploited, fishing efforts should be maintained with strict monitoring;
E ≥ 1 = Over-exploited, fishing efforts must be reduced.
Source: Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number 19/KEPMEN-KP/2022.

Results of Potential Estimation, TAC, Utilization Rate, and Stock Health Indicators 2021

Fish Group	WPPNRI 714 (Tolo Bay and Banda Sea)			WPPNRI 715 (Tomini Bay, Maluku Sea, Halmahera Sea, Seram Sea, and Berau Bay)			WPPNRI 716 (Sulawesi Sea and Northern of Halmahera Island)		
	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate
Small Pelagic Fish	222,881	156,017	0.7	443,944	310,761	0.7	197,012	137,908	0.7
Large Pelagic Fish	370,653	259,457	0.7	74,908	52,436	0.7	176,382	123,468	0.5
Demersal Fish	292,000	204,400	0.7	80,226	56,158	0.7	215,900	194,31	0.4
Reef Fish	121,326	60,663	1.1	105,336	52,668	1.3	24,909	12,455	1.6
Penaeid Shrimp	6,472	3,236	1.0	5,295	3,707	0.7	6,705	4,694	0.5
Lobster	724	362	1.7	1,217	609	1.2	1,494	1,046	0.9
Crab	1,758	879	1.4	336	235	0.7	1,470	1,029	0.8
Swimming Crab	4,705	3,294	0.6	157	110	0.7	265	186	0.5
Squid	13,460	9,422	0.5	3,874	2,712	0.9	1,908	1,336	0.9
Total	1,033,979			715,293			626,045		

*Large Pelagic Fish other than Tuna and Skipjack
Utilization Rate (E):
E < 0.5 = Moderate, fishing efforts can be increased;
0.5 ≤ E < 1 = Fully-exploited, fishing efforts should be maintained with strict monitoring;
E ≥ 1 = Over-exploited, fishing efforts must be reduced.
Source: Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number 19/KEPMEN-KP/2022.

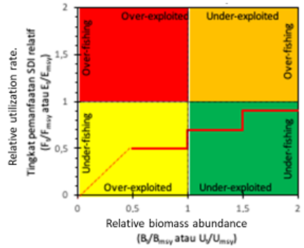
Results of Potential Estimation, TAC, Utilization Rate, and Stock Health Indicators 2021

Fish Group	WPPNRI 717 (Cendrawasih Bay and Pacific Ocean)			WPPNRI 718 (Arafura Sea, Aru Sea, and Eastern of Timor Sea)		
	Potential estimation (ton)	TAC (ton)	Utilization Rate	Potential estimation (ton)	TAC (ton)	Utilization Rate
Small Pelagic Fish	135,140	121,626	0.3	836,973	669,579	0.51
Large Pelagic Fish	189,718	132,803	0.9	818,870	655,096	0.99
Demersal Fish	69,210	48,447	0.5	876,722	701,378	0.67
Reef Fish	19,814	9,907	1.2	29,485	23,588	1.07
Penaeid Shrimp	7,423	6,681	0.5	62,842	50,274	0.86
Lobster	736	515	0.8	1,187	950	0.97
Crab	545	491	0.2	1,498	1,198	0.85
Swimming Crab	291	146	1.5	775	620	0.77
Squid	1,826	1,278	0.6	9,212	7,370	1.28
Total	424,703			2,637,564		

*Large Pelagic Fish other than Tuna and Skipjack
Utilization Rate (E):
$E < 0.5$ = Moderate, fishing efforts can be increased;
$0.5 \le E < 1$ = Fully-exploited, fishing efforts should be maintained with strict monitoring;
$E \ge 1$ = Over-exploited, fishing efforts must be reduced.
Source: Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number 19/KEPMEN-KP/2022.

Control of fish resources utilization

Harvest control rule

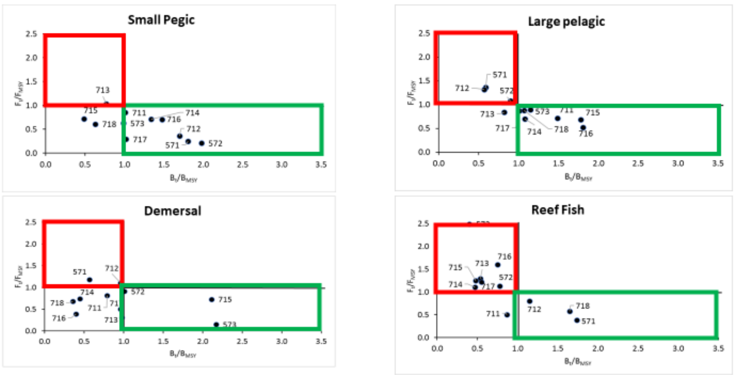


The control rules of fish resource utilization were implemented through control inputs (effort) as follows:

Moderate → 0.9 E_{MSY}
Fully-exploited → 0.7 E_{MSY}
Over-exploited → 0.5 E_{MSY}

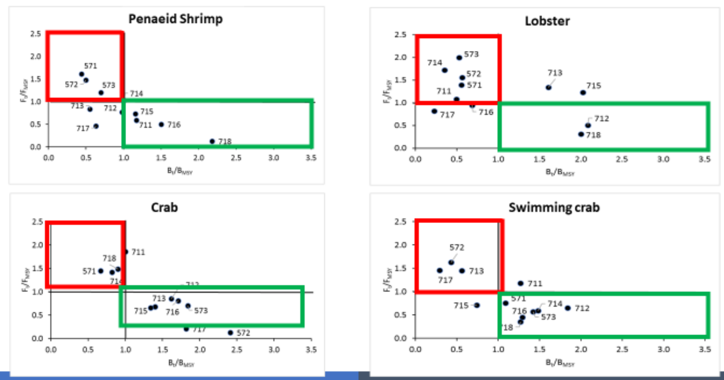
STATUS [KOBE PLOT]

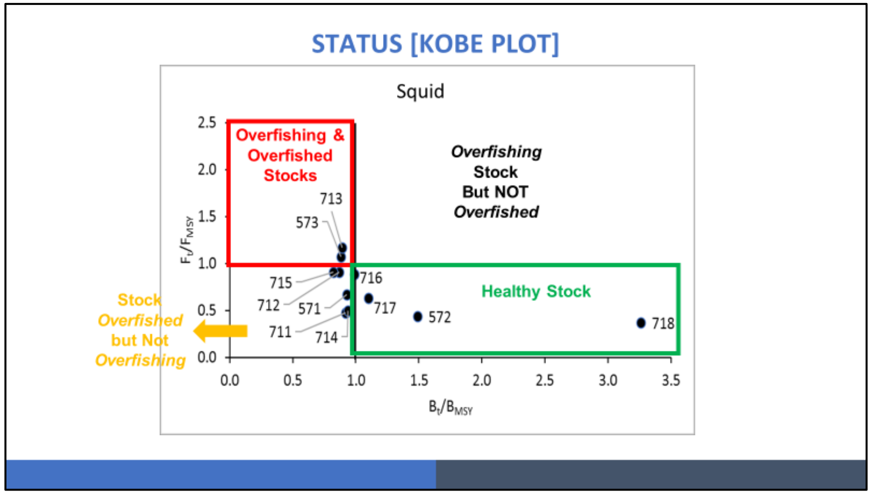
Small Pelagic, Large Pelagic, Demersal & Reef Fish Resources

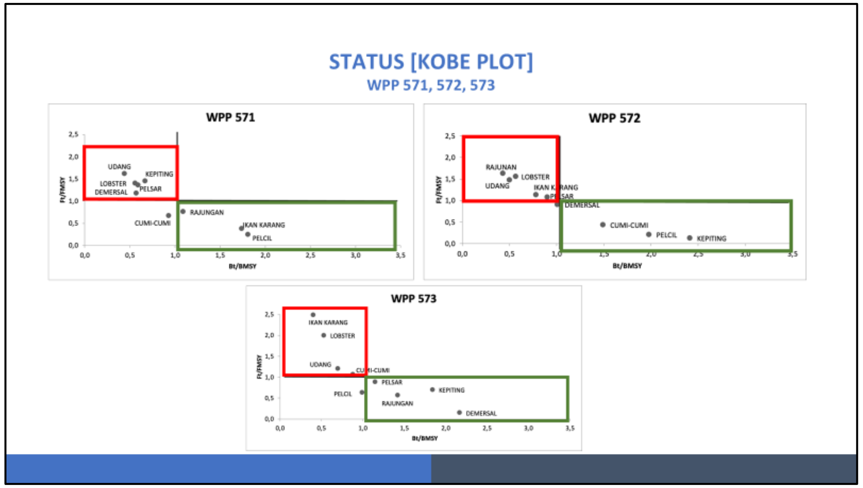


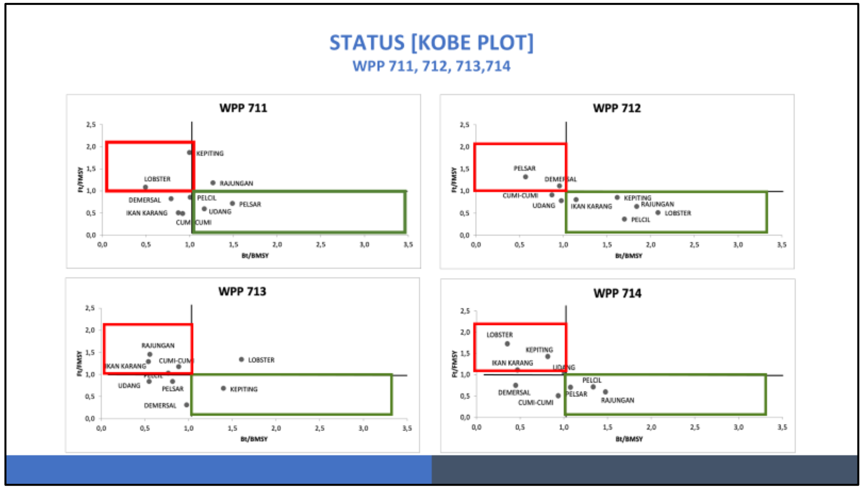
STATUS [KOBE PLOT]

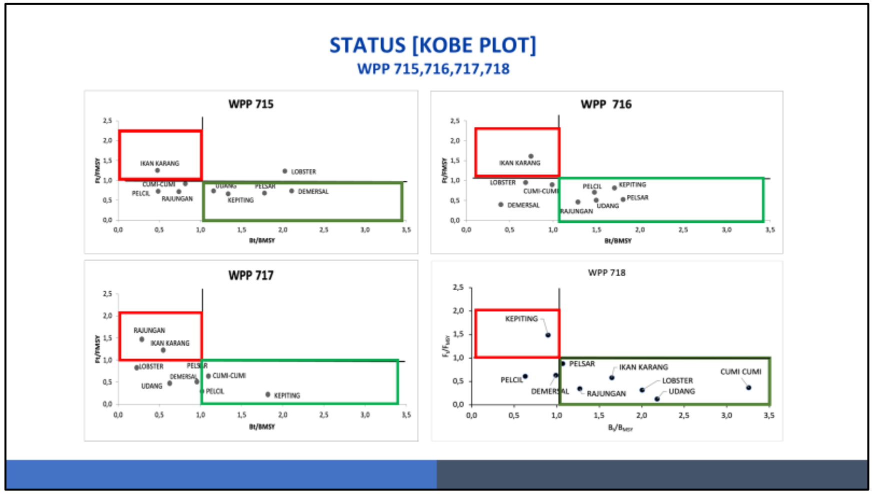
Shrimp , Lobster, Crab and Swimming Crab




STATUS [KOBE PLOT]
Squid
Overfishing &
Overfished
Stocks
Overfishing
Stock
But NOT
Overfished
Healthy Stock
Stock
Overfished
but Not
Overfishing
713
573
715
712
571
711
714
716
717
572
718
2.5
2.0
1.5
1.0
0.5
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5


STATUS [KOBE PLOT]
WPP 571, 572, 573
WPP 571
WPP 572
WPP 573


STATUS [KOBE PLOT]
WPP 711, 712, 713,714
WPP 711
WPP 712
WPP 713
WPP 714


STATUS [KOBE PLOT]
WPP 715,716,717,718
WPP 715
WPP 716
WPP 717
WPP 718

Fisheries Management

Fisheries Management Steps in Indonesia:

- **Establishment of Catch Quotas:**
  - The government sets catch quotas for various fish species and water regions.
  - The aim is to prevent overfishing and allow fish populations time to recover.
- **Determination of Fishing Seasons:**
  - Specific periods are designated as fishing seasons for certain fish species.
  - This is done to protect fish during spawning seasons or when their populations are vulnerable.
- **Designation of Fishing Zones:**
  - Waters are divided into zones with different fishing regulations.
  - There are protected zones, general fishing zones, and zones specifically for traditional fishermen.

- **Development of Environmentally Friendly Fishing Technology:**
  - The government promotes the use of selective fishing gear, such as larger-mesh gillnets, to reduce bycatch.
  - Improving fish processing technology for greater efficiency is also a priority.
- **Development of Fish Farming:**
  - Aquaculture is being promoted to ease pressure on natural fish resources.
  - The government provides support in the form of seed, technology, and market access for fish farmers.
- **Law Enforcement:**
  - The government is strengthening surveillance and law enforcement against fisheries regulation violations.
  - Penalties for illegal fishing are becoming more severe.

- **Collaboration with Communities:**
  - The government involves coastal communities in fisheries management by forming fishing groups, cooperatives, and fisheries management groups.
  - The goal is to raise community awareness about the importance of preserving fish resources.
- **Development of Conservation Areas:**
  - The government establishes marine conservation areas to protect ecosystems and fish habitats.
  - These areas serve as breeding and growth grounds for fish populations.
- **Capacity Building for Human Resources:**
  - The government provides training to fishermen and fish farmers on sustainable fishing techniques, catch processing, and marketing.
- **Research and Technology Development:**
  - Continuous research is conducted to understand fish population dynamics, marine environmental conditions, and the development of better fisheries technologies.

Problem and Constrain

Priority Issues Identified for Fisheries Resource Management:

a. Fish Resources:

1. High levels of exploitation and pressure on fish resources;
2. Indications of a decline in biomass abundance (fish stock);
3. The continued capture of bycatch, especially rare, endangered, and protected marine species (ETP).

b. Fish Resource Environment:

1. The ongoing use of non-environmentally friendly fishing gear by fishermen from within and outside the province in WPPNRI 711;
2. Habitat degradation of fish resources due to coastal development activities, pollution, and climate change;
3. High levels of marine pollution from domestic waste, industrial waste (including oil spills), and fishing activities (discarded or lost fishing gear, leading to ghost fishing).

c. Socio-Economic Aspects of Fisheries:

1. Competition among fishermen, which has the potential to lead to conflicts between fishing communities;
2. Indications that fishing grounds are becoming farther for local fishermen, leading to higher operational costs for fishing activities.

d. Fisheries Management Governance:

1. Limited infrastructure and facilities to support fisheries management governance;
2. The availability of scientific data on key fish commodities remains very limited;
3. The lack of involvement of fishermen, industries, and other stakeholders in decision-making processes related to fisheries management, resulting in low compliance with regulations.

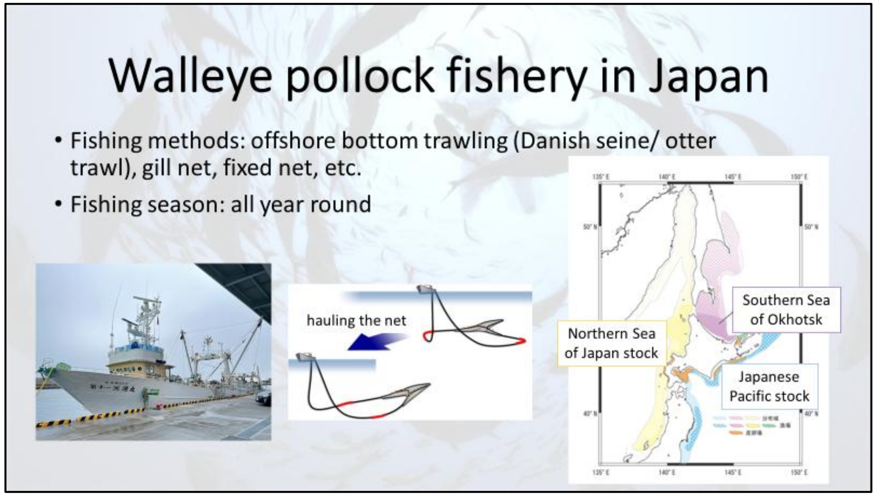
Suggestion and Conclusion

- ✓ To improve accuracy and reduce uncertainty in estimating the potential of fish resources, institutional support and human resources are required to ensure that data collection and processing units under the Ministry of Marine Affairs and Fisheries can function optimally.
- ✓ Funding also needs to be increased, particularly for the collection of fisheries statistical data, fisheries research, stock assessments of fish resources, and the management of operational logbook data and observers.
- ✓ The recommendations from the National Commission on Fish Resource Assessment should be used as a basis for decision-making and the formulation of regulations for sustainable fisheries management.
- ✓ Fisheries management in Indonesia is a complex and evolving process. Despite numerous challenges, the government's efforts demonstrate a commitment to preserving fish resources and improving the well-being of fishermen.

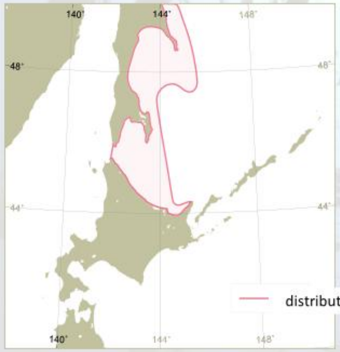

SEAFDEC
JTF
TRUST FUND - FISHERIES AGENCY OF JAPAN
The Current Status of Fisheries and Stock Assessment in Japan (especially in Hokkaido)
Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17-24 September 2024
Prepared by: Kuwahara Nagisa
Research Scientist, Demersal Fish Resourse Division,
Fisheries Stock Assessment Center,
National Research and Development Agency, FRA


Kuwahara Nagisa （桑原 凪沙）
• I joined FRA as a researcher this April.
→I just started learning about stock assessment!
↑ in Redang Island ↓
↑stomach of SSL
My study in Hokkaido University
stomach contents analysis of Steller Sea Lions
I have lived in Malaysia in my childhood.
I am very glad to be here today!!!


Walleye pollock: one of the most caught fish in the world (3.4 million tons). (FAO 2024)
• Production in Japan: 160 thousand tons (2022)
• Production value in Japan: 11 billion yen (7.8 billion USD) (2022)
• Mainly used as raw material for surimi.
https://umito.maruha-nichiro.co.jp/article70/


Walleye pollock fishery in Japan
• Fishing methods: offshore bottom trawling (Danish seine/ otter trawl), gill net, fixed net, etc.
• Fishing season: all year round
hauling the net
Southern Sea of Okhotsk
Northern Sea of Japan stock
Japanese Pacific stock

Walleye pollock Southern Sea of Okhotsk



- Production: 38 thousand tons in 2023
- Distribution: across Japanese and Russian waters

→**Little biological information**

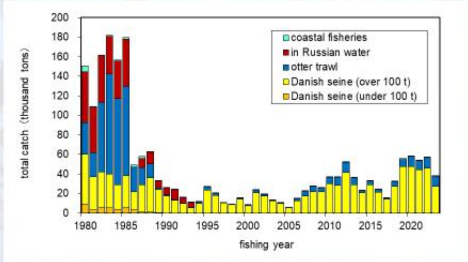
→ Impossible to define a stock

- Difficult to collect age-based data

→ Impossible to employ age-based assessment model

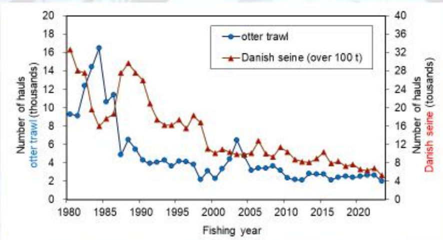
→use **CPUE** as a target to manage

Trend and Relevant statistic (catch)



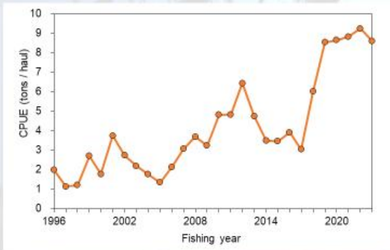
- Early 1980s: Around 150 thousand tons
- 1990s & 2000s: under 30 thousand tons
- 38 thousand tons in 2023

Trend and Relevant statistic (efforts)



- Otter trawl: decreased from 16 thousand (1984) to 2-3 thousand since 1998
- Danish seine: decreased from 16-33 thousand (1980s) to around 10 thousand since 1999 (5 thousand in 2023)

Trend and Relevant statistic (CPUE)

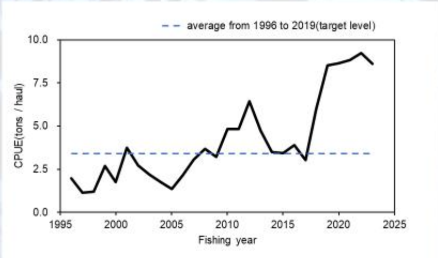


How to calculate CPUE

$$\frac{\textbf{annual catch}}{\textbf{the number of hauls (Danish seine fishery)}}$$

- CPUE has been rising since 2018.
- 8.6 tons/haul in 2023

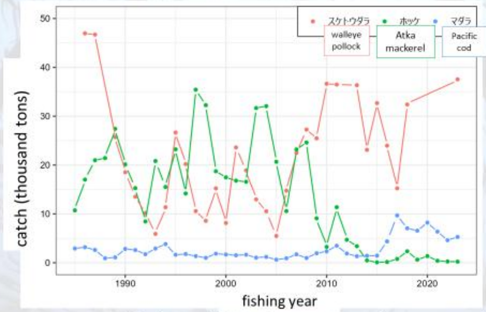
Stock status and Fishery Management



- We use the average CPUE from 1996-2019 (3.41 tons / haul) as a target to manage this resource.
- 8.6 tons / haul in 2023 → More than twice as high as the target!
- TAC is determined by maximum catch in recent years: 58 thousand tons in 2024

(TAC: Total Allowable Catch)

Problem and Constrain



- The main targets of fishing differ from period to period

ex.) 1990s & early 2000s: Atka mackerel, 2010s: walleye pollock

→ These differences in operations may affect CPUE.

Suggestion and Conclusion

CPUE standardization

ex.)

Step1: Logit(rate of encounter) = year + area + area-time + season

Step2: Log(CPUE) = year +area + area-time + fishing method + season

We are trying to remove operational bias in CPUE.

It is difficult to obtain details of biological information, so we have to maximize the use of available information.

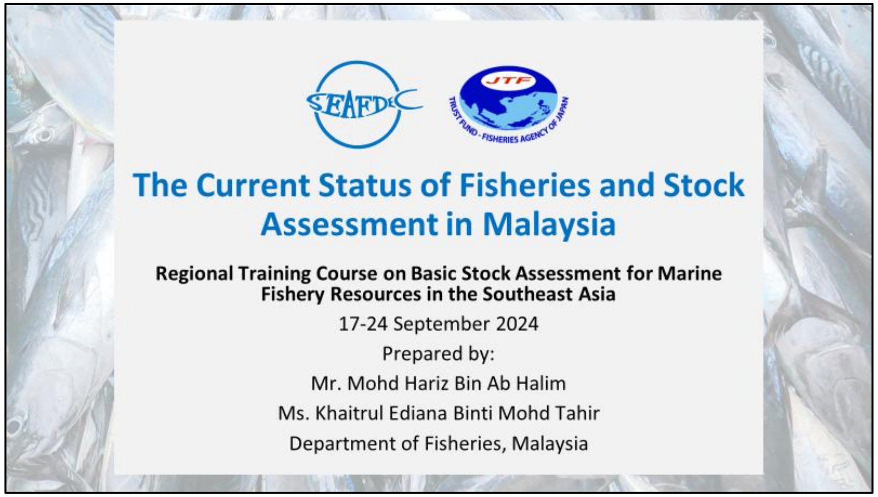
Stock assessments of the other two stocks

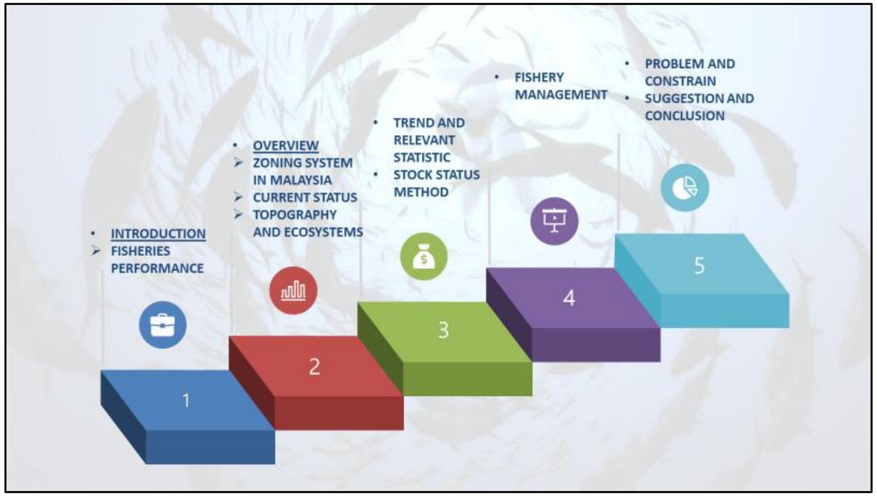
Japanese Pacific stock and Northern Sea of Japan stock

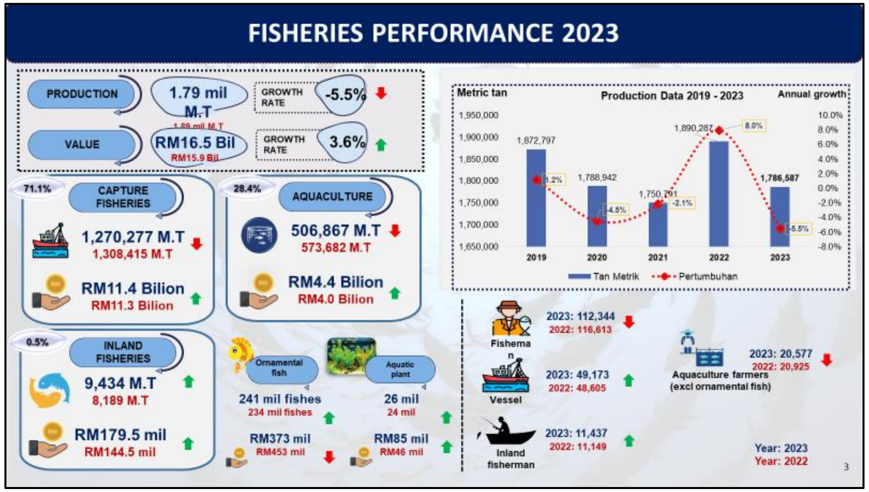
- Assessed by **tuned VPA** (age-based stock assessment model)
- MSY-based management has been conducted since 2020.

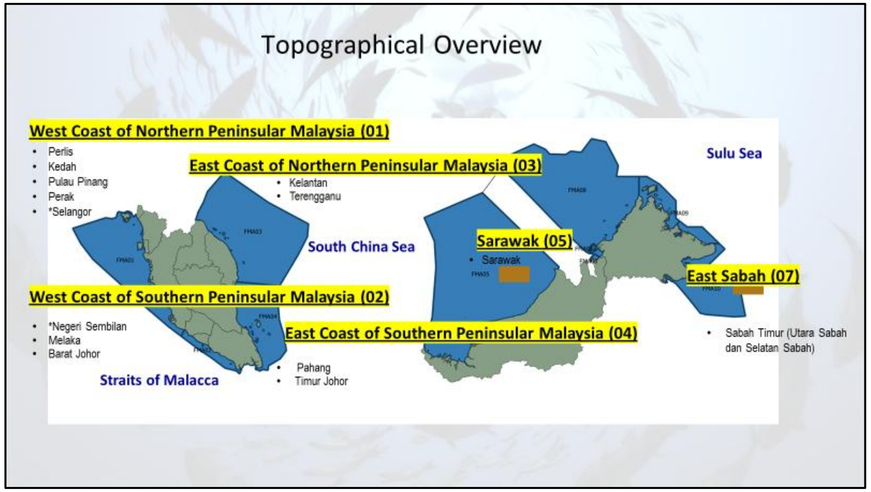
To tune the VPA model

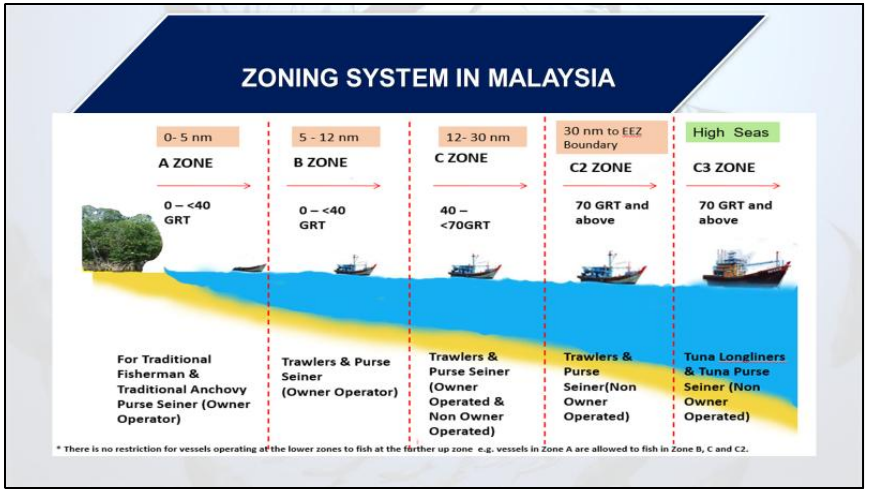
- Japanese Pacific Stock: use CPUEs of Danish seine fishery of each age
- Northern Sea of Japan stock: use abundance indices based on acoustic surveys

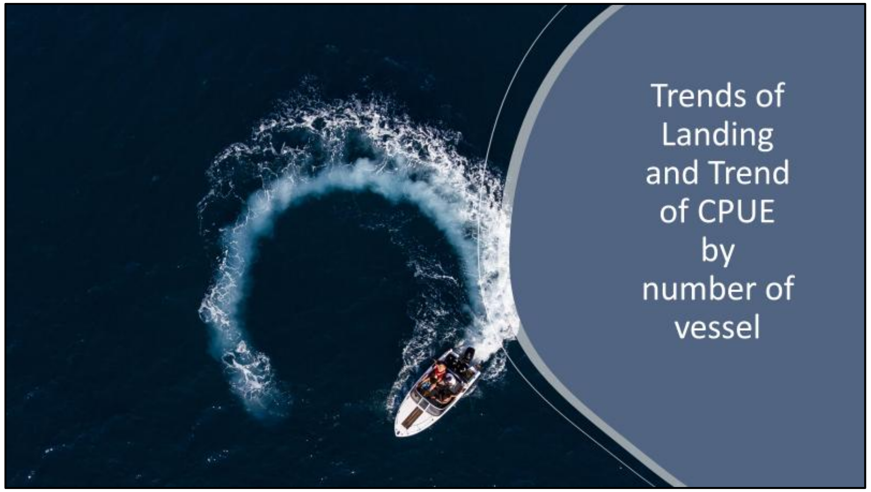

SEAFDEC
JTF
TRUST FUND · FISHERIES AGENCY OF JAPAN
The Current Status of Fisheries and Stock Assessment in Malaysia
Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17-24 September 2024
Prepared by:
Mr. Mohd Hariz Bin Ab Halim
Ms. Khaitrul Ediana Binti Mohd Tahir
Department of Fisheries, Malaysia

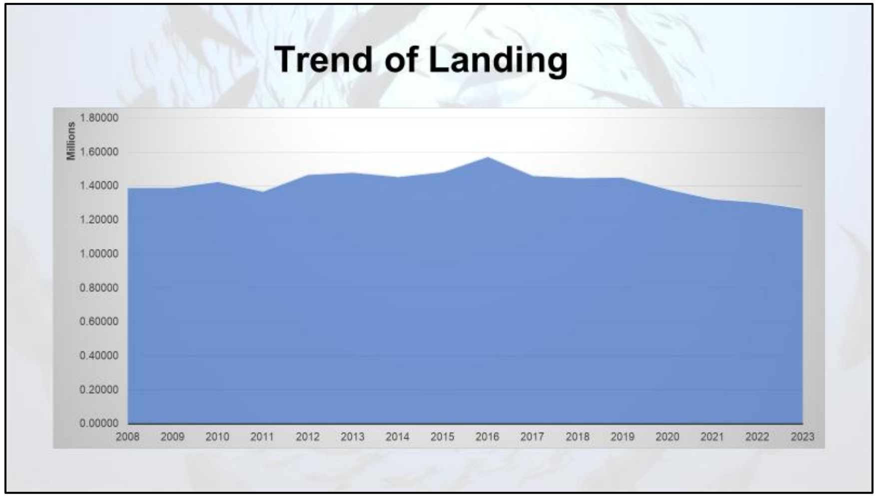

• INTRODUCTION
➢ FISHERIES PERFORMANCE
• OVERVIEW
➢ ZONING SYSTEM IN MALAYSIA
➢ CURRENT STATUS
➢ TOPOGRAPHY AND ECOSYSTEMS
• TREND AND RELEVANT STATISTIC
• STOCK STATUS METHOD
• FISHERY MANAGEMENT
• PROBLEM AND CONSTRAIN
• SUGGESTION AND CONCLUSION
1
2
3
4
5

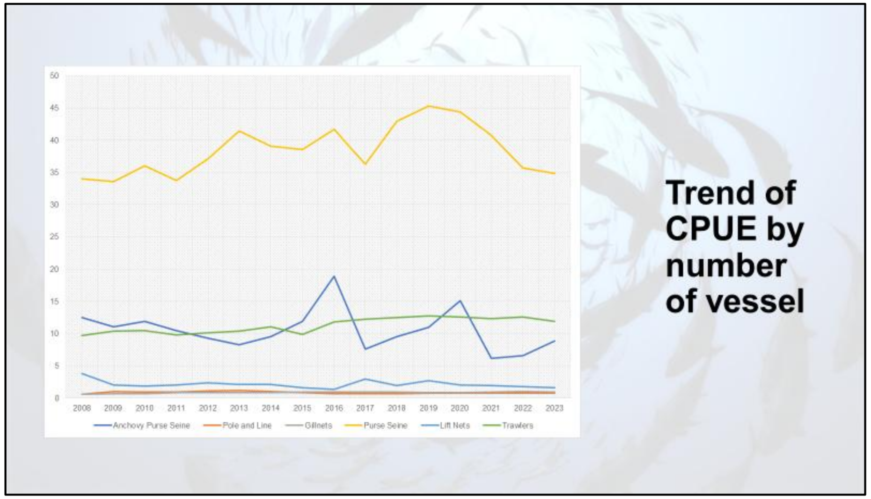

FISHERIES PERFORMANCE 2023
PRODUCTION
1.79 mil M.T
1.89 mil M.T
GROWTH RATE
-5.5%
VALUE
RM16.5 Bil
RM15.9 Bil
GROWTH RATE
3.6%
71.1%
CAPTURE FISHERIES
1,270,277 M.T
1,308,415 M.T
RM11.4 Bilion
RM11.3 Bilion
28.4%
AQUACULTURE
506,867 M.T
573,682 M.T
RM4.4 Bilion
RM4.0 Bilion
0.5%
INLAND FISHERIES
9,434 M.T
8,189 M.T
RM179.5 mil
RM144.5 mil
Ornamental fish
241 mil fishes
234 mil fishes
RM373 mil
RM453 mil
Aquatic plant
26 mil
24 mil
RM85 mil
RM46 mil
Metric tan
Production Data 2019 - 2023
Annual growth
1,872,797
1,788,942
1,750,791
1,890,287
1,786,587
1.2%
-4.8%
-2.1%
8.0%
-5.5%
2019
2020
2021
2022
2023
Tan Metrik
Pertumbuhan
Fisherman
2023: 112,344
2022: 116,613
Vessel
2023: 49,173
2022: 48,605
Inland fisherman
2023: 11,437
2022: 11,149
Aquaculture farmers (excl ornamental fish)
2023: 20,577
2022: 20,925
Year: 2023
Year: 2022
3


Topographical Overview
West Coast of Northern Peninsular Malaysia (01)
• Perlis
• Kedah
• Pulau Pinang
• Perak
• *Selangor
East Coast of Northern Peninsular Malaysia (03)
• Kelantan
• Terengganu
South China Sea
Sarawak (05)
• Sarawak
Sulu Sea
East Sabah (07)
West Coast of Southern Peninsular Malaysia (02)
• *Negeri Sembilan
• Melaka
• Barat Johor
East Coast of Southern Peninsular Malaysia (04)
• Pahang
• Timur Johor
Straits of Malacca
• Sabah Timur (Utara Sabah dan Selatan Sabah)

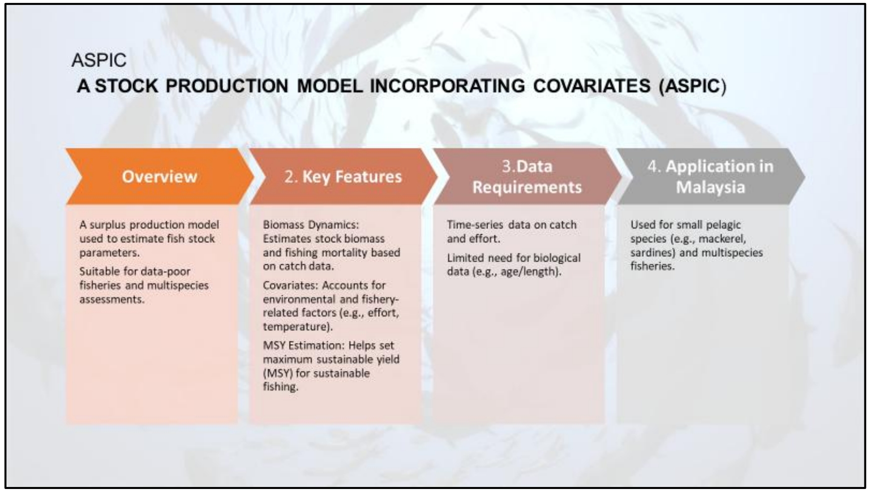

ZONING SYSTEM IN MALAYSIA
0- 5 nm
A ZONE
0 – <40 GRT
For Traditional Fisherman & Traditional Anchovy Purse Seiner (Owner Operator)
5 - 12 nm
B ZONE
0 – <40 GRT
Trawlers & Purse Seiner (Owner Operator)
12- 30 nm
C ZONE
40 – <70GRT
Trawlers & Purse Seiner (Owner Operated & Non Owner Operated)
30 nm to EEZ Boundary
C2 ZONE
70 GRT and above
Trawlers & Purse Seiner(Non Owner Operated)
High Seas
C3 ZONE
70 GRT and above
Tuna Longliners & Tuna Purse Seiner (Non Owner Operated)
* There is no restriction for vessels operating at the lower zones to fish at the further up zone e.g. vessels in Zone A are allowed to fish in Zone B, C and C2.

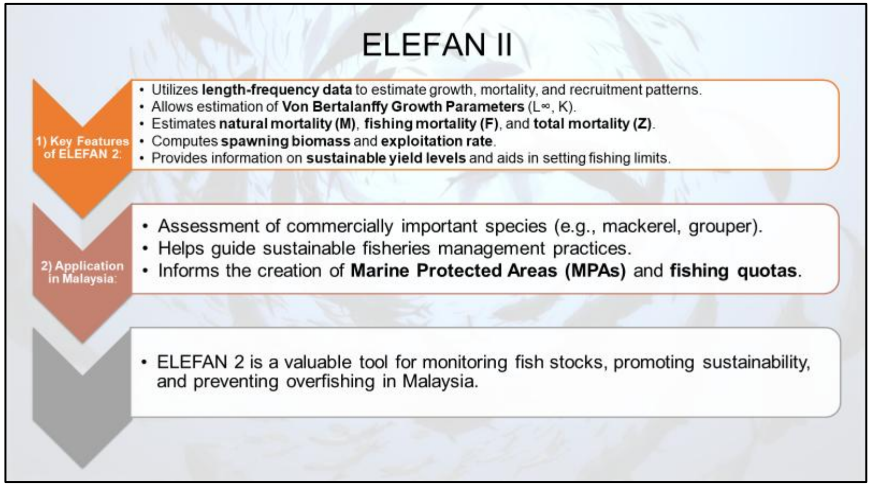

Trends of Landing and Trend of CPUE by number of vessel

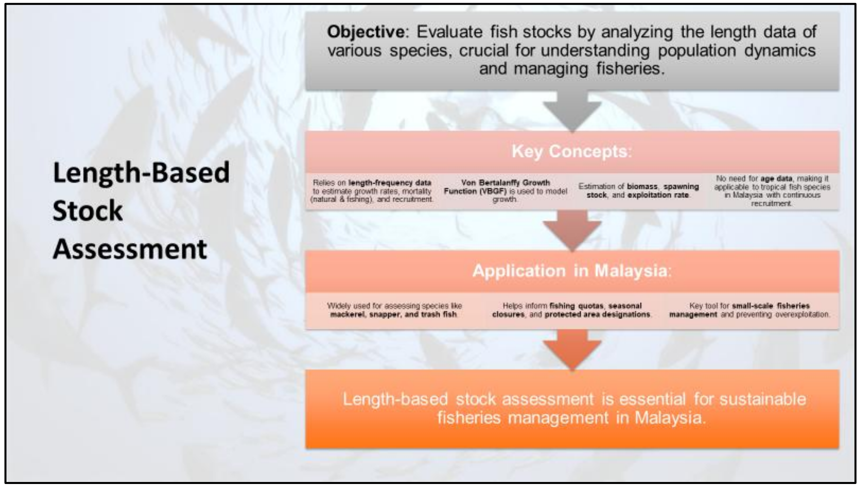

Trend of Landing
Millions
1.80000
1.60000
1.40000
1.20000
1.00000
0.80000
0.60000
0.40000
0.20000
0.00000
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023

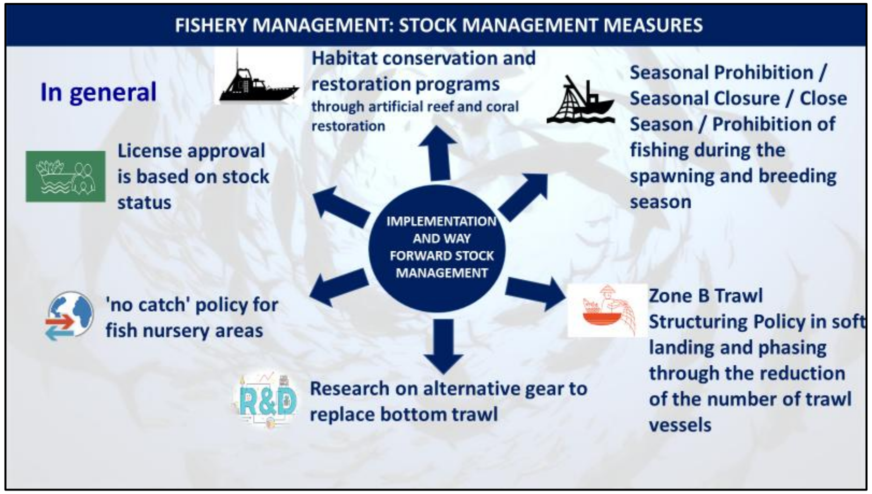

Trend of CPUE by number of vessel
50 45 40 35 30 25 20 15 10 5 0
2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023
Anchovy Purse Seine
Pole and Line
Gillnets
Purse Seine
Lift Nets
Trawlers

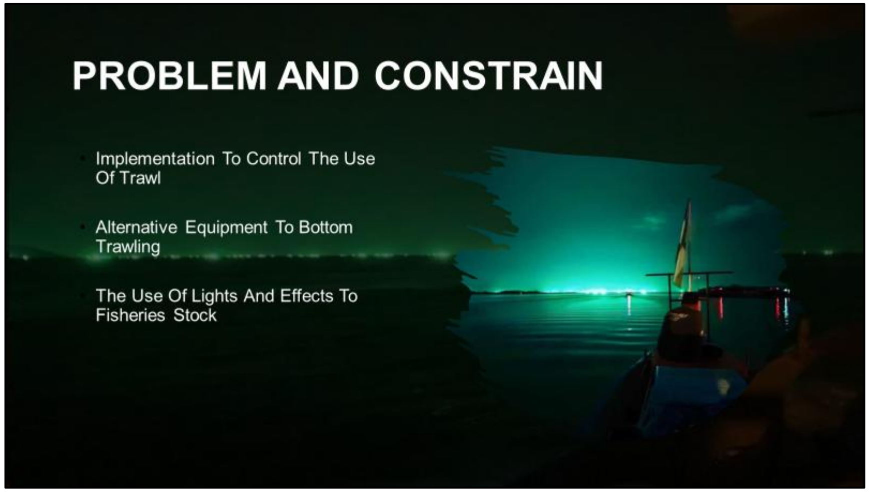

Stock assessments in Malaysia

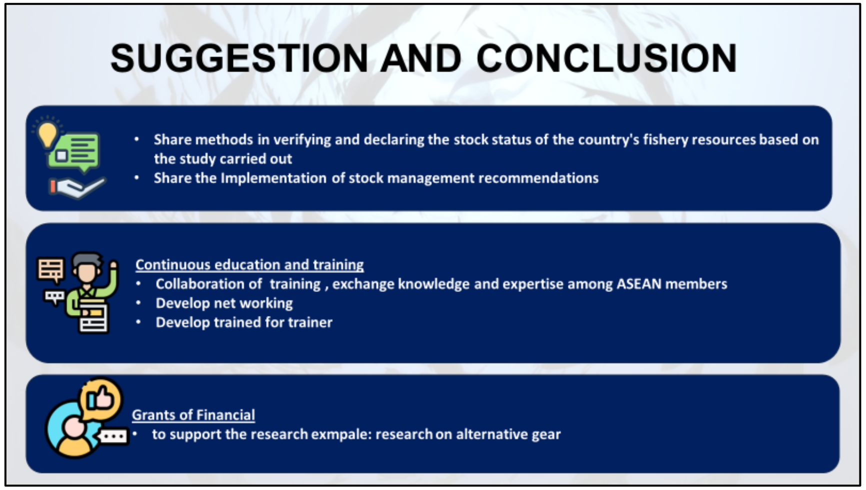

ASPIC
A STOCK PRODUCTION MODEL INCORPORATING COVARIATES (ASPIC)
Overview
2. Key Features
3.Data Requirements
4. Application in Malaysia
A surplus production model used to estimate fish stock parameters.
Suitable for data-poor fisheries and multispecies assessments.
Biomass Dynamics: Estimates stock biomass and fishing mortality based on catch data.
Covariates: Accounts for environmental and fishery-related factors (e.g., effort, temperature).
MSY Estimation: Helps set maximum sustainable yield (MSY) for sustainable fishing.
Time-series data on catch and effort.
Limited need for biological data (e.g., age/length).
Used for small pelagic species (e.g., mackerel, sardines) and multispecies fisheries.


ELEFAN II
1) Key Features of ELEFAN 2:
• Utilizes length-frequency data to estimate growth, mortality, and recruitment patterns.
• Allows estimation of Von Bertalanffy Growth Parameters (L∞, K).
• Estimates natural mortality (M), fishing mortality (F), and total mortality (Z).
• Computes spawning biomass and exploitation rate.
• Provides information on sustainable yield levels and aids in setting fishing limits.
2) Application in Malaysia:
• Assessment of commercially important species (e.g., mackerel, grouper).
• Helps guide sustainable fisheries management practices.
• Informs the creation of Marine Protected Areas (MPAs) and fishing quotas.
• ELEFAN 2 is a valuable tool for monitoring fish stocks, promoting sustainability, and preventing overfishing in Malaysia.


Length-Based Stock Assessment
Objective: Evaluate fish stocks by analyzing the length data of various species, crucial for understanding population dynamics and managing fisheries.
Key Concepts:
Relies on length-frequency data to estimate growth rates, mortality (natural & fishing), and recruitment.
Von Bertalanffy Growth Function (VBGF) is used to model growth.
Estimation of biomass, spawning stock, and exploitation rate.
No need for age data, making it applicable to tropical fish species in Malaysia with continuous recruitment.
Application in Malaysia:
Widely used for assessing species like mackerel, snapper, and trash fish.
Helps inform fishing quotas, seasonal closures, and protected area designations.
Key tool for small-scale fisheries management and preventing overexploitation.
Length-based stock assessment is essential for sustainable fisheries management in Malaysia.


FISHERY MANAGEMENT: STOCK MANAGEMENT MEASURES
In general
Habitat conservation and restoration programs
through artificial reef and coral restoration
Seasonal Prohibition / Seasonal Closure / Close Season / Prohibition of fishing during the spawning and breeding season
License approval is based on stock status
IMPLEMENTATION AND WAY FORWARD STOCK MANAGEMENT
'no catch' policy for fish nursery areas
Zone B Trawl Structuring Policy in soft landing and phasing through the reduction of the number of trawl vessels
R&D
Research on alternative gear to replace bottom trawl


PROBLEM AND CONSTRAIN
Implementation To Control The Use Of Trawl
Alternative Equipment To Bottom Trawling
The Use Of Lights And Effects To Fisheries Stock


SUGGESTION AND CONCLUSION
• Share methods in verifying and declaring the stock status of the country's fishery resources based on the study carried out
• Share the Implementation of stock management recommendations
Continuous education and training
• Collaboration of training , exchange knowledge and expertise among ASEAN members
• Develop net working
• Develop trained for trainer
Grants of Financial
• to support the research exmpale: research on alternative gear


Thank You

Ministry of Agriculture, Livestock and Irrigation

Department of Fisheries

Country Personation of Myanmar for

Regional Training Course on Basic Stock Assessment for Marine Fisheries Resources in the Southeast Asia

Min Khaing, Assistant Fishery Officer

Cho Zin Thet, Assistant Fishery Officer

Date: 17/09/2024

Venue: SEAFDEC-MFRDMD

Types of Fisheries in Myanmar

- Three Categories
  - (a) Inland Fisheries
    - Leasable Fisheries
    - Open Fisheries
  - (b) Marine Fisheries
    - Inshore Fisheries– normally10 nm from shoreline/fishingboat – traditionaltype, 40 ft, 50 HP
    - Offshore Fisheries–outer limitof inshorefishingzone to ExclusiveEconomicZone
  - (c) Aquaculture

2

Marine Fisheries

- Department of Fisheries demarcate the fishing zone to easily manage fishing vessel and gear
- There are four fishing zones (Rakhine,Ayeyarwaddy, Mon and Tanintharyi)
  - ✓ 30 fishing grounds in Rakhine
  - ✓ 44 Fishing grounds inAyeyarwaddy
  - ✓ 14 Fishing grounds in Mon
  - ✓ 52 Fishing ground in Tanintharyi
- One Fishing ground is about 30 nm wide (0.5 degree of Lat and Long)

3

Marine Fisheries

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  - ✓ 52 Fishing ground in Tanintharyi
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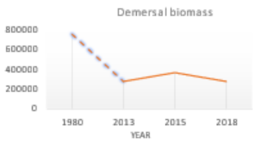
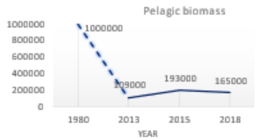
3

Marine Ecosystem Survey Results

➤ Biomass and Stock Changes

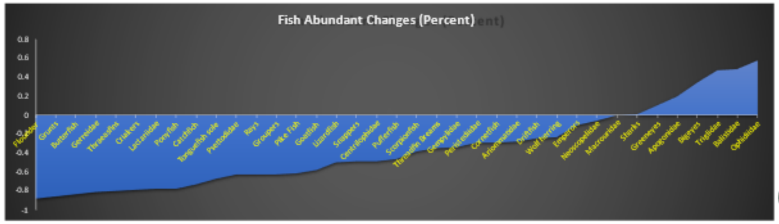




A significant reduction in the most valuable commercial species

A significant increase in smaller fast recruiting, less valuable species.

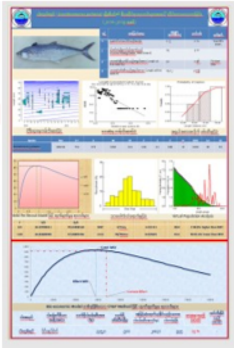
This is a typical indication of overfishing.



5

Fish Stock Assessment Results

No.	Species	Year	L∞	K	Φ	M	F	Z	E	Lr	L50%
1	*Arius maculatus*	2018-19	68.4	1.02	3.679	1.41	4.87	6.28	0.77	11	26.89
2	*Congresoxtalabonoies*	2018-19	147.8	1.01	4.33	1.13	5.89	7.02	0.83	27	72
3	*Trichiuruslepturus*	2018-19	139	0.26	3.701	0.47	1.86	2.33	0.8	43	65.74
4	*Nemiterusjaponicus*	2018-19	37.9	0.51	2.865	1.06	1.86	3.92	0.64	11	12.77
5	*Leptomelanosoma indicum*	2018-19	61.8	0.26	2.997	0.58	3.8	4.38	0.87	15	24.74
6	*Cynoglossusbilineatus*	2018-19	55.75	0.73	3.356	1.2	2.42	3.62	0.67	10	20.45
7	*Daysciaena albida*	2018-19	45.5	0.3	2.793	0.71	0.41	1.2	0.37	13	20.8
8	*Atrobuccanibe*	2018-19	44.8	0.5	3.002	1	1.34	2.34	0.57	10	13.85
9	*Pampus argenteus*	2017-18	54.5	0.95	3.294	1.44	2.44	3.68	0.61	10	12.9
10	*Rastrelligebrachisoma*	2018-19	35	3.36	3.614	3.72	1.77	5.49	0.32	12	16.46
11	*Megalaspiscordyla*	2018-19	56.75	0.88	3.452	1.35	0.59	1.94	0.30	10	14.54
12	*Scombromorus guttatus*	2018-19	73.2	0.73	3.594	1.11	1.09	2.2	0.49	13	25
13	*Euthynusaffinis*	2018-19	64.05	1.01	3.617	1.42	1.02	2.44	0.42	30	44.11
14	*Auxisthazard*	2018-19	38.5	0.9	3.12	1.53	1.43	3.26	0.533	17	29.33
15	*Chirocentrusnudus*	2018-19	75	1.15	3.811	1.49	2.12	3.61	0.59	31	36.4
16	*Tenualosailisha*	2018-19	55.1	0.52	3.198	0.97	3.44	4.41	0.78	21	28.82



6

Fisheries Management

- Marine fisheries Law

Activities

- Supervision on fishing vessel license and registration
- Vessel marking by fishing ground
- Limited new constriction and new fishing license
- Monitoring on check in check out system, log book and sailing order
- Using VMS

7

Fisheries Management

Low abundance of fish eggs was found during the 2018 cruise, particularly in the southern Rakhine region. Also abundance of ripe and running fish in the trawl hauls was low. Hence, both the ichthyoplankton and the trawl sampling are consistent indicating that August – September is mostly off spawning season for the most important marine species. This is also confirmed by literature on spawning fish.

