REPORT OF THE TRAINING WORKSHOP

ON THE DEEP SEA FISHERY RESOURCES EXPLORATION ON THE CONTINENTAL SLOPES IN SOUTHEAST ASIAN WATERS LINGAYEN GULF, PHILIPPINES WATERS

M/V DA-BFAR, THE PHILIPPINES

11-25 MAY 2008

TD/RP/124

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

May 2008

Report of the Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters

M/V DA-BFAR, The Philippines

11-25 May 2008

The Training Department
Southeast Asian Fisheries Development Center

TD/RP/124 May 2008

Preparation and distribution of this document

The Report of the Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters 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. 2008. Report of the Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters, Southeast Asian Fisheries Development Center, Training Department, Thailand, TD/RP/124: 194 pp.

SEAFDEC Training Department
P.O. Box 97
Phrasamutchedi
Samut Prakan 10290
Thailand

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M/V DA-BFAR, The Philippines

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PART I

Report of the Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters

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I. Introduction

1. The Training Workshop on Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters was jointly organized by the Philippine Bureau of Fisheries and Aquatic Resource (BFAR) and SEAFDEC Training Department (SEAFDEC/TD) from 11 to 25 May 2008 onboard the research vessel M.V. DA-BFAR of the Philippines. The Training Workshop was co-financed by BFAR and SEAFDEC through the Japanese Trust Fund.

2. The Workshop was attended by researchers and specialists in the field/area of deep sea taxonomy and fish identification from the SEAFDEC Member Countries, an expert from Tokyo University of Fisheries, and researchers from SEAFDEC/TD and SEAFDEC Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD). The list of participants appears as **Annex 1**.

3. The collaborative research activity between BFAR and SEAFDEC on deep sea fisheries resources survey on the continental slopes along the Lingayen Gulf has been an effort under two major activities implemented by BFAR in CY 2007 and 2008 as part of its collaborative program with the National Museum of National History of Paris, France on the conduct of surveys of the deep waters of the Philippines onboard the M.V. DA-BFAR. Since the results from the pervious cruises/surveys were focused only on the identification of biodiversities including fishes, there were indications that potential major/commercial species of fishes and shrimps can still be developed, hence, this collaborative Deep Sea Resources Survey between BFAR and SEAFDEC.

4. This activity was developed under the SEAFDEC project on “Deep Sea Fisheries Resources Exploration in the Southeast Asian Waters” implemented since 2007, with the overall objective of:
   - Investigating the potential fisheries resources in the deep sea waters in the EEZs and trans-boundary areas of the SEAFDEC Member Countries in collaboration with the respective countries using the M.V. SEAFDEC 2 and other national research vessels adopting the cost-sharing policy of SEAFDEC;
   - Searching for new deep sea fisheries resources and fishing grounds in the Southeast Asian waters;
   - Investigating the impact of deep sea trawl to the bottom ecosystem through the identification of species composition and analysis of the results from the recorded video;
   - Enhancing human resources capacity on deep sea resources exploitation including
     - the methodology for sampling deep sea fisheries resources, identification of deep sea fishers and larval fishers, and

    - taxonomy and development of appropriate/responsible fishing gear/methods and practices for harvesting/sampling of the deep sea resources
- Supporting national resources survey using national research vessels by providing advice to Member Countries on the improvement of fishing gear and methods for deep sea fish sampling.

5. The Workshop was carried out with the following specific objectives:
    - To explore the deep sea fishery resources on the continental slope using bottom trawl, beam trawl, and deep sea trap onboard the research vessel M.V. DA-BFAR of the Philippines;
    - Investigate the topographic features for the bottom trawl fishery on the continental slope of the Lingayen Gulf;
    - Document the important deep sea species in the survey area;
    - Share and exchange ideas and experiences on deep sea fishery resources survey;
    - Discuss the possibility for future initiative work on deep sea fishery resources at national/regional level; and
    - Conduct shipboard training and workshop on deep sea fishery research.

II. Opening of the Training Workshop

6. The Chief of the MFDC[1] of BFAR, Dr. Alma Dickson welcomed and thanked the technical experts and participants from the SEAFDEC Member Countries and BFAR for their participation in the training. She recalled that since there are only few research vessels in the region which could conduct deep sea resources surveys; BFAR through the M/V DA-BFAR has initially spearheaded this activity with the SEAFDEC Training Department to jointly share the technical knowledge and experiences among the experts and researchers on deep sea fisheries resources exploitation. Her Welcome Remarks appear as **Annex 2**.

7. In his Opening Address, Mr. Benjamin F.S. Tabios, BFAR Assistant Director on behalf of the Director of BFAR, reminded the participants and resource persons that the Training Workshop has been organized as a direct response to the need for an assessment of the potentials of the deep sea resources as well as to discover and optimize the use of available fisheries resources for the benefit of the fishing industry. His Opening Address appear as **Annex 3**.

8. The Secretary-General of SEAFDEC, Dr. Siri Ekmaharaj in His Opening Message, welcomed the participants to the Training Workshop. He underlined the importance of utilizing the resources in the deep sea and in particular expressed appreciation to BFAR, the experts and resource persons for their support to the Workshop. His Message appears as **Annex** 4.

[1] MFDC = National Marine Fisheries Development Center

[1] MFDC = National Marine Fisheries Development Center

III. Resource Persons Presentations and Country Reports

9. The arrangement and activities of the Workshop appear as **Annex 5/1-5/3**.

10. The presentations made by the Resource Persons provided the basis that guided, transferred the knowledge, and shared experiences and lessons learned among the participants and the resource persons. These were considered useful in the discussions during the survey. The presentations included:
    - Introduction to Deep Sea Resources Survey/Orientation by Dr. Worawit Wanchana of SEAFDEC/TD (**Annex 6**)
    - Fishing Gear for Deep Sea Resource Survey by Mr. Rafael Ramiscal of BFAR (**Annex 7**)
    - Experiences and Lessons Learned from Fishing Trials on Beam Trawl by Mr. Sayan Promjinda, and IKMT [2] by Mr. Nakaret Yasook, Fishing Gear Researchers of SEAFDEC/TD (**Annex 8**)
    - Country Reports on the Deep Sea Exploration (**Annex 9**)
    - Overview of Deep Sea Fish Taxonomy in the South China Sea by Mr. Montri Sumontha, Fish Taxonomist of the Department of Fisheries of Thailand (**Annex 10**)
    - Study on Deep Sea Ecosystem and Its Impact from Fishing Activities by Associate Prof. Dr. Tsuhiya Kotaro of the Tokyo University of Marine Science and Technology (**Annex 11**)
    - Collection and Preservation of Deep Sea Fauna Specimens for Museum Documentations by Dr. Natinee Sukramongkol of SEAFDEC/TD (**Annex 12**).

IV. Survey Results and Discussion

11. A total of 15 operations were conducted in the waters of Lingayen to explore the deep sea fauna of the area. Three fishing (sampling) gears were used to survey the area, namely: the beam trawl, otter-board trawl, and deep sea trap. Each station was recorded in three stages of the setting, dragging and hauling of the fishing gears used. The area of the survey and operations appears as **Annex 13/1-13/2**.

12. The fifteen fishing operations carried out comprised 11 beam trawl operations, 3 deep sea trap, and one otter trawl operations. During the cruise the deepest area that was surveyed was at station BTR514 with a depth of 1227 meters during dragging and 1200 meters at the start of hauling, and the shallowest area was at station BTR515 which was 283-253 meters deep.

13. A series of adverse situations occurred during the survey, including damages to some of the gears. At station BTR512 for example, the cable of the trawl snapped that resulted in low

[2] Isaac-Kidd Midwater Trawl

amount of catch. At the station OTR525, the net was broken due to the uneven topography of the sea floor.

14. The samples collected from the sampling gears were brought to the laboratories for fine sorting (according to family and species level), recording and photography. The sorted/identified specimens where placed in pre-labeled plastic bags and preserved in 10% formalin solution and/or ethyl alcohol (80%).

15. The results of the survey/operation are shown below:

4.1 Sea Bottom Topographic Survey

16. The bottom topographic survey was carried out 1 minute before and during fishing operation by using Furuno model FCV-292. A total of 12 transect lines were established consisting of 11 lines for the beam trawl, and 1 line for the otter-board trawl survey. These were carried out in the area where the recorded depth ranged from 230 to 1270 meters, and the average depth was 617 meters. The sea floor topography of the survey area is an irregular substrate, as shown in **Annex 14**.

4.2 Shrimps

17. Deep sea crustaceans were sorted and identified according to the species and were weighed. The carapace lengths and group weights of the shrimp catch were also recorded. The sorting and identification procedures, and the recorded data appear as **Annex 15**.

18. Fifty-four crustacean species were identified which were mainly composed of shrimps, lobsters, and crabs. The highest shrimp catch from the beam trawl operations was observed in BTR513 (201 pieces) while the lowest catch was taken from BTR512 (6 pieces). For the trap operations, the highest catch was taken from station TRA511 (352 pieces) and the lowest catch was in station TRA516 (16 pieces).

19. It was found that species belonging to Family Pandalidae (e.g. *Heterocarpus* sp. and *Plesionika* sp.) were dominant in the deep sea shrimp catch for beam trawl and trap stations. However, species belonging to Family Aristedae (*Aristeus virilis*) was dominant in the otter-board trawl catch.

4.3 Fishes

20. The fishes recorded from the results of the survey are shown in the table in Annex 6. The Workshop noted that some potential commercial fish species can be those belong to the

Congridae and Macrouridae families. **Annex 16** shows the details of the fishes caught from the survey.

4.4 Cephalopods

21. In this survey, 11 lots of cephalopods were collected which belong to eight (8) families (Octopdidae, Ctenopterygidae, Sepioliidae, Ommastrephidae, Mastigotheuthidae, Ocopoteuthidae, Histioteuthidae, and Pyroteuthidae) under class Cephalopoda. Family Ommasrephidae, which was observed to be dominant consisted of two (2) species, namely: *Ornithoteuthis volatilis* and *Sthenoteuthis eualaniensis*. A total of nine (9) species of cephalopods were also identified as: *Pyroteuthis* sp*., Sthenoteuthis eualaniensis, Octopoteuthis* sp*., Ornithoteuthis volatilis, Ctenopteryx sicula, Histioteuthis meleagroteuthis, Mastigoteuthis cordiformis, Heteroteuthis* sp*., and Octopus* sp. Among the species of cephalopods identified, five (5) species were collected using the otter trawl (**Annex 1**7). The Workshop noted that there is a high possibility of collecting more number of deep sea squids using the otter board trawl sampling gear.

4.5 Invertebrates

22. The invertebrates collected using the abovementioned sampling gears were categorized into four groups, namely: 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 sea grasses were also included in this group) as shown in **Annex 18**.

23. A total of 2861 lots of invertebrates were gathered from the survey. Echinoderms dominated (1540 pieces) the collection, followed by sponges (511 pieces), anthozoans (505 pieces), and other invertebrates (305 pieces). Among the gears used, beam trawl had the most abundant and diverse group of invertebrates collected. Anthozoans and sponges were not present in the deep-sea trap collection since most of the species under these groups are not mobile.

24. The abundance of organisms were also evaluated into two levels of depth strata such as <500 m and >500 m. The results showed that invertebrates (echinoderms, sponges, and other invertebrates) collected were abundant at water depths of less than 500 m while the anthozoans group was found in waters deeper than 500 m.

4.6 Mollusks

25. At least 64 species belonging 35 families of shelled mollusks were preliminarily identified from 475 individuals caught by the beam trawl, which consisted of 3 polyplacophorans, at least 43

gastropods, 5 scaphopods, and 13 bivalves. Gastropods shared more than 67% of the total species composition and 70% of the total count of the specimens, most of which were recorded alive but only few in worn shells. The gastropods comprised 6 species in 2 families of vetigastropods, 7 species in 5 families of sorbeoconchs, over 30 species in 11 families of neogastropods, and 2 heterobranchs. Vetigastropod families have rhipidoglossate radula and are usually herbivore or grazer in shallow waters (e.g. *Fissurella* sp.), but are detritus feeders or grazing on bacteria mat or organic matters derived from such materials as sunken woods in the deep sea. Sorbeoconch species are usually filter feeders (e.g. *Capulus* sp.) or carnivores (e.g. *Natica* sp.). It has been known that naticids feed on other mollusks, and cassids feed on echionoderms. Neogastropoda is a divergent group and is mainly carnivore. No species of herbivore-dominant group such as turbinids and haliotids, was observed **(Annex 17)**.

26. The most abundant family counted was Turridae sharing 71% of the total gastropods, followed by Xenophoridae and Fasciolariidae sharing 5% each. It seemed that there was a large gap of the biomass among these families. Turridae also showed the highest species diversity among the gastropods, where over 15 species were recorded including some unidentified species. Turridae is considered to be an active hunter with its toxoglossate radula, which could swallow the whole feeding habitat and is adaptive for soft-sediment deep sea bottom.

