REPORT OF THE TRAINING WORKSHOP

ON RESEARCH METHODOLOGIES FOR THE STUDY ON IMPACT OF FISHING TO DEEP-SEA ECOSYSTEM

NEGARA BRUNEI DARUSSALAM/M.V. SEAFDEC 2

16-20 OCTOBER 2010

TD/RP/141

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

NOVEMBER 2010

Report of the Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem

M.V. SEAFDEC 2, Brunei Darussalam

16-20 October 2010

The Training Department
Southeast Asian Fisheries Development Center

TD/RP/141 November 2010

Preparation and distribution of this document

The Report of the Training Workshop on the Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem was prepared by the Coastal Fisheries Technology Division of the Training Department of the Southeast Asian Fisheries Development Center (SEAFDEC). The Document is distributed to the participants and resource persons of the Workshop, SEAFDEC Member Countries, SEAFDEC Departments and concerned institutions/organizations.

BIBLIOGRAPHIC CITATION

SEAFDEC. 2010. Report of the Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem, Southeast Asian Fisheries Development Center, Training Department, Thailand, TD/RP/141: 120 pp.

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M.V. SEAFDEC 2, Brunei Darussalam

16-20 October 2010

PART I

Report of the Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem

16-20 October 2010, Brunei Darussalam

I. Introduction

1. The Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem organized by the SEAFDEC Training Department (SEAFDEC/TD) and hosted by the Department of Fisheries, Ministry of Industry and Primary Resources of Brunei Darussalam was held from 16 to 20 October 2010 in Brunei Darussalam through the Japanese Trust Fund.

2. The Workshop was carried out both at the SEAMEO VOCTECH International House in Bandar Seri Begawan and on the M.V. SEAFDEC 2 with attendance by researchers from the SEAFDEC Member Countries, namely Brunei Darussalam, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam and experts of marine ecology/biology and fishing gears from Japan, Thailand and the SEAFDEC/TD. The list of participants and resource persons appears as **Annex 1**.

3. The workshop was promoted as part of activity of a Japanese Trust Fund program which is entitled "Deep Sea Fisheries Resources Exploration in the Southeast Asian Waters" and has been initiated by the SEAFDEC/TD in 2007. Envisaged outcomes of the workshop include:
    - Knowledge of the participants on research methodologies on impact of fishing to deep-sea ecosystem will be enhanced; and
    - Human resources capacity will be developed through actual practices, including: research planning, topographic survey; sampling gears operating methods; sampling methods (quantitative and qualitative); and data collection methodology from the actual survey.

II. Opening and Introduction of the Workshop Arrangement

4. The workshop was officially opened on October 16, 2010 at SEAMEO VOCTECH, Gadong, Brunei Darussalam. On behalf of the Director of the Fisheries Department, Negara Brunei Darussalam, Ms. Mariani Haji Sabtu welcomed and thanked the technical experts and participants from the SEAFDEC Member Countries and Department of Fisheries of Brunei Darussalam for their participation to the workshop. She recalled the program of deep-sea resources survey which had been initiated with the SEAFDEC/TD to share the technical

knowledge and experiences among the experts and researchers on deep-sea fisheries resources exploitation among the experts and researchers.

5. In his opening address, Dr. Chumnarn Pongsri, SEAFDEC Secretary General and Training Department Chief reminded the participants and esperts that the depletion of the coastal resources is a major problem in all Southeast Asian countries. One of the solutions that many countries select is to explore new fishery resources in deep-sea areas. However, an international concern on the ecosystem-based approach for fisheries management there is a need to provide the SEAFDEC member countries with knowledge and better understandings on the ecosystem-based approach for fisheries management prior to full implementation of the deep-sea fishery exploration. His opening address appears as **Annex 2**.

6. The introduction of the workshop was made by Dr. Worawit Wanchana, Capture Fisheries Technology Division Head of the SEAFDEC/TD. He provided the background and introduction of the Japanese Trust Fund project and the arrangement of the workshop activities. The arrangement and activities of the workshop appear as **Annex 4A-4C**.

III. Country Reports and Experts Presentation

7. The country reports were presented by participants from Brunei Darussalam, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. Experiences and lessons learned from the national activities/programs related to the deep-sea resources exploration and the impact of fishing to ecosystem were presented to the workshop. Their expectations from the workshop were also presented (**Annex 5A-5G**).

8. The presentations made by the experts provided the basics methodology and the practical methods of research surveys on the deep-sea fisheries resources exploration and its impact to the bottom ecosystem. The presentations by the experts included:
   - Scientific thinking and species biodiversity index by Dr. Chittima Aryuthaka (**Annex 6**);
   - General procedures for sampling, identification and collection management of deep-sea fishes by Dr. Yoshinobu Konishi (**Annex 7**);
   - Introduction to invertebrate classification and preservation techniques by Dr. Sumaitt Putchakarn (**Annex 8**);
   - Arrangement of activities and sample sorting by Dr. Natinee Sukramongkol (**Annex 9**);
   - Briefing on bottom topographic survey by Ms. Penchan Laongmanee (**Annex 10A)**
   - Briefing on seafloor survey using underwater VDO camera by Mr. Sukchai Arnupapboon (**Annex 10B)**

- Fishing gear and operation: Agassi trawl, beam trawl and deep-sea trap by Messrs. Sayan Promjinda and Narong Ruangsivakul (**Annex 11**).

IV. Results and Discussion

9. All participants and experts onboard M.V. SEAFDEC 2 from 17 to 19 October 2010. Four topographic surveys using hydro-acoustic echo sounder and four fishing operations consisting of 1 beam trawl operation, 2 Agassiz trawl operations, and 1 deep-sea trap, were conducted in the continental slope areas off-Brunei Darussalam Waters (zone 3 and 4) at two main depth strata of 100-200m and 200-300m. Each fishing station was recorded in three stages procedures namely setting, dragging and hauling of the fishing gears used. The positions of the survey and topography were mapped and appear as **Annex 12**.

10. All participants were divided into four groups for conducting the topography survey and a serial work of sorting, identification, tagging, photography, measurement in number and weight, and preserving of benthic specimens collected. The collected organisms were sorted in four categories, namely fishes, crustaceans, mollusk, and other invertebrates. Sorting categories were rotated in the four groups for each operation of the fishing gears. Finally, the identified specimens were preserved under -30^{o}C and/or in 75% ethyl alcohol with a label of sampling data for future work in laboratory.

11. The results of the survey/operation are described as follows;

4.1 Sea-floor Topographic Survey

12. The bottom topographic survey was carried out before and during fishing operation by using hydro-acoustic echo sounder. Sea depth (in meter) and position (latitude and longitude) were recorded every 1 minute and a total of 4 transect lines were established consisting of 1 lines for the beam trawl, 2 lines for the Agassiz trawl, and 1 line of deep-sea trap. The survey was carried out in the areas where the recorded depths ranged from 110 to 400m. The sea-floor topography from the survey is shown as **Annex 13A-13D**.

4.2 Sea-floor Living Resources Sampling

13. All specimens were sorted and identified to the lowest taxa before counting the number and weighing. Results of the survey were divided and presented by participants from four different groups/fishing operations. The results of each group appear as **Annex 14 to 17**. Details of the specimens caught from the survey are shown below;

Sampling gear	Fishes			Crustaceans			Mollusks			Othe invertebrates		
	Number of specimens	Number of species	Total weight (g)	Number of specimens	Number of species	Total weight (g)	Number of specimens	Number of species	Total weight (g)	Number of specimens	Number of species	Total weight (g)
Beam-trawl 01	62	25	991	66	21	-	17	7	-	43	11	-
Agassiz-trawl 01	52	26	1,144	27	8	-	30	9	-	30	21	-
Deep-sea trap	7	4	3,480	376	24	10,682	-	-	-	-	-	-
Agassiz-trawl 02	81	29	2,023	83	16	541	23	8	4,477	7	4	150

14. By four operations of fishing gears, at least 29 fish species were identified from a total of 202 specimens. The dominant fish species comprised of Families Sternoptychidae, Macrouridae, Neoscopelidae, Scorpaenidae, Triglidae, Acropomatidae, Polymixiidae, and Cynoglossidae.

15. At least 24 crustacean species were identified from a total of 552 specimens which mainly composed of shrimps, lobsters, crabs, and isopod. The highest number of shrimp catch (376 individuals) was from the deep-sea trap operation, and the dominant species was *Heterocarpus* sp. in the Family Pandalidae. However, dominant shrimp species in the beam-trawl and Agassiz trawl catches was *Peneaopsis* sp. in the Family Penaeidae. The deep-sea trap catch was dominated by big isopod which consists of 63% of total specimens.

16. Only 70 specimens of mollusks were collected: Bivalvia (36), Gastropoda (28), and Cephalopoda (6). At least 21 shelled mollusks (64 individuals) collected from beam trawl and Agassiz trawl were preliminary identified into Families Xenophoridae, Cassidae, Cerithiidae, Turridae, Fasciolariidae, Veneridae, and Pectinidae. Collected cephalopods belong to five families (Sepiidae, Enoploteuthidae, Enoploteuthidae, Ommastrephidae, and Histioteuthidae). External parasite to echinoderm (starfish and sea urchin) of gastropoda and bivalvia were also observed.

17. Approximately 80 specimens of invertebrates were gathered from the survey. There was no invertebrate presented in the deep-sea trap collection. The invertebrates collected using beam trawl and Agassiz trawl sampling gears were composed of echinoderms (sea cucumber, sea urchin, sea feathers, brittle stars and sea stars); anthozoans (soft corals, hard corals and sea anemones); sponges; and other invertebrates (annelids, other cnidarians, and hydrozoans were also included in this group) as shown in **Annex 14 to 17**.

18. Additional information of the invertebrate specimens collected was presented by Dr. Sumait Putchakarn (**Annex 18**). During the training survey, a particular benthic habitat of the tube worms (Polychaeta: Siboglinidae). It is normally found at the sea bottom with rich hydrogen sulfide, methane, and other hydrocarbon fluid.

19. Species identification was not completed onboard, and it would be necessary to conduct further study on the detailed taxonomy.

V. Recommendations

20. As for the purpose to improve the effectiveness for survey/study on the impact of the fishing/sampling gears to the deep-sea bottom ecosystem, the following recommendations were made at the workshop.

    - Since the impact of the trawl gear is generally considered as a destructive fishing gear to the benthic community, therefore, the improvement of the fishing gear design and it operation method should be developed;
    - Comparative study on suitability of fishing/sampling gears (e.g. Beam trawl, Agassiz trawl, etc.) should be conducted to make standard fishing gears for the research survey and study on the deep-sea fisheries resources exploration and its impact to the bottom ecosystem;
    - Granulometric properties which are considered to regulate spatial distributions of the benthic organisms should be included in research item as well as infauna organisms like polychaete and peanut worm;
    - SEAFDEC should develop training courses on identification and taxonomy of the benthic, invertebrate organisms to enhance the capacity building of the SEAFDEC member countries;
    - The research title on ***"****Preliminary study on the fishing impact in terms of* ***deep-sea fishes and benthic communities"*** was proposed instead of ***"ecosystem"*** term.

21. For the purpose of supporting and enhancing participant's knowledge on research and methodologies on impact of fishing to deep-sea fishes and benthic-communities, Dr. Chittima Aryutthaka, resource person of the workshop recommended the workshop that the sampling methodology and study on fishing impact on deep-sea fishes and benthic fauna as shown in **Annex 19**.

22. The workshop noted that the program of "Deep-Sea Fisheries Resources Exploration in the Southeast Asian Waters" which has been conducted under the Japanese Trust Fund from the year 2007 would be terminated the first phase by the year 2012. The obtained biological and topographic results and the experience of fishing gear operations from the present, exploratory survey are useful to plan the next phase of the program.

VI. Conclusion

23. The workshop concluded that;
    - Based on the actual survey, participants from the SEAFDEC member countries have learned to identify the fresh specimens as possible as supervised by the experts;

- The participants are encouraged to keep their efforts to study on the impact of the fishing/sampling gears in close collaboration with other SEAFDEC member countries and may consider scoping the study topic on the “Fishes and benthic communities” rather than “ecosystem”;
- The present survey indicates that the deep-sea shrimp, *Heterocarpus* sp. is considered to be the promising fisheries resources in the continental slope area off Brunei Darussalam.

VII. Closing

24. Mrs. Ranimah H.A. Wahab, Head of Division of Marine Fisheries Development and Management of Fisheries Department, Negara Brunei Darussalam expressed her appreciation to the experts and thanked the participants for their active participation in the workshop as well as the organizing team for their support and cooperation during the workshop. She also reminded the participants that the realization of their respective activities for the deep-sea fisheries resources exploration depends on their willingness and intention to apply what the participants have learned from this training workshop, and then she declared the workshop close. Her closing remarks appear as **Annex 3**.

Annex 1

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Annex 2

Opening Address
By Dr. Chumnarn Pongsri
SEAFDEC Secretary General and Training Department Chief

Ms. Hajah Hasnah Ibrahim, Director of Fisheries Department, Negara Brunei Darussalam
Resource Persons,
Participants from SEAFDEC Member Countries,
SEAFDEC staffs,
Ladies and Gentlemen, Good morning!

On behalf of SEAFDEC, I am very pleased to welcome all of you to this Training Workshop on Research Methodology for Study on Impact of Fishing on Deep-Sea Ecosystem. Please allow me to thank also the participants for taking part in this training workshop. I also would like to thank the Department of Fisheries of Brunei Darussalam for your hospitality to co-organize this training workshop.

We all recognize that the depletion of the coastal resources is a major problem in all Southeast Asian countries. One of the solutions that many countries selected is to explore new fishery resources in deep-sea areas. In this connection and in order to support the Member Countries, SEAFDEC has initiated a program with funding support from the Government of Japan to conduct deep-sea resources exploration in the Southeast Asian waters. Since 2008, various programs of activities have been carried out in close collaboration with the Member Countries.

Considering that ecosystem-based approach for fisheries management has been an international and our concern, therefore there is a need to provide the member countries with knowledge and better understandings on this issue prior its full implementation. Collaboration and coordination with key agencies and initiatives will have to be strengthened in order to exchange information and expertise on this topic. In this regard, a human resources capacity building program on the “Research Methodologies for the Study on Impact of Fishing on Deep-Sea Ecosystem” is now being made available to the Member Countries to facilitate sustainable development and management of deep-sea fishery resources for the region.

At this juncture, please allow me to inform you that SEAFDEC is glad to have Dr. Yoshinobu Konishi, former senior researcher from Seikai National Fisheries Research Institute, Nagasaki, JAPAN, and Associate Professor Dr. Chittima Aryuthaka, from Faculty of Fisheries, Kasetsart University and Dr. Sumaitt Putchakarn, Senior researcher from Research Scientist Institute of Marine Science, Burapa University with us during this training workshop. Being experts in marine ecology, marine vertebrate and invertebrate identification, I am sure that they would be happy to share knowledge and experiences with you. I therefore hope that you will enjoy this 5 days training workshop.

Lastly, I wish to take this opportunity to encourage all the participants in this training workshop to continue your strong desire and interest in gaining knowledge and experience in studying the impacts of fishing on the deep-sea ecosystems. With that note, I now declare a training/workshop on Research Methodology for Study on Impact of Fishing on Deep-Sea Ecosystem open.

Thank you and Good Day!

Annex 3

Closing Remarks

By Dyg Ranimah H.A. Wahab

Head of Division of Marine Fisheries Development and Management of Fisheries Department, Negara Brunei Darussalam

Distinguished Resource Persons, participants, and colleagues from the Training Department, Good afternoon!

First of all, I wish to inform you that I am very happy to note the success of this Regional Training fishing on Workshop on Research Methodologies for Study on Impact of Fishing on Deep Sea ecosystem. I must say that I am most impressed by your active participation during the 5-day training workshop, especially your strong sense of interest and the efforts you exerted in the working onboard MV SEAFDEC 2 in the Brunei water. I am also pleased to learn that you have planned to establish a network of deep sea fish taxonomists. Recognizing this as a very useful avenue to share/exchange and update the progress of deep sea fish identification in our region, SEAFDEC would be willing to provide assistance for the sustainability of this network.

As this regional training workshop comes to a close today, I would like to thank our resource persons and experts in the persons of Dr. Yoshinobu Konshi, Dr. Chitima Aryuthaka and Dr. Sumaitt Putchakarn for sharing their knowledge and skills with the participants. We are also thankful to the organizing team for your efforts in providing the best support to this training workshop. We are also grateful for the continued financial support from the Japanese Trust Fund through SEAFDEC, for making this training workshop possible.

Ladies and gentlemen, our work does not end here. Please keep in mind that the realization of your respective activities on Deep Sea Fisheries Resources Exploration depends on your willingness and intention to apply what you have learned from this training workshop. On our part, SEAFDEC will make effort to provide you with the necessary support to ensure the success and sustainability of this important collaborative effort in the near future.

Finally, I wish you all the best and every success in your future challenges. May you have a safe journey back home. With that Ladies and Gentlemen, I now declare the Regional Training Workshop closed. Thank you very much.

Annex 4A

Agenda and Arrangement of the Training/Workshop

1 **Opening**

2 **Introduction to the training/workshop activities**

3 **Transferring Knowledge and Sharing Experiences on related to deep-sea resource exploration and/or study on impact of fishing to ecosystem as well as expectation from the training workshop**

- Scientific thinking and species biodiversity index
- General procedures for sampling, identification and collection management of deep-sea fishes
- Arrangement of activities and sample sorting
- Bottom topographic survey and sea floor survey using underwater VDO camera
- Fishing gear and method: Agassi trawl, beam trawl and deep-sea trap

4 **Actual Surveys and Operations for Deep Sea Resources Exploitation**

- Topographic Survey
- Beam-Trawl Operation
- Deep Sea Trap Operation
- Agassiz Trawl Operations
- Sea floor survey using underwater VDO camera

5 **Report the results of the survey/operations**

6 **Discussion and Recommendations**

7 **Conclusion and Closing**

Annex 4B

Activities of the Training Workshop

Date/Program	Activities
15 Oct 2010, Friday	
	Participants arrive at Brunei Darussalam
16 Oct 2010, Saturday	
At Room: Dewan Teratai	
08:30-09:30	Welcome address by Ms. Mariani Haji Sabtu On behalf of Director of Fisheries Department, Negara Brunei Darussalam
	Opening speech by Dr. Chumnarn Pongsri SEAFDEC Secretary General and Training Department Chief
	Introduction of the Training Workshop by Dr. Worawit Wanchana Project Director/Capture Fishery Technology Division Head
09:30-10:00	Group photo and coffee break
At Room: CIC Room	
10:00- 11:00	Background/experience of participant related to deep-sea resource exploration and/or study on impact of fishing to ecosystem as well as expectation from the training workshop. Maximum: 10 min/country - Brunei Darussalam - Indonesia - Malaysia - Myanmar - Philippine - Thailand - Vietnam
11:00-12:30	Scientific thinking and species biodiversity index by Assoc. Prof. Chittima Aryuthaka
12:30-13:30	Lunch break
13:30-14:30	General procedures for sampling, identification and collection management of deep-sea fishes. By Dr. Yoshinobu Konishi
On board activities brief:	
14:30-15:00	Arrangement of activities and sample sorting by Dr. Natinee Sukramongkol
15:00-15:30	Coffee break
15:30-16:00	Bottom topographic survey by Ms. Penchan Laongmanee and Seafloor survey using VDO by Mr. Sukchai Arnupapboon
16:00-16:30	Fishing gear and method: Agassi trawl, beam trawl and deep-sea trap by Mr. Sayan Promjinda and Mr. Narong Ruangsivakul

Date/Program	Activities
17 October 2010, Sunday	
On board training (flexible schedule)	
07:30-08:00	All participant on board M.V.SEAFDEC 2
08:30	M.V.SEAFDEC 2 leave Muara fishing port to station no.1
09:00-09:15	General orientation by Captain Tossaporn Sukrapindha
09:15-10:15	Introduction to invertebrate classification and preservation technique by Dr. Sumaitt Putchakarn
10:15-11:30	Fishing gear preparation (lead by Mr. Sayan Promjinda and Mr. Narong Ruangsivakul)
11:30-13:00	Lunch
13:00-14:00	Topographic survey search for area >200 meter depth (group 1)
14:00-15:00	Beam Trawl at operation 1 (L05°41′.00N λ114°24′.00E)
15:00-17:00	Sampling sorting*
17:00-18:00	Set Deep sea trap (L05°41′.00N λ114°24′.00E)
18 October 2010, Monday	
06:30-07:00	Topographic survey search for area <200 meter depth (group 2)
07:00-08:00	Beam Trawl operation 2 (L05°36′.00N λ114°25′.00E)
08:00-09:00	Sampling sorting*
09:00-09:30	Topographic survey search for area <200 meter depth (group 3)
09:30-10:30	Agassiz Trawl operation 1(L05°36′.00N λ114°25′.00E)
10:30-11:30	Sampling sorting*
11:30-12:00	Topographic survey search for area >200 meter depth (group 4)
12:00-13:00	Agassiz Trawl operation 2 (L05°36′.00N λ114°19′.00E)
13:00-14:30	Sampling sorting*
14:30-16:30	Hauling Deep sea trap
16:30	Sample sorting*
19 October 2010, Tuesday	
07:00-08:00	Setting underwater VDO camera sledge
08:00-11:00	Topographic survey by underwater VDO camera , demonstrate by Mr. Sukchai Arnupapboon
12:00	M.V.SEAFDEC 2 proceed to Muara Fishing port
~17:00	All participant disembark from M.V.SEAFDEC 2
20 October 2010, Wednesday	
At Room: CIC Room	
07:30-10:00	Participant prepare group work result presentation

Date/Program	Activities
10:00-10:30	Coffee break
10:30-12:30	Presentation of group work result (bottom topography, species composition and etc.) ~ 30 min/group - Group 1 - Group 2 - Group 3 - Group 4
12:30-13:30	Lunch
13:30-15:00	Result discussion and recommendation
15:00-17:30	City Excursion
18:00-20:00	Dinner party host by Negara Brunei Darussalam
21 Oct 2010, Thursday	
	All participants back to home country

Annex 4C

List of Documents

Information Papers

INF01	Provisional Prospectus and Agenda
INF02	List of Documents
INF03	List of Participants
INF04	Information Note

Working Papers

WP01	Tentative shipboard training

References (in CD-ROM)

Ref01	Biodiversity survey of seamounts & slopes of the Norfolk Ridge and Lord Howe Rise: Final report to the Department of the Environmental and Heritage (National Ocean Office-Australia, 2006)
Ref02	High seas bottom trawl fisheries and their impacts on the biodiversity of vulnerable deep-sea ecosystem: Option for international action (Matthew Gianni, 2004)
Ref03	Final report: Comparison of rapid methodologies for quantifying environmental impacts of otter trawls (R.A.Coggan, et al, 2001)
Ref04	Micronekton-What are they and why are they important? (Brodeur, et al.)
Ref05	Deep Sea 2003: Conference on the Governance and Management of Deep-sea Fisheries. Part 1: Conference reports (FAO Fisheries Proceeding)
Ref06	Deep Sea 2003: Conference on the Governance and Management of Deep-sea Fisheries. Part 2: Conference poster papers and workshop papers (FAO Fisheries Proceeding)
Ref07	Report of the FAO Workshop on Vulnerable Ecosystem and Destructive Fishing in Deep-sea Fisheries (FAO Fisheries report no. 829)
Ref08	On the deep sea demersal fish communities of the East China Sea (Jinao and Yanhong, 1989)
Ref09	Fauna and zoogeography of deep-benthic Chondrichthyan fishes around the Japan Archipelago (Nakaya and Shirai, 1992)
Ref10	How we fish matters: Addressing of the ecological impacts of Canadian fishing gear. (A.D. Fuller, et al, 2008)
Ref 11	FAO Species identification guide for fisheries purposes. The living marine resources of the Western Central Pacific, Vol. 1 to 6, (1998).

Report of the Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem

M.V. SEAFDEC 2, Brunei Darussalam

16-20 October 2010

PART II
Presentations and Results of the Survey/Operation

Annex 5A: Country Report of Brunei Darussalam

By Mr. Matzaini Haji Juna

INITIATIVES/PROGRAM ON DEEP-SEA FISHERIES RESOURCES EXPLORATION AND THE IMPACT OF FISHING TO DEEP-SEA ECOSYSTEM IN BRUNEI DARUSSALAM

PRESENTED BY

MATZAINI HAJI JUNA
DEPARTMENT OF FISHERIES

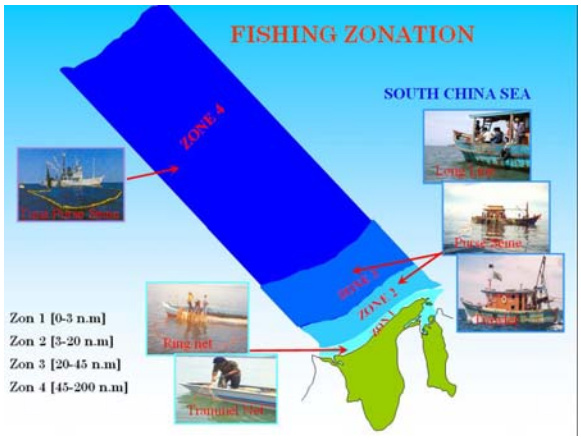
CONTENT

- Introduction
  - Characteristic of offshore area
  - Fishing Zonation
  - Deep Sea Fishing Survey
- Objectives
- Methodologies
- Results
- Impacts
- Conclusion
- Recommendations

CHARACTERISTIC OF OFFSHORE AREA

- Offshore area covers ~75% of the territorial Waters also known as Zone 4;
- Physical features: largely rough with plenty of deep troughs and depth of > 3,000m.
- The 100-200 meter depth is a very narrow strip (about 2 nm) forming the continental edge with an area of about 120 nm² and 40 nm from the shoreline The bottom type is generally muddy on the western side, and rocky on the eastern side.
- The continental slope creeps sharply from the 200 m depth up to about 3,000 m depth of the sea floor towards the Palawan trough that ends in Brunei waters.