Change Closed Season and Closed Area

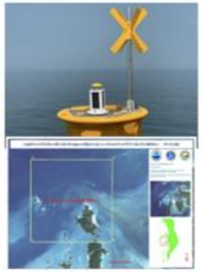
- June, July and Aug to April, May and June
- Try to conduct the most commercial species spawning periods

8

Fisheries Management

- **Protected Area**

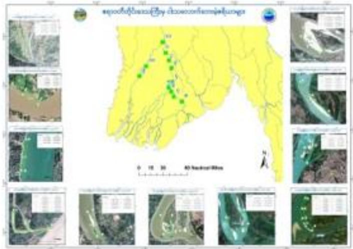
- **Gear Restricted area**



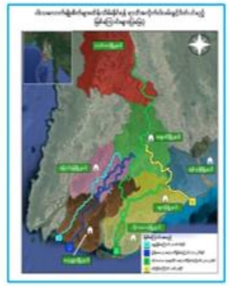
9

Fisheries Management

Conservation area for specific Species



- Seasonal Closed Area for Specific Species



10

Expectation from Training

- **Myanmar try to conduct fishery trawl survey using Local fishing Vessel in the end of 2024.**
- **Gain knowledge and skill of the analyzing methods for trawl survey data.**
- **Gain the experiences of Malaysian Culture, Traditional, food, etc.**

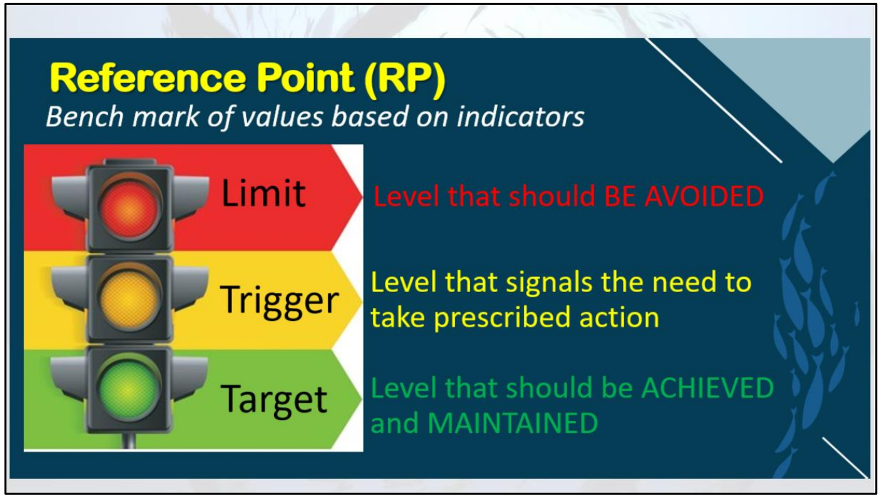
11

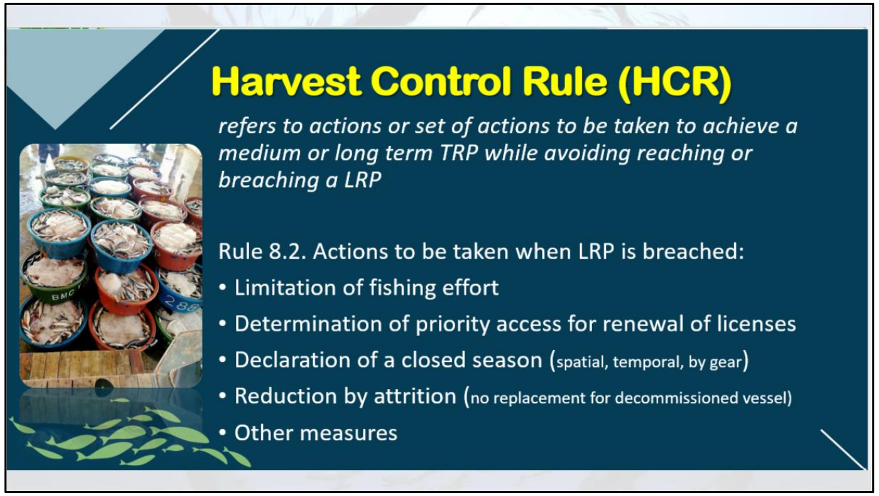
THANK YOU

12


SEAFDEC
JTF
TRUST FUND · FISHERIES AGENCY OF JAPAN
The Current Status of Fisheries and Stock Assessment in the Philippines
Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia
17-24 September 2024
Prepared by:
Sheryll V. Mesa and Rhoda S. Bacordo
Department of Agriculture
BUREAU OF FISHERIES AND AQUATIC RESOURCES


RA 10654
Sec. 8. Harvest Control Rules (HCR) and Reference Points (RP)
• Establishing HCR and RPs in a fishery management area
• may be established upon the concurrence and approval or recommendation of such special agency and the concerned LGU in consultation with the FARMC for conservation or ecological purposes.

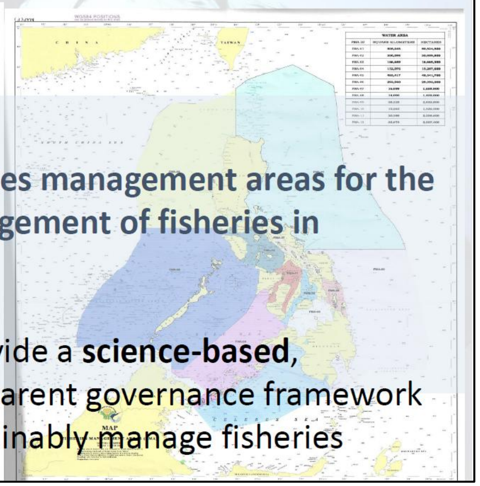

Reference Point (RP)
Bench mark of values based on indicators
Limit
Level that should BE AVOIDED
Trigger
Level that signals the need to take prescribed action
Target
Level that should be ACHIEVED and MAINTAINED

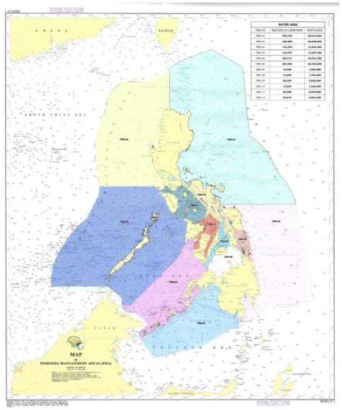

Harvest Control Rule (HCR)
refers to actions or set of actions to be taken to achieve a medium or long term TRP while avoiding reaching or breaching a LRP
Rule 8.2. Actions to be taken when LRP is breached:
• Limitation of fishing effort
• Determination of priority access for renewal of licenses
• Declaration of a closed season (spatial, temporal, by gear)
• Reduction by attrition (no replacement for decommissioned vessel)
• Other measures

FAO 263, s.2019

Establishment of fisheries management areas for the conservation and management of fisheries in Philippine waters

Establish FMAs and provide a **science-based**, participatory and transparent governance framework and mechanism to sustainably manage fisheries





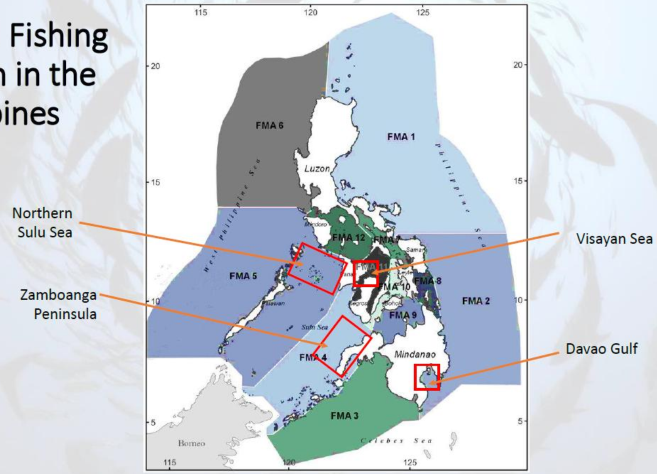
Fisheries Management Areas (FMAs) Implementation

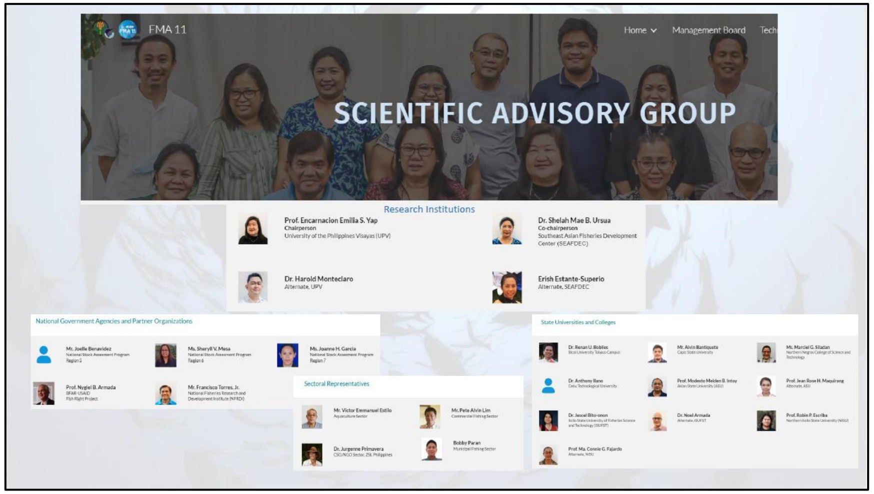
- Spatial delineation of Philippine waters as a means to manage at appropriate scale
- Approximation of an ecosystem scale of management
- Approximation of stocks and fisheries distribution based on best available science
- Builds on previous efforts such as previous FMUs, bay-wide management

Fishery Management in Place

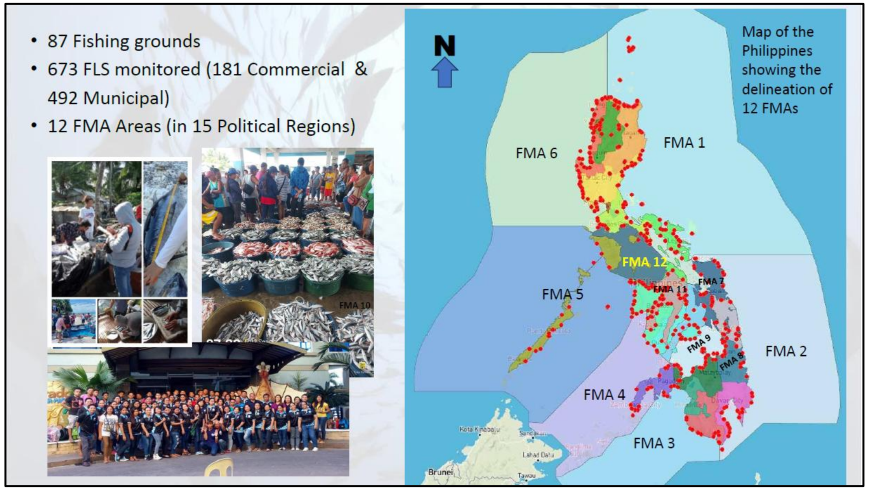
Classification/Policy	Fishing Gear Type
I. Banned gears (FAO 246 & JMC 2018-03)	Danish seine & Otter Trawl
II. Regulation on the use of fine meshed net gears (Site Specific) – FAO 155 and 155-1	Ring net/Sinsuro catching Lobo-lobo that can be operated during the peak season
III. Compliance to 3cm mesh size regulation (Sec. 93 of RA 10654)	Fish coral, stationary lift net, round haul seine, modified cast net, gillnets; bunt of purse seine and ring net

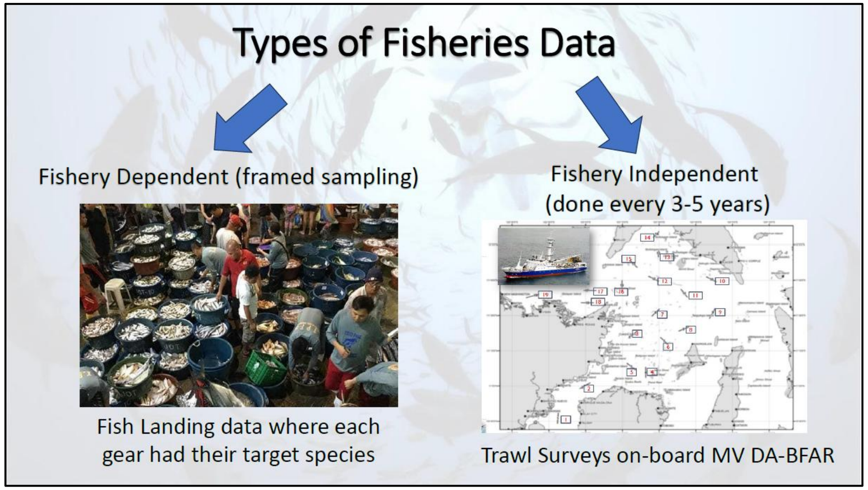
Closed Fishing Season in the Philippines

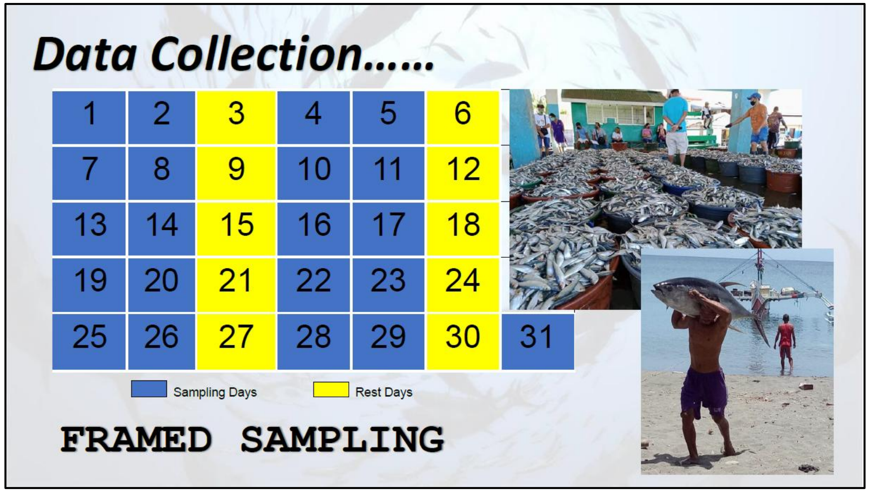



FMA 11
Home
Management Board
SCIENTIFIC ADVISORY GROUP
Research Institutions
Prof. Encarnacion Emilia S. Yap
Chairperson
Dr. Shelah Mae B. Ursua
Co-chairperson
Dr. Harold Monteclaro
Erish Estante-Superio

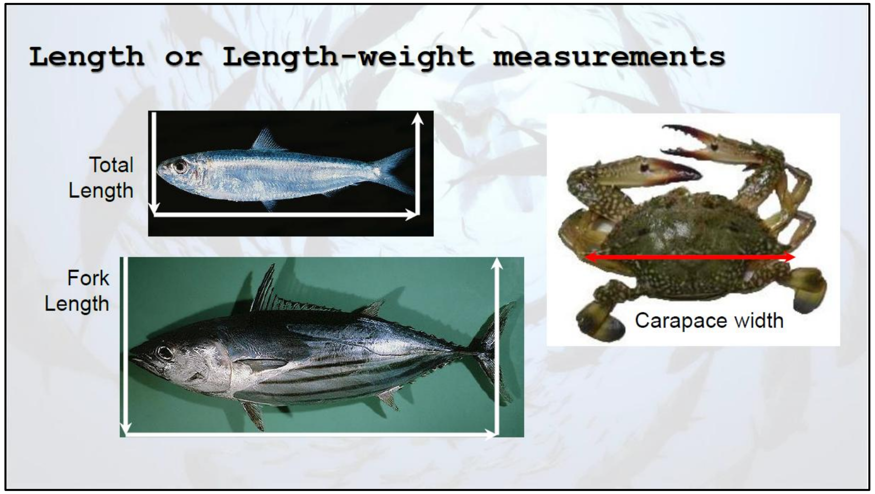

Introduction
• NSAP - National Stock Assessment Program
• NFRDI as the lead implementer
• BFAR as implementer at the regional level
• NSAP is mandated to come up with science base information as basis for Fisheries Management Area implementation
i am FMA 11

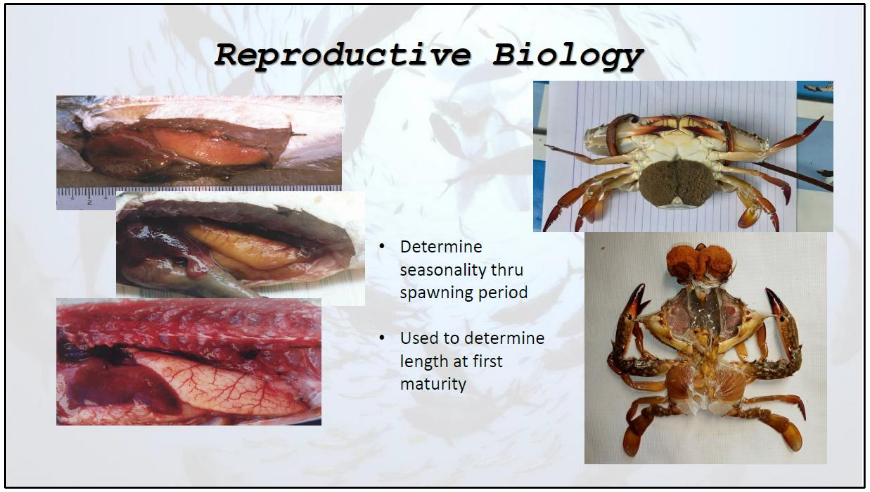

• 87 Fishing grounds
• 673 FLS monitored (181 Commercial & 492 Municipal)
• 12 FMA Areas (in 15 Political Regions)
N
Map of the Philippines showing the delineation of 12 FMAs
FMA 6
FMA 1
FMA 12
FMA 5
FMA 2
FMA 4
FMA 3

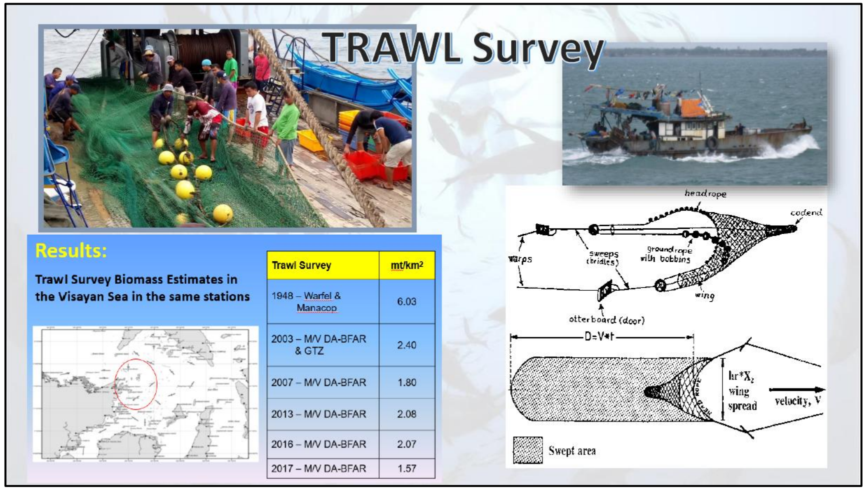

Types of Fisheries Data
Fishery Dependent (framed sampling)
Fishery Independent (done every 3-5 years)
Fish Landing data where each gear had their target species
Trawl Surveys on-board MV DA-BFAR



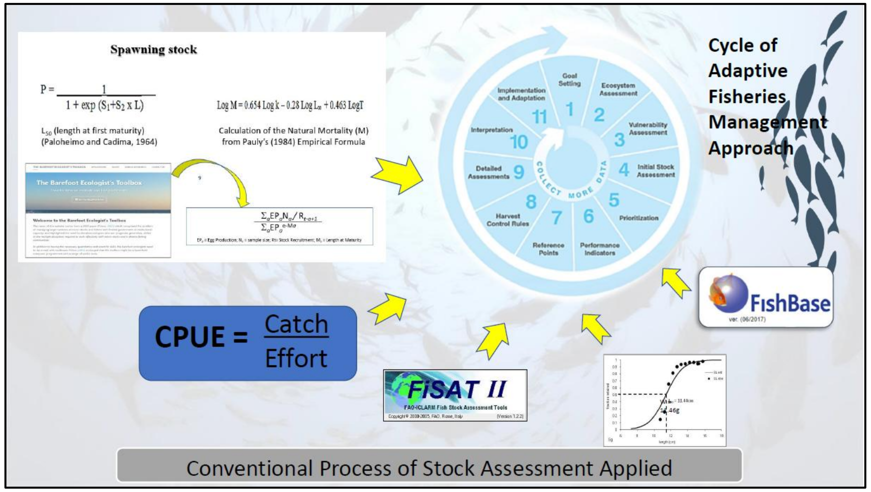
1	2	3	4	5	6	
7	8	9	10	11	12	
13	14	15	16	17	18	
19	20	21	22	23	24	
25	26	27	28	29	30	31

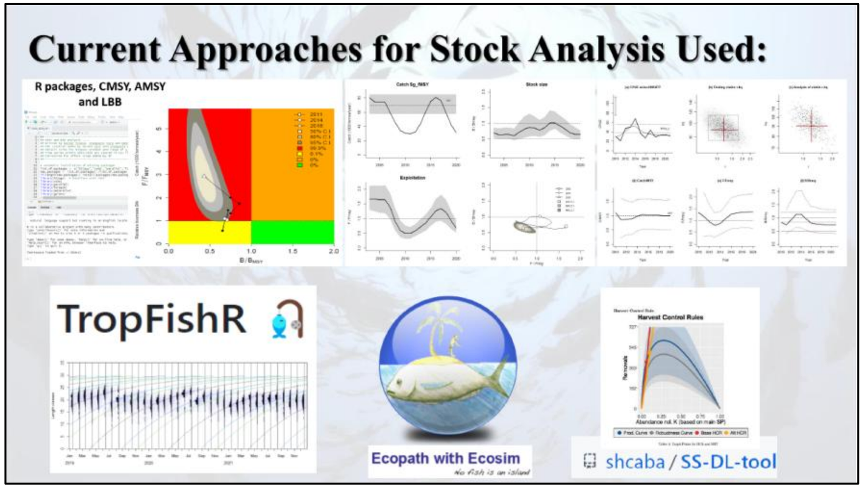


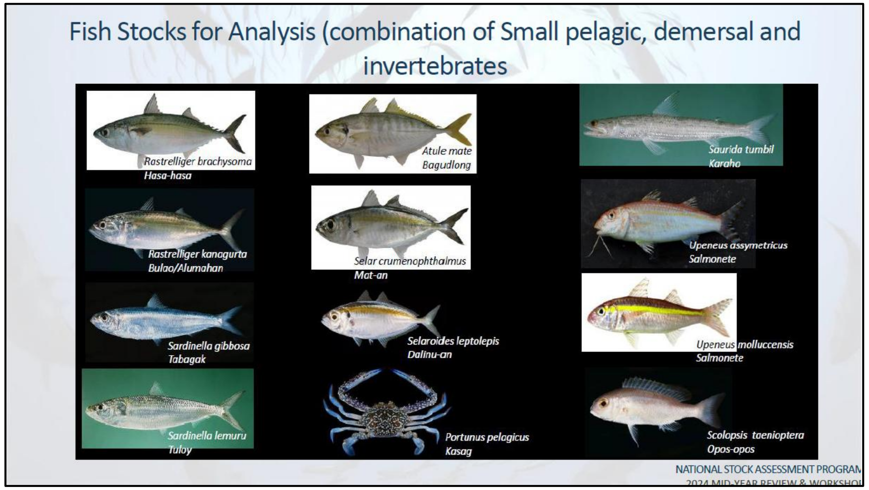




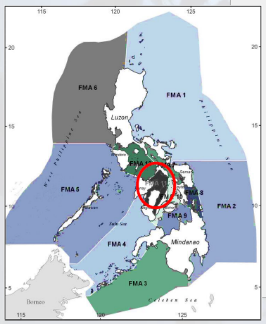
Trawl Survey	mt/km²
1948 – Warfel & Manacop	6.03
2003 – M/V DA-BFAR & GTZ	2.40
2007 – M/V DA-BFAR	1.80
2013 – M/V DA-BFAR	2.08
2016 – M/V DA-BFAR	2.07
2017 – M/V DA-BFAR	1.57





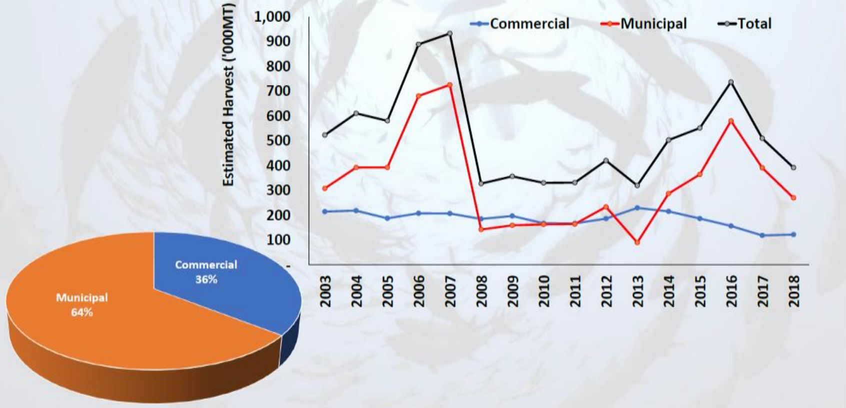


Gear type & count for FMA 11



Sector	Gear	Sector	Gear				
C(11)	BgN	M	BgN	DIN	HL	RN	SpGC
	DS	(54)	BrN	DivC	HLm1	RNAC	MWSGN
	MWT		BS	Spear Diving	HLm2	ScN	Poison (Chlorine) Fishing
	OT		BSGNC	DS	HPC	ShT	Sabay
	PS		BSGNF	EGN	LN	SLN	BSGNS
	RHS		BSLL	FC	MH	SpG	CN
	RN		CLN	FN	MHL	SqJ	SqTr
	RNAC		CP	FP	MPN	SqP	DIV
	RNFF		CT	FT	OT	SqT	DLL
	SqT		DGN	GLE	PN	SSGN	EGNFF
	TB		DGNm	RHS	TL	HARPOON	

Estimated Harvest Distribution by Sector for FMA 11



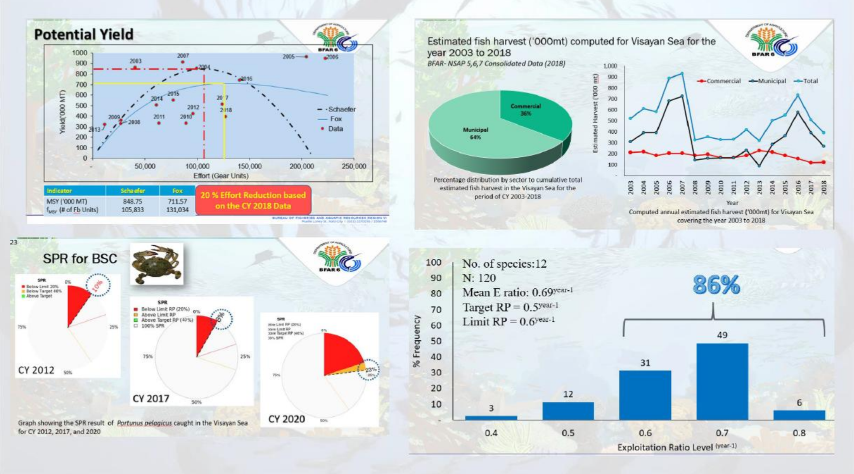
ANNUAL CPUE (kg/d) for the commercial sector in FMA 11

Gear	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Danish Seine	961.43	737.15	913.27	851.17	819.88	813.31	949.58	1,106.55	1,198.35	566.54	1,029.93
Mid-water	1,265.86	1,382.17	1,408.85	1,233.51	893.77	1,011.79	1,528.40	1,377.72	1,244.10	1,251.96	1,053.44
Otter trawl	866.20	676.12	603.55	542.97	806.02	893.57	668.17	565.38	840.79	677.38	811.52
Purse seine	5,455.34	5,286.93	4,889.69	4,746.59	4,682.45	3,260.60	2,975.99	4,446.28	4,399.02	2,107.88	2,123.63
Round haul seine	209.32	240.02	240.84	288.96	269.40		850.09	1,177.42	1,193.66	1,302.15	1,362.78
Ring net	1,110.93	1,026.63	1,133.39	910.82	638.15	448.08	2,604.25	1,329.79	1,364.74	1,245.45	585.25
Bag net					49.14						
Squid trawl					49.52	54.52	63.85	50.33		62.19	89.29
Ring net (compressor)								312.52	426.57	324.64	299.01
Ring net (Fish finder)								317.43	278.25	243.79	257.30
Trawl boat										838.47	584.91

STOCK STATUS:

Froese indicator results indicating the target and limit reference as to the percentage of mature sized caught major fish species of the Visayan Sea covering the recent years of CY 2016 to 2018.

Species	Target	Limit	2016	2017	2018	Evaluation	Method
Atule mate	80% adult size-catch	50% adult size-catch	38	11	14	breached	LF data/ FROESE
Selar crumenophthalmus			87	76	71	ok	
Selaroides leptolepis			86	85	83	ok	
Rasrtelliger brachysoma			80	60	53	breached	
Rasrtelliger kanagurta			58	41	41	breached	
Sardinella gibbosa			79	40	62	breached	
Sardinella lemuru			72	65	78	breached	
Scolopsis taenioptera			25	15	11	breached	
Saurida tumbil			22	31	37	breached	
Upeneus assymetricus			37	-	42	breached	
Upeneus molluccensis			62	58	76	breached	
Portunus pelagicus			73	36	40	breached	

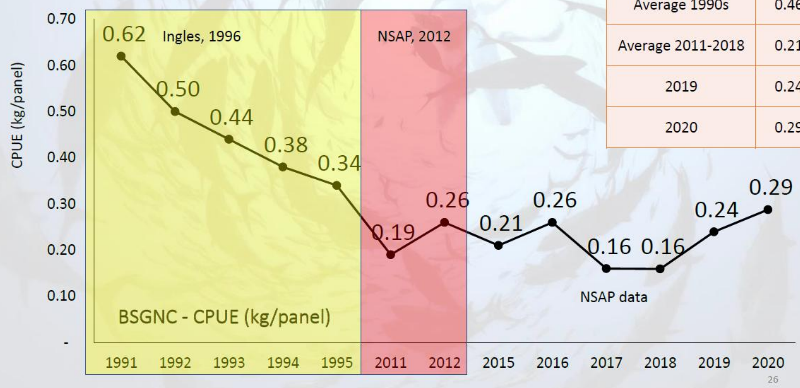


Reference Indicator:

Performance Indicators	Target Reference Point	Limit Reference Point	Results 2016	Results 2017	Results 2018	Inter-pretation
FROESE	80% mature	50% mature	73%	36%	40%	x
Fishing Mortality (F)	F/M < 1	F = 1.5M	1.73	2.87	2.52	x
Exploitation Value (E)	0.5	0.6	0.67	0.72	0.69	x
CPUE @ MSY (Schaefer) $CPUE_{current}/CPUE_{MSY}$						
	>1	<1	0.72			x

Community-based data collection and simple analysis

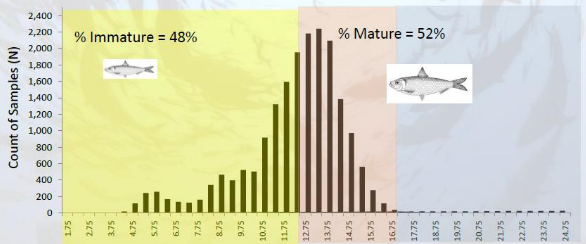
Average 1990s	0.46
Average 2011-2018	0.21
2019	0.24
2020	0.29



Froese Indicator:

80% Mature Stages

Reference Point for Mature-sized Catch
Target Reference Point: 80%
Limit Reference Point: 50%



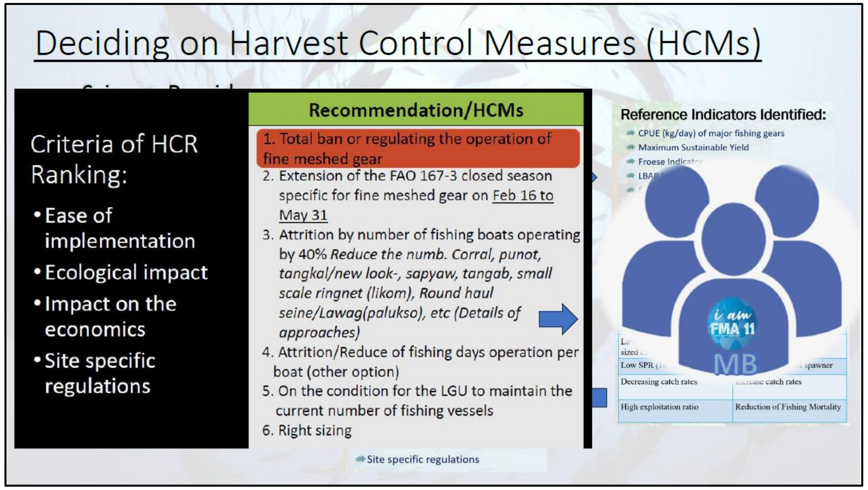
Growth performance indicator:

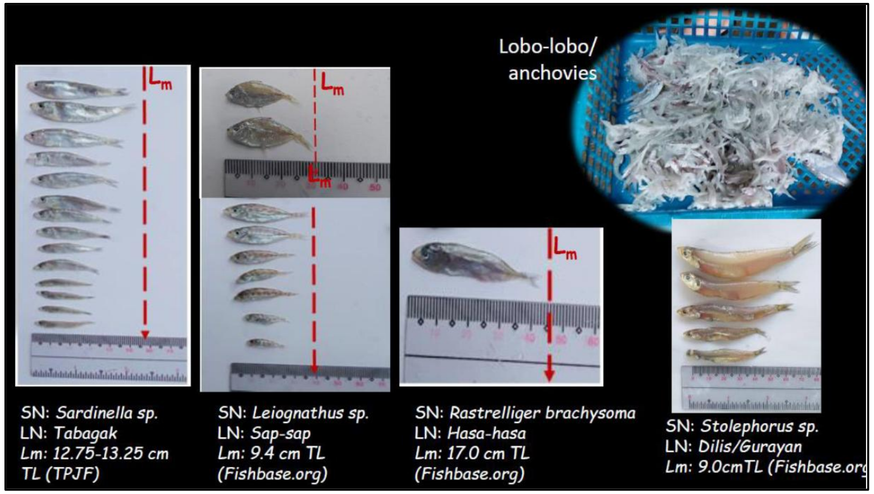
TRP – Increasing values LRP- Stable values

Year	L∞	Lm	L_{50} (Probability of Capture)	$\bar{L}$	Mode
2010-2012	19.1	11.5	11.0	11.3	10.8
Sept '19 to Sept'20	20.5	11.7	11.9	12.0	12.8

Note: All variables used the centimetre gauge (cm)

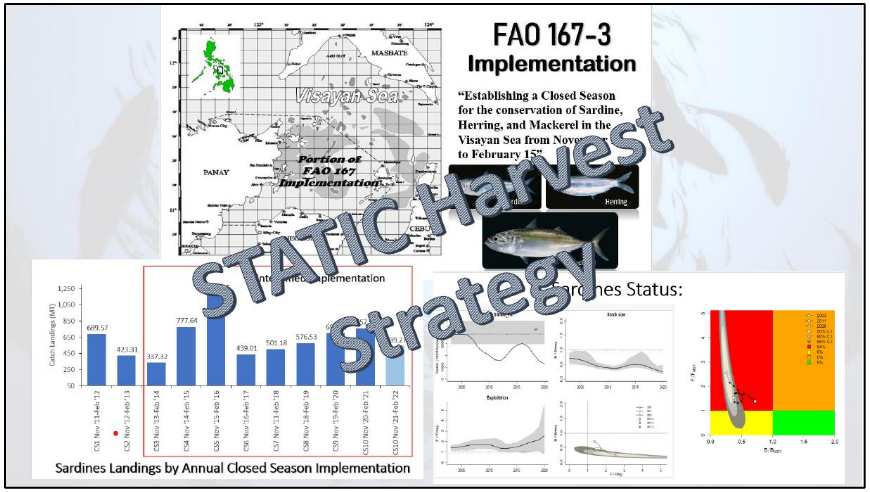
Findings/ Analysis (IF)	Harvest Control Rules (THEN)	Management Action
Low % catches of mature sized crab (Froese)	Increase survival of juvenile & spawner	Improve HCRs to protect the spawning population
Decreasing catch rates of BSGNC (CPUE Trend)	Increase catch rates	Equitable distribution of fishing opportunities to resource user
High exploitation ratio	Reduction of Fishing Mortality	Reduce fishing effort and/or put limits on fisheries output

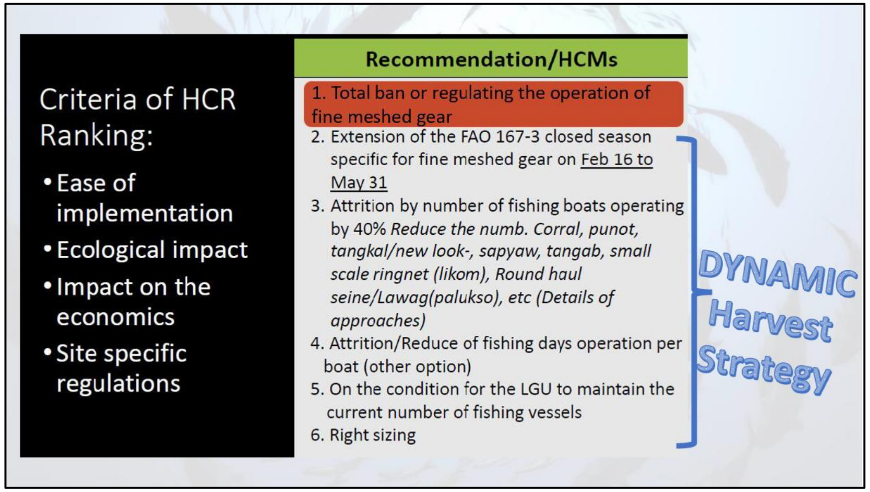




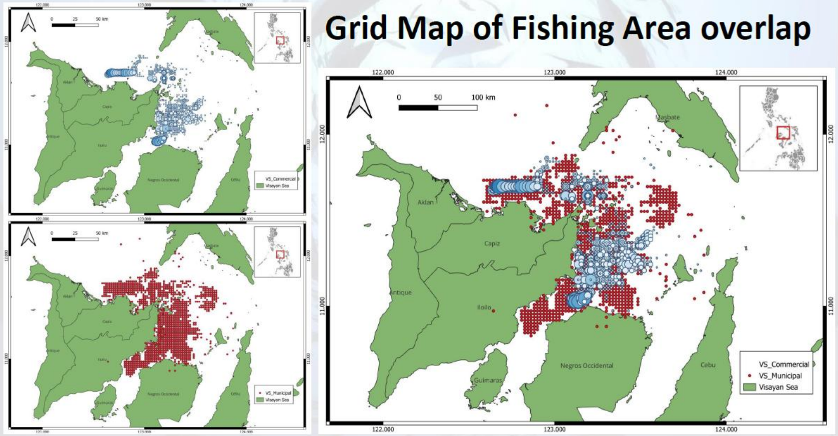

Gears that needs to comply the 3cm mesh size regulation


the
STRATEGIES


FAO 167-3
Implementation
"Establishing a Closed Season for the conservation of Sardine, Herring, and Mackerel in the Visayan Sea from November 15 to February 15"
MASBATE
Visayan Sea
PANAY
Portion of FAO 167 Implementation
Herring
STATIC Harvest Strategy
Sardines Status:
689.57
423.31
337.32
777.64
439.01
501.18
576.53
Sardines Landings by Annual Closed Season Implementation

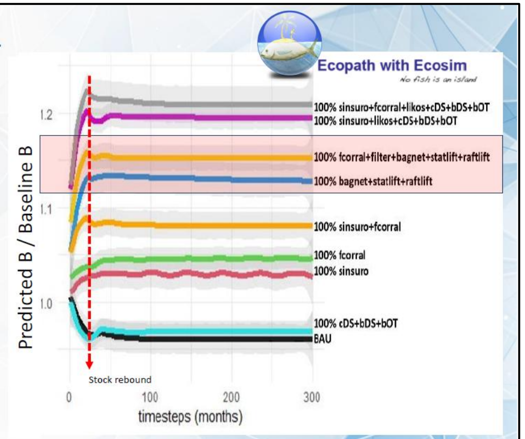

Criteria of HCR Ranking:
• Ease of implementation
• Ecological impact
• Impact on the economics
• Site specific regulations
Recommendation/HCMs
1. Total ban or regulating the operation of fine meshed gear
2. Extension of the FAO 167-3 closed season specific for fine meshed gear on Feb 16 to May 31
3. Attrition by number of fishing boats operating by 40% Reduce the numb. Corral, punot, tangkal/new look-, sapyaw, tangab, small scale ringnet (likom), Round haul seine/Lawag(palukso), etc (Details of approaches)
4. Attrition/Reduce of fishing days operation per boat (other option)
5. On the condition for the LGU to maintain the current number of fishing vessels
6. Right sizing
DYNAMIC Harvest Strategy

Grid Map of Fishing Area overlap



Harvest Strategy for FMA 11

- Business as Usual : continued decline, stabilizes around month 25 (or year 2)
- Largest positive impact results from ban of sinsuro and fish corral (F juveniles) + IUUF removed (F juveniles, adults)
- Reducing IUUF alone is not enough to improve the sardines' biomass



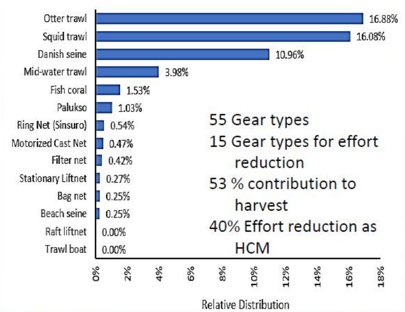
FISHERIES MANAGEMENT AREA __

NATIONAL STOCK ASSESSMENT PROGRAM
2024 MID-YEAR REVIEW & WORKSHOP

Harvest Strategy being Rolled-out in FMA 11

A. EFFORT REDUCTION IN FB UNITS

- 100% removal of Danish seine operation
- 100% removal of trawl operation in municipal water
- 100 % effort removal of Ring net using fish finders (Dec. 2024 last day of operation)



B. EFFORT REDUCTION IN FISHING DAYS OPERATION

- Visayan Sea Closed Season – 91 days
- Additional 91 days extension of non-operation for:

  Fish coral, filter net, stationary lift net, raft lift net, round-haul seine, beach seine, motorized cast net

C. REDUCTION PLAN

- Target effort reduction by HCM is 40%
- 15 gear types targeted for banning or regulation would account to 53% effort reduction
- Banned gears as DS, all trawl types, and Ring net (sinsuro) would account for 48% effort reduction

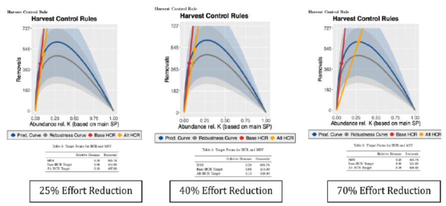
FISHERIES MANAGEMENT AREA 11

Stock Synthesis (US-NOAA)

Used in FMAs with single gear and single species analysis

SSBmsyRatio- Spawning stock biomass at MSY
SSBO- Virgin stock biomass
SPR msy- Spawning Potential Ratio at MSY
SSBcurr- current Spawning stock biomass
SPR curr- current Spawning Potential Ratio
RecDev- Recruitment Deviation

Parameter		Value
MSY	<	605.74
SSBmsyRatio	<	0.277761399
SSB0	<	5800.05
SPRmsy	<	0.355144
SSBcurr	<	335.679
SSBcurrRatio	<	0.057875191
SPRcurr	<	0.000045327
RecDev	<	0.5



Using the SSDL and HCR design Tool, we ran the following scenarios for 25%, 40% and 70% effort reductions

			Number of gears		
	Relative Biomass	Removals/ Effort reduction	Crab Gill net	Crab Pots	Crab Traps
Base/ Current Stock Status	0.06	414.00	6,764	1,650	2,605
25% Effort Reduction	0.10	497.00	5,073	1,238	1,954
40% Effort Reduction	0.12	528.00	4,057	990	1,563
70% Effort Reduction	0.28	606.00	2,029	495	782
Size regulation 11 cm	TBD	TBD	6,764	1,650	2,605
Ban on berried crabs	TBD	TBD	6,764	1,650	2,605
Size regulation and ban on berried	TBD	TBD	6,764	1,650	2,605

Fishery Management Process

SCIENCE DATA → REFERENCE POINT → HARVEST CONTROL RULES → HARVEST CONTROL MEASURE → HARVEST STRATEGY

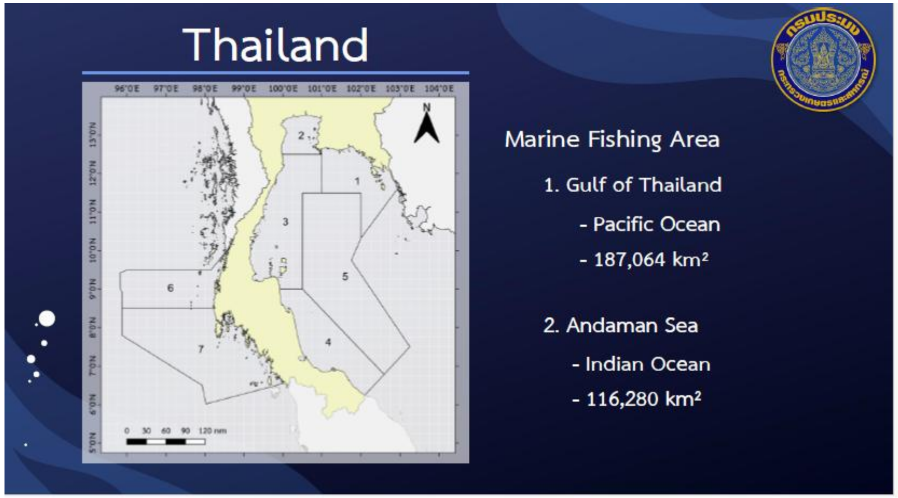
Problem and Constrain

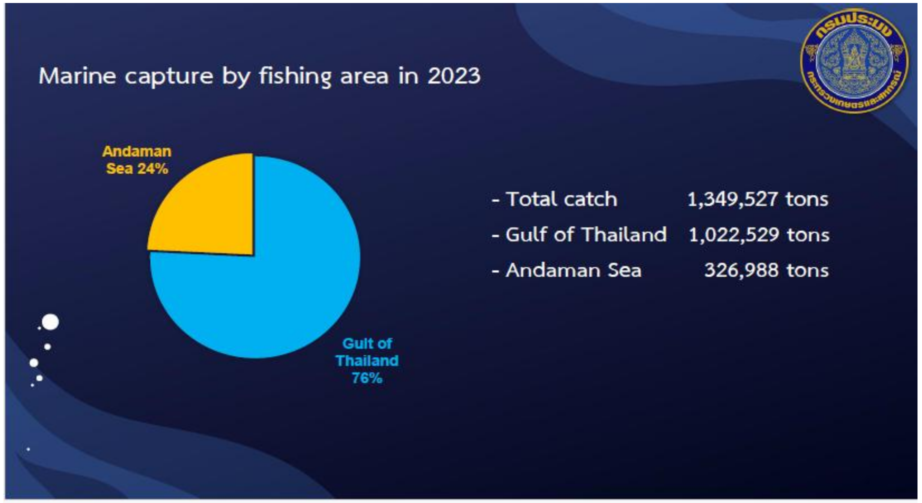
- No standard process of stock assessment analysis
- Analysis is decided depending on the characteristics of fishing activities that ultimately causes the problems such as overfishing
- Availability of funds to conduct detailed activities in support to stock assessment (total census of boat and gears)
- Availability of data collected that would fit a certain stock assessment model data requirement

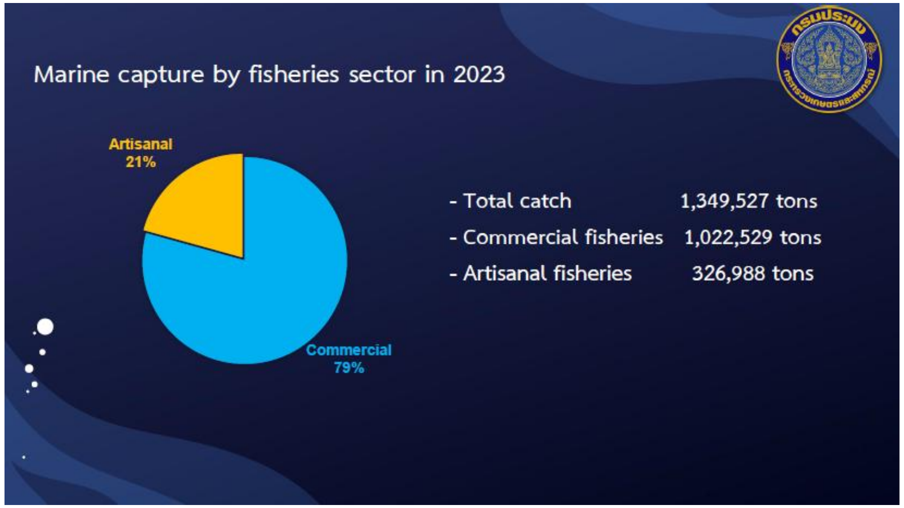
Suggestion and Conclusion

Do the best analysis that we could do based on the available science data that we have to support fisheries management

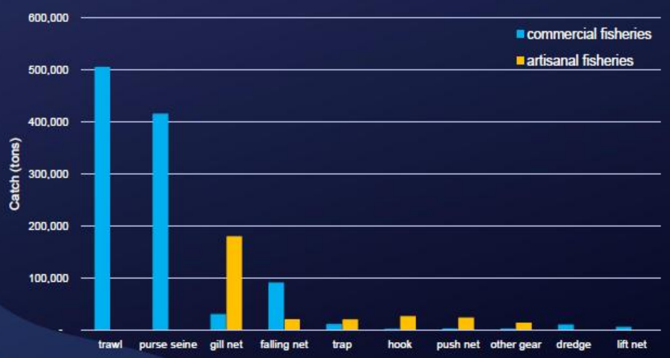

Status of Fisheries
and
Stock Assessment Methods
in Thailand


Thailand
Marine Fishing Area
1. Gulf of Thailand
- Pacific Ocean
- 187,064 km²
2. Andaman Sea
- Indian Ocean
- 116,280 km²


Marine capture by fishing area in 2023
Andaman Sea 24%
Gulf of Thailand 76%
- Total catch 1,349,527 tons
- Gulf of Thailand 1,022,529 tons
- Andaman Sea 326,988 tons


Marine capture by fisheries sector in 2023
Artisanal 21%
Commercial 79%
- Total catch 1,349,527 tons
- Commercial fisheries 1,022,529 tons
- Artisanal fisheries 326,988 tons

Marine capture production by fishing gear, 2023



THAI FISHING VESSELS STATISTICS 2024

commercial fishing vessels

- Gulf of Thailand 7,053 vessels
- Andaman Sea 1,840 vessels

artisanal fishing vessels

- 45,799 vessels

Categories of fishing vessels in Thailand

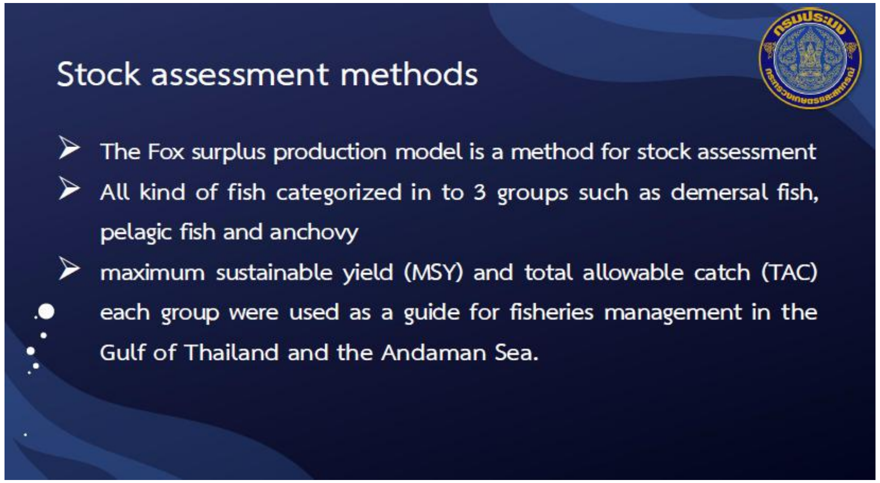
The fishing fleet is categorized into five categories based on size of fishing vessels (gross tonnage (GT)) and gear type (high efficiency and low efficiency gear)

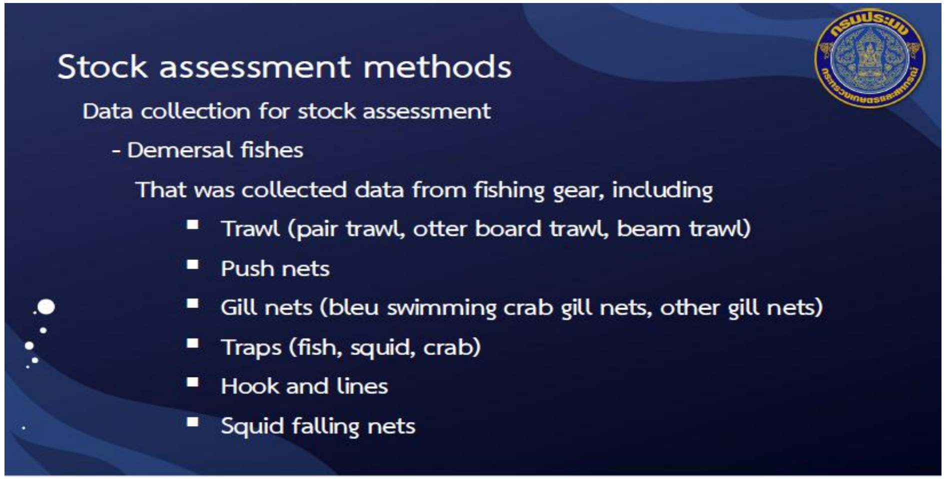
By size of fishing vessels

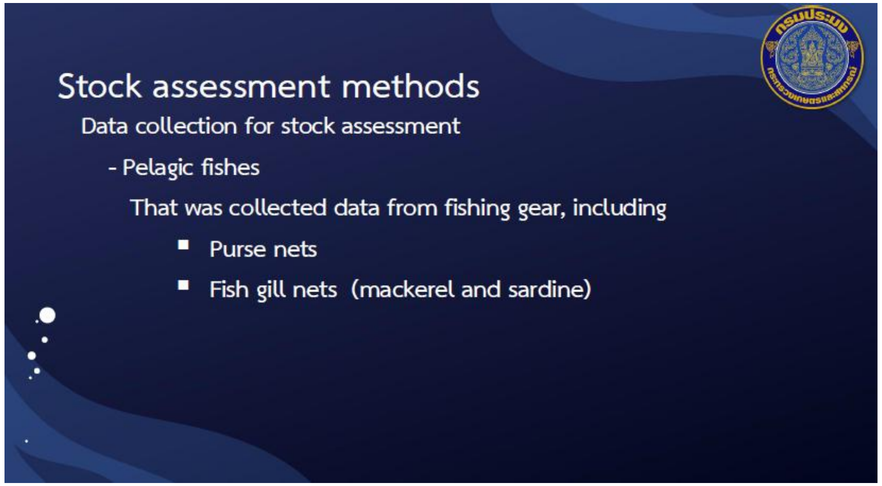
1. Artisanal fishing vessels are fishing vessels < 10 GT
2. Small commercial fishing vessels are fishing vessels between 10 – < 30 GT
3. Medium commercial fishing vessels are fishing vessels between 30 – < 60 GT
4. Large commercial vessels are fishing vessels 60 – < 150 GT.
5. Extra-large commercial vessels are fishing vessels > 150 GT

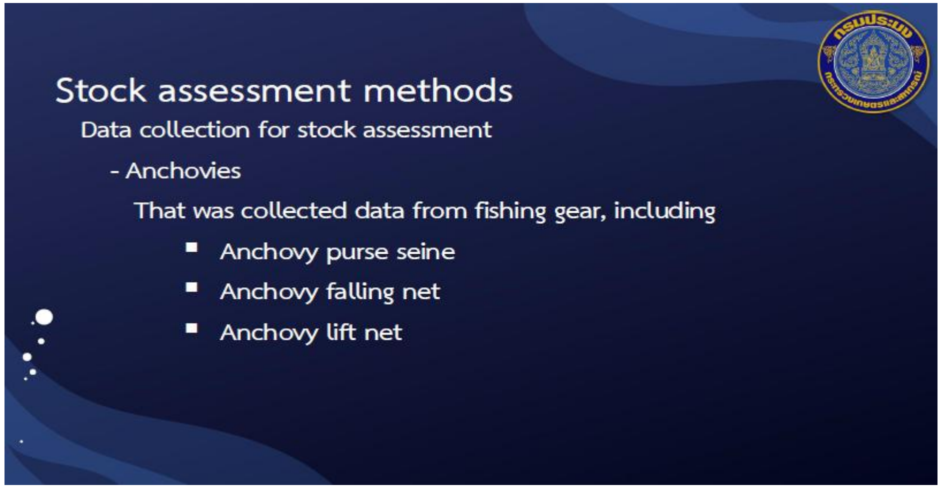
By gear type

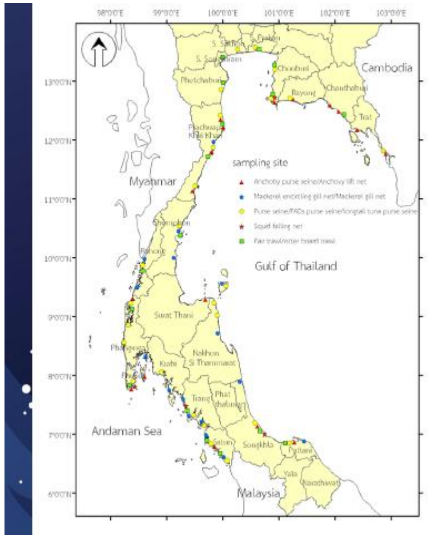
High efficiency fishing gear	Low efficiency fishing gear
pair trawl	squid falling net
otter board trawl	pomfret lift net
beam trawl	gill net
purse seine	sergestid shrimp push net
anchovy purse seine	short-necked clam dredge
anchovy falling net	blood clam dredge
anchovy lift net	other shell dredge
light luring vessel	trap
	longline
	handline


Stock assessment methods
The Fox surplus production model is a method for stock assessment
All kind of fish categorized in to 3 groups such as demersal fish, pelagic fish and anchovy
maximum sustainable yield (MSY) and total allowable catch (TAC) each group were used as a guide for fisheries management in the Gulf of Thailand and the Andaman Sea.