27. In summarizing the vertical distribution, species diversity was highest in water depths of around 500 m, while mollusca fauna shifts around the water depths of 600 m. For the *Xenophora* and *Fusinus* species, their distribution was limited to waters shallower than 600 m. It appeared that in estimating the species diversity, there was a bias towards fishing gear selectivity for large-sized (e.g., *Buccinidae* spp.) and micro-species as fishing target and majority of which are in deep sea floor, respectively.

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

4.7 Oceanographic Survey

29. The proposed oceanographic survey could not be carried out due to the damages caused to the deployment platform of the CTD by “Typhoon COSME” during the cruise.

V. Recommendations

5.1 Comments on the activities during the cruise survey

30. For the purpose of improving the effectiveness in conducting surveys in deep sea waters, the workshop recommended that the following matters should be considered:
    - Standardize the sampling gears which is important for better practice and to facilitate formulation of information/data compilation/comparison;
    - Use other sampling gears such as bottom vertical longline, bottom gillnet, bottom giant traps;
    - Assign additional resource persons in the field of taxonomy for effective identification and analysis of the samples;
    - Plan a longer duration (e.g. two weeks) for data gathering; and
    - Establish oceanographic stations in addition to fishing gear stations.

31. The Workshop noted that the operation/survey during this Workshop was conducted in an exploratory manner and the data gathered represented the deep sea fishery resources and some indications of the potentials for fisheries.

5.2 Development of an appropriate program for future deep sea exploration

32. Based on the discussion, the Workshop further suggested that:
    - SEAFDEC should participate in various fora where information could be disseminated to the Member Countries and other relevant agencies, as this could help in formulating and facilitating future work on deep sea fishery resources;
    - Strengthening the capacity, both at national and regional level, should be considered for future collaboration in the deep sea fishery resources exploration;
    - SEAFDEC could play a coordinating role in further development of the regional program to support the Member Countries on deep sea fishery exploration;
    - Similar initiatives with BIMP-EAGA could be carried out through a SEAFDEC regional program;
    - Development of an appropriate regional program at the regional gathering fora, e.g. FAO-SEAFDEC-DOF/Thailand, etc. should be facilitated;
    - Possibility of developing regional/national capacity for deep sea fishery resource, such as deep sea taxonomist, fishing (sampling) gear, etc. should be considered;
    - SEAFDEC should develop a regional training course for deep sea taxonomists, deep sea fishing gear experts, and standardize the methodologies for deep sea fishery exploration (SOP), inviting available experts, as soon as possible;
    - Regional event to review the past/existing initiatives on the deep sea fishery resources survey and develop an appropriate regional program, should be organized; and
    - Regional understanding on the definition with regards to the deep sea, such as “regional guideline/handbook for deep sea fishery”, should be developed.

5.3 Recommendations on future plan for the utilization of the M.V. SEAFDEC 2 and/or other national research vessel(s) for future deep sea resources exploration

33. The M.V. SEAFDEC 2 should focus on deep sea fishery resource survey in the Member Countries under the cost-sharing scheme in collaboration with DOF of Thailand, Malaysia, Indonesia, Philippines, Vietnam, and Myanmar. Brunei Darussalam and Vietnam would be in the position to share information on deep sea resources survey (carried out in June 2008 and scheduled in 2009, respectively) with the other Member Countries.

34. SEAFDEC/TD and MFRDMD should develop the appropriate deep sea fishing gears for sustainable development of the deep sea fisheries in the region. As the Workshop also suggested, in addition to deep sea trawl other alternative fishing gears could also be developed.

35. SEAFDEC should look into the possibility of sharing the experiences and lessons learned from other regions for future development of the deep sea fishery in the Southeast Asian waters.

36. A regional network/expert for deep sea fisheries should be established through coordination and collaboration with the other initiatives in the region.

VI. Conclusions

37. The Workshop concluded that:
    - Programs similar to the DA-BFAR Lingayen 2008 of the Philippines could also be conducted in other Member Countries;
    - Indication of the potential species for deep sea fisheries was observed during the survey/operation;
    - Dissemination of the results of this survey to other Member Countries should be pursued;
    - DA-BFAR and SEAFDEC should collaborate for the publication of the results of the exploratory survey.

38. The report will be circulated to the participants and resource persons to obtain comments/amendments. This report will be finalized as soon as possible.

VII. Closing of the Training Workshop

39. Certificates of achievements were presented to the participants and resource persons by Dr. Alma Dickson. After expressing her appreciation to the resource persons, the M/V DA-BFAR

staff and crew as well as the SEAFDEC staff for their support and cooperation during the workshop and survey, she declared the workshop closed.

Annex 1

List of Participants and Resource Persons

Participants

Brunei Darussalam	Abdul Hamid Haji Zainin Head Fisherman Department of Fisheries Email: hamid.zainin@fisheries.gov.bn dol_1605@hotmail.com
Indonesia	Muhammad Taufik Fishery Biologist Research Institute for Marine Fisheries Jl. Muara Baru Ujung Kompleks Pelabuhan Perikanan Samudera Nizam Zachman Jakarta Utara 14444 Email: bang_opot@yahoo.co.id, taufik_rimf@yahoo.co.id
Malaysia	Mohammad Faisal bin Md. Saleh Research Office, Southeast Asian Fisheries Development Center Marine Fishery Resources Development and Management Department Email: mohdfaisal@seafdec.org.my; and mobularay@yahoo.com
Philippines	Rafael Ramiscal Supervising Aquaculturist Bureau of Fisheries and Aquatic Resources (BFAR) Email: rv_ram55@yahoo.com Rhoda Servidad (Ms) Researcher – BFAR Email: jadesummer21@yahoo.com Jennifer Viron (Ms) Researcher – BFAR Email: jennyviron@yahoo.com Pierre Easter Velasco Aquaculturist, NMFDC – BFAR Email: pierrevelasco@gmail.com Remar Asuncion Fishing Master, M/V DA-BFAR Email:
Thailand	Narupon Darumas Fisheries Biologist Deep Sea Fishery Technology Research and Development Institute Marine Fisheries Research and Development Bureau E-mail: n_darumas@hotmail.com
Vietnam	Pham Quoc Huy Researcher Fisheries Resources Research Division Research Institute for Marine Fisheries E-mail: pqhuy@rim.org.vn

SEAFDEC/Marine Fishery Resources Development and Management Department	Mr. Mohamad Azmi Bin Abdullah Captain of KK SENANGIN II Southeast Asian Fisheries Development Center/Marine Fisheries Resources Development and Management Department E-mail: azmi@seafdec.org.my

Resource Persons

Japan	Kotaro Tsuchiya Associate Professor Laboratory of Invertebrate Zoology Tokyo University of Marine Science and Technology Email:kotaro@kaiyodai.ac.jp
Department of Fisheries Thailand	Montri Sumontha Fish Taxonomist Ranong Marine Fishery Station Thailand Email:montri_sumontha@yahoo.co.th; montri.sumontha@gmail.com
SEAFDEC Training Department	Worawit Wanchana Capture Fisheries Technology Division Head Email: worawit@seafdec.org
	Natinee Sukramongkol (Ms) Fishery Oceanographer Email: natinee@seafdec.org
	Mr. Sayan Promjinda Fishing Gear Technologist Email: sayan@seafdec.org
	Nakaret Yasook Fishing Gear Technologist Email: nakaret@seafdec.org
	Tossaporn Sukhapindha Captain M.V. SEAFDEC2 Email: tossaporn@seafdec.org

Annex 2

WELCOME REMARKS
By Dr. ALMA C. DICKSON
Chief of MFDC, BFAR

Honored Guests, Dr. Siri, Secretary General and Chief Training Department, SEAFDEC; Director Sarmiento of BFAR; Dr. Toledo, SEAFDEC/AQD Chief; Dr. Kotaro, Mr. Somontha, Dr. Dickson, Dr. Worawit, Dr. Natinee; delegates from the SEAFDEC Member Countries, from Brunei, Indonesia, Malaysia, Vietnam and Thailand; colleagues, Ladies and Gentlemen, Good Morning.

Welcome onboard the M/V DA-BFAR!! Your presence in this program is indeed an honor to the Bureau of Fisheries and Aquatic Resources for the gathering of technical experts among the SEAFDEC member countries is a rare opportunity to happen, but it did happen in view of our commitments to share our expertise and facilities to attain a common goal.

This Collaborative Research Program Between BFAR and SEAFDEC on Deep Sea Fisheries Resource Survey on the Continental Slopes along the approaches of Lingayen Gulf has been an offshoot of two major activities by BFAR in CY 2007 and 2008, respectively, more particularly in its collaborative program with the National Museum of National History of Paris, France during the surveys of deep water benthic fauna of Aurora and South China Sea adjacent waters on board the M/V DA-BFAR. Since the results of both cruises were focused only on identification of biodiversities including fishes, there were indications that potential major/commercial species of fishes and shrimps can still be developed, hence, this project on Deep Sea Resources Survey. Moreover during the SEAFDEC Program Committee Meeting in Iloilo last November 2007 and the Council Meeting in 2008, one of the major significant activities proposed was the conduct of Deep Sea Fisheries Resources Survey in the Region and National Waters

Since there are only few research vessels in the Region which can conduct the deep sea resources surveys, BFAR through the M/V DA-BFAR has initially spearheaded this activity with the SEAFDEC Training Department Research Group with the assistance of Dr. Somboon Siriraksophon whom I and Raffy have jointly conceptualized this project. Likewise, in order to optimally share the technical know how and expertise among the Researchers of the concerned Member Countries, a back to back training on the Deep Sea Fishery Resources Exploitation on Continental Slopes in Southeast Asian waters will also be conducted. Hence, we are very much thankful to our counterpart Researchers, Experts, Resource Persons from SEAFDEC, Department of Fisheries of Thailand, Tokyo University of Marine Science and Technology who are here to share their expertise on deep sea taxonomy, deep sea ecosystem and its impact to fishing activities, and collection and preservation of deep sea fisheries specimens.

With the convergence of the technical experts in this Survey, I am optimistic that this collaborative undertaking will be a success.

Again welcome to each and everyone. Good morning!!!!

Annex 3

Opening Address
By Atty. Benjamin F.S. Tabios
Asst. Director for Administrative Services, BFAR

Dr. Siri Ekmaharaj, SEAFDEC Secretary General,
Dr. Worawit Wanchana of SEAFDEC Training Department,
Dr. Tsutsiya Kitaro of Tokyo University of Marine Science and Technology,
Mr. Montri Somontha of the Department of Fisheries of Thailand,
Representatives from SEAFDEC Member Countries from Brunei Darussalam, Indonesia, Malaysia, Thailand, and Vietnam,
Representatives from SEAFDEC/MFRDMD in Malaysia,
Representatives from SEAFDEC/TD in Thailand,
Dr. Jonathan Dickson, Alma Dickson and Staff,
The M/V DA-BFAR Officers, Researchers and Crew,

Good Morning. Please allow me to extend my gratitude to everyone for coming and contributing to our efforts to investigate the deep sea resources in the Philippines.

The Philippines like many fishing nations are also confronted with overexploitation and high fishing pressure in the traditional fishing grounds both in the coastal and offshore waters. It is for this reason that our initiatives to assess the potential of our deep sea resources have been a priority to discover and optimize the use of available fisheries resources for the benefit of the fishing industry.

It is a fact that while 88% of our marine waters are considered deep sea zones, we have very limited exploitation of our deep sea fisheries potentials considering that much efforts have been given only on the development and management of the country's pelagic resources. However, our neighboring countries like Japan and Taiwan with relatively limited deep sea areas have developed their fisheries based on deep sea resources

We also took cognizant on the findings of our recent collaborative surveys with the French National Museum that a number of interesting shrimp species are found in our deep sea waters which could provide benefits to our fishers and fishing industry. But the survey with the French was mainly for taxonomic and biodiversity studies. Thus, BFAR has planned to embark on a survey focusing on the assessment of the fisheries potential of the deep sea resources.

Likewise, this collaborative program between BFAR and SEAFDEC/TD is very timely. I am grateful that SEAFDEC has also a similar initiative for the deep sea resources in this region. I believe that this is long overdue. Many countries particularly the more advanced fishing nations with even relatively limited deep sea areas have long enjoyed their resources. In fact there are proposals for a moratorium on exploiting these resources due to overfishing of their areas and yet we have just started assessing what we have in this part of the world.