FISHING ZONATION



DEEP SEA FISHERIES SURVEY

- The survey is in line with the goal of the Department of Fisheries to assess and determine the fisheries potential of the offshelf marine areas of Brunei Darussalam from the continental edge onwards for sustainable fisheries development.
- Aims to provide the most recent information on the deep sea demersal and pelagic marine resources of Brunei Darussalam
- The Survey is conducted using MV SEAFDEC 2.
- As a supplement information, DoF also engaged Japanese Commercial Fishing Vessel in 2000 and 2001. Gears used were tuna longline, bottom-set gillnet, squid jigs and pots;

PROGRAMMES – MV SEAFDEC 2

- Pelagic Fisheries Survey (Deep Sea)
  - 2004 – 2006
- Demersal Fisheries Survey (Deep Sea)
  - June, 2008
  - March – April, 2009
  - September – October, 2010
  - Overall analysis and finding from above survey

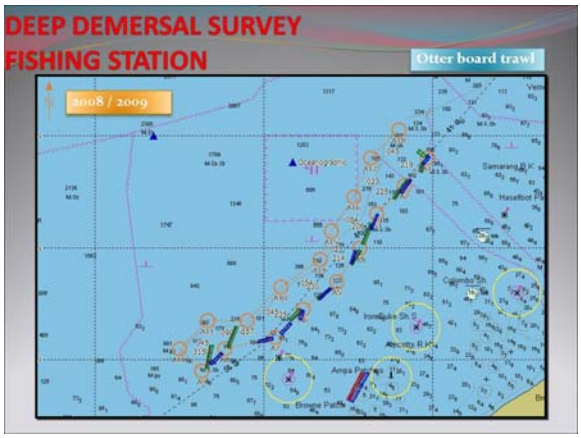
OBJECTIVES

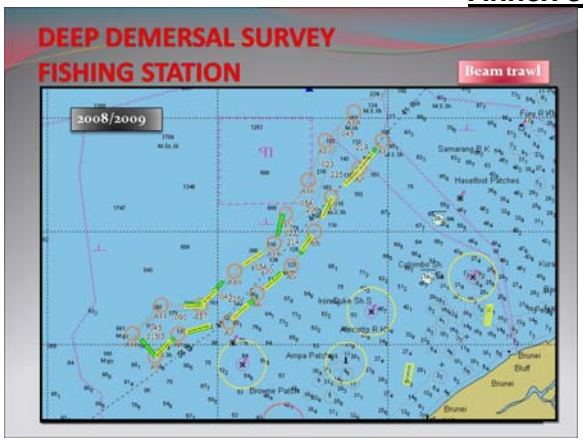
- To assess ecological resources including the **deep demersal and pelagic fisheries resources** in the area that covers zone 3 and 4.
- To assess the health of the marine environment of the demersal fish stocks by conducting oceanographic survey simultaneously with the demersal surveys

METHODOLOGIES

- Oceanographic survey are as follows: iCTD, Bongo net, Neuston net, TSG- Fluorometer and IKMT net
- Demersal Fishes Resources in Zone 3, by using Otter board bottom trawl, Bottom beam trawl and Shrimp Traps.
- Acoustic survey by FQ 80

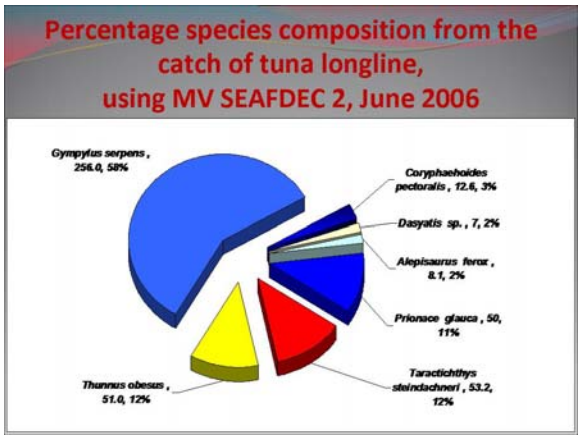
Annex 5A

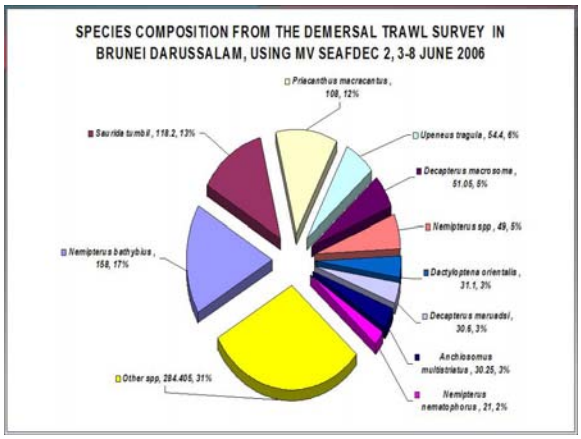




RESULTS

- Oceanographic data reveals healthy and normal conditions of the marine environment.
- Acoustic data revealed the abundance of large pelagics and other benthic resources.





Fishing operation results 2009

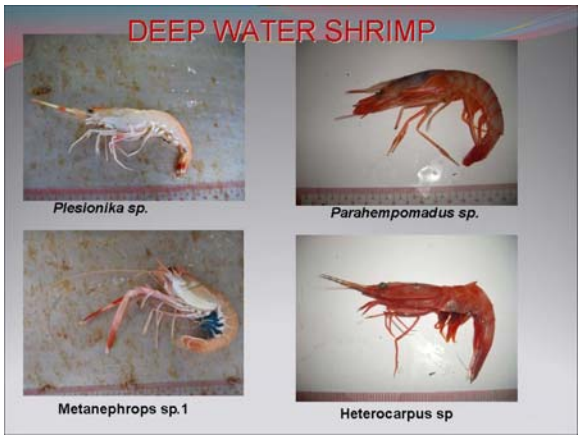
Otter board trawl	Bottom Beam trawl
9(7) Fishing operations	11 Fishing operations
Sea depth 100 – 132 meter	Sea depth 100 – 350 meter
Towing time 30 minutes	Towing time 60 minutes
Ship speed 2.5 – 3.4 knot	Ship speed 2.4 – 3.3 knot
Towing distance 1.5 – 1.9 nm	Towing distance 2.3 – 2.6 nm
Total CPUE 95.65kg/ hrs.	Total CPUE 3.66 kg / hrs.

Annex 5A

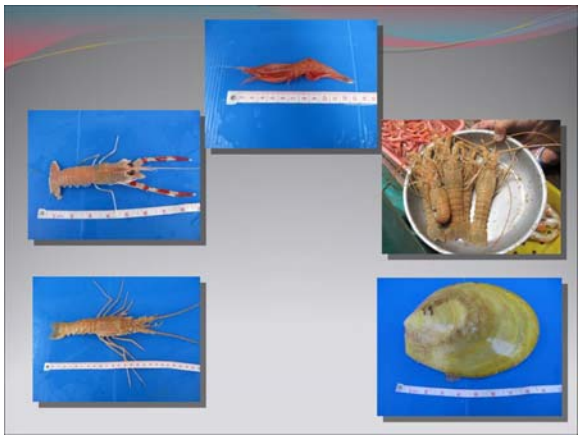

Capture (Otter trawl)


Result of Beam trawl


Result of Beam trawl
Flat fishes
Deep sea Shrimps


DEEP WATER SHRIMP
Plesionika sp.
Parahempomadus sp.
Metanephrops sp.1
Heterocarpus sp

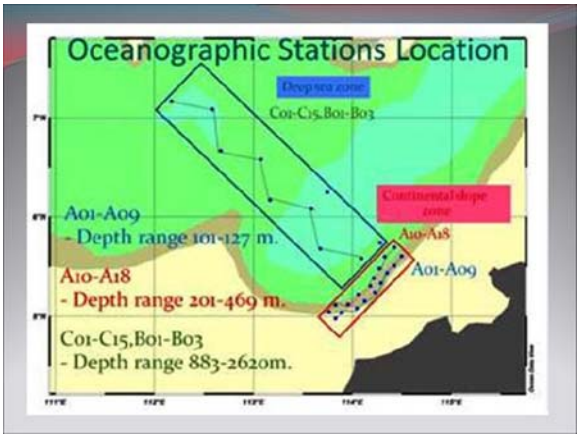

Deep sea fishes

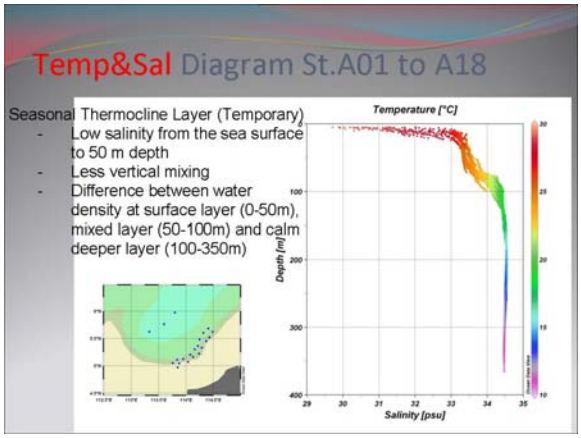



IMPACT OF BEAM TRAWL GEAR


IMPACT OF OTTER BOARD TRAWL GEAR

Annex 5A





CONCLUSION

- Brunei Darussalam has a relatively short history of quantitative and systematic fisheries research especially in the offshelf areas as evidenced by the paucity of published works. Therefore the surveys with MV SEFADEC 2 aim to provide the most recent information that is needed in the rational management of the deep sea resources.
- Valuable oceanographic data were generated to validate previous information collected in the past to determine any changes that can influence the plankton and fish biomass of the marine resources.

CONCLUSION

- The general conclusion based on the preliminary examination of the data shows a good potential for deep water-shrimps in the area. The new discovery poses a challenge to the research group and in view of this, a follow-up survey is recommended to verify the results of the survey.
- Valuable oceanographic data were generated to validate previous information collected in the past to determine any changes that can influence the plankton and fish biomass of the marine resources. Among these are the samples collected by IKMT that provides for the first time a sample of the **back scattering layer in Brunei Darussalam. Thick scattering layer will be further analysis for its potential to fisheries.**

RECOMMENDATION

- It is important to do resource assessment procedures together with oceanografic and marine environment assessment includes the use of hydroacoustic system, the ICTD oceanographic sampler and Bongo plankton net determine any changes that can influence the plankton and fish biomass of the marine resources.
- Any sample from otter board and beam trawl must be taken as a sample for assess the effect of fishing gear to the environment scientifically.

Annex 5B: Country Report of Indonesia

By Mr. Bram Setyadji

Annex 5B

DEVELOPMENT OF DEEP-SEA FISHERIES RESEARCH IN INDONESIA

BRAM SETYADJI
RESEARCH INSTITUTE FOR MARINE FISHERIES
JAKARTA, INDONESIA

INTRODUCTION

- Approx. 2/3 of the region are covered by water
- Deep sea research are so far limited

1. High Cost
2. Lack of expert related

- One of the challenge and opportunity research on the fishery is the ability of science and technology for exploiting and developing of new commodities or frontier commodities as an alternative utilization of marine fishery resources in the future

DEEP SEA RESEARCH (FROM TIME TO TIME)

1. INDIAN OCEAN

- 1972 and 1975 with the assistance from Fisheries Research and Development Agency Office of Fisheries, Busan, Korea (Indian ocean – Southern Java)
- 1979-1981, Government of Indonesia, The Federal Republic of Germany, the Commonwealth of Australia and the FAO/UNDP as Coordinating Agency through the Jetindofish Project. (Indian Ocean - Southern Lombok Island to Eastern Timor)
- 1980, Government of Indonesia and the FAO/SCSDEVPRO (Southern and Western Sumatera)
- 2004-2005, Research Institute for Marine Fisheries (RIMF) of the Government of Indonesia had in association with Overseas Fishery Cooperation Foundation (OFCF) of Japan (South of Java and West of Sumatera)

DEEP SEA RESEARCH (FROM TIME TO TIME)

2. BANDA AND ARAFURA SEA

- 1992 and 1993, using RV Baruna Jaya-I (700 GT) of Agency for The Assessment and Application of Technology, Indonesia
- 1993, Research on fishing technique of deep sea trap
- 2000-2004, Investigation of bottom longline fishing of the Arafura Sea continental slope

DEEP SEA RESEARCH (FROM TIME TO TIME)

3. TIMOR SEA

- 1993, RV Baruna Jaya-I (700 GT). The survey was conducted in slope waters between 200 m to 1000 m deep extending from Timor trench

4. SULAWESI SEA

- 2010, INDEX SATAL 2010: Indonesia-USA Deep Sea Exploration of the Sangihe Talaud Region. It was a joint research between Indonesian and U.S. Government, involving 2 Research vessels, RV Baruna Jaya IV and Okeanos Explorer.

T.E.R.I.M.A.K.A.S.I.H.

Annex 5C: Country Report of Malaysia

By Mr. Jamil B. Musel

Annex 5C

DEEPSEA DEMERSAL EXPLORATION SURVEYS IN EEZ MALAYSIA , SABAH AND SARAWAK.

Jamil Musel

INTRODUCTION

- The implementation of the Malaysia Exclusive Economic Zone (EEZ) in 1981, extended the fishing grounds beyond traditional area.
- The state of Sarawak, Sabah and Federal Territory Labuan are separated from Peninsular Malaysia by the South China Sea and have a combines EEZ of approximately 250,000 km².
- This is 46% of the total EEZ area of Malaysia at 548,800km² .
- The EEZ of Sarawak is the largest within Sabah and Federal Territory Labuan, which is at 160,000km².

- The first fisheries resources survey in the EEZ of Malaysia was conducted from 1985-1987 (R.V.RASTRELLIGER)
- The second survey was carried out from 1996-1997 (K.K.MANCHONG)
- The objectives of both survey is to estimate the demersal and semi pelagic/pelagic fish biomass and potential in the waters of the Malaysian EEZ,
- covering the west and east coast of Peninsular Malaysia, as well as in the South China Sea area off Sarawak and Sabah.
- The third survey was conducted in 2004-2005 off EEZ Sarawak water area also using K.K. Manchong.
- The main objective of the third survey was to assess the resource of the area more than 30nm offshore, which has been exploited by deep sea vessels.

- In the year 2005, a survey in the untrawlable area within 180 meter depth were conducted in Sarawak water and this survey was carried out using MV SEAFDEC 2,
- The objective of this survey is to assess the fish stock and resources in untrawlable area.
- Beside the EEZ survey, two tuna surveys in Sabah and Sarawak water were conducted in 2008 using the KP2 YELLOWFIN vessel owned by the National Agriculture Training Council (NATC).
- The latest survey was conducted in 2010 off EEZ Sarawak water area also using K.K. Manchong and MV SEAFDEC 2.

OBJECTIVES

- The objective of the survey was to assess the resources of in Sabah and Sarawak Waters.
- To investigate species diversity and distribution of un-exploited resources i.e. demersal and pelagic fish resources by using beam trawl and the other gears.

MATERIALS AND METHODS

- **1. Resource abundance**
  - **MV SEAFDEC 2**
  - **KK Manchong**
  - **Beam trawl**
  - **Other gears**
  - **Swept area method & Other method**

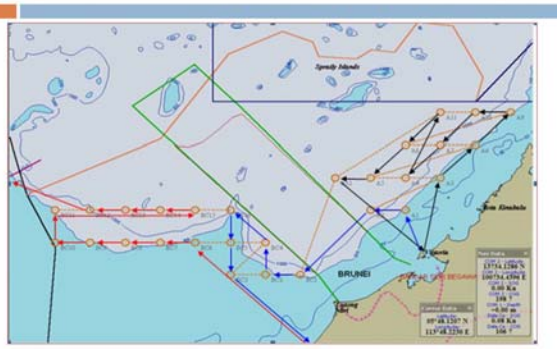
MATERIAL AND METHOD

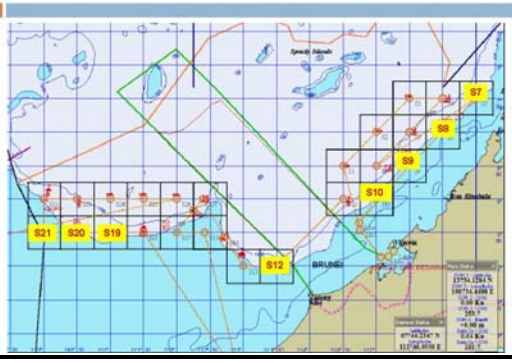
- **2. Biological research**
  - **For dominant species in the catch, take 100 individuals randomly and measure their L-W**
  - **For potential target species, select 20 individuals randomly for detailed measurements (L-W, stomach cont., maturity stage)**
  - **Every species caught is to be recorded in an electronic media with a digital camera.**

Survey area for demersal deepsea EEZ Malaysia, Sabah and Sarawak.

Annex 5C

Survey stations for Beam Trawl





Sampling Equipment – Beam Trawl

Catch Composition - Beam Trawl

Sampling Equipment – Trap

Catch Composition - Trap

Sampling Equipment - PLL

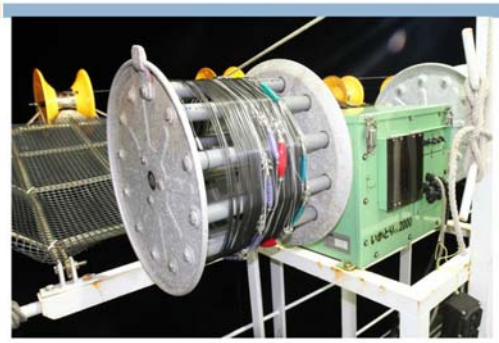
Catch Composition - PLL

Annex 5C

Sampling Equipment - BVL

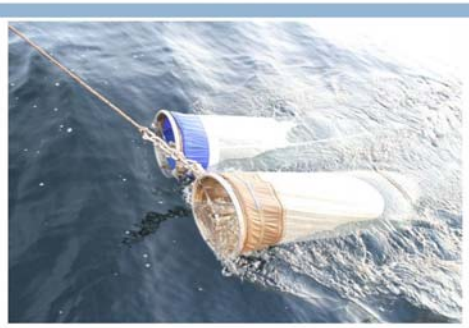
Catch Composition - BVL

Sampling Equipment – Squids jigging



Catch Composition – Squids Jigging

Sampling Equipment – Bongo Net

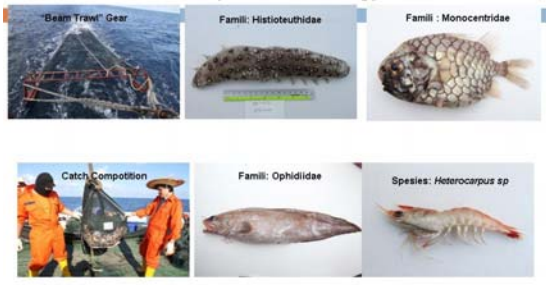


Catch Composition – Bongo Net

RESULTS – Beam Trawl

- **SPECIES & CATCH COMPOSITION**
- **About *150* species of fish belonging of about *58* families were identified from the catches within 8 station of trawl operation.**

Photos Activities (KK Manchong)



Annex 5C


Photos Activities
(MV SEAFDEC 2)
"Beam Trawl" Gear
Sample Management
Famili: Ophidiidae
Fishes Sample
Deep sea Shrimps
Catch Composition
Spesies: Heterocarpus sp


Thank you
For Your Attention

Annex 5D: Country Report of Myanmar

By Mr. Han Win

Annex 5D

Country Report of DoF Myanmar
for the Training Workshop on Research Methodologies for The study on Impact of Fisheries to Deep-sea Ecosystem

-Introduction
-Marine Fisheries resources
-Information of Deep-sea Fishing
-Commercial fishing in deep sea
-Present Survey in EEZ of Myanmar
-Conclusion

Intoduction

- The length of coastline (2832km)
- 3 Cosatal Region
- -Rakhine Coastal Region(740km)
- -Ayeyarwady Delta and Gulf ofMottama Coastal Region(460km)
- -Taninthari Coastal Region (1200 km)
- continental shelf -230,000sq.km
- Territorial sea-12 nm from the base line
- EEZ-200 nm-from the base line
- Total area of marine fisheries waters(486-000 sq.km)

Marine Fisheries Resources

(Marine Fisheries Resources survey and Exploratory Fishing Project, assistance of FAO during197983, within200 meter depth)
- -Acoustic experimental fishing survey
- -Trawl survey

-Biomass
- -1.0mmt of pelagic fish
- -0.8mmt of demersal fish

-MSY
- -0.5mmt of pelagic fish
- -0.55mmt of demersal fish
- -totaling 1.05 mmt

Marine Fisheries Resources

- Possesses a considerable diversity of habits
- A crucial role
  - -in Marine fish production of foods
  - -improvement of income
  - -generating of employments and foreign exchange
- Third as in national economy
- Growing production in marine fish
- 1.17mmt in 1999-2000 to 1.37mmt in 2009-2010
  - -Only from the coastal marine fisheries resources/within 100meter depth
- Resources in beyond 100m depth and EEZ (under utilize resources)
- To exploit gave permission to228 foreign fishing vessel in 2009-10
- For the long-term sustainable use of coastal fisheries
  - -Aims to extent utilization of EEZ resources encouraging to national fishing industry/ vessels
  - -hard to consider on impact of fishing to deep-sea ecosystem
  - -But less information of deep-sea fishing / further studies will be needed

---

Information of deep-sea fishing in Myanmar

- Two experimental long line deep-sea shark fishing / off the Tenasserim coast (taninthari)/ depth zone of 200-600meter
  - -In 1986 two species of deep sea shark were caught
  - -The second, in 1987,23 species were collected
- In 1990 One joint survey, Thai Government and Myanmar Government, using FRTV-CHULABHORN, Research vessel of DoF thailand
  - -Fishery Biological Survey
  - -Acoustic Survey
  - -Oceanographic Survey
- 12 Bottom Vertical Longline (7 days)
- 9696 hooks were used, total yield 709 kg- catch rate of 7.3kg/100hooks
- The deeper water, beyond 100m depth line (16kg/100hooks)showed a higher catch rate than in the shallow water
- Dominant species consisting of 59.70% *Lipochelus carnolabrum* and 24.67% *Epinephelus radiatus*
- A complete classification of 34 families and 63 species

Information of deep-sea fishing in Myanmar

- Some important commercial species

1. *Lipocheilus carnolabrum* (Yellow snapper)
   - -Average catch rate 1.68kg/100hooks
   - -Average size 38.0cm
   - -At the depth of 130-140 meter
2. Carangoides spp.(trevally)
   - -Average catch rate 1.71kg/100hooks
   - -Average size 54.0cm
   - -At the depth of 50-100 meter
3. *Epinephelus radiatus* (banded grouper)
   - -Average catch rate 0.87kg/100hooks
   - -Average size 43.0cm
   - -At the depth of 100-400 meter

Commercial fishing in deep-sea

- Three foreign fishing vessel (longline fishing) in Rakhine Coastal Region in 2000, target fish Tuna

The monthly catch of Tuna longline fishing

vessel	February(kg)	March (kg)	April (kg)	May (kg)
Vessel-1	-	10558	6070	-
Vessel-2	-	23534	26277	-
Vessel-3	7132	21561	23066	22061
total	7132	55653	55313	22061

Present survey in EEZ of Myanmar

- The National Research Survey in the EEZ of Myanmar, between SEAFDEC/TD and DoF, Myanmar, was conducted by MV.SEAFDEC-2 in 1Feb to 15 March (43days) 2007
  - -Covering along the eastern coast of Myanmar's continental shelf within EEZ
  - -74 station of Oceanographic survey
- 2 types of fishing gears namely BT, and PPL survey
  - -BT Survey for demersal resources is separated into 2 part
  - -Upper gulf of Mataban (Mottama), eastern central part of continental shelfCatch composition from 17 station of BT
  - -A total of 1,459.42 kg from16h 14min
  - -113 fish species
  - -Highest catch rate of demersal fish species was *Saurida undosqumis* (20.03% by weight)
- The PPL Survey economic pelagic fish in the deeper zone, at the upper part of Andaman Sea, will be respond by SEAFDEC/TD

Annex 5D

Expecting from the training workshop

- to be known and broadened in knowledge on the status of deep sea resources and condition of fishing ground in the Southeast Asia water, what kind of fishing methods and gears would be impacted to Vulnerable Marine Ecosystem.
- to gain a chance to study on the ways fishing Gear operating method, and selecting and using it on the depth and bottom condition of fishing ground, and target species, and the facts which are consisted of data collecting of standard survey by lecture and practical work
- To know related material which should be studied and involved in fisheries exploration and before exploitation of fisheries resources.(ecosystem, marine organism
- To have an experience in the facts / steps of drawing are search plan

Annex 5E: Country Report of the Philippines

By Mr. Remar Asuncion

Annex 5E

Deep-Sea Fish:
The BFAR Experience

"Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep - Sea Ecosystem"

16 – 20 October 2010
Negara Brunei Darussalam

Remar Asuncion
Master Fisherman, M/V DA-BFAR
Bureau of Fisheries and Aquatic Resources
Philippines

Outline:

- M/V DA-BFAR's Experiences with deep sea survey
  - Collaborators
  - Collection Gears
  - Coverage
  - Fish Species Collected (photos)
- References
- Retention/Preservation
- **Network of Fish Taxonomist / Technical Support for ID**

Experience:

Three deep-sea exploration onboard M/V DA-BFAR conducted under the Project "Census of Marine Life" - Focused on Taxonomical and Morphological studies on the deep-sea benthic fauna.

Panglao Expedition (2005)
Aurora-Baler Expidition (2007)
LuMiWan Expidition (2008)

- In May 2008, Survey for deep-sea survey with fisheries approach was conducted onboard with SEAFDEC Member Countries along the outskirts of Lingayen Gulf.