Stock assessment methods
Data collection for stock assessment
- Demersal fishes
That was collected data from fishing gear, including
Trawl (pair trawl, otter board trawl, beam trawl)
Push nets
Gill nets (bleu swimming crab gill nets, other gill nets)
Traps (fish, squid, crab)
Hook and lines
Squid falling nets


Stock assessment methods
Data collection for stock assessment
- Pelagic fishes
That was collected data from fishing gear, including
Purse nets
Fish gill nets (mackerel and sardine)


Stock assessment methods
Data collection for stock assessment
- Anchovies
That was collected data from fishing gear, including
Anchovy purse seine
Anchovy falling net
Anchovy lift net



Port sampling

Stock assessment methods

Data collection for stock assessment

- Catch and effort : from 2 sources

  1. Statistic data : (logbook) total catch by gear, by month, by area, by fishing vessel size (GT) and divide into group of fish

  2. Field survey data : fishing effort, catch and length composition

Field survey

1. Date interview
2. Fishing port
3. Vessel name and No. of vessel registration
4. Type of fishing gear
5. Fishing ground, distant from shore (mile) and water depth (m)
6. Fishing day
7. Fishing effort (no. of hauls per day or per night, no. of fishing gear operated)
8. Operating time
9. Total catch
10. Catch by species

Interview (items 1–10)

Field survey

11. Species composition
12. Total length (TL), Fork length in centimeter
13. Weight (W) in gram

measure (items 11–13)

The Current Status of Fisheries and Stock Assessment in Vietnam

Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia

17-24 September 2024

Prepared by:

Overview

- Describe fisheries including boat type, gear type, fishing grounds (with map), fishing season and any other relevant matters for the selected species.
- Economical value.

Overview

Table 1. Quota Offshore fishing fleets by gears in 2024 (DoF)

FISHING FLEET	BOTTOM TRALWS	PURSE SEINE	GILL NET	HOOKS AND LINE	FALLING NET	POTS TRAP FISH	OTHERS
TOTAL	8,729	3,834	4,738	6,404	2,013	486	3,348

- Total offshore fishing vessels in Vietnam: **29.552**

Overview

Table 2. Yield (x1000 tone) and fishing effort (x1000 vessel days) of all fleets fishing in Vietnam seawater

Chỉ số	Năm	Vịnh Bắc Bộ	Trung Bộ	Đông Nam Bộ	Tây Nam Bộ	Tổng	So với năm 2014-2015
Cường lực (x1.000 ngày tàu)	2014-2015	1.823	3.122	1.927	1.665	8.538	-
	2015-2016	1.591	3.404	2.092	1.760	8.846	3,61
	2016-2017	1.896	3.179	1.848	1.744	8.667	1,51
	2017-2018	1.335	3.617	1.871	1.427	8.250	-3,37
	2018-2019	1.380	2.869	1.880	1.937	8.067	-5,52
	2019-2020	1.461	2.152	1.908	2.508	8.030	-5,95
Sản lượng (x1.000 tấn)	2014-2015	652	1.446	925	699	3.723	-
	2015-2016	448	1.519	908	662	3.536	-5,01
	2016-2017	645	1.263	791	630	3.328	-10,60
	2017-2018	528	1.476	939	754	3.696	-0,72
	2018-2019	508	1.080	964	747	3.299	-11,38
	2019-2020	516	1.032	905	895	3.349	-10,04

Overview

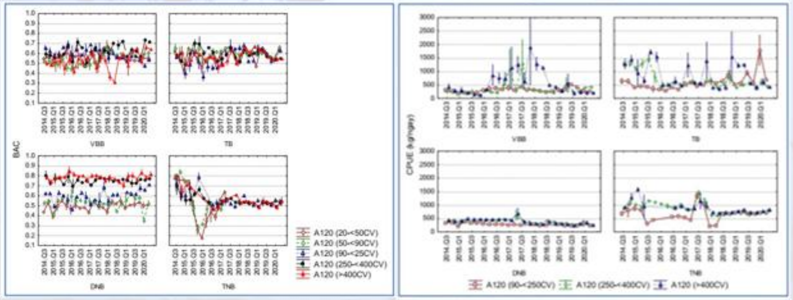
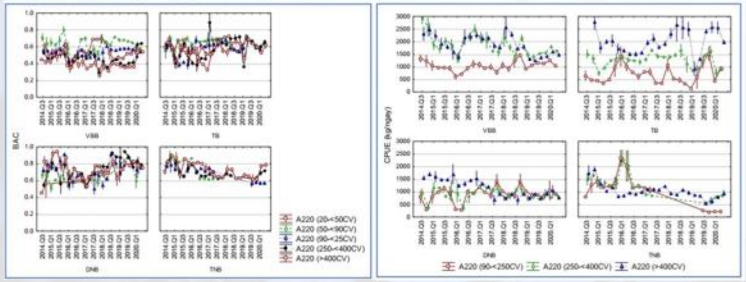


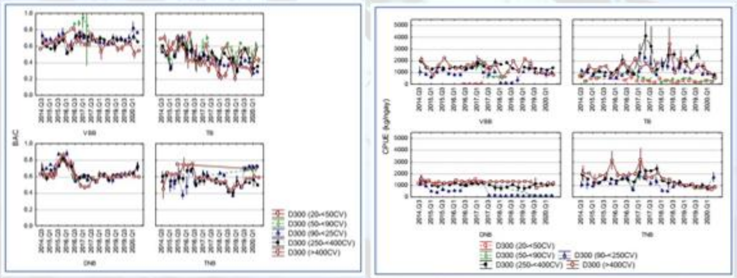
Figure x. BAC and CPUE of trawl all region of Vietnamese seawater

Overview



Figuree x. BAC and CPUE of patrawl all region of Vietnam seawater

Overview



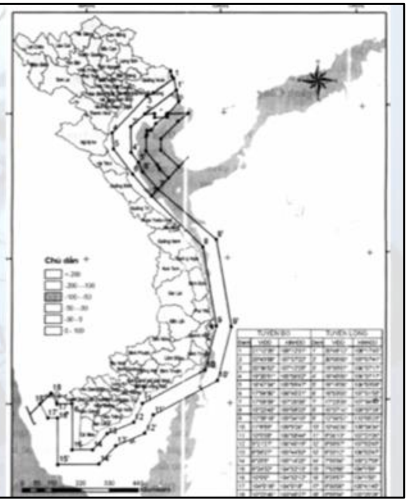
Figuree x. BAC and CPUE of light purse seine all region of Vietnam seawa

Fishing grounds:

+) Coastal area: Fishing vessels < 12 meter

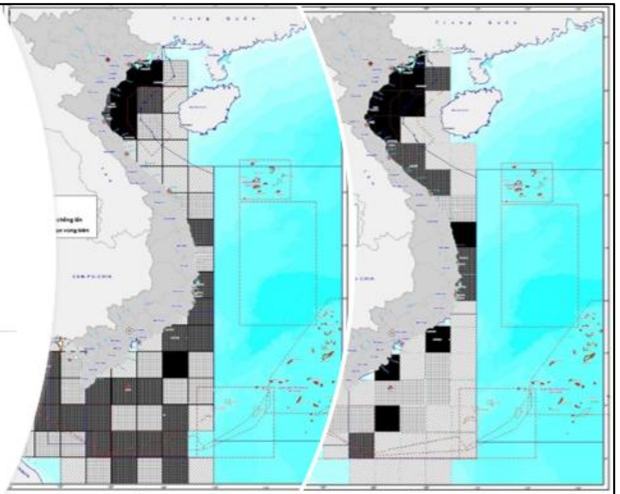
+) Nearshore: vessel 12 -<15 meters

+) Offshore: vessel >15 meters



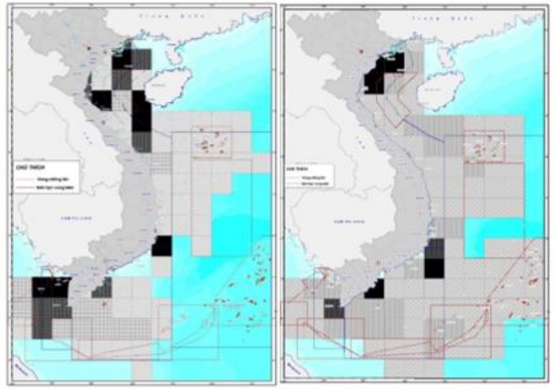
Overview

Fishing grounds left (pairtrawl) and right (singletrawl)



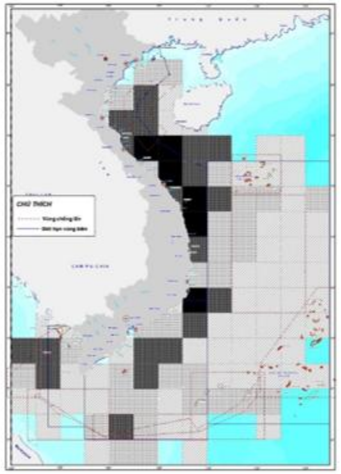
Overview

Fishing grounds of bottom net (left) and surface net (right)



Overview

Fishing grounds of purse seine with light



Overview

Economical value.

Total value of seafood exports (including aquaculture and fishing) of Vietnam in the last 5 years (according to 2023 data):

- 2023: About 11.5 billion USD (fishing3.5)
- 2022: About 11.2 billion USD (fishing 3.3)
- 2021: About 9.5 billion USD (fishing 3.2)
- 2020: About 8.8 billion USD (fishing 3.0)
- 2019: About 9.1 billion USD (fishing 3.1)

Trend and Relevant statistic

Demersal fish group: Survey fishing gear is bottom trawl

Year	Seasonal	Number station
2012	NE	119
2013	SW	250
2014	SW	120
2015	NE	219
2016	NE	220
	SW	159
2017	SW	229
2018	NE	160
2019	SW	120
Grand Total		1.596

Trend and Relevant statistic

Pelagic group: fishing gear is (longline, gill net)

Year	Sea Area	Number station
2012	Northern Gulf	21
	Centre	22
	Southeast	38
	Southwest	26
Total		107
2017	Northern Gulf	28
	Centre	41
	Southeast	13
	Southwest	25
Total		107

Landing data:

includes: total catch; boat activities; Biological data as follow

- ***Biological information of some species in the sea of Vietnam***

Sea Area	Latin name	Loo	k	M	F	Z	E
North	*Decapterus maruadsi*	28.35	0.85	1.61	2.69	4.3	0.63
	Evynnis cardinalis	23.1	0.77	1.66	2.21	3.87	0.57
	Rastrelliger kanarguita	26.5	0.49	1.2	2.33	3.33	0.66
	Saurida tumbil	32.55	0.67	1.38	3.33	4.71	0.71
	Saurida undosquamis	31.5	0.54	1.15	2.51	3.66	0.46
	En. Herteroloba	10.5	1.3	2.91	5.04	2.13	0.42
	Nemipterus mesoprion	18.9	0.39	1.09	0.52	1.61	0.33
	Loligo chinensis	27.3	0.48	4.77	9.6	14.4	0.67
	Loligo duvaucelli	17.85	0.86	1.82	1.19	3.01	0.39
	Metapenaeus affinis	15.75	0.55	1.41	0.9	1.9	0.26
	Metapenaeopsis barbata	12.6	1.2	2.5	5.79	8.29	0.7
	Nemipterus japonicus	24.4	0.45	1.13	2.38	3.5	0.68

- ***Biological information of some species in the sea of Vietnam***

Sea Area	Latin name	Loo	k	M	F	Z	E
Centre	*Decapterus maruadsi*	27.3	0.46	1.11	0.83	1.93	0.43
	Encrasichinila puntifer	10.78	1.4	2.04	0.06	2.1	0.03
	Saurida tumbil	28.35	0.47	1.11	0.84	1.95	0.43
	Trachinocephalus myops	30.5	0.51	1.15	0.7	2.22	0.48
	Loligo chinensis	35.5	0.3	0.77	1.86	2.63	0.71
	Upeneus japonicus	19.95	0.72	1.61	4.81	6.41	0.75
	Auxis rochei	31.5	0.93	1.68	3.56	5.24	0.68
	Auxis therard	50.4	0.33	0.73	0.72	1.45	0.49
	Katsuwonus pelamis	61.5	0.3	0.67	0.32	0.99	0.32

- ***Biological information of some species in the sea of Vietnam***

Sea Area	Latin name	Loo	k	M	F	Z	E
East	*Decapterus maruadsi*	26.25	0.9	1.63	4.57	6.2	0.74
	Encrasichinila puntifer	10.76	1.2	2.68	1.51	4.19	0.37
	Loligo duvaucelli	18.9	0.41	1.62	1.07	2.69	0.65
	Nemipterus furcossus	24.15	0.77	1.5	1.86	3.36	0.55
	Parapenaeopsis sculptilis	17.85	0.63	1.6	1.43	3.03	0.53
	Priacanthus macracanthus	30.45	0.9	1.59	1.4	3.49	0.54
	Rastrelliger kanarguita	23.1	0.82	1.65	1.35	2.99	0.63
	Saurida tumbil	32.55	0.47	1	1.62	2.62	0.62
	Upeneus japonicus	17.85	0.72				
West	*Atule mate*	27.3	0.95	0.95	1.91	2.86	0.67
	Encrasichinila heteroloba	8.86	1.1	1.94	0.79	2.73	0.3
	Loligo duvaucelli	22	0.94	1.8	1.44	3.24	0.44
	Mulloidichthys vanicolensis	17.85	0.59	1.5	1.64	3.14	0.52
	Penaeus semiculnatus	18.9	0.46	1.25	0.54	1.79	0.3
	Rastrelliger brachysoma	22.05	0.53	1.32	0.63	1.95	0.33
	Saurida elongata	31.5	0.48	1.12	0.36	1.48	0.26
	Selaroides leptolepis	16.8	0.81	1.87	2.68	4.45	0.59

Stock assessments in the past

- **In Vietnam, there were two methods for stock assessment:**

1) Independence fisheries: calculating from survey data on science vessel
2) Depence on fisheries: data used from fisheries landing port (catch, biology metters, ...), logbook and Observer data.

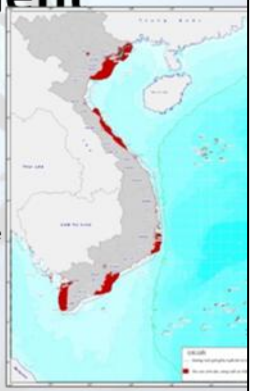
Fishery Management

1. Catch quota management

- Catch quotas are determined based on the resilience of fishery resources to limit the volume of catch.
- Every 5 year, the competent authority can set specific quotas for each type of fishery.

2. Establishment of Marine Protected Areas and Marine Protected Areas

- Vietnam has established many Marine Protected Areas (MPAs) and Marine Protected Areas (MPAs) to protect marine ecosystems and maintain biodiversity.
- In these areas, fishing and exploitation activities may be completely prohibited or strictly restricted according to the season or type of exploitation.



3. Regulations on fishing gear and size

- Fish size regulations: Only allow fishing of fish of a certain size to ensure the reproductive capacity of the species.
- Fishing gear regulations: Restrict or prohibit the use of certain types of harmful fishing gear such as small mesh gillnets, trawls, or equipment that can deplete marine resources.

4. Fishing ban periods

- To protect the breeding season of aquatic species, sea areas can apply seasonal fishing ban periods.
- This period is usually applied from April to July every year to avoid fishing during the breeding season of many species.

6. Stock assessment and monitoring of aquatic resources

Vietnam regularly conducts stock assessments to develop policies appropriate to the status and trends of decline or growth of species.

7. Others: VMS (technologies are used to monitor the activities of fishing vessels group have over 15 meter), community-based fisheries management,..

Problem and Constrain

- Overfishing with some commercial species being exploited at rates that exceed their ability to regenerate
- Some of commercially species are being exploited beyond their ability to regenerate.
- Illegal and unreported fishing
- Decline in fisheries resources and coastal environment
- Others: Marine Pollution; Impacts of Climate Change, ..

Suggestion and Conclusion

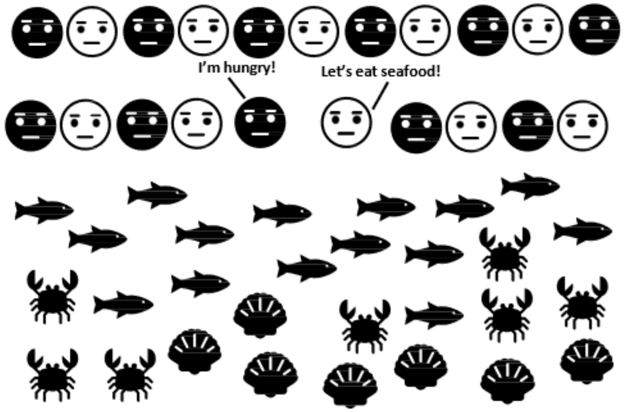
- Receive sharing of experience in fisheries management from countries in the region and sub -region

Fishery Biology

Supapong Pattarapongpan
SEAFDEC/TD, Samutprakarn, Thailand

Introduction

2



Introduction

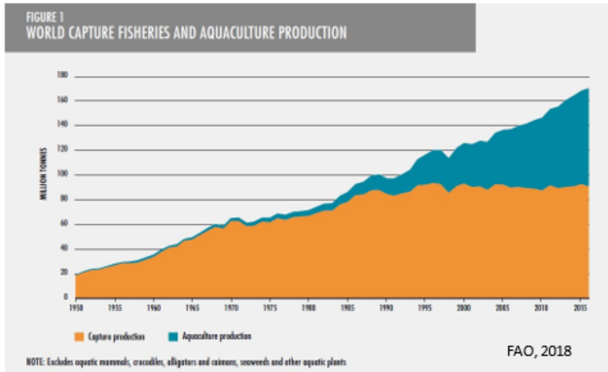
3

- Mankind has known how to fish since, at least, 40,000 years ago
- At least in A.D. 800 (Viking), the record of fishing vessels sailling to the ocean was found

Introduction

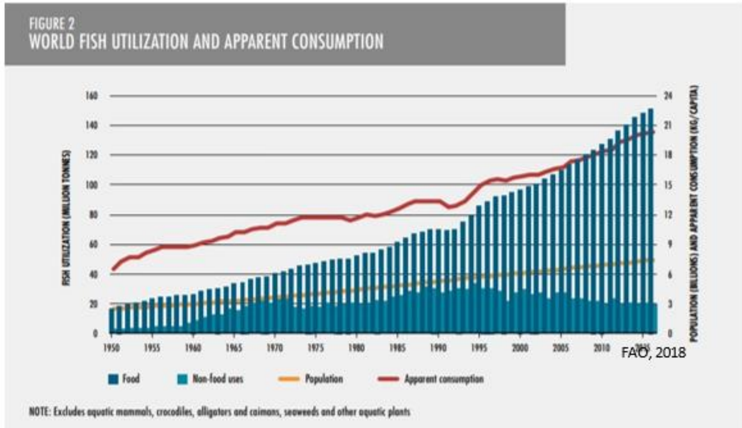
4

- The different trend between capture fishery and aquaculture provided since 1990s



FAO, 2018

Introduction 5



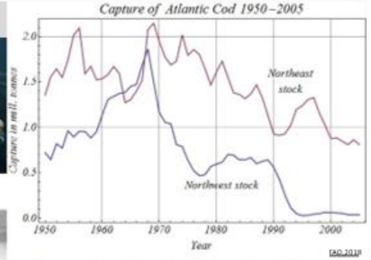
FAO, 2018

Introduction 6

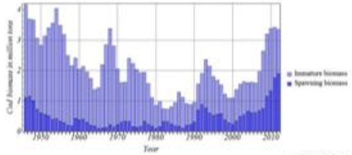
- "Cod fishery"

Gadus spp.

- Heavily exploited during 1960s-1980s
- Declined from 1980s



FAO 2019



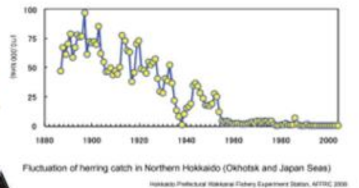
FAO 2019 and https://en.wikipedia.org/wiki/Cod_fisheries

ICES Report, 2007

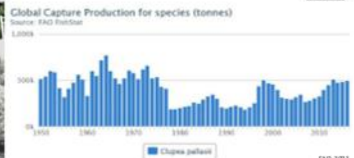
Introduction 7

- "Herring Fishery",

Kamuyčep to Phantom Fish



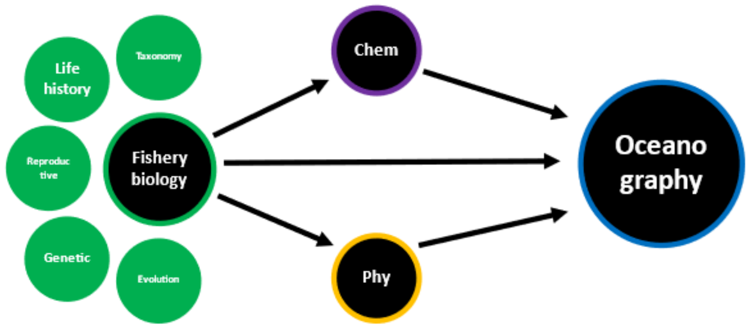
Hamada 2011



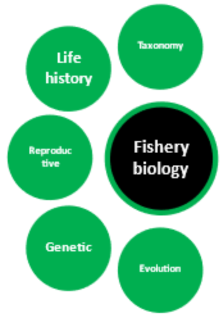
FAO 2021

What is Fishery Biology 8

- Fishery biology is the study of the biological aspect of fishery resource for



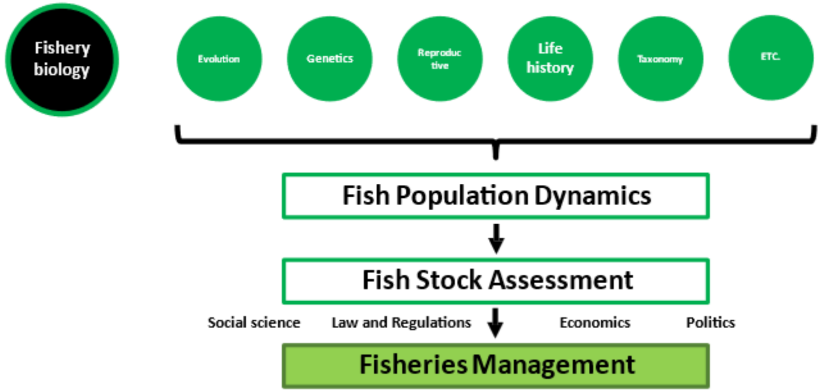
What is Fishery Biology 9



The definition

- The study of the anatomy, physiology, and life history of various species of fishes, the study also involved the relationship between fish to their environment such as plankton, water current, adaptation, reproductive strategies, population dynamics, etc. (Marsh-Matthews, 2009).
- The body of organized knowledge regarding the natural supply of natural supply of fish commercially exploited, the variation in supply and their causes, and the way to husbanding the fishery resources (Higgins, 1934).
- The applied science concerning the obtaining of the best yields in commercial and sports fisheries (Fishbase).

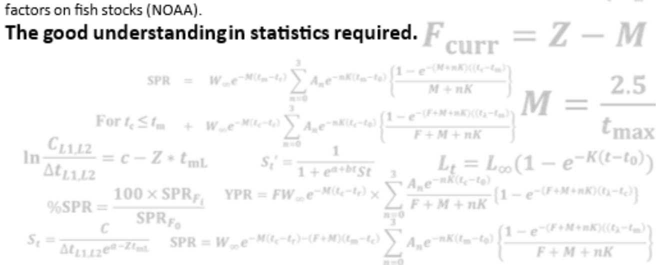
What is Fishery Biology 10



What is Fishery Biology 11

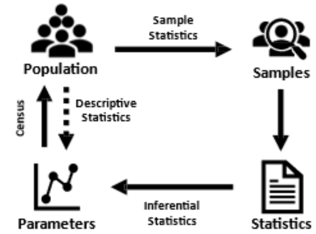
Fish Stock Assessment

- A fishery stock assessment is the scientific process of collecting, analyzing, and reporting on the condition of a fish stock and estimating its sustainable yield.
- Stock assessments are the backbone of sustainable fisheries management.
- Stock assessment models are the mathematical and statistical techniques stock assessments use to analyze and understand the impact of fisheries and environmental factors on fish stocks (NOAA).
- **The good understanding in statistics required.**



The statistics 12

- Statistics is the way to manipulate the data mathematically to extract the information from it
- Statistics have the process as;



The statistics 13

- Statistics can be divided into two meanings

Statistical data
- The data that is recorded statistically as a numerical description of things
- Can be counted, measured, and manipulated
- Separated into 1) nominal, 2) ordinal, 3) interval, and 4) ratio scale

Statistical methods
- Methods used for collecting, organizing, analyzing, and interpreting of the data
- Many models and methods developed to handle each of the data characteristics
- Known as 'data distribution'

http://diglib.globalcollege.edu.et:8080/xmlui/bitstream/handle/123456789/1721/ln_biostat_hss_final%5B1%5D.pdf?sequence=1&isAllowed=y

The statistics 14

Statistical data

- All of the data are categorized into these four categories

Nominal scale **Ordinal scale** **Interval scale** **Ratio scale**

The statistics 15

Statistical data

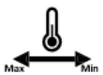
Nominal scale

- To categorize only
- Cannot compare both qualitatively and quantitatively
- Such as gender, married status, education, etc.

Ordinal scale

- Can be divided into level
- Can measure the middle value (mean, median, average) **just to see the distribution**
- Such as satisfaction level, opinion level, pain score, etc.

Interval scale



- Can provide the level of difference, can be compared quantitatively
- However, no absolute zero (value = 0 just because our equipment cannot measure)
- Such as temperature, DO, pH, etc.

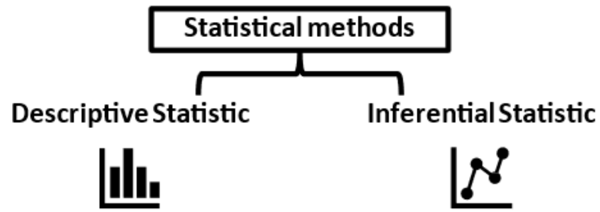
Ratio scale

- Contained all abilities of previous scales
- Can be applied with all kinds of analysis and mathematical models with absolute zero value
- Weight, high, pressures, etc.

The statistics 16

Statistical methods

- The methods to extract the information from the data to observe the trend for predicting the possible trend of data relationship
- The types of methods depending on what kind of data scale we have



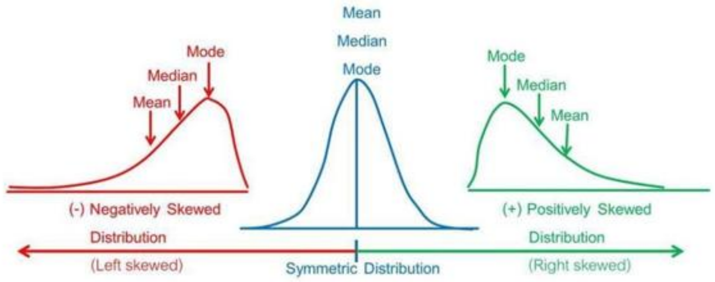
DescriptiveStatistic 17

- Generally describe the characteristics of the data
- To observe the mean value and the distribution of data

Frequency	Central	Variation
Percentage	Mean	Range (±)
Skewness	Median	Deviation (SD)
Kurtosis	Mode	Variance (Var)

DescriptiveStatistic 18

- Descriptive statistics works well under the normal distribution
- Also can be used to describe the distribution of data as well



DescriptiveStatistic 19

- Mean

$$\bar{x} = \frac{\sum x}{n}$$

- Variance

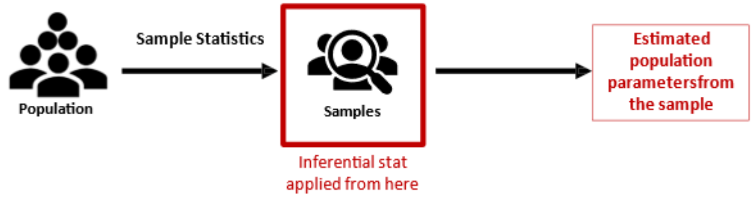
$$s^2 = \sum_{i=1}^{n} \frac{(x - \bar{x})^2}{n-1}$$

DescriptiveStatistic 20

- Exercise

Inferential Statistic 21

- The conventional methods can work well under the normal distribution assumption
- Also, the non-normal distribution version has been established and implemented
- Used for determining the parameter of the population from the sample



Inferential Statistic 22

- Inferential statistics is the utilization of the information from descriptive statistics to make a scientific-based decision and predict the results
- Can be divided as;

Inferential Stat

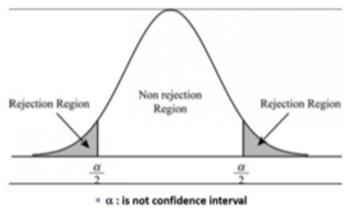
Hypothesis Testing
- Z-test
- F-test
- T-test
- ANOVA

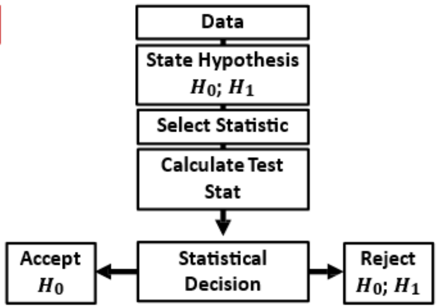
Relationship Analysis
- Regression
- Correlation

Inferential Statistic 23

Hypothesis Testing
- Z-test
- F-test
- T-test
- ANOVA

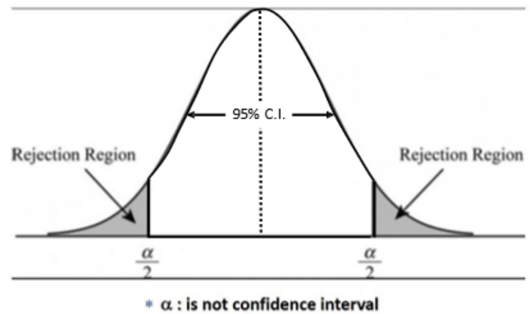
Level of significance: alpha (α)





Inferential Statistic 24

95% Confident Interval



Inferential Statistic
25

Type I and Type II Error

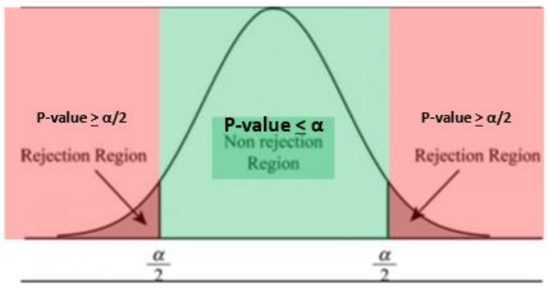
Null hypothesis is ...	True	False
Rejected	Type I error False positive Probability = α	Correct decision True positive Probability = 1 - β
Not rejected	Correct decision True negative Probability = 1 - α	Type II error False negative Probability = β

Scribbr

Testing the hypothesis
26

The p-value

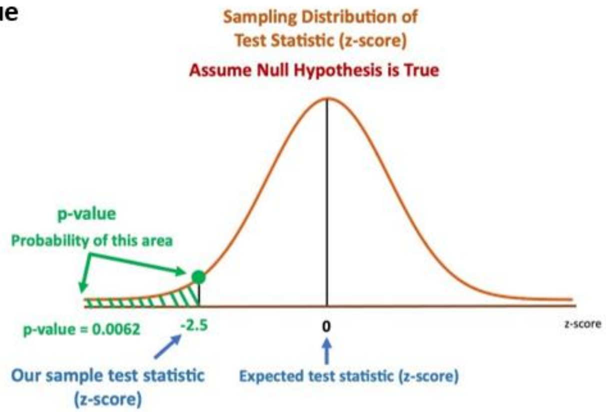
- The probability of finding the observed or more extreme results
- When the null hypothesis is TRUE



- α : is not confidence interval

Testing the hypothesis
27

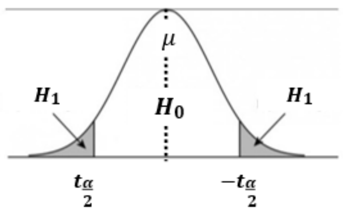
The p-value



Testing the hypothesis
28

- **One-sample t-test model**
  - Comparing between the mean and constant
  - Assume that the sample mean has 0 difference from the population mean or H_0: $\bar{x} - \mu = 0$ and H_1: $\bar{x} - \mu \neq 0$

Level of significance: alpha (α)

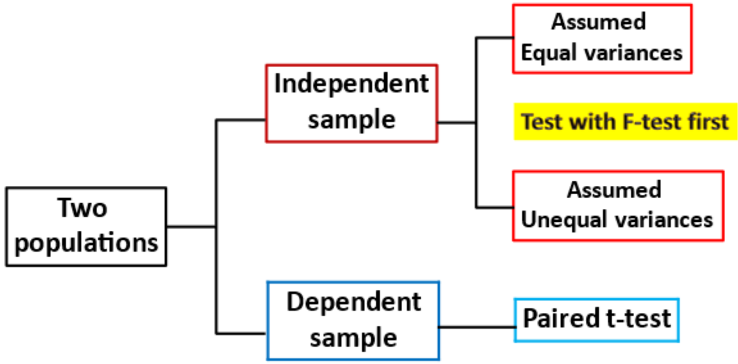


$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

μ:	population mean
$\bar{x}$:	sample mean
s:	sample standard deviation (SD)
n:	sample size
α:	type I error, probability of incorrectly reject the null hypothesis
t:	distance of the data's parameter (SD and $\bar{x}$) from μ

Testing the hypothesis 29

• Two-samples model



Testing the hypothesis 30

• Two-samples model

Independent sample

Assumed Equal variances ← Test with F-test first → Assumed Unequal variances

Assumed Equal variances

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$s_p{}^2 = \frac{(n_1 - 1)S_1{}^2 + (n_2 - 1)S_2{}^2}{n_1 + n_2 - 2}$$

$$df = n_1 + n_2 - 2$$

Assumed Unequal variances

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_p\sqrt{\frac{S_1{}^2}{n_1} + \frac{S_2{}^2}{n_2}}}$$

$$df = \frac{\left[\frac{S_1{}^2}{n_1} + \frac{S_2{}^2}{n_2}\right]}{\frac{\frac{S_1{}^2}{n_1}}{n_1 - 1} + \frac{\frac{S_2{}^2}{n_2}}{n_2 - 1}}$$

Testing the hypothesis 31

• Two-samples model

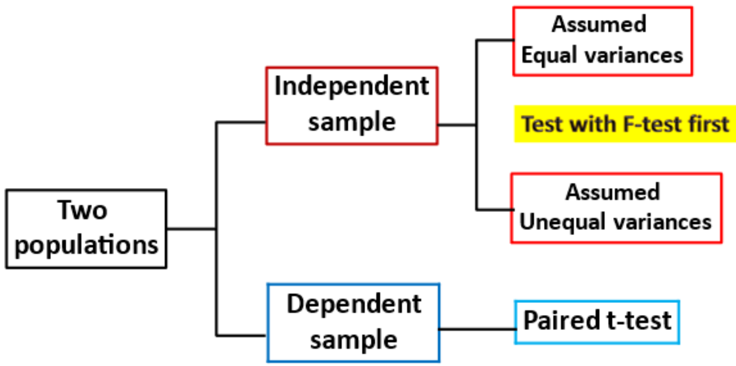
Test with F-test first

$$F = \frac{S_i{}^2}{S_j{}^2}\left(df = D_1 = n_{i-1} and D_2 = n_{j-1}\right)$$

Where
- n_i: sample size of population ith
- n_j: sample size of population jth
- $S_i{}^2$: variance of population ith
- $S_i{}^2$: variance of population jth

Testing the hypothesis 32

• Two-samples model



Testing the hypothesis 33

- **Two-samples model**

Dependent sample — **Paired t-test**

$$t = \frac{\bar{D} - \mu_D}{S_{\bar{D}}}$$

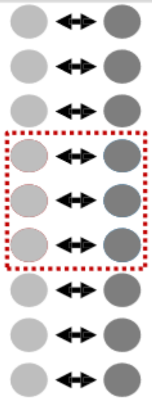
$$S_{\bar{D}} = \frac{S_D}{\sqrt{n}}$$

$\bar{D}$: average difference in each pair of the sample

μ_D: average difference in each pair of the population

$S_{\bar{D}}$: standard deviation of the average difference

n: sample size



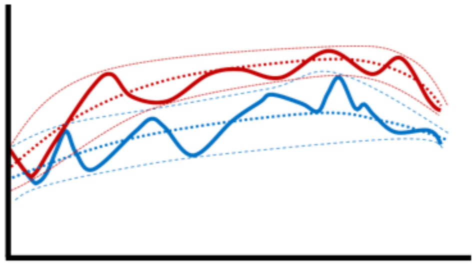
Testing the hypothesis 34

- Exercise two independent samples
- Exercise two dependent samples

Testing the hypothesis 35

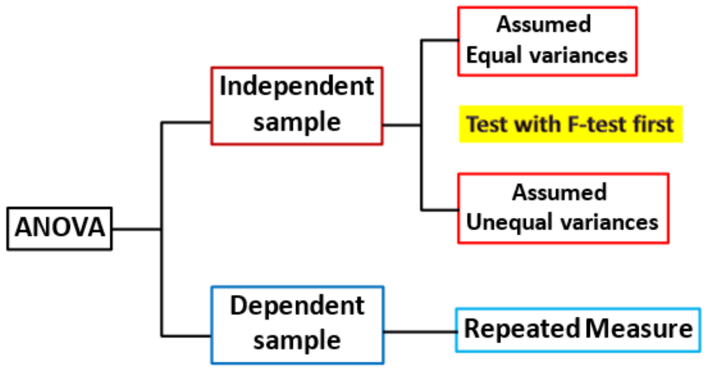
- **Analysis of Variance (ANOVA)**

- The observation of the variance of the data
- Comparing the mean of the data and variance together to see the significant difference
- Suitable for the multi-dimensional data with assumptions;
  - Normal distribution of data
  - Homogeneity of variance (equal variance)
  - Independence
  - Random sampling



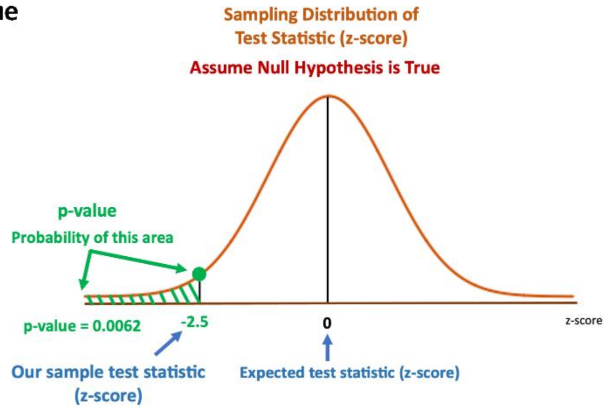
Testing the hypothesis 36

- **Analysis of Variance (ANOVA)**



Testing the hypothesis 27

The p-value



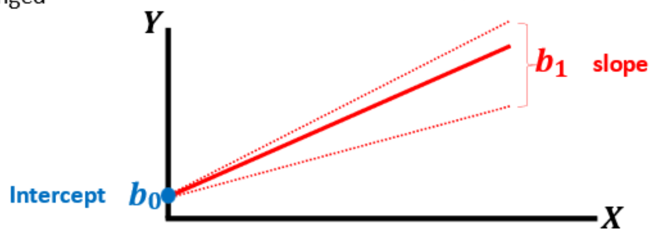
Testing the hypothesis 38

- Exercise

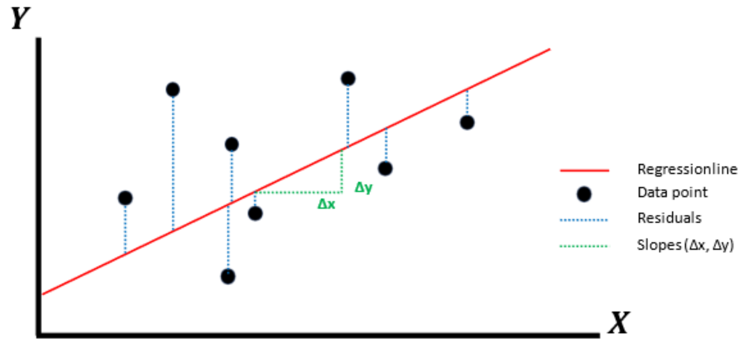
Regression Analysis 39

- A relationship between X and Y variable
  - X variable (independenceor predictor)
  - Y variable (dependenceor responder)
- To observe how much Y changed when X changed

$$Y = b_0 + b_1X$$

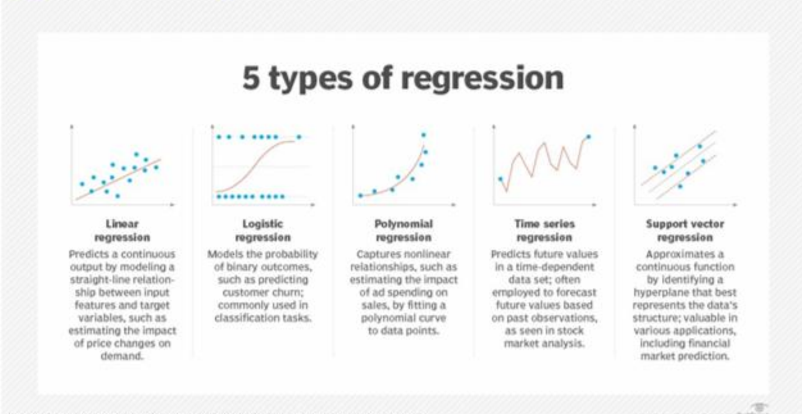


Regression analysis 40



Regression analysis

41



https://www.techtarget.com/searchenterpriseai/feature/Whatis-regression-in-machine-learning

Regression analysis

42

- Exercise

Conclusion

43

- Many statistical methods are available for each data condition and results expectation
- The most important part is the data distribution analysis
- The normal and non-normal distribution affecting the method selected
- Most traditional methods are based on the normal distribution assumption
- Selecting the most appropriate method for the data condition and result expectation is very important.

Regression Analysis

19 September 2024 (08.30-10.30)

Thanitha Darbanandana 'Emmie'

Cause-Effect Analysis

Variables	numbers	Scales
Independent (X)	**≥ 1**	**Quantitative**
Dependent (Y)	**1**	**Metric Variable**

Why Regression?

- **Analyze the relationship among variables**
- **Causal relationship**

Objectives

❶Study the pattern of relationship between variables

❷ Estimates or Forecast

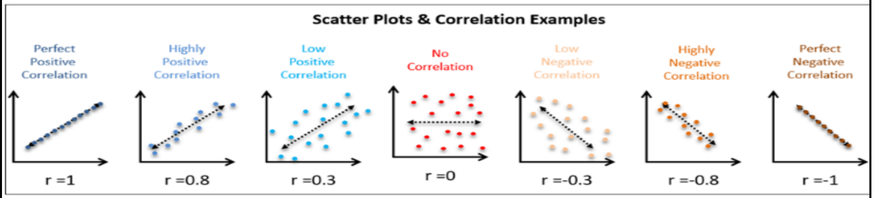
Important Noted

- Correlation IS NOT regression
- If you don't want to forecast, no need to use regression
- Coefficient of determination (R^2) is not correlation coefficient (r) square (different meaning)
- r is a statistical measure of the strength of a linear relationship between two variables
- Its values can range from -1 to 1
- If correlation coefficient <1, = negative, or inverse, correlation and vice versa
- No cause-effect (no X and Y)

Important Noted

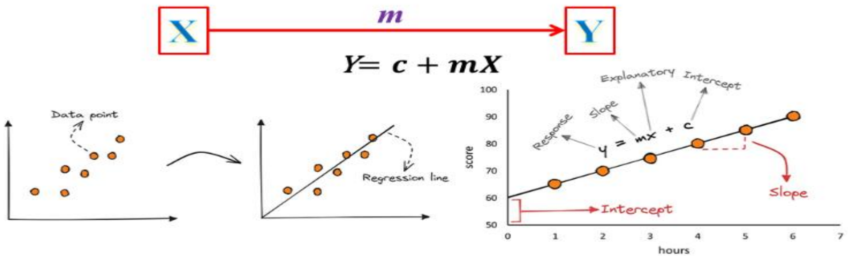
- The coefficient of determination (R^2) is a measurement that's used to explain how much the variability of one factor is caused by its relationship to another factor
- R^2 is represented as a value between 0.0 and 1.0 or 0% to 100%.

Degree	Meaning
0.81 – 1.00	Highly correlated
0.51 – 0.80	Moderately correlated
0.21 – 0.50	Low correlated
0.00 – 0.20	Very low correlated

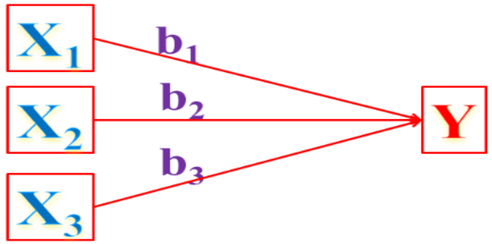


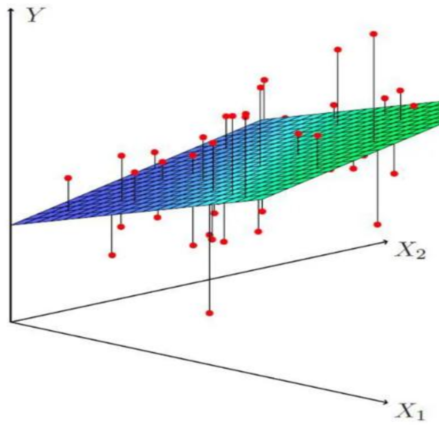
https://cqeacademy.com/cqe-body-of-knowledge/continuous-improvement/quality-control-tools/the-scatter-plot-linear-regression/

Simple Regression



Multiple Regression





https://medium.com/analytics-vidhya/multiple-linear-regression-an-intuitive-approach-f874f7a6a7f9

Predicted by Regression Line

Estimated a and b by

- **Ordinary Least Square Analysis (OLSA)**
- **Maximum Likelihood Estimator (MLE)**
  - **Solver in Excel**
  - **R program**

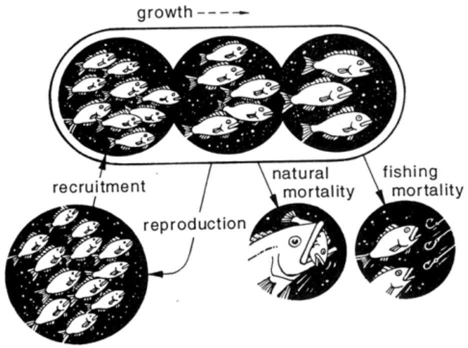
Practice #1

Growth Theory

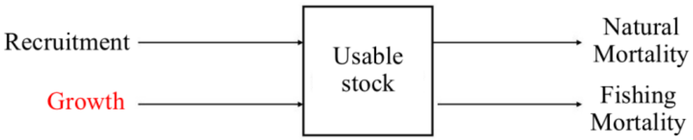
19 September 2024 : 12.00-13.00

Thanitha Darbanandana 'Emmie'

Factors controlling Population



Factors controlling Population



Growth Model

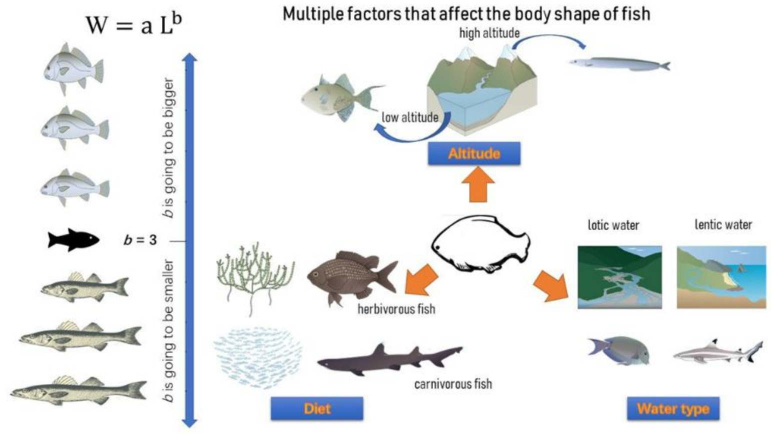
- Relationship between Length/Weight (X) and Age/Time (Y)
- Temperate Zone: actual age from hard part (Otholith, scale etc.)
- Temperate Zone: estimate Length from Age
- Tropical zone: difficult in reading actual age from hard part
- Tropical Zone: estimate Age from Length
- Tropical Zone: use 'coded age' or 'time'

von Bertalanffy's Growth Function (vBGF)

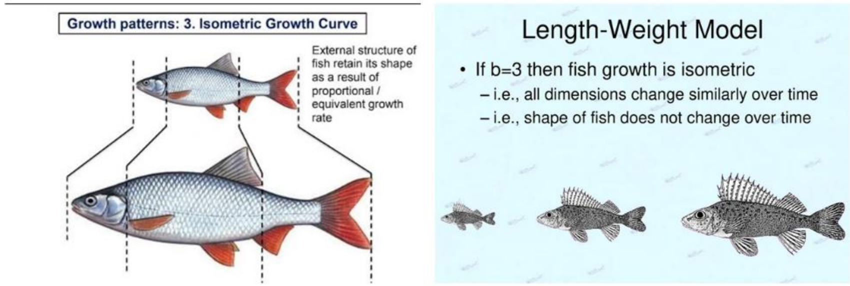
Ludwig von Bertalanffy
1901-1972

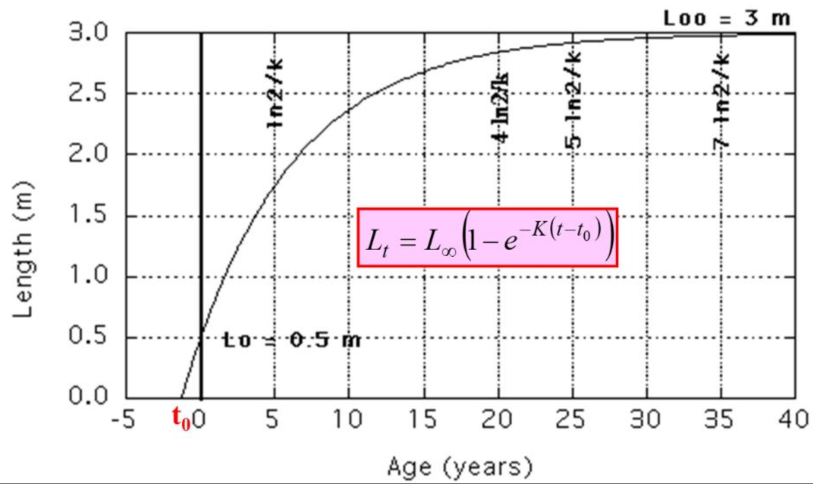
Model Assumptions

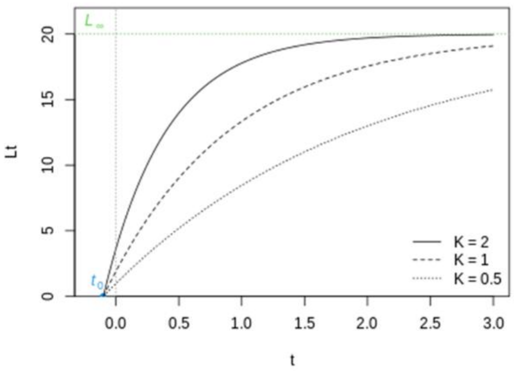
1. Anabolism rate is direct proportion of Resorbing Surface
2. Catabolism Rate is direct proportion of Body Weight
3. Growth pattern is Isometric



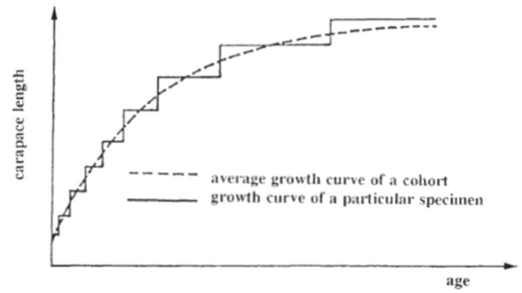
Isometric Condition







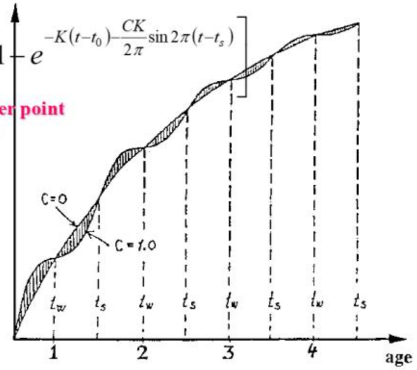
Stepwise Growth Curve



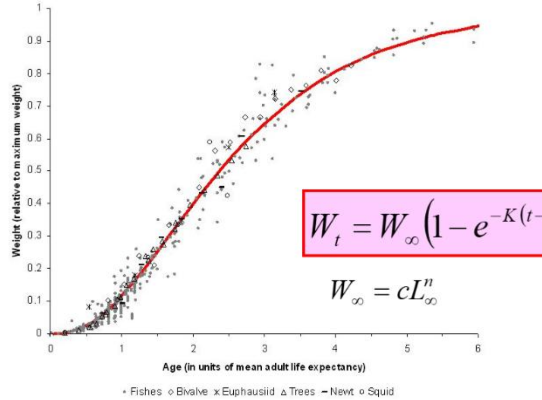
Seasonalized VBGF

$$L_t = L_\infty \left[1 - e^{-K(t-t_0) - \frac{CK}{2\pi}\sin 2\pi(t-t_s)} \right]$$

- t_s = summer point
- $t_w = t_s + 0.5$



Most Species (Exception: birds and mammals) Grow Throughout their Lifes



$$W_t = W_\infty \left(1 - e^{-K(t-t_0)}\right)^n$$

$$W_\infty = cL_\infty^n$$

Reproductive Biology

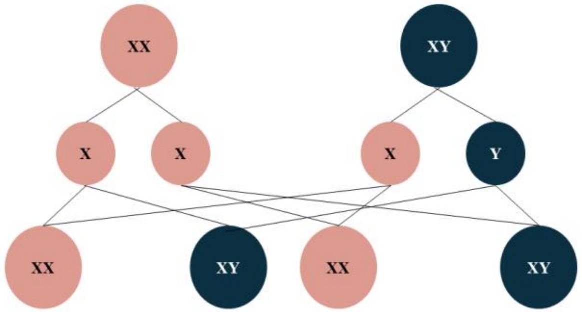
- Sex Ratio
- Maturity
- Fecundity
- Spawning Season

19 September 2024 (14.30-16.00)

Thanitha Darbanandana 'Emmie'

Sex Ratio

General Concept



What happened IF….