In conducting this survey we should thus bear in mind lessons from those developed countries. I will be very pleased if we find resources that can contribute to fish production and increase income of fishers. But in so doing, we should also be prudent enough to make sure that these deep sea fisheries resources which are highly vulnerable to overexploitation can provide long-term benefits to the country's economy. Thereby, a management plan for each commercially major species discovered must be prepared and effectively implemented.

Last but not least, I wish you safe trip and successful expedition. Again our sincere thanks to everyone especially to Dr. Siri and SEAFDEC-TD staff, the member countries' representatives and resource persons from Thailand and Japan for unselfishly sharing their respective expertise and efforts for these significant undertaking.

Good Day to Everyone!!!

Annex 4

Opening Message
By Dr. Siri Ekmaharaj, SEAFDEC Secretary-General
At the Opening Ceremony of the
Ship board Training on the Deep Sea Fishery Resources Exploration on the Continental Shelf in the Southeast Asian Waters
11-25 May 2008, Onboard the Philippine M.V. DA-BFAR

Mr. Benjamin Tabios, Asst. Director of BFAR,
Dr. Alma C. Dickson, Chief of MFDC, BFAR,
Dr. Jonathan Dickson,
Dr. Jobert Teledo, Chief of SEAFDEC/AQD,
Distinguished guests and participants,
Good Morning!

On behalf of SEAFDEC, I wish to welcome you to the Opening Ceremonies of the Ship Board Training on Deep Sea Fishery Resources Exploration on the Continental Shelf in the Southeast Asian Waters. I would also like to thank the Philippine Bureau of Fisheries and Aquatic Resources for hosting this collaborative Shipboard Training onboard its M.V. DA-BFAR.

We all know that in the geographic feature of the Southeast Asian waters, more than 50% of the sea areas are identified as deep sea where the utilization of resources in these waters have not been fully initiated yet. One of the reasons could be the lack of information on the potentials of such resources. In addition, we also strongly believe that there may have been researches already conducted on deep sea fisheries resources exploration in the region. However, such researches may have been limited as there are not many research vessels in our region that can be used to conduct such activity. It is therefore a good opportunity for all of us to experience this collaborative training on Deep Sea Fishery Resources Exploration on board the M.V.DA-BFAR, which is well equipped with the necessary instruments and related facilities needed for this training.

We are also faced with the challenge of sustainable managing the deep sea resources. As we are all aware of, poor management of the deep sea resources can lead to over fishing. As responsible citizens of the region, we do not want to lose the deep fisheries resources as what has happened to our coastal areas. Therefore, we need to understand the deep sea ecosystem and its resources as well as the impact to such resources from fisheries. SEAFDEC is very glad to have Dr. Tsuchiya Kotaro from Tokyo University of Marine Science and Technology as resource person for this collaborative training. With his vast knowledge and expertise, he can share with all of us his experience on deep sea ecosystem and its impact from fishing activities.

Lastly, I wish that this shipboard training course will run very smoothly and hope for the success of this collaborative training. I also wish to take this opportunity to express my congratulations to all the participants in this training for your strong desire and interest in gaining the experience from this Deep Sea Fishery Resources Exploration. With that note, I now declare the Shipboard Training on Deep Sea Fishery Resources Exploration on the Continental Shelf in the Southeast Asian Waters open.

Thank you and Good Day!

Annex 5/1

Agenda and Arrangement of the Training/Workshop

1 Opening

2 Introduction

- Introduction to the training/workshop activities
- Deep Sea Resources Survey/Exploitation

3 Transferring Knowledge and Sharing Experiences on Deep Sea Resources Survey/Exploitation

- Fishing Gear for Deep Sea Resources Survey
- Experiences and Lessons Learned from Fishing Trials: Deep Sea Beam Trawl and IKMT in the Andaman Sea
- Overview of Deep Sea Fish Taxonomy in the South China Sea
- Study on Deep Sea Ecosystem and Its Impact from Fishing Activities
- Collection and Preservation of the Deep Sea Fauna Specimens for Museum Documentations

4 Actual Surveys and Operations for Deep Sea Resources Exploitation

- Topographic Survey
- Trawl Survey/Operation
- Deep Sea Trap Operation
- Beam Trawl Operations
- Oceanographic Survey

5 Report the results of the survey/operations

6 Discussion and Recommendations

- Development of an Appropriate Program for Future Survey/Exploitation
- Recommendations on Future Plan for Utilization of MV SEAFDEC 2 and/or National Research Vessels for Future Survey/Exploration
- Etc

7 Conclusion and Closing

Annex 5/2

Activities of the Training Workshop

Time	*Activities*	*Facilitators/Responsible Persons*
11 May 2008, Sun (Day 1)		
15:00-20:00 hrs	Registration	
12 May 2008, Mon (Day 2)		
10:00-11:30 hrs	Opening Program	Invocation, Cheche Salcepuedes
	Welcome Remarks	Dr. Alma C. Dickson, BFAR
	Opening Address	Director Malcolm I. Sarmiento, Jr., BFAR
	Message	Dr. Siri Ekmaharaj, Secretary-General of SEAFDEC
	Introduction of Participants	Mr. Rafael Ramiscal – Chief Scientist
	Overview/Background of the survey	Mr. Worawit Wanchana – SEAFDEC/TD
	Survey/training overview	Mr. Rafael Ramiscal – Chief Scientist, and Mr. Worawit Wanchana – SEAFDEC/TD, Emcee, Jenny Veron
	Closing remarks	Dr. Jonathan O. Dickson Chief, CFTD/SEAFDEC National Coordinator, the Philippines
12:00 hrs	Lunch Break	
13:00-13:30 hrs	Cruise Orientation	Capt of the DA-BFAR, Mr. Rafael Ramiscal – Chief Scientist, and Mr. Worawit Wanchana–SEAFDEC/TD
13:00-13:30 hrs	Deep sea resources survey/exploitation	Mr. Worawit Wanchana
13:30 hrs	Leave Manila for Lingayen Gulf, Western Luzon	
14:00-14:30 hrs	Fishing gear for deep sea resources survey	Mr. Rafael Ramiscal
14:30-15:00 hrs	Experiences and lesson learned from fishing trials: Deep sea beam trawl and IKMT in the Andaman	Mr. Sayan Promjinda and Mr. Nakaret Yasook, researchers of SEAFDEC/TD
15:00-15:20 hrs	Refreshment break	

(continued)

Annex 5/2

15:20-15:40 hrs	Country report	Brunei Darussalam
15:40-16:00 hrs	Country report	Indonesia
16:00-16:20 hrs	Country report	Myanmar
16:20-16:40 hrs	Country report	Malaysia
16:40-17:00 hrs	Country report	SEAFDEC/MFRDMD
17:00-17:20 hrs	Country report	Thailand
17:20-17:40 hrs	Country report	Vietnam
13:30-17:00 hrs	Fishing gear and survey equipments preparation	
13 May 2008, Tue (Day 3)		
09:00-09:30 hrs	Overview of the deep sea fish taxonomy in the South China Sea	Mr. Montri Sumontha, Fish Taxonomist – DOF Thailand
09:30-10:00 hrs	Study on deep sea ecosystem and its impact from fishing activities (issue on the deep sea ecosystem and invertebrate zoological)	Dr. Tsuchiya Kotaro, Japanese expert
10:00-10:30 hrs	Refreshment break	
10:30-11:00 hrs	Collection and preservation of the deep sea fauna specimens for museum documentation	Ms. Natinee Sukramongkol, researcher – SEAFDEC/TD
11:15-12:00 hrs	Explanations for the research survey planning	Mr. Rafael Ramiscal
12:00-13:00 hrs	Lunch break	
14:10-14:40 hrs	Shooting Deep Sea Trap (TRA511)	
15:08 hrs	Topographic survey line 1	
15:20-16:50 hrs	Beam Trawl operation (BTR512)	
16:44 hrs	Topographic survey line 2	
17:05-18:20 hrs	Beam Trawl operation (BTR513)	
14 May 2008, Wed (Day 4)		
07:49-08:45 hrs	Hauling Deep Sea Trap (TRA511)	
09:39 hrs	Topographic survey line 3	
10:10-12:00 hrs	Beam Trawl operation (BTR514)	
16:10 hrs	Arrived Polopoint and port along side	
15 May 2008, Thu (Day 5)		
09:15 hrs	Leave Polopoint port	
10:35 hrs	Topographic survey line 4	
12:00-13:05 hrs	Beam Trawl operation (BTR515)	
16:10 hrs	Arrived Sual Point and drop anchor	

(continued)

Annex 5/2

	near the shelter to escape from the direction of typhoon COSME	
16 May 2008, Fri (Day 6)		
15:00-17:00 hrs	Summarized on the research survey by Working group	
17 May 2008, Sat (Day 7)		
16:30-21:30 hrs	Typhoon COSME strike Lingayan Gulf	
18 May 2008, Sun (Day 8)		
08:00-05:00 hrs	Anchoraged at the Sual Point shelter	
19 May 2008, Mon (Day 9)		
09:30-15:00 hrs	Re-watering/Re-provisioning	
10:00-15:30 hrs	Sight seeing at Sual town	
16:00-17:00 hrs	Agriculture secretary Mr. Arthur C. Yap, Bureau of Fisheries and Aquatic Resources visit M/V DA_BFAR	
19:30 hrs	Leave Saul shelter for Deep Sea Trap fishing	
23:50 hrs	Shooting Deep Sea Trap (TRA516)	
20 May 2008, Tue (Day 10)		
05:32 hrs	Topographic survey line 5	
05:40-06:50 hrs	Beam Trawl operation (BTR517)	
07:42 hrs	Topographic survey line 6	
07:45-09:15 hrs	Beam Trawl operation (BTR518)	
09:45-11:00 hrs	Beam Trawl operation (BTR519) and Topographic survey line 7	
11:20 hrs	Topographic survey line 8	
12:15:13:30 hrs	Beam Trawl operation (BTR520)	
14:45-15:50 hrs	Hauling Deep Sea Trap (TRA516)	
16:45-17:30 hrs	Shooting Deep Sea Trap (TRA521)	
17:33 hrs	Topographic survey line 9	
18:10-19:30 hrs	Beam Trawl operation (BTR522)	
21 May 2008, Wed (Day 11)		
05:40 hrs	Topographic survey line 10	
06:05-07:30 hrs	Beam Trawl operation (BTR523)	
08:45-10:15 hrs	Hauling Deep Sea Trap (TRA521)	
11:10-12:20 hrs	Beam Trawl operation (BTR524)	

(continued)

Annex 5/2

13:00~hrs	Otter Trawl gear preparation	
22 May 2008, Thu (Day 12)		
05:00-06:00 hrs	Topographic survey line 11	
06:00-08:20 hrs	Otter Trawl operation (OTR525)	
08:20 hrs	Proceed to Manila	
23 May 2008, Fri (Day 13)		
13:00-15:00 hrs	Report the results of the survey/operation	All participants and resource persons, to be facilitated by SEAFDEC/TD
15:00-17:00 hrs	Discussion and Recommendation	
17:00h	Conclusion and Closing	DA-BFAR, BFAR and SEAFDEC
24 May 2008, Sat (Day 14)		
08:00~ hrs	Sight seeing in Manila	
25 May 2008, Sun (Day 15)		
09:00-12:00 hrs	Participants disembarking aboard M/V DA-BFAR	

Annex 5/3

List of Documents

Information Documents

INF_01	Provisional Prospectus
INF_02	List of Documents
INF_03	Participants list
INF_04	Notes for Participants

Working Documents

WP_01	Agenda
WP_02	Agenda and Timetable
WP_03	Annotated Agenda
WP_04	Introduction to Deep Sea Resources Survey/Exploitation
WP_05	Fishing Gear for Deep Sea Resources Survey
WP_06	Experiences and Lessons Learned from Fishing Trials: Deep Sea Beam Trawl and IKMT in the Andaman Sea
WP_07	Overview of Deep Sea Fish Taxonomy in the South China Sea
WP_08	Study on Deep Sea Ecosystem and Its impact from Fishing Activities
WP_09	Collection and Preservation of the Deep Sea Fauna Specimens for Museum Documentations

References

REF_01	FAO Species Identification Guide for Fishery Propose: The living marine resources of the Western Central Pacific. Volume 1-6
REF_02	FishBase: List of Deep-water Fishes for the Philippines
REF_03	Review of the Deep-Sea Fish Family Platytroctidae (Pisces: Salmoniformes)
REF_04	The Japan-Indonesia Deep Sea Fishery Resources Joint Exploration Project (final report and photo album)
REF_05	Guideline for Oceanographic Survey*
REF_06	Guideline for Trawl Fishing Survey/Operation*
REF_07	Guideline for Deep Sea Trap Operation*
REF_08	Guideline for Beam Trawl Operation*
REF_09	Guideline for Isaacs-Kid Mid-water Trawl*
REF_10	Check lists of the deep sea fishes in the South China Sea and Adjacent Waters*