Depth Covered:

Panglao Expedition **(May 22 – 31, 2005)**
62 - 2,217 meters
77 collecting operations

Aurora-Baler Expidition **(May 18-June 5, 2007)**
42 - 2,253 meters
112 collecting operations

LuMiWan Expidition **(March 19 – April 02, 2008)**
105 - 2,249 meters
68 collecting operations

Lingayen w/ SEAFDEC **(May 11 -25, 2008)**
358 - 882 meters
14 operations

Collaborators:

CENSUS OF MARINE LIFE

Collection:

Gear	Dimensions	General Specifications
Beam Trawl	4 m (Beam) X 0.35 m (Height of shoe)	•Kept open by 6' X 6' heavy duty wooden Beam attached to iron runners at both ends •Fine-meshed end cupable of holding muddy substrates. •Lead-line/sinkerline is also of chain to allow digging in the substrate. •Towed for 30-60 min on the seafloor depending on the topography
Otter Trawl	15 m. Lead line	•Kept open by two metal otter boards. •With 4-ply cod-end

Catch Pics...

Interesting Species...

Annex 5E

Interesting Species…

Barathronus sp.; this gelatinous specimen is probably undescribe. The genus falls under family Aphyonidae that lives below 700 meters.

Bathypterois guntheri; also known as tripod fish, eyes are very small and almost blind.

Iprops agassii ; only few specimens have been collected from Pacific. Almost blind, their eyes were degenerated and were covered with skin.

Ref. Aurora 2007 Cruise Rep. Kwang-Tsao Shao, Yun-Chin Liao, Academia Sinica, Taipei

Major References:

"Experiences and Thru Specimens Gathered During the deep-sea explorations conducted onboard the vessel"

Retention/Preservation of Specimens:

- Collected specimens of Deep Sea Fish, Crustaceans and other invertebrates for proposed BFAR-Museum are on display at BFAR-NMFDC Laboratory Building.
- This will serve as the Bureaus outreach material for Academic and research institutions.

Network of Fish Taxonomist / Technical Support for ID:

at National Level:

- Fisheries Academes
- BFAR Taxonomist – Coastal Fishes Only
- NGO's
  Rudy Reyes, INCOFish, FishBase Project, Los Banos, Laguna, Philippines

Int'l Links:

Dr Tin-Yam CHAN, **National Taiwan Ocean University, Keelung**
Mao-Yin LEE, **Academia Sinica, Taipei**
Dr Yunn-Chih LIAO, **Academia Sinica, Taipei**
Dr Cia-Wei LIN, **National Taiwan Ocean University, Keelung**

Thank you very much…

Annex 5F: Country Report of Thailand

By Mr. Pirote Naimee

Annex 5F

Deep Sea Fishery in the Andaman Sea Thailand

National paper prepared

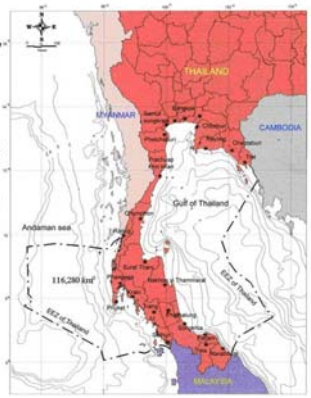
By

Pirote Naimee

Department of Fisheries, THAILAND

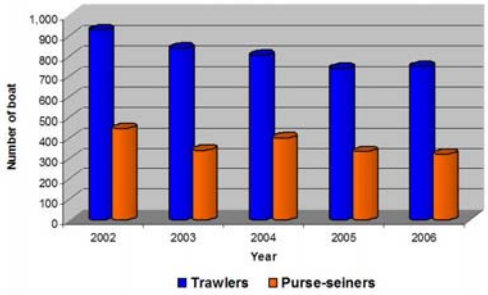
Fishing ground in the Andaman Sea, Thailand

- The coastline of Thailand along the Andaman Sea is approximately 945 km
- The EEZ of the country in this area are estimated 116,280 km^2
- Marine fisheries comprise
  - inshore fisheries
  - offshore fisheries
  - oversea fisheries



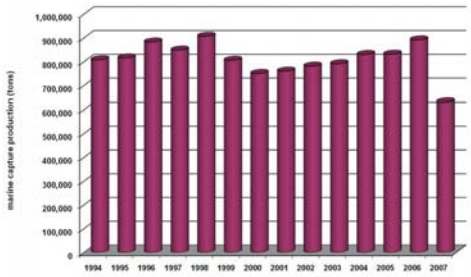
Inshore Fishery Status in the Andaman Sea

- Number of trawlers and purse-seiners in the Andaman Sea during 2002-2006



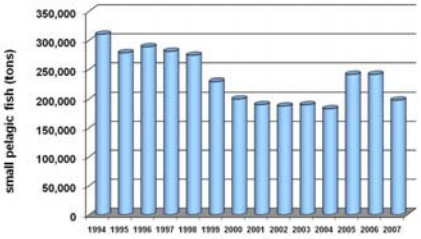
Inshore Fishery Status in the Andaman Sea

Marine capture production during 1994-2007



Inshore Fishery Status in the Andaman Sea

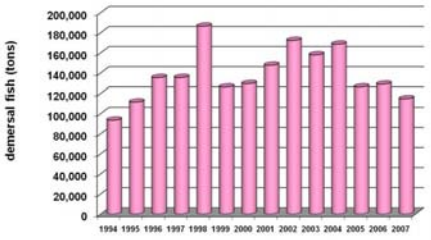
During 1994-2007,the main component of catch was
- small pelagic fish (22-38% of total catch)



small pelagic fish

Inshore Fishery Status in the Andaman Sea

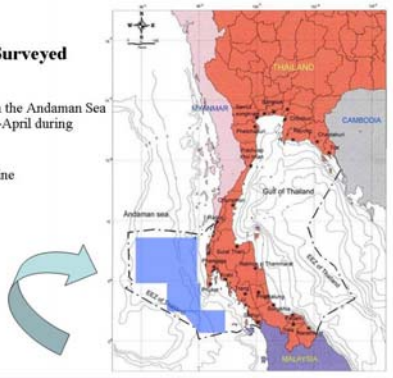
During 1994-2007 the main component of catch was
- demersal fish (12-21% of total catch)



demersal fish

Offshore Fishery Surveyed

The research survey area in the Andaman Sea were conducted in January-April during the year 1991-2008 with
- pelagic longline
- bottom vertical longline
- and deep sea trap

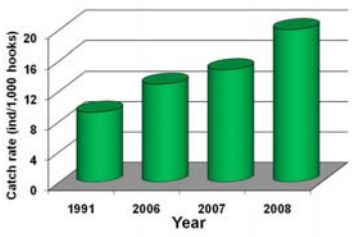


The research survey area in the Andaman Sea

Offshore Fishery Surveyed

Pelagic Longline Catch rate

- 9.2 number/1,000 hooks in 1991
- 12.9 number /1,000 hooks in 2006
- 14.8 number/1,000 hooks in 2007
- 20.0number/1,000 hooks in 2008

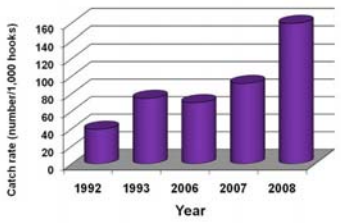


Annex 5F

Offshore Fishery Surveyed

Bottom Vertical Longline

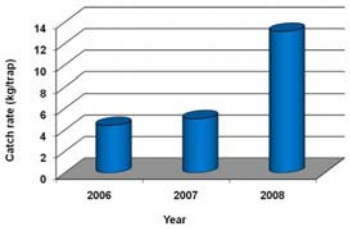
- Operate on rough bottom with rocky feature or else corral reef structure
- Sea depth was in the range of 70-200 m.
- The majority of fish caught were groupers and snappers



Offshore Fishery Surveyed

Deep Sea Trap

- Operated on the continental shelf of the Andaman Sea
- Catch rate
  4.42 kg/trap in 2006
  5.05 kg/trap in 2007
  13.14 kg/trap in 2008



Annex 5G: Country Report of Vietnam

By Mr. Nguyen Van Hung

Annex 5G

Overview research on deep-sea in Vietnam

Presentation: Hung Van Nguyen
Officer – Capture of Fisheries Management Division – Department of Capture Fisheries and Resources Protection (DECAFIREP)

1. Overview

- The research resources and ecosystem on deep-sea of Vietnam is very limitation
- It has not research topic on this issue, special impact of fishing on deep-sea marine ecosystem.
- Vietnam has about 16 thousand vessels capture fisheries on off-sea but the fishing grounds are normally distributes in shallow water around 50m

- It has not report on the biodiversity of benthic fauna on deep-sea
- Marine fish of Vietnam has the characteristics as being small. It found 2030 the salt – water fish species on Vietnam's sea, including 1075 pelagic fish and 995 demersal fish
- Total marine fish biomass of Vietnam is at about 3.8-4.4 milion tons with the fishing capacity of 1.5 to 1.7 milion tons

2. Main gear used in Vietnam

- The type of fishing gear used in Vietnam's sea include: gills net, trawl net, push net, purse net, long line
- Capture on deep-sea: gills net and long line
- The trawl didn't operate on deep-sea because fishing technology not allow gear operation at depth beyond 100 meter
- Bottom ecosystem of deep –sea hardly impact of fishing

3. Species of fishing

- The species captured on deep-sea essential pelagic fish as tuna, mackerel, round scad, jach mackerel, billfish, marlin,…
- Average yield: 600 thousand tons/year

4. Direction development in the future

- Have research topic on marine and ecosystem on deep-sea
- Development fishing technology on deep – sea
- Enhance collaboration capture fisheries with other country

Thank you !

Annex 6: Scientific Thinking and Species Biodiversity Index

By Dr. Chittima Aryuthaka

Annex 6

Self - introduction

name : Chittima Aryuthaka

education :

D.SC. in Marine Biology, Kyushu Univ

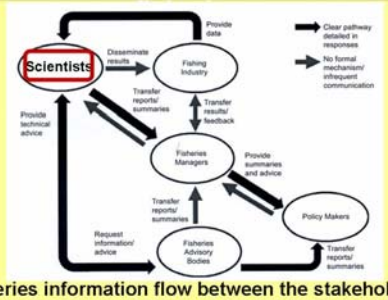
Thesis – Taxonomy and ecology on free – living marine nematodes in *Zostera marina* bed, Amakusa, Japan

Self - introduction

career: Associate professor
Department of Marine Science
Faculty of Fisheries Kasetsart Univ.

main teaching subjects:
Marine Ecology,
Marine Benthic Community,
Reproductive Strategies of Marine Benthc
Research methods in marine science

necessary of scientific information in



Fisheries information flow between the stakeholders (Soomai, 2010)

What is scientific procedure & why do we need to follow the procedure ?

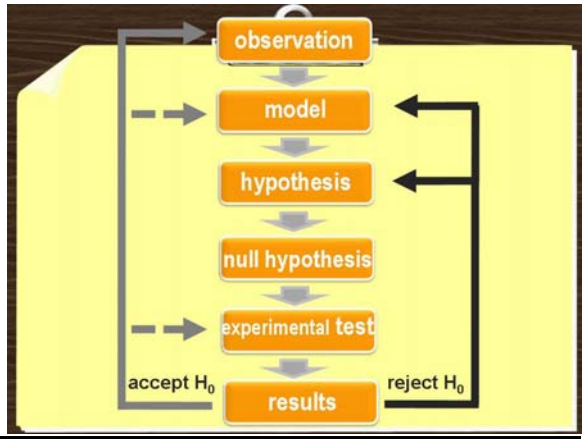
How do scientists define criteria for result decision ?

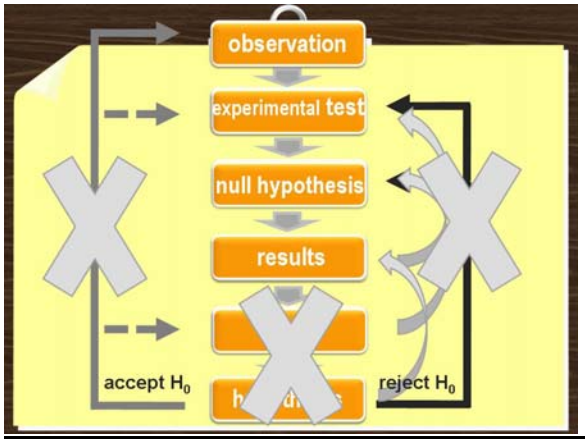
Statistical test

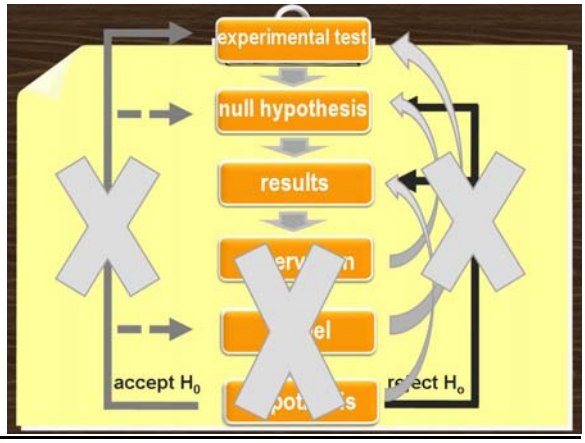
Analysis of Variance (ANOVA)

Biological diversity

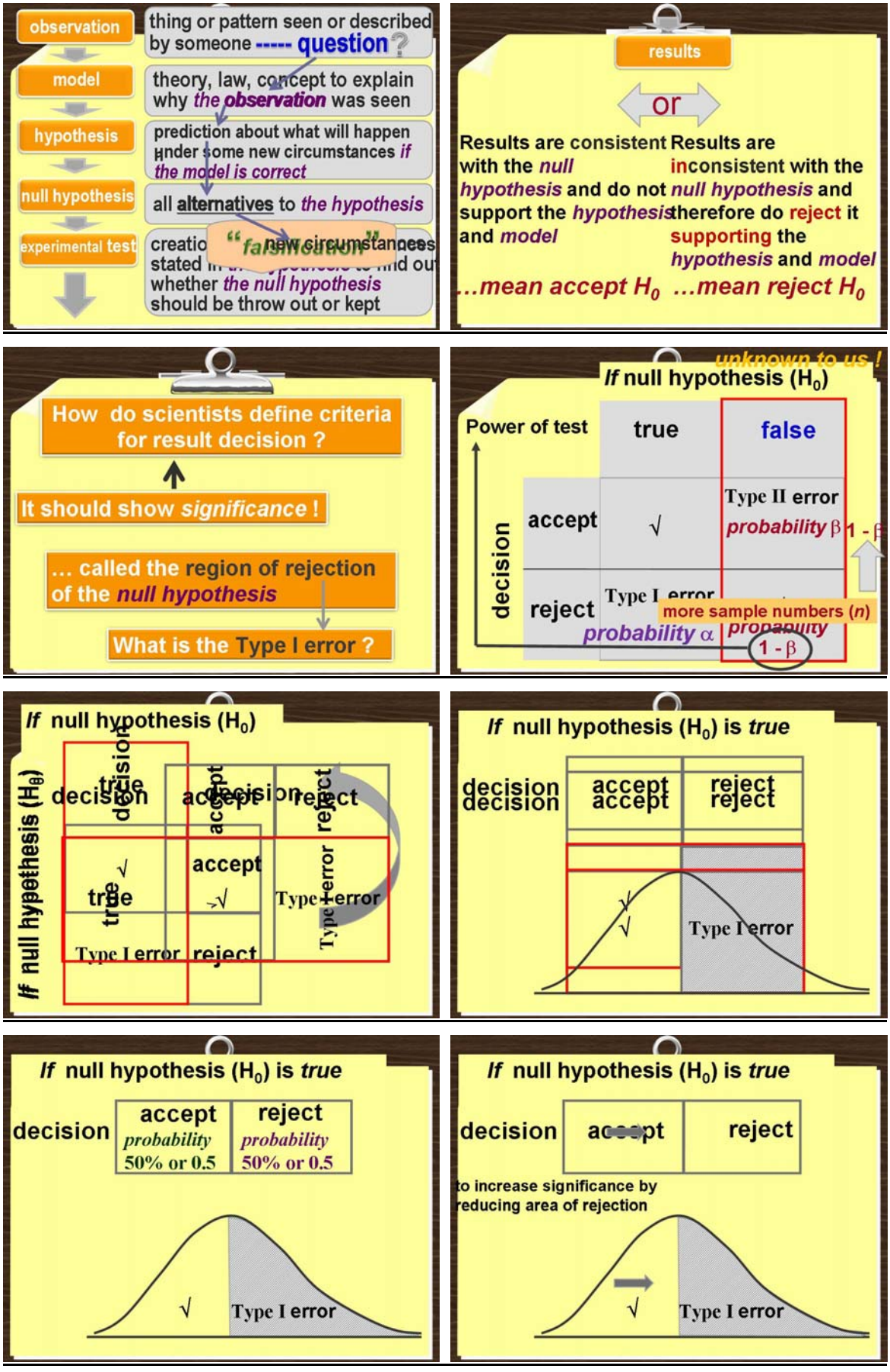
Logical process in scientific research







Annex 6


observation
thing or pattern seen or described by someone ----- question ?
model
theory, law, concept to explain why the observation was seen
hypothesis
prediction about what will happen under some new circumstances if the model is correct
null hypothesis
all alternatives to the hypothesis
experimental test
"falsification"
new circumstances
whether the null hypothesis should be throw out or kept
results
or
Results are consistent with the null hypothesis and do not support the hypothesis and model
Results are inconsistent with the null hypothesis and therefore do reject it supporting the hypothesis and model
...mean accept H_0
...mean reject H_0
How do scientists define criteria for result decision ?
It should show significance !
... called the region of rejection of the null hypothesis
What is the Type I error ?
unknown to us !
If null hypothesis (H_0)
Power of test
true
false
decision
accept
reject
Type II error
probability β
1 - β
Type I error
probability α
more sample numbers (n)
1 - β
If null hypothesis (H_0)
If null hypothesis (H_0) is true
decision
accept
reject
probability
50% or 0.5
Type I error
to increase significance by reducing area of rejection

Annex 6

If null hypothesis (H_0) is *true*

decision | accept | reject

probability 95% or 0.95

* * *highly significant*
α = 0.01
* *significant*
Type I error
α = 0.05

ANOVA : Analysis of Variance

F - value in *F* - distribution

accept *null hypothesis* (H_0)

* reject *null hypothesis* (H_0)

α = 0.05

F calculation

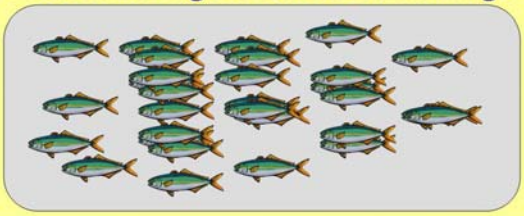
$F_{0.05}$ *F* calculation

F - value

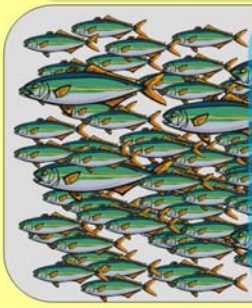
small large

Statistical tests

any of several tests of the statistical significance of findings



Statistical tests



fish population

size of [illegible] in the population

collecting fish samples and measure size

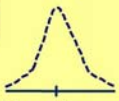
parameter

Numerical characteristic of a population computed using every element in the population. For example, the *mean* and the mode are parameters of a population.

variable

something that is changed or altered in an experiment. Having no fixed quantitative value measured from samples. For example, length, weight of fish, density etc.

parametric tests



- *location parameter* (μ)

determines where the origin will be located. If μ is positive, the origin will be shifted to the right, and if μ is negative, it will be shifted to the left.

used this parameter comparing among different populations to test null hypothesis

parametric tests

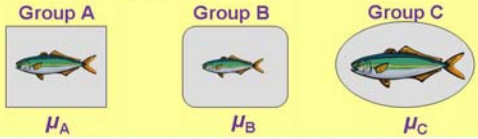
- *dispersion parameter* (σ^2)

or called a scale parameter, since its value determines the "scale" or statistical dispersion of the probability distribution. If σ^2 is large, then the distribution will be more spread out; if σ^2 is small then it will be more concentrated.

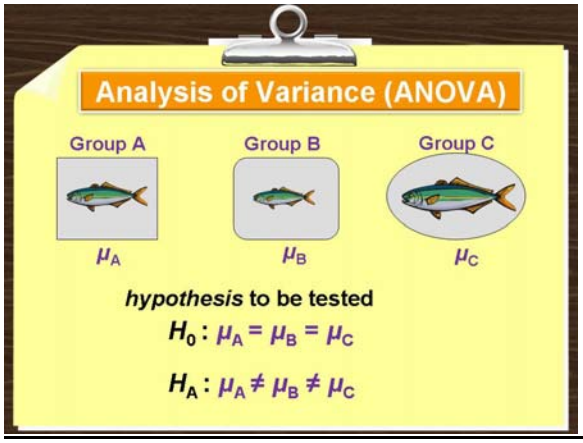
used its ratio for calculation of *F-value* in statistical test : Analysis of Variance (ANOVA)

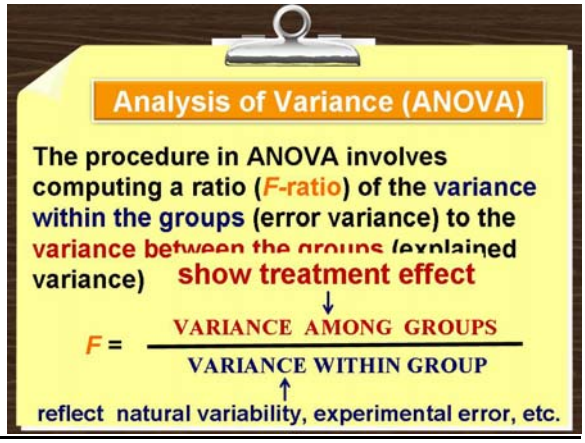
Analysis of Variance (ANOVA)

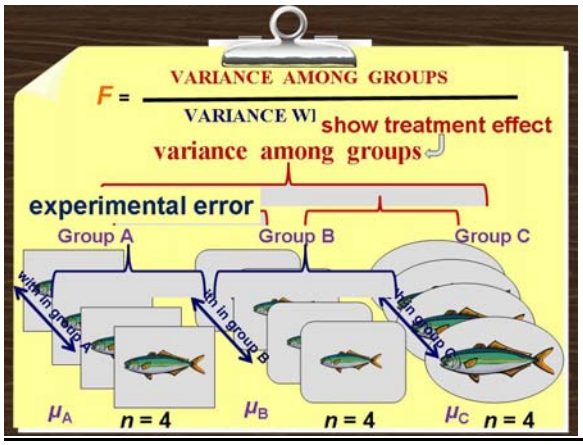
A test (null hypothesis : H_0) of the statistical significance of the differences among the mean scores of more than two groups (or populations)

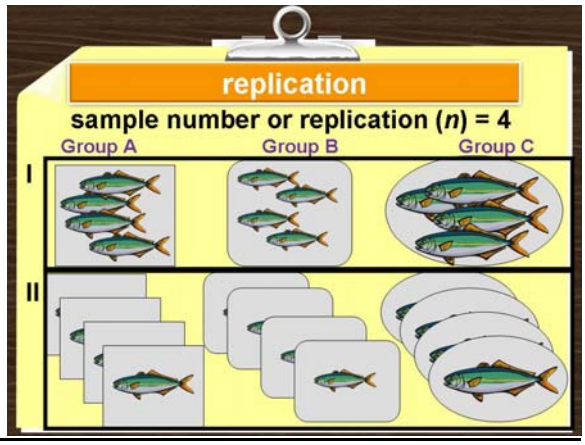


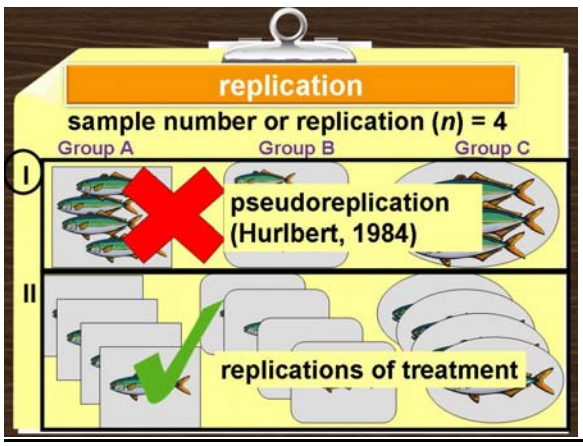
Annex 6

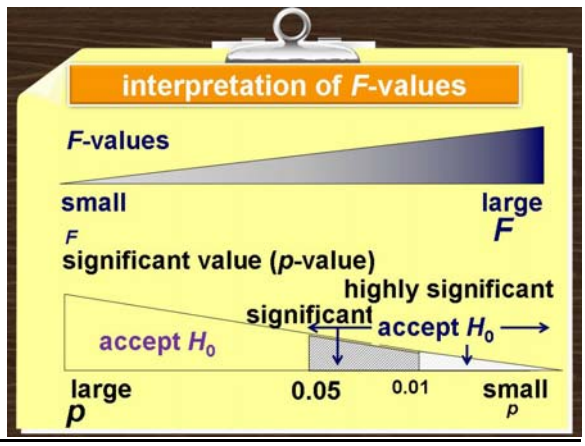

Analysis of Variance (ANOVA)
Group A
Group B
Group C
μ_A
μ_B
μ_C
hypothesis to be tested
$H_0: \mu_A = \mu_B = \mu_C$
$H_A: \mu_A \neq \mu_B \neq \mu_C$

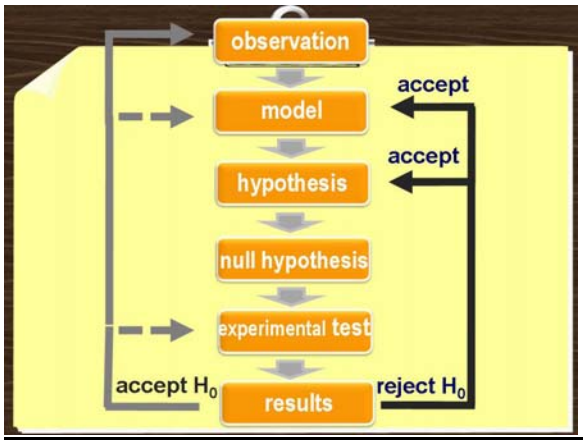

Analysis of Variance (ANOVA)
The procedure in ANOVA involves computing a ratio (*F*-ratio) of the variance within the groups (error variance) to the variance between the groups (explained variance)
show treatment effect
$F =$ VARIANCE AMONG GROUPS / VARIANCE WITHIN GROUP
reflect natural variability, experimental error, etc.