H_0 : male : female = 1:1
H_1 : male : female < 1:1

Male can fertilize several females !!!

Harem?
Low Fecundity?

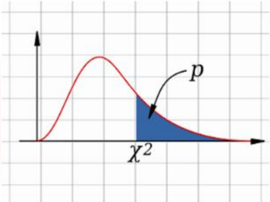
H_0 : male : female = 1:1
H_1 : male : female > 1:1

Female can fertilize by several males

Spawning Migration?
High Fecundity?

Chi-Square test

$$\chi^2 = \sum_{i=1}^{k} \frac{(O_i - E_i)^2}{E_i}, df = n - 1$$



Where : χ^2 = Chi square
O_i = Observed value of nominal variables
E_i = Expected value of two nominal variables

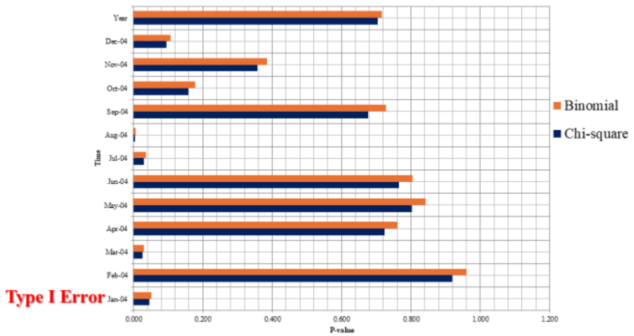
3.84, α=0.05

Sex	Observed number [O]	Expected number [E]	O-E	$(O-E)^2$	$(O-E)^2/E$	$\sum(O-E)^2/E$	Calculated X^2	Tabulated X^2
Male	30	114	-84	7056	61.89	123.78	123.78	3.84
Female	198	114	84	7056	61.89			
Sex Ratio (M:F)	1:7	1:1						

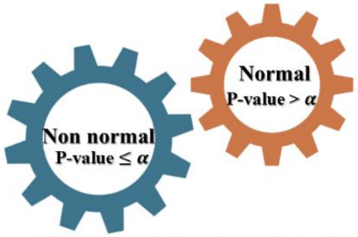
Percentage Points of the Chi-Square Distribution

Degrees of Freedom	Probability of a larger value of x^2								
	0.99	0.95	0.90	0.75	0.50	0.25	0.10	0.05	0.01
1	0.000	0.004	0.016	0.102	0.455	1.32	2.71	3.84	6.63
2	0.020	0.103	0.211	0.575	1.386	2.77	4.61	5.99	9.21
3	0.115	0.352	0.584	1.212	2.366	4.11	6.25	7.81	11.34
4	0.297	0.711	1.064	1.923	3.357	5.39	7.78	9.49	13.28
5	0.554	1.145	1.610	2.675	4.351	6.63	9.24	11.07	15.09
6	0.872	1.635	2.204	3.455	5.348	7.84	10.64	12.59	16.81

Problem Happened



Distribution Test



Shapiro-Wilk test (W test)

The Shapiro–Wilk test is a test of normality in frequentist statistics.

$$W = \frac{b^2}{\sum_{i=1}^{n}(X_i - \overline{X})^2}$$

>name=c(M_1,M_2,…,M_n,F_1,F_2,…,F_n)
>shapiro(name)

```
> total=c(46,38,52,58,52,56,13,29,35,46,28,35,15,31,46,51,42,45,30,28,29,45
> shapiro.test(total)

        Shapiro-Wilk normality test

data:  total
W = 0.96764, p-value = 0.5632
```

Statistical testing

1

Chi-square — H_0 : sex ratio of blue swimming crab = 1:1

H_1 : sex ratio of blue swimming crab ≠ 1:1

Binomial

Proportion — H_0 : Proportion of female equal to Proportion of male

H_1 : Proportion of female unequal to Proportion of male

2 — $\alpha = 0.05$

3 — Non-normal Distribution: Chi-square test, Binomial test; Normal Distribution: Proportion test

4 — Calculate by Statistical Program (R Program)

5 — Conclusions
- P-value > 0.05 accept H_0
- P-value ≤ 0.05 reject H_0 accept H_1

R – Base Language

Proportion test by R Program

```
>prop.test(F, n, p=0.5 , alt = c("two.sided"))
```

Binomial test by R Program

```
>binom.test(F, n, p=0.5 , alt=c ("two.sided"))
```

Chi – square test by R Program

```
>name = c(M,F)
>chisq.test(name)
```

Where : M = number of male
F = number of female
n = M+F

He can help you !!

If we don't use chi-square

Population Study	Sex ratio	
Distribution test	Normal	Non- normal
Statistical testing	Proportion test	Binomial test

Maturity

Primary Sexual Character

Testes

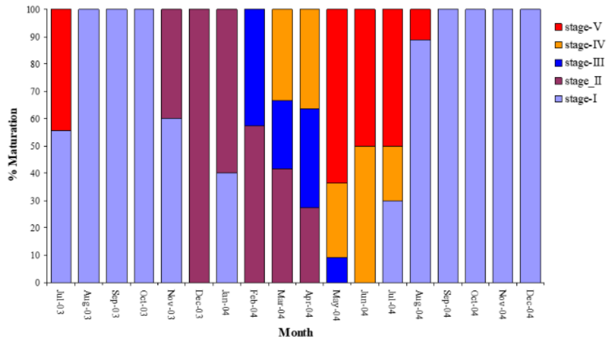
Ovaries

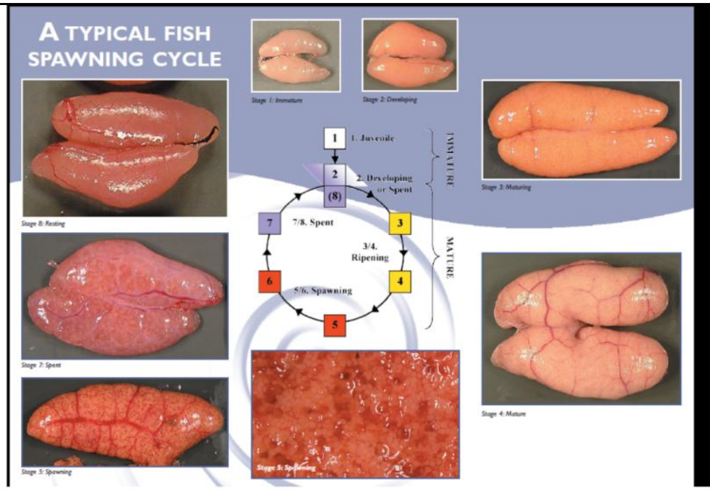
Stages of Ovarian Development

Stage	Description	Ovary	Eggs
1	Resting	Thread-like, translucent, small and undeveloped	None visible to naked eye
2	Developing	Medium to large, cream/orange, opaque and almost filling body cavity	Oocyte visible and opaque
3	Ripe	Ovary full and almost filling body cavity	Hydrated oocyte visible, translucent, large and round
4	Ovulated	Ovary completely filling body cavity	Eggs in oviduct and can be extruded with gentle pressure
5	Spent	Ovary small, flaccid and bloody	Can be found some residual eggs

Applied from De Silva et al. (1985); Pankhurst and Carragher (1991); King (1995).

Mode of Egg Stage

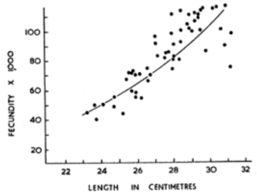




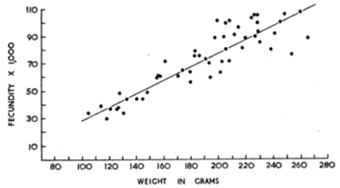
Fecundity

$$F = aL^b$$

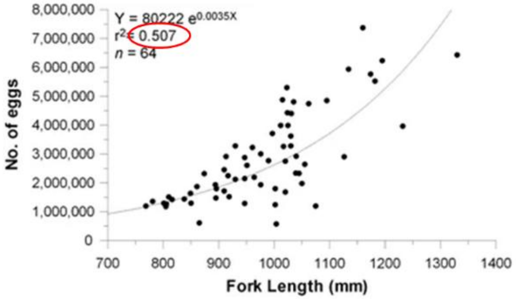
$$lnF = a + blnL$$



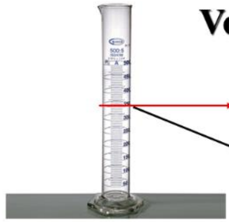
$$F = a + bW$$



Some cases are happened



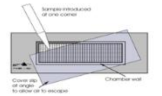
Volumemetric Method



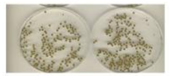
Total volume of eggs

Sampling (1 ml.)

Sedgewick Rafter



$$F = \frac{nV}{v}$$



≥3 rep.

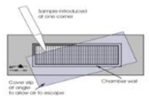
n = no. of eggs in each sub-samples
V = total volume of eggs
v = volume of sub-sample (1 ml.)

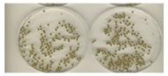
Gravimetric Method

Total Weight of eggs

Sampling (1 g. or mg.)

Sedgewick Rafter





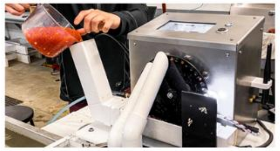
$$F = \frac{nG}{g}$$

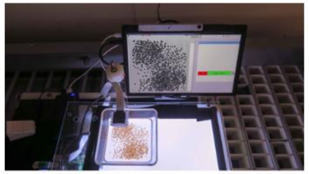
≥3 rep.

n = no. of eggs in each sub-samples
G = total weight of eggs
g = weight of sub-sample (1 g. or mg.)

Automatic Eggs Count

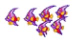
- Hight accuracy ☺
- Takes time ☹





Active Gear Selectivity

Logistic Function = Selection Ogive Curve by Probability of Capture

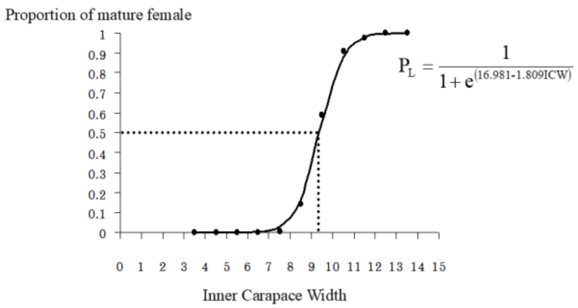


Application

Probability of Capture =>> Probability of Fecundity

mid-length	total number	mature number
6.50	17	8
7.50	72	32
8.50	181	84
9.50	400	196
10.50	512	251
11.50	302	143
12.50	117	57
13.50	36	17
14.50	6	3
15.50	2	1

Maturity Curve

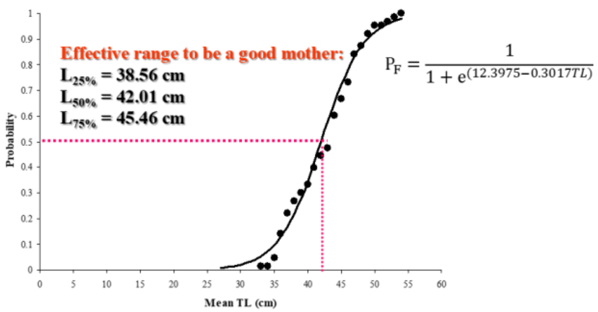


Cumulative fecundity frequency of shark catfish.

TL (cm)	Frequency of occurrence of matured female	Cumulative Frequency	P_F
33.0	1	1	0.021
34.0	0	1	0.021
35.0	3	4	0.083
36.0	6	10	0.208
37.0	4	14	0.292
38.0	1	15	0.313
39.0	4	19	0.396
40.0	2	21	0.438
41.0	1	22	0.458
42.0	5	27	0.563
43.0	3	30	0.625
44.0	3	33	0.688
45.0	3	36	0.750
46.0	2	38	0.792
47.0	3	41	0.854
48.0	2	43	0.896
49.0	2	45	0.938
50.0	0	45	0.938
51.0	1	46	0.958
52.0	1	47	0.979
53.0	0	47	0.979
54.0	1	48	1.000

Length at 50% maturity

Probability of Cumulative Fecundity



Maturity size of female shark catfish in the Mun River, estimating from frequency of occurrence of matured female.

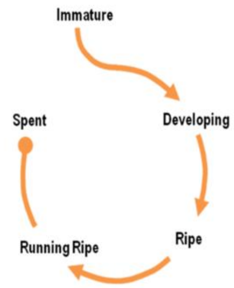
Spawning Season

Spawning Season

- Spawning Patterns
- Gonadosomatic Index
- Histological Profile (mostly, ovary)
- Sex Steroid Hormones Profile

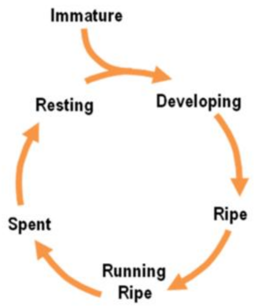
Spawning Patterns

- **Synchronous**: Total Spawners / Semelparity or Big Bang



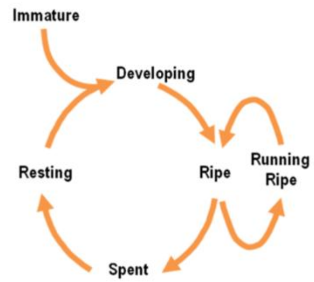
Spawning Patterns

- **Group-Synchronous**: Partial Spawner / Clutch



Spawning Patterns

- **Asynchronous**: Batch Spawners / All year round



Gonadosomatic Index (GSI)[1]

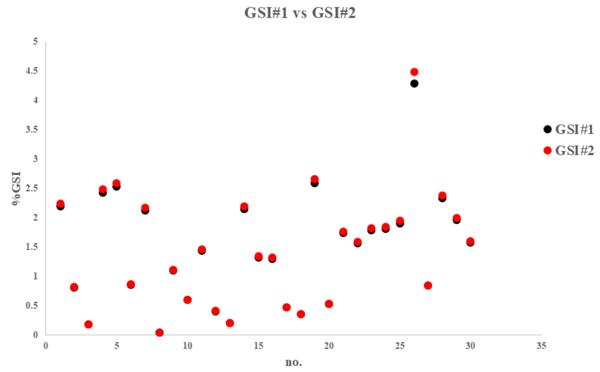
$$GSI = \frac{gonad\ weight\ (g)}{whole\ body\ wt.(g) - gonad\ wt.(g)} x100$$

Hepatosomatic Index (HSI)[2]

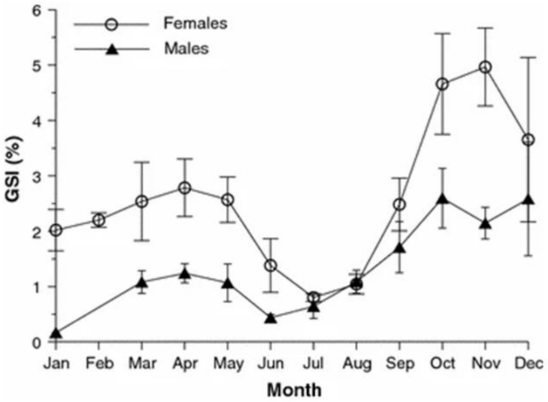
$$HSI = \frac{liver\ weight\ (g)}{body\ weight} x100$$

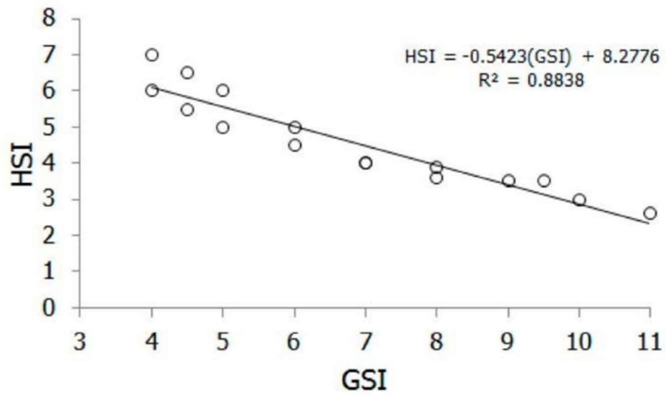
[1]*http://link.springer.com/10.1007/s12562-009-0177-y#Tab1*

[2]*Prakah,S. The Scientific Temper 13:1 (46-50)*



Example

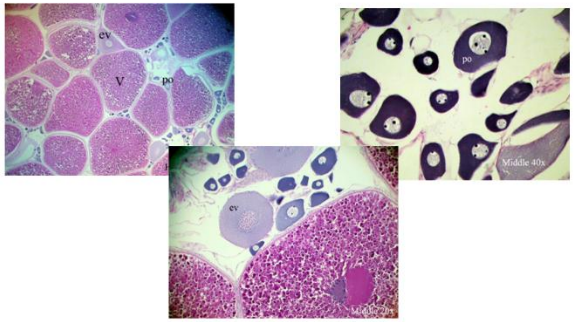




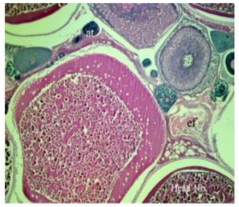
Classification for ovarian development stages, based on histological criteria

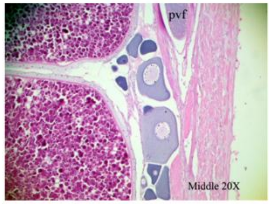
Stage	Features
Regressed	Primary oocytes or a mixture of primary and secondary oocytes present; secondary oocytes may be beginning to enlarge but are not vacuolated
Previtellogenic	Oocytes with clear peripheral vacuoles (cortical alveoli); zona radiata present
Vitellogenic	Yolked oocytes present
Spawning	Yolk globules blending, hydrated oocytes present; postovulatory follicles visible
Spawned out	Many postovulatory follicles present; yolked oocytes undergoing resorbtion; inflammatory infiltrate, beta or gamma atretic follicles and/or macrophage aggregates generally present

Ovarian Histology

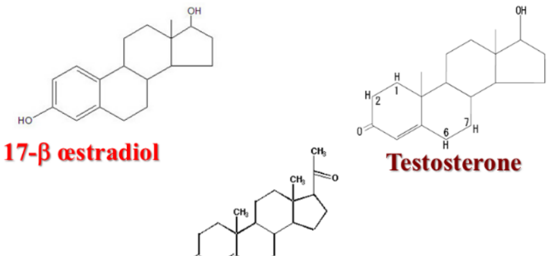


Ovarian Histology





Sex Steroid Hormones



17-β œstradiol

Testosterone

Progesterone

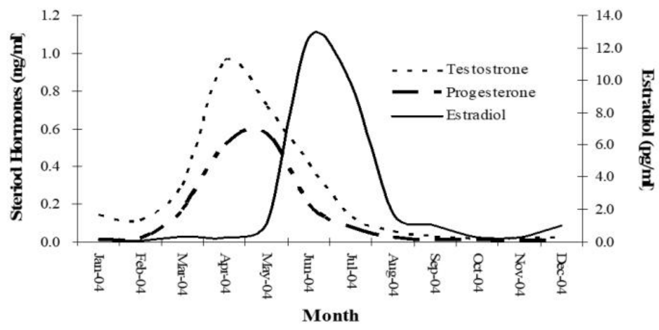
Fish Gonadal Hormones and their Functions

- In mature stages, gametogenesis and spawning in both sexes are
  - directly controlled by steroids hormones on germ cells or
  - indirectly on somatic elements
- Sex steroid hormones also regulate in many reproduction-linked behaviours
  - development and recognition of secondary sexual characteristics
  - pheromonal attraction
  - spawning
  - parental care

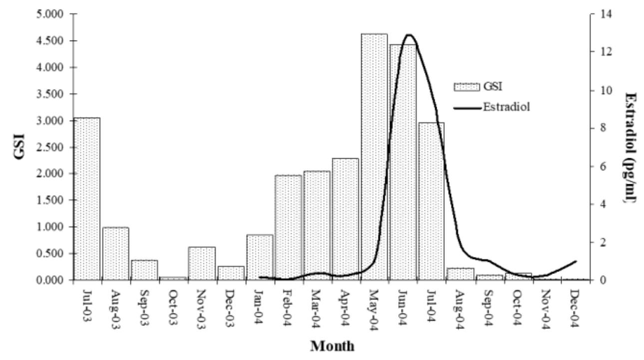
Fish Gonadal Hormones and their Functions

- Other important non-steroid hormone which is well-studied is 'prostaglandins'
- Family of cyclopentane fatty acids found in most tissues
- Acts as a stimulator for the ovulation in female fish

Sex Steroid Hormones Profile



Estradiol vs. GSI



Basic Sampling Theory

19 September 2024 : 16.30-17.30

Thanitha Darbanandana 'Emmie'

Why Sampling?

- To examine 'representative' sub – sets of the data to 'estimates' of population parameters
  - LFD, Catch, Fishing Effort, Price, etc.
  - as close as possible to the 'true' values
  - would be obtained through population
- To reduce operational costs
- To reduce analytical and computing requirement

IF: appropriate sampling design

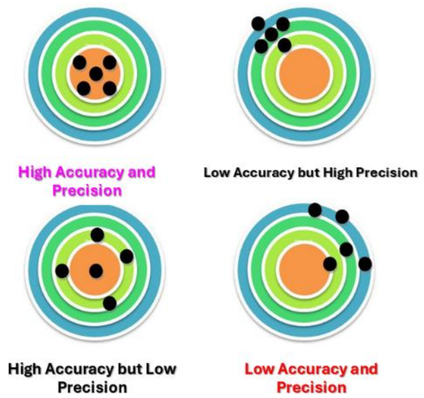
Sampling Precision

- Related to the variability of the sample used and can be measured by *'Coefficient of Variation' or CV*
- Also determine the *confident limit* of estimates
- Estimates can be of high precision, but low accuracy, when sample are not representative and estimated result lower or higher than true population value
- Precision will be *increasing* as well as the *increasing of the sample size* and the *decreasing of variables*

Sampling Accuracy

- Usually expressed as a relative index in percentage and indicates the closeness of a sample – based parameter estimator to the true population value
- When expressed as a relative index, sampling accuracy is independent of the variability of the data population
- When sample size increases and sample are representative, sampling accuracy also increases

Accuracy vs. Precision; which one you prefer?



The Risks by biased estimates

- Biased estimates are systematically *lower or higher* than the true population value
- Generally caused from the sample that not representative of the population data from:
  - Human error
  - Incorrect sampling design
  - The fishing gears selectivity must be concern
- Not easily detectable, cannot detect by time

How many sample size we need?

"A minimum of 30 observations is sufficient to conduct significant statistics."

The determination of safe sample size for surveys for fisheries

1. Rules of Thumb

(Gross estimation for sample size)

- If N about $\leq$ 999 : n should be sampled at least 25%
- If N about 1,000 – 9,999 : n should be sampled at least 10%
- If N about 10,000 – 99,999 : n should be sampled at least 5%
- If N about $\geq$ 100,000 : n should be sampled at least 1%

Calculation of sample sizes (n) when population (N) is unknown: Method 2

- Let "d" is maximum absolute error from the average sample mean ($\overline{y}$) for the estimation the population mean
- Let (1-α)100% is confident interval of the estimation, the number of samples (n_0) can calculate by:

$$n_0 = \frac{Z^2 S^2}{d^2}$$

Where Z come from the table at (1-α)100%

Calculation of sample sizes (n) when population (N) is unknown: Method 1

$$n = \frac{z^2 * \hat{p}(1-\hat{p})}{\varepsilon^2} \qquad n = \frac{1.96^2 * 0.50(1-0.50)}{0.05^2}$$

- 90% – Z Score = 1.645
- 95% – Z Score = 1.96
- 99% – Z Score = 2.576

$n = 385$

where:

- z = 1.96 (Based on a 5% margin of error)
- $\hat{p}$ = 50% or 0.50 (This value is often pulled from previous research/ literature. If unsure, use 50%.)
- ε = 5% or 0.05 (Same value used to get the z-score estimate but provided as a decimal/ percentage.)

2. Margin of Error (MOE)

	Size of population					
Margin of error	>5000	5000	2500	1000	500	200
±10%	96	94	93	88	81	65
±7.5%	171	165	160	146	127	92
±5%	384	357	333	278	217	132
±3%	1067	880	748	516	341	169

Example

In the preliminary surveys of shrimp, fishery biologist random sampling for 1 Kg 6 times. He count no. of shrimp in each sampling are: 60, 50, 170, 80 and 60 tails respectively. He wants to know the optimum shrimp tails in the real survey with less than 10% of error at the 95% confident interval.

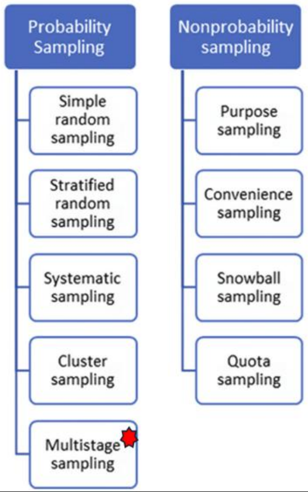
::Step by step::

- Calculate the mean of samples : $\frac{(60+50+170+70+80+50)}{6}$ =80 tails
- d = 8 (10% of error of mean)
- Calculate variance = 2,080 $(\text{tails/Kg})^2$
- Open Z table at α=0.05 equal to 1.96

$$n_0 = \frac{Z^2 S^2}{d^2} = \frac{(1.96)^2 (2080)}{(8)^2} = 124.85 \approx 125$$

Basic Sampling Design

General Roadmap for Basic Sampling Design



Normally Two-stage sampling in Fisheries

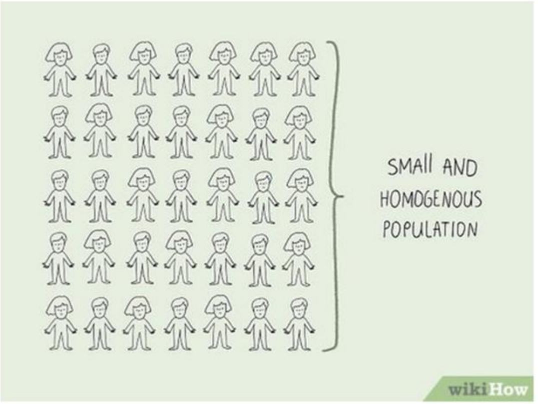
Probability sampling	Non-probability sampling
The samples are randomly selected.	Samples are selected on the basis of the researcher's subjective judgment.
Everyone in the population has an equal chance of getting selected.	Not everyone has an equal chance to participate.
Researchers use this technique when they want to keep a tab on sampling bias.	Sampling bias is not a concern for the researcher.
Useful in an environment having a diverse population.	Useful in an environment that shares similar traits.
Used when the researcher wants to create accurate samples.	This method does not help in representing the population accurately.
Finding the correct audience is complex.	Finding an audience is very simple.

Probability Sampling

Simple Random Sampling (SRS)

Advantage	Disadvantage
1. The easiest sampling design	1. Only suitable for small and homogeneous population
2. Easy estimation, methods can be adjusted.	2. Not suitable for an indefinite population because it is difficult to estimate the suitable sample size
	3. It is the most expensive plan as it may require a large sample size. To control the 8 discrepancies within the desired scope

Simple Random Sampling (SRS)



Systematic Sampling

- Taking the first sample unit randomly
- After that, every k next sample unit will be selected until the desired n unit of sample is obtained
- For convenience, $N = kn$ in order to have k of all possible sample units
- There are 2 methods:
  - Linear systematic sampling
  - Circular systematic sampling

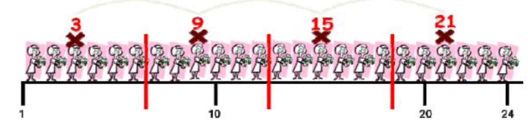
Linear systematic sampling

- Give rank to all units in the population from *1, 2, 3, …..N*
- Let *n* be the specified sample size
- Calculates the sampling interval using the symbol *I*, which $I = \frac{N}{n}$
- Select the Random Start (*R*) where *R* is between *1* and *I*, where *R* may be random from lucky draw, random number table or computer
- The unit selected as an example is a unit with ordinal numbers corresponding to the values *R, R + I, R + 2I, …, R + (n-1) I*

Linear systematic sampling

Example We want to select a sample of 4 people out of a total of 24 people, it can proceed as follows:

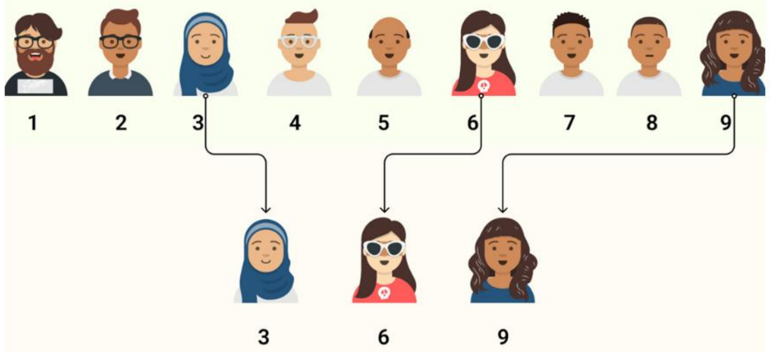
N = 24 n = 4 I = N/n = 24/4 = 6 R = 3



Sampling Fraction = n/N = 4/24 → 1 : 6

This means that for every 6 people, one sample will be picked up

Linear Systematic Sampling

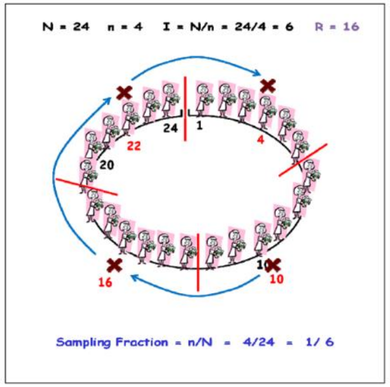


Circular systematic sampling

- Let the numbers in order with every unit in the population are 1,2,3, … N
- Let *n* be the specified sample size
- Calculates the sampling interval using the symbol *I*, which $I = \frac{N}{n}$
- Select the Random Start (*R*) where *R* is between *1* and *I*, where *R* may be random from lucky draw, random number table or computer
- The unit selected as an example is a unit with ordinal numbers corresponding to the values *R, R + I, R + 2I, …, R + (n-1) I*

Circular systematic sampling

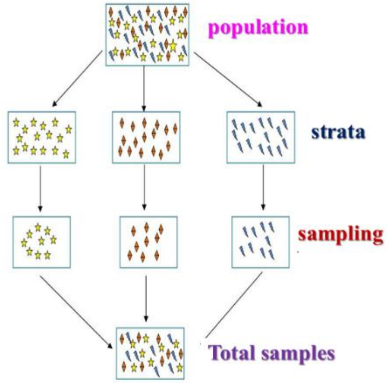
In case that the value of $R + I$ or $R + 2I$ or ...., is greater than N, then N is subtracted. The result that matches any number of units is an example

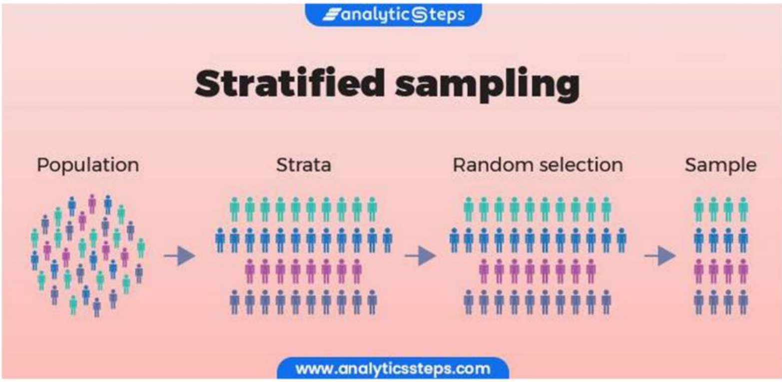


Systematic Sampling

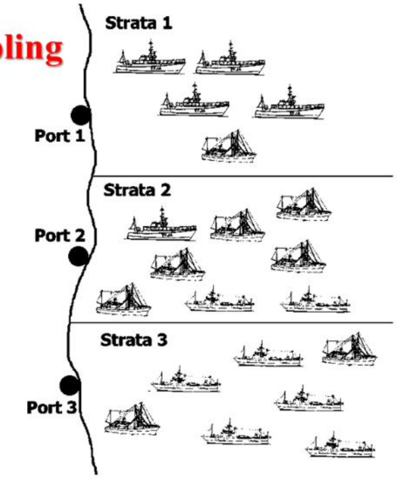
Advantage	Disadvantage
1. Easy, time-consuming and low-cost method	1. Get a bias estimator in the case that N is not equal to kn
2. Will be very effective when a population has a good order of sample units. Sampling can be selected more thoroughly than SRS	2. Cannot calculate unbiased estimators of the variance of the approximator from a single random sample (after every k units have been selected) then it is necessary to calculate the estimates from SRS
	3. If the data is not sorted well, the estimates are less effective than SRS

Stratified Sampling

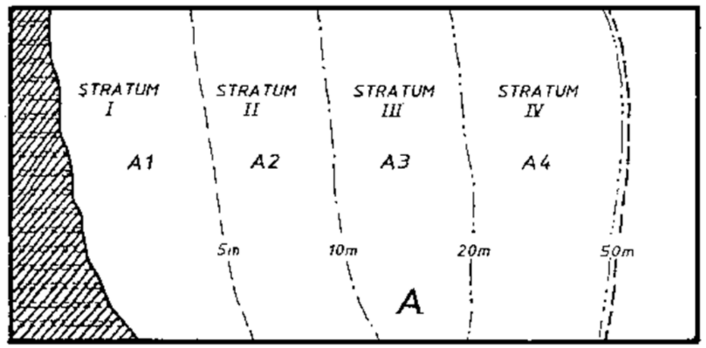




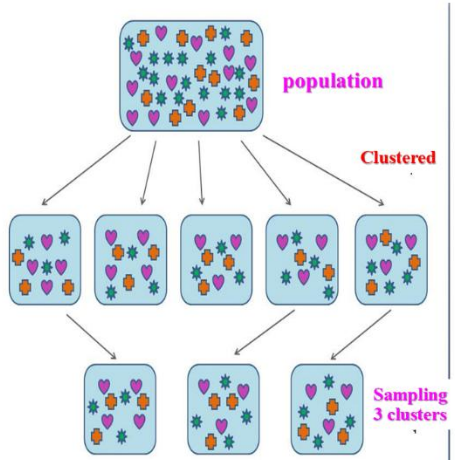
Stratified Sampling

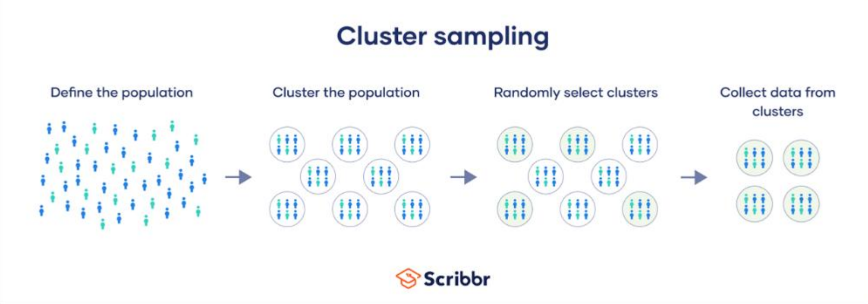


Stratified Sampling



Cluster Sampling (Area Sampling)



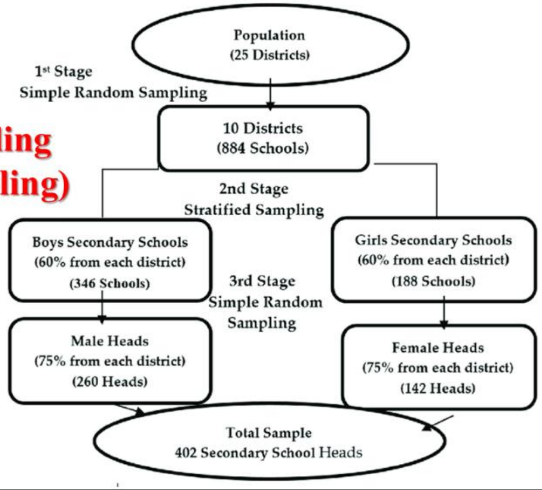


Stratified Sampling / Cluster Sampling / SRS

:: Noted ::

- **Demersal fish stock usually non-uniform distribution**
- **Abundance of demersal fish stocks depend on DEPTH**
- **Depth = strata/landing port**
- **SRS == the most expensive sampling design**
- **Pelagic fish stock: random (?) / non-uniform (?)**

Multistage Sampling (Two Stage Sampling)



Non-probability Sampling

PURPOSIVE SAMPLING

Purposive Sampling

- Intentionally selecting participants because they have characteristics that you need in your sample
- Also called judgmental sampling relies on the researcher's judgment
  - characteristics,
  - knowledge,
  - experiences, or
  - some other criteria

When to use purposive sampling

- Purposive sampling is best used when you want to focus in depth on relatively small samples
- The main goal of purposive sampling is to identify the cases, individuals, or communities best suited to helping you answer your research question
- For this reason, purposive sampling works best when you have a lot of background information about your research topic
- The more information you have, the higher the quality of your sample

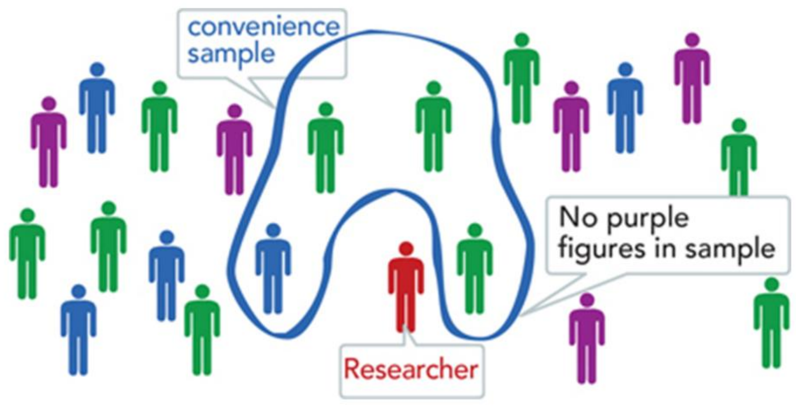
In-depth Interview

Convenience Sampling

Convenience sampling

- In case that the easiest for the researcher to access
- Sometimes called accidental sampling
- Suppose you are researching public perception towards the city of Bangkok. You have determined that a sample of 100 people is sufficient to answer your research question.
- To collect your data, you stand at a subway station and approach passersby, asking them whether they want to participate in your research. You continue to ask until the sample size is reached.

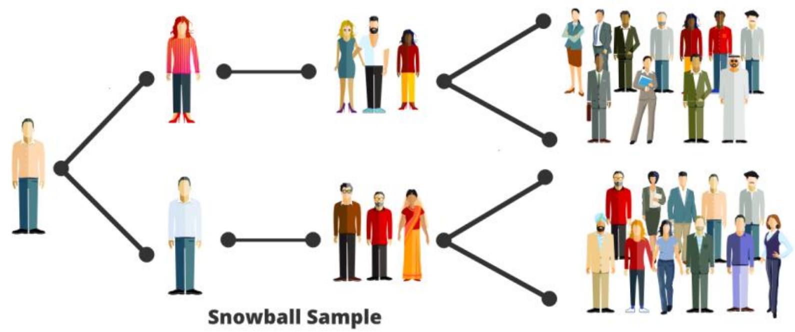
Purposive Sampling	Convenience Sampling
• Depend on reason • Follow research question • Samples have the qualification that you want	• Depend on the easiest in collecting samples • Researcher cannot expect who will be his sampling



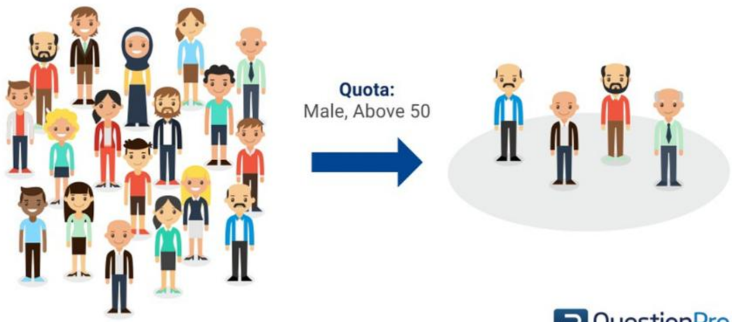
Snowball Sampling

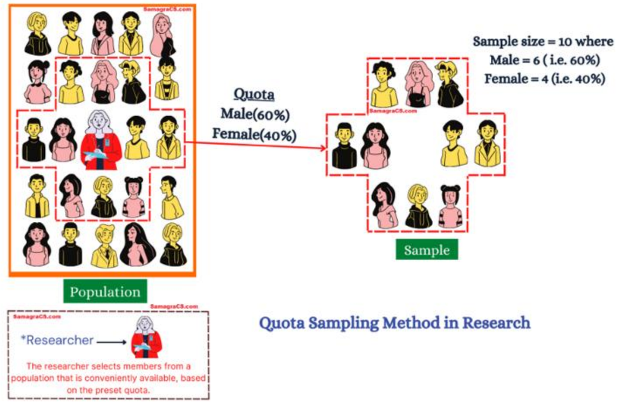
Snowball Sampling

- **Snowball sampling (or chain sampling, chain-referral sampling, referral sampling) is a technique where existing study subjects recruit future subjects from among their acquaintances**
- **You need the primary data from the first sample, then your first sample will suggest another samples**
- **The sample group is said to grow like a rolling snowball**

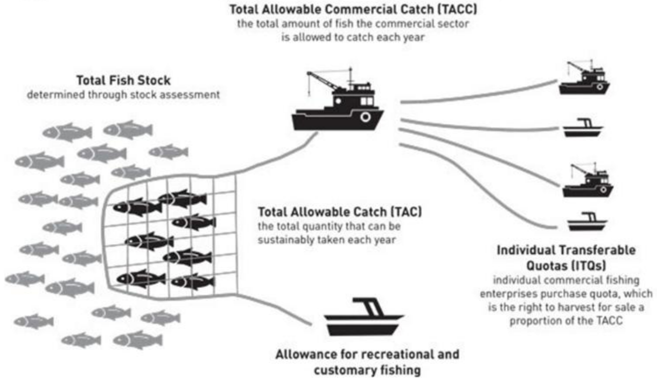


Quota Sampling





Application to Quota Management (TAC/TACC)



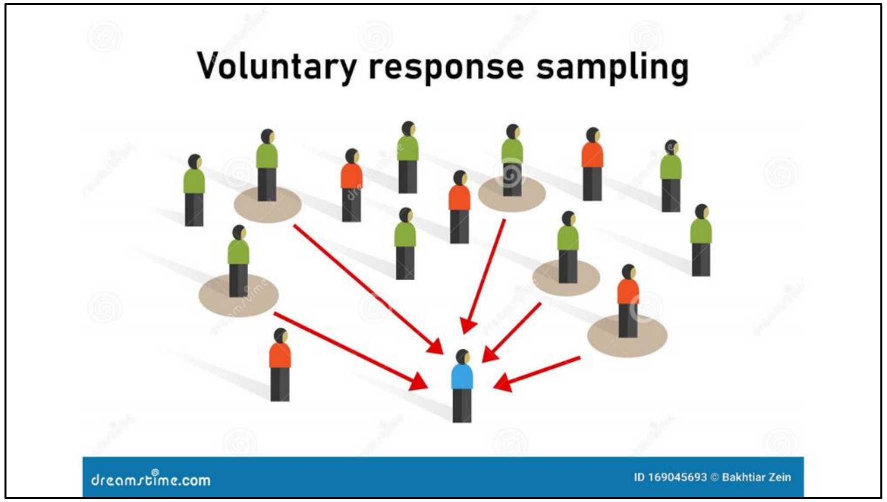
Volunteer Sampling

- Selection of representative sample units

01

02

- Impossible to select the originally sample unit due to the difficulty in selecting the sample unit and / or
- The occurrence of unforeseen circumstances
- Need to find an agent to compensate for the original samples

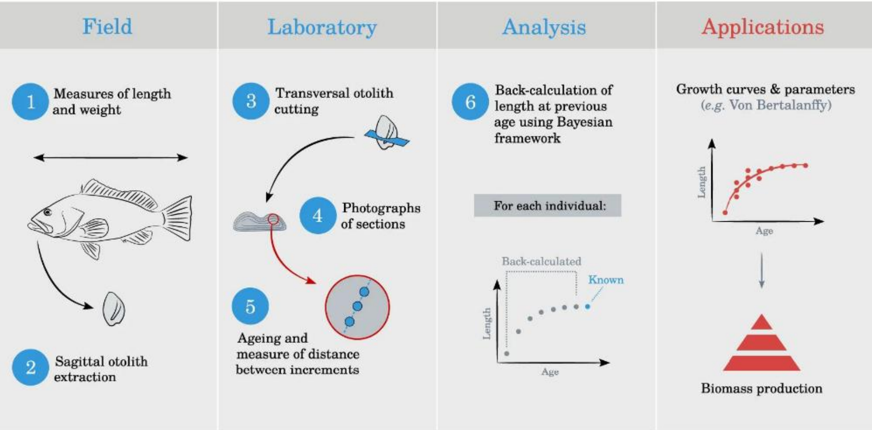

Voluntary response sampling
dreamstime.com
ID 169045693 © Bakhtiar Zein

การศึกษาอายุสัตว์น้ำจากส่วนแข็งในร่างกาย

รศ. ดร. ธนิษฐา ทรรพนันทน์

วัตถุประสงค์

- เพื่อศึกษาการเติบโตของสัตว์น้ำ
- มีข้อสมมติว่า การเติบโตของสัตว์น้ำโตเป็นสัดส่วนโดยตรงกับอายุ (direct proportional growth)
- สร้างสมการเชิงเส้นของการเติบโต เพื่อทำนายความยาวจากอายุที่อ่านได้ ด้วยวิธีการคำนวณกลับ (back calculation)



ส่วนแข็งที่นิยมนำมาศึกษา

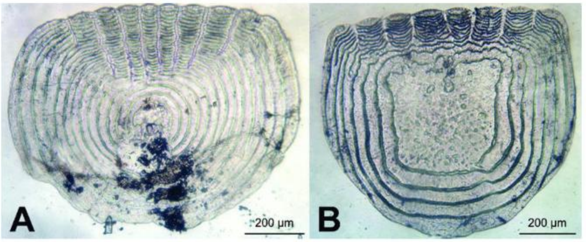
- เกล็ด (Scale)**
- กระดูกหู (Otolith)**
- Statolith (ในกลุ่ม Cephalopods)**
- กระดูกสันหลัง (Vertebrae)**
- กระดูกแผ่นปิดเหงือก (Operculum)**
- กระดูกฐานครีบหู (Cleithrum)**
- กระดูกเพดานปาก (Mesopterygoid)
- ก้านครีบ (Fin Spines) ทั้ง การครีบแข็ง และก้านครีบอ่อน

การอ่านอายุจากเกล็ด

****double blind

เกล็ดที่ไม่นำมาใช้

- Regenerated Scale
  - บริเวณกึ่งกลางเกล็ด จะไม่มีจุด Focus และเส้นวงเกล็ด
  - เกล็ดเดิมหลุดไป และมีการสร้างใหม่ทดแทน

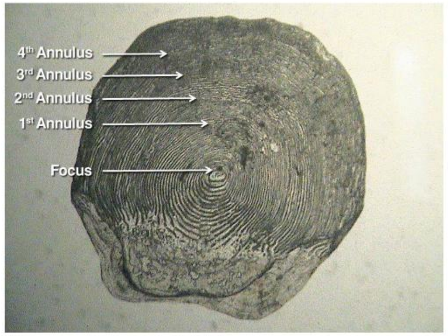


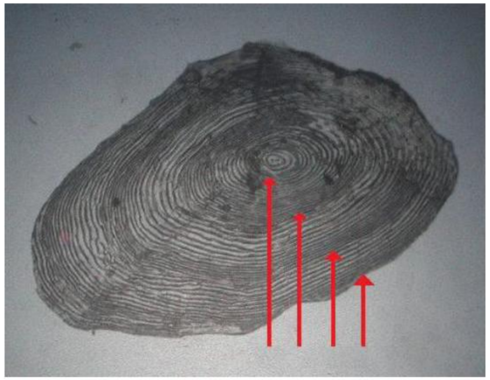
การจำแนกวงปี

**** triple blind reading

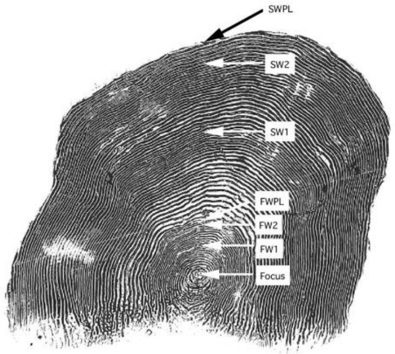
- บริเวณที่วงเกล็ดแนบชิดกัน คือช่วงหยุดชะงักการเติบโต เนื่องจากอดอาหาร
- บริเวณที่วงปีห่างจากกัน คือช่วงที่มีการเติบโต

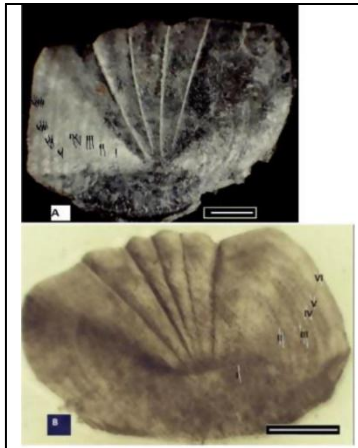
วงชิด + วงห่าง = อายุ 1 ปี



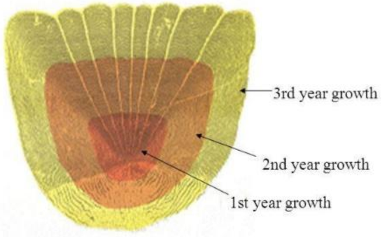


ตัวอย่างวงปีของเกล็ดปลาที่เป็น Diadromous Fish





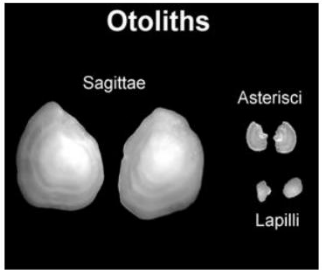
Aging Fish by Scales

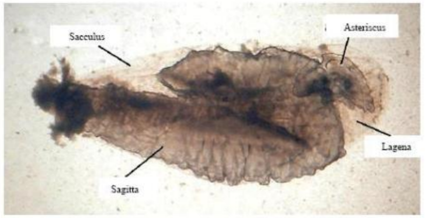


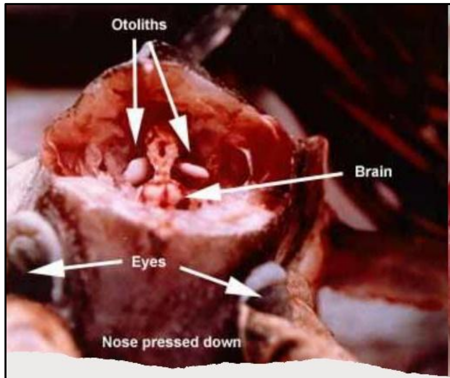
การอ่านอายุจากกระดูกหู (Otolith)

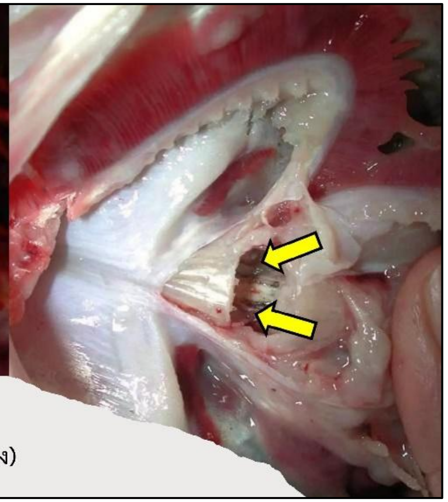
โครงสร้างของกระดูกหู

- กระดูกหู แบ่งออกเป็น 3 ส่วน คือ Sagittae; lapilli และ Asteriscii
- นิยมใช้ชิ้น Sagittae เพราะชิ้นใหญ่ที่สุด (แต่ไม่แน่เสมอไป)









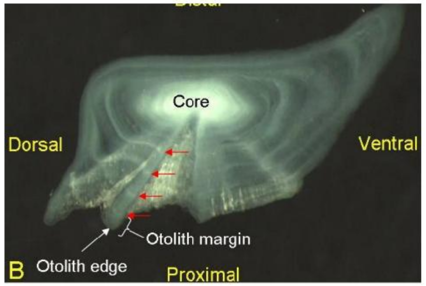
การเก็บกระดูกหู

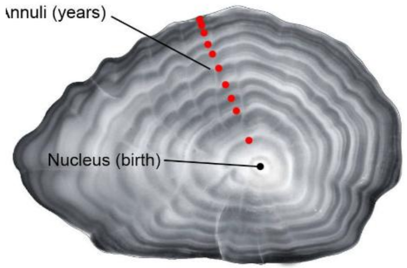
(ขนาดกระดูกหูไม่ขึ้นกับขนาดปลาเจ้าของ)

การอ่านวงปี

ส่วนใส (Hyaline Zone or Transparent Zone) คือช่วงที่อดอาหารและเกิดกระบวนการ Calcification

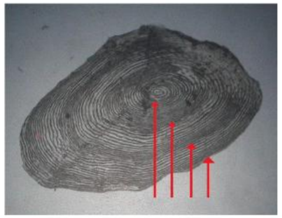
ส่วนขุ่น (Opaque Zone) เกิดจากการมีอาหารอุดมสมบูรณ์ มีการสะสมของสารอินทรีย์สูง



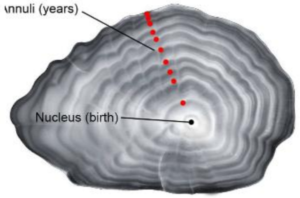


โปรดระวัง

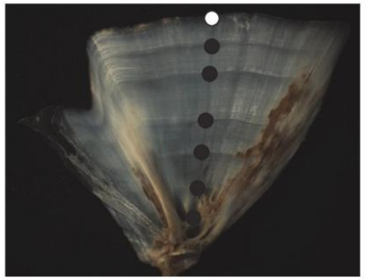
- บริเวณที่วงเกล็ดแนบชิดกัน คือช่วงหยุดชะงักการเติบโต เนื่องจากอดอาหาร
- บริเวณที่วงปีห่างจากกัน คือช่วงที่มีการเติบโต



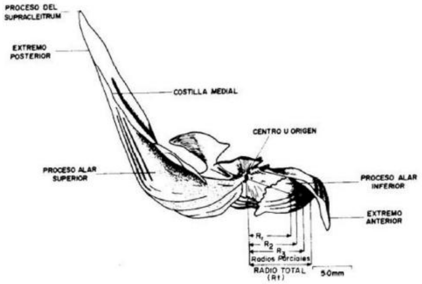
- ส่วนใส (Hyaline Zone or Transparent Zone) คือช่วงที่อดอาหารและเกิดกระบวนการ Calcification
- ส่วนขุ่น (Opaque Zone) เกิดจากการมีอาหารอุดมสมบูรณ์ มีการสะสมของสารอินทรีย์สูง



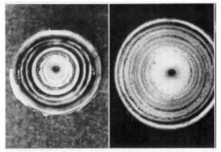
การอ่านอายุจากแผ่นปิดเหงือก (Operculum)



การอ่านอายุจากกระดูก Cleitrum



การอ่านอายุในปลากระดูกอ่อน (ไม่มีกระดูกหูนะจ๊ะ)



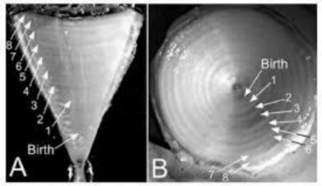
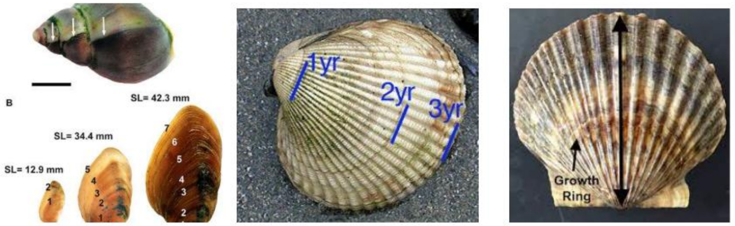
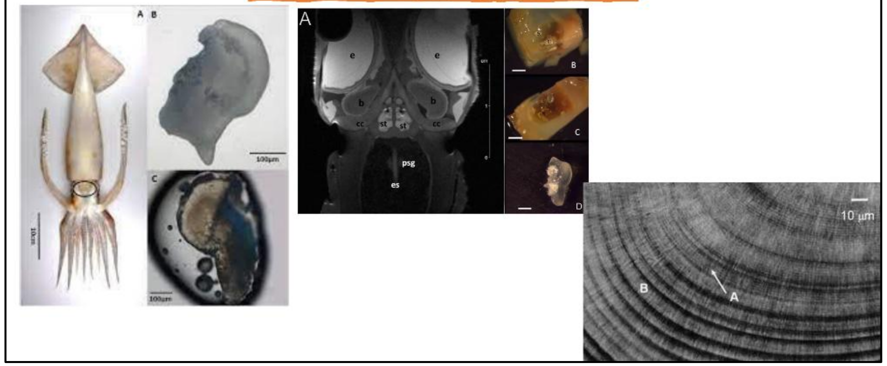


Figure 17. Comparison of annual growth bands visible in a single *Prionace glauca* vertebra after sectioning (A) and as viewed whole (B); annual growth bands are indicated.