*** Available in CD-ROM**

Report of the Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters

M/V DA-BFAR, The Philippines

11-25 May 2008

PART II
Presentations and Results of the Survey/Operation

Annex 6: Introduction to Deep Sea Resources Survey/Exploration

By Dr. Worawit Wanchana, SEAFDEC/TD – Cruise Coordinator

Annex 6

Introduction to Deep Sea Resources Survey/Exploration

Worawit Wanchana
SEAFDEC Training Department

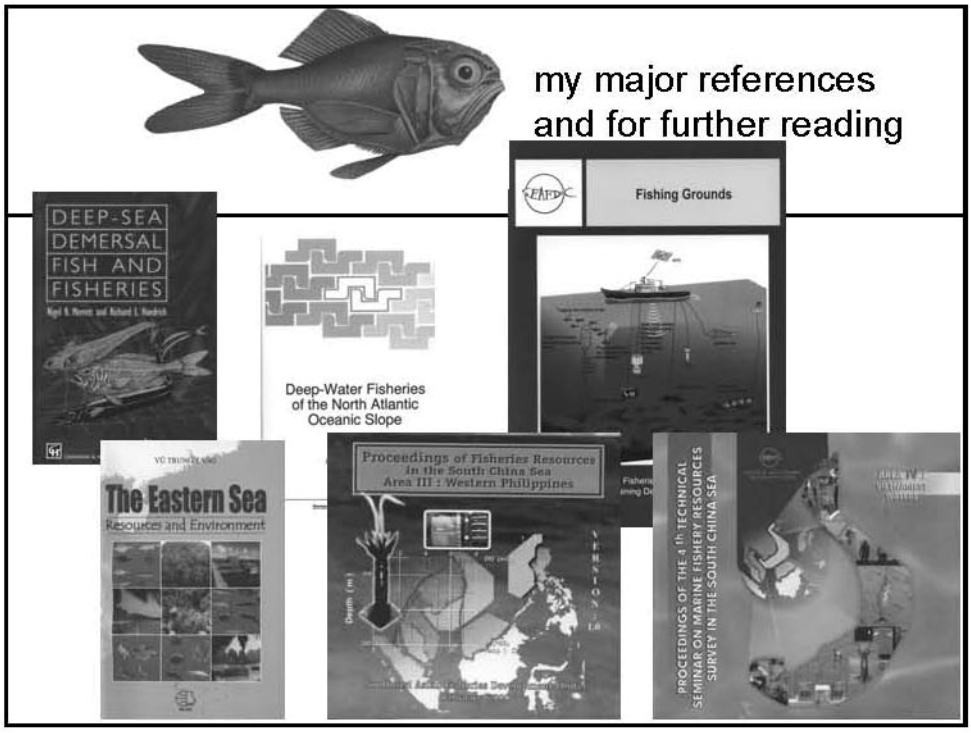
Introduction…

- Background: marine science; fishing gear materials (physical properties); some of fishing techniques, oceanography, coastal fisheries management…
- Preparation: short period…
- Expectation: enhance your/my knowledge/understanding on deep sea…
- Expectation: to facilitate participants' interest in future collaboration/coordination in deep sea research and exploitation

(continued) **Annex 6**

Contents

- Introduction
- Resources survey/assessment
- Information on the deep sea of the Southeast Asian Waters



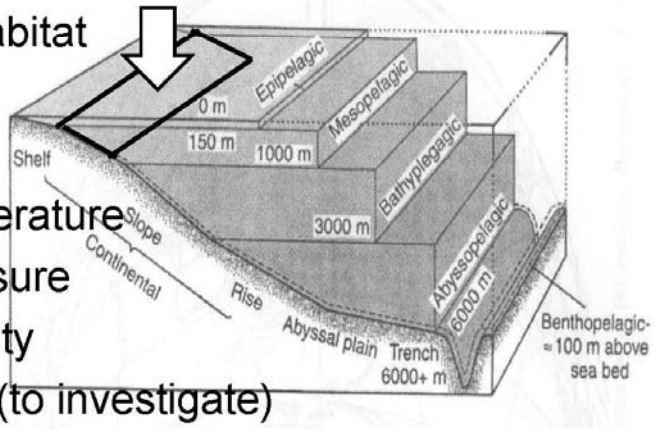
(continued) **Annex6**

Three Major Oceans

- Pacific, Atlantic, and Indian Oceans
- The rests are seas…

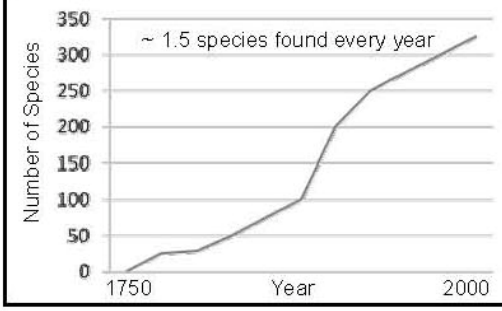
Deep Sea !

- Largest habitat
- Low light
- Low food
- Low temperature
- High pressure
- High salinity
- High cost (to investigate)
- High risk (human life, marketing of potential species of fauna, environmental impact? etc.)



Some History

- Deep sea sampling/survey started > 120 years, focusing on non-living resources
- 20 years past…living resources



Cumulative number of deep sea demersal fish species described per year, reported by 25 years intervals, data based on the Atlantic (Haedrich and Merrett, 1988)

Resources Estimation/Assessment

1. Information collection

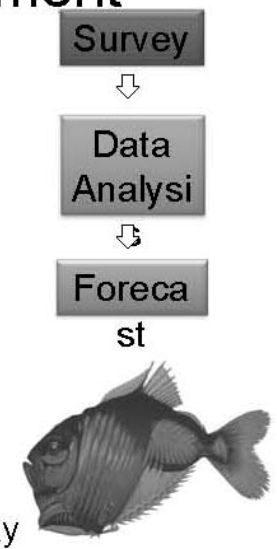
- General environment
- Species composition
- Distribution
- Ecology of deep sea and pelagic/ demersal fishes
- Feeding habitat, stomach contents

2. Data analysis

- Potentially exploitation species

3. Suggestion and Consideration

- Special problems in a sustainable way



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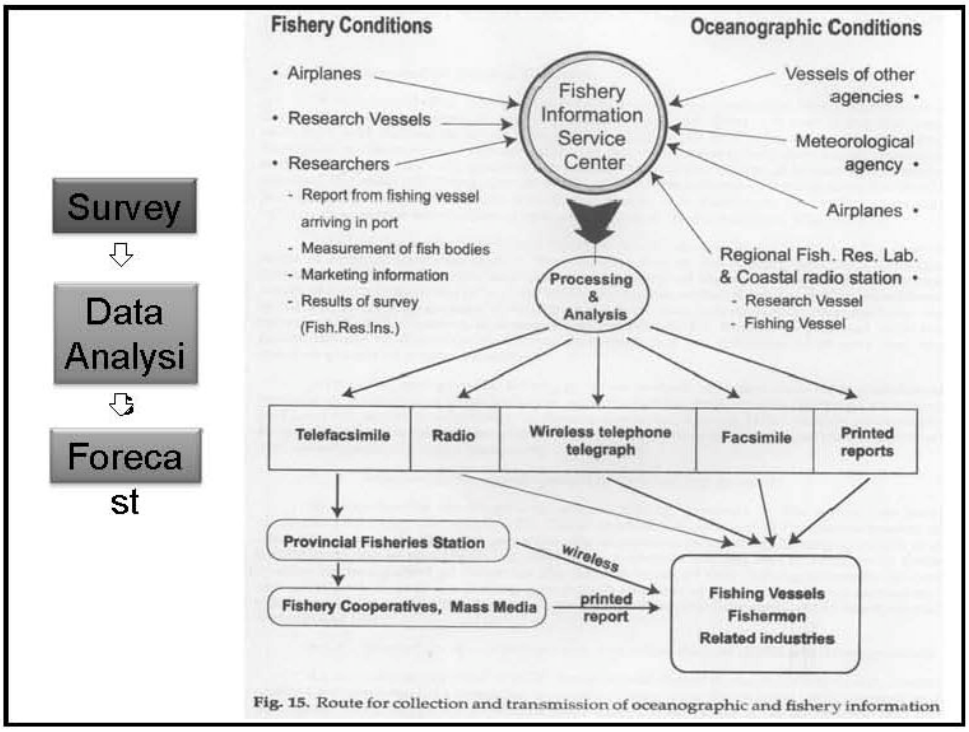
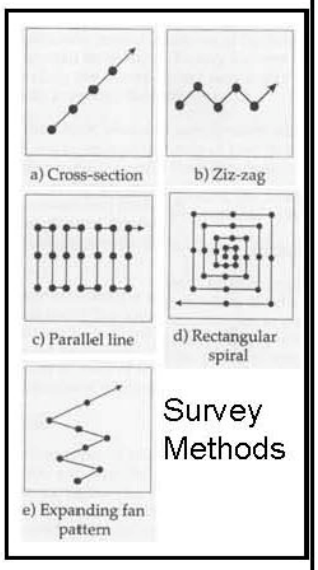


Fig. 15. Route for collection and transmission of oceanographic and fishery information

Fishing Ground Survey

- Survey: methods, equipments, cruise planning, preparation, etc.
- Collection and analysis of data.
- Reporting and data/information dissemination
- Etc.



Observation Methods

- ROV (observation, record, analyze, etc.)
- Fauna/Fish Sampling: trawl, beam trawl, longline, gillnet, trap, etc. → stock, population, biomass, etc…

SEAFDEC's Initiatives in SCS

- TD and MFRDMD "Collaborative Research Program on Fishery Resources in the South China Sea" since 1995, with financial assistance from the Government of Japan, to collect information and develop a database on fishery oceanographic and marine environmental conditions and their effects on abundance and distribution of fishes, needed to plan their management in the long term.

SEAFDEC's Initiatives in SCS

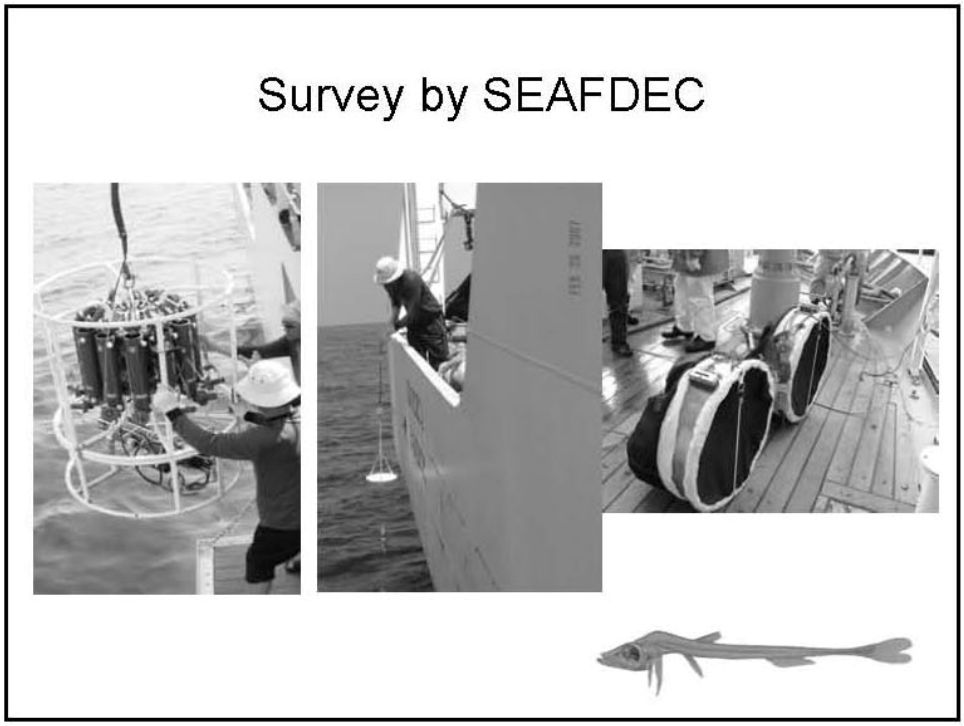
- ✓ Area I : Gulf of Thailand and East Coast of Peninsular Malaysia
- ✓ Area II : Waters of Sabah, Sarawak and Brunei Darussalam
- ✓ Area III: Western Philippines
- ✓ Area IV: Vietnamese Waters