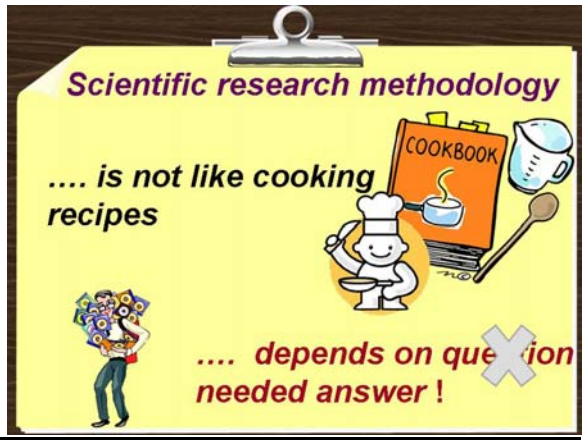

$F =$ VARIANCE AMONG GROUPS / VARIANCE WI
show treatment effect
variance among groups
experimental error
Group A
Group B
Group C
μ_A $n = 4$
μ_B $n = 4$
μ_C $n = 4$


replication
sample number or replication (*n*) = 4
Group A
Group B
Group C
I
II


replication
sample number or replication (*n*) = 4
Group A
Group B
Group C
I
II
pseudoreplication (Hurlbert, 1984)
replications of treatment


interpretation of *F*-values
F-values
small
large
F
significant value (*p*-value)
highly significant
significant
accept H_0
accept H_0
large
p
0.05
0.01
small
p


observation
model
hypothesis
null hypothesis
experimental test
results
accept
accept
accept H_0
reject H_0


Scientific research methodology
.... is not like cooking recipes
COOKBOOK
.... depends on question needed answer !

biological diversity

the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

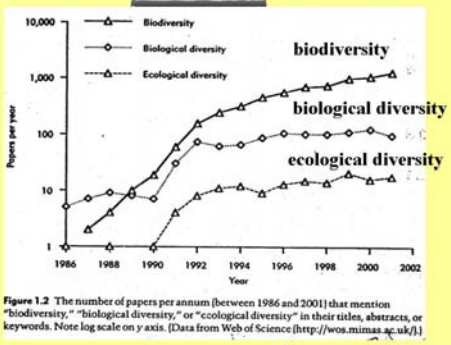
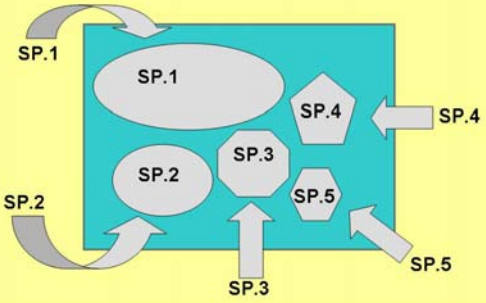


Figure 1.2 The number of papers per annum (between 1986 and 2001) that mention "biodiversity," "biological diversity," or "ecological diversity" in their titles, abstracts, or keywords. Note log scale on *y* axis. (Data from Web of Science (http://wos.mimas.ac.uk/).)

Magurran, 2004

SPATIAL DISTRIBUTION



Species diversity

- Species richness (number of species)

any value depending on occurrence species found in the samples

1. species numbers depending on :
   - individual numbers
   - sample size and sample number
2. Margalef's index

$$D_{Mg} = \frac{(S - 1)}{\log N}$$

S = total numbers of species
N = total individual numbers

evenness increases diversity

- increasing evenness → greater diversity
  - –true for all indices

Species diversity index

Shannon diversity index (H')

$$p_i = \frac{n_i}{N}$$

k = species numbers in each sample

$$H' = -\sum_{i=1}^{k} p_i (\log p_i)$$

the relative abundance of each species

species evenness

species richness

unit of index
$\log_2$ " bit "
ln " nat"
$\log_{10}$ " decit"

Pielou's evenness value

$$J' = \frac{H'(observed)}{H'_{max}}$$

H'_{max} the index is maximized when each species is present in equal numbers

$$H'_{max} = \ln S$$

	St.1	St.2	St.3	St.4	St.5	St.6
Sp.1	20	40	40	100	120	160
Sp.2	20	32	40	65	45	34
Sp.3	20	25	40	28	24	4
Sp.4	20	20	40	1	4	1
Sp.5	20	18	40	1	2	1
Sp.6	20	16	0	1	1	0
Sp.7	20	14	0	1	1	0
Sp.8	20	13	0	1	1	0
Sp.9	20	12	0	1	1	0
Sp.10	20	10	0	1	1	0
Sp.11	0	0	0	0	1	0
Sp.12	0	0	0	0	1	0
Sp.13	0	0	0	0	1	0
Sp.14	0	0	0	0	1	0
Sp.15	0	0	0	0	1	0
Sp.16	0	0	0	0	1	0
Sp.17	0	0	0	0	1	0
Sp.18	0	0	0	0	1	0
Sp.19	0	0	0	0	1	0
Sp.20	0	0	0	0	1	0
total abun.	200	200	200	200	200	200

	Highest value	High value	Medium value	Medium value	Medium value	Low value
	St.1	St.2	St.3	St.4	St.5	St.6
H'(loge)	2.30	2.21	1.61	1.17	1.15	0.61
no of species	M 10	M 10	L 5	M 10	H 20	L 5
Evenness (J')	H 1.00	H 0.96	H 1.00	L 0.51	L 0.39	L 0.38
dominant sp.	no	no	no	yes	yes	yes

Results of analysis of species diversity indices

Species composition & abundance of macrobenthos in Phuket seagrass bed

Annex 6


conclusion
Good observation
Good reading
Good study design
Good data quality
Good finding
Thank you for your attention
Sawasdee ka

Annex 7: General Procedures for Sampling, Identification and Collection Management of Deep-Sea Fishes

By Dr. Yoshinobu Konishi

General Procedure for Identification and Collection Management of Deep-sea Fishes

Content

- Research on the fisheries resources exploration of deep-sea bottom fishes and impacts of the fishing to the ecosystem
- General procedure for identification and collection management of deep-sea fishes

Yoshinobu KONISHI

(Retired from the Seikai National Fisheries Research Institute in Nagasaki, Japan in 2009)

Topographic recognition of deep-sea demersal fisheries in the Southeast Asian region

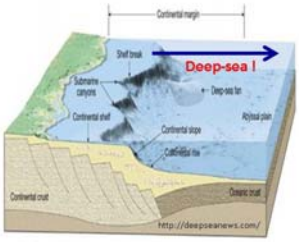


Fig. by Matsushita at the deep-sea meeting in 2009

- **100 – 200 m depth** (shelf break area) due to low utilization for demersal fisheries
- ◎ **200 m depth –** (international standard on deep sea area) important demersal fishes inhabit in continental slope area (200 - 500 m depth)

* Note: 1) fish fauna is different between the shelf break and continental slope areas, 2) the fauna in the shelf break area is nearly same as that in the coastal area less than 100 m depth.

Deep sea ranging from 200 – 1000 m depth and past surveys on deep-sea demersal fisheries resources exploration in the region

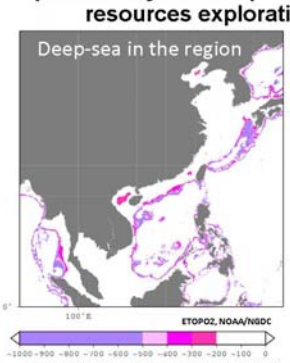


Fig. by Matsushita at the deep-sea meeting in 2009

Main surveys after 1980

- Brunei Darussalam (SCS)
- Indonesia (W-N of Sumatra Isl., S of Java Isl.)
- Malaysia (off Sarawak & Sabah)
- Myanmar (Andaman Sea)
- Philippines (Luzon, Mindro, Palawan, Lingayen Gulf etc)
- Thailand (Andaman Sea)
- Vietnam (off the central Vietnam)
- SEAFDEC-TD (Brunei waters, Sabah & Sarawak waters, Andaman Sea)

Some important demersal fishes for deep-sea fisheries in the region

Alfonsino (***Beryx splendens***)
Photo by Satria at the deep-sea meeting in 2010

Seapearch (***Malakichthys wakiyae***)

Deep-water snapper (***Etelis radiosus***)
Photo by Satria at the deep-sea meeting in 2010

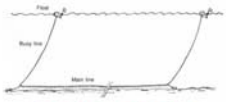
Rattail (***Caelorichus*** sp.)

Mirror dory (***Zenopsis nebulosa***)
Photo from *Fishbase*

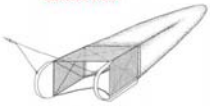
Roughy (***Hoplostethus crassispinus?***)
Photo by Satria at the deep-sea meeting in 2010

Some fishing gears for deep-sea demersal fishes

Bottom trawl



Bottom horizontal longline



Beam trawl

Trap

Note: gear(s) to be used is depending on the sea bed topography and substratum, and has fish-size and species selectivity.

Expected impacts of deep-sea demersal fisheries to the bottom ecosystem

- Destruction of the vulnerable ecosystem (corals, sponge, starfish and sea urchin)
- Reduction of stock size of targeted fishes and then collapse of the resources by the high fishing pressure
  Deep-sea fishes: slow growth, long life span, late mature age
- Simplicity of the biodiversity in marine organisms such as fishes and crustacea, that enable to be captured by fisheries
- Structural change of the ecosystem

Toward to the fisheries resources exploration of deep-sea demersal fishes and their management in the Southeast Asian region [1/2]

Early-step subjects

1. Identification of possible fishing grounds by topographic and substratum surveys and fish echo surveys with the echo sounder (mainly at 200-500 m depth area)
2. Identification of commercially important fishes and crastacea by fishing surveys with various gears, and acquisition of their spatial distributions and abundances (including fish larvae and juveniles)
3. Mapping of possible fishing grounds for each fishing gear and important species
4. Identification of the aggregated vulnerable-ecosystem organisms by visual surveys with a drop camera system and ROV to set the fishing preserve for conservation of the ecosystems

Toward to the fisheries resources exploration of deep-sea demersal fishes and their management in the Southeast Asian region [2/2]

Middle- and long-term subjects

5. Growth, recruitment, reproduction (spawning season) of important fish species as the basic information for the fisheries management
6. Fish food web, and physical and biological environment for understanding the structure and interaction of the ecosystem
7. Monitoring of the fish and crastacea diversities and abundances of the targeted species for the precautionary fisheries management
8. Development and improvement of fishing gears for reduction of the incidental catch of untargeted fishes and impacts to the vulnerable ecosystems
9. Life-history study of vulnerable-ecosystem organisms

Procedure of fish collection

1 Sampling of deep-sea fishes
- on-board sampling with sampling gears
- fish-market sampling

2 Handling of fish specimens
- freezing
- cold storage with ice
- preservation in 10% formalin solution

3 Identification
- photography
- muscle sampling for DNA analysis

4 Collection management
- registration of specimens in database
- storage of registered specimens in the dark and cool space, and the tissues in refrigerater

◎ *Request of identification for unknown specimens*

2. Handling of fish specimens

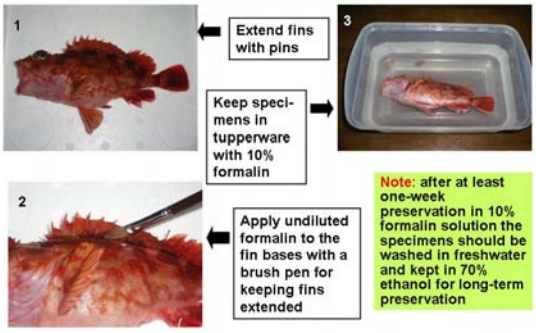
Freezing (on board)
- Specimens are kept frozen until identification in laboratory
- To avoid drying the specimens, each of them is better to be kept into a plastic bag or be covered with wrap

Cold storage with ice (on board, at fish market)
- Specimens are kept in a cooler with ice until identification in laboratory

Preservation in 10% formalin solution (on board, at fish market)
- Under no freezer or limit of capacity of the freezer at specimen sampling/handling, the specimens should be preserved in 10% formalin solution
- Muscle tissues in right-side body of specimen to be registered in database should be sampled before preservation with formalin

Note: specimens which have characteristic body color and/or pigment patterns on the fin membranes are better to be taken photo prior to the handling above

Preservation of specimens in 10% formalin solution



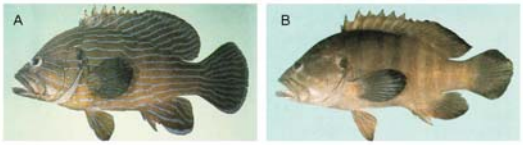
Note: after at least one-week preservation in 10% formalin solution the specimens should be washed in freshwater and kept in 70% ethanol for long-term preservation

Example of characteristic body color and pigment on body and fins

A part of key to Indo-Pacific species of *Cephalopholis* (from FAO species catalogue, vol. 16)

7a. Pectoral fins short, their length contained 1.5 to 1.8 times in head length; color generally brown or yellowish brown, with dark blue lines on head, body and fins (Fig. A) ·····*C. formosa*

7b. Pectoral fins 1.3 to 1.6 in head length; body brown, usually with 7 or 8 dark bars; no blue lines on head or body; fins dark brown, with a pale blue line at corners of caudal (Fig. B) ·····*C. boenak*



3. Identification (laboratory work)

Identification
- Defrosting of frozen specimens prior to identification (sometimes from one-day before)
- Identification of specimens with references

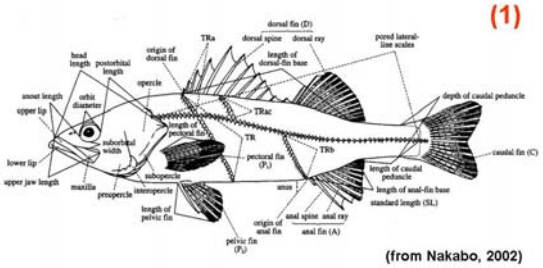
Photography
- Taking pictures of important specimens scientifically

Tissues sampling for DNA analysis
- Sampling of muscle in the right-side body for specimens to be registered in database

* DNA analysis is useful for verification of the original identification and larval fish identification

Preservation of specimens
- Preservation of fresh specimens in 10% formalin solution for collection (the specimens should be transferred into 70% ethanol 1 week to 1 month later)

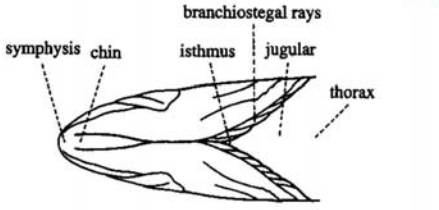
External characters of bony fish and methods of measuring (1)



(from Nakabo, 2002)

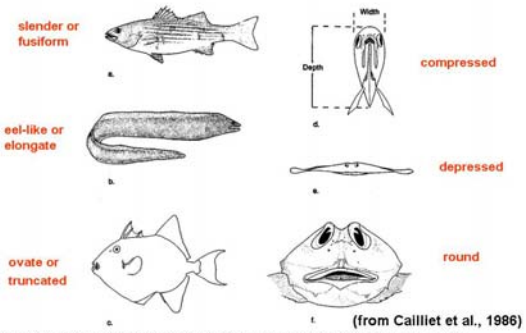
Nakabo, T. (ed.) 2002: Fishes of Japan with pictorial keys to the species, English edition. Tokai University Press, Tokyo, 1749 pp.

External characters of bony fish and methods of measuring (2)



(from Nakabo, 2002)

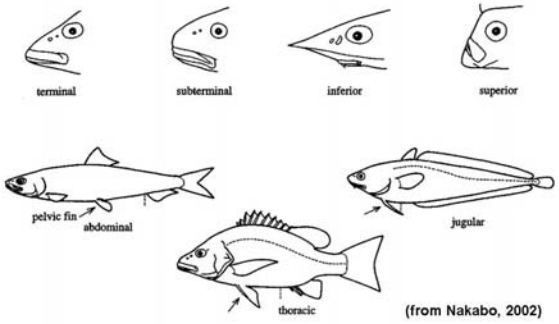
Body shapes of bony fish



(from Caillliet et al., 1986)

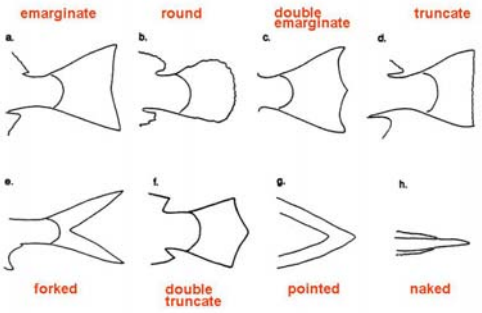
Caillliet, G. M., Love, M. S. and Ebeling A. W. 1986: Fishes. Field and laboratory manual on their structure, identification, and natural history. Wadsworth Publishing Company, California, 194 pp.

Position of mouth and pelvic fins



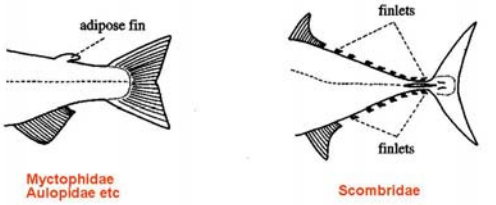
(from Nakabo, 2002)

Caudal fin forms



(modified Cailliet et al., 1986)

Adipose fin and finlets



Myctophidae
Aulopidae etc

Scombridae

Adipose fin is membranous.
Finlet has fin element (like ray).

(from Nakabo, 2002)

Methods of measurements

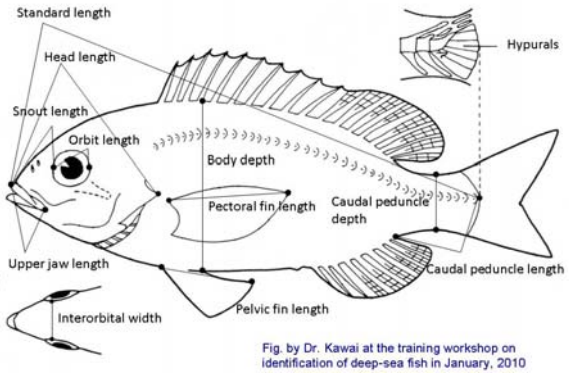


Fig. by Dr. Kawai at the training workshop on identification of deep-sea fish in January, 2010

Methods of counts

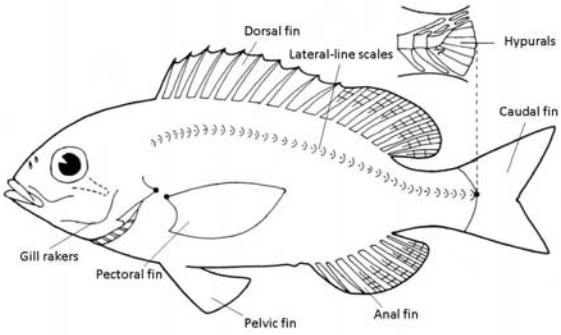
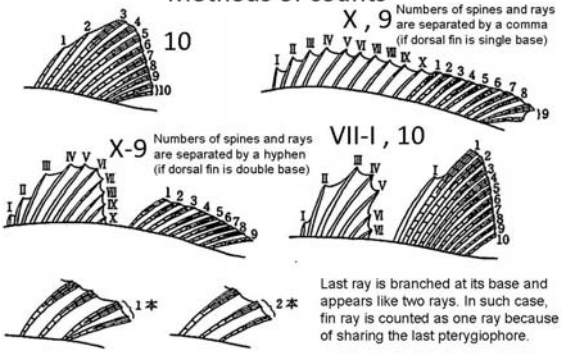


Fig. by Dr. Kawai at the training workshop on identification of deep-sea fish in January, 2010

Methods of counts

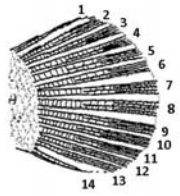


Last ray is branched at its base and appears like two rays. In such case, fin ray is counted as one ray because of sharing the last pterygiophore.

Spines: Roman numerals Soft rays: Arabic numerals

Fig. by Dr. Kawai at the training workshop on identification of deep-sea fish in January, 2010

Principal caudal fin counts



Branched rays +Two unbranched rays

12+2=14

Fig. by Dr. Kawai at the training workshop on identification of deep-sea fish in January, 2010

Some useful references for identification of fishes in the Southeast Asian region

http://www.fao.org/docrep/009/x2400e/x2400e00.HTM

Nakabo, T. (ed.) 2002: Fishes of Japan with pictorial keys to the species (English edition). Tokai University Press, Tokyo, 1749pp.

Heemstra, P. C. and J. E. Randall. 1993: Groupers of the world (family Serranidae, subfamily Epinephelinae). FAO Fisheries Synopsis, no. 125, vol.16, 382pp.

FishBase:
http://www.fishbase.org/
Catalog of Fishes:
http://research.calacademy.org/ichthyology

Photography and tissues sampling

Photos:
Pristigenys niphonia (upper)
Callanthias japonicus (lower)

Tissues samples in 90% ethanol

- Cut a small piece of muscle in the right-side body (two pieces/specimen)
- Put the piece and a label into a vial with 90% ethanol
- Keep a tupperware with vials in a refrigerator as tissues collection

4. Collection management

- registration of specimens into database
- storage of the registered specimens in the dark and cool space, and the tissues samples in refrigerator

Input items of database
- catalogue (bottle) number
- genus name
- species name
- no. of individuals
- min. body length (mm)
- max. body length (mm)
- TL/FL/SL
- body weight (g)
- family name
- order name
- sampling position/place
- sampling date
- sampling gear/method
- sampling person
- identification person
- vial no. of tissues

Preserved specimen and a water-proof label (catalogue no., species, sampling position, sampling date, family)

Storage shelf

Package of specimens for request of identification

Fig. 1

Fig. 2

1. Roll a specimen by wet gauze with the preserved solution (Fig. 1)
2. Put the specimen into a reinforced plastic bag (Fig. 2)
3. Seal the opening portion of the plastic bag by impulse sealer
4. Put the plastic bag with the specimen into another plastic bag and seal the outside plastic bag

Package of specimens for request of identification

Fig. 3

Fig. 4

5. Roll the double plastic bag with the specimen by plastic sheet with air cells
6. Put the specimen rolled by plastic sheet into a box (Fig. 3)
7. Cover the box with hard paper and stick a sticker of "Scientific specimen of fish preserved" (Fig. 4)
8. Send the parcel (or EMS) with the specimen and its data to an expert

On-board works in the deep-sea demersal fish survey

For each sampling station and gear

1. Sorting and identification
2. Measurements of number and weight of captured fishes for each species including the unknown specimens
3. Body length punching of at least 50-100 specimens for the selected species
4. Taking photos for the selected species, in particular fishes with the characteristic body color and pigment patterns, and the unknown specimens
5. Freezing/icing or preservation by 10% sea water-formalin for 50-100 specimens of the selected fishes for detailed and precise examination in the laboratory (including the unknown specimens)

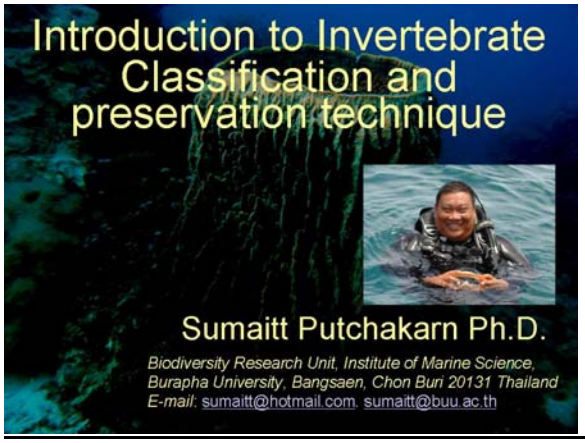
Until the end of the survey cruise

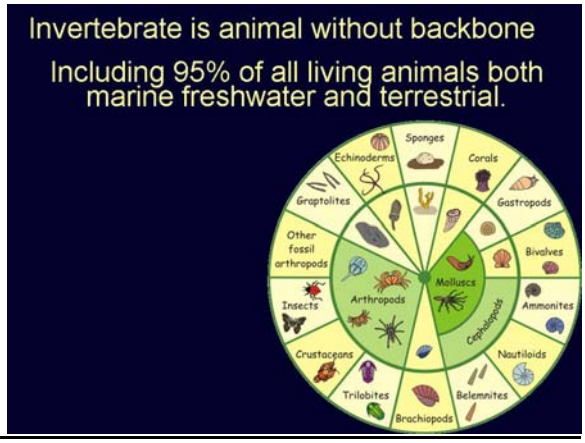
6. Making the catch data table with gear operation data and the size composition figures

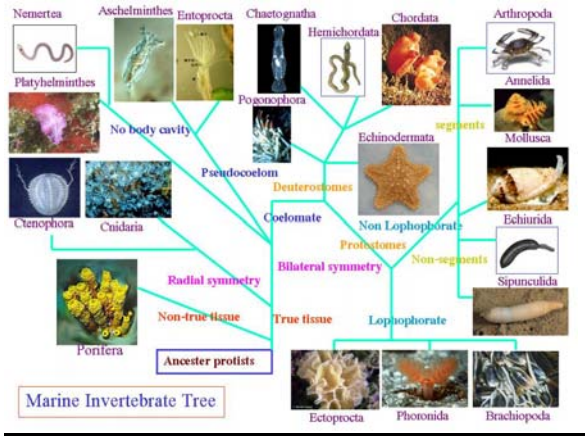
Dishes with unfamiliar deep-sea fishes at the taste party