การอ่านอายุในกลุ่มหอยฝาเดียว-สองฝา

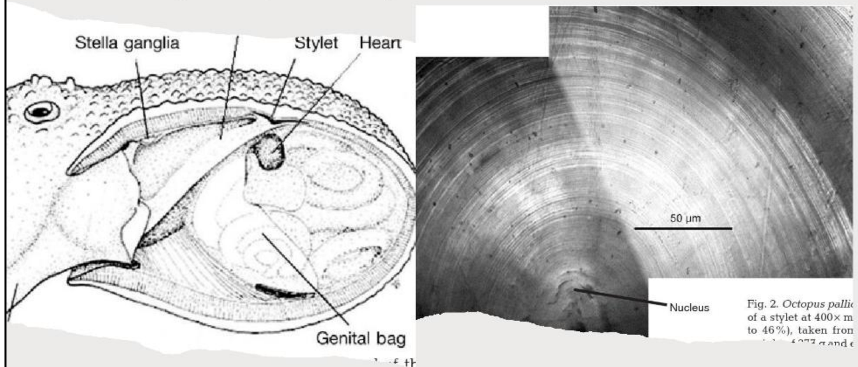


การอ่านอายุจาก Statolith กลุ่มหมึกกล้วย, หมึกหอม



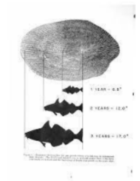
การอ่านอายุจากกระดองกลุ่มหมึกกระดอง

การอ่านอายุจาก Stylet ในกลุ่มหมึกสาย



ข้อควรระวัง

- ปลาและกลุ่มหอย ใช้วงปี หรือวงเดือน
- กลุ่มหมึกใช้ วงวัน
- เขตร้อน ใช้วงเดือน วงวัน
- ลูกปลา ใช้วงวัน
- การอ่านวงปี จะใช้ blind test (validation)



Back Calculation

Direct Proportional Method

$$L_{a(i)} = \left(\frac{S_{a(i)}}{S_c}\right) * L_c$$

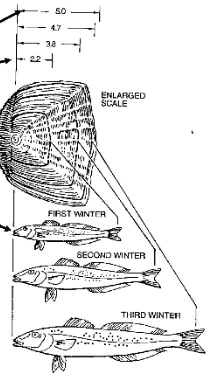


Figure 3.42 The relationship of annual checks to age in the scale of a temperate-water fish, the whiting *Silloginodes punctatus* (scale redrawn from Anon. 1987). Distances from the focus (or scale centre) to the three winter checks and the posterior edge of the scale are in arbitrary units.

ตัวอย่างการคำนวณ

ความยาวปลาเจ้าของเกล็ด=250 มม.

รัศมีเกล็ด=100 มม.

รัศมีเกล็ดของปลาอายุ 2 ปี=60 มม.

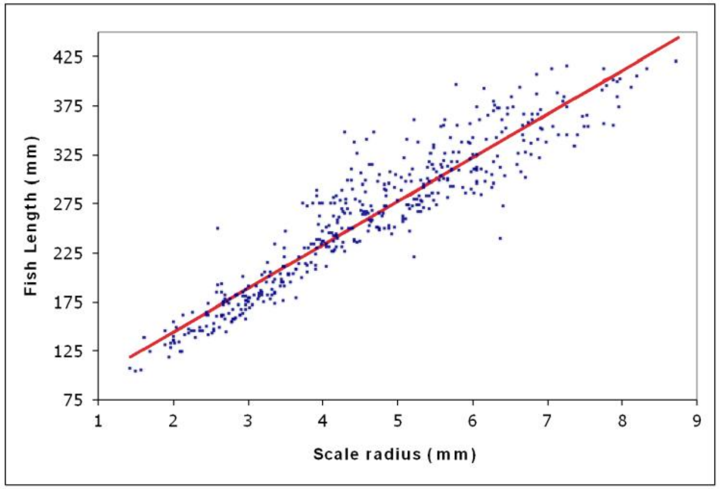
$$\left(\frac{60}{100}\right) * 250 = 150\ mm$$

Fraser-Lee Method ห้ามใช้วิธีนี้กับกระดูกหู!!!

- นิยมมากกว่า เพราะใช้ปัจจัยปรับค่า (correction factor) แก้ปัญหาความคลาดเคลื่อนจากวิธี direct proportional
- มีความแม่นยำกว่า

$$L_{a(i)} = a + \left(\frac{S_{a(i)}}{S_c}\right) * (L_c - a)$$

จุดตัดแกนY



ตัวอย่างการคำนวณ

ความยาวปลาเจ้าของเกล็ด=250 มม.

รัศมีเกล็ด=100 มม.

จุดตัดแกนY=35 มม.

รัศมีเกล็ดของปลาอายุ 2 ปี=60 มม.

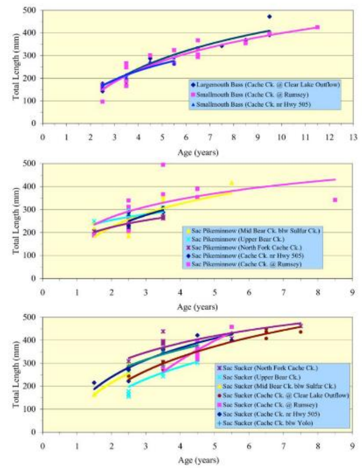
$$35+\left(\frac{60}{100}\right)*(250-35)=164\,mm$$

Lee Phenomenon

- ปลาอายุมากกลับมีความยาวน้อยกว่าปลาที่อายุน้อย
- สาเหตุเกิดจาก
  - พันธุกรรม
  - ความสมบูรณ์ของอาหาร
  - อุณหภูมิน้ำ
  - คุณภาพของไข่ และน้ำเชื้อ

Table 2. Age and length relationships in perch.

	Fish Age (years)					
	1	2	3	4	5	6
Length (mm)	78	94	103	105	134	135
	82	91	110	125	130	132
	84	86	113	121	125	
	83	99	99	118		
	79	87	97	126		
	77		114			
	84		111			
	81					
	85					
	80					



ไปเรียนรู้เกี่ยวกับแบบจำลองการเติบโตใน
บทเรียนเรื่องการเติบโต

Annex 23

Regional Training Course on Basic Stock Assessment for Marine Fishery Resources in the Southeast Asia

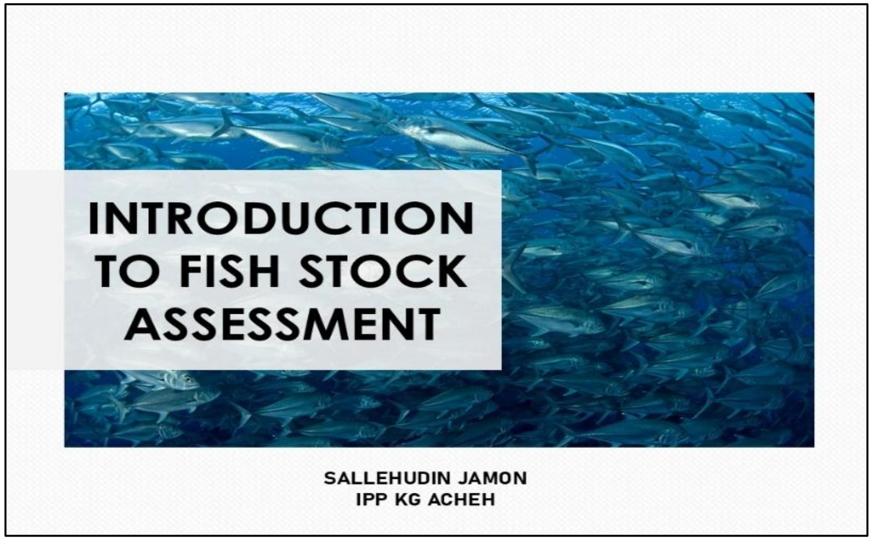
TRAVEL ITINERARY

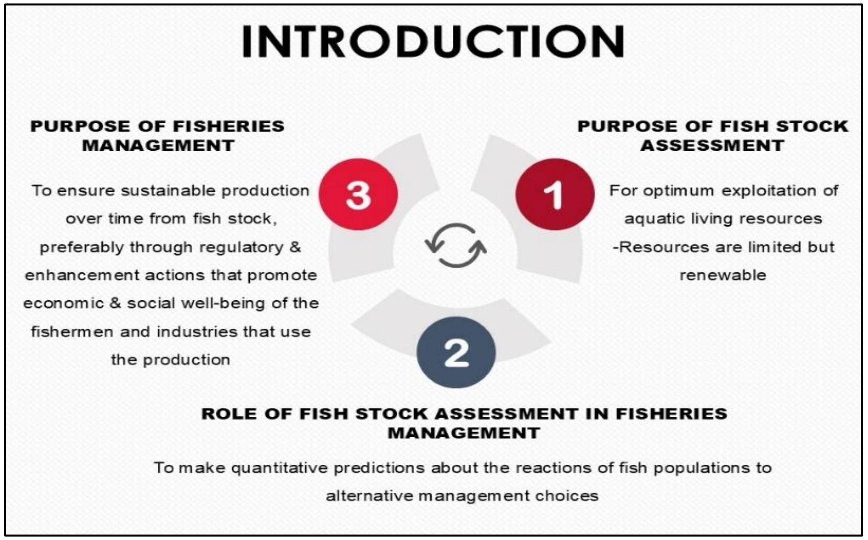
DATE: 20/9/2024

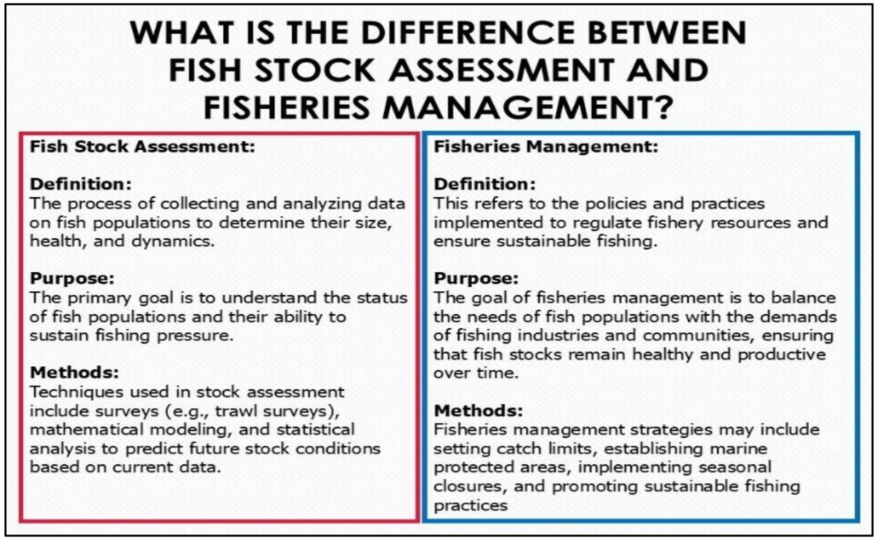
TIME	ACTIVITY
9.30 AM	Check-out from Tanjung Vista Hotel Kuala Terengganu
10.00 AM	Depart from Tanjung Vista Hotel
10.30 AM	Stop by MFRDMD office for luggage drop-off
10.40 AM	Depart to Kuantan
1.00 PM	Pit stop at a mosque in Kemaman
2.30 PM	Continue travelling to Classic Hotel
4.00 PM	Check-in to Classic Hotel Kuantan
8.00 PM	Gather in the hotel lobby, heading to dinner
8.30 - 10.30 PM	Dinner

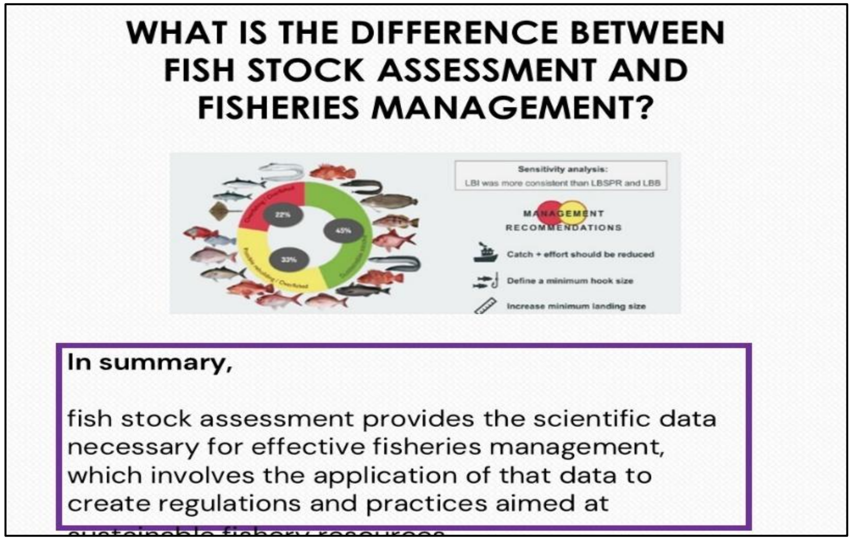
DATE: 21/9/2024

TIME	ACTIVITY
3.30 AM	Gather in the hotel lobby, heading to LKIM Fishing Landing Complex
4.30 - 7.30 AM	Visit to LKIM Fishing Landing Complex
8.00 AM	Breakfast at Classic Hotel
9.45 AM	Gather in the hotel lobby, heading to Kuantan 188 Tower
10.00 - 11.30 AM	Visit to Kuantan 188 Tower
11.45 AM	Check-out from Classic Hotel
12.00 - 1.00 PM	Lunch
1.00 - 2.00 PM	Heading to Natural Batik Village
2.30 - 4.00 PM	Tour around Natural Batik Village
4.00 PM	Departing to Terengganu
8.30 PM	Stop by MFRDMD to pick-up bags
8.40 PM	Heading to Tanjung Vista Hotel

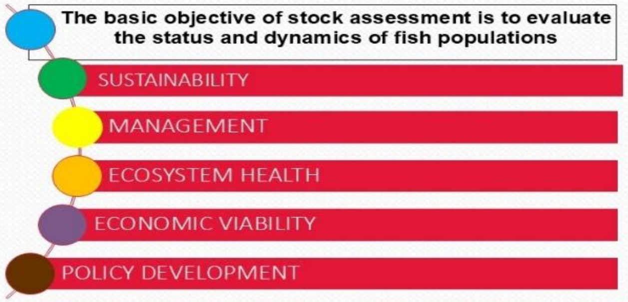

INTRODUCTION TO FISH STOCK ASSESSMENT
SALLEHUDIN JAMON
IPP KG ACHEH


INTRODUCTION
PURPOSE OF FISHERIES MANAGEMENT
3
To ensure sustainable production over time from fish stock, preferably through regulatory & enhancement actions that promote economic & social well-being of the fishermen and industries that use the production
PURPOSE OF FISH STOCK ASSESSMENT
1
For optimum exploitation of aquatic living resources
-Resources are limited but renewable
2
ROLE OF FISH STOCK ASSESSMENT IN FISHERIES MANAGEMENT
To make quantitative predictions about the reactions of fish populations to alternative management choices


WHAT IS THE DIFFERENCE BETWEEN FISH STOCK ASSESSMENT AND FISHERIES MANAGEMENT?
Fish Stock Assessment:
Definition:
The process of collecting and analyzing data on fish populations to determine their size, health, and dynamics.
Purpose:
The primary goal is to understand the status of fish populations and their ability to sustain fishing pressure.
Methods:
Techniques used in stock assessment include surveys (e.g., trawl surveys), mathematical modeling, and statistical analysis to predict future stock conditions based on current data.
Fisheries Management:
Definition:
This refers to the policies and practices implemented to regulate fishery resources and ensure sustainable fishing.
Purpose:
The goal of fisheries management is to balance the needs of fish populations with the demands of fishing industries and communities, ensuring that fish stocks remain healthy and productive over time.
Methods:
Fisheries management strategies may include setting catch limits, establishing marine protected areas, implementing seasonal closures, and promoting sustainable fishing practices

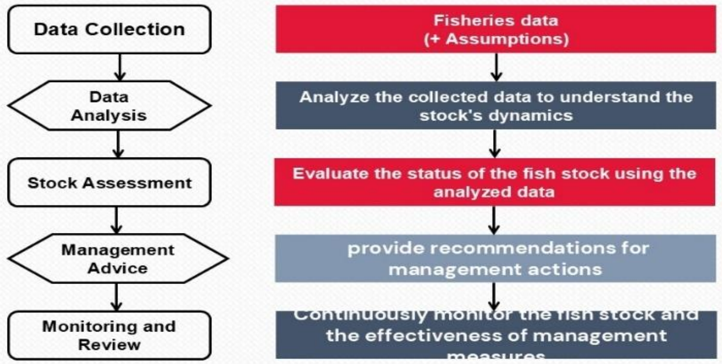

WHAT IS THE DIFFERENCE BETWEEN FISH STOCK ASSESSMENT AND FISHERIES MANAGEMENT?
Sensitivity analysis:
LBI was more consistent than LBSPR and LBB
MANAGEMENT RECOMMENDATIONS
Catch + effort should be reduced
Define a minimum hook size
Increase minimum landing size
In summary,
fish stock assessment provides the scientific data necessary for effective fisheries management, which involves the application of that data to create regulations and practices aimed at

THE BASIC OBJECTIVE OF THE S.A



GENERAL PROCEDURE IN S.A

FIVE BASIC STEPS (SPARRE & VENEMA, 1992)

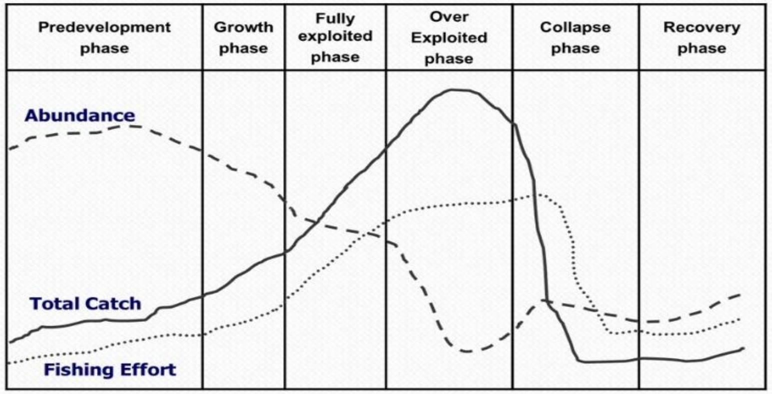


STAGES IN THE DEVELOPMENT OF THE USE OF THE FISH RESOURCES, REGIER (1976)

	FISHERY		RESEARCH ACTIVITY	
	Fishing activity	Catches	Biological studies	Stock Assessment
1.	Exploration, trial fishing	Low	General description: - Taxonomy - Distribution	Order of magnitude estimate of main stock.
2.	Developing fisheries on most profitable stocks	Moderate & increasing	Detailed description: - Life history	Assessment on potential.
3.	Intensify fishing on most profitable stocks & start fishing on less profitable stocks	Moderate to high	Population dynamics: - interactions between stocks	Assessment on: - yield curve & target points (MSY)
4.	Intense fishing	High with possible decreases from vulnerable stocks	Population dynamics: - interactions - ecosystem	Assessment on: - yield curve of all stocks. - estimates of interactions.
5.	Resource management	High	Ecosystem studies & dynamics	Assessment on the effects of action in any stock/fishery on any other stock/ fishery.

Since fisheries in most parts of the world have arrived at/are moving towards, the later stages (the resources are moderately to fully exploited), stock assessment work must also be mainly concerned with these later stages, be considered with the operation of the whole ecosystem & of the interaction between different resources and fisheries

PHASE OF DEVELOPMENT OF UNCONTROLLED FISHERIES (CSIRKE & SHARP, 1984)



UNIT STOCK

- A 'stock' or 'unit stock' means a sub-set of one species having the same growth & mortality parameters, inhabiting a particular geographical area treated as a homogeneous and independent unit
- Cushing (1968): as one that 'has single spawning ground to which the adults return year after year'

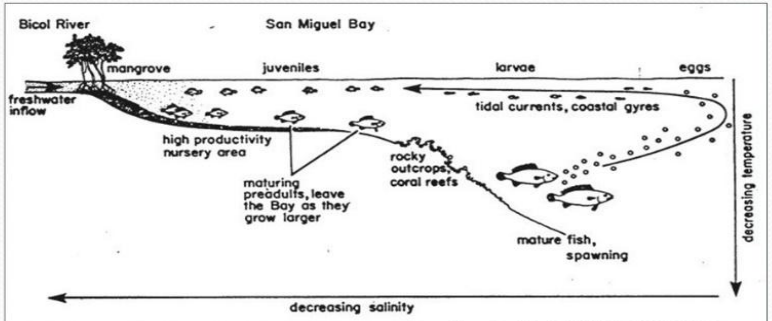


Fig. 4. Schematic representation of the role of San Miguel Bay as a nursery ground for marine fishes hatched further offshore. Generalized from Gunter (1967), Pauly (1976), Johannes (1978) and Buri (1980).

UNIT STOCK

1. Hilborn & Walters, 1992 described unit stock as a homogeneous collection of fish that are all subject to the same opportunities for growth and reproduction and the risks of natural and fishing mortality

2. **Gulland (1983), stated that for fisheries management purposes, a sub-group of a species can be treated as a stock if possible differences within the group and interchanges with other groups can be ignored without making the conclusions reached invalid**
   - This means that it is preferable to start by making stock assessments over the entire area of distribution of a species, as long as there are no indications that separate unit stocks exist in that area
   - If it becomes clear that the growth and mortality parameters differ significantly in various parts of the area of distribution of the species, then it will be necessary to assess the species on a stock by stock basis

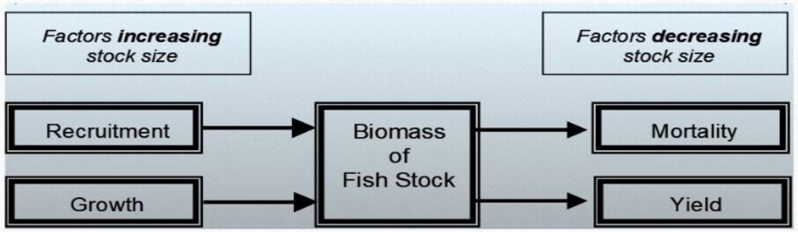
3. **Fish stock assessment should be made for each stock separately**
   - The results may/may not be pooled into an assessment of a fishery

UNIT STOCK - THE CONCEPTS OF GROWTH & MORTALITY

- **The 'growth parameters' are numerical values in an equation by which one can predict the body size of a fish when it reaches a certain age**

$$L(t) = L_{oo} * [1- \exp\{-K*(t - t_o)\}] \quad \text{or}$$

$$W(t) = W_{oo} * [1- \exp\{-K*(t - t_o)\}]^3$$



Factors determining the size of fish stock

UNIT STOCK - THE CONCEPTS OF GROWTH & MORTALITY

The concepts of growth and mortality are fundamental to understanding unit stocks in fisheries. These concepts help define the dynamics of fish populations and are critical for effective management

Growth

Definition:
Growth refers to the increase in size or weight of fish over time. (Genetic, environmental conditions, food availability & age)

Growth Models:

1. Von Bertalanffy Growth Model:
2. Length-Weight Relationships:

Implications for Management:
Understanding growth rates is essential for determining the age structure of a stock, predicting future population sizes, and setting sustainable catch limits.

Mortality

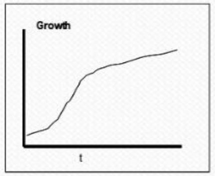
Definition:
Mortality refers to the rate at which individuals in a fish population die ((predation, disease, environmental stress) and fishing (harvest mortality).

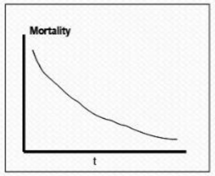
Types of Mortality:

1. Natural Mortality (M):
2. Fishing Mortality (F):
3. Total Mortality (Z): (Z = M + F).

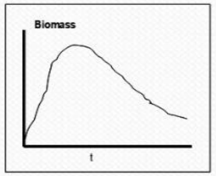
Implications for Management:
Mortality rates are critical for estimating the maximum sustainable yield (MSY) and determining the appropriate fishing pressure on a stock.

THE NORMAL CHARACTERISTICS OF GROWTH, MORTALITY & BIOMASS





- To determine whether a species forms one or more distinct stocks, - its spawning areas, growth and mortality parameters and morphological and genetic characteristics need to be examined



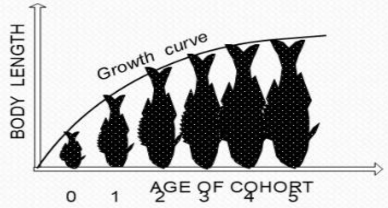
- By comparing the fishing patterns in various areas or
- By carry out tagging studies

GROWTH PARAMETERS: Loo, K, to

The von Bertalanffy growth equation:

$L(t) = L_{oo} * [1- \exp\{-K*(t - t_o)\}]$ or

$W(t) = W_{oo} * [1- \exp\{-K*(t - t_o)\}]^3$.



Where:

$L(t)$ = length of fish at age t,

$L(w)$ = weight of fish at age t,

L_{oo} = asymptotic length at which the fish would grow if they were allowed to live and grow indefinitely according to the formula,

W_{oo} = asymptotic weight at which the fish would grow if they were allowed to live and grow indefinitely according to the formula,

k = growth coefficient

t_o = hypothetical age the fish would attain at length zero, if it has always grown in a manner as described by the von Bertalanffy equation

GROWTH PARAMETERS: Loo, K, to

The ways of obtaining input data for the methods used to derive the growth parameters :

i). Age reading and length measurements combined

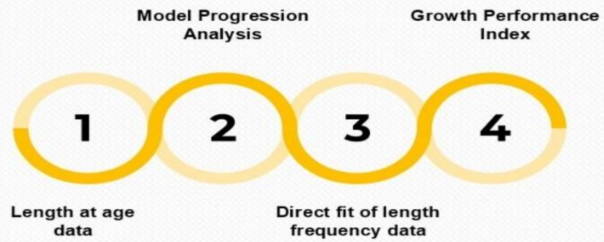
a). data from resource surveys with a research vessel
b). data from samples taken from commercial catches

ii). Length measurements only

a). data from resource surveys with a research vessel
b). data from samples taken from commercial catches

iii). Mark-recapture (tagging) experiments.

WAYS OF OBTAINING GROWTH PARAMETERS:



- ❑ ELEFAN 1
- ❑ Powell-Wetherall
- ❑ Shepherd's method
- ❑ Maximum length

FOUR WAYS OBTAINING GROWTH PARAMETERS

1.0 LENGTH AT AGE DATA

Method: 1.1 Ford-Walford plot
1.2 Chapman's method

Assumption:

a) L_{oo} is attained when there is no more growth or length increment is zero

- Length where L(t) = L(t+1), in the case of Ford-Walford plot
- Length at which $\triangle L = 0$, in the Chapman's method

The age of the fish at length zoro (t_o) is:

$t_o = t + 1/k \ln(L_{oo} - Lt/L_{oo})$

Average t_o = (-.38)+(-.31)+(-.41)+(-.37)+(-.49)+(-.37)/6 = -0.39

Small size t_o = -0.31

Example: Length at age data for the Atlantic yellowfin tuna (*Thunnus albacares*) off Senegal.

Age (years)	1	2	3	4	5	6
Fork length (cm)	35	55	75	90	105	115

Table 1. Input data for the Ford-Walford plot and Chapman's method.

Ford-Walford plot		Chapman's method	
L_t	L_{t+1}	L_t	dL
35	55	35	20
55	75	55	20
75	90	75	15
90	105	90	15
105	115	105	10

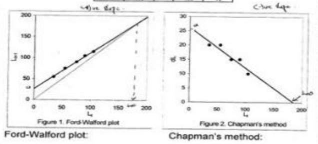


Figure 1. Ford-Walford plot
Figure 2. Chapman's method

Ford-Walford plot:

y = a + bx
$L_{t+1} = a + b(L_t)$

b = 0.86
a = 26.17
$L_\infty = a/(1-b) = 185$
$k = -\ln b = 0.15$

Chapman's method:

y = a + bx
$\Delta L = a + b(L_t)$

b = 0.14
a = 26.17
$L_\infty = -a/b = 185$
$k = -b = 0.14$

FOUR WAYS OBTAINING GROWTH PARAMETERS

2.0 MODEL PROGRESSION ANALYSIS

There are two ways of doing analysis of length-frequency data;

i). Petersen's Method.

Step:
a). Graphical separation of a length-frequency distribution into normally distribution components or cohorts.
b). Identifying the peak of each cohort
c). Assigning relative ages to these peaks to obtain a set of length at relative age data

ii). Model Progression analysis.

Step:
a). Linking of peaks of length frequency distributions collected at successive periods, virtually tracking the progress of cohort through time

MODEL PROGRESSION ANALYSIS (MPA)

1. It is a method of isolating normal distribution from a composite length frequency distribution
2. These normal distributions represent age groups or cohorts contained in the composite distribution
3. The method follows a process of removing normal distributions from a compound distribution
4. The normal distribution identified is subsequently subtracted from the entire frequency distribution

BHATTACHARYA'S METHOD

(MPA)

BHATTACHARYA'S METHOD

Table 2. Steps performed in estimating the means of the first and second cohorts using Battacharya's method.

ML	N_1	$\ln(N_1)$	$d\ln(N_1)$	est $d\ln(N_1)$	$\ln N_1'$	N_1'	N_2	$\ln(N_2)$	$d\ln(N_2)$	est $d\ln(N_2)$	$\ln N_2'$	N_2'	N_3
13	1	0.000				1							
14	4	1.386	1.386	1.376		4							
15	11	2.398	1.012	1.060		11							
16	24	3.178	0.780	0.744		24							
17	38	3.638	0.460	0.428	3.638	38							
18	42	3.738	0.100	0.112	3.750	42.50	-0.50						
19	33	3.497	-0.241	-0.204	3.546	34.66	-1.66						
20	20	2.996	-0.501	-0.520	3.026	20.61	-0.61						
21	7	1.946	-1.050	-0.836	2.190	8.93	-1.93						
22	3	1.099	-0.847	-1.152	1.038	2.82	0.18	-1.735					
23	3	1.099	0.000	-1.468	-0.430	0.65	2.35	0.854	2.589				
24	5	1.609	0.511	-1.784	-2.213	0.11	4.89	1.587	0.733				
25	8	2.079	0.470				8	2.079	0.492			8	
26	11	2.398	0.318				11	2.398	0.318			11	
27	14	2.639	0.241				14	2.639	0.241	0.249	2.639	14	
28	17	2.833	0.194				17	2.833	0.194	0.108	2.747	15.60	1.40
29	16	2.773	-0.061				16	2.773	-0.061	-0.033	2.714	15.09	0.91
30	15	2.708	-0.065				15	2.708	-0.065	-0.174	2.540	12.68	2.32
31	14	2.639	-0.069				14	2.639	-0.069	-0.315	2.224	9.25	4.75
32	11	2.398	-0.241				11	2.398	-0.241	-0.457	1.768	5.86	5.14
33	11	2.398	0.000				11	2.398	0.000	-0.598	1.170	3.22	7.78
34	10	2.303	-0.095				10	2.303	-0.095	-0.739	0.431	1.54	8.46
35	9	2.197	-0.105				9	2.197	-0.105	-0.880	-0.449	0.64	8.36
36	10	2.303	0.105				10	2.303	0.105	-1.021	-1.470	0.23	9.77
37	11	2.398	0.095				11	2.398	0.095	-1.162	-2.633	0.07	11
38	10	2.303	-0.095				10	2.303	-0.095				10
39	10	2.303	0.000				10	2.303	0.000				10
40	11	2.398	0.095				11	2.398	0.095				11
41	11	2.398	0.000				11	2.398	0.000				11
42	9	2.197	-0.201				9	2.197	-0.201				9
43	7	1.946	-0.251				7	1.946	-0.251				7
44	7	1.946	0.000				7	1.946	0.000				7
45	5	1.609	-0.336				5	1.609	-0.336				5
46	6	1.792	0.182				6	1.792	0.182				6
47	5	1.609	-0.182				5	1.609	-0.182				5
48	3	1.099	-0.511				3	1.099	-0.511				3
49	2	0.693	-0.405				2	0.693	-0.405				2
50	2	0.693	0.000				2	0.693	0.000				2
51	2	0.693	0.000				2	0.693	0.000				2
52	1	0.000	-0.693				1	0.000	-0.693				1

Linking of mean lengths

- The mean lengths are plotted against sampling dates
- Lengths believed to belong to the same cohort are linked.

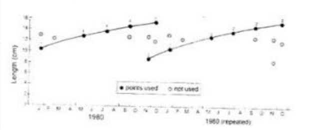


Figure 5a. Example of mean lengths that are easy to link. (Gayanilo and Pauly, 1997)

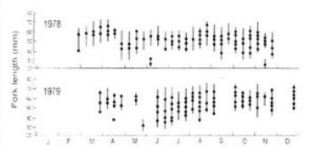


Figure 5b. Example of mean lengths that are difficult to link. (Gayanilo and Pauly, 1997)

(MPA)

BHATTACHARYA'S METHOD

These normal distributions represent age groups or cohorts contained in the composite distribution

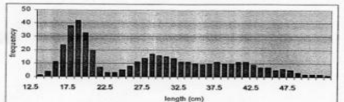


Figure 3. Length frequency distribution used for the estimation of cohorts using Battacharya's method.

Removing normal distributions from a compound distribution

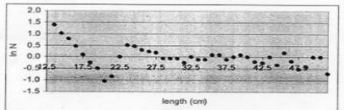


Figure 4. Plot to estimate the first cohort

The normal distribution identified is sub-sequently subtracted from the entire frequency distribution

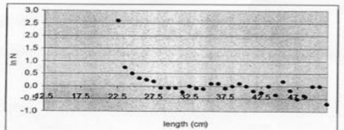


Figure 5. Plot to estimate the second cohort

MODEL PROGRESSION ANALYSIS (MPA)

GULLAND AND HOLT PLOT

Length measurement from unequal time intervals
(in tagging experiments or from catch sampling with unequal sampling intervals)

STEP:
a) Plotting length increments against the midpoints of consecutive length measurements

MODEL PROGRESSION ANALYSIS (MPA)

GULLAND AND HOLT PLOT

L_{oo} and K values are estimated through linear regression:

$$\triangle L/\triangle t = a+b.\overline{L}$$

The values obtained in this example are:

b = -0.93
a = 47.01
L_{oo} = -a/b = 54.4 cm
K = - b = 0.93

2.2. Gulland and Holt plot

Length measurements from unequal time intervals.
- in tagging experiments
- length at relative age data from modal progression analysis may have been obtained from catch sampling with unequal sampling intervals

Table 3. Input data for the Gulland and Holt plot

Relative age (years)	0.64	1.16	1.65	2.10	2.64	3.21
Length (cm)	17.3	27.9	35.3	40.2	43.3	45.5

Table 4. Spreadsheet used to estimate the growth parameters through the Gulland and Holt plot

Relative age t	Length L_t	dt	dL	dL/dt (y)	L (x)
0.64	17.3	0.52	10.6	20.4	27.5
1.16	27.9	0.49	7.4	15.1	35.5
1.65	35.3	0.45	4.9	10.9	40.7
2.10	40.2	0.54	3.1	5.7	43.1
2.64	43.3	0.57	2.2	3.9	45.2
3.21	45.5				

Plotting length increments against the midpoints of consecutive length measurements:

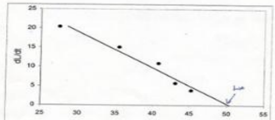


Figure 6. Gulland and Holt plot corresponding to Table 4.

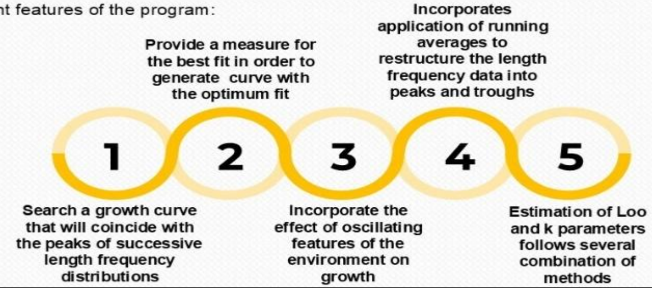
FOUR WAYS OBTAINING GROWTH PARAMETERS

3.0 DIRECT FIT OF LENGTH FREQUENCY DATA

3.1 ELEFAN 1 (of FiSAT)

ELEFAN 1 is software developed to estimate growth parameters from length frequency distributions arranged in a time sequence

Important features of the program:



ELEFAN 1:

METHODS AVAILABLE:

- Curve-fitting by eye.
- Response surface analysis
- Scan of k-values
- Automatic search routine
- Output routine

FiSAT

The restructuring of the length frequency data and the identification of peaks and troughs are shown in the following example:

Table 5. Steps performed in restructuring length-frequency data.

		A	B	C	D	E	F	G
ML	n	Moving average ma	n/ma	((n/ma)/m')-1	Zero frequencies	De-emphasizing Nr		Highest points
4.5	4	5.80	0.690	-0.353	(2)	-0.353	-0.145	
5.5	10	7.40	1.351	0.269	1	0.134	0.134	
6.5	15	7.80	1.923	0.805	0	0.805	0.805	0.805
7.5	8	7.00	1.143	0.073	1	0.036	0.036	
8.5	2	5.00	0.400	-0.624	(2)	-0.624	-0.257	
9.5	0	2.20	0.000	-1.000	(1)	-1.000	0	
10.5	0	1.40	0.000	-1.000	(1)	-1.000	0	
11.5	1	1.40	0.714	-0.329	(2)	-0.329	-0.136	
12.5	4	1.40	2.857	1.682	2	0.421	0.421	0.421
13.5	2	1.60	1.250	0.174	1	0.087	0.087	
14.5	0	1.80	0.000	-1.000	(0)	-1.000	0	
15.5	1	1.20	0.833	-0.218	(1)	-0.218	-0.090	
16.5	2	0.80	2.500	1.347	2	0.337	0.337	0.337
17.5	1	0.80	1.250	0.174	2	0.043	0.043	

m' 1.065

SPV/-SNV 0.412

As the growth curve hits the peaks and troughs, a goodness-of-fit index (R_n) is generated, defined by:

$$R_n = \frac{10^{ESP/ASP}}{10}$$

where: ASP = Available Sum of Peaks (is computed by adding the best values of the available peaks)

ESP = Explained Sum of Peaks (is computed by summing all the peaks and troughs hit by the growth curve

FOUR WAYS OBTAINING GROWTH PARAMETERS

3.2 POWELL-WETHERALL

Powell-Wetherall plot is incorporated in the FiSAT in the form of the linear equation:

$$L - L' = a + bL'$$

Where: L = mean length of all fishers >= L'

L' = smallest length of fish fully represent in the length frequency data, or also called the cut-off length

L_{oo} and Z/k are estimated from the regression parameters:

$L_{oo} = a/-b$ and

$Z/k = (1 + b)/-b$

3.3 SHEPHERD'S METHOD

The approach in estimating L_{oo} and k values is similar to FiSAT but without incorporate seasonal oscillation.

3.4 MAXIMUM LENGTH

It is a method which is independent of any deterministic growth model.

It is based on measurements of largest fishes from a series of samples.

FOUR WAYS OBTAINING GROWTH PARAMETERS

4. GROWTH PERFORMANCE INDEX

- Growth performance index (ϕ') is used to compare the growth performance among fishes whose growth parameters were estimating using the same mathematical model.
- It is useful to compare results or to validate estimates of growth parameters.

The formula involves is as below:

$\phi' = \log 10\ (k).\ 2 \log 10(L_{oo})$

ESTIMATING OF MORTALITY

Model for the exponential decay process:

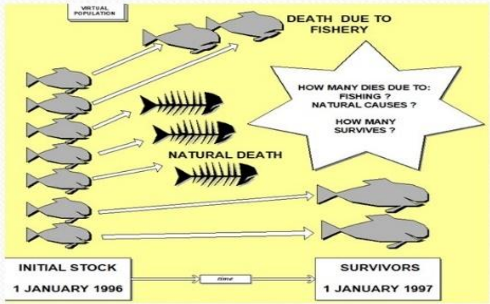
$$N_{i+1} = N_i e^{-Z(t_{i+1} - t_i)}$$

Where:

N_{i+1} = number of surviving fish at time t_{i+1}

N_i = initial number of fish in time t_i

Z = instantaneous total mortality coefficient



The expression for surviving (S) & Total Mortality coefficient (Z):

$S = N_{i+1}/N_i \quad e^{-Z(ti+1-ti)} = N_{i+1}/N_i$ or linear form: $\ln N_{i+1} = \ln N_i - Z(t_{i+1} - t_i)$

Two things to remember/consider:

1. We don't estimate on the survivor since our information is mainly on catch data.
2. We have to assume a constant parameter system (year by year) since seldom that collected data covers several years.

ESTIMATING OF MORTALITY

The components of the instantaneous total mortality (Z) are:

$$Z = M + F$$

Where: M = instantaneous natural mortality coefficient or death caused by predation, old age, pollution, etc.
F = instantaneous fishing mortality coefficient or death caused by fishing.

Classical approach: $Z = M + qf$

Where: f = fishing effort
q = catchability coefficient

The basic assumption is that f and F are related, such that:

$$F = qf$$

Data required: estimated of Z and f for a number of periods covering a wide range of effort.

ESTIMATING OF TOTAL MORTALITY (Z)

Z can be estimated either by:

1) CATCH CURVE BASED ON AGE/LENGTH COMPOSITION DATA

a). Age-structure catch curve
b). Length-converted catch curve (without seasonality of growth)
c). Jones and van Zalinge cumulative plot.
d). Length-converted catch curves accounting for seasonal growth (FiSAT)
e). Hoenig's models
$\ln(Z) = 1.44 - 0.984 \ln(t_{max})$
suitable for fast growing, short-lived species with minimal variability in length about age

2) FROM MEAN LENGTH - BEVERTON & HOLT'S Z EQUATION

a). Beverton and Holt model
b). Ault and Ehrhardt method

TOTAL MORTALITY (Z)

1-A). CATCH-CURVE BY AGE

The linear form for constant time interval is:

$$\ln C_{i+1} = a - Z.t_i$$

Where:
C_i = number of fish in the catch belonging to age group ti
Z = the slope
t = time interval
a = intercept of the regression line

Table 1. Table used for the linearized catch curve based on age composition (from Sparre and Venema, 1992)

Age	Catch	Ln C	Remarks
0	599	6.395	not used in the analysis
1	860	6.757	
2	1071	6.976	
3	269	5.595	used in the analysis
4	69	4.234	
5	25	3.219	
6	8	2.079	

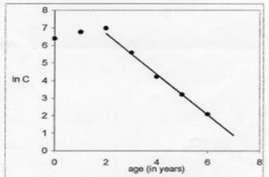


Figure 1. The linearized catch curve based on age composition data from Tab 1.

Total mortality Z is estimated from the catch curve using only catch data of age groups that are fully recruited into the fisheries.

Total mortality Z = -b (slope of the regression line)
Z= 1.16.

TOTAL MORTALITY (Z)

1-B). CATCH-CURVE BY LENGTH

Conversion of length classes into age classes utilizing the inverse of the von Bertalanffy growth equation;

$$t_1 = t_0 - 1/k \ln[1-L_i/L_{\infty}]$$

Table 2. Steps performed for the linearized catch curve based on length composition data of *Nemipterus japonicus* from Manila Bay (Ziegler, 1979).
Asymptotic length = 29.2 cm, k = 0.607 per year

L_1	L_2	$C_{(L1,L2)}$	t_{L1}	t_{L2}	dt	$t((L_1+L_2)/2)$ x	$\ln(C_{(L1,L2)}/dt)$ y	Remarks
7	8	11	0.452	0.527	0.076	0.489	4.976	not used in the analysis
8	9	69	0.527	0.607	0.080	0.567	6.765	
9	10	187	0.607	0.691	0.084	0.649	7.712	
10	11	133	0.691	0.779	0.088	0.735	7.319	
11	12	114	0.779	0.872	0.093	0.825	7.110	
12	13	261	0.872	0.971	0.099	0.921	7.880	
13	14	386	0.971	1.076	0.105	1.023	8.210	
14	15	445	1.076	1.188	0.112	1.132	8.286	
15	16	535	1.188	1.308	0.120	1.248	8.400	used in the analysis
16	17	407	1.308	1.438	0.130	1.373	8.051	
17	18	428	1.438	1.579	0.141	1.508	8.019	
18	19	338	1.579	1.733	0.154	1.656	7.693	
19	20	184	1.733	1.903	0.170	1.818	6.987	
20	21	73	1.903	2.092	0.190	1.998	5.953	
21	22	37	2.092	2.307	0.214	2.199	5.152	
22	23	21	2.307	2.553	0.246	2.430	4.446	
23	24	19	2.553	2.843	0.290	2.698	4.183	
24	25	8	2.843	3.195	0.352	3.019	3.124	
25	26	7	3.195	3.643	0.448	3.419	2.749	not used
26	27	2	3.643	4.260	0.617	3.951	1.176	

Plot of the mid-points of the age classes against the natural logarithm of the catch representing each age class.

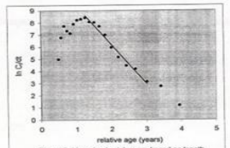


Figure 2. Linearized catch curve based on length composition data from Tab. 2.

The estimated value of Z is 3.18.

TOTAL MORTALITY (Z)

1-C). CATCH-CURVE BY COMMULATIVE LENGTH

$\ln(C_{Li,\infty}) = a + b.\ln(L_{\infty} - L_i)$

Where:

$C_{Li,\infty}$ = cummulative catch corresponding to length class I,

a = intercept on the y axis

b = slope = Z

L_i = length class I

Table 3. Steps performed for the linearized catch curve based on length composition data of *Nemipterus japonicus* from Manila Bay (Ziegler, 1979), using the Jones and van Zalinge method. Asymptotic length = 29.2 cm, k = 0.607 per year

L_1 (cm)	L_2 (cm)	Catch $C_{(L1,L2)}$	Cummulative Catch $C_{L,\infty}$	$\ln(C_{L,\infty})$ y	$\ln(L_{\infty}-L_1)$ x	Remarks
7	8	11	3665	8.207	3.100	not used in the analysis
8	9	69	3654	8.204	3.054	
9	10	187	3585	8.185	3.006	
10	11	133	3398	8.131	2.955	
11	12	114	3265	8.091	2.901	
12	13	261	3151	8.055	2.845	
13	14	386	2890	7.969	2.785	
14	15	445	2504	7.826	2.721	
15	16	535	2059	7.630	2.653	used in the analysis
16	17	407	1524	7.329	2.580	
17	18	428	1117	7.018	2.501	
18	19	338	689	6.535	2.416	
19	20	184	351	5.861	2.322	
20	21	73	167	5.118	2.219	
21	22	37	94	4.543	2.104	
22	23	21	57	4.043	1.974	
23	24	19	36	3.584	1.825	
24	25	8	17	2.833	1.649	
25	26	7	9	2.197	1.435	not used
26	27	2	2	0.693	1.163	

The estimated value of Z from the method is 4.99

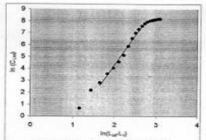


Figure 3. The Jones and van Zalinge plot for estimating Z of data from Tab 3.

TOTAL MORTALITY (Z)

2. FROM MEAN LENGTH

2-A). BEVERTON AND HOLT MODEL

Uses mean length to estimate Z:

$Z = k\{(L_{\infty}-L)/L_{\infty}-L')\}$ Where L = mean length of all fishes >= L'

L' = smallest length of fish fully represented in length frequency data

2-B). AULT AND EHRHARDT METHOD

This method is applicable to short-lived tropical species

$\{(L_{\infty} - L_{max})/(l_{\infty} - L')\} = \{Z(L' - L) + k(L_{\infty} - L)/Z(L_{max} - L) + k(L_{\infty} - L)\}$

Where L' = cut-off length

L = mean length of fish above L'

L_{max} = maximum length

NATURAL MORTALITY (M)

ESTIMATE M

i). Pauly's (1980) empirical formula:

$\text{Log } M = 0.654 \text{ Log } K - 0.28 \text{ Log } L_{\infty} + 0.463 \text{ Log } T$

Where T is the average water temperature (°C) of the fishing ground

ii). M from selection data

The requirement:

a). Catch length composition data average over at least one year, or preferable for several years.

b). Estimate of growth parameters

c). Estimate of probability of capture (P) at successive length (L_i).

Table 5. Spread sheet used to estimate M of *Priacanthus tayenus* caught by trawl in the Gulf of Thailand (from Sparre and Venema). (Linf = 29.0, k = 1.2 per year, L' = 7.6 cm)

Year	Effort f (millions of trawling hours)	Mean length (cm)	Total mortality Z
1966	2.08	15.7	1.97
1967	2.80	15.5	2.05
1968	3.50	16.1	1.82
1969	3.60	14.9	2.32
1970	3.80	14.4	2.58
1971			
1972			
1973	9.94	12.8	3.74
1974	6.06	12.8	3.74

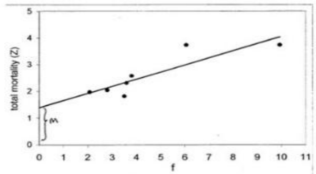


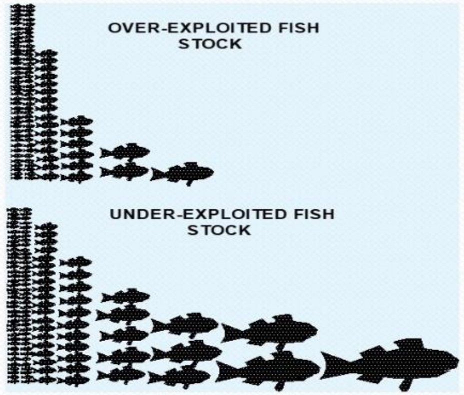
Figure 4. Plot of Z on fishing effort to estimate M from Tab. 5.

Natural Mortality coefficient based on this estimate is 1.39.

ESTIMATION OF EXPLOITATION RATE (E)

The exploitation rate (E) is expressed by using the mortality components F and Z

E = F / Z



A few recommendations by Hilborn & Carl (1992) are quoted as a food for thought;

1 You cannot predict how a stock will respond to exploitation. Your best hope is either replication or qualitative experience with similar stocks elsewhere or the same stock in the past. You cannot predict MSY without exceeding it. You must weigh the risk of each possible management action against the potential benefits

2 There is almost always a tradeoffs between catch rate and total catch. If you want to maximize catch, you will have to accept lower catch rates. The figure showing yield versus effort, should be replaced by showing catch rate versus catch. If a politician asks you what MSY is, you should ask what CPUE he is willing to accept

3 Always present managers with decision tables showing biological alternatives, and management alternatives. The output of a stock assessment should not be recommended quotas or fishing effort, it should be the biological consequences of different actions. The people doing the stock assessment are not likely to be the right people to weigh the risks of alternative management actions

CONCLUSION

THANK YOU

Fishing Gear

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1

Content

- ✓ Introduction
- ✓ Classification of Fishing Gear;
  - ➢ Component & Specification
  - ➢ Operation
  - ➢ Target Species
- ✓ Issue / Problem

2

Inroduction

1) *Since 2010, the country continues to face the issue of rising fish prices. This shows the challenges faced not only to ensure the adequacy of supply but also to guarantee the people's ability to obtain fish as a source of protein in food.*
2) *Ensuring the supply of food fish will continue to be a major challenge in the future due to the effects of climate change, limited production factors, rising input prices, food competition for bio-energy production and trade liberalization.*
3) *Demand will continue to increase as a result of population growth and changing consumer tastes.*
4) *The continuity of an adequate supply of fish depends on the viability of this enterprise as well as guaranteeing income to fishermen and fish farmers.*

3

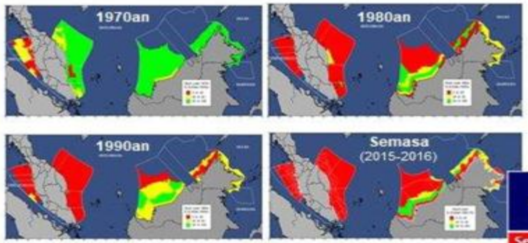
5) Over exploitation causes a decrease in production. Biomass resources of coastal waters in Malaysia at this time has decreased significantly since the beginning of use trawlers in the 1960s; biomass in some areas now it has decreased over 80%.

6)It was found that the fish density had declined from 24,000 - 53,000 kg @ 24 - 53 t.m per km2 for each Zone on year 1970 to around 3 - 14 t.m per km2 based last survey 1997.

7)To avoid the above scenario from continuing to happen, parties the government needs to continue to support and prioritize to the management of the country's marine catch fishery resources because almost 80% of the country's fish production comes from catch fishery.

4

STATUS STOK PERIKANAN 2017



TAHAP EKSPLOITASI IKAN DIMERSAL

Kawasan	Biomass ™ (dulu)	Biomass ™ (skrq)	% biomass yq tinqqal
Semenanjunq Malaysia	473,345	21,002	4.4
Sabah/ Sarawak/ Labuan	215,213	89,681	41.7

5

……

- *The effectiveness of fishing depends on how well we understand a certain fishing system.*
- *There are various types of fishing tools that are practiced;*

  Traditional + Commercial
- *There are various modifications of fishing equipment.*

6

Marine capture fisheries play an important role for the country:

1. Supply of protein sources to the population
2. Job opportunities (fishermen)
3. National income
4. Foreign exchange balance
5. Recreation, medicine etc

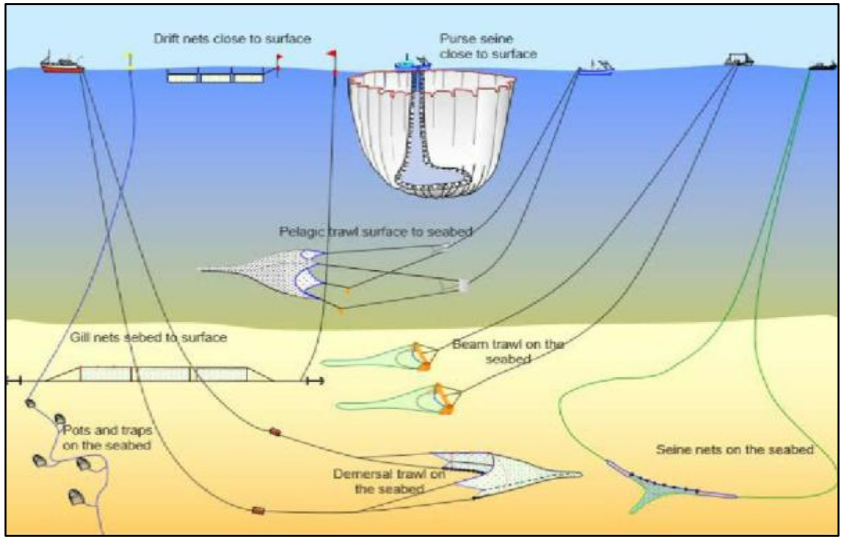
Therefore marine fisheries resources need to be used/harvested sustainably/sustainably!