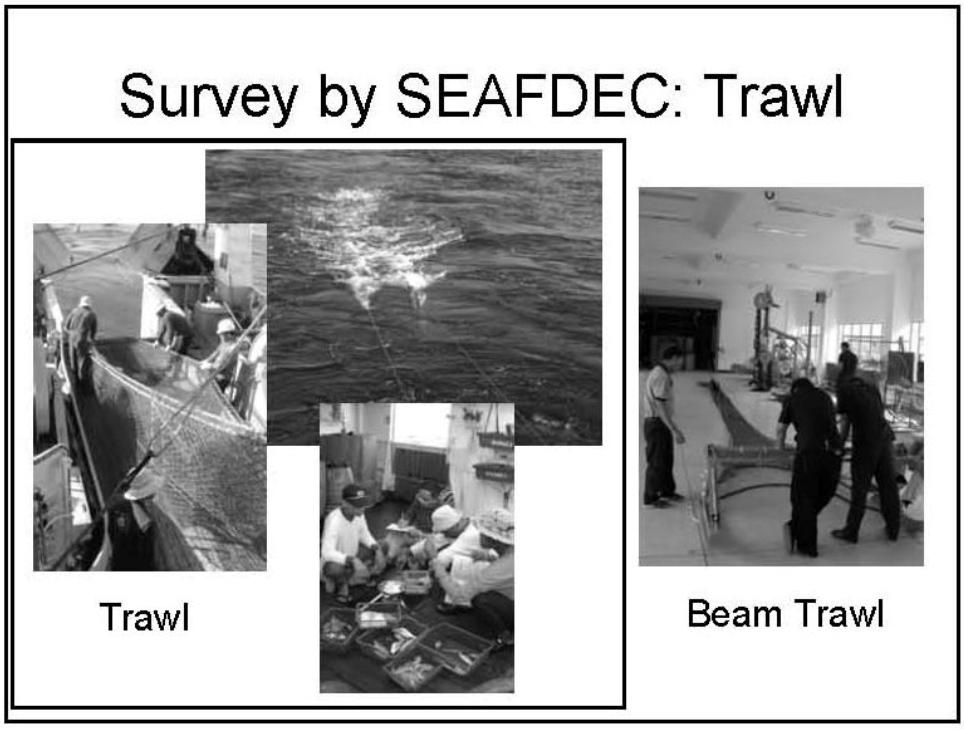
- Studies in the four designated areas have been completed and its scientific findings were discussed at Technical Seminars, proceedings of which were published;
- Summarized highlights of the findings in the four areas have also been published.

Various Initiatives

- SEAFDEC Regional Events
  - Fisheries Resources in the South China Sea, 2000 ~
  - Technical Seminar on Marine Fishery Resources Survey in South China Sea, 2001
- FAO/SEAFDEC workshop on " Assessment and management of the offshore resources of south and southeast Asia" to be held in Thailand, 17-20 June 2008
- Others (need your input during the country paper presentation)

(continued) **Annex6**





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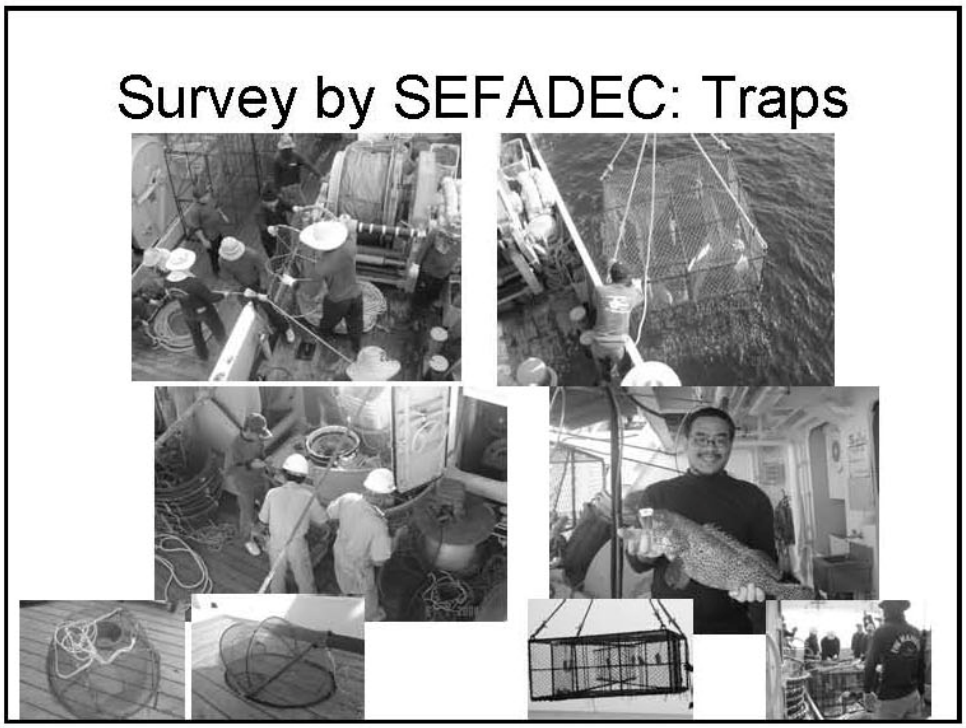

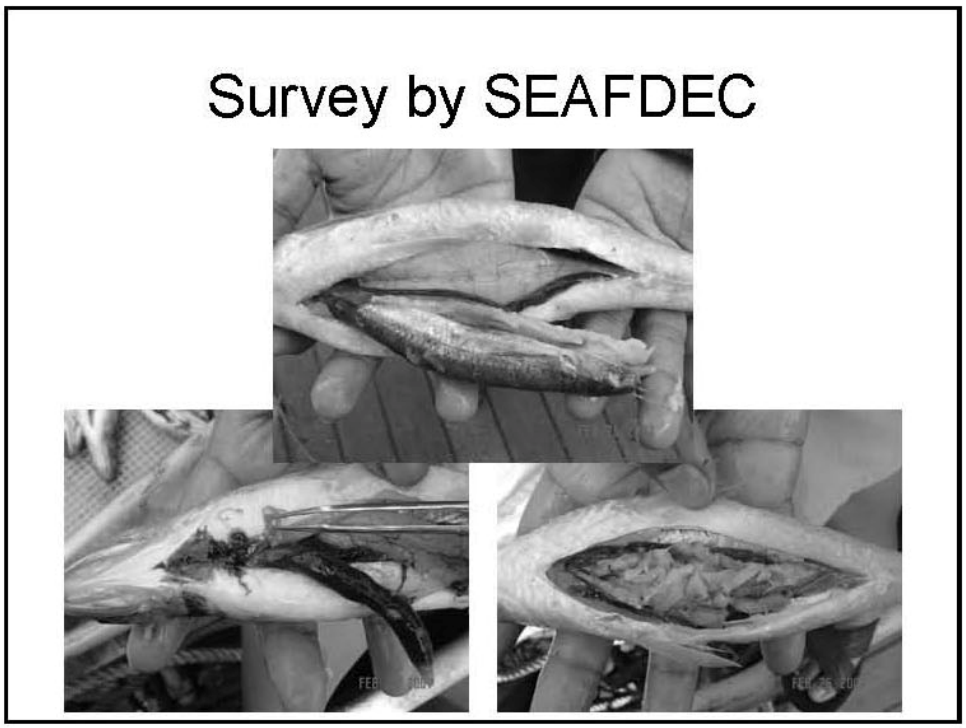

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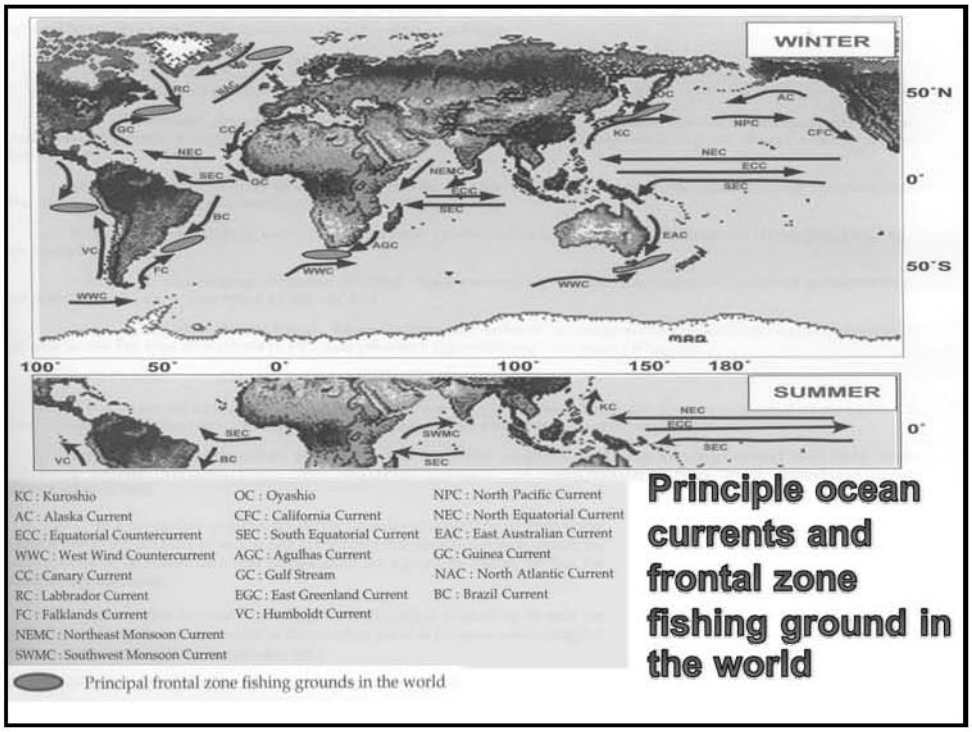
Other Initiatives and Information



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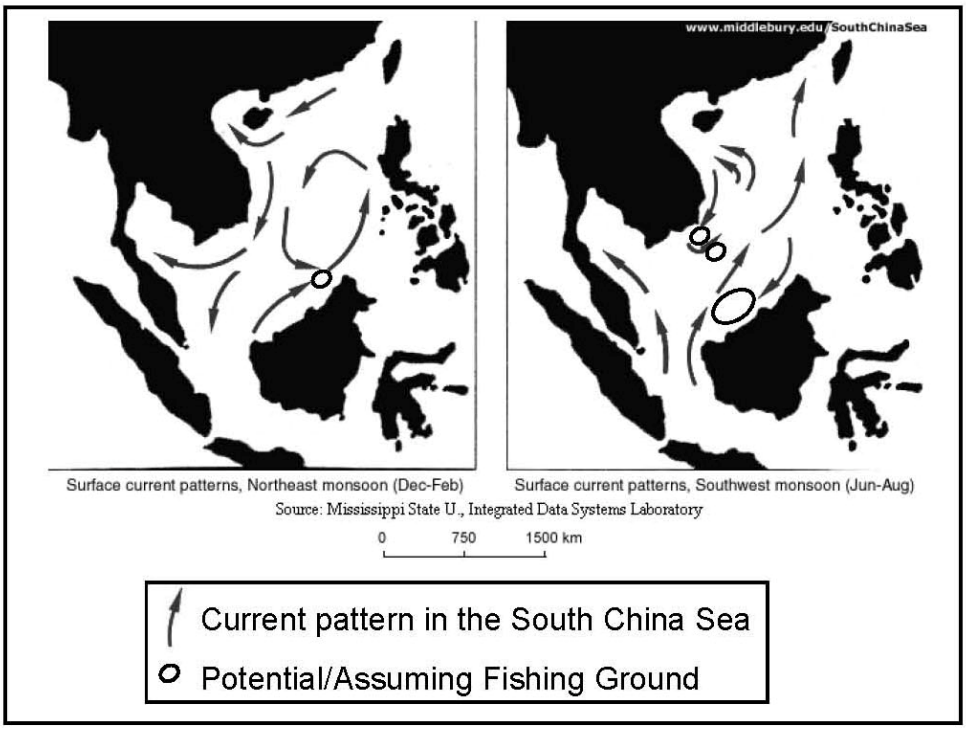