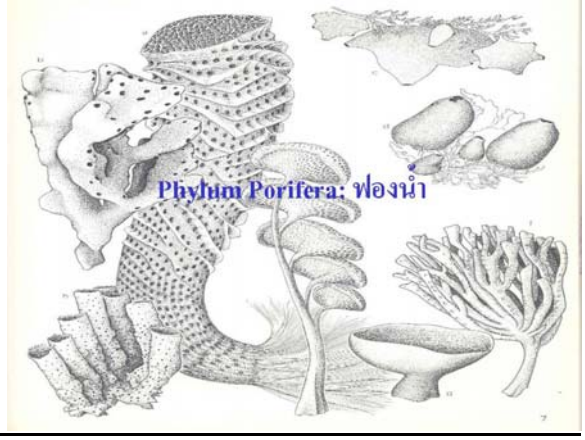
Annex 8: Introduction to Invertebrate Classification and Preservation Technique

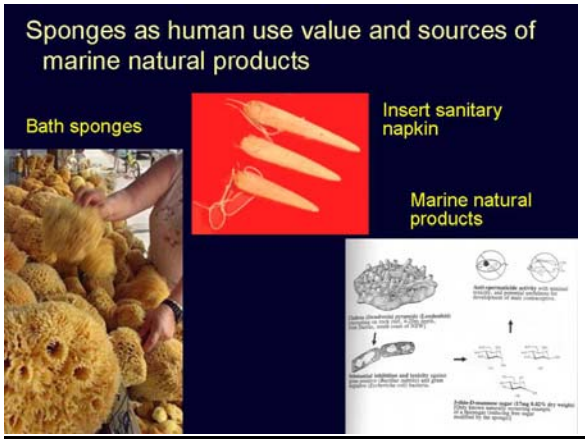
By Dr. Sumaitt Putchakarn

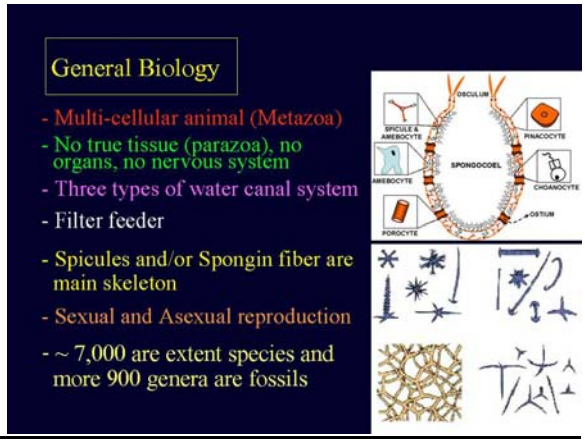

Introduction to Invertebrate Classification and preservation technique
Sumaitt Putchakarn Ph.D.
Biodiversity Research Unit, Institute of Marine Science, Burapha University, Bangsaen, Chon Buri 20131 Thailand
E-mail: sumaitt@hotmail.com, sumaitt@buu.ac.th

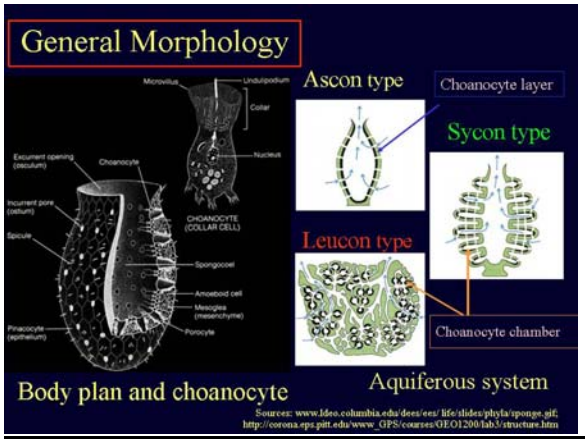

Invertebrate is animal without backbone
Including 95% of all living animals both marine freshwater and terrestrial.
Sponges
Corals
Gastropods
Bivalves
Ammonites
Nautiloids
Belemnites
Brachiopods
Trilobites
Crustaceans
Insects
Other fossil arthropods
Graptolites
Echinoderms
Molluscs
Arthropods
Cephalopods

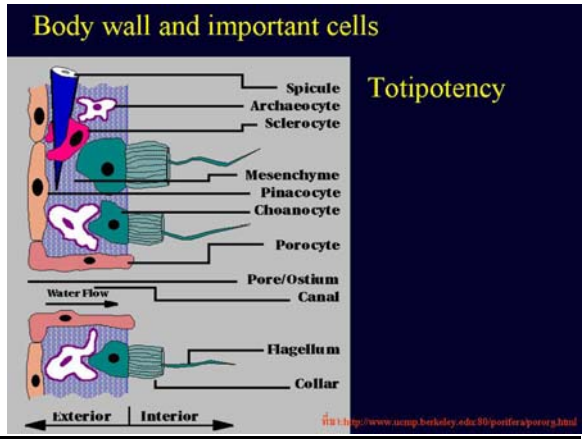

Nemertea
Aschelminthes
Entoprocta
Chaetognatha
Hemichordata
Chordata
Arthropoda
Platyhelminthes
Annelida
Pogonophora
No body cavity
segments
Mollusca
Echinodermata
Pseudocoelom
Deuterostomes
Ctenophora
Cnidaria
Coelomate
Non Lophophorate
Echiurida
Protostomes
Non-segments
Bilateral symmetry
Sipunculida
Radial symmetry
Non-true tissue
True tissue
Lophophorate
Porifera
Ancester protists
Marine Invertebrate Tree
Ectoprocta
Phoronida
Brachiopoda


Phylum Porifera: ฟองน้ำ

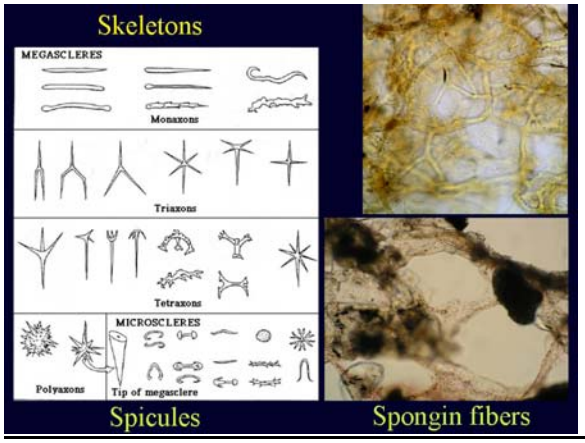

Sponges as human use value and sources of marine natural products
Bath sponges
Insert sanitary napkin
Marine natural products

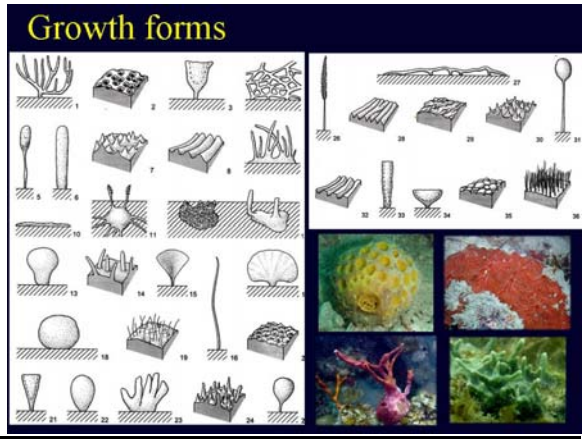

General Biology
- Multi-cellular animal (Metazoa)
- No true tissue (parazoa), no organs, no nervous system
- Three types of water canal system
- Filter feeder
- Spicules and/or Spongin fiber are main skeleton
- Sexual and Asexual reproduction
- ~ 7,000 are extent species and more 900 genera are fossils
OSCULUM
SPICULE & AMEBOCYTE
PINACOCYTE
SPONGOCOEL
AMEBOCYTE
CHOANOCYTE
POROCYTE
OSTIUM

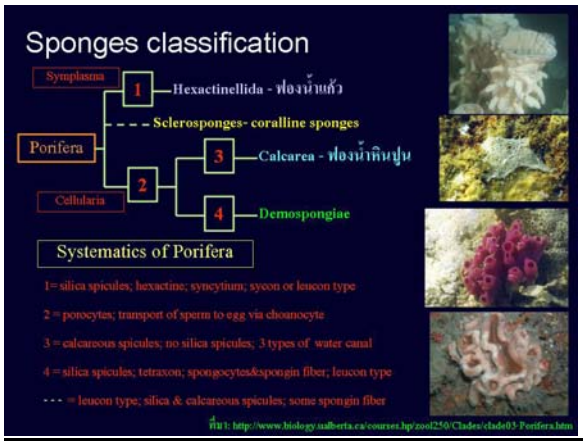

General Morphology
Ascon type
Choanocyte layer
Sycon type
Leucon type
Choanocyte chamber
Body plan and choanocyte
Aquiferous system

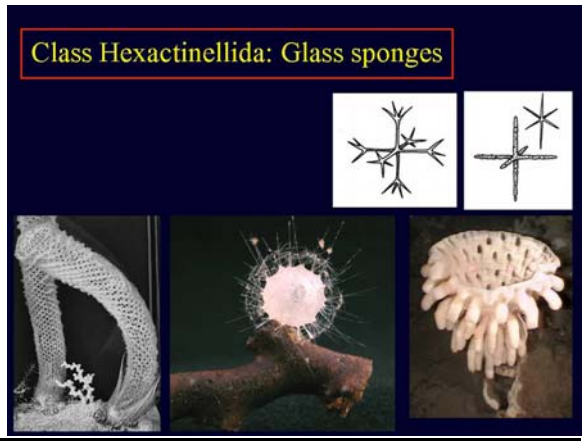

Body wall and important cells
Spicule
Archaeocyte
Sclerocyte
Mesenchyme
Pinacocyte
Choanocyte
Porocyte
Pore/Ostium
Canal
Water Flow
Flagellum
Collar
Exterior
Interior
Totipotency

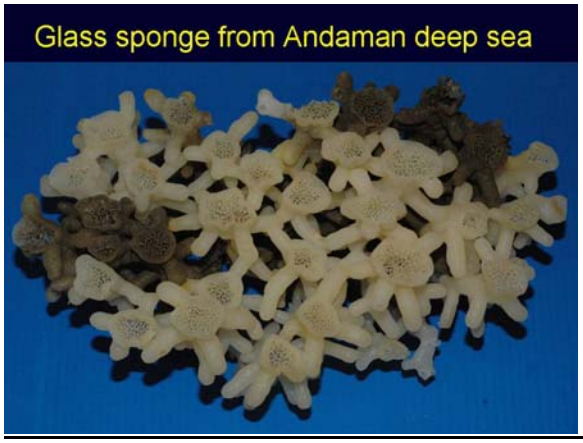
Annex 8

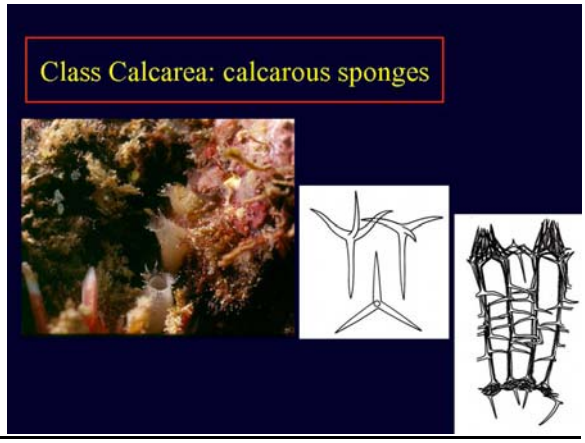

Skeletons
MEGASCLERES
Monaxons
Triaxons
Tetraxons
MICROSCLERES
Polyaxons
Tip of megasclere
Spicules
Spongin fibers

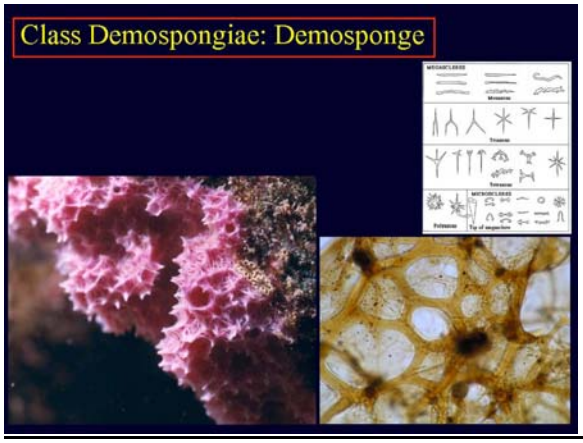

Growth forms


Sponges classification
Symplasma
1
Hexactinellida - ฟองน้ำแก้ว
Sclerosponges- coralline sponges
Porifera
3
Calcarea - ฟองน้ำหินปูน
2
Cellularia
4
Demospongiae
Systematics of Porifera
1= silica spicules; hexactine; syncytium; sycon or leucon type
2 = porocytes; transport of sperm to egg via choanocyte
3 = calcareous spicules; no silica spicules; 3 types of water canal
4 = silica spicules; tetraxon; spongocytes&spongin fiber; leucon type
- - - = leucon type; silica & calcareous spicules; some spongin fiber
ที่มา: http://www.biology.ualberta.ca/courses.hp/zool250/Clades/clade03-Porifera.htm


Class Hexactinellida: Glass sponges

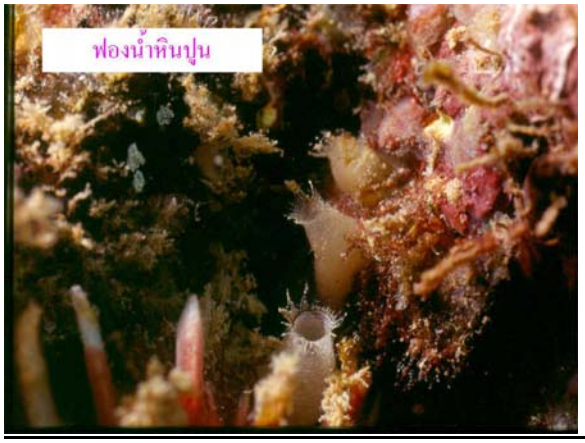

Glass sponge from Andaman deep sea


Class Calcarea: calcarous sponges


Class Demospongiae: Demosponge


Class Demospongiae: Coralline sponge

Annex 8


ฟองน้ำหินปูน

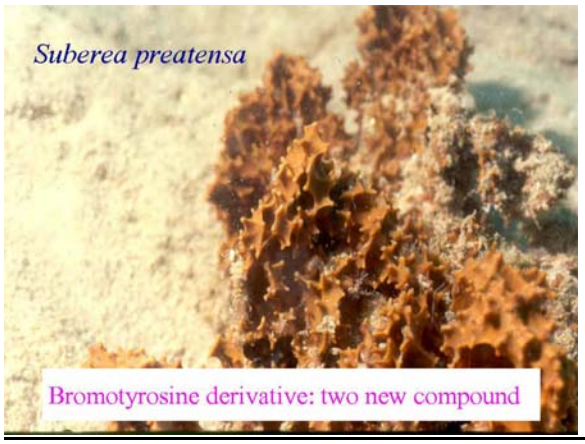

ฟองน้ำหินปูน


ฟองน้ำหินปูน


ฟองน้ำเคลือบหินสีน้ำตาล


ฟองน้ำลูกกอล์ฟ


Tetilla japonica
Tetrahydrofurylhydro-xypyran-2-one: two new compounds


Suberea preatensa
Bromotyrosine derivative: two new compound


ฟองน้ำเปลี่ยนสี, Pseudoceratina sp.

Annex 8


ฟองน้ำแคลือบสีม่วง

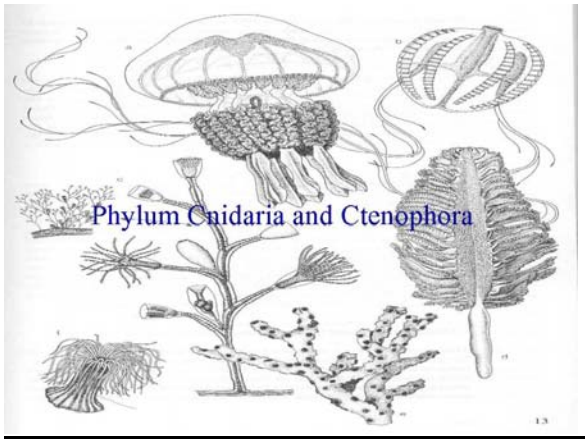
Annex 8


ฟองน้ำสีชมพู


ฟองน้ำสีน้ำเงิน


ฟองน้ำเส้นหมี่


ฟองน้ำหูช้าง


Phylum Cnidaria and Ctenophora


Class Hydrozoa
ไฮดรอยด์


ขนนกทะเล


แว่นตาพระอินทร์

Annex 8


ปะการังไฟแผ่น


ปะการังไฟกิ่ง


Class Scyphozoa
แมงกะพรุนหนัง


แมงกะพรุนไฟ

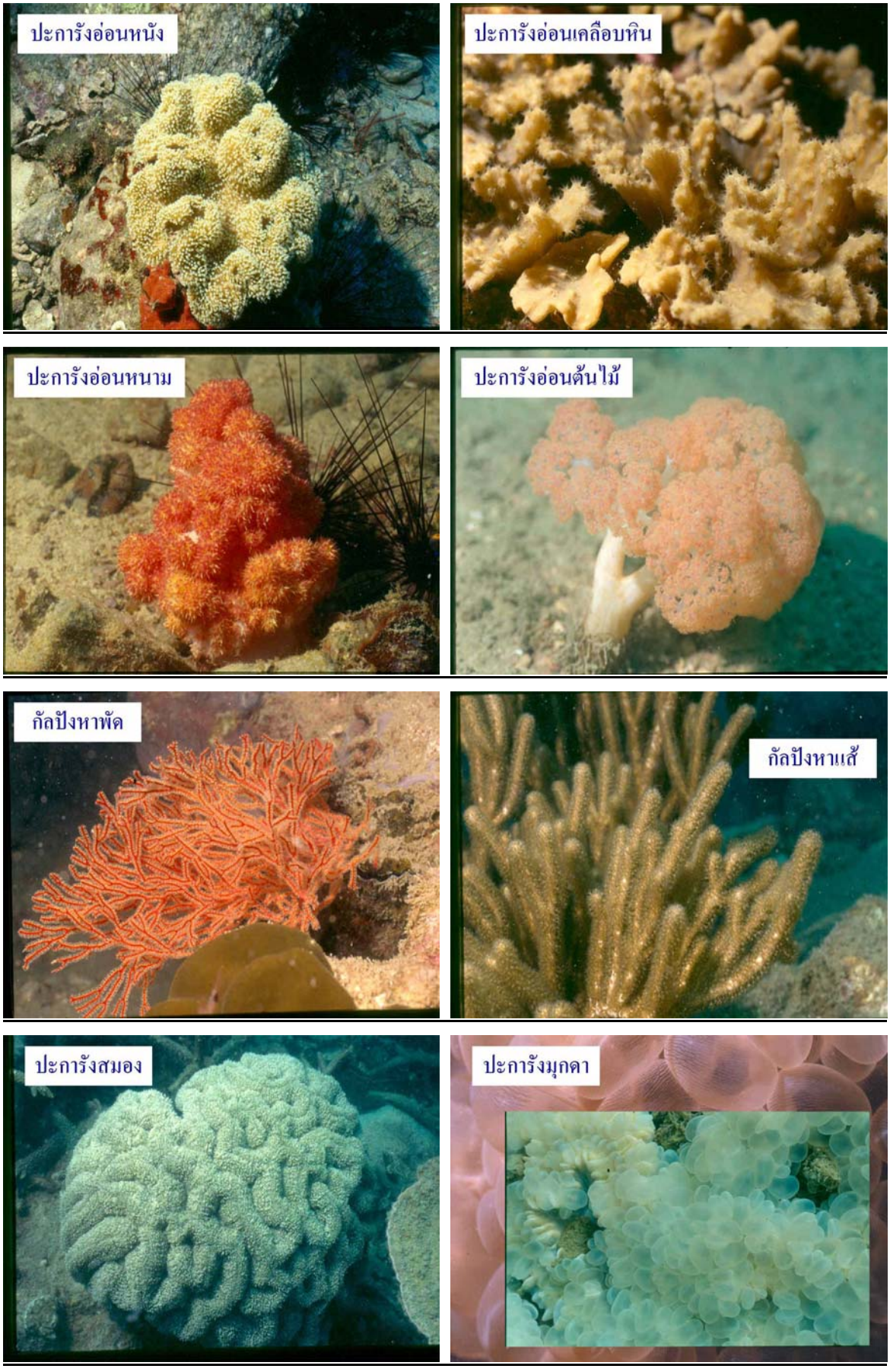

Class Anthozoa
ปะการังสีน้ำเงิน


ปากกาทะเล


ปะการังอ่อน


ปะการังอ่อนนิ้วมือ

Annex 8


ปะการังอ่อนหนัง
ปะการังอ่อนเคลือบหิน
ปะการังอ่อนหนาม
ปะการังอ่อนต้นไม้
กัลปังหาพัด
กัลปังหาแส้
ปะการังสมอง
ปะการังมุกดา

Annex 8


ปะการังโต๊ะ

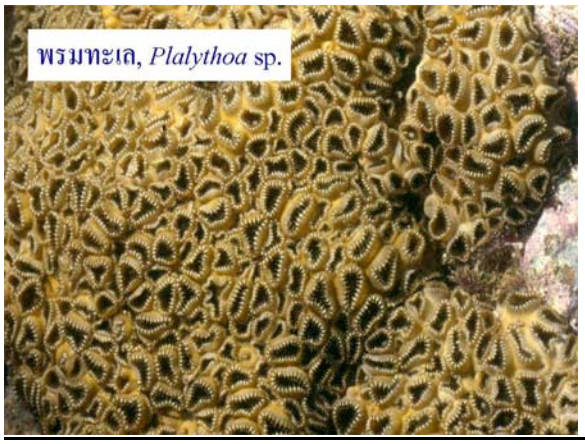

ปะการังเขากวาง


ปะการังเห็ด


ปะการังถ้วยส้ม

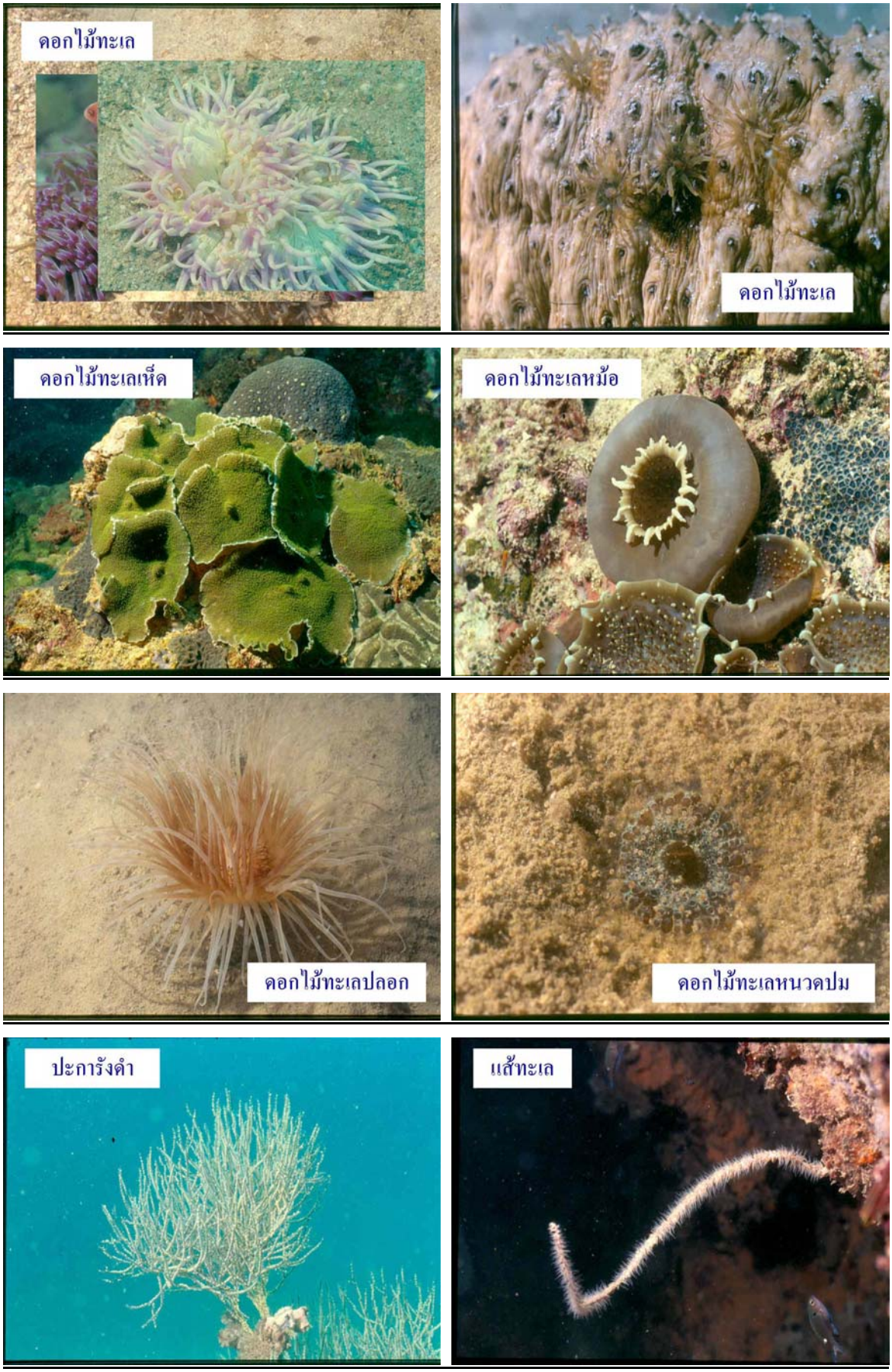

ปะการังเม็ดกระดุม


พรมทะเล, *Zoanthus* sp.
New ecdysteroid compound: Zoanthusterone

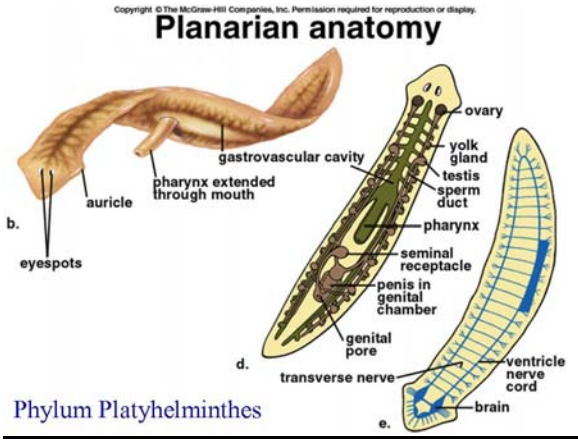

พรมทะเล, *Plalythoa* sp.