7

FISHING GEAR IN MALAYSIA

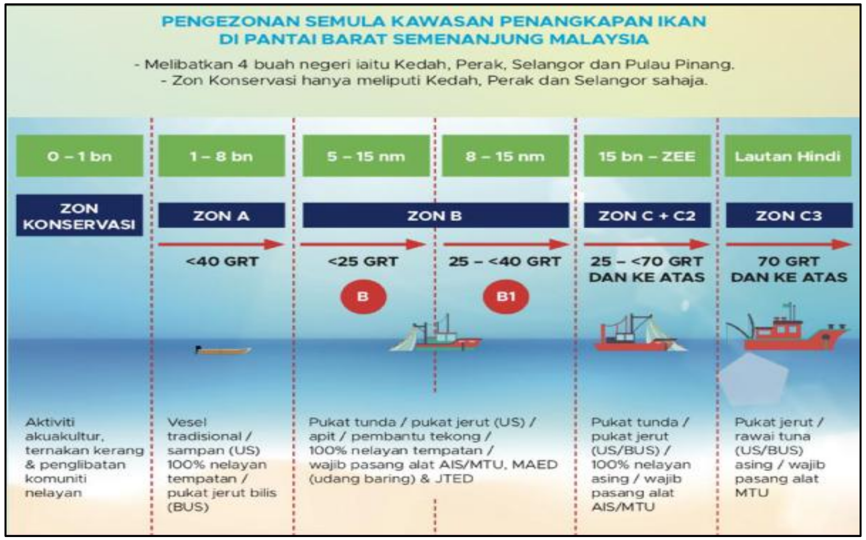
1. *Surrounding Nets*
2. *Seine Nets*
3. *Trawl Nets*
4. *Lift Nets*
5. *Falling Gear*
6. *Drift/Gill Nets & Entangling Nets*
7. *Traps*
8. *Hook and Line*
9. *Scoop Nets*
10. *Dredges*

8

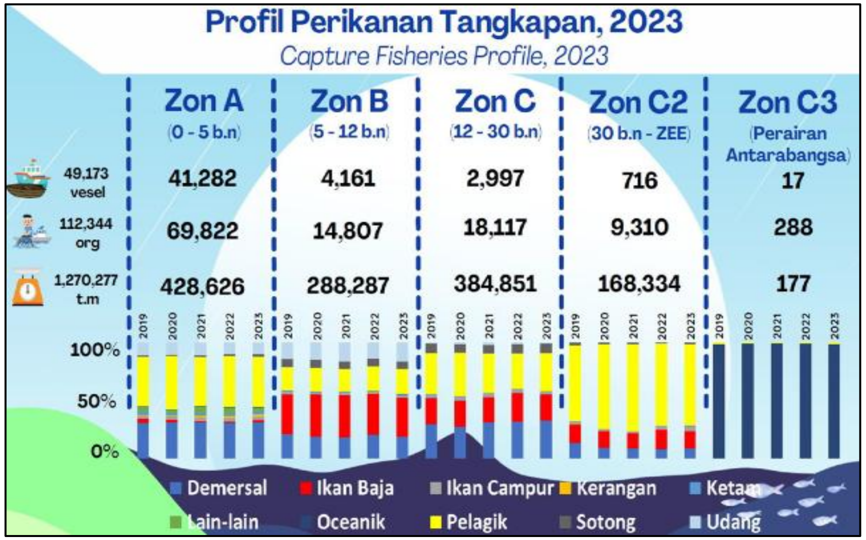


Drift nets close to surface
Purse seine close to surface
Pelagic trawl surface to seabed
Gill nets sebed to surface
Beam trawl on the seabed
Pots and traps on the seabed
Demersal trawl on the seabed
Seine nets on the seabed

PENGEZONAN KAWASAN PENANGKAPAN IKAN
PENGEZONAN KAWASAN PENANGKAPAN IKAN DI SEMENANJUNG MALAYSIA
0 – 5 bn
ZON A
<40 GRT
Vesel tradisional / sampan (US) 100% nelayan tempatan / pukat jerut bilis (BUS)
5 – 12 bn
ZON B
<40 GRT
Pukat tunda / pukat jerut (US) / apit / pembantu tekong / 100% nelayan tempatan / wajib pasang alat AIS / MTU, MAED (udang baring) & JTED
12 – 30 bn
ZON C
40 – <70 GRT
Pukat tunda / pukat jerut (BUS) / 100% nelayan asing / wajib pasang alat AIS / MTU
30 bn hingga sempadan ZEE
ZON C2
70 GRT DAN KE ATAS
Pukat tunda / pukat jerut (BUS) / 100% nelayan asing / wajib pasang alat MTU
Lautan Hindi
ZON C3
70 GRT DAN KE ATAS
Pukat jerut / rawai tuna (BUS) asing / wajib pasang alat MTU

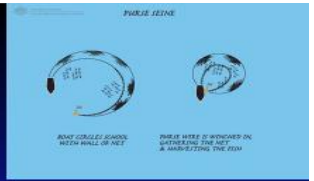


PENGEZONAN SEMULA KAWASAN PENANGKAPAN IKAN DI PANTAI BARAT SEMENANJUNG MALAYSIA
- Melibatkan 4 buah negeri iaitu Kedah, Perak, Selangor dan Pulau Pinang.
- Zon Konservasi hanya meliputi Kedah, Perak dan Selangor sahaja.
0 – 1 bn
ZON KONSERVASI
Aktiviti akuakultur, ternakan kerang & penglibatan komuniti nelayan
1 – 8 bn
ZON A
<40 GRT
Vesel tradisional / sampan (US) 100% nelayan tempatan / pukat jerut bilis (BUS)
5 – 15 nm
8 – 15 nm
ZON B
<25 GRT
25 – <40 GRT
B
B1
Pukat tunda / pukat jerut (US) / apit / pembantu tekong / 100% nelayan tempatan / wajib pasang alat AIS/MTU, MAED (udang baring) & JTED
15 bn – ZEE
ZON C + C2
25 – <70 GRT DAN KE ATAS
Pukat tunda / pukat jerut (US/BUS) / 100% nelayan asing / wajib pasang alat AIS/MTU
Lautan Hindi
ZON C3
70 GRT DAN KE ATAS
Pukat jerut / rawai tuna (US/BUS) asing / wajib pasang alat MTU



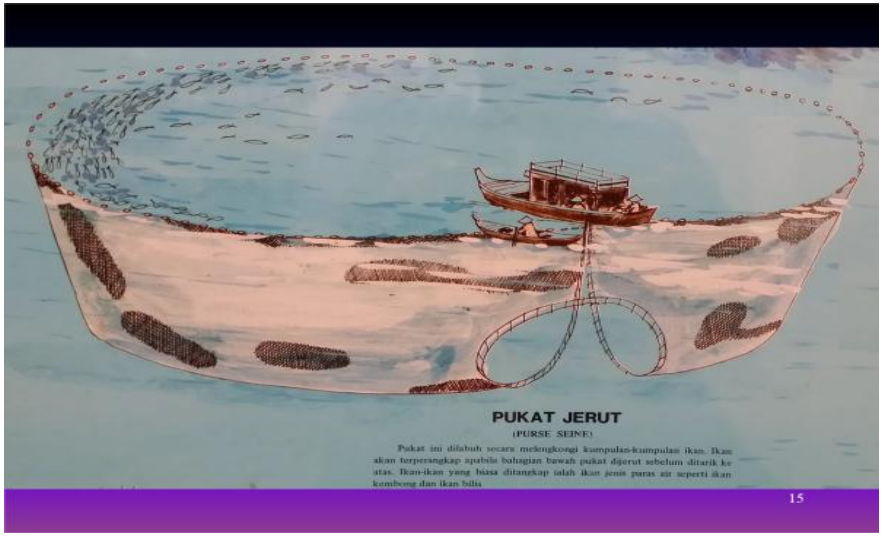
Profil Perikanan Tangkapan, 2023
Capture Fisheries Profile, 2023
Zon A (0 - 5 b.n)
Zon B (5 - 12 b.n)
Zon C (12 - 30 b.n)
Zon C2 (30 b.n - ZEE)
Zon C3 (Perairan Antarabangsa)
49,173 vesel
41,282
4,161
2,997
716
17
112,344 org
69,822
14,807
18,117
9,310
288
1,270,277 t.m
428,626
288,287
384,851
168,334
177
2019
2020
2021
2022
2023
100%
50%
0%
Demersal
Ikan Baja
Ikan Campur
Kerangan
Ketam
Lain-lain
Oceanik
Pelagik
Sotong
Udang

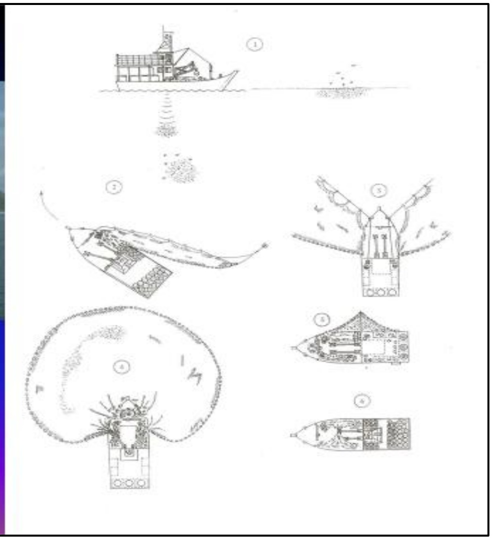
1.0 Surrounding Nets



There are various methods used and depending on the time the operation is carried out. This type of net catches fish circularly from all sides. The upper part is equipped with floats and the lower part is equipped with weights.

14





Pukat Jerut Bilis
(Anchovy Purse Seine)

2.0 Seine Net

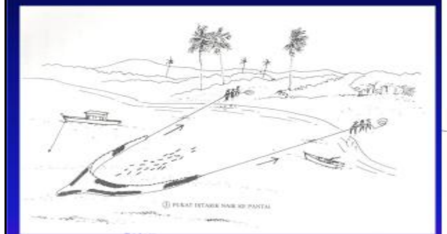
Classified as a small-scale fishing gear, and less popular in this country. It is a traditional tool. Known as 'Pukat Tarik'.With the bottom touching the base. Bag-shaped with 2 wings, usually larger wings than trawl wings. Both wings are folded simultaneously.

18

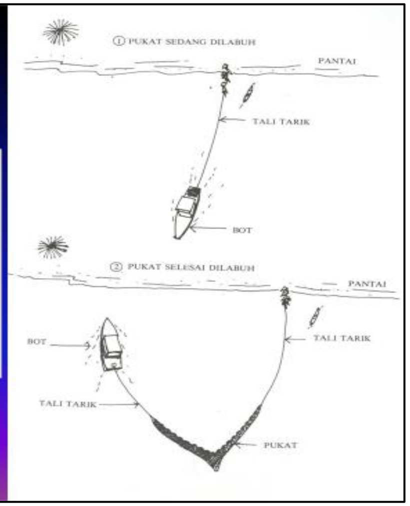
Type of Seine Nets

1. *Beach Seine*
2. *Boat Seine*
    1. *One Boat Seine*
    2. *Two Boat Seine*

19



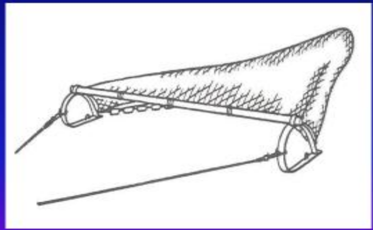
(Pukat Tarik Pantai)



Pukat Tarik Pantai *(Beach Seine)*

21

3) Trawl Net



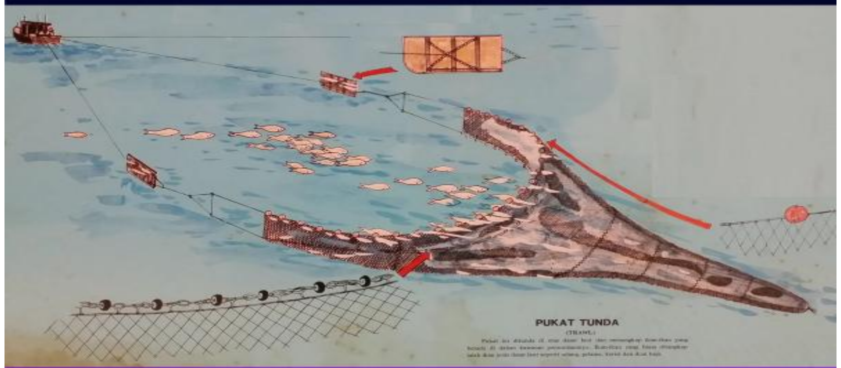
Bottom Beam Trawl

22

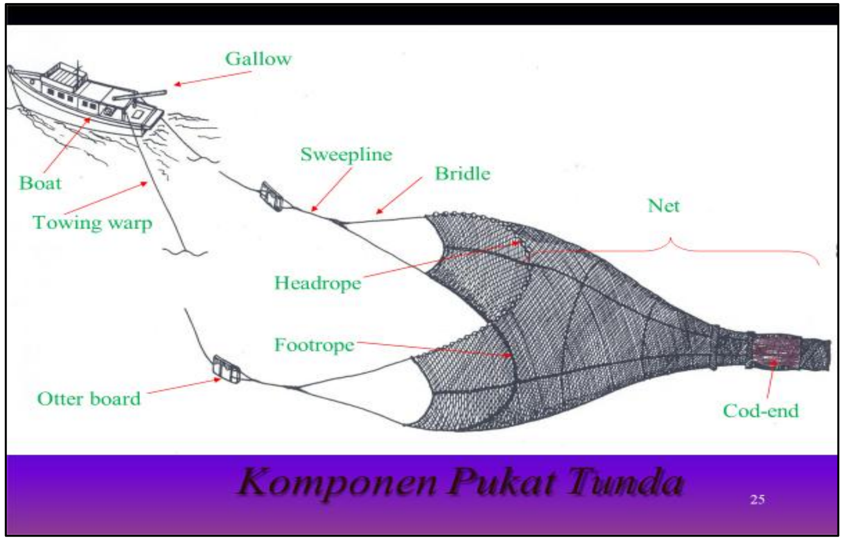
Type of Trawl Net

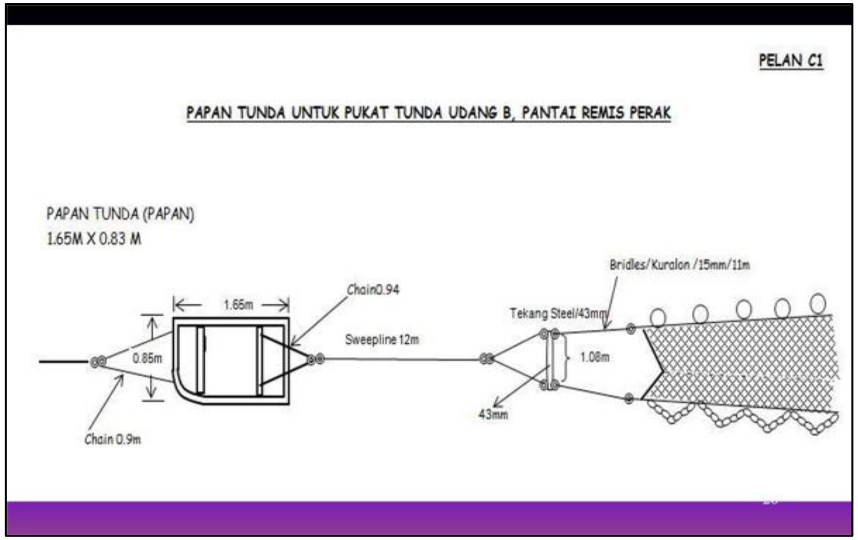
1. *Otter Trawl*
2. *Pair Trawl*
3. *Beam Trawl*

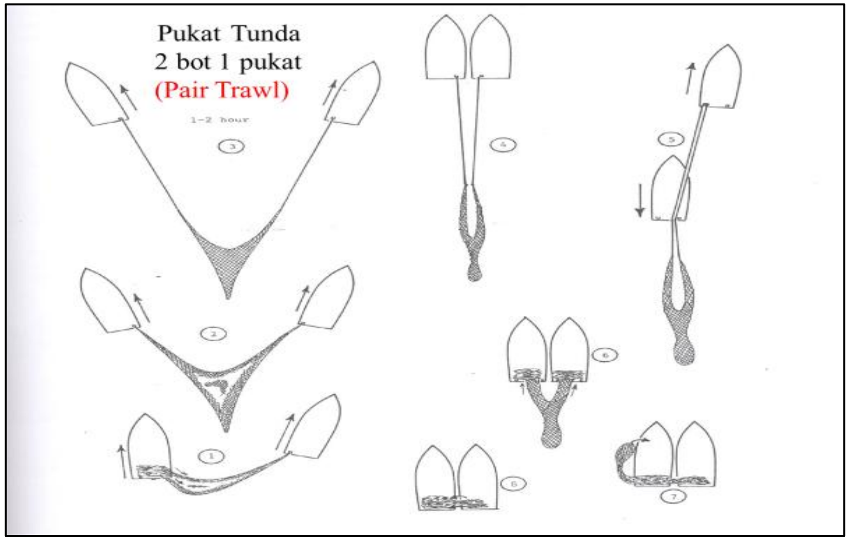
23



24

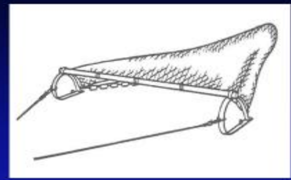

Gallow
Boat
Towing warp
Sweepline
Bridle
Net
Headrope
Footrope
Otter board
Cod-end
Komponen Pukat Tunda
25

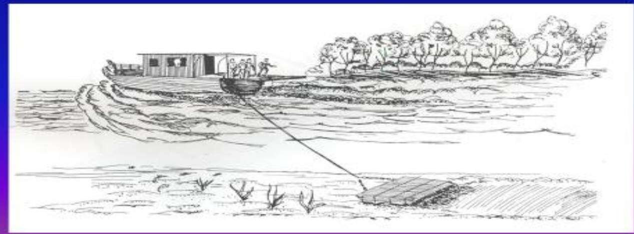

PELAN C1
PAPAN TUNDA UNTUK PUKAT TUNDA UDANG B, PANTAI REMIS PERAK
PAPAN TUNDA (PAPAN)
1.65M X 0.83 M
Bridles/Kuralon /15mm/11m
Chain0.94
1.65m
Tekang Steel/43mm
Sweepline 12m
0.85m
1.08m
43mm
Chain 0.9m


Pukat Tunda
2 bot 1 pukat
(Pair Trawl)
1-2 hour


Pukat Tunda 2 Bot 1 Pukat
28

Beam Trawl





30

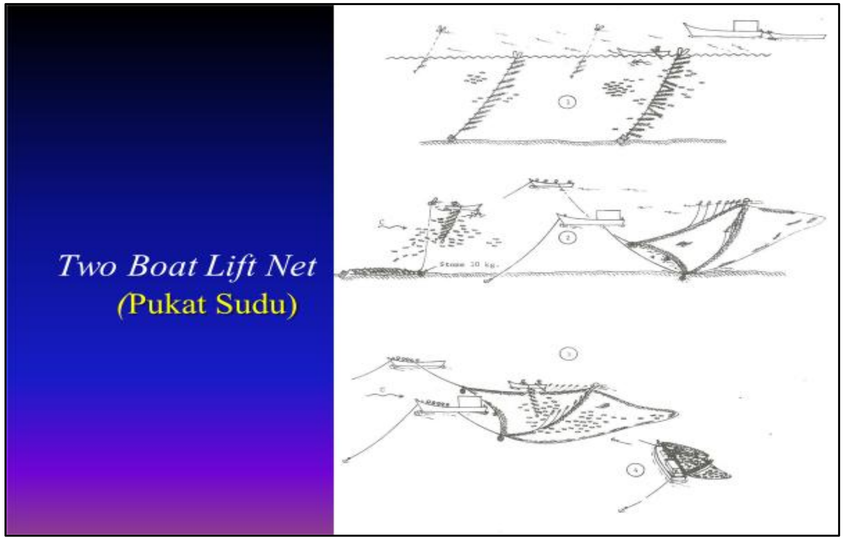
4) Lift Nets

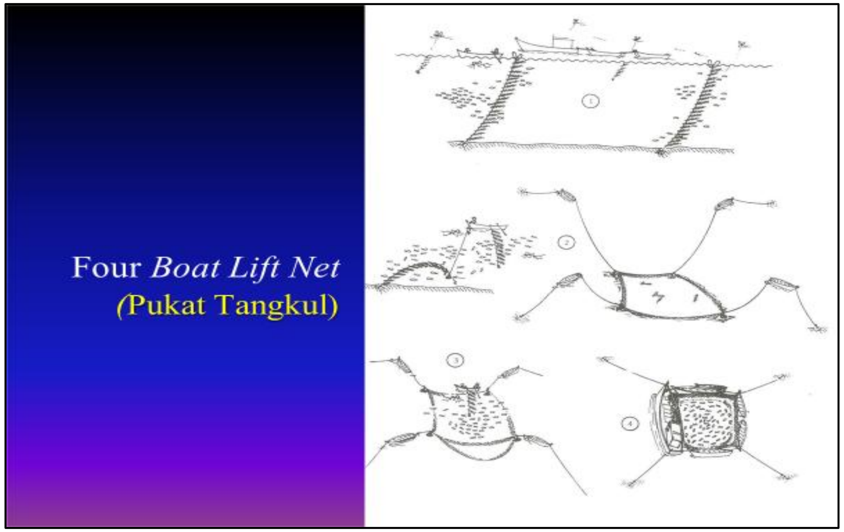
31

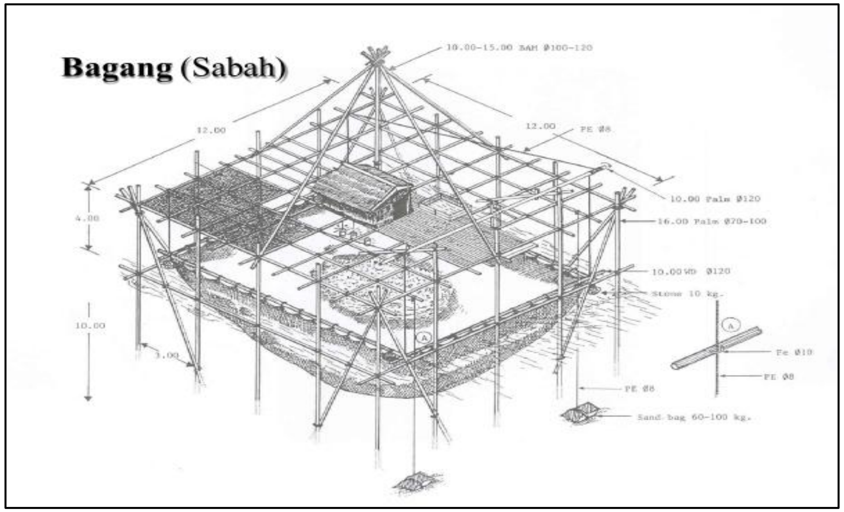
Type of Lift Net

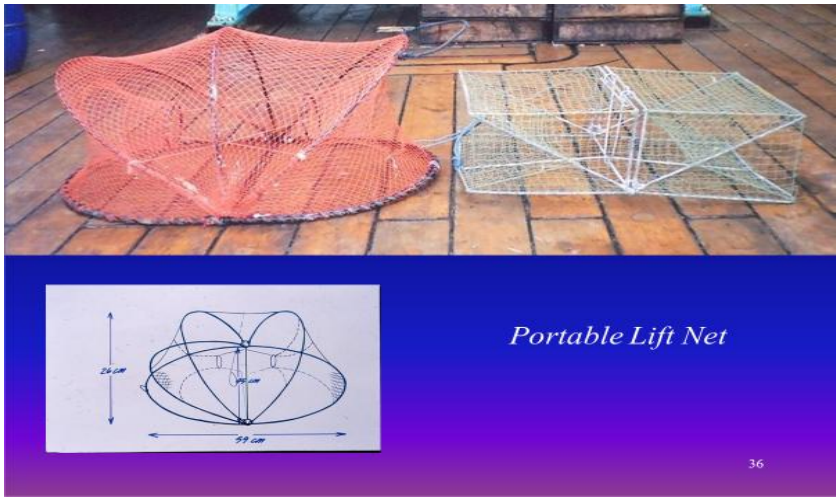
1. *Boat/Raft Lift Net*).
    1. *Two Boat Lift Net* (Pukat Sudu)
    2. Four *Boat Lift Net* (Pukat Tangkul)
2. *Stationary Lift Net*
    1. *Stake Lift Net* (Kelong Tanpa Injap)
3. *Portable Lift Net* (Bintoh)

32


Two Boat Lift Net
(Pukat Sudu)
Stone 10 kg.


Four Boat Lift Net
(Pukat Tangkul)


Bagang (Sabah)
10.00-15.00 BAM Ø100-120
12.00
12.00
PE Ø8
10.00 Palm Ø120
16.00 Palm Ø70-100
4.00
10.00 WD Ø120
Stone 10 kg.
10.00
3.00
Fe Ø10
PE Ø8
PE Ø8
Sand bag 60-100 kg.

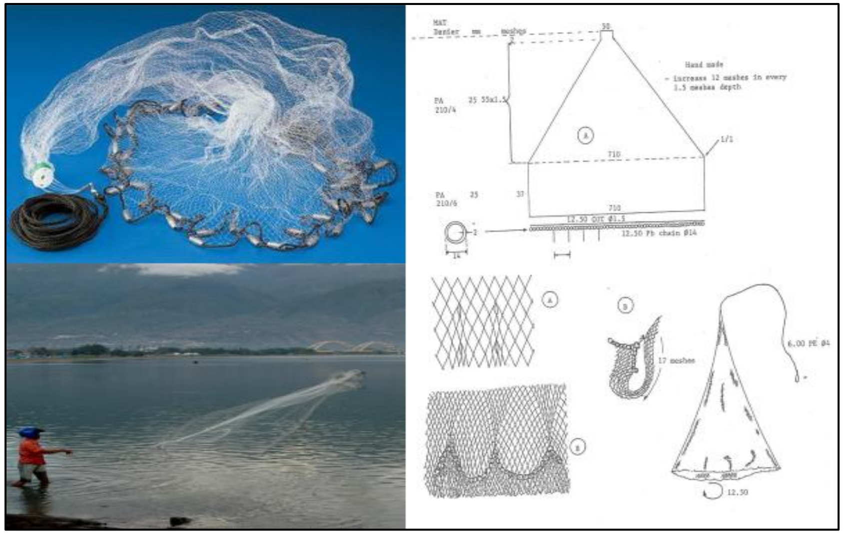

Portable Lift Net
36

5) *Falling Gear*

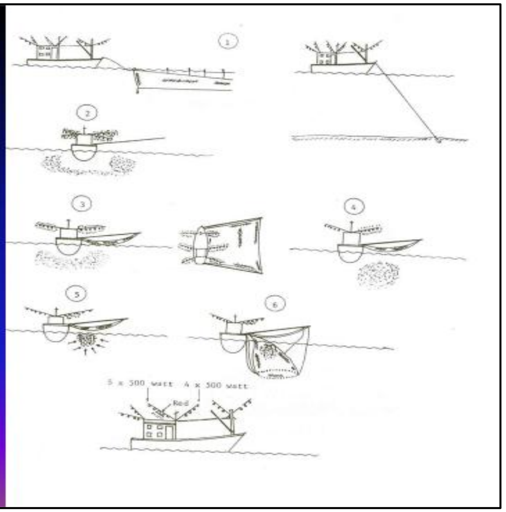
Type of Falling Gear

1. ***Cast Net***
2. ***Stick-held Cast Net***
3. ***Stick-held Dip Net***

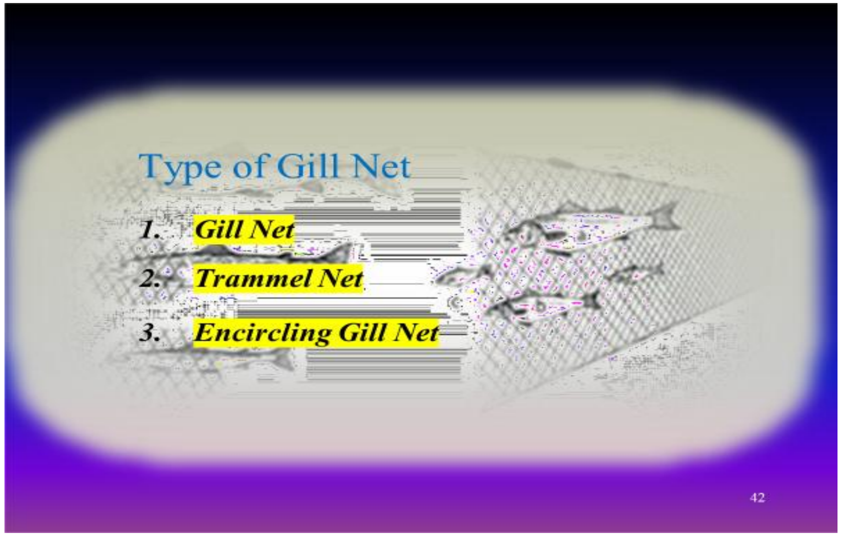
37

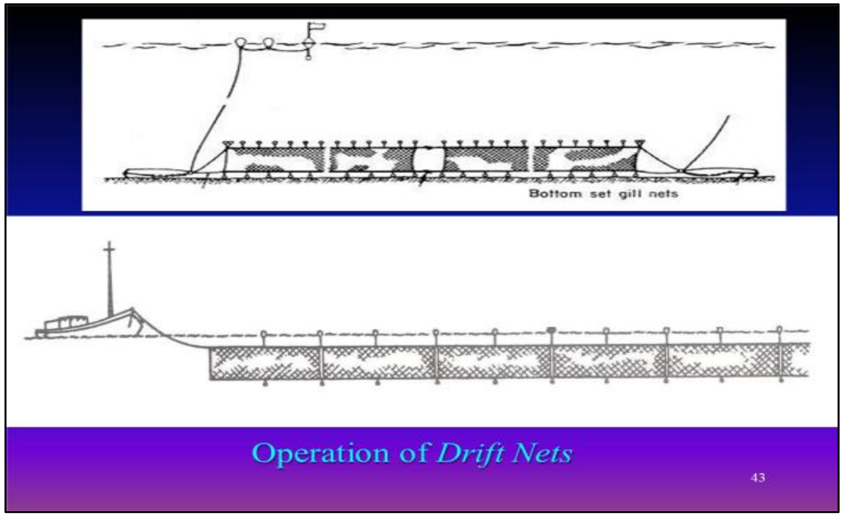


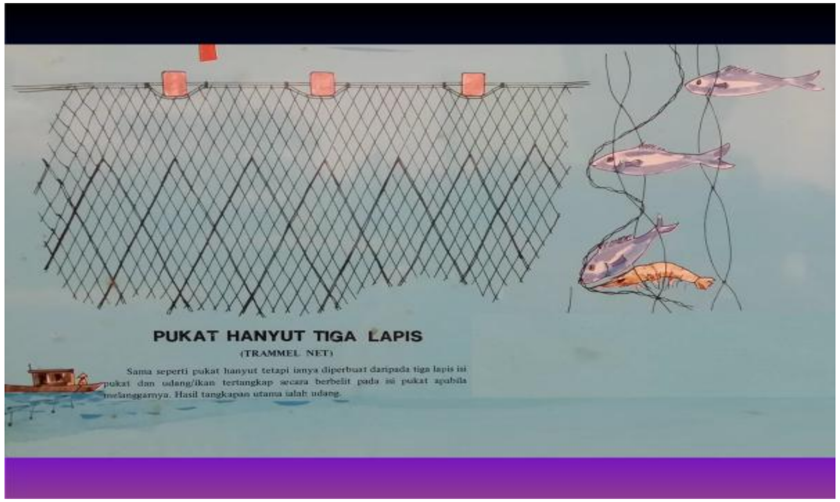
Pukat Sotong
(Stick-Held Cast Net)

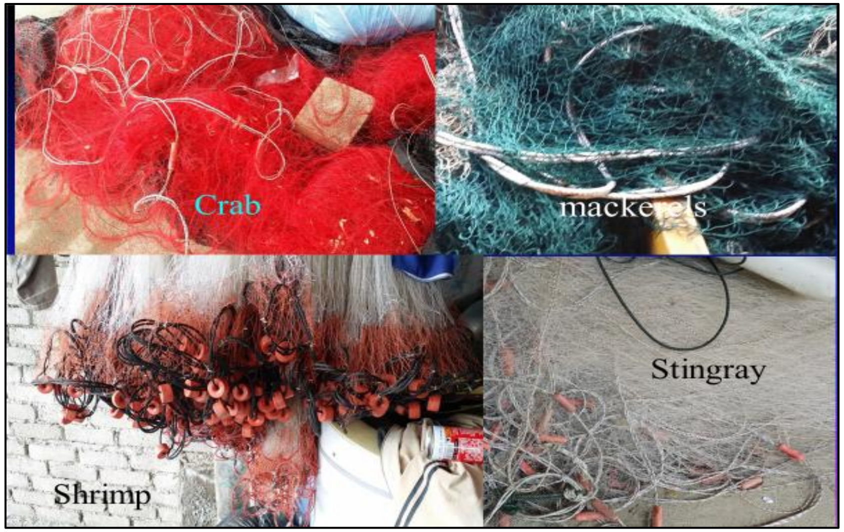



6) Drift/Gill Nets
PUKAT HANYUT
(DRIFT/GILL NET)
Pukat ini dilabuhkan merentang arus air secara membiarkan hanyut atau ditahan pada dasar laut. Ikan-ikan tertangkap apabila merempuh isi pukat. Hasil tangkapan kebiasaannya ikan-ikan tenggiri, senangin, belanak, bawal hitam, bawal putih dan udang.
41


Type of Gill Net
1. Gill Net
2. Trammel Net
3. Encircling Gill Net
42


Bottom set gill nets
Operation of Drift Nets
43


PUKAT HANYUT TIGA LAPIS
(TRAMMEL NET)
Sama seperti pukat hanyut tetapi ianya diperbuat daripada tiga lapis isi pukat dan udang/ikan tertangkap secara berbelit pada isi pukat apabila melanggarnya. Hasil tangkapan utama ialah udang.


Crab
Stingray
Shrimp

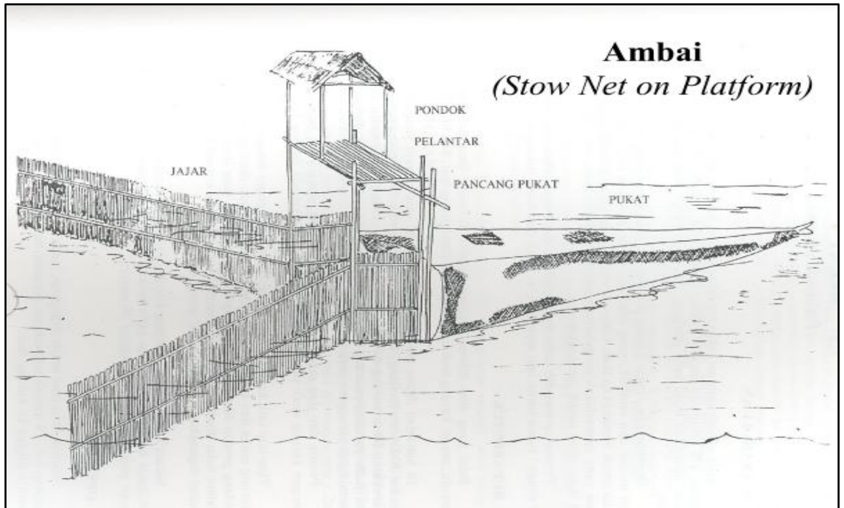

Weights


PUKAT DALAM
(ENCIRCLING GILL NET)
48

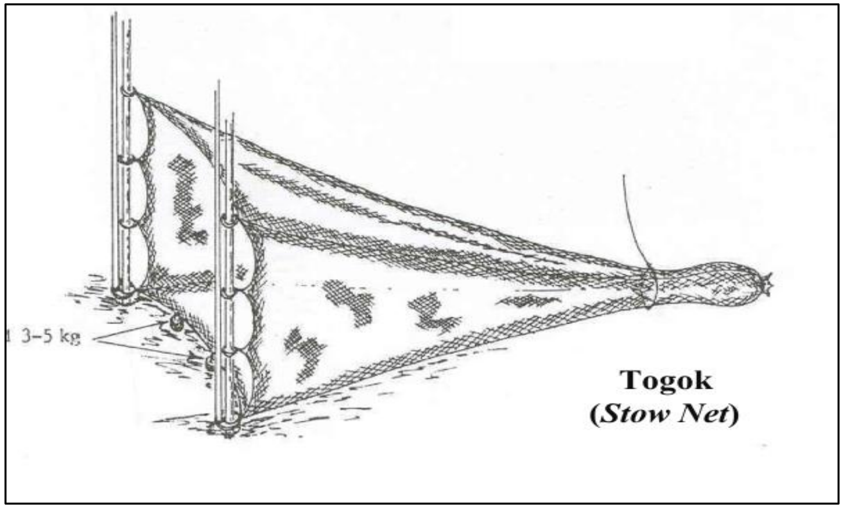
7) *Trap*

Type of Trap

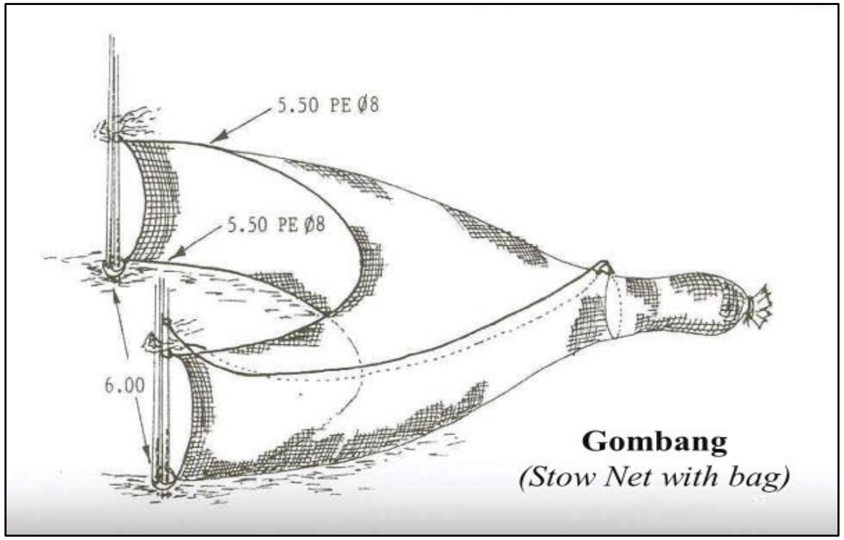
1. *Bag Net*
    1. *Stow Net on Platform* (Ambai)
    2. *Stow Net on Stake* (Gombang)
    3. *Anchored Stow Net* (Pompang)
2. *Palisade Traps* (Belat)
    1. *Barrier Net* (Pukat Cekam/Tagan)
    2. *Palisade Fishing Stake* (Belat Lingkung)
    3. *Chambered Fishing Stake* (Kelong Berinjap)
3. *Portable Traps/Pots* (Bubu)

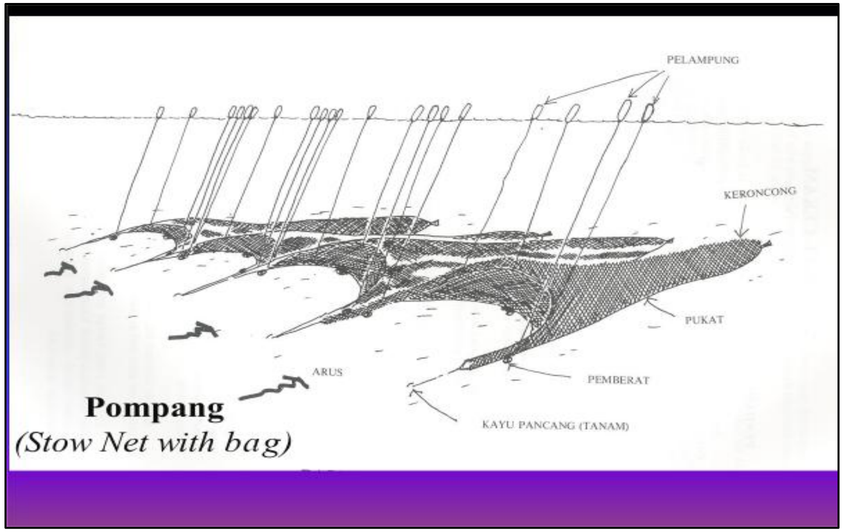


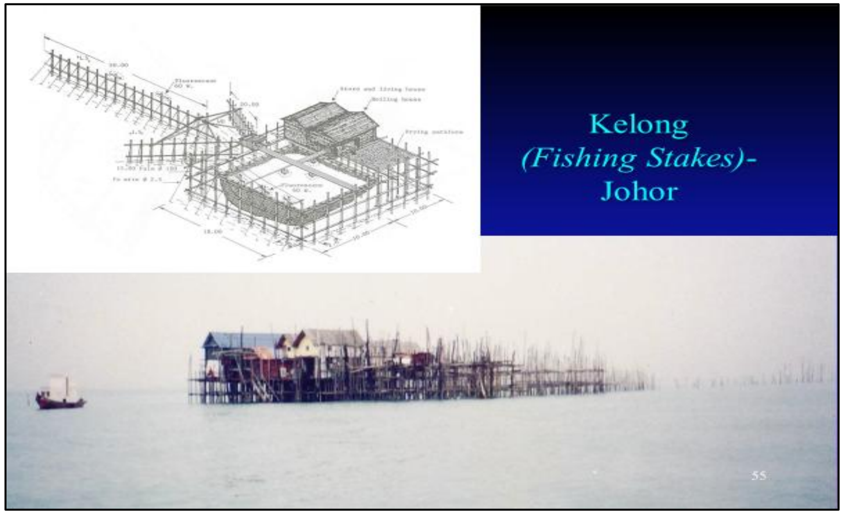
Ambai
(Stow Net on Platform)

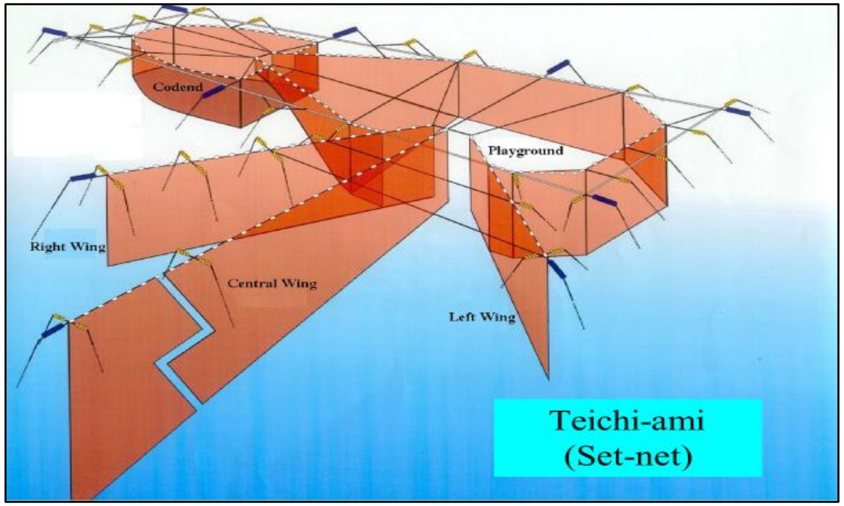


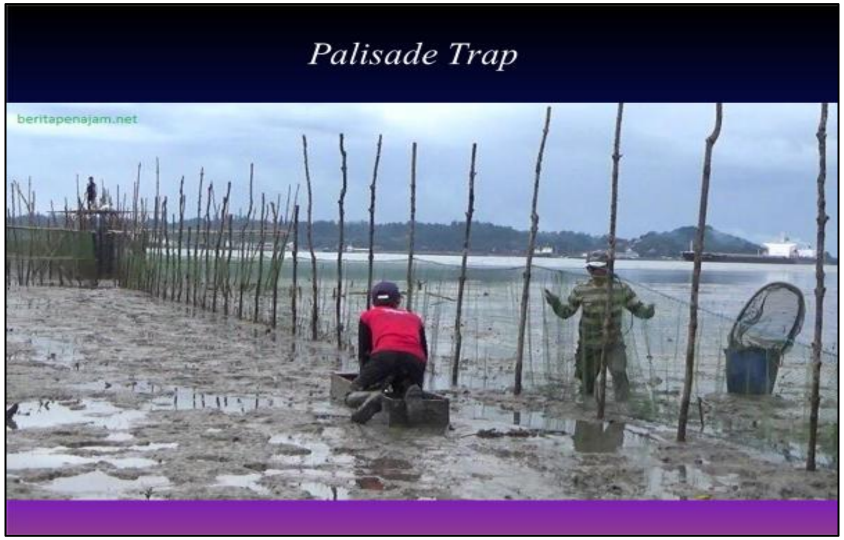
Togok
(*Stow Net*)

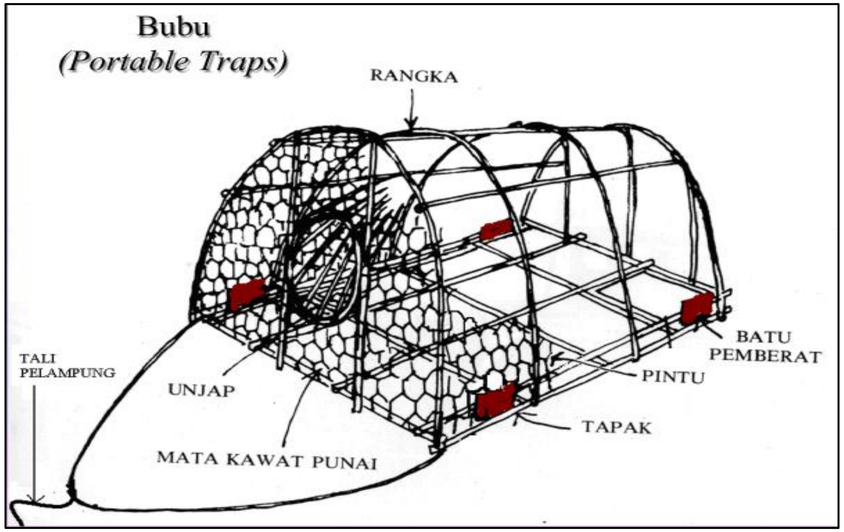

5.50 PE Ø8
5.50 PE Ø8
6.00
Gombang
(Stow Net with bag)


PELAMPUNG
KERONCONG
PUKAT
ARUS
PEMBERAT
KAYU PANCANG (TANAM)
Pompang
(Stow Net with bag)


Kelong
(Fishing Stakes)-
Johor
55

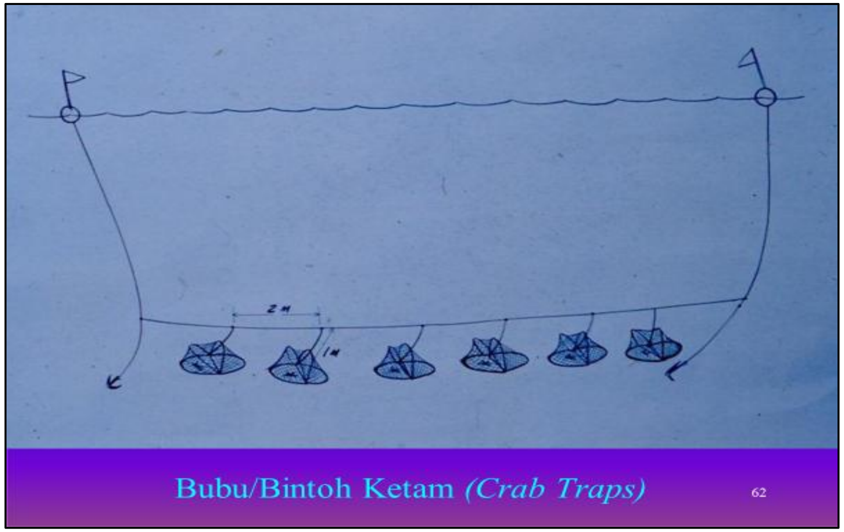

Codend
Playground
Right Wing
Central Wing
Left Wing
Teichi-ami
(Set-net)


Palisade Trap
beritapenajam.net


Bubu
(Portable Traps)
RANGKA
TALI
PELAMPUNG
UNJAP
MATA KAWAT PUNAI
TAPAK
PINTU
BATU
PEMBERAT

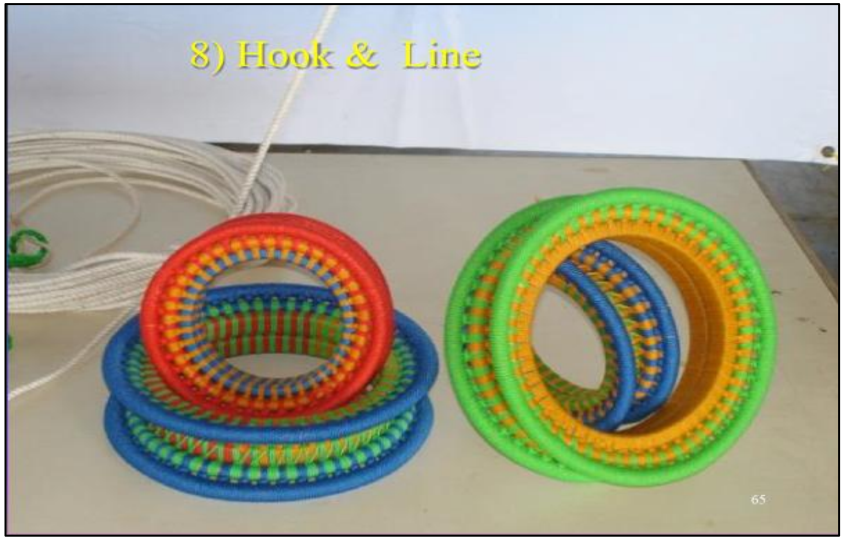

TRF649
Bot Bubu Ikan *(Fish Traps Boat)*


Lobster Trap
13 9:20 AM

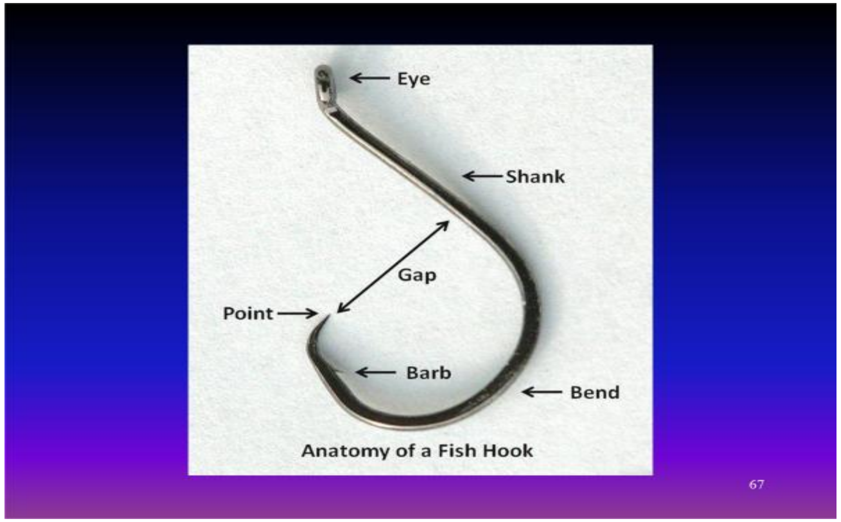

Bubu/Bintoh Ketam *(Crab Traps)*
62

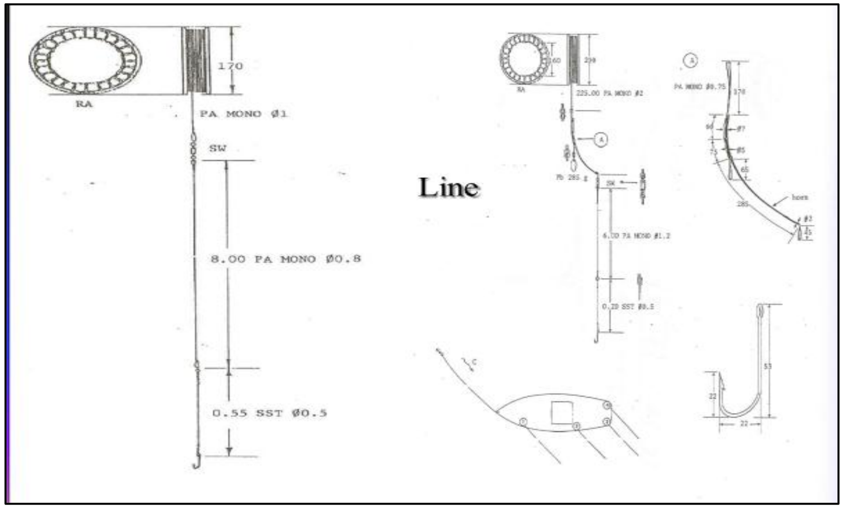

Squid Trap
63

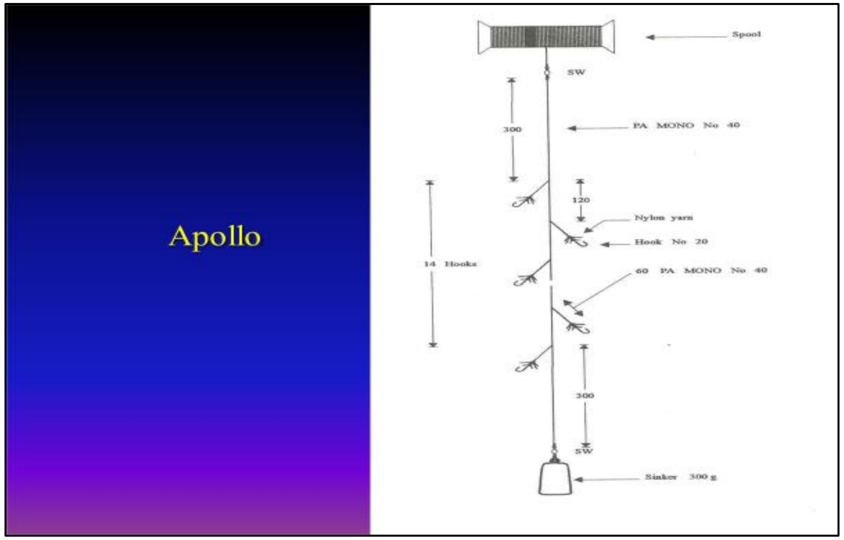

Chinese shrimps trap
Specification
• Length : 40 feet (12 meters)
• Center frame size: 43 cm x 30 cm; mesh size: 18 mm
• End frame size: 36 x 24 cm; mesh size: 16 mm
• Number of medium/large frames: 30
• Total end/small frame: 4 (2 + 30 + 2)
• Frame made: Plastic coated iron
• Keroncong length from the right side of the body: 76 cm
• Number of valves: 15 left & 15 right
• Valve opening: 160 mm x 60 mm
64


8) Hook & Line
65

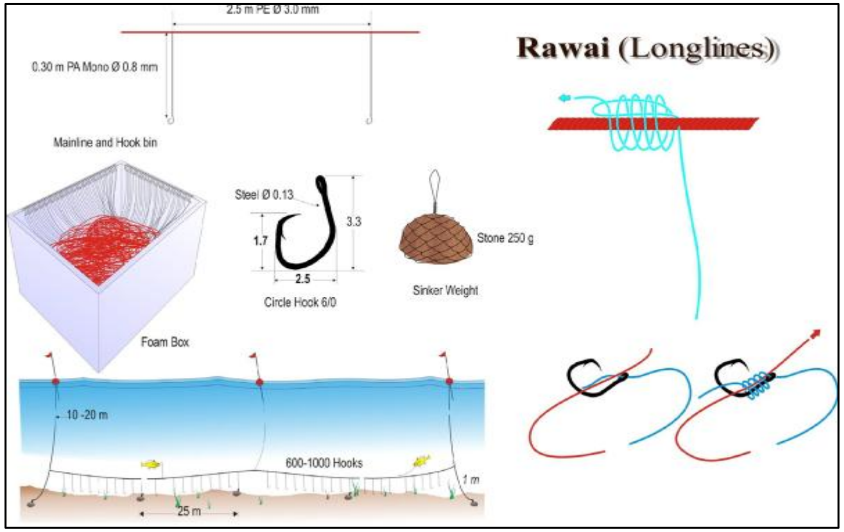

Type of Hook & Line
1. *Pole and line / Handlines*
2. *Longline* (Rawai)
1. *Vertical Longline* (Rawai Tegak)
2. *Horizontal Longline* (Rawai Mendatar)
3. *Trolling* (Mengeret/mengolak)
4. *Jigging* (Candat)
66