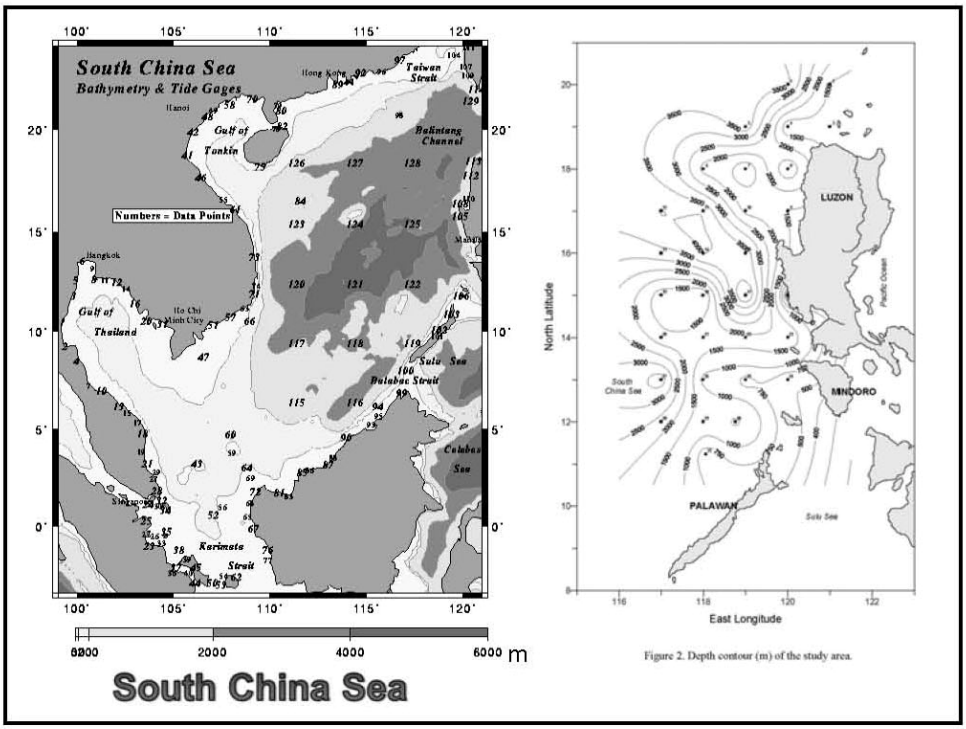

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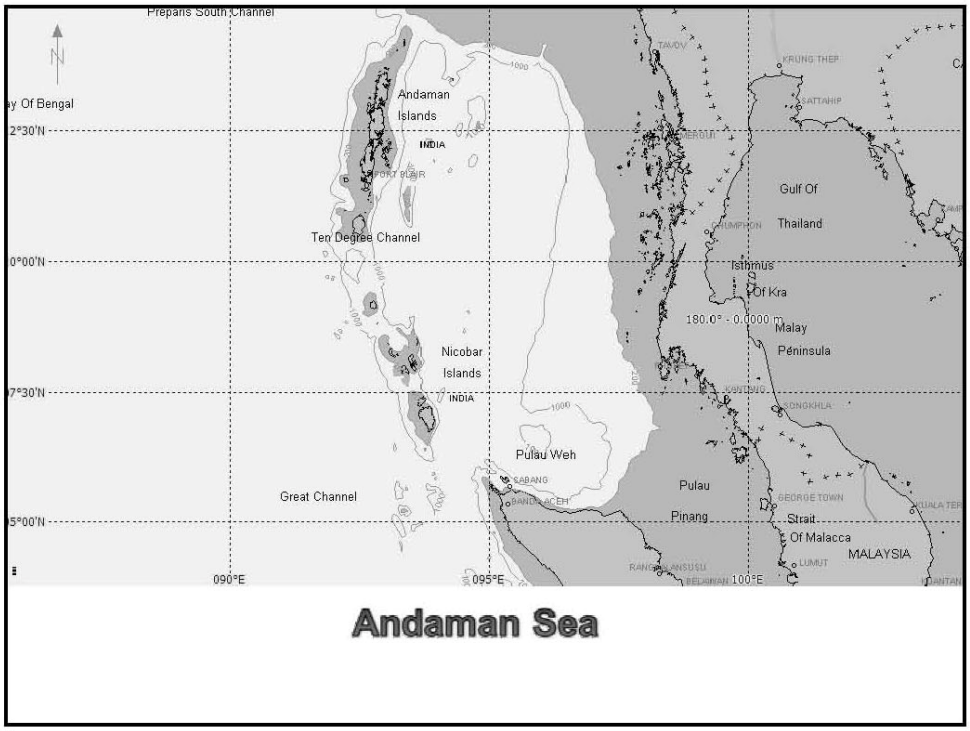

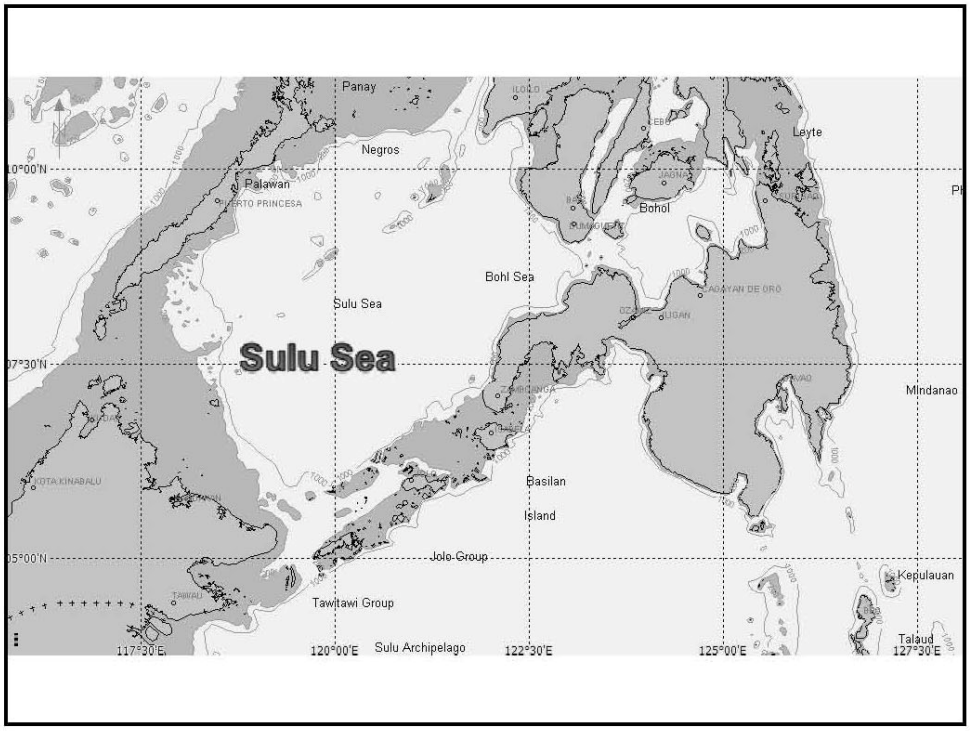

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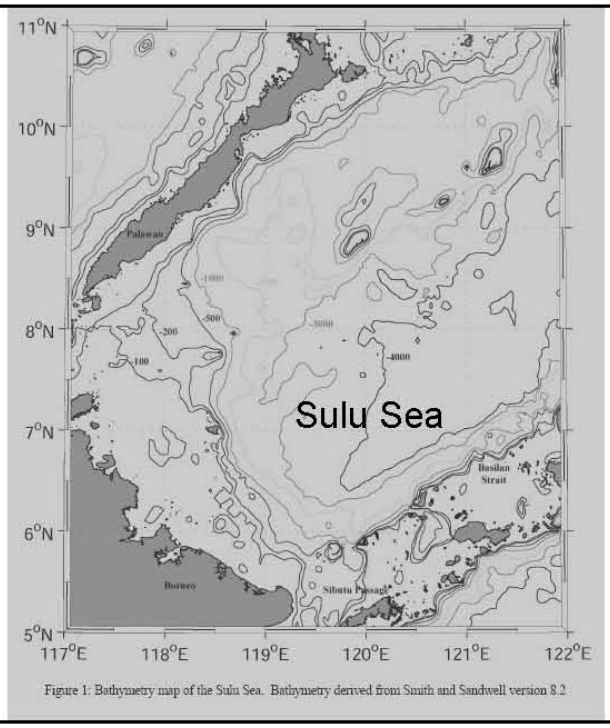


Figure 1: Bathymetry map of the Sulu Sea. Bathymetry derived from Smith and Sandwell version 8.2

Current pattern in Indonesia

(continued) **Annex6**

Science News Share Blog Cite

Bottom Trawling Destroys Deep Sea Life: UN Review Shows Need To Halt Destructive Fishing Practice

ScienceDaily (Jul. 17, 2006) — A long-awaited report by the United Nations shows the need for an international moratorium on bottom-trawling and other destructive fishing practices that damage deep sea life, Conservation International (CI) said.

See also:

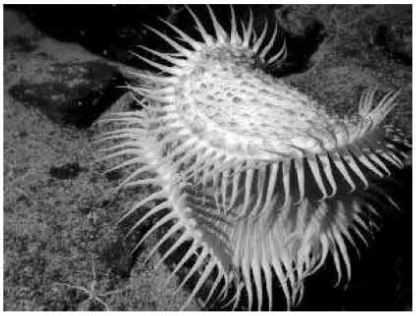
Plants & Animals
- Fish
- Marine Biology
- Sea Life

Earth & Climate
- Environmental Policy
- Oceanography
- Global Warming

Reference
- Marine conservation
- Deep sea fish
- Fishery
- Environmental effects of fishing

The U.N. Division for Ocean Affairs and Law of the Sea (DOALOS) reviewed measures to protect the vulnerable deep oceans of the high seas – the 64 percent of ocean that lies beyond the national jurisdictions of any individual nation. Its review, ordered by the U.N. General Assembly in 2004, was based on reports from member states on steps taken to stop destructive high seas fishing practices.

A draft version of the review posted July 14 on the DOALOS Web site said extremely vulnerable deep sea habitats require protection, but that fishing for newly discovered resources in the high seas often proceeds unregulated to the point of



Intensive bottom trawling affects entire ecosystems as nets are dragged across the sea floor. Shown above: an unidentified cnidarian that resembles a Venus flytrap from the family Hormathiidae. Found at 1874 meters depth on the slopes of the Davidson Seamount. (Image courtesy of NOAA/MBARI)

Annex 7: Fishing Gear for Deep Sea Resources Survey

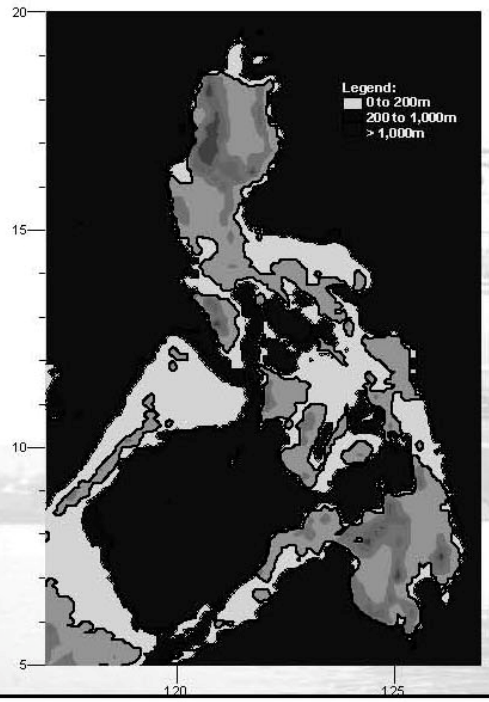
By Mr. Rafael Ramiscal, Chief Researcher

Annex7

Philippine Deep Sea Fauna Expeditions

OVERVIEW SAMPLING GEARS BRIEF FINDINGS

Rafael V. Ramiscal
Supervising Aquaculturist



Philippine Deep Water Areas

- Marine Deep waters are defined to have depths exceeding 200m
- 88% of the Philippine Territorial waters is comprised of Deep water Zones.