ดอกดิน

Annex 8


ดอกไม้ทะเล
ดอกไม้ทะเล
ดอกไม้ทะเลเห็ด
ดอกไม้ทะเลหม้อ
ดอกไม้ทะเลปลอก
ดอกไม้ทะเลหนวดปม
ปะการังดำ
แส้ทะเล

Annex 8


Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.
Planarian anatomy
gastrovascular cavity
pharynx extended through mouth
auricle
eyespots
b.
ovary
yolk gland
testis
sperm duct
pharynx
seminal receptacle
penis in genital chamber
genital pore
d.
transverse nerve
ventricle
nerve cord
brain
e.
Phylum Platyhelminthes


Phylum Platyhelminthes
หนอนตัวแบน


หนอนตัวแบน


Phylum Nemertea
proboscis opening
proboscis
retractor muscle
หนอนริบบิ้นม้าลาย

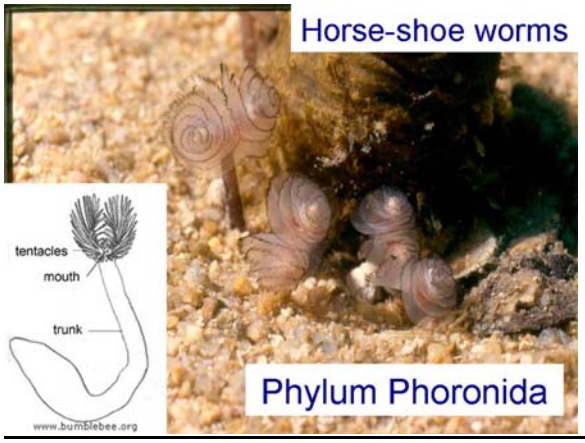

mouth
anus
stomach
stalk
Phylum Entoprocta
Goblet worms


Phylum Ectoprocta
Bryozoa

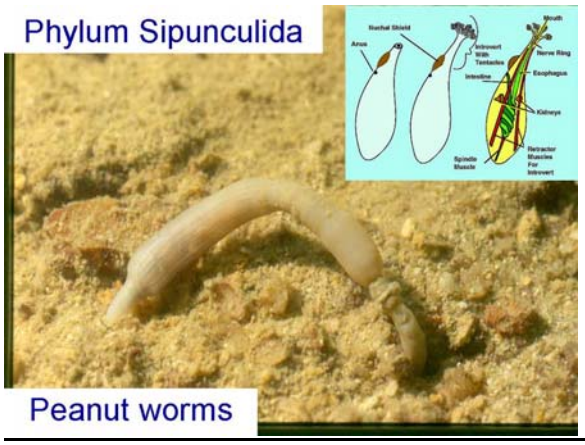

ไบรโอซัวร่ม


ไบรโอซัวเส้นหมี่

Annex 8


Horse-shoe worms
tentacles
mouth
trunk
www.bumblebee.org
Phylum Phoronida


Phylum Brachiopoda
Lamp shell


Phylum Sipunculida
Peanut worms


Phylum Echiurida
หนอนช้อน


Phylum Mollusca
ลิ่นทะเล


หอยมือผี


หอยม่วง


หอยสังข์หน้ายักษ์

Annex 8


หอยเบี้ยปะการังอ่อน


กระต่ายทะเล


กระต่ายทะเล


ทากเปลือย

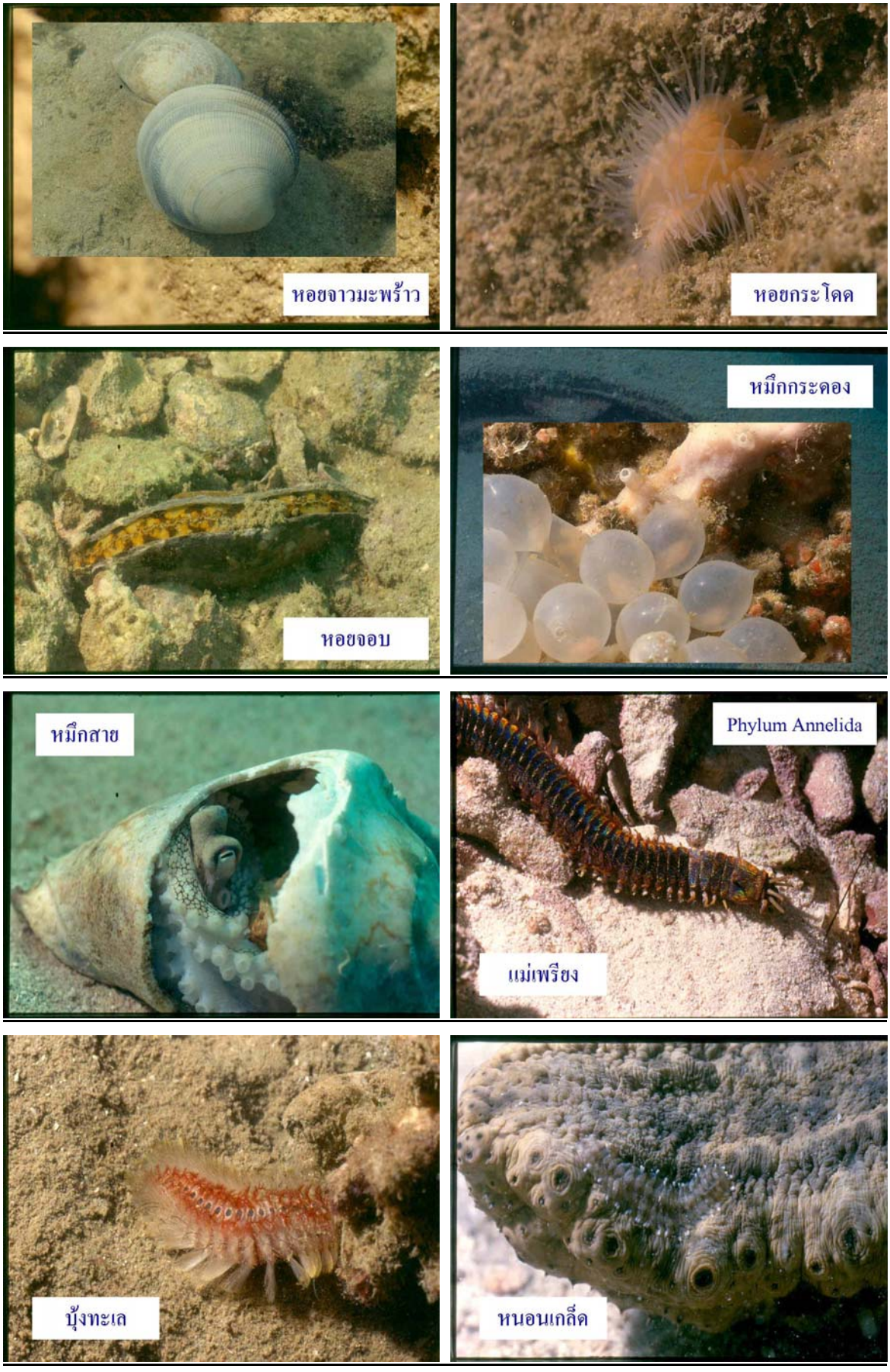

หอยมุกขนนกทะเล


หอยปะการัง


หอยมือเสือ


หอยมือแม่ว

Annex 8


หอยจาวมะพร้าว
หอยกระโดด
หมึกกระดอง
หอยจอบ
หมึกสาย
Phylum Annelida
แม่เพรียง
บุ้งทะเล
หนอนเกลี็ด

Annex 8


หนอนท่อ


หนอนท่อหินปูน


หนอนดอกไม้พู่ฉัตร


หนอนดอกไม้พายหางนกยูง


Phylum Arthropoda
แมงดาทะเลหางกลม

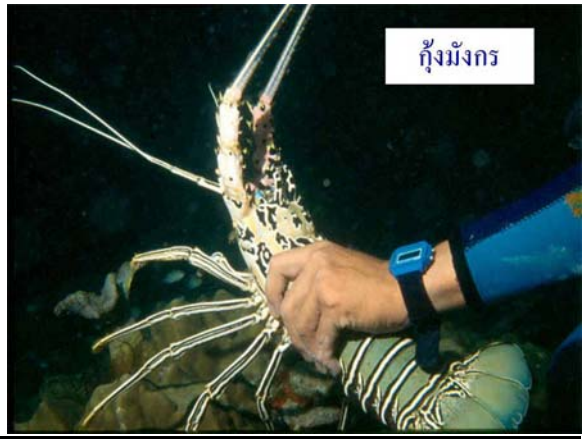

แม่หอบ


ปลาบู่กับกุ้งตาบอด


กุ้งแม่บ้านกับหอยจอบ

Annex 8


กุ้งแม่บ้านกับดอกไม้ทะเล


กุ้งมังกร

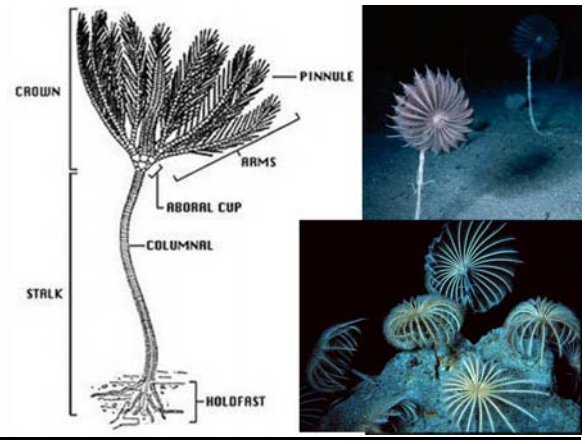

ปูเสฉวนยักษ์


จั๊กจั่นทะเล


ปูใบ้หลังเต่า


ปูม้าลายกับแม่แต่งตัว

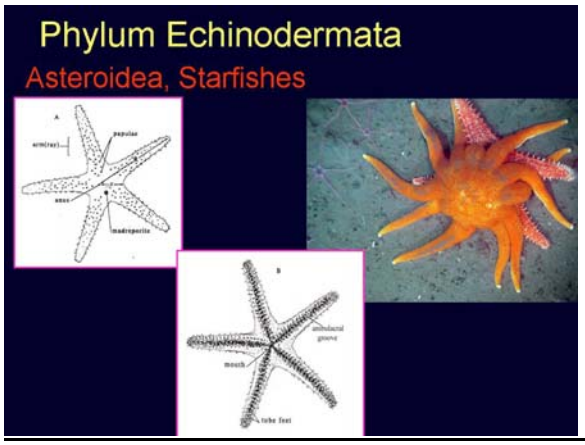

Phylum Echinodermata
Divided into 5 Clases:
Crinoidea
Sea lily, feather star


CROWN
PINNULE
ARMS
ABORAL CUP
COLUMNAL
STALK
HOLDFAST

Annex 8


ดาวขนนก


ความผันแปรสีของ Lamprometra palmata


Phylum Echinodermata
Asteroidea, Starfishes


Phylum Echinodermata
Asteroidea, Starfishes

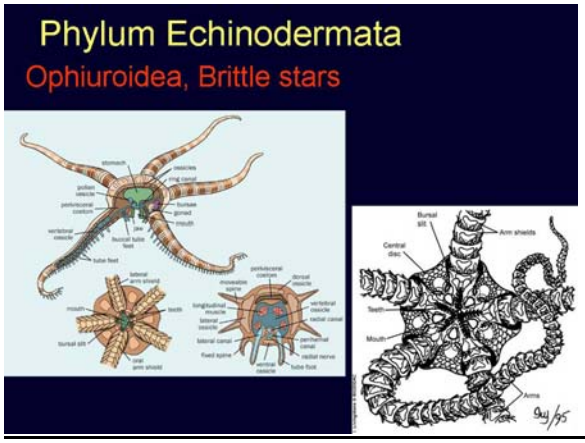

พฤติกรรมการกินอาหารของดาวแสงอาทิตย์
ดาวแสงอาทิตย์, Luidia maculata


ดาวหมอนปักเข็ม, Culcita novaeguineae Muller & Troschel, 1842


ดาวมงกุฎหนาม, Acanthaster planci


ดาวหนาม, Asteropsis carinifera

Annex 8


Phylum Echinodermata
Ophiuroidea, Brittle stars


Phylum Echinodermata
Ophiuroidea, Brittle stars

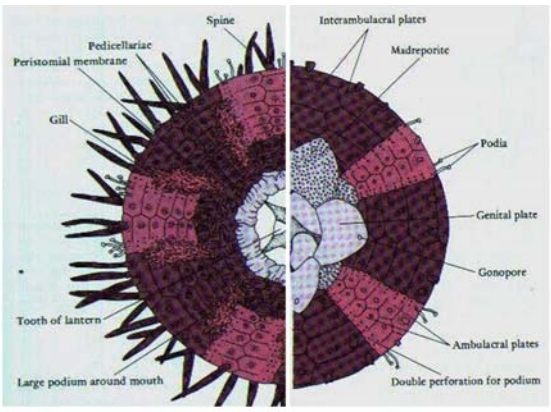

Amphilycus scripta


ดาวเปราะกัลปังหา, Ophiothela danae

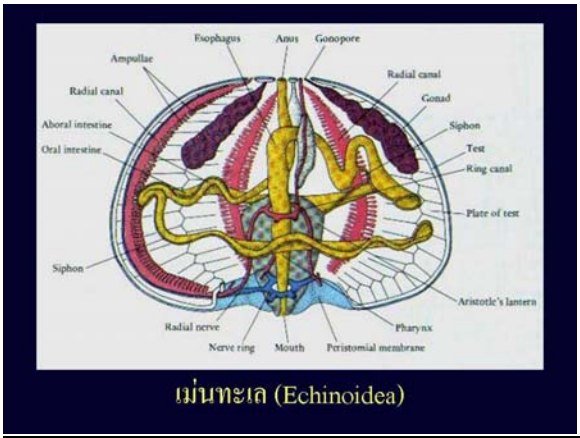

ดาวเปราะหนามใหญ่, Macrophiothrix longipeda


Ophiarachnella gorgonia

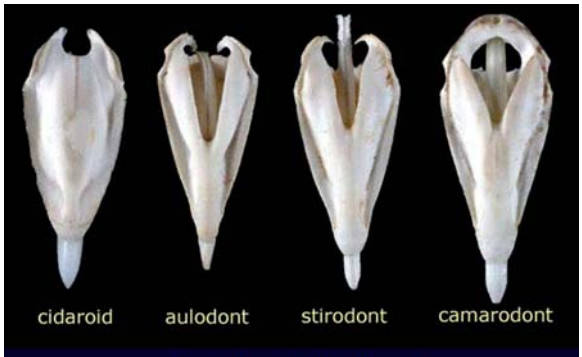

Phylum Echinodermata
Echinoidea, Sea urchin, sand dollars, heart urchins
©2007 MBARI


Spine
Pedicellariae
Peristomial membrane
Gill
Tooth of lantern
Large podium around mouth
Interambulacral plates
Madreporite
Podia
Genital plate
Gonopore
Ambulacral plates
Double perforation for podium

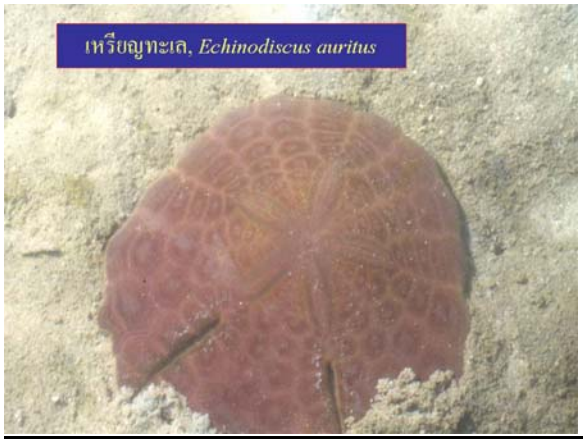
Annex 8



เม่นทะเล (Echinoidea)



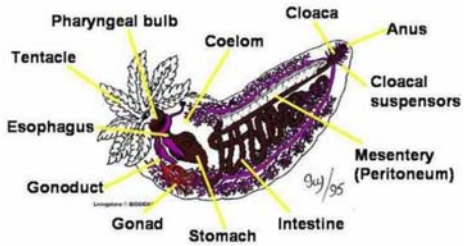
Aristrotle's lantern



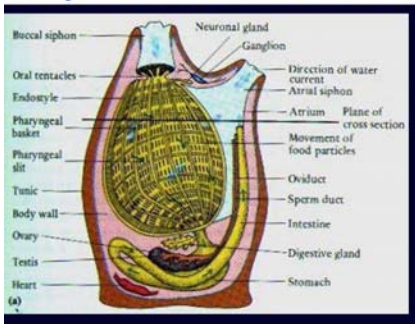
Annex 8

Phylum Echinodermata

Holothuroidea, Sea cucumber



Phylum Urochordata



Ascidian, sea squirts

Phylum Urochordata

Ascidian, sea squirts

Annex 8


Phylum Urochordata
เพรียงหัวหอมเดี่ยว


เพรียงหัวหอมเดี่ยวสีเหลือง


เพรียงหัวหอมเดี่ยวสีส้ม


เพรียงหัวหอมเดี่ยวขาวใส

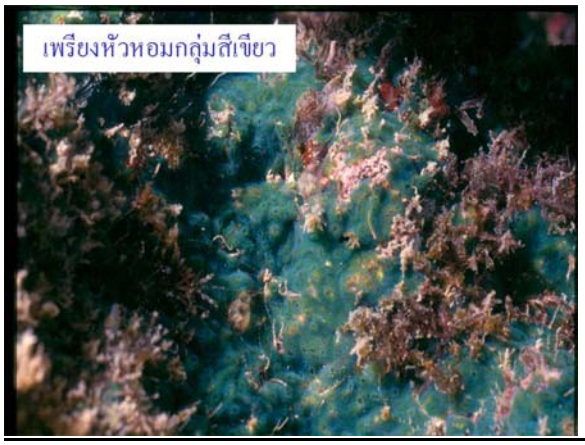

เพรียงหัวหอมเดี่ยวฟ้าใส


เพรียงหัวหอมกลุ่มสีม่วง


เพรียงหัวหอมกลุ่มสีขาว


เพรียงหัวหอมกลุ่มสีส้ม

Annex 8



Invertebrate Preservation

3 steps includes

1. Anaesthetization : relax and set specimen

2. Fixation: Fix specimen, stop microorganism and cells process

3. Preservation: permanent preservation

Anaesthetization : methods

- **Simple methods:** Oxygen starvation, Carbon dioxide excess, Freezing, Ethyl alcohol
- **Formaldehyde method**
- **Magnesium chloride (MgCl2. 6H2O)** ~ 73 g/ DW 1 litre
- **Magnesium sulfate (MgSO4)** 10% in sea water
- **Menthol**

Fixation : Formalin 4-10 %

3. **Preservation** for permanent preserve specimen

Preservation chemicals: 2 most popular chemicals

1. Formaldehyde or formalin

-Change protein in cytoplasm become big molecule and non water soluble kill micro-organisms and non color change

- Commercial grade is 37-40 % concentration, should dilute to 4-10 % by calculated from 37-40 %

- Formalin is acid and not useful for calcareous animal skeleton, it should neutralized by using Borax

Annex 8

2. Ethanol or Ethyl alcohol

- Alcohol is useful for many animals but not useful for animal with fat
- The most popular is Ethanol and Isopropanol
- Non-toxic to human
- Normal concentration for preservation is 70%

Annex 9: Arrangement of Activities and Sample Sorting

By Dr. Natinee Sukramongkol

Annex 9

Arrangement of Activities Onboard M.V. SEAFDEC 2

17 to 19 October 2010

Area of the Sampling Sites

General Information

Title:	Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem
Period:	17-19 October 2010
Vessel:	M.V. SEAFDEC 2
Area:	Continental slope area of Brunei waters (Zone 3 and 4)
Sea depth:	Two main depth strata 100-200m and 200-300m
Type of: bottom	Muddy (generally)

Activities onboard M.V.SEAFDEC 2

1. Topographic survey using Hydro-acoustic Echo sounder
2. Sampling gear operations (target on demersal fishes and benthic fauna)
   - 2.1 Beam Trawl = 2 operations
   - 2.2 Agassiz Trawl = 2 operations
   - 2.3 Deep-sea traps = 1 operations
3. Sorting specimens, Tagging, Preservation, Data record
4. Seabed survey by towing underwater VDO camera

Day 1 (17)	Day 2 (18)	Day 3 (19)
Topographic Survey #1	Topographic Survey #2	Seabed survey: Towing under-water VDO camera (all hand)
Beam trawl op.01 & Sorting #1	Beam trawl op.02 & Sorting #2	
Shooting Deep-sea trap (all hand)	Topographic survey#3	
	Agassiz Trawl op.01 & Sorting #3	
	Topographic Survey #4	
	Agassiz Trawl op.02 & Sorting #4	
	Hauling Deep-sea trap & Sorting (all hand)	

Group Assignment-I

*Participants (16 persons) will be separated into four groups and rotation for sorting specimens

Op. no.	Fishes	Crustaceans	Mollusk	Other invertebrate
	Dr.Konishi	Dr.Chittima	Ms.Natinee	Dr.Sumaitt
#1	Group 1	Group 2	Group 3	Group 4
#2	Group 2	Group 3	Group 4	Group 1
#3	Group 3	Group 4	Group 1	Group 2
#4	Group 4	Group 1	Group 2	Group 3

Group Assignment-II

**Each group is requested to present the results from the survey on 20th October 2010

Group #1	Group #2	Group #3	Group #4
1. Mr. Pirote	1. Mr. Han Win	1. Mr. Remar	1. Mr. Nguyen
2. Mr. Jamil	2. Mr. Bram	2. Mr. [illegible]	2. Mr. Bidin
3. Mr. Sheikh	3. Ms. Desi	3. Mr. Sayan	3. Mr. Sukchai
4.	4.	4.	4.