Eye
Shank
Gap
Point
Barb
Bend
Anatomy of a Fish Hook
67


RA
170
PA MONO Ø1
SW
8.00 PA MONO Ø0.8
0.55 SST Ø0.5
Line



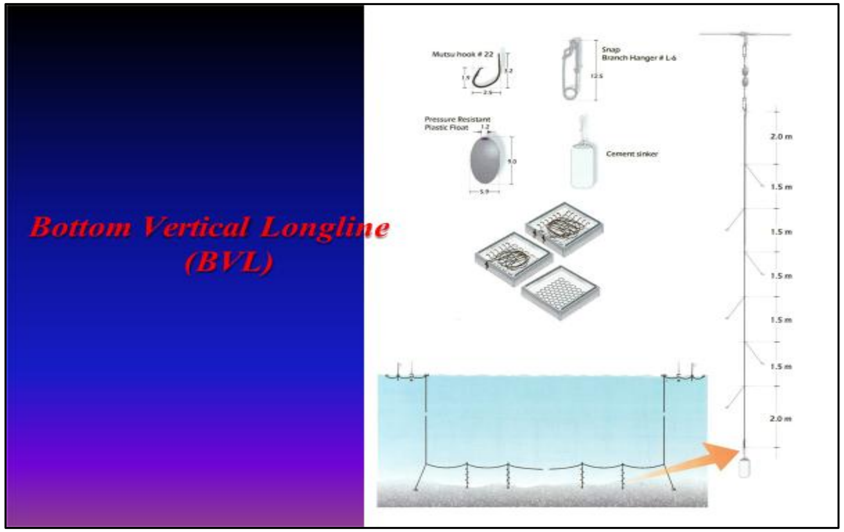
Apollo
Spool
SW
300
PA MONO No 40
120
Nylon yarn
Hook No 20
14 Hooks
60 PA MONO No 40
300
SW
Sinker 300 g



2.5 m PE Ø 3.0 mm
0.30 m PA Mono Ø 0.8 mm
Rawai (Longlines)
Mainline and Hook bin
Steel Ø 0.13
3.3
1.7
2.5
Circle Hook 6/0
Stone 250 g
Sinker Weight
Foam Box
10 -20 m
600-1000 Hooks
1 m
25 m

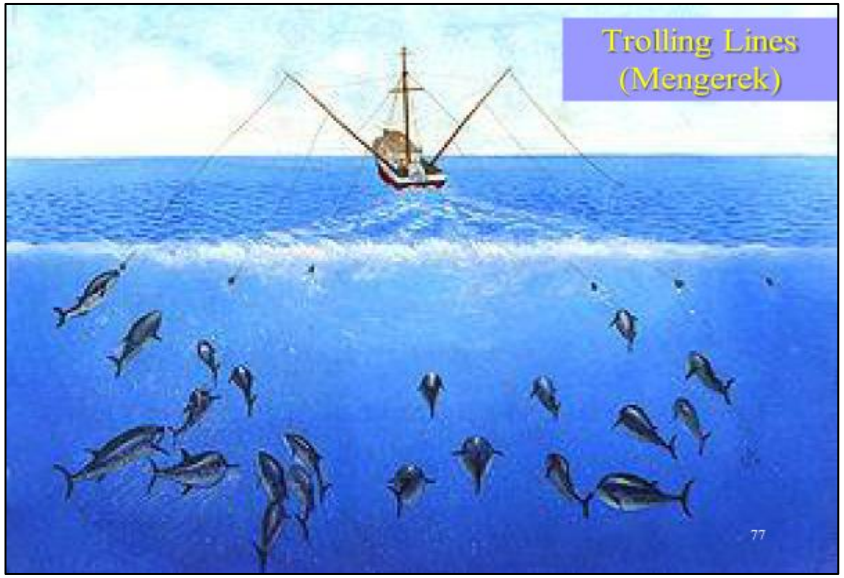
71


73


Bottom Vertical Longline
(BVL)
Mutsu hook # 22
Snap
Branch Hanger # L-6
Pressure Resistant
Plastic Float
Cement sinker
2.0 m
1.5 m
1.5 m
1.5 m
1.5 m
1.5 m
2.0 m

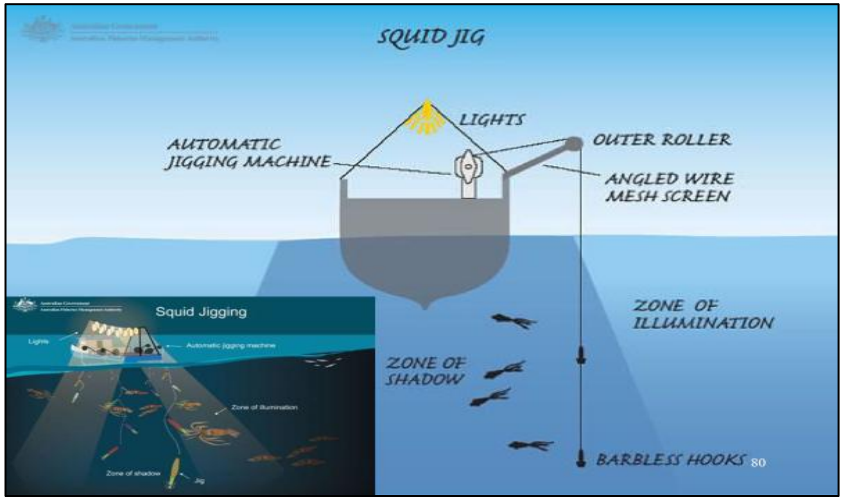

75

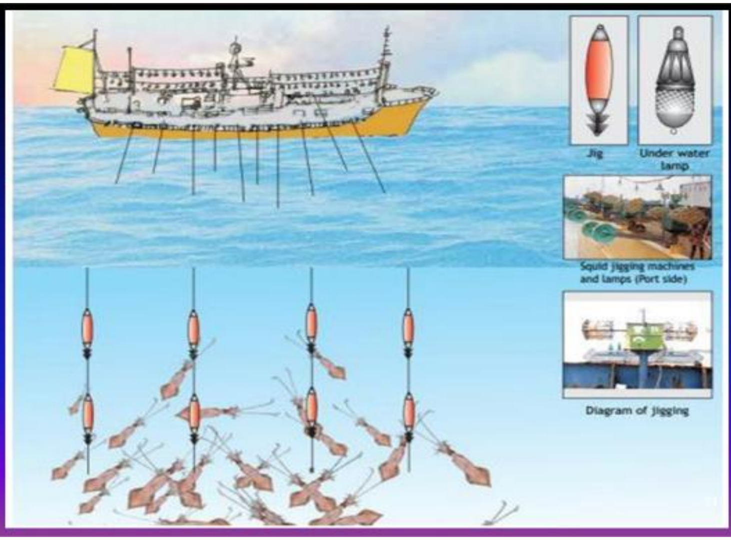

Stingray lines
76


Trolling Lines
(Mengerek)
77


Drop Line
78


Candat
(Squid Jigging)
A.
B.
C.
D.
E.
79


SQUID JIG
LIGHTS
AUTOMATIC JIGGING MACHINE
OUTER ROLLER
ANGLED WIRE MESH SCREEN
ZONE OF ILLUMINATION
ZONE OF SHADOW
BARBLESS HOOKS
80
Squid Jigging
Lights
Automatic jigging machine
Zone of illumination
Zone of shadow
Jig



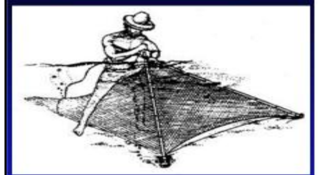
9) Scoop Nets

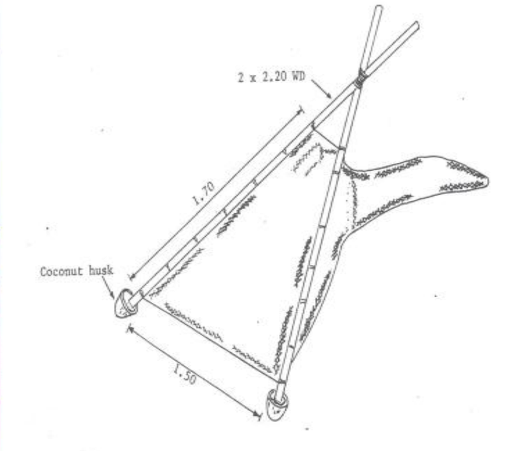
Type of Scoop Nets

1. *Portable Push Net* (Sungkur)
2. *Boat Push Net* (Pukat Surung / Surong / Pukat Subor)

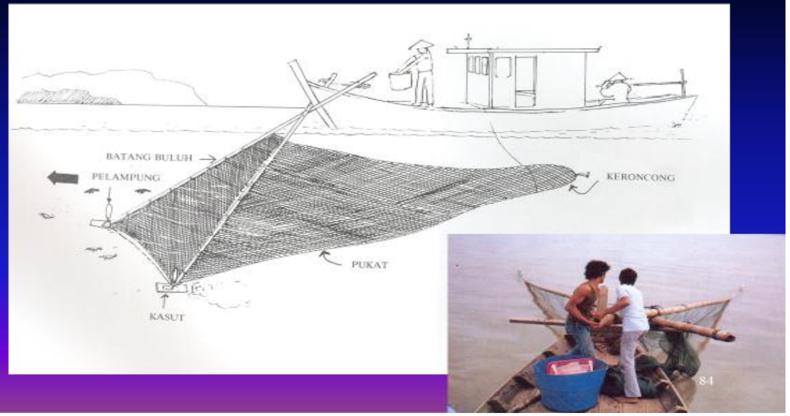
82

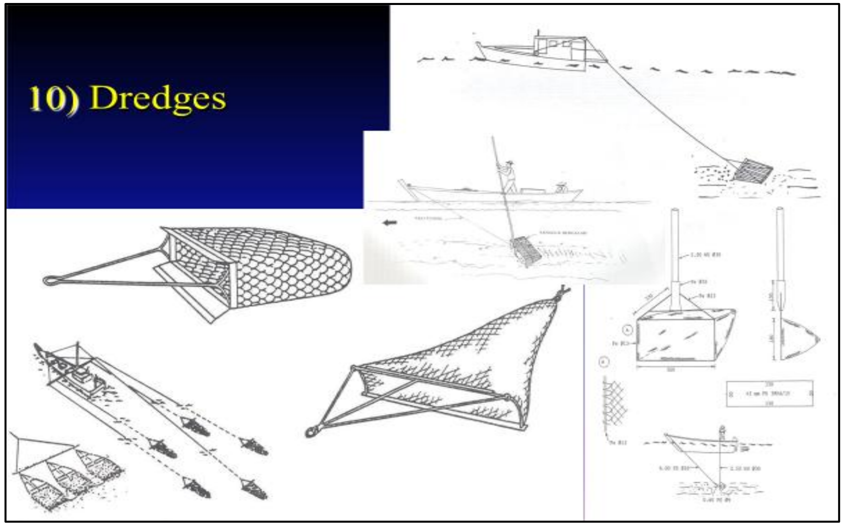
Portable Push Net





Pukat Surung / Pukat Rawa Surung
(Boat Push Net)

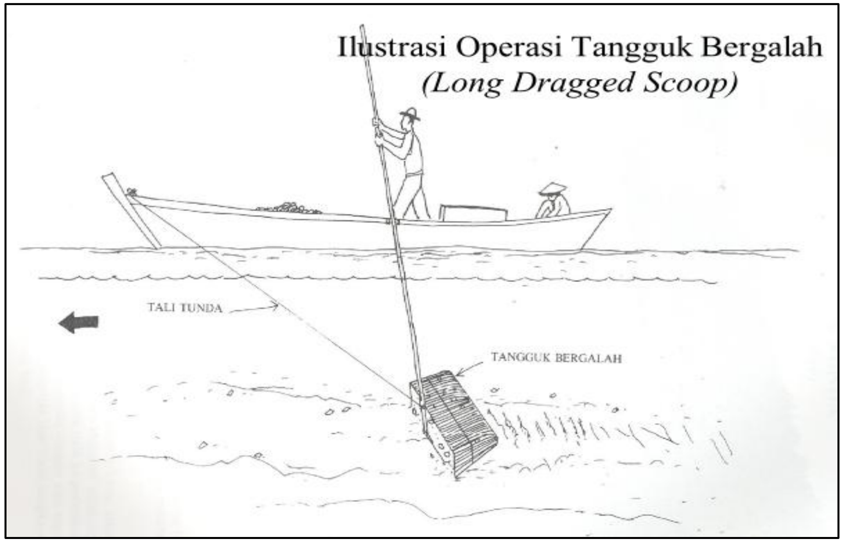




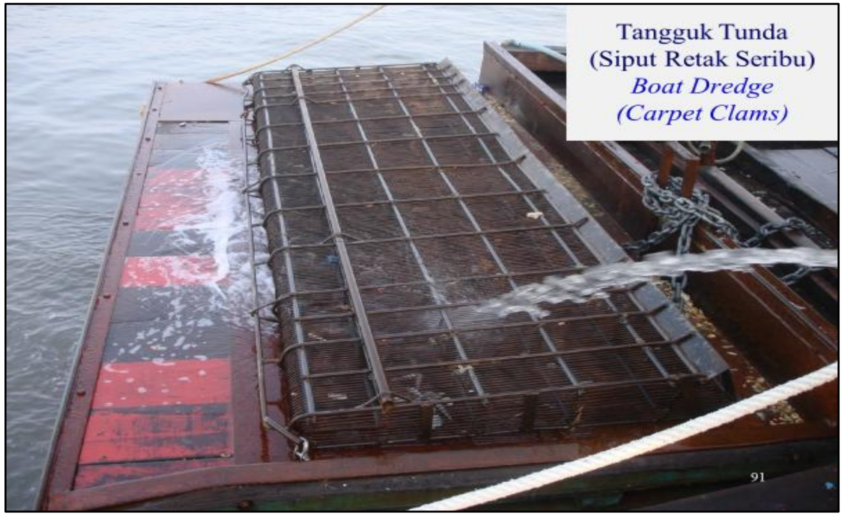
JENIS-JENIS TANGGUK DAN SAUK

1. *Boat Dredges* (Tangguk Bergalah)
2. *Boat Dredges* (Tangguk Tunda)
3. *Hand Dredges* (Tangguk Tarik)
4. *Hand Scoop* (Sauk/Tangguk Tangan)

87


Ilustrasi Operasi Tangguk Bergalah
(Long Dragged Scoop)
TALI TUNDA
TANGGUK BERGALAH


Tangguk Tunda (Siput Retak Seribu)
Boat Dredge (Carpet Clams)
90


Tangguk Tunda
(Siput Retak Seribu)
Boat Dredge
(Carpet Clams)
91


Tangguk Tarik
(Hand Dredges)
92

20 www.hmetro.com.my @hmetromy HarianMetro @hmetromy — Jumaat 18.02.2022 | Harian Metro

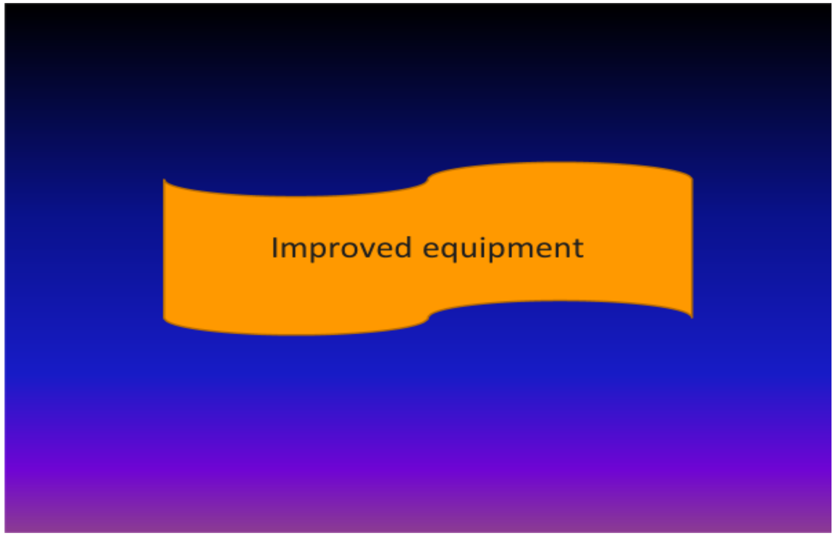
lokal

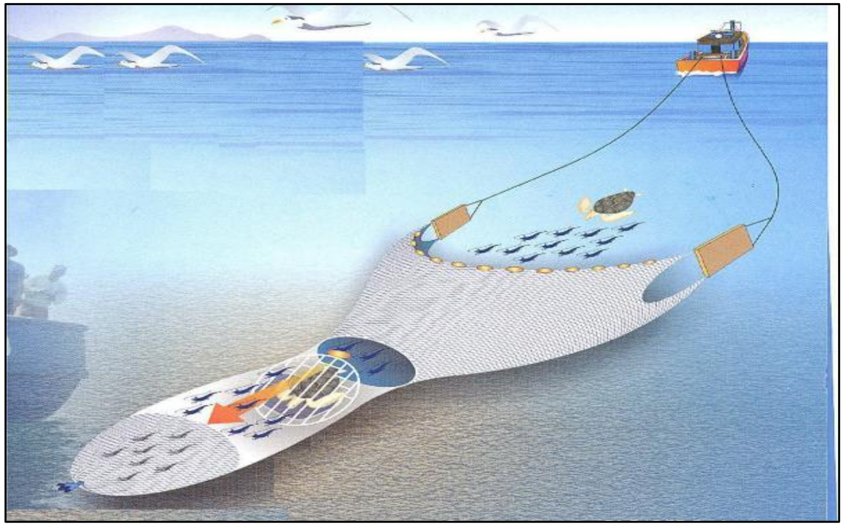
'Pukat malas' bunuh penyu

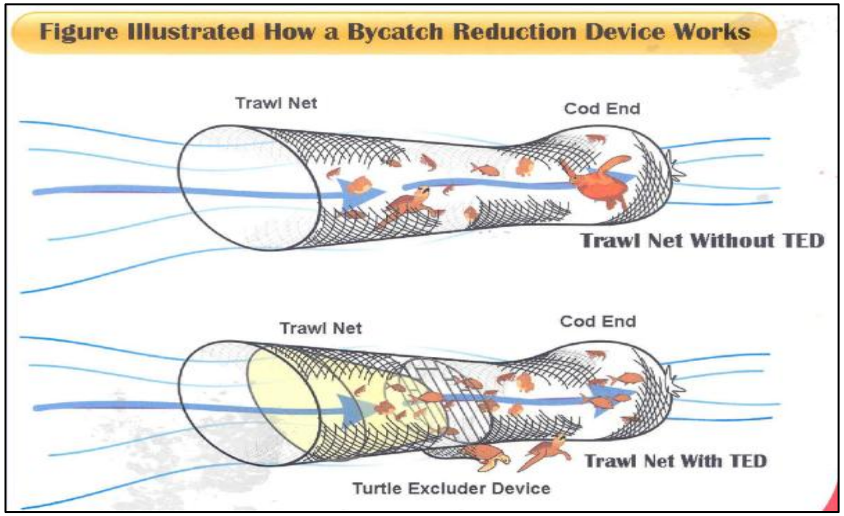
Penggunaan pukat tak ikut spesifikasi faktor utama kematian reptilia di Terengganu: FRI

Rantau Abang

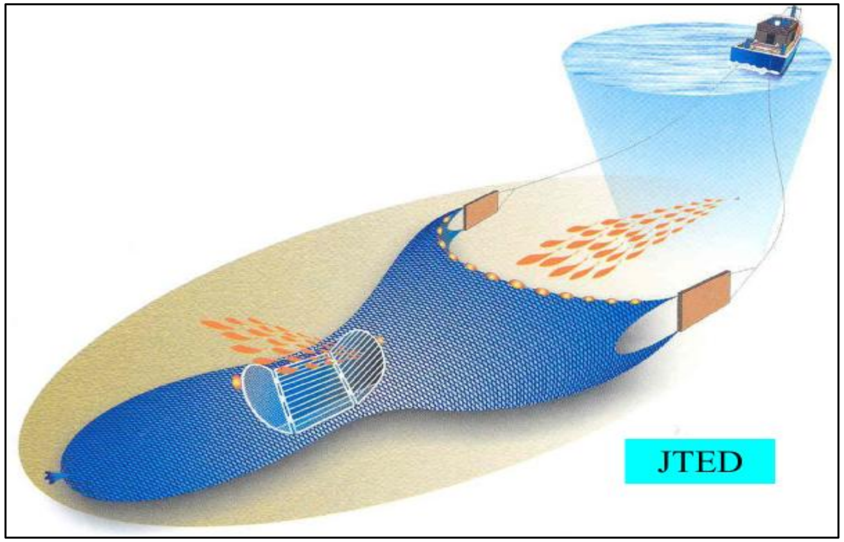
"Haiwan itu akan kelemasan dan mati kerana gagal timbul di permukaan air" — Sharum







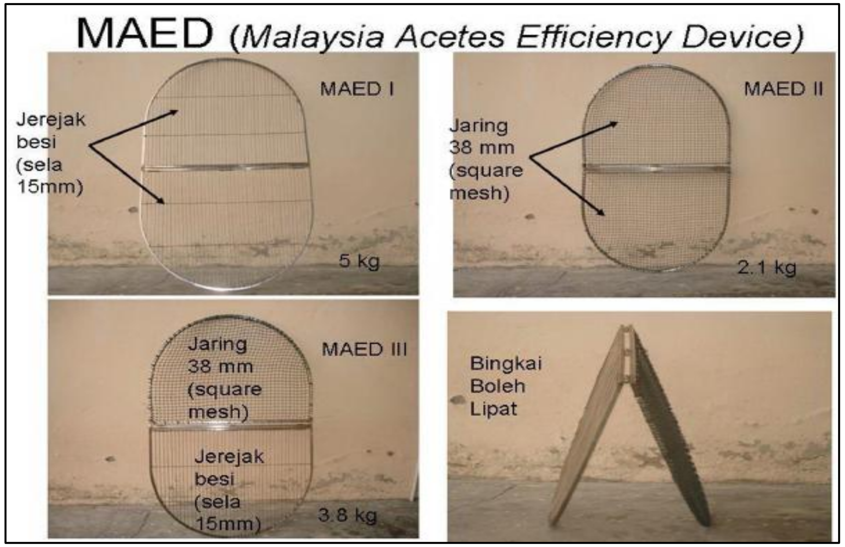
Pengarah Institut Penyelidikan Perikanan (FRI) Rantau Abang, Sharum Yusof menunjukkan cara penggunaan Peranti Penyisih Penyu (Turtle Excluder Device) pada pukat tunda sepanjang musim tengkujuh (November hingga Mac) semasa ditemui di FRI Kuala Abang di Dungun. - Foto BERNAMA.


JTED

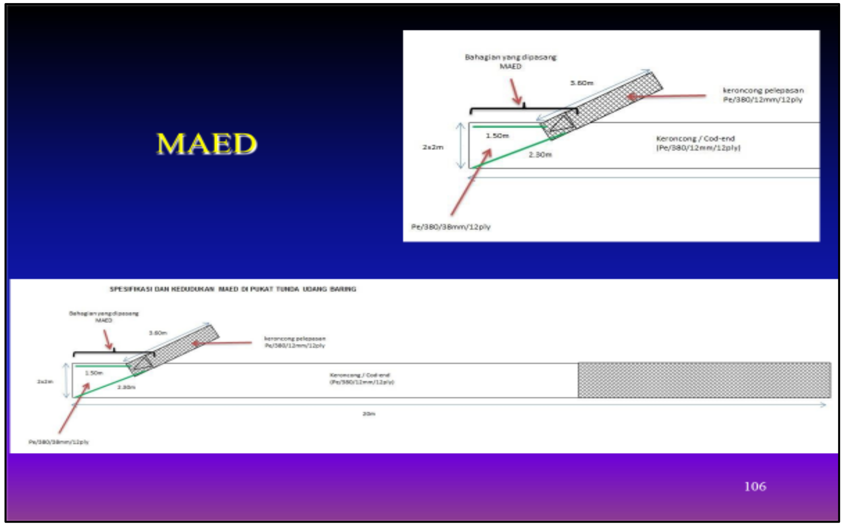

JTED


PUKAT TUNDA UDANG BARING
1. PENGENALAN
Pukat Tunda Udang Baring masih banyak digunakan oleh nelayan di Selangor dan Perak bagi menangkap udang baring untuk membuat belacan. Namun begitu, sebahagian daripada hasil tangkapannya adalah ikan baja (anak-anak ikan komersial yang ditangkap sebelum mencapai saiz pasaran). Ini adalah kerana saiz mata pukat bahagian keroncong pukat ini sangat kecil iaitu antara 9-12mm sahaja. Pada 1 November 2013, Jabatan Perikanan Malaysia telah menguatkuasakan penggunaan saiz mata pukat bahagian keroncong 38mm bagi mengurangkan tangkapan ikan baja tetapi penggunaan saiz mata pukat baru ini telah mengakibatkan hampir kesemua udang baring terlepas dari pukat.
2. SYARAT-SYARAT PELESENAN PUKAT TUNDA UDANG BARING:
i. Wajib memasang alat MAED pada bahagian hadapan keroncong pukat tunda udang baring.
ii. Wajib meletak jalur hitam selari dan diatas jalur putih di rumah kemudi.
iii. Warna ispukat untuk membuat MAED hendaklah berwarna OREN.
iv. Pengusaha hendaklah menandatangani surat AKUJANJI dengan Jabatan Perikanan Malaysia mengenai persetujuan menggunakan alat MAED.
v. Vesel-vesel pukat tunda udang baring hanya dibenarkan berpangkalan di Sungai Tiang, Bagan Datuk dan Hutan Melintang di Perak dan Kuala Selangor, Sekinchan dan Sungai Besar di Selangor.
vi. Wajib memasang alat MTU di atas vesel pukat tunda udang baring bagi memudahkan pemantauan vesel dibuat melalui Bilik Operasi Jabatan Perikanan Malaysia.
MAED (Malaysian Acetes Efficiency Device)
Institut Perikanan Malaysia (FRI) Kg Acheh, Perak telah berjaya memperkenalkan alat MAED yang berjaya mengurangkan tangkapan ikan baja (50% terlepas) tetapi dalam masa yang sama dapat mengekalkan tangkapan udang baring dengan hanya kurang 5% terlepas. Hasil tangkapan lebih bersih dan alat MAED sangat mesra pengguna, mudah dipasang, ringan dan boleh digulung di dalam "net drum" serta kosnya tidak mahal.
3. SIAPA YANG BOLEH GUNA ALAT MAED?
Vessel - vesel pukat tunda udang baring yang berpangkalan di Sungai Tiang, Bagan Datuk dan Hutan Melintang di negeri Perak serta Kuala Selangor, Sekinchan dan Sungai Besar di Negeri Selangor.
Udang Baring
MAED
MALAYSIAN ACETES EFFICIENCY DEVICE
PUKAT TUNDA UDANG BARING
Komponen Pukat Tunda
103


4. TARIKH PENGUATKUASAAN PENGGUNAAN MAED
01 JUN 2014
5. HUKUMAN KESALAHAN MENGUSAHAKAN PUKAT TUNDA UDANG BARING TANPA PERALATAN MAED
Boleh didakwa di bawah Seksyen 25(b) Akta Perikanan 1985 di mana pengusaha yang didapati bersalah boleh dihukum
DENDA MAKSIMUM RM 20 RIBU RINGGIT ATAU PENJARA TIDAK MELEBIHI DUA(2) TAHUN ATAU KEDUA-DUANYA SEKALI.
PERAK
SELANGOR
OTTER BOARD
INJAP MAED
UDANG BARING
UDANG BARING
Sungai Tiang
Bagan Datuk
Hutan Melintang
Sungai Besar
Sekinchan
Kuala Selangor
N
104



MAED (Malaysia Acetes Efficiency Device)
MAED I
Jerejak besi (sela 15mm)
5 kg
MAED II
Jaring 38 mm (square mesh)
2.1 kg
MAED III
Jaring 38 mm (square mesh)
Jerejak besi (sela 15mm)
3.8 kg
Bingkai Boleh Lipat



MAED
Bahagian yang dipasang MAED
3.60m
keroncong pelepasan Pe/380/12mm/12ply
1.50m
2x2m
2.30m
Keroncong / Cod-end (Pe/380/12mm/12ply)
Pe/380/38mm/12ply
SPESIFIKASI DAN KEDUDUKAN MAED DI PUKAT TUNDA UDANG BARING
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OVER-FISHING COULD KILL OCEANS BY 2050.
— MARINE SCIENTISTS
AKTIVITI PENANGKAPAN IKAN SECARA BERLEBIHAN BOLEH
MEMBUNUH LAUTAN MENJELANG 2050
- ahli sains kelautan


Terima
Kasih
110

Introduction to Fisheries Acoustic Survey

By
Raja Bidin Raja Hassan
rbidin61b@gmail.com

22 September 2024

Contents

- Basic theory on acoustic
- Survey Planning
- Data Collection
- Data Massage – cleaning
- Data Analysis
- Results interpretation
- Fisheries Management

Basic Theory

Underwater Sound

Leonardo da Vinci (1490)

using a tube… 'you will hear ships at a great distance'

The Evolution of Fisheries Acoustics

The First Sonars

Sperm whale (*Physeter macrocephalus*)

Animals that use echolocation emit sounds that travel underwater until they encounter objects, then bounce back to their senders—revealing the location, size, and shape of their target.

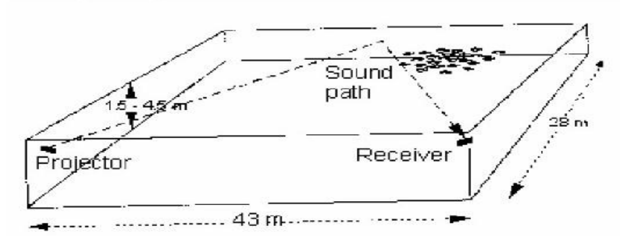
Killer whale (*Orcinus orca*)

Early History in Fisheries Acoustic

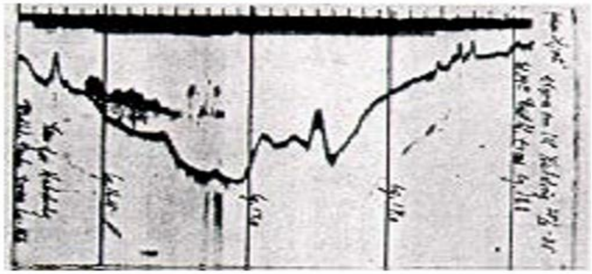
- The first successful experiment on the acoustic detection of fish was described by Kimura in 1929
- He installed a transmitter and a separate receiver in a pond used to cultivate fish
- Thus acoustic instruments which transmit and receive sound waves are capable of detecting fish or other objects far beyond the range of vision.

1st Lab Acoustic Fish Detection

Kimura (1929)



First International Publication



Sund (ICES 1935)

Echogram of cod in Vestfjord, Norway

International Council for the Exploration of the Sea (ICES)

Capabilities of hydroacoustics

- As a tool - Instruments which transmit and receive sound waves are capable of detecting fish or other objects far beyond the range of vision
- Fast result
- Wider coverage
- Techniques are become increasingly important over the years

It is an extremely powerful and effective fishery assessment tool when properly applied under appropriate conditions

Basic Acoustic Principles

An acoustic echo sounder transmits a pulse of acoustic energy into the water

The pulse of energy travels through the water at a speed of approximately 1450 - 1550m/s

When acoustic pulse encountered an object, such as fish or the bottom, some of the energy is reflected back to the transducer

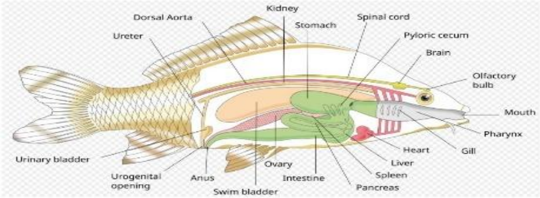
Echo sounder amplifies the received signal and then send it to an output device and echo processor

Signal level exceeds a mark threshold level, a mark appears on the output display device

Acoustic Monitoring of Fish

This density difference that causes sound to reflect from the fish, producing an echo

Fish without air bladder produce echoes too – However the amplitude of these echoes is significantly less than echoes from fish of the same size with air bladders



Acoustic Pulse Characteristics

- Generated by mechanical vibrations in the transducer
- Introduce a pressure variation in the water
- Typical vibration rates for hydroacoustic monitoring of fish are between 38 – 500 kHz
- Important characteristic – pulse duration (pulse length) –typical 0.2 – 1.0 msec
- One of the factors that affects the spatial resolution of the acoustic system – to distinguish two fish near each other as individual fish
- 38 Khz for long range

Factors Affecting Pulse Length

- The spatial resolution of an acoustic system is a function of the pulse length used
- To optimize the detectability of the echoes in noise – use a pulse length as long as possible
- Short pulse length (Add) – better range resolution
- Disadv – Digital sampling limitation – auto processing of the received echoes may be more difficult
- 38 Khz – acoustic wavelength 3.9cm
- 120 Khz – Aco. WL, 1.3cm

Factors affecting frequency

- The physical size of the transducer for a given beam width is inversely proportional to its frequency
- High acoustic freq – small objects such as entrained air burbles and debris will produce larger returns than at lower freq.
- In sea water the amount of signal loss due to absorption increases with freq.
- Minimum size object that could be detected increases with increasing frequency.
- High Freq – short wave length

Acoustic Levels

- Acoustic level is measured in units of pressure
- Standard unit is the microPascal (n/m^2)
- Output of the echo sounder is measured in volts.
- Standard logarithmic unit of pressure or voltage is the deciBel, dB
- 1000uPa = 20 Log_{10} (pres) = 60dB

Spreading loss

- The nature of sound waves is that they spread out in space as they travel from their source
- This spreading causes the acoustic pressure level to decrease as the distance from the source increases
- Pressure decreases as the reciprocal of the distance
- The range-dependent spreading loss is compensated by the echo sounder TVG

Absorption Loss

- There is friction loss that occurs when the acoustic pulse propagates through water.
- The absorption loss in dB is proportional to range
- Increases with increasing frequency
- In freshwater – loss is small
- 38 Khz – Loss 10.3dB/1000m
- 120 Khz – Loss 33.8dB/1000m
- For 38Khz – Body length less than 3.9cm, TS is not correct

Acoustic For Fish Abundance

- The measurement of fish abundance is probably the most important application of acoustic in fisheries research
- The acoustic method records the fish echoes and estimates the abundance as the quantity of fish which would be expected to produce such echoes

- Fish have a structure, their air bladder, that causes them to reflect sound quite easily. This air bladder has a very low density compared to the surrounding medium, water. It is this density difference that causes sound to reflect from the fish, producing an echo

- Acoustic methods of observation are unsuited to the flatfish and other species which live in close association with the sea-bed

- The basic system of hydroacoustic equipment includes a high frequency echo sounder, a chart recorder, an oscilloscope, one or more transducers with cables, and a computer-based echo processing system

Important Parameters for Hydroacoustic

SA	Back scattering layers by area
SV	Back scattering layers by volume
TS	Target Strength
M	Mortality rate
Y	Total catch
B	Biomass
D	Density

Acoustic Application

- To assess the fish abundance/biomass
- To estimate the body length of fish/TS
- To understand the ecology of aquatic animals and their habitats
- **fish counting, sizing, and tracking**
- **swimming pattern**
- **Multifaceted visualization on artificial reef**
- **Seabed classification**

Backscattering strength

Type	E1	E2	Sv (dB)
Sand	6.16 – 7.67	3.74 – 5.75	-21.79 – -4.59
Shell	5.35-7.44	3.09 – 5.19	-30.47 – -8.20
Mud	3.95-7.03	2.90 – 4.25	-38.70 – -12.31

Survey Planning

- Survey Objectives
- Technical Team
- Survey Area & Transect Pattern
- Calibration Process
- Depth Layer Setting

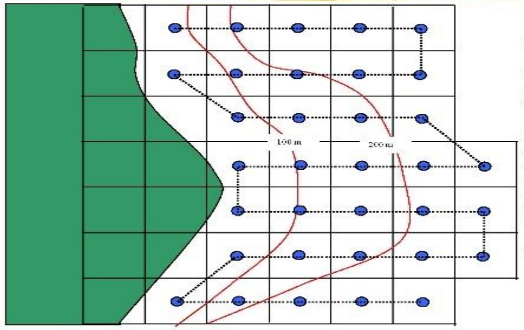
Objectives

- To develop sv or sa data correction
- To identify fish density distribution pattern
- To locate potential fishing grounds for pelagic fishes in the region

Technical Team

- Expert
- Cruise Leader
- Technical Staff

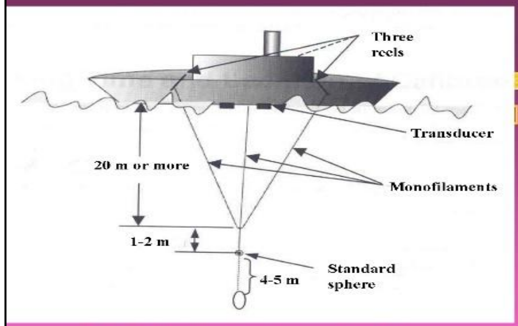
Survey Area



Calculation of survey area

- GIS – Marine Explorer Software
- manual

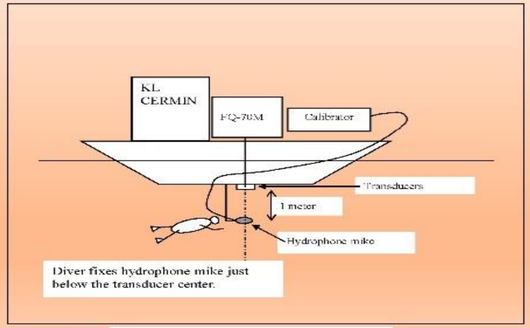
Calibration of Hydroacoustic Equipments



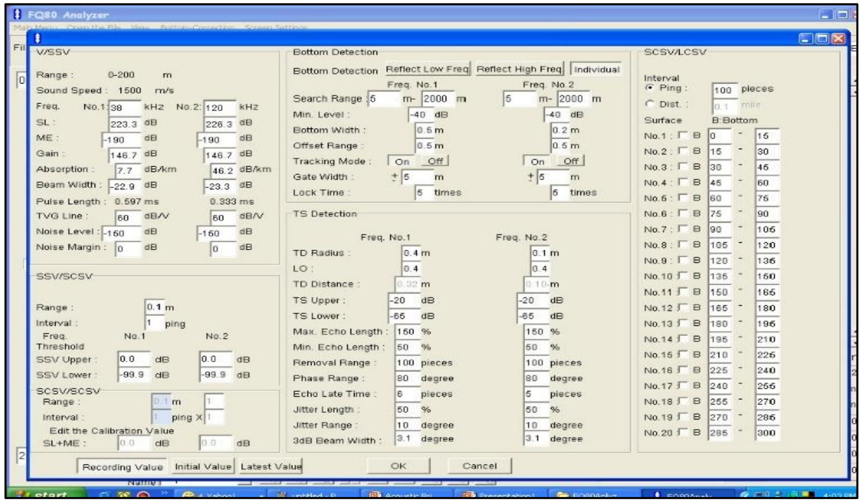
(Ideal situation for calibration process of FQ80)

- Calibration is an experiment conducted to determine the correct value of the scale reading of an instrument, by measurement or comparison with a standard

Calibration of Hydroacoustic Equipments



Calibration process for FQ70M

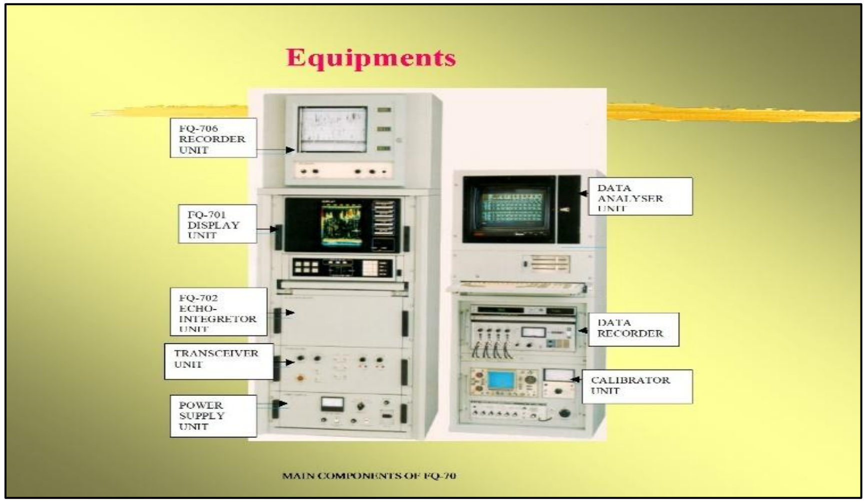


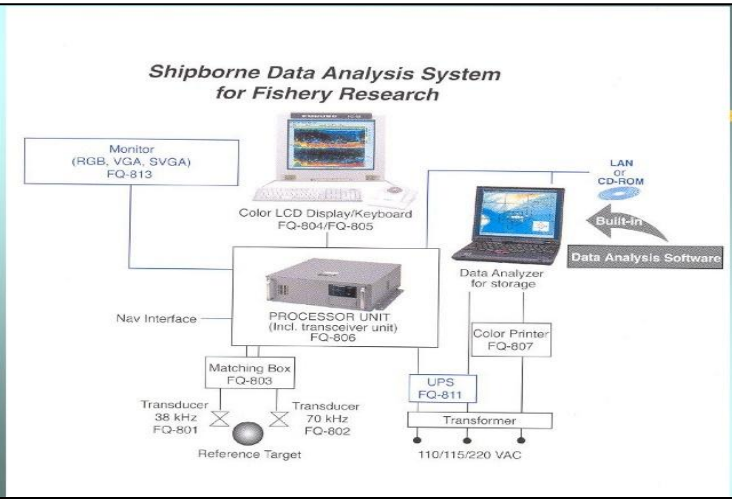
Data Collection

Equipment - Vessel / Echosounder
Observation on board – Cruise leader
- Observation form

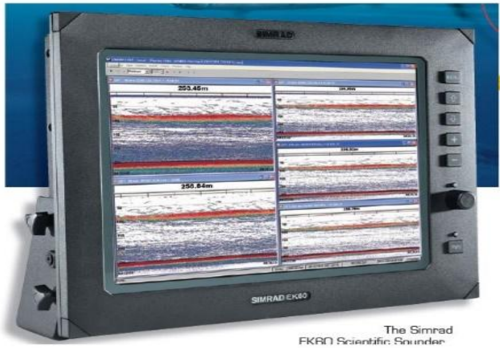
Integration – No of pings
- distant

Fish sampling – Mid water trawl / Purse seine





Scientific
Echosounder
SIMRAD EK60



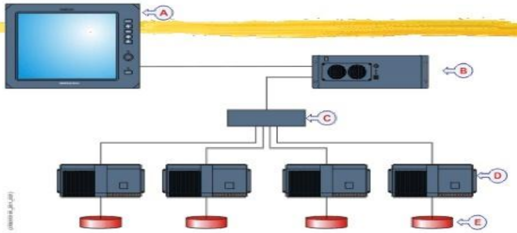
Biosonic DT-X series

Portable unit

Now

EK80

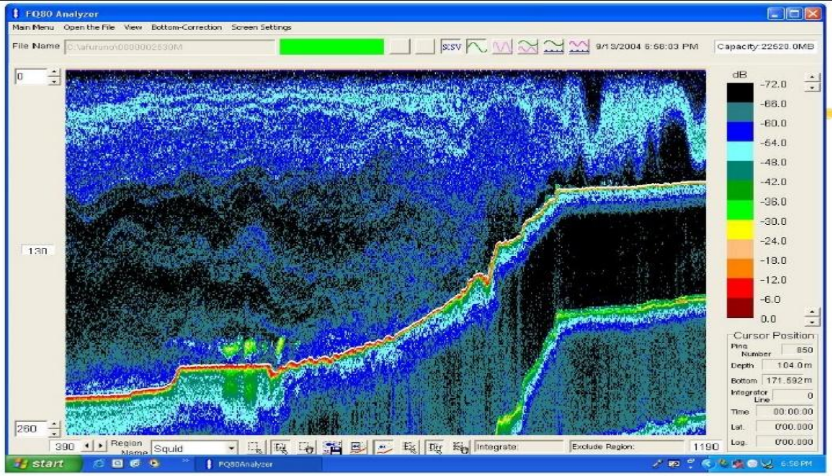
System Diagram EK80



A: Display
B: Processor Unit (computer)
C: Ethernet switch
D: Transceiver Unit (Wide Band Transceiver (WBT))
E: Transducer

Data Massage (Cleaning)

- Trafic noise
- Debris
- Bottom association – high value of SA



Data Analyses

- Dedicated Software
- Determination of target strength
- Dominant species
- Biological parameters of dominant species

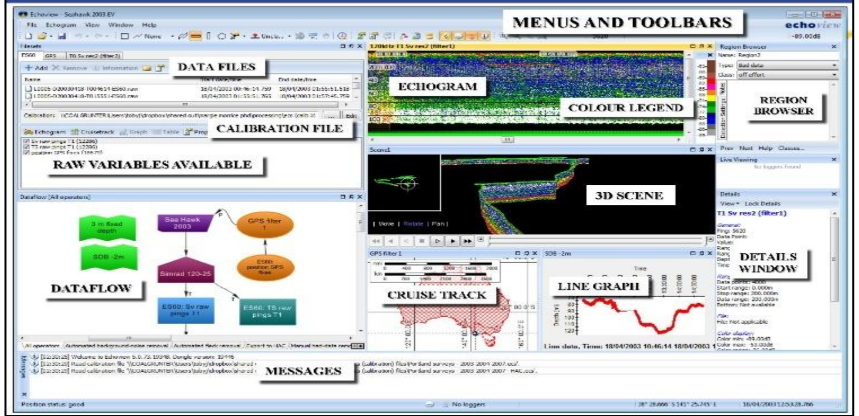
Data analysis - software

- Echoview ver. 14 (Echoview Software Pty. Ltd) - acoustic data analysis
- Eonfusion ver. 2.3.1 (Echoview Software Pty. Ltd) - GIS (Geographic Information System) data analysis
- ArcGIS ver. 9.3 (ESRI) - GIS data analysis
- Excel 2010 (Microsoft) – Graphs and tables

Marine Explorer - GIS Software

1. Load and view

Echoview layout

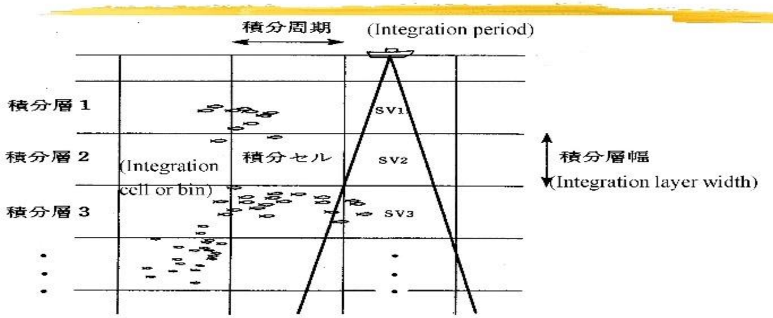


Marine Electronics

FURUNO

FQ-80 Analyzer

Mean volume backscattering strength (mean SV、MVBS)



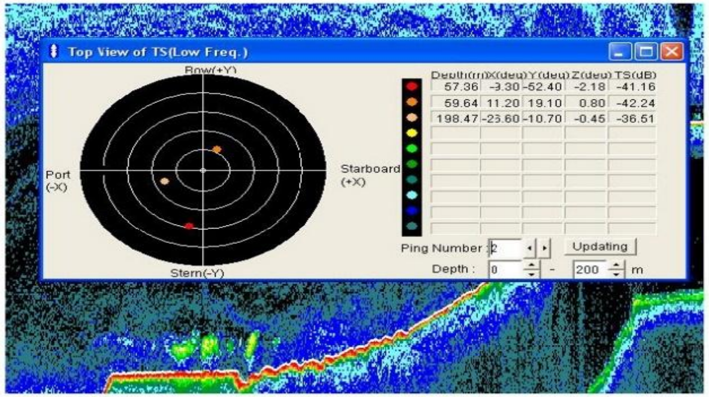
Conversion factor

Decibel to Linear form

-40dB = a = 10^(a/10)

Linear to Decibel

0.00004 = b = 10*LOG(b)



Target Strength

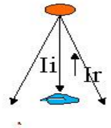
When an active sonar pulse is transmitted into the water, some of the sound reflects off of the target. The ratio of the intensity of the reflected wave at a distance of 1 yard to the incident sound wave (in decibels) is the target strength, TS.

$$TS = 10\log\left(\frac{I_r}{I_i}\right) = 10\log\left[\frac{\sigma}{4\pi}\right]$$

I_r = Intensity reflected from target

I_i = Intensity incident on target

σ = Backscattering cross-section



Target Strength (TS)

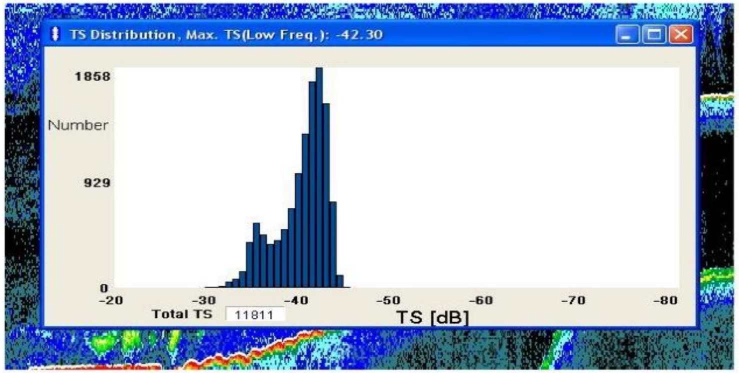
Target strength (TS) was estimated using the Furusawa (1990) equation - previously

TS = 20 log SL - 66

Where, TS = Target strength (dB)

SL = Fish Standard Length (cm)

Currently – apply TS values generated by FQ80 Analyzer

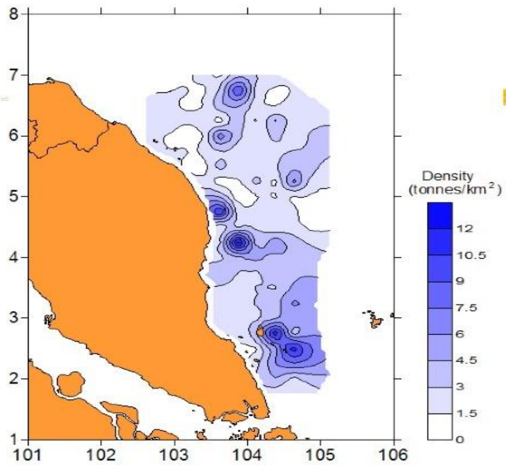


Results Interpretation

- Error and Bias
- Fish Density
- Biomass
- MSY
- Correlation with Oceanographic Parameters

A. Errors affecting both relative and absolute biomass estimation			
SOURCE OF ERROR	Random	Bias	Comment
Instrument platform			
Instrument calibration	± 2 to 5%	± 2 to 5%	Worse at higher frequencies
Vessel motion		0 to 25%	Narrow beams are more biased
Bubble attenuation		0 to 90%	Keel mounted and deep towed systems are less sensitive
Hydrographic conditions	± 2 to 5%	0 to 25%	High frequencies and deep targets are more biased
Fish behaviour			
Target Strength	± 5 to 25%		Uncertainty in fish size and fish orientation
Species identification	± 0 to 50%		Depends on species and level of species mix
Random sampling	± 5 to 20%		Depends on spatial distribution and school size distribution
Migration		0 to 30%	Depends on timing between survey and fish movement
Vertical movements	± 0 to 50%		Depends on TS change due to pressure variations
Vessel avoidance		0 to 50%	Stronger in shallow areas and noisy vessels
B. Additional errors affecting only the absolute biomass estimation			
Source of error		Bias	Comment
Instrument calibration		± 3 to 10%	Worse at higher frequency and narrow beam
Hydrographic conditions		±2 to 25%	High frequencies and deep targets are more biased
Target Strength		0 to 50%	Best for well investigated swimbladdered species.