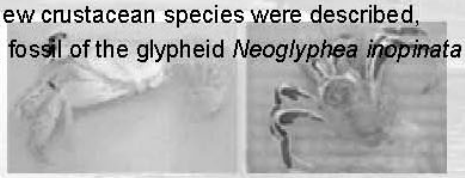
DEPTH ZONE AREAS

Depth Zone	Area (km^2)
0 to 200 m	254,547.4
>200 to 1,000 m	231,986.9
>1,000m	1,287,294.8

(continued) **Annex7**

EXPLORATION OF DEEP SEA FAUNA IN THE PHILIPPINES

- Early expeditions in the 19th century
  - "Samarang" 1843-46; "Novara"1857-59; "Challenger" 1874-75; Th. Mortensen, 1914; "Galathea", 1951)
- Beginning of the 20th century
  - "Challenger", "Siboga", "Valdivia"), Americans organised long series of deep sea sampling in the Pacific, Hawaiian Islands, the Philippines and Indonesia.
  - "Albatross" from the US Bureau of Fisheries stayed in the Philippines from February 1908 to January 1910,
    - 577 dredgings and trawlings
    - 292 stations > 100 fathoms (ca. 185 m)
    - Numerous taxonomic works based on the materials brought back to the US by the Albatross Expedition were produced
    - Many new crustacean species were described,
    - A living fossil of the glypheid *Neoglyphea inopinata*



- 70s-80s
  - MUSORSTOM explorations French scientists in 1976, 1981 and 1985 , off SW Luzon, near Mindoro, and Marinduque on board the R/V Vauban and R/V Coriolis
  - Focused on the recapture of *Neoglyphea* specimens
  - Resullted to 5 volumes of taxonomical description
  - New specimens of *Neoglyphea* were caught
- 21ST Century
  - PANGLAO 2004 using small trawl vessel
  - PANGLAO 2005, MV DA-BFAR in the Bohol Sea
  - AURORA 2007, MV DA-BFAR, Pacific Seaboard
  - LUMIWAN 2008, MV DA-BFAR, Lubang, Mindoro, Palawan

(continued) **Annex7**

DEEP SEA SURVEY SAMPLING GEARS

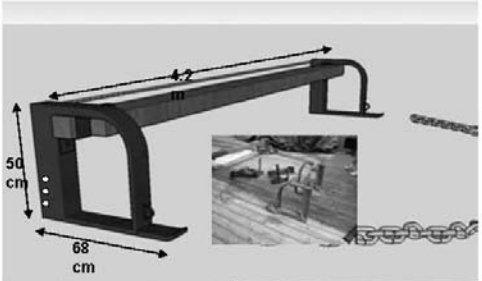
BEAM TRAWL

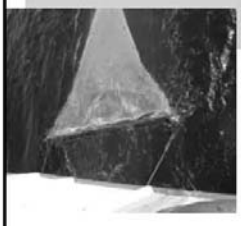
WARÉN DREDGE

OTTER TRAWL

TRAP

SAMPLING GEARS

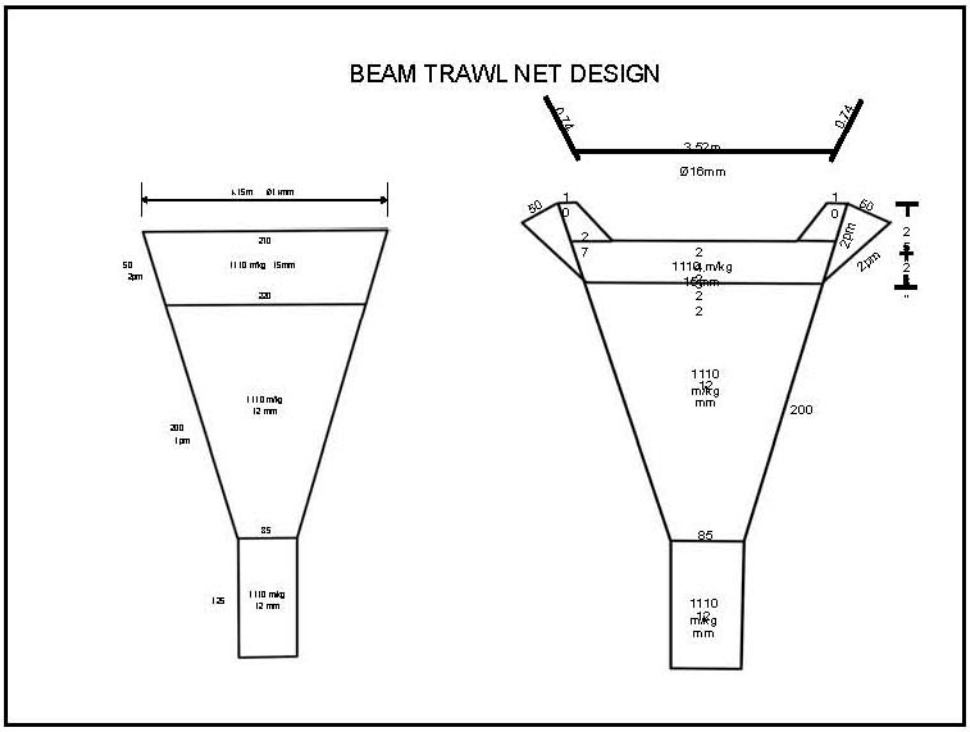




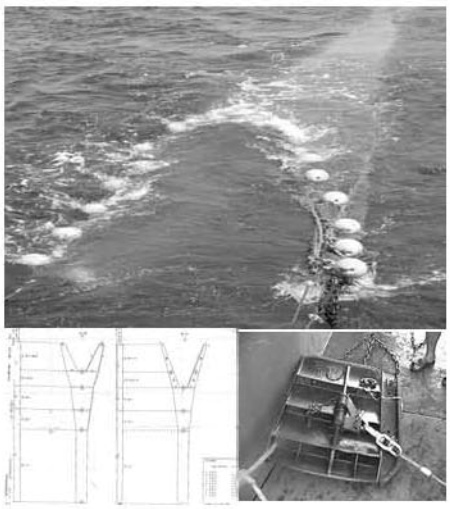
BEAM TRAWL

- 4.2 meter- wide
- kept open by a wooden
- glides on iron runners at both ends
- a net is attached to this system
- the ground rope of the net is strengthened with chain
- a tickler chain is placed before ground rope between the two runners.
- the beam trawl is towed with one cable only.
- used to sample specifically on soft substrate at any depths

(continued) **Annex7**



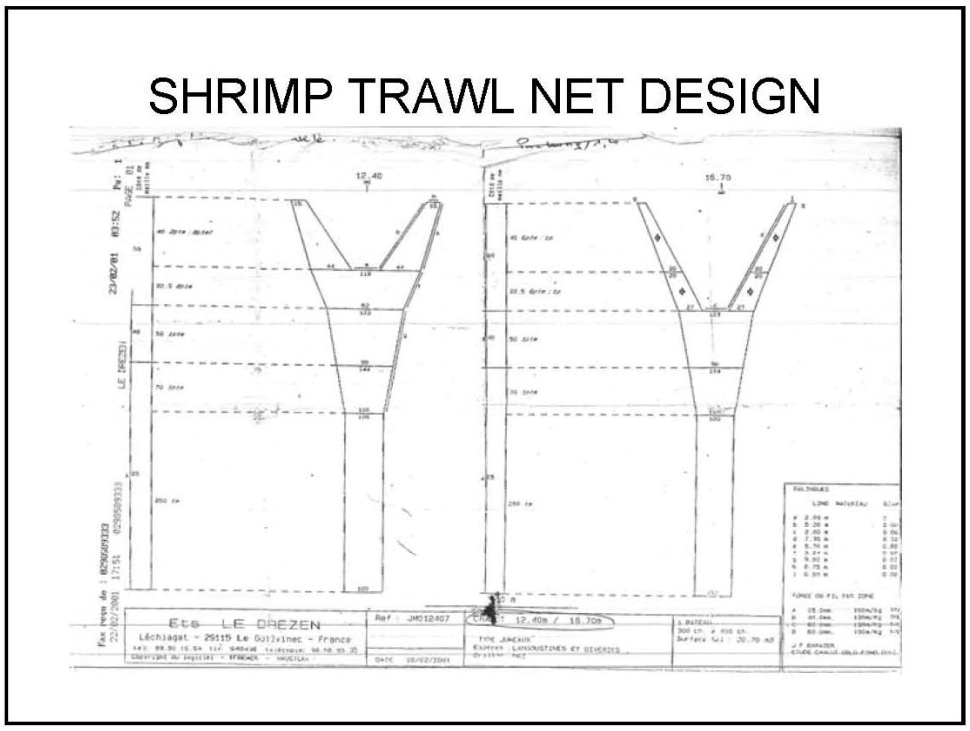
SAMPLING GEARS



OTTER (SHRIMP) TRAWL

- Kept horizontally opened by otter doors
- Footrope around 16.7 m; headrope 12.4m
- Foot rope fitted with chain and ticklers to enhance ploughing of sediments; hard rubber rollers to minimize bottom snags
- Provided with floats that withstand pressures at 1500m deep

(continued) **Annex7**



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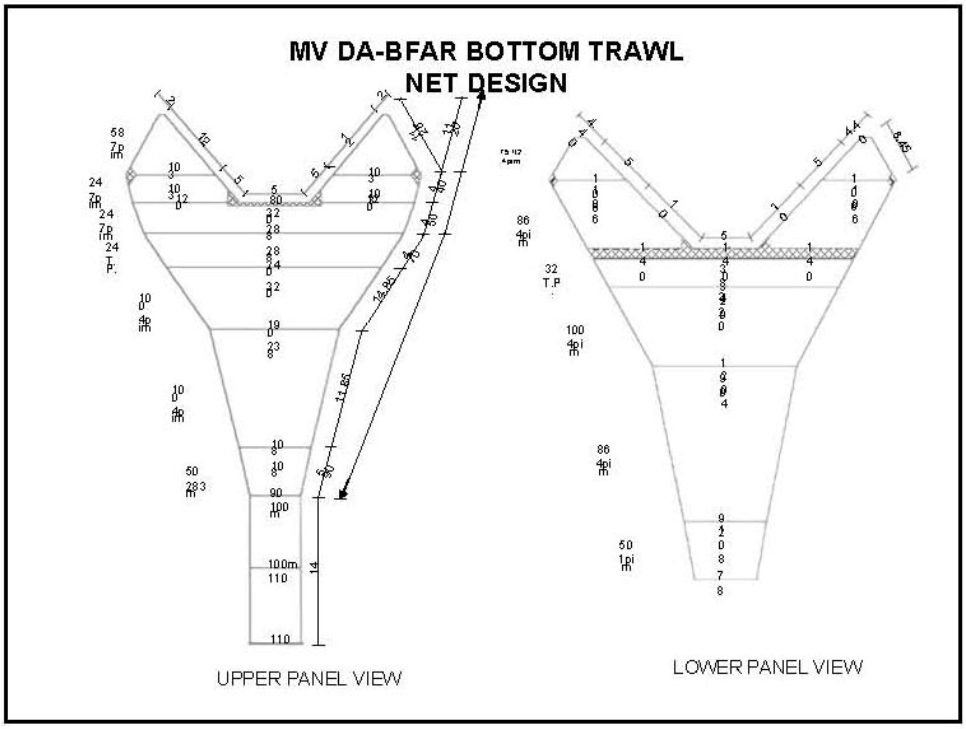
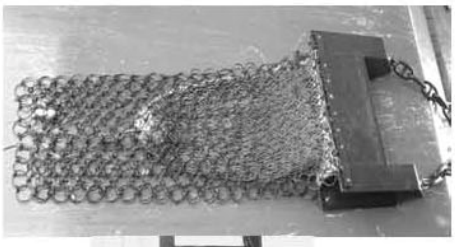


SAMPLING GEARS



DREDGE (*Warén Dredge*)

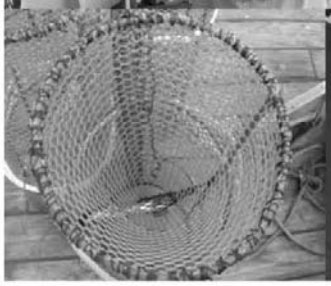
- Made of very strong and sturdy metal of about 1cm thick
- Bag 3-ply netting, 1.5 meters in length encased by strong iron net
- take samples of coarse sediments, rubble and sand on hard bottoms.
- Sediments sieved on wire mesh sizes; 10 mm, 5 mm, 2.5 mm, 1 mm, and 0.5 mm