Sampling Procedure

Onboard sampling (washing over sieve)

↓

Sorted by species, preliminary identification

↓

Assigning TAG to specimens

↓

Number and Weight of specimens recording (logsheet)

↓

Photography

↓

Preservation

Annex 9


Some photograph of fishes and benthic fauna
during 21 Sep. to 13 Oct. 2010

Annex 10A: Bottom Topographic Survey

By Ms. Penchan Laongmanee

Training Workshop on Research Methodologies for the Study on Impact of Fishing to Deep-Sea Ecosystem

16-20 October 2010, Negara Brunei Darussalam

Bottom Topographic Survey

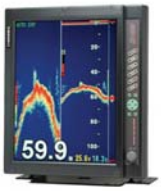
Penchan Laongmanee
& Sukchai Arnupapboon

Sounding

The first primitive maps were rendered from successions of single soundings produced by lowering weighted lines into the water and noting when the tension on the line slackened, indicating the ocean floor. The depth was then measured by the amount of line paid out.

http://oceanexplorer.noaa.gov/explorations/02fire/background/seafloor_mapping/seafloor.html

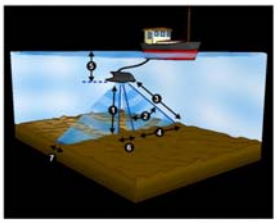
Single beam echo sounder

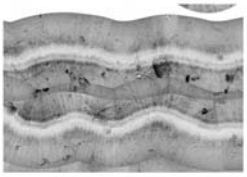


Echo sounding is the technique of using sound pulses directed from the surface or from a submarine vertically down to measure the distance to the bottom by means of sound waves

http://en.wikipedia.org/wiki/Echo_sounding

Side-scan Sonar

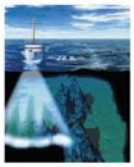


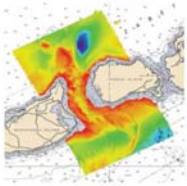


The sound frequencies used in side-scan sonar usually range from 100 to 500 kHz; higher frequencies yield better resolution but less range

http://en.wikipedia.org/wiki/Side-scan_sonar

Multibeam echo sounders (MBES)

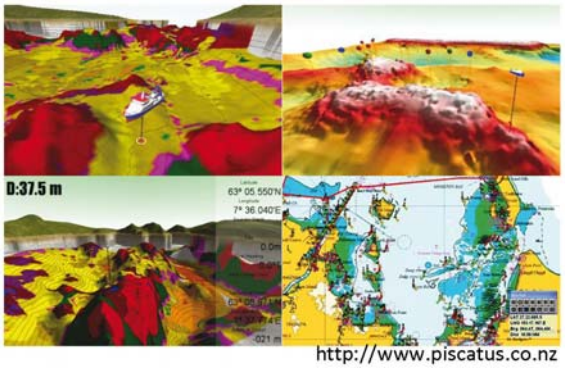




Multibeam echo sounders (MBES), like other sonar systems, transmit sound energy and analyze the return signal (echo) that has bounced off the seafloor or other objects. Multibeam sonars emit sound waves from directly beneath a ship's hull to produce fan-shaped coverage of the seafloor.

http://www.nauticalcharts.noaa.gov/hsd/multibeam.html

Multibeam echo sounder in commercial fishing boat

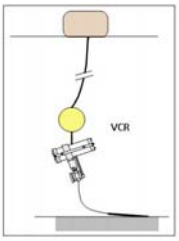


http://www.piscatus.co.nz

Substrate type: Under water VDO camera

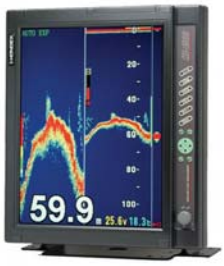
Watanabe and Kitagawa, 2003

Substrate type: Under water VDO camera, camera



Annex 10A

Bottom topographic survey activity



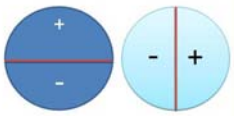
	A	B	C	D
1	longitude	latitude	depth	
2	119.805	16.4798	-469	
3	119.804	16.478	-469	
4	119.803	16.476	-468	
5	119.802	16.4738	-469	
6	119.802	16.4722	-470	
7	119.801	16.471	-471	
8	119.801	16.4703	-471	
9	119.801	16.4693	-471	
10	119.8	16.4682	-471	
11	119.799	16.467	-471	
12	119.798	16.4655	-471	
13	119.797	16.4643	-472	
14	119.797	16.4633	-473	
15	119.796	16.4632	-473	

Arranging position data

- Calculate recorded number from Echo Sounder convert to decimal number

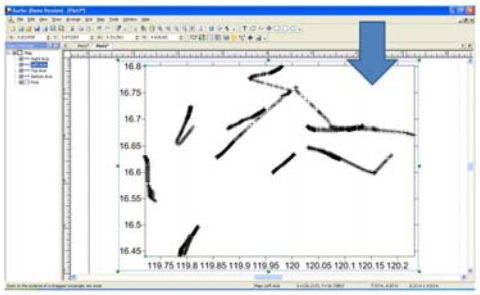
Degree + (min/60) = decimal number

- Longitude → N → +, S → -
- Latitude → E → +, W → -
- Depth → -



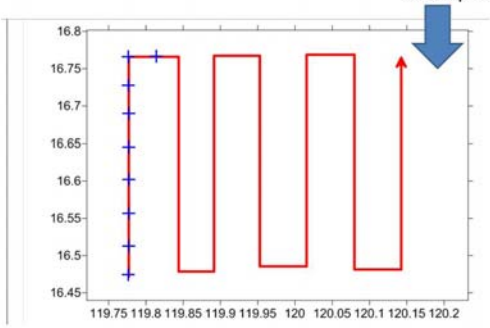
Position of data

Scatter data

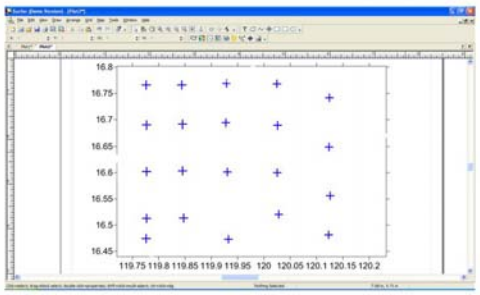


Position of data

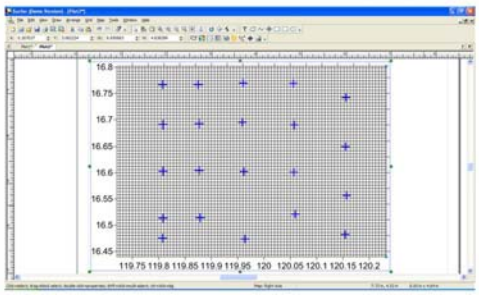
On ship track



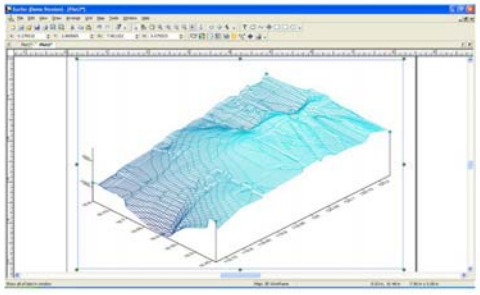
Position of data



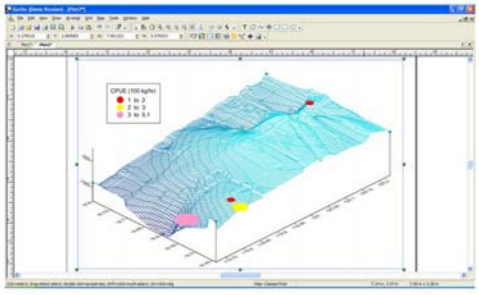
Add data position → gridding method



3D wire frame map

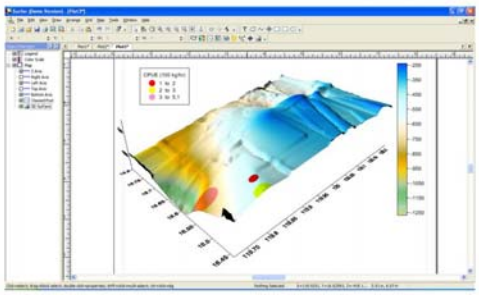


Overlay with CPUE



Annex 10A

3D surface map



Annex 10B: Seafloor Survey Using Underwater VDO Camera

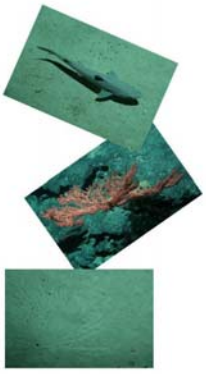
By Mr. Sukchai Arnupapboon

Annex 10B

Objective

- To identify benthic resources and seafloor features for biodiversity or relationships between benthic and seafloor features

15



Seafloor Survey Using Underwater Video Camera

Sukchai Arnupapboon
and
Penchan Laongmanee

SEAFDEC's facilities

ROV
Remote Operated Vehicle

TUV
Towed Underwater Video

2

ROV

- Advantage
  - Able to operate in submarine obstruction area
  - Able to close-up examination on seafloor
  - Able to collect benthic samples

3

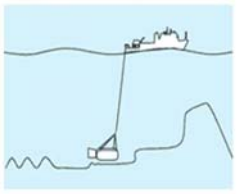
ROV

- Disadvantage
  - -Difficult to fix distance from objective
  - -Difficult to employ in strong current area
  - -Radios operation (Sampling is non-random)

4

TUV

- Without frame



- With frame

5

TUV

- Advantage
  - Able to survey large expanse of seafloor
  - Allow precise density measurement of interest

6

TUV

- Disadvantage
  - Unable to focus on objective
  - Could damage by obstruction or constant by seafloor topography

7

Annex 10B

TUV component

- Underwater camera
- Metal frame
- Monitor display
- Light
- GPS

8

Video camera features

- Wide angle lens, deepest recess to protect against accidents
- Lens is auto focus
- Inert-gas filled electronic compartment

9

Metal frame design

- Towable on the seafloor
- Adjustable camera angel
- Flexible tow angle

10

Metal frame design

- Towable on the seafloor

11

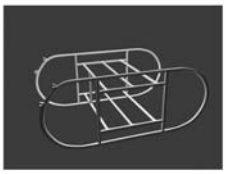
Metal frame design

- Adjustable camera angle

12

Metal frame design

- Flexible tow angle



13

Survey method and analysis

- Mount video camera to metal frame normally above seafloor 50-100 cm
- Deploy to seafloor when ship moving slowly
- Keep tow speed at 1 knot or below as far as possible and record the condition of the seafloor along a series of transects
- Record onto data file and copy to DVD and review with slow motion
- Count the feature of interest

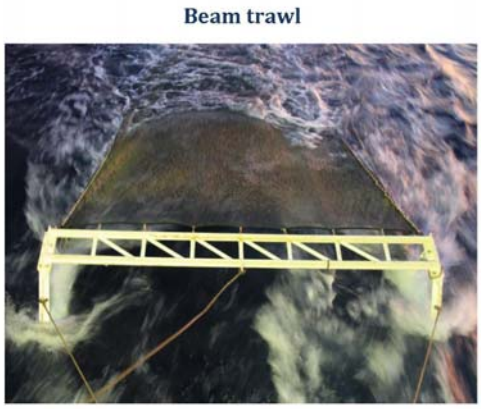
14

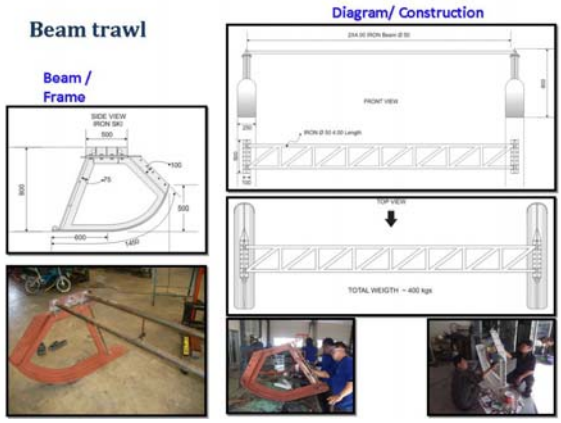
Annex 11: Fishing gear and method: Agassi trawl, Beam Trawl and Deep-Sea Trap

By Mr. Sayan Promjind and Mr. Narong Ruangsivakul

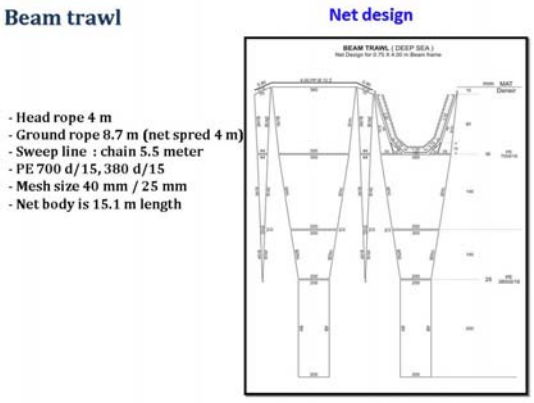
Annex 11


Deep-sea fishing gears and method
for the Training Workshop
on Research Methodologies for the Study
on Impact of Fishing to Deep-Sea Ecosystem
16-20 October 2010
Brunei Darussalam
Beam Trawl
Agassiz Trawl
Deep sea Trap
Sayan Promjinda
Narong Ruangsivakul
Capture Fisheries Technology Division
Southeast Asian Fisheries Development Center
Training Department

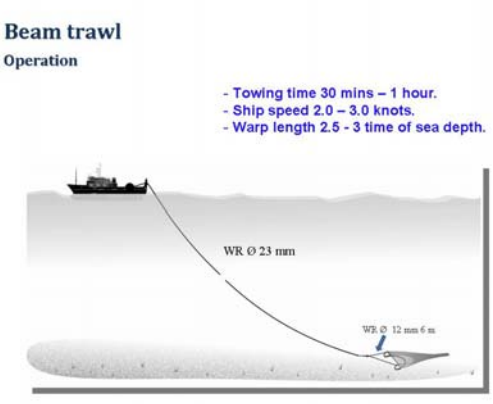

Beam trawl


Beam trawl
Diagram/ Construction
Beam /
Frame
FRONT VIEW
TOP VIEW
TOTAL WEIGTH = 400 kgs


Beam trawl
Diagram
Beam /
Frame


Beam trawl
Net design
- Head rope 4 m
- Ground rope 8.7 m (net spred 4 m)
- Sweep line : chain 5.5 meter
- PE 700 d/15, 380 d/15
- Mesh size 40 mm / 25 mm
- Net body is 15.1 m length


Beam trawl
Gear preparation

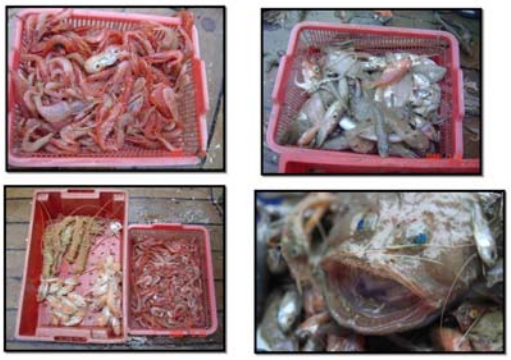

Beam trawl
Operation
- Towing time 30 mins – 1 hour.
- Ship speed 2.0 – 3.0 knots.
- Warp length 2.5 - 3 time of sea depth.
WR Ø 23 mm
WR Ø 12 mm 6 m


Beam trawl
Sampling sorting

Annex 11

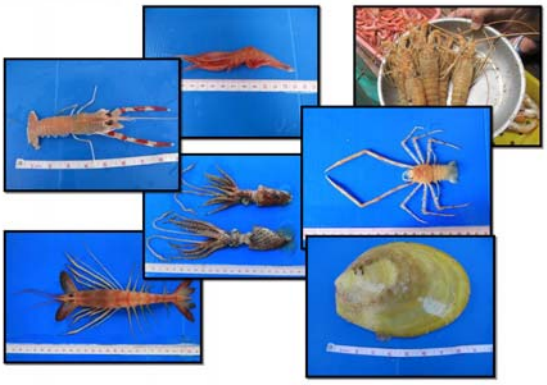
Beam trawl

Specimens



Beam trawl

Specimens



Agassiz trawl

The Agassiz trawl is used to collect organisms, particularly invertebrates, living on the ocean bottom.

www.kc-denmark.dk

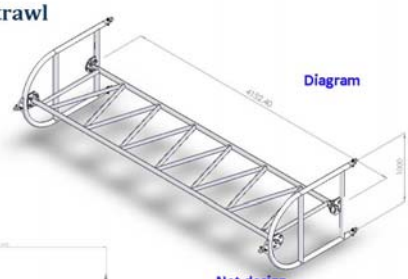
Agassiz trawl

Construction

Frame Ø 380 mm 4 meter STT pipe
- Weight ~ 200 kg

Agassiz trawl

Diagram



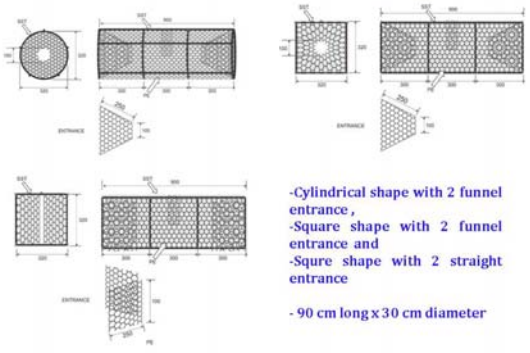
Net design

- Head rope 4 m
- Ground rope 4 m
- PE 700 d/15,
- Mesh size 40 mm
- Net body is 15 m length

Deep SeaTraps

Deep Sea Trap

Construction



-Cylindrical shape with 2 funnel entrance ,
-Square shape with 2 funnel entrance and
-Squre shape with 2 straight entrance

- 90 cm long x 30 cm diameter

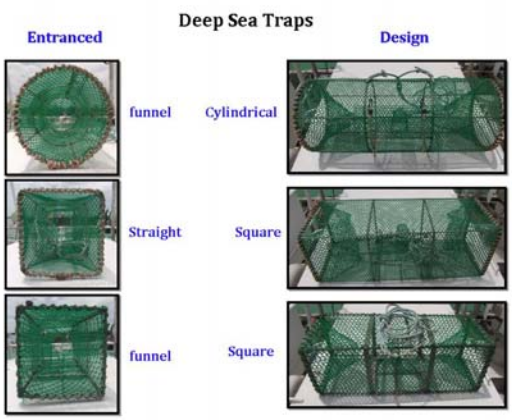
Deep Sea Traps

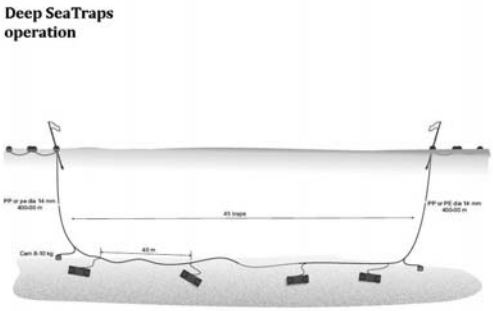
Construction

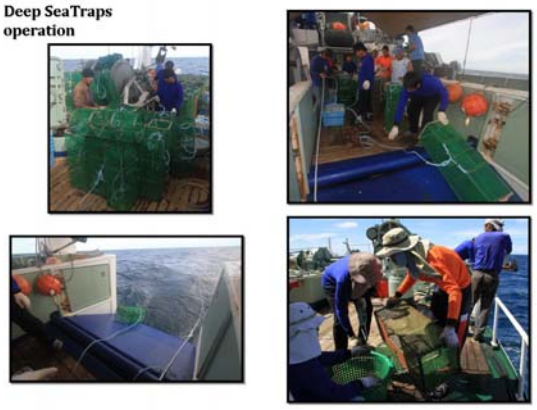
- Stationary fishing gear with
- baits inside

- Made plastic net, STT frame

Annex 11


Deep Sea Traps
Entranced
Design
funnel
Cylindrical
Straight
Square
funnel
Square


Deep SeaTraps
operation

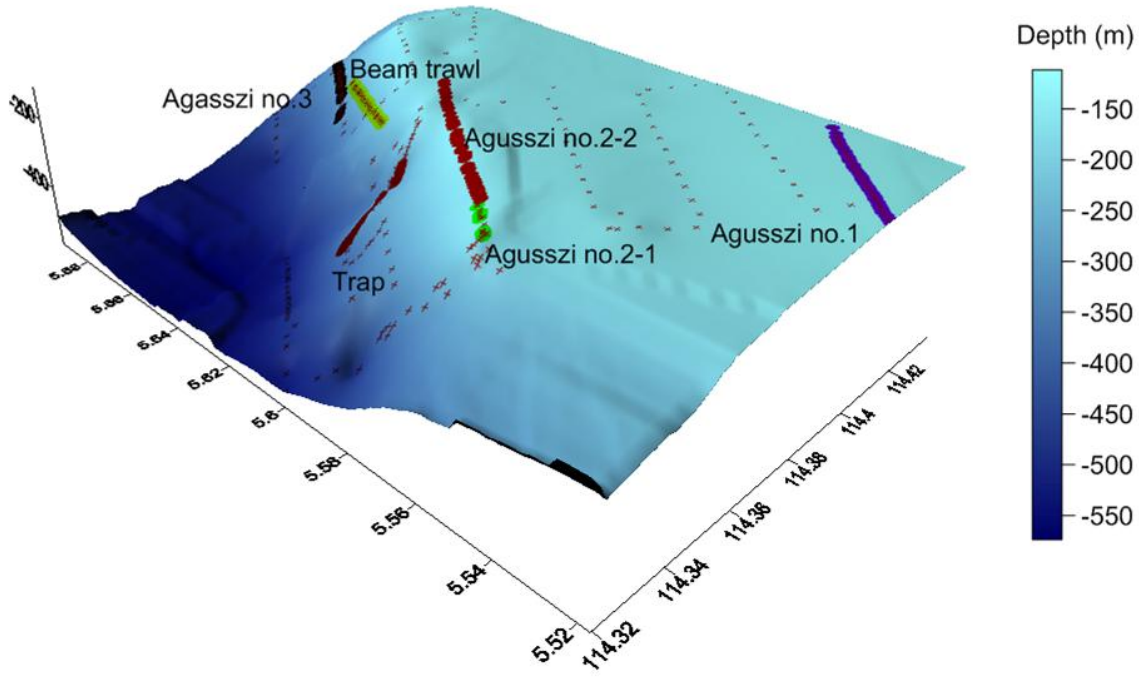

Deep SeaTraps
operation


Deep SeaTraps
The specimens from DST


THANK YOU FOR
ATTENTION

Annex 12: Position of the Survey and Topography

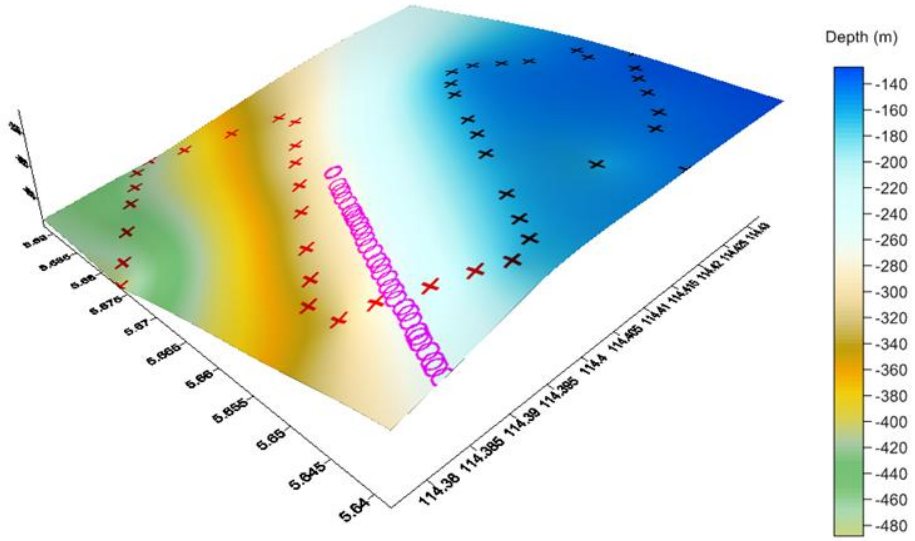
Annex 12


Depth (m)
-150
-200
-250
-300
-350
-400
-450
-500
-550
Agasszi no.3
Beam trawl
Agusszi no.2-2
Agusszi no.2-1
Agusszi no.1
Trap
5.52
5.54
5.56
5.58
5.6
5.62
5.64
114.32
114.34
114.36
114.4
114.42

Annex 13A: Sea-Floor Topography of the Fishing Ground Operation 01

Annex 13A

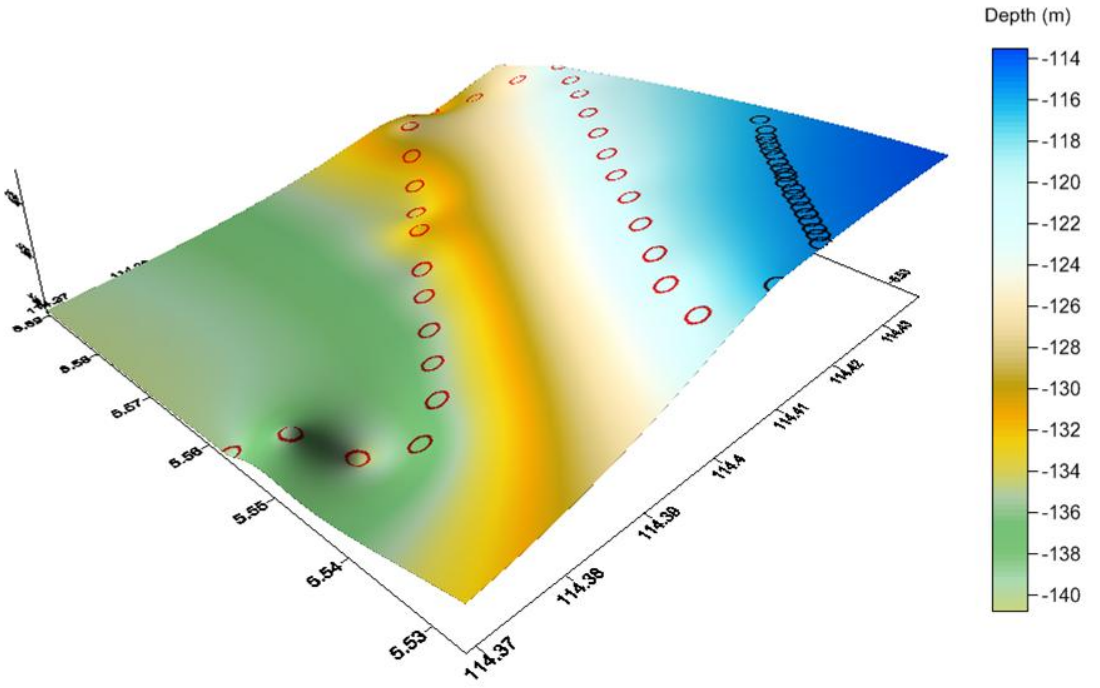
Group 1 (Trawl depth,245-278 m)