BIAS



High density of pelagic fish –

Offshore bordering Vietnam water

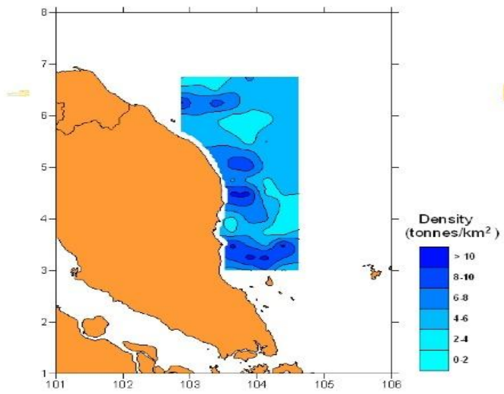
Coastal area off Dungun

Off Kuantan

Off Tioman Island

3.58 tan/km²

149,463 tan metrik



Coastal area – High density

6. 11 tonnes/km²

230,592 tonnes

Biomass Estimation

Biomass →

Biomass estimation
TS=20logL-66 (L: standard length)
Q=(sv/ts)*w*a*d =(sa/ts)*w*a
sa=sv*d
w: average weight
a: survey area square
d: layer depth

Biomass Estimation – Table Form

Calculation For MSY

Cadima's formula for exploited area:

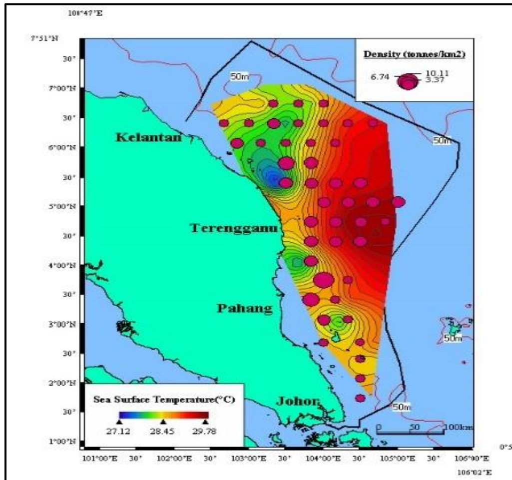
- MSY = 0.2*(M*Bc + Y)

Where;

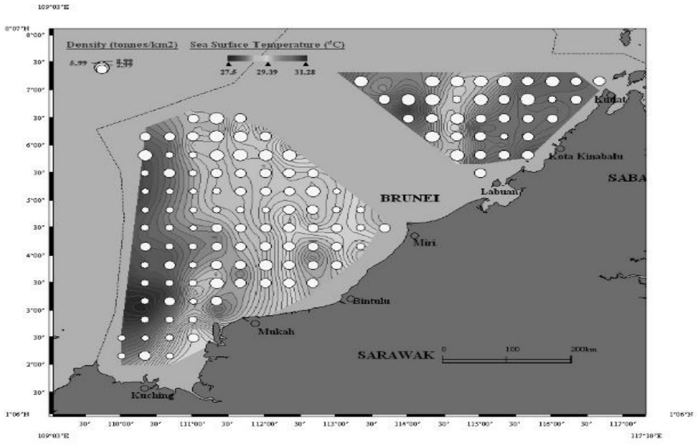
Bc = current biomass determined

Y = current yield

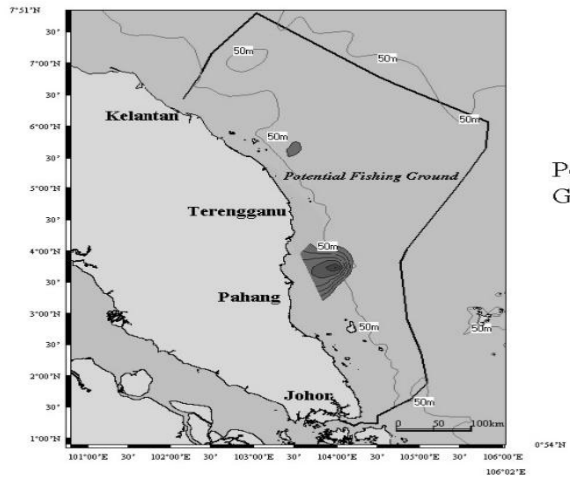
M = natural mortality



Correlation not always positive



No positive correlation was observed between pelagic fish density and SST



Potential Fishing Grounds

Management Action

Item(s)	Unit	West coast Peninsular	East coast Peninsular	Sarawak	West coast of Sabah	East coast of Sabah
Surplus/Deficit	MT	-17,529	12,959	32,415	12,344	-4,603
Additional/Reduction effort	Unit	-44	32	81	30	-12

Limitations

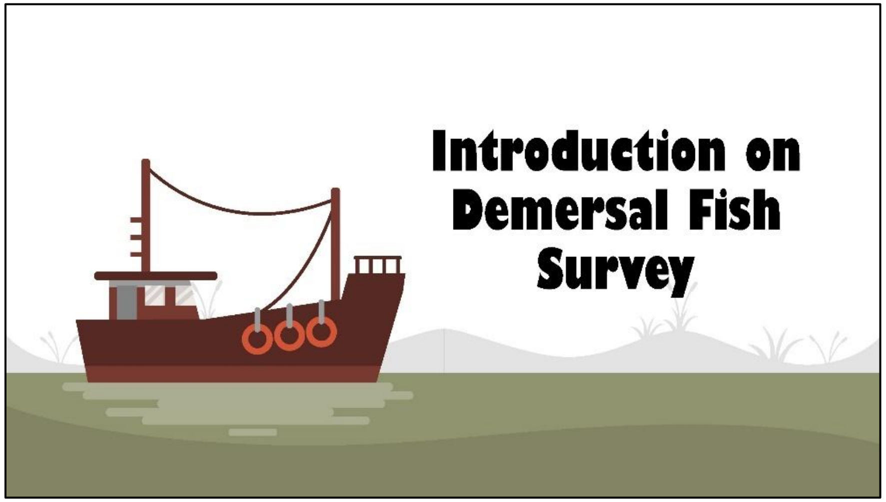
- Noise interference - caused by many elements such as other acoustic equipments, current indicator and rough sea condition
- Not enough fishing activities for echo identification
- Representative species from limited sampling program may incurred some level of bias - over or underestimation for biomass
- Biomass estimation for the whole survey area is based on single representative species

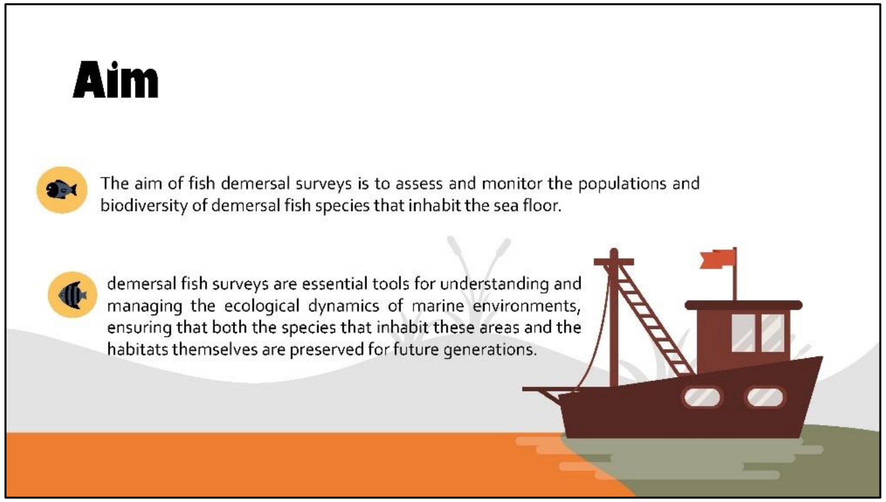
Recommendations

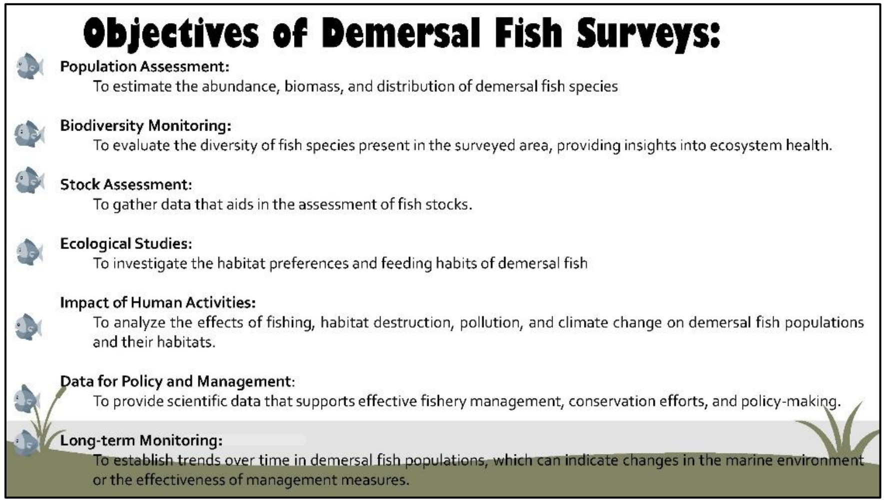
- Speed reduction during rough sea conditions
- Fishing is conducted for every transects to determine representative species
- TS measurement for rep. Species is pre-determined using the same equipment under the same environmental condition
- Biomass is calculated for every transect and based on their representative species

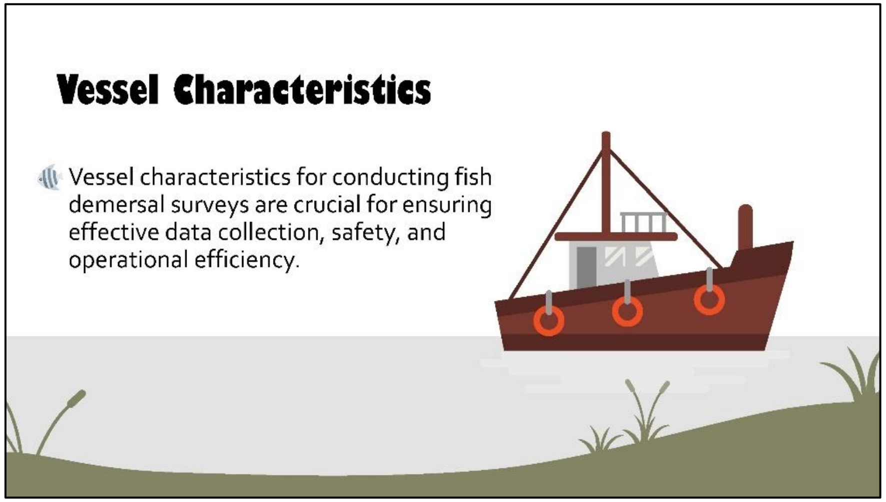
Terima Kasih

Thank You For Your Attention


Introduction on
Demersal Fish
Survey


Aim
The aim of fish demersal surveys is to assess and monitor the populations and biodiversity of demersal fish species that inhabit the sea floor.
demersal fish surveys are essential tools for understanding and managing the ecological dynamics of marine environments, ensuring that both the species that inhabit these areas and the habitats themselves are preserved for future generations.


Objectives of Demersal Fish Surveys:
Population Assessment:
To estimate the abundance, biomass, and distribution of demersal fish species
Biodiversity Monitoring:
To evaluate the diversity of fish species present in the surveyed area, providing insights into ecosystem health.
Stock Assessment:
To gather data that aids in the assessment of fish stocks.
Ecological Studies:
To investigate the habitat preferences and feeding habits of demersal fish
Impact of Human Activities:
To analyze the effects of fishing, habitat destruction, pollution, and climate change on demersal fish populations and their habitats.
Data for Policy and Management:
To provide scientific data that supports effective fishery management, conservation efforts, and policy-making.
Long-term Monitoring:
To establish trends over time in demersal fish populations, which can indicate changes in the marine environment or the effectiveness of management measures.


Vessel Characteristics
Vessel characteristics for conducting fish demersal surveys are crucial for ensuring effective data collection, safety, and operational efficiency.

Characteristics and features that a vessel should possess for such surveys:

Size and Stability

- Length and Tonnage
- Ballast and Stability Systems

Deck Space

- Operational Space
- Working Deck:

Equipment and Gear Handling

- Hydraulic or Electric Winches
- Storage for Equipment:

Acoustic Equipment

- Fish Finding Sonar:.
- Multibeam Echosounders:

Scientific Equipment

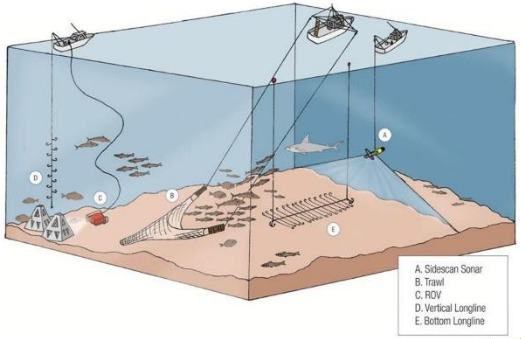
- Sampling Gear
- Biodiversity Monitoring Tools:

Navigation and Communication Systems

- Modern GPS and Navigation Systems:
- Communication Tools:

Sampling Gear

Sampling gear used in fish demersal surveys is designed to effectively capture species that inhabit the sea floor or the bottom layers of the water column.



Common types of sampling gear employed during these surveys

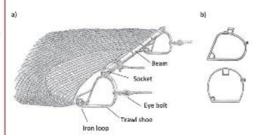
Description: A net that is towed along the seabed to catch demersal fish and invertebrates

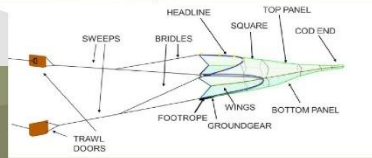
Types:

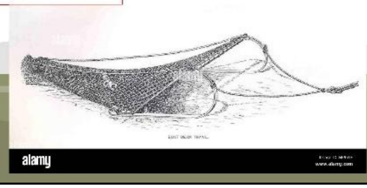
Otter Trawl: Designed with side wings and a heavy footrope to capture a wide range of species.

Beam Trawl: Often used for capturing flatfish and other species in shallow waters.

Features: Usually equipped with weights and cod-ends to retain the catch for analysis.

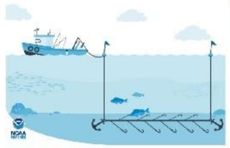






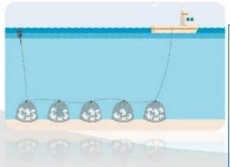
Common types of sampling gear employed during these surveys

Description:
A type of gear used to scrape along the seabed, often employed for capturing benthic invertebrates and some demersal fish species.
Types:
Shellfish Dredges: Typically designed for catching mollusks and crustaceans.
Modified Dredges: Adapted to capture specific fish species in certain habitats.



Bottom Longlines

Description:
A gear with a main line (the backbone) to which shorter individual lines (hooks) are attached.
Features:
Useful for targeting specific species, such as bottom-dwelling fish like oceanic tuna
Advantages:
Allows for selective fishing, reducing by catch of non-target species.



Traps

Description:
Various types of traps can be used to catch specific desirable species, especially those that are less mobile.
Types:
Fish Traps: Designed for capturing demersal species selectively without extensive bycatch.
Crab and Lobster Traps: Target specific crustacean species that might inhabit similar habitats.

Considerations for Gear Choice

Target Species:
The choice of gear depends on the specific fish species being studied and their habits.

Habitat Type:
Different gears are suited for different environments (e.g., rocky, sandy, or muddy bottoms).

Sampling Objectives:
The goals of the survey, such as stock assessment or biodiversity monitoring, will influence the selection of gear.

Regulatory Compliance:
It's essential to use gear that complies with local regulations regarding sustainable fishing practices and minimized by catch.

Survey Design :

Designing a suitable survey for fish demersal surveys in the sea involves careful planning to ensure that the data collected is reliable, representative, and informative for fishery management and ecological studies.

Key components and considerations for developing an effective on demersal survey design:

1.Objectives of the Survey - Define

2.:**Study Area**: - Identify, Consider habitat

3.Sampling Design- random, stratified or systematic

4.Sampling Gear-Select appropriate gear

5.Data Collection Protocols- Establish protocol

6.Temporal Considerations – Timing and frequency of survey

7.Data Analysis – Statistical methods / Software

8.**Quality Control** - data quality assurance and control

9.Stakeholder Engagement – Involve stakeholders

10.Budget and Resources – Estimate costs

Stratified random sampling

Stratified random sampling is a statistical method used to ensure that various subgroups (strata) within a population are adequately represented in the sample.

Here are the key steps involved in conducting stratified random sampling:

1. **Define the Population**
2. **Identify Strata**
3. **Determine Sample Size**
4. **Allocate Samples to Strata** -Use one of the following methods to allocate samples to each stratum:
   - **Proportional Allocation**:.
   - **Equal Allocation**:
   - **Optimal Allocation**: Allocate more samples
5. **Randomly Select Samples**
6. **Collect Data**
7. **Analyze Data**
8. **Report Findings**

Systematic sampling

Systematic sampling is a probability sampling method in which researchers select subjects based on a fixed, periodic interval.

- **Key Steps in Systematic Sampling**
  - ❖ Define the Population: Clearly identify the entire population you want to sample
  - ❖ Create a Sampling Frame: Develop a list or map of the population or its habitat areas..
  - ❖ Determine the Sample Size: Decide the total number of samples you want to collect.
  - ❖ Calculate the Sampling Interval:
    - Divide the total population size (or the number of units in the sampling frame) by the desired sample size to determine the sampling interval (k). For example, if the population has 100 units and you want to select 10 samples, k would be 100/10 = 10.
  - ❖ Select the Starting Point: Randomly select a starting point from the first k units in the sampling frame.
  - ❖ Select Samples Based on the Interval: From the starting point, select every k-th unit. For example, if k = 10 and the starting point is the 3rd unit, you would select the 3rd, 13th, 23rd, and so on.
  - ❖ Data Collection: Conduct the survey at the selected sampling locations, gathering relevant data on fish populations.

Adaptive sampling

Adaptive sampling is a flexible sampling method that allows researchers to adjust their sampling strategy based on the information collected during the survey.

- **Key Features of Adaptive Sampling :**

  Responsive Design: Adjusts the sampling strategy
  Focus on Variability: This method aims to improve sampling efficiency..
  Continuous Learning: As data are collected and analyzed, subsequent sampling efforts can be modified.

- Steps : 1.Initial Sampling
  2. Data Analysis
  3. Adjustment of Sampling Strategy:
  - increase sampling frequency in those locations.
  - reduce or eliminate sampling in those locations.

  4. Iterative Process: Continue this process iteratively until sufficient information is gathered
  5. Final Analysis: Perform a comprehensive analysis -distribution, abundance, and population

Advantages & Disadvantages of Sampling methods

Stratified Random Sampling

Advantages
- Increased Precision
- Representation of Subgroups
- Reduced Variability:
- Flexibility:
- Improved Comparisons

Disadvantages
- Complexity
- Need for Detailed Population Information:
- Potential for Misclassification
- Increased Cost and Time:

Systematic Sampling

Advantages
- Simplicity:
- Even spread
- Efficiency

Disadvantages
- Periodic Patterns:
- Sampling Frame Requirement:

Adaptive Sampling

Advantages
- Efficiency
- Improved Estimates:
- Flexibility:

Disadvantages
- Complexity:.
- Bias Risks:

Handling of the Sample

Proper sample handling during survey

1. Sample Collection
- Use Appropriate Gear
- Gentle Handling
- Immediate Data Recording

2. Sample Processing on Site
- Designated Processing Area
- Quick Processing
- Species Identification

3. Sample Transportation
- Proper Containers:
- Temperature Control
- Minimize Transport Time

4. Laboratory Processing
- Immediate Processing
- Standardized Measurement:

5. Data Management
- Organized Data Entry:
- Traceability

Data Reporting

- By gathering and analyzing this information through a structured approach, researchers can make informed decisions to support sustainable practices in the demersal fishery sector.

The key components of data reporting on such a survey would include:

Survey Objectives

- Determine the population structure of target species.
- Assess the biomass and abundance of demersal fish stocks.
- Evaluate habitat conditions and environmental variables.

Methodology

- **Survey Area**: Define geographic boundaries and depth ranges of the survey.
- **Data Collection Methods**: Use of trawl nets, video surveys, or underwater visual census.
- **Sampling Frequency**: Outline the time periods during which data is collected (seasonal, annual, etc.).
- **Data Parameters**: Record species composition, lengths, weights, age composition, and reproductive status, as well as environmental data (temperature, salinity, substrate type).

Analysis

- **Statistical Methods**: Any statistical analyses used to interpret the data (e.g., ANOVA, regression models).
- **Comparison to Historical Data**: How current data compare to previous surveys.
- **Trends Identified**: Noteworthy trends in population increases or decreases, shifts in species composition, etc.

Results

- **Species Composition:** List of species observed, with notes on relative abundance and diversity.
- **Biomass Estimates**: Total biomass (in metric tons) for target species.
- **Size and Age Distribution:** Statistics on sizes of fish and age class distribution.
- **Catch Per Unit Effort (CPUE):** Data representing the abundance of fish relative to the effort exerted in fishing.

Discussion

- The discussion section of a report, such as a demersal fish survey, plays a critical role in interpreting and contextualizing the findings

Importance of the Discussion Section:

1. **Interpretation of Results:.**
2. **Integration with Existing Knowledge**
3. **Implications for Management:**
4. **Identification of Trends and Patterns:**
5. **Limitations of the Study:**
6. **Future Research Directions:.**
7. **Stakeholder Relevance:.**
8. **Conclusions and Recommendations:.**

Conclusion

- The conclusions section of a report, such as a demersal fish survey, is essential for summarizing the key findings and implications of the research

Importance of Conclusions:

1. **Summary of Key Findings:**
2. **Clarity and Focus:**
3. **Implications for Management and Policy**
4. **Reinforcement of Objectives:**
5. **Call to Action:**
6. **Foundation for Future Research:**
7. **Final Impression:**
8. **Integration with Recommendations .**

Conclusion

- The conclusion---whether it is one paragraph or several---brings the essay to a satisfying close. Rather than simply repeating what has gone before, the conclusion brings all the writer's ideas together and answers the question, so what? Writers should remember the classical rhetoricians' advice that the last words and ideas of a text are those the audience is most likely to remember.
- 1 paragraph-conclusion

Recommendations

Importance of Recommendations
:

1. Guidance for Management:
2. Addressing Issues:
3. Sustainability:
4. Policy Development:
5. Research Priorities:.
6. Stakeholder Engagement:
7. Monitoring and Evaluation:

Recommendations for future studies

1. To assess susceptibility amongst cancer patients, SARS-CoV-2 transmission should be explored within both healthcare and household settings. For inpatients, the primary admission reason should be reported to distinguish nosocomial from community acquired infections.
2. To assess the relative risk of infection, the incidence of SARS-CoV-2 infection should be longitudinally measured in large cohorts of individuals with and without cancer, recruited using probabilistic sampling methods.
3. To assess mortality risk, both in-hospital and community deaths must be taken into account; for this, cause of death information can be linked with COVID-19 surveillance data.
4. To distinguish mortality risk related to COVID-19 from mortality related to cancer, implementation of ceilings of care should be considered and palliative versus curative therapeutic objectives should be reported.
5. To assess the impact of confounding variables, key demographic, social, and clinical characteristics should be reported for all patients:
   a. Demographic: age, sex, ethnicity.
   b. Social: occupation, socio-economic status, smoking status.
   c. Clinical: BMI, performance status, co-morbidities, cancer type, cancer stage, treatment type, treatment history and therapeutic strategy.

References

- Cite relevant literature, methodologies, and previous studies upon which the report is based.
- **Importance of References**
  - Credibility
  - Contextualization
  - Methodology Support
  - Further reading
  - Attribute
- **Common type of references**
  - Peer-Reviewed Journal
  - Books and Textbooks
  - Government &NGO Report
  - Conference Proceedings
  - Theses and Dissertations
  - Websites and online Databases

References

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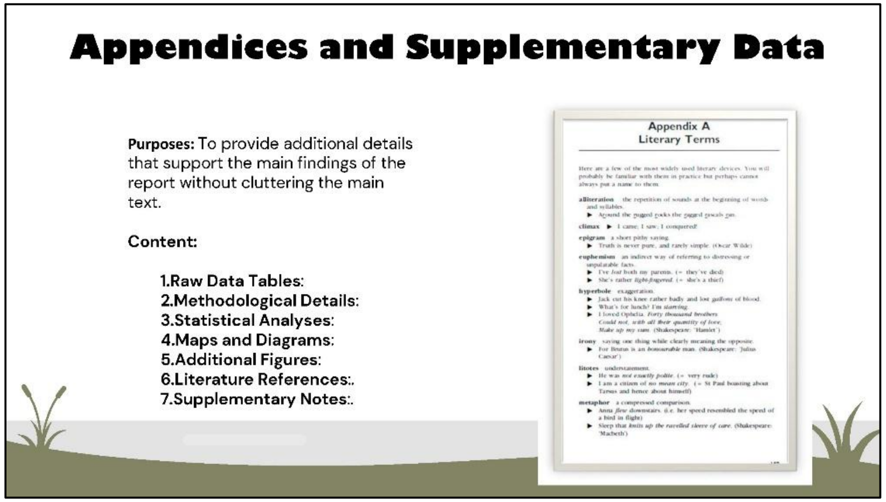


Appendix A
Literary Terms

Here are a few of the most widely used literary devices. You will probably be familiar with them in practice but perhaps cannot always put a name to them.

alliteration the repetition of sounds at the beginning of words and syllables.
- ▶ Around the rugged rocks the ragged rascals ran.

climax ▶ I came; I saw; I conquered!

epigram a short pithy saying.
- ▶ Truth is never pure, and rarely simple. (Oscar Wilde)

euphemism an indirect way of referring to distressing or unpalatable facts.
- ▶ I've *lost* both my parents. (= they've died)
- ▶ She's rather *light-fingered*. (= she's a thief)

hyperbole exaggeration.
- ▶ Jack cut his knee rather badly and lost gallons of blood.
- ▶ What's for lunch? I'm *starving*.
- ▶ I loved Ophelia. *Forty thousand brothers Could not, with all their quantity of love, Make up my sum.* (Shakespeare: 'Hamlet')

irony saying one thing while clearly meaning the opposite.
- ▶ For Brutus is an *honourable* man. (Shakespeare: 'Julius Caesar')

litotes understatement.
- ▶ He was *not exactly polite*. (= very rude)
- ▶ I am a citizen of *no mean city*. (= St Paul boasting about Tarsus and hence about himself)

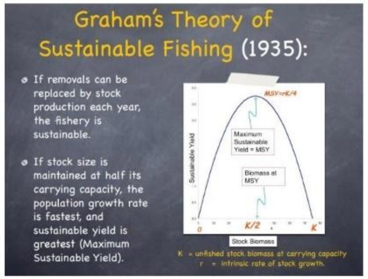
metaphor a compressed comparison.
- ▶ Anna *flew* downstairs. (i.e. her speed resembled the speed of a bird in flight)
- ▶ Sleep that *knits up the ravelled sleeve of care*. (Shakespeare: 'Macbeth')

Introduction to Maximum Sustainable Yield (MSY)

SALLEHUDIN BIN JAMON
FISHERIES RESEARCH INSTITUTE
KG ACHEH
SITIAWAN PERAK MALAYSIA

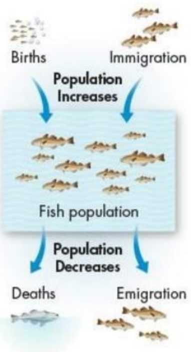
INTRODUCTION

- The term "over-fishing" was coined already in the mid-1850s,
- The over-exploitation of marine fisheries resources was only realized in the early 1900s, when the first study by Garstang, 1900 and articles on overfishing by Petersen, 1903 & Kyle, 1905 were published.
- By that time, the need for simple and easy to understand guidance on catch limits emerged.
- The maximum catch that a population can support seemed to be an excellent reference point for fisheries management.



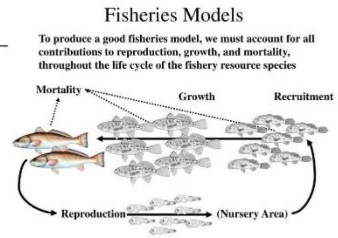
The productivity of a population is maximum at intermediate population sizes

- When we discuss the productivity of a population in the context of fisheries management, it is important to understand that maximum productivity typically occurs at intermediate or moderate population sizes.
- This means that at population levels that are not too small or too large, the population tends to achieve the highest level of productivity.



Beverton and Holt 1956

- The productivity of a fish population is a balance between individual growth and mortality.
  - In a healthy fish population, there is a delicate equilibrium between growth and mortality
  - if mortality rates surpass growth rates, the population may decline in numbers and productivity
- Fisheries yield will have a maximum
  - there is a natural limit on the amount of fish that can be caught to ensure the sustainability of the fisheries resource.



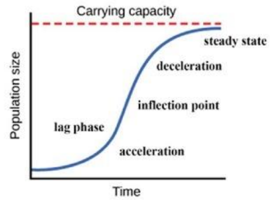
Sustainable Yield

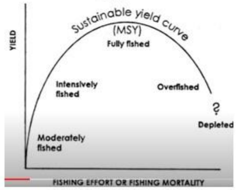
Sustainable Yield

- The natural income that can be exploited each year without depleting the original stock or its potential for replenishment.

Maximum Sustainable Yield

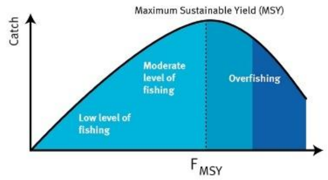
- The highest amount that can be taken without depleting stock
- How many fish, and of what size can be taken in any year?





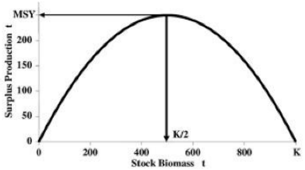
What is MSY? Maximum Sustainable Yield

- The maximum sustainable yield (MSY) for a given fish stock means the highest possible annual catch that can be sustained over time, by keeping the stock at the level producing maximum growth.
- The MSY refers to a hypothetical equilibrium state between the exploited population and the fishing activity
- MSY is a concept in fisheries management that refers to the largest long-term average catch or yield that can be taken from a fish stock under existing environmental conditions without compromising the stock's ability to replenish itself.



Continue--- What is MSY? Maximum Sustainable Yield

- It is a key principle in fisheries science and management, aiming to ensure the sustainability of fish populations and the long-term viability of fisheries.
- MSY is typically calculated based on the population dynamics of a fish stock, taking into account factors such as growth rates, reproduction rates, and natural mortality.
- By setting catch limits at or below the MSY level, fisheries managers can help prevent overfishing and ensure the long-term health of fish populations.



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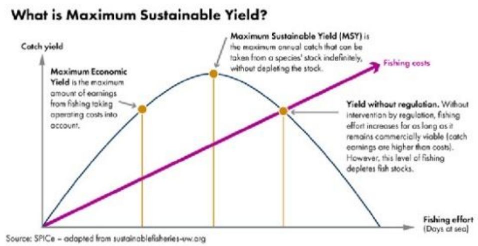
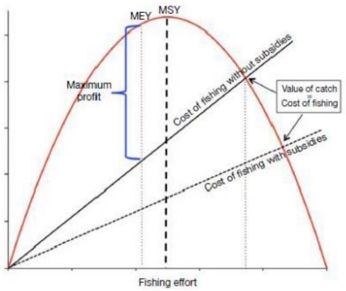
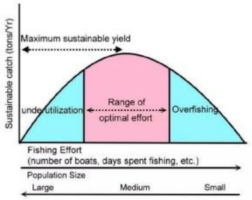




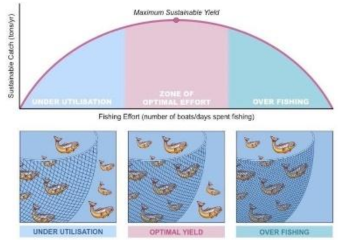
Concept of MSY

- Aims to maintain the population size at the point of maximum growth rate and allowing the population to continue to be productive indefinitely
- In logistic growth, resource limitations don't affect reproductive rates when populations are small. However, due to the low number of individuals, the total reproductive output is also low.
- At intermediate population densities, particularly at half carrying capacity, individuals reproduce at their maximum rate, creating a surplus for harvesting known as the maximum sustainable yield.
- Beyond this point, density-dependent factors limit reproduction until the population reaches carrying capacity, where yields drop to zero.
- The maximum sustainable yield is usually greater than the optimal sustainable yield and maximum economic yield.



MSY in Fisheries Management

- MSY seems an easy basis for fisheries management
  - One of the reasons why MSY is considered an easy basis for fisheries management is that it provides a clear target for fisheries managers to aim for.
  - By setting catch limits at or below the MSY level, it is believed that fish populations can be maintained at a healthy level and prevent overfishing.
  - This simplicity can make it easier for policymakers, stakeholders, and fishery managers to understand and implement management measures.



CONTINUE…

- The concept of Maximum Sustainable Yield (MSY) serves as a straightforward framework for fisheries management
  - **Clear Biological Target-**allowing managers to set specific catch limits
  - **Preventing Overfishing-** By establishing catch limits at or below the MSY level
  - **User-Friendly** Metrics-MSY is widely understood and can be communicated in accessible terms
  - **Data Utilization:** The MSY framework relies on data
  - **Flexibility in Management-**MSY provides a baseline
  - **Guidance for Policy and Regulation-** MSY serves as a guiding principle for regulatory frameworks
- **However, while MSY presents an easy starting point, it is also important to recognize its limitations**
- while MSY provides a clear and pragmatic basis for fisheries management, its effective application requires a broader understanding of the complexities of marine ecosystems and the socio-economic dynamics of fisheries.

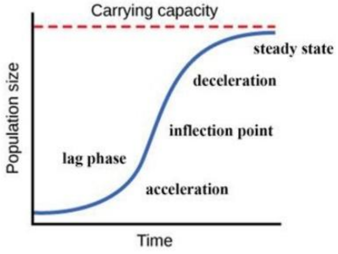
History and Legal Status of MSY

- The concept of Maximum Sustainable Yield (MSY) is deeply rooted in classical ecological principles, particularly the logistic population growth model, which was developed in the 1830s:
  - **The Logistic Growth Model**
  - **Historical Application to Marine Species**
  - **Adoption of MSY as a Management Goal**
  - **Legal Framework Under UNCLOS**
  - **Regional Fisheries Management Organizations (RFMOs)**

The Logistic Growth Model

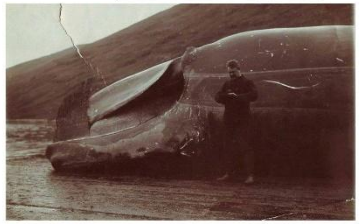
The Logistic Growth Model:

- The logistic growth model describes how populations grow in a constrained environment.
- The key insight from the logistic model is that there is an optimal yield



Historical Application to Marine Species:

- The first application of the logistic model on marine species was by Johan Hjort and his colleagues in the 1930s, who studied the blue whale fishery, based on mortality and reproduction data



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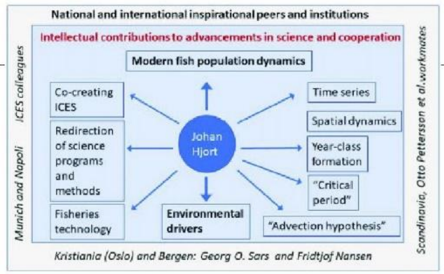


Johan Hjort was a giant who stood on the shoulders of other significant scientists. The figure illustrates his contributions to fisheries and marine science, and how Hjort's concept was influenced by previous researchers, and his social interactions with national and international colleagues and institutions.

Adoption of MSY as a Management Goal:

- After the late 1950s, MSY has been adopted as the primary management goal by several international organizations (IWC,IATTC, IC CAT, ICNAF) and countries
- ICNAF change to NAFO 1979- (Northeast Atlantic Fisheries)

International Whaling Commission

CIAT IATTC

ICCAT

ICNAF change to NAFO

Regional Fisheries Management Organizations (RFMOs):

- All 39 existing RFMOs is agreed to implement management measures to ensure that fish stocks were capable of producing their MSY sustainably.
- Aimed to balance ecological health with the economic interests of fishing communities, ensuring that fish populations are not overexploited while providing livelihoods for fishers.

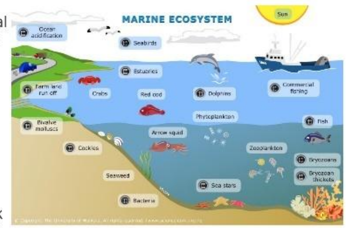
Critique of MSY

- ❑There are criticisms towards the use of MSY in fisheries management.
- ❑However, efforts are being made to take these criticisms as suggestions to further strengthen the use of MSY in global fisheries management.

1. Oversimplification
2. Variability and uncertainty
3. Social and Economic consideration
4. Failure to address Bycatch
5. Incorporating ecosystem based management
6. Adapting to variability and uncertainty
7. Stakeholder Engagement and co-management
8. Utilizing technology innovations
9. Focusing on Non Target species and bycatch

Later critique
A. Does not consider other elements of ecosystem

- ❑MSY is a valuable concept in fisheries management, it is essential to complement it with ecosystem-based approaches that consider the broader ecological context.
- ❑Ecosystem-based fisheries management takes into account the interactions between species, the physical environment, and human activities to ensure the health and resilience of the entire ecosystem.
- ❑By integrating ecosystem considerations into fisheries management practices, managers can better address the complex and interconnected nature of marine ecosystems and work towards achieving sustainable fisheries that support both the target species and the overall ecosystem health.



B. Relates to equilibrium and a constant nature –this never applies in reality

- MSY is a useful concept for setting sustainable catch limits, it is important to recognize its limitations in capturing the full complexity of marine ecosystems.
- Ecosystem-based approaches that consider the dynamic and interconnected nature of ecosystems are essential for effective fisheries management and conservation.
- By acknowledging the non-constant and dynamic nature of ecosystems, managers can better adapt their strategies to account for uncertainty and variability, ultimately promoting the long-term sustainability of fisheries and marine resources.

C. Focus limited so biological sustainability

- MSY is a valuable tool for promoting biological sustainability in fisheries, it should be complemented with ecosystem-based approaches that consider the broader ecological context and interactions within marine ecosystems.
- By taking a more holistic view of fisheries management and incorporating factors beyond just maximum yield, we can better ensure the long-term health and resilience of marine ecosystems and the sustainability of fisheries for future generations

MSY limits
'MSY' must be within –not replacing other boundaries:

- A balanced approach that considers multiple boundaries and objectives is essential for effective and holistic fisheries management.
- 'MSY' should be viewed as one of the tools or targets within this broader framework, rather than as the sole determinant of success in fisheries management.
- By integrating 'MSY' within a comprehensive management framework, we can work towards achieving sustainable fisheries that benefit both the environment and the communities that depend on marine resources.

The limitations of the Maximum Sustainable Yield (MSY) approach

- **Assumption of Stability:** population growth rates and environmental conditions remain constant
- **Variability in Ecosystems:** : Ecosystems are dynamic and can experience fluctuations
- **Ignoring Species Interactions:** often overlooks the impacts of species interactions
- **Estimation Challenges:** Accurately estimating carrying capacity and growth rates can be difficult,
- **Delayed Response:** The time lag between management decisions and population responses
- **Economic Factors:** The MSY approach may not account for market dynamics
- **Focus on Single Species:** MSY typically emphasizes single species management
- **Socioeconomic Considerations:** It often fails to incorporate socioeconomic factors

Conclusions

- Yield (MSY) approach has historically played a significant role in fisheries management
- The dynamic nature of ecosystems, species interactions, and environmental uncertainties require a more holistic and adaptive management strategy.
- Modern fisheries management increasingly adopts ecosystem-based approaches that consider ecological, economic, and social factors.
- While MSY can be a useful guideline, it should be applied cautiously alongside other management tools to ensure the long-term sustainability of fish populations and marine ecosystems.

Surplus production model in R

Using package 'TropFishR'

Supapong Pattarapongpan
Fishery Oceanographer
Fishing Ground and Oceanography Section
Research and Development Division
SEAFDEC/TD
Thailand

R coding

- Case sensitive; 'R' and 'r', 'T' and 't', 'F' and 'f' are not the same in R program
- **>name=function(data,conditions)**
- **>function(data,conditions)**
- **>library(TropfishR)**
- **>prod_mod(kaw,plot=TRUE)**
- **>prod_mod_ts(kaw2,method="Schaefer")**
- **>prod_mod_ts(kaw2,method="Fox")**

R package: TropfishR

General information

- TropFishR was developed under the concept of the former length-based stock assessment as FiSATII to handle the data-poor situation.

Function	FiSAT II	TropFishR
Growth	Standard methods	Updated methods
Mortality	5 Conventional methods	> 10 up to date methods
Selectivity	Standard methods	Standard + high functional
VPA	Standard interface	High functional code
YPR	Standard interface	High functional code
Surplus Prod.	Standard interface	Simpler code


Methods in Ecology and Evolution

Methods in Ecology and Evolution 2017, 8, 1520-1527 doi: 10.1111/2041-210X.12791

APPLICATION

TropFishR: an R package for fisheries analysis with length-frequency data

Tobias Karl Mildenberger*[1], Marc Hollis Taylor[2] and Matthias Wolff[3]

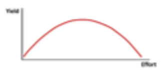
Surplus production model (SPM)

Surplus production models (SPMs)

- Based on the concept that **the next generation should outnumber the previous population** under the ideal condition
- The method focuses on the relationship between catch (Yield; Y) and effort (f).
- Result providing the curve of yield and effort.
- Reference point, Maximum Sustainable Yield (MSY), can be observed from the peak.

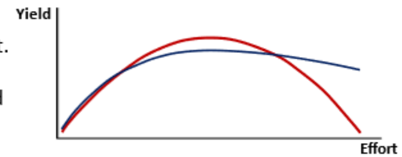
Schaefer Model

$$\frac{Y_i}{f_i} = a + bf_i$$



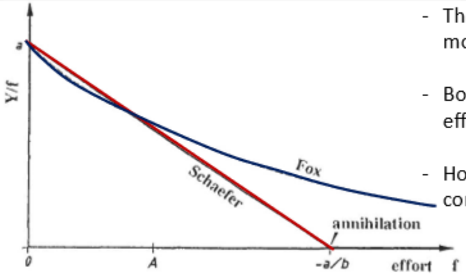
Fox Model

$$\ln\left(\frac{Y_i}{f_i}\right) = c + df_i$$



Surplus production model (SPM)

Surplus production models (SPMs)



- The difference between the Schaefer and Fox models.
- Both models confirm that Y/f declined when effort increased.
- However, only the Schaefer model provides the concept of the annihilation point.

Surplus production model (SPM)

- The original concept of SPM is the 'equilibrium' state
- Growth and recruitment = natural and fishing mortality
- However, it is not answer to many cases in the tropical region species or temperate species with short life spam
- Thus, the 'non-equilibrium model' was established
- Equilibrium situations: increased = decreased
  - **>prod_mod(...)**
- Non-equilibrium situations: increase ≠ decreased
  - Using time series to adjust the model (Hilborn and Walter, 1992)
  - **>prod_mod_ts(...)**

Input data

EQUILIBRIUM CONDITION

>prod_mod(...)

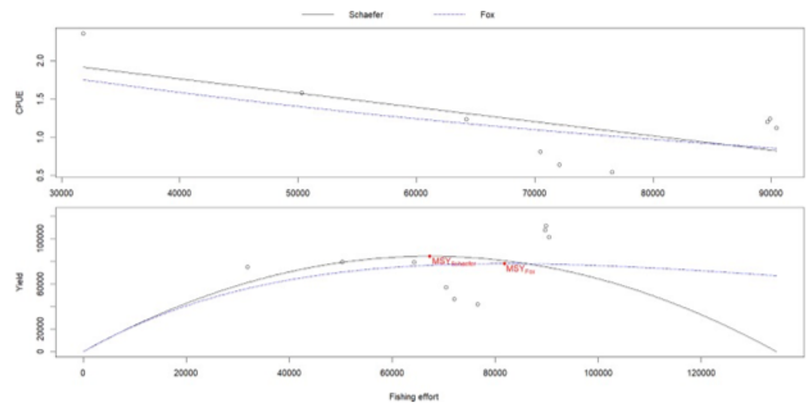
	A	B	C
1	year	Y	f
2	2010	46444	72081.09
3	2011	42011	76544.04
4	2012	57062	70471.57
5	2013	75137	31858.09
6	2014	79300	64233
7	2015	79737	50314.05
8	2016	107759	89655.49
9	2017	101704	90414.86
10	2018	111648	89876.64

NON-EQUILIBRIUM CONDITION

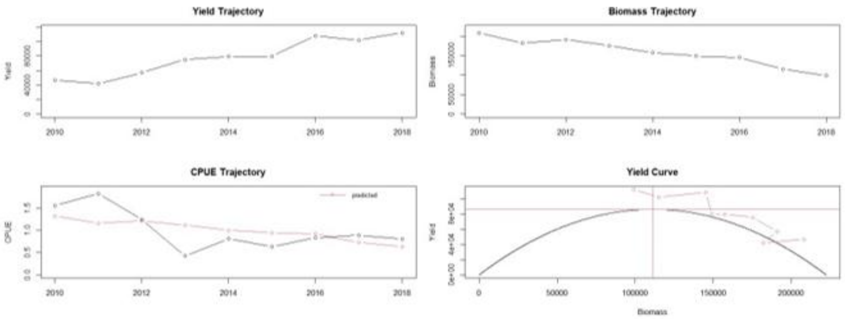
>prod_mod_ts(...)

	A	B	C
1	year	Y	CPUE
2	2010	46444	1.552
3	2011	42011	1.822
4	2012	57062	1.235
5	2013	75137	0.424
6	2014	79300	0.81
7	2015	79737	0.631
8	2016	107759	0.832
9	2017	101704	0.889
10	2018	111648	0.805

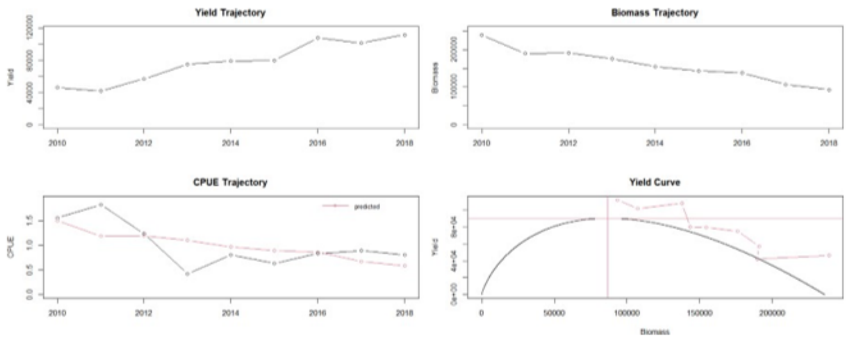
>prod_mod(kaw2,plot=TRUE) #assumed equilibrium



>prod_mod_ts(kaw,method="Schaefer") #assumed non-equilibrium



>prod_mod_ts(kaw,method="Fox") #assumed non-equilibrium



Some equations

Basic surplus production model

$$B_{t+1} = B_t + rB_t\left(1 - \frac{B_t}{K}\right) - C_t$$

Where			
	B	=	biomass
	t	=	time/ current year
	t+1	=	next time/ next year
	r	=	population growth rate
	K	=	carrying capacity
	C	=	catch amount

Mortality relationship

If $Z = M + F$ and $F = q * f$

Then, $Z = M + qf$

Where			
	Z	=	total mortality
	M	=	natural mortality
	F	=	fishing mortality
	q	=	catchability coefficient
	f	=	fishing effort

Schaefer

$$f(B_t) = rB_t\left(1 - \frac{B_t}{K}\right)$$

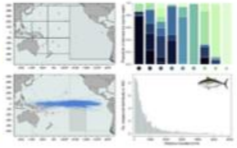
Fox

$$f(B_t) = \log(K)\, rB_t\left(1 - \frac{\log(B_t)}{\log(K)}\right)$$

Ways forward

USAID Southeast Asia Fisheries Partnership (SEAFish) Project

- Stock conditions and future trend stock assessment toward establishment of a subregional platform for joint tuna fisheries management of the concerned countries, including Indonesia, Malaysia, andthe Philippines
- Utilizing resource persons of Understandingthe relationship between climate change stock trends through the forecast model



Food and Agriculture Organization of the United Nations

Sustainable Fisheries Partnership

SEAFDEC Southeast Asian Fisheries Development Center

The University Of Queensland Australia

Component 1: Regional transboundary fisheries governance and management strengthened

Outcome 1.1: Fisheries resources and marine biodiversity ecosystem services are restored

- strengthened regional transboundary governance and cooperation ofGoT fisheries
- building resilience through improved habitat and fisheries management (SAP-Objective 1)

Outcome 1.2: Development and implementation of Ecosystem Approach to Fisheries (EAF) management plans in the Gulf of Thailand

- enhanced resilience against climate change
- managed fishing effort of fisheries stakeholders (women and men) (related SAPObjective 1)

New JTF-VII Project (2025-2029)

Enhanced marine research capacities to manage fisheries resources

1) System design for Marine Fish Stock Assessment in the Southeast Asian Region (MFRDMD)
2) Capacity building on marine environment change monitor and estimation impact on fishery resources (TD)
3) Improve the capacity building for the estimation of fishery biomass with the scientific hydroacoustic survey (TD)

Annex 31

CLOSING REMARKS

by *Dr. Suttinee Limthammahisorn,*
Secretary-General, SEAFDEC Secretariat

Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia
17 to 24 September 2024
SEADFEC/MFRDMD, Kuala Terengganu, Terengganu, Malaysia

Chief of MFRDMD, Mr. Haris, Deputy Chief of MFRDMD, Dr. Hirota, and resource persons, Prof. Dr. Thanitha Darbanandana (ธนิษฐา ทรรพนันทน์), my colleagues from SEAFDEC, distinguished participants from SEAFDEC Member Countries, ladies and gentlemen,

Good afternoon.
It is my pleasure and honour to be here with you today, to address in the Closing session and express gratitude to all those who made this training a great success. Let me first extend my sincere thanks and appreciation to the government of Japan through the Japanese Trust Fund for supporting the RECAB program, for over three years.

I would like to express my sincere gratitude to the resource persons for sharing important knowledge and your expertise with the participants and making the Training an enriching experience. Thank you for your time to be here with us.

I would like to congratulate all participants for your dedication and active engagement in the learning experience. I am happy to hear that this Training course attended by participants from SEAFDEC Member Countries, as it showed how important the stock assessment works.

I confident that you have gained a lot of knowledge and techniques on various topics of stock assessment provided during the course. SEAFDEC will continue our effort to enhance the capacity of the researchers on stock assessments to provide the important scientific information necessary for the conservation and management of fish stocks for your countries. As always, SEAFDEC is pleased to assist our Member Countries in any way possible. If you have concerns after you head out, please get in touch with the resource persons and your colleague.

I would like to express my deepest appreciation to Chief Haris and Deputy Chief Dr. Hirota for supporting and leading this Training course and to MFRDMD staff for organizing this Training. I appreciate your hard work and extra time in preparing and organizing this Training.

I convey SEAFDEC's best wishes for you as you apply the knowledge acquired from this Training, and please continue to work in collaboration among your network towards the sustainability of fisheries resources of the region. With this note, I would like to declare the Regional Training Course on Strengthening Basic Stock Assessment for Effective Fisheries Management in Southeast Asia, closed. Thank you, everyone, have safe flights back home.

APPENDIX

Workshop images were photographed by Ms. Fauzana Che Su

The opening of the Regional Training Course (RECAB) on 17 September 2024 was officiated by *Deputy General Secretary of SEAFDEC*, Dr. Nakazato Tomoko

Resource Persons

Assoc. Prof. Dr.Thanitha Darbanandhana
Kasetsart University, Bangkok

Dr. Supapong Pattarapongpan
SEAFDEC Training Department

Mr. Sallehudin Jamon
Director of FRI Kampung Acheh, Perak

Mr. Raja Bidin Raja Hasan
Former Chief of MFRDMD

Mr. Sharum Yusof
Director of FRI Rantau Abang, Terengganu

Participants

Mr. Muhammad Azizi Mahali
Brunei Darussalam

Mr. Muhammad Abdul Hakeem Julaihi
Brunei Darussalam

Mr. Muhammad Zulfadzli Haji Zulkifli
Brunei Darussalam

Dr. Chea Tharith
Cambodia

Mr. Ly Seyha
Cambodia

Mr. Herlisman
Indonesia

Mr. Roy Kurniawan
Indonesia

Ms. Miyako Shinagawa
Japan

Ms. Nagisa Kuwahara
Japan

Mr. Khamhou
Thongsamout
Lao PDR

Ms. Daovieng
Yaibouathong
Lao PDR

Ms. Khaitrul Ediana
Mohd Tahir
Malaysia

Mr. Mohd. Hariz
Ab. Halim
Malaysia

Ms. Cho Zin Thet
Myanmar

Mr. Min Khaing
Myanmar

s. Sheryll V. Mesa
Philippines

Ms. Rhoda S. Bacordo
Philippines

Ms. Jutima Jangjaiboon
Thailand

Mr. Tossapol
Ruangwattanakul
Thailand

Mr. Cao Van Hung
Viet Nam

Mr. Nguyen Van Minh
Viet Nam

Dr. Koki Abe
SEAFDEC Training Deparment

Mr. Muhammad Amirullah Al-Amin Ayob
SEAFDEC/MFRDMD

Mr. Mohd Tamimi Ali Ahmad
SEAFDEC/MFRDMD

Ms. Annie Nunis Billy
SEAFDEC/MFRDMD

Ms. Hamizah Nadia Alias @ Yusof
SEAFDEC/MFRDMD

Tour visit MFRDMD 17.09.2024

Exhibition Room

Genetic Laboratory

Main Laboratory

Knowledge Management Centre (Library)

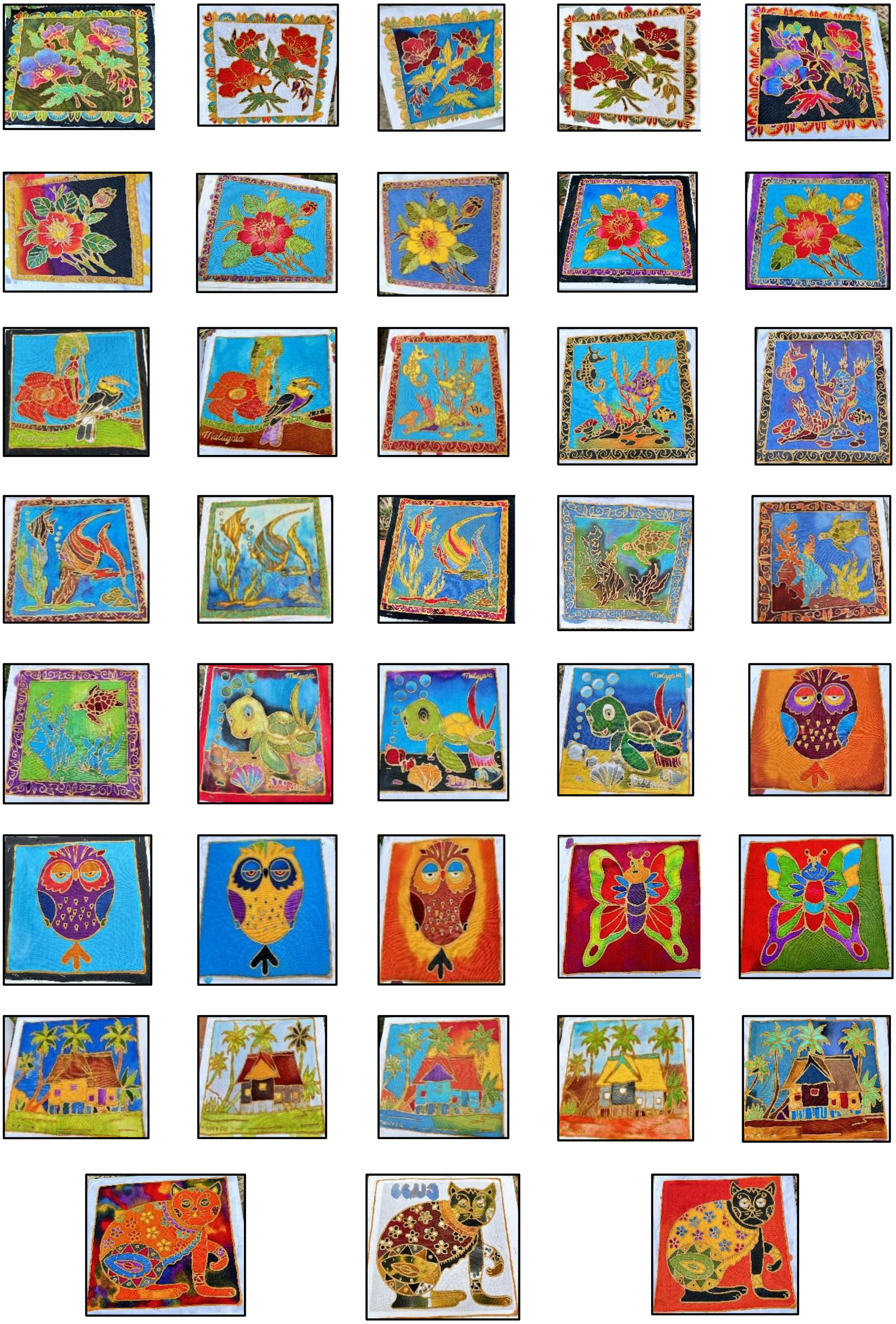
Study trip to Kuantan, Pahang, Malaysia (20.9.2024- 21.09.2024)

Visit to LKIM Kuantan, Pahang, Malaysia (Fisheries Development Authority of Malaysia)

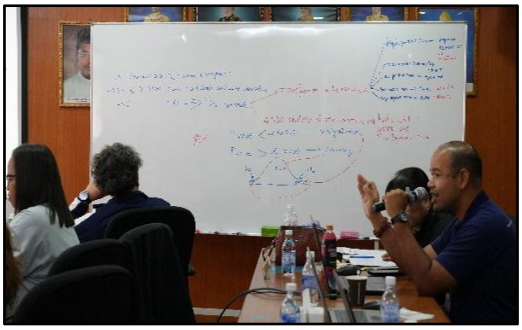
Visit to Kuantan Tower (Menara 188)

Visit to Natural Batik Village, Kuantan

Batik Colouring



The training course (17.9.2024 – 24.9.2024)



The closing of the Regional Training Course (RECAB) on 24 September 2024 was officiated by the *General Secretary of SEAFDEC*, Dr. Suttinee Limthammahisorn

Southeast Asian Fisheries Development Center (SEAFDEC)

What is SEAFDEC?

SEAFDEC is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia. SEAFDEC currently comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam.

Vision

Sustainable management and development of fisheries and aquaculture to contribute to food security, poverty alleviation and livelihood of people in the Southeast Asian region

Mission

To promote and facilitate concerted actions among the Member Countries to ensure the sustainability of fisheries and aquaculture in Southeast Asia through:

i. Research and development in fisheries, aquaculture, post-harvest, processing, and marketing of fish and fisheries products, socio-economy and ecosystem to provide reliable scientific data and information.
ii. Formulation and provision of policy guidelines based on the available scientific data and information, local knowledge, regional consultations and prevailing international measures.
iii. Technology transfer and capacity building to enhance the capacity of Member Countries in the application of technologies, and implementation of fisheries policies and management tools for the sustainable utilization of fishery resources and aquaculture.
iv. Monitoring and evaluation of the implementation of the regional fisheries policies and management frameworks adopted under the ASEAN-SEAFDEC collaborative mechanism, and the emerging international fisheries-related issues including their impacts on fisheries, food security and socio-economics of the region.


Secretariat


TD


MFRD


AQD


MFRDMD


IFRDMD

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