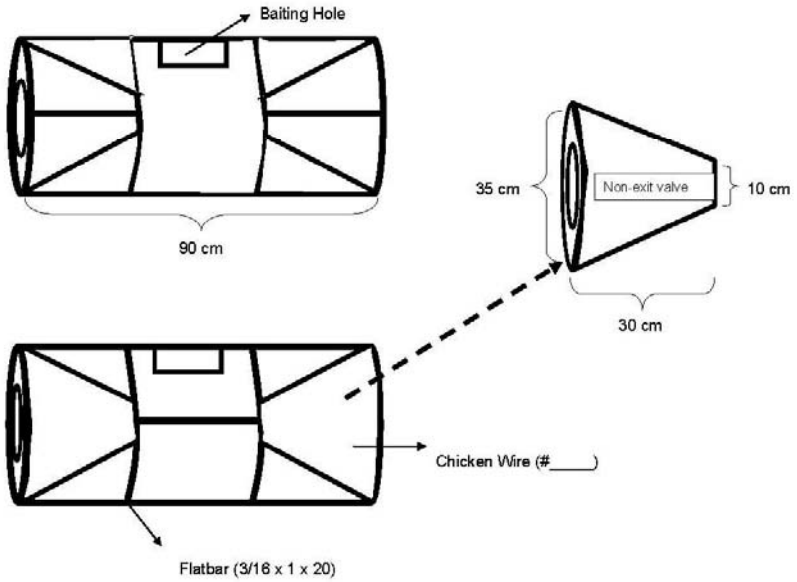
(continued) **Annex7**

SAMPLING GEARS

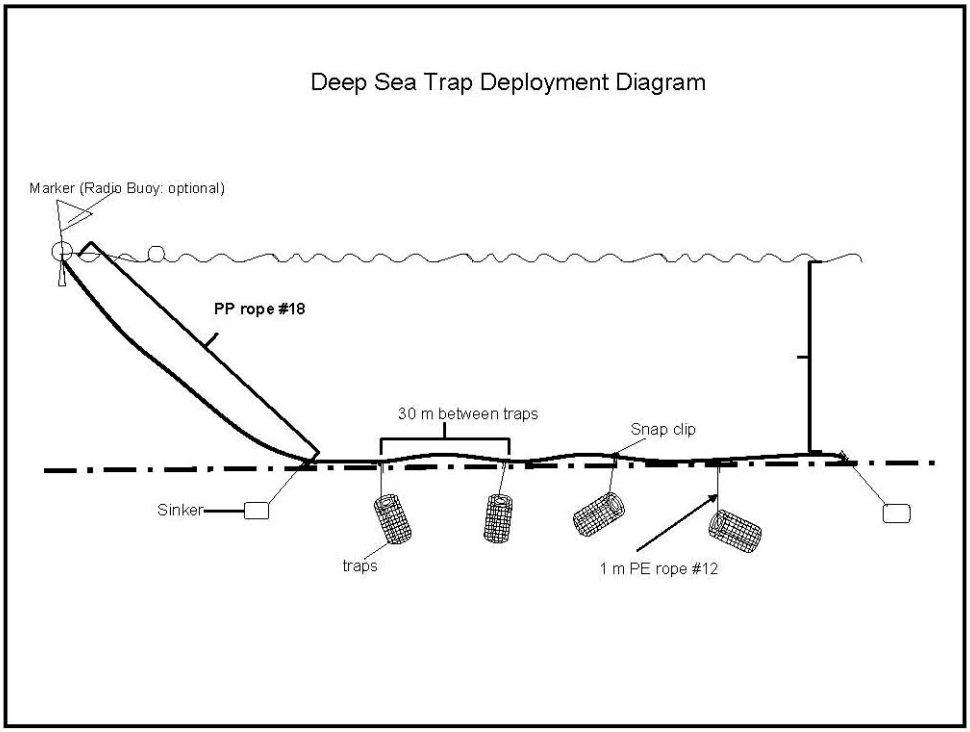
Deep Sea Traps

- Stationary fishing gears with baits inside
- Made plastic, with iron bar frames.
- Cylindrical shaped with 2 funnels on both ends
- About 90 cm long x 30 cm diameter





(continued) **Annex7**



- My presentation.ppt

DEEP SEA SURVEYS OF THE PHILIPPINES: INITIAL RESULTS OF RECENT SURVEYS

AURORA 2007: Pacific Seaboard

- Beam trawl
- Shrimp trawl
- Dredge

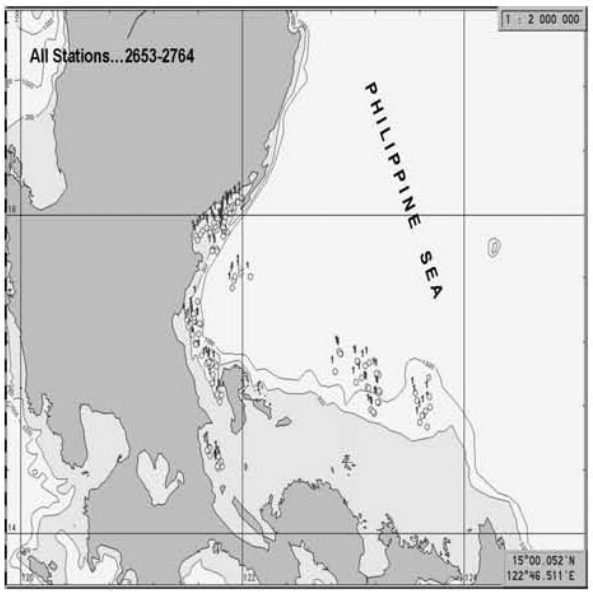
LUMIWAN 2008: North Sulu Sea; South China Sea

- Beam trawl
- Shrimpr trawl
- Dredge

Mindanao Sea 2007

- Deep sea traps

(continued) **Annex7**

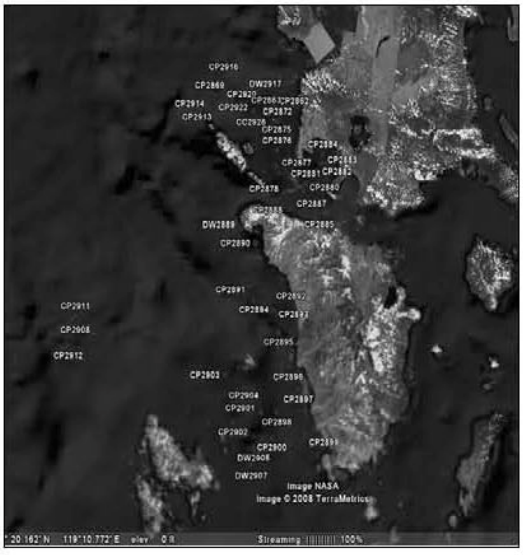


AURORA 2007

Depth range	=42m- 2296m
<200 m	= 25
200-400	= 31
400-600	= 27
600-800	= 7
800-1000	= 3
<1000	= 19
TOTAL	= 112

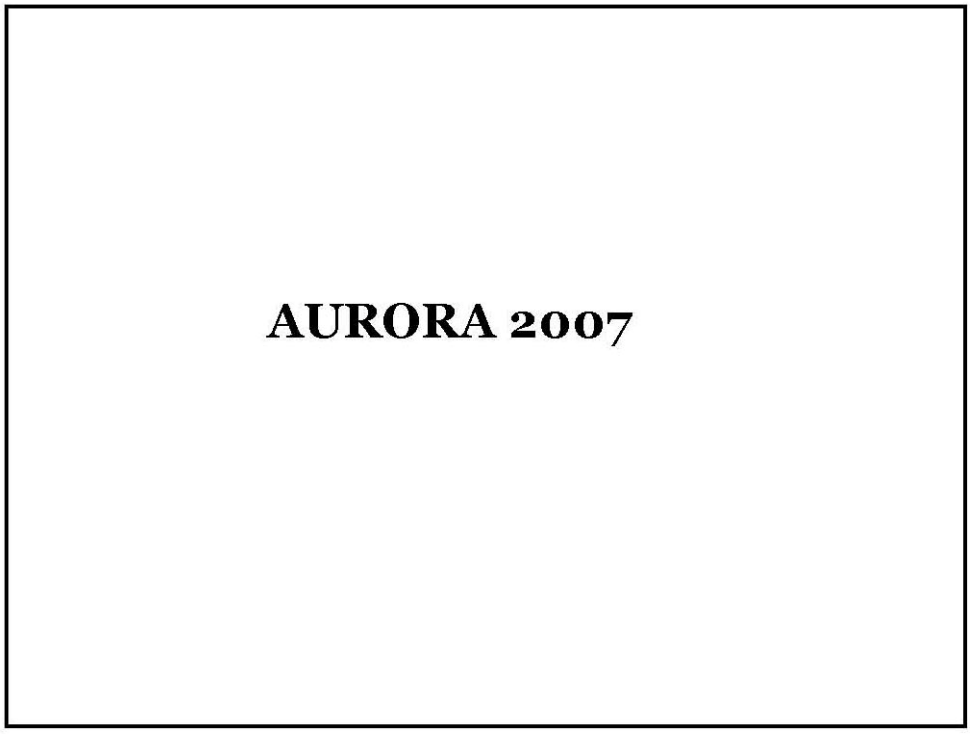
CP	**77**
DW	**20**
CC	**15**
TOTAL	**112**

LUMIWAN 2008 Stations



68 Drags
59 – beam trawl
5 – dredge
4 – otter trawl

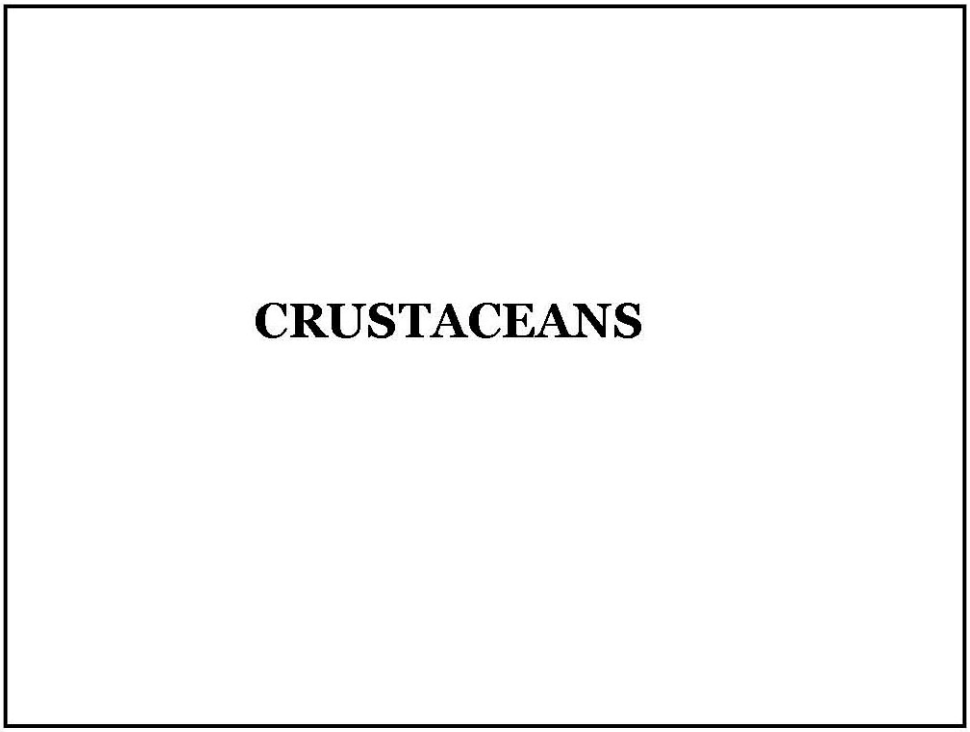
Depth Range	=97-2249m
<250 m	= 20 stations
251-800 m	= 28 stations
801-1500	= 11 stations
1,501-2,000+	= 9 stations



AURORA 2007

- 230 species of decapod crustaceans
- 12 species stomatopods
- 60 species of fish
- 60 species echinoderms
  - 19 holothuroids
  - 8 asteroids
  - 14 ophiuroids
  - 8 crinoids
  - 11 echinoids

(continued) **Annex7**



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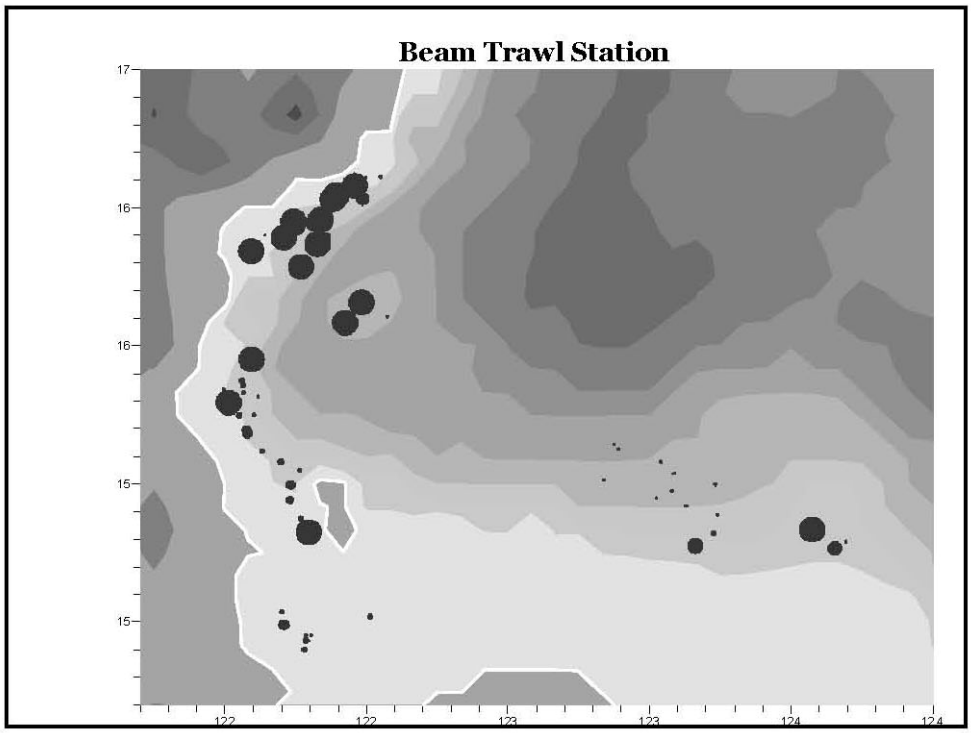