Annex 13B: Sea-Floor Topography of the Fishing Ground Operation 02

Annex 13B

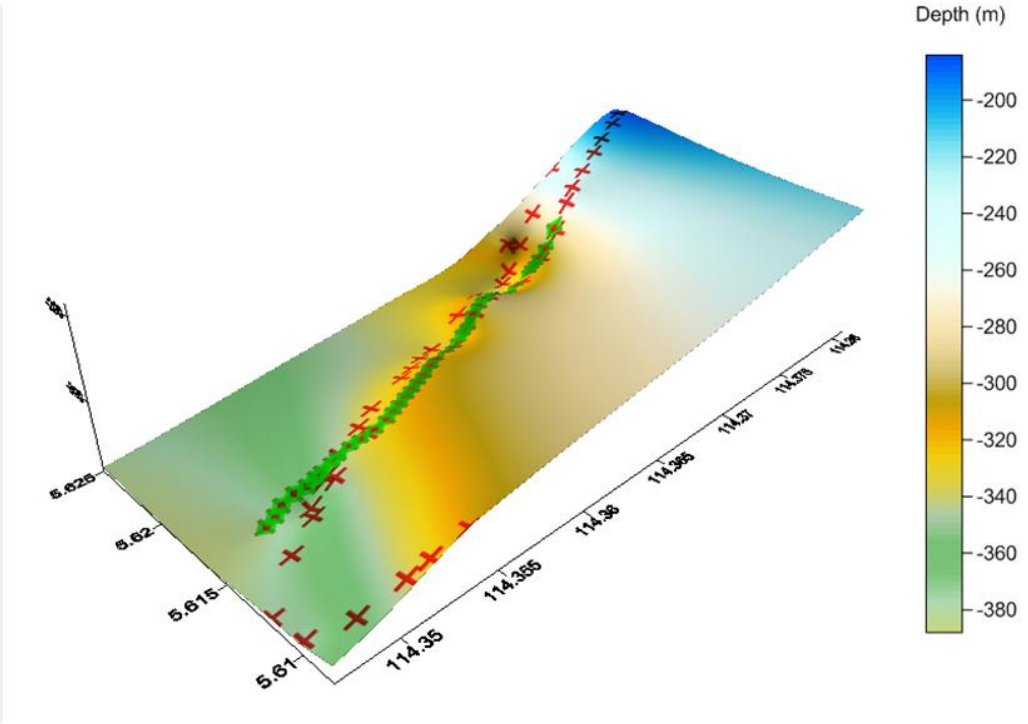
Group 2(trawl depth, 113-114 m)



Annex 13C: Sea-Floor Topography of the Fishing Ground Operation 03

Annex 13C

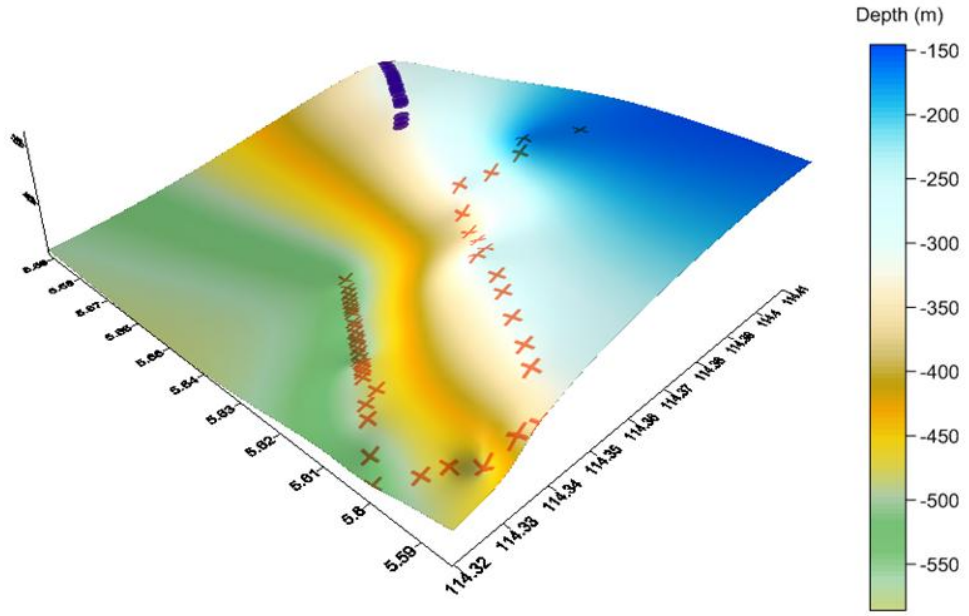
Group 3 (trap at depth 285-383 m)



Annex 13D: Sea-Floor Topography of the Fishing Ground Operation 04

Annex 13D

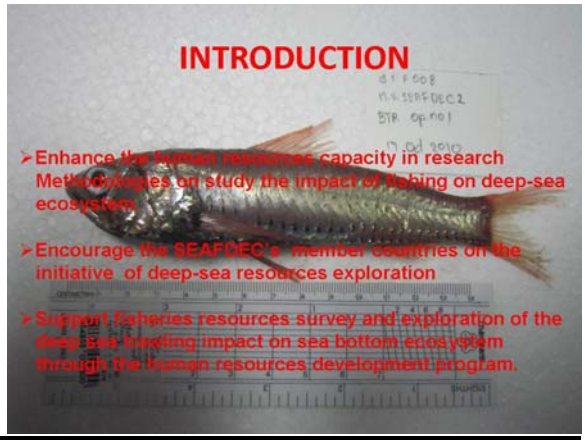
Group 4 (trawl depth 303-363 m)



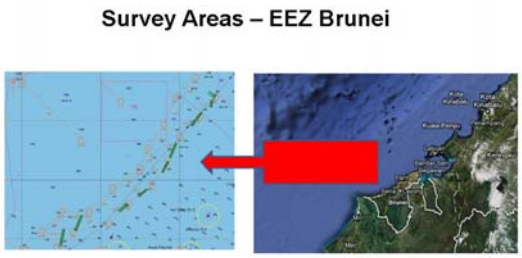
Annex 14: Sampling Results of Group 1: (Beam Trawl Operation 01)

Annex 14

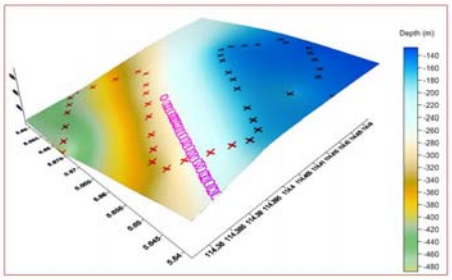

THE RESULTS FROM SURVEY STATION A 18
FOR
TRAINING WORKSHOP ON RESEARCH METHODOLOGIES FOR STUDY ON IMPACT OF FISHING ON DEEP-SEA ECOSYSTEM
(16 – 20 OCTOBER 2010)
BY
MR.JAMIL
MR.PIROTE
MR. SHEIKH


INTRODUCTION
➢Enhance the human resources capacity in research Methodologies on study the impact of fishing on deep-sea ecosystem
➢Encourage the SEAFDEC's member countries on the initiative of deep-sea resources exploration
➢Support fisheries resources survey and exploration of the deep sea trawling impact on sea bottom ecosystem through the human resources development program.

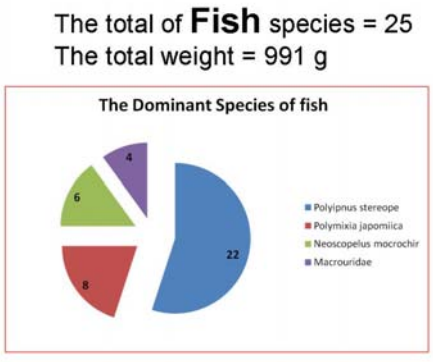

MATERIALS & METHODS
➢Survey Areas – EEZ Brunei
➢Research Vessel – MV SEAFDEC 2
➢Fishing Gear – Beam Trawl
➢Data Collection:
1. Topography
2. Fish
3. Crustacean
4. Mollusk
5. Other Invertebrates


Survey Areas – EEZ Brunei


RESULTS


Topography of beam trawl op.no1
Group 1 (Trawl depth,245-278 m)

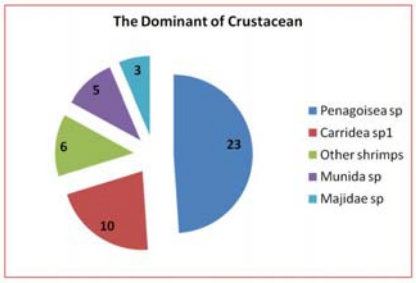

Muddy Areas


The total of Fish species = 25
The total weight = 991 g
The Dominant Species of fish
4
6
22
8
Polyipnus stereope
Polymixia japomiica
Neoscopelus mocrochir
Macrouridae

Annex 14

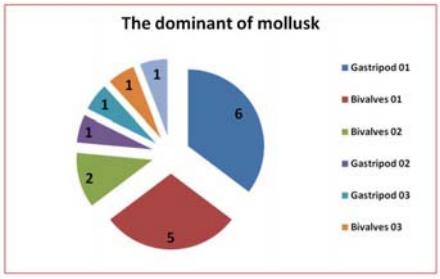
Species	Number	Photos
Polyipnus stereope	22	
Polymixia japonica	8	
Neoscopelus mocrochir	6	
Macrouridae	4	

The total of **Crustaceans** species = 21



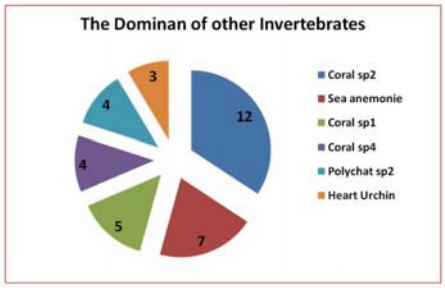
Species	Number	Photos
Penagosisae sp	23	
Carridea sp 1	10	
Other shrimps	6	
Munida sp	5	
Majidae sp	3	

The total of **Mollusk** species = 7

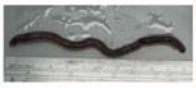


Species	Number	Photos
Gastropod sp1	6	
Bivalves sp1	5	
Bivalves sp2	2	

The total of **Other Invertebrate** species = 11



Species	Number	Photos
Coral sp2	12	
Sea anemonie	7	
Coral sp1	5	

Species	Number	Photos
Coral sp 4	4	
Polychat sp2	4	
Heart Urchin	3	

Annex 14

DISCUSSION/ CONCLUSION

Beam Trawl gear affects the environment in both direct and indirect ways. Direct effects include scraping and pouching of the substrate, sediment resuspension, destruction of benthos, and dumping of processing waste. Indirect effects include post-fishing mortality and long-term trawl-induced changes to the benthos.

Annex 15: Sampling Results of Group 2: (Agassiz Trawl Operation 01)

Annex 15

DEEP SEA *AGASSIZ* TRAWL FISHING TRIAL IN BRUNEI WATERS

BRAM SETYADJI
HAN WIN
DESEMAWATI HAJI IMETALI

Regional Training Workshop on Research Methodologies for the Study on Impact of Fishing on Deep-sea Ecosystem

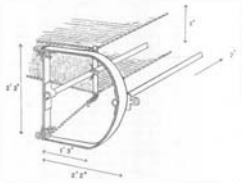
DEFINITION

AGASSIZ TRAWL : A dredge consisting of a net attached to an iron frame with a hoop at each end that is used to collect organisms, particularly **invertebrates**, living on the ocean bottom.

GEAR CONSTRUCTION

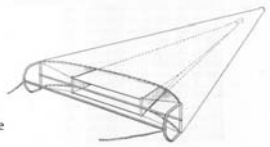
- Frame Square steel tube, 40 x 40 x 4 mm
- Opening of net W x H: 300 x 80 cm. Equipped with a chain on all sides.
- Inner net bag The inner net is knotless (no. 6) having a mesh size of 10 x 10 cm. Closed by a loop at the end.
- Outer net bag: The outer net has a mesh size of 30 x 30 cm. Closed by a loop at the end.
- Length of net: 600 cm

GEAR CONSTRUCTION



1. Illustration of Agassiz trawl frame

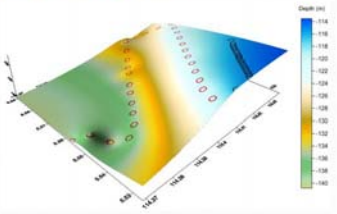
2. Illustration of Agassiz trawl net



SURVEY STATION

Note: Shadow circle is area for fishing gear operation of the training workshop

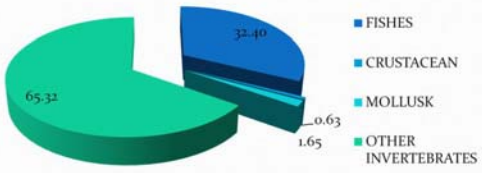
TOPOGRAPHIC SURVEY



TRAWL DEPTH : 113 – 114 METER
BOTTOM CHARACTERISTIC : SANDY MUD AND RELATIVELY FLAT

CATCH COMPOSITION

TOTAL CACTH (%)



CATCH COMPOSITION

1. FISHES
- Total 52 species within 21 families (H' = 1.33)
- Stands up: Pleuronectiformes (5 species w/in 4 families, Scorpaeniformes (4 species)
- Commercially important : *Epinephelus areolatus*
- Note: *Lophiodes mutilus* is a bathydemersal fish, depth range 234 - 760 m

Annex 15

CATCH COMPOSITION

2. CRUSTACEAN
- 8 species managed to be identified
- Mostly are Portunidae (*Charybdis bimaculata*/5 pcs), Hermit crabs (6 pcs) and Pilumnidae (*Parapanope* sp/6 pcs)
- Only one shrimp (*Metapenaeus* sp 1)
- Not reaching its potential

CATCH COMPOSITION

3. MOLLUSK
- Bivalves, gastropods, and squids
- Small amount of number, and not promisingly potential for commercial purpose
- Substrate not supported?

CATCH COMPOSITION

4. OTHER MARINE INVERTEBRATES
- 21 species under 12 class
- Consist of stony corals, starfishes, worms, sponges, and hydrozoans
- No data number available
- Dominating the weight of total catch
- Supported by the bottom substrate

*No PICTURE YET AVAILABLE

SUMMARY AND REMARKS

- The depth (113-114) is unlikely represent the deep sea region
- The lack of diversity on fishes gained may caused by the using of inappropriate gear
- Since the Agassiz trawl intended for collecting marine invertebrates so with the result showed.
- Knowing the type of the sea bed and its substrate will cause less damage to fishing gear
- The using of better technology is advisable (if possible)

T.E.R.I.M.A.K.A.S.I.H.

MIN.GA.LA.PA

THANKS A BUNCH!

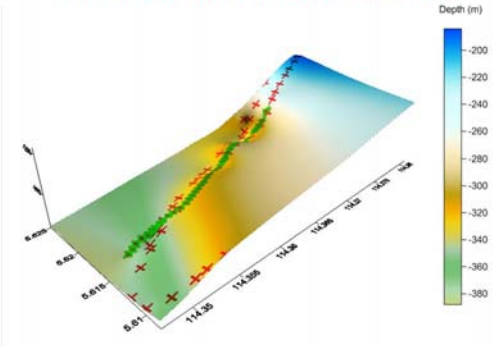
Annex 16: Sampling Results of Group 3: (Deep-Sea Trap Operation 01)

Annex 16

INTRODUCTION

Group 3
Remar Asuncion
Matzaini Hj Juna
Sayan

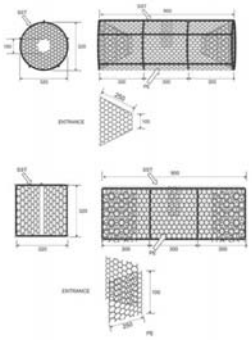
Group 3 (trap at depth 285-383 m)
Soaking time 25 hrs 30 minutes



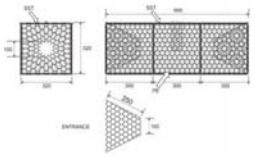
Deep SeaTraps

MATERIALS AND METHODS

Deep Sea Trap



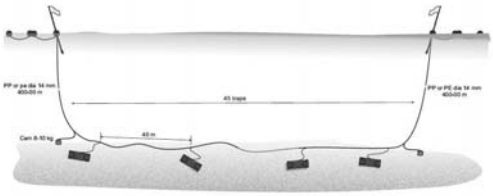
Construction



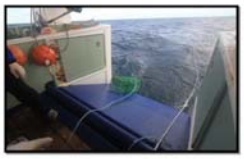
-Cylindrical shape with 2 funnel entrance ,
-Square shape with 2 funnel entrance and
-Squre shape with 2 straight entrance

- 90 cm long x 30 cm diameter

Deep SeaTraps operation



Deep SeaTraps operation



RESULTS

Annex 16

Total Catch

- Cylindrical shape with 2 funnel entrance
  - 4,255 grms
- Square shape with 2 funnel entrance
  - 2,892 grms
- Square shape with 2 straight entrance
  - 7,015 grms

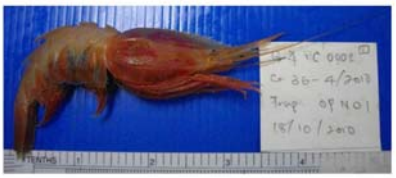
Shape of traps:	Square flat	Round	Square round
Species:	Sample weight (grms)		
Heterocapus sp. 1	400.00	300.00	150.00
Heterocapus sp. 2	50.00	0.00	0.00
Heterocapus woodmasone	40.00	100.00	160.00
Crab 1	0.00	60.00	0.00
Crab 2	0.00	150.00	0.00
Crab 3	0.00	15.00	0.00
Crab 4	0.00	0.00	0.00
Isopod 1 - 9 spine	2140.00	2620.00	1712.00
Isopod 1 - 11 spine	1115.00	150.00	
Isopod 1 - 13 spine	120.00	530.00	620.00
Cephaloscyllium umbratice	2750.00		250.00
Eptatretus sp	350.00	250.00	
Sebasticus sp.	50.00		
Setarches sp		80.00	
Total sample wt (kg)	7015.00	4255.00	2892.00

FISHES

CRUSTACEAN

Isopod

Heterocapus sp.



CRUSTACEAN

Crab 3

Crab 1

Crab 2

Conclusion

- Most of the trap catch are dominated by Isopods (63%)
- Square flat trap has a better catch, 50% of the total catch as compare to other designs.
- Impact of the trap gears include better quality sample compare to net gear with less impact to destruction of the environment.
- The disadvantage of the gear have to wait to get the sample (25 hrs) as compare to net gears.

Annex 17: Sampling Results of Group 4: (Agassiz Trawl Operation 02)

Report for Sampling result of Agassiz trawl on M.V. SEAFDEC 2 17-19/10/2010

Group 4

Sukchai Arnupapboon
Bidin Suru
Nguyen Van Hung

Sampling process (7 step)

1. Topographic survey
2. Fishing gear preparation
3. Shooting
4. Hauling
5. Sampling collect
6. Sampling sorting
7. Sample and Data save

Topographic survey

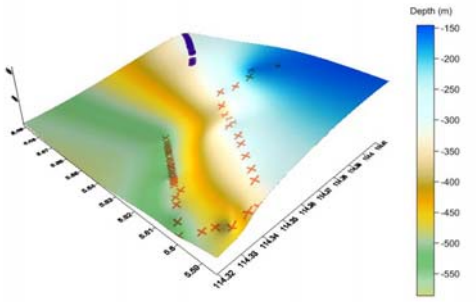
1. Collect data on the machine (GPS)
- Data point : Longitude, latitude and depth
- 2 minute for collect data/time
- Need from 35-50 date point

2. To input data to software topographic

3. Result

- Have form bottom terrain

Group 4 (trawl depth 303-363 m)



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2. Fishing gear preparation (example Agassiz trawl)

- The Agassiz trawl was preparation

3. Shooting

Start shooting		Finish shooting	
Time	07/07	Time	07/30
Latitude	05°38'8 N	Latitude	05°39'7 N
Longitude	114°22'5 E	Longitude	114°23'2 E

Speed:2.5-3 knot, Towing time: 40 min

Towing distance: 2.3 Nm, operation depth: 300-350m

4. Hauling

Start hauling		Finish hauling	
Time	08/20	Time	08/47
Latitude	05°38'8 N	Latitude	05°39'7 N
Longitude	114°22'5 E	Longitude	114°23'2 E

5. Sampling collect

The Sample will wash, after that sorting

---

6. Sampling sorting

The Sample will be classified 4 group: Fish, crustacean, mollusk and other

- Fish total weight: 2023 g
- Fish total amount: 81
- Crustacean total weight:541 g
- Crustacean total amount: 83
- Mollusk total weight: 4477 g
- Mollusk total amount: 23
- Other total weight: 150 g
- Other total amount: 7

Species	Number	Photos
Satyrichthys sp1	0003	
Satyrichthys sp1	0007	
Malatichthys waciyae	0006	
Setarches gvertheri	0024	

Annex 17

Species	Number	Photos
Heterocapus hiyachii	0001	
Aristeus virillis	004	
Isopod sp.1(9spine)	0014	
Leucosidae	0002	

Species	Number	Photos
Hiztioteuthis sp.	0001	
Nototodarus sp1	0004	
Xenophora solaris	0002	
Bivalves sp 2	0008	

Species	Number	Photos
Benthoped sp1	0001	
Molpadiida	0002	
Sen anemones	0003	
Polychaet	0004	

Conclusion and recommendation

1. To need continuous study on impact of fishing on deep-sea ecosystem
2. To should use the gear similar to fact because it evaluate impact and economic effect of fishing on deep-sea,

- To determine issue
  + Type gear
  + effect depth

The end

Thank you for your attention

Thank you for your attention

Annex 18: Additional Information on Sampling Results

By Dr. Sumaitt Putchakarn

Annex 18

Other Invertebrates

Lamellibrachia sp. live in cold seep habitat: area of the ocean floor where hydrogen sulfide, methane, and other hydrocarbon-rich fluid. They provide as producer in deep sea community

Tubeworm, Vestimentifera (Polychaeta: Siboglinidae), Lamellibrachia sp.

Other Invertebrates

Predator-prey in the benthic community

Other Invertebrates

Diversity in the Benthic community

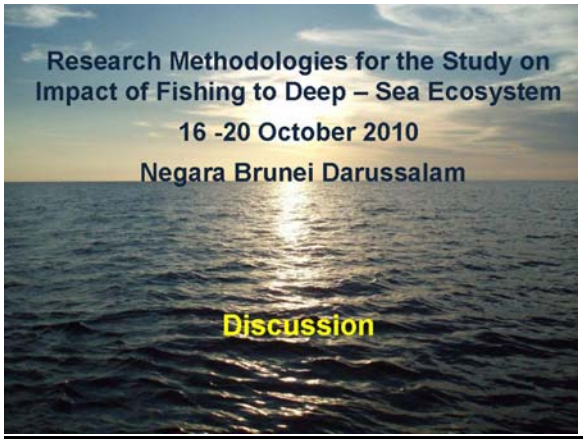
Other Invertebrates

Diversity in the Benthic community

Annex 19: Sampling Methodologies and Design to Study on Fishing Impact on Deep-Sea and Benthic Fauna

By Dr. Chittima Aryuthak

Annex 19



baseline information on fish & benthic communities and environmental factors, particularly granulometric properties

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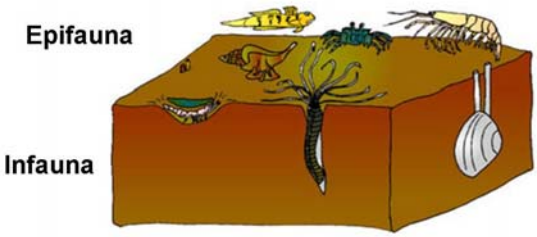
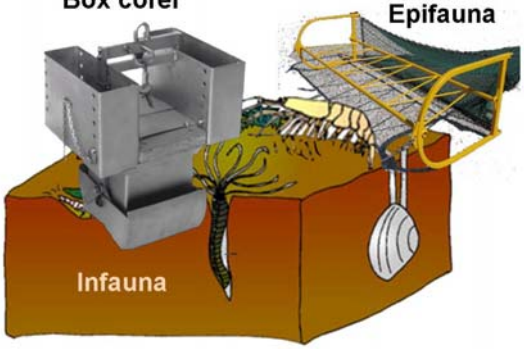
Fish & Benthic communities



Baseline information on fish &benthic communities



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baseline information on fish & benthic communities and environmental factors, particularly granulometric properties

We could get some information from our practice during this training workshops.

baseline information on fish & benthic communities and environmental factors, particularly substrate properties

comparative study on suitability of sampling gears such as beam trawl, Agassiz trawl, etc

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baseline information on fish & benthic communities and environmental factors, particularly substrate properties

comparative study on suitability of sampling gears such as beam trawl, Agassiz trawl, etc

preliminary study on fishing impact on deep sea fish and benthic communities

---

preliminary study on fishing impact on deep sea fish and benthic communities

Observation :

fishing gear disturbs sea bottom — epifauna

and re-suspend surface sediment — infauna

Model :

Physical disturbance

Hypothesis : Variables: species diversity index and evenness values

More fishing efforts decrease biological diversity of epifauna and infauna

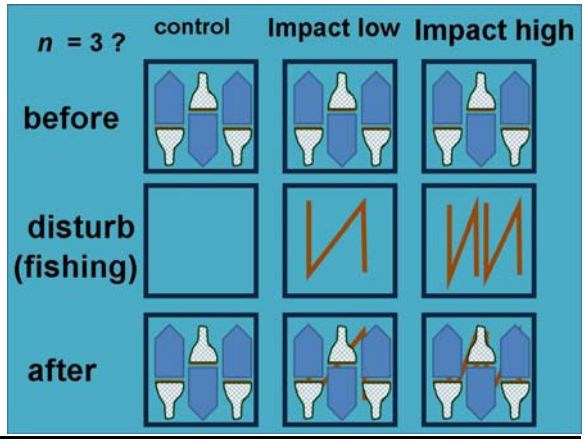
More fishing efforts decrease abundance of epifauna and infauna

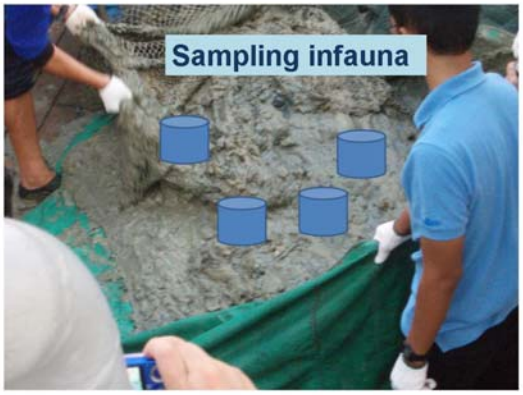
Tested hypothesis : Variables: density and biomass

$H_0: \mu_C = \mu_{I1} = \mu_{I2}$

$H_0: \mu_C \neq \mu_{I1} \neq \mu_{I2}$

Proposed sampling design





Do not trust my propose with 100% confidence

Please read more literatures and consider your own questions before any study

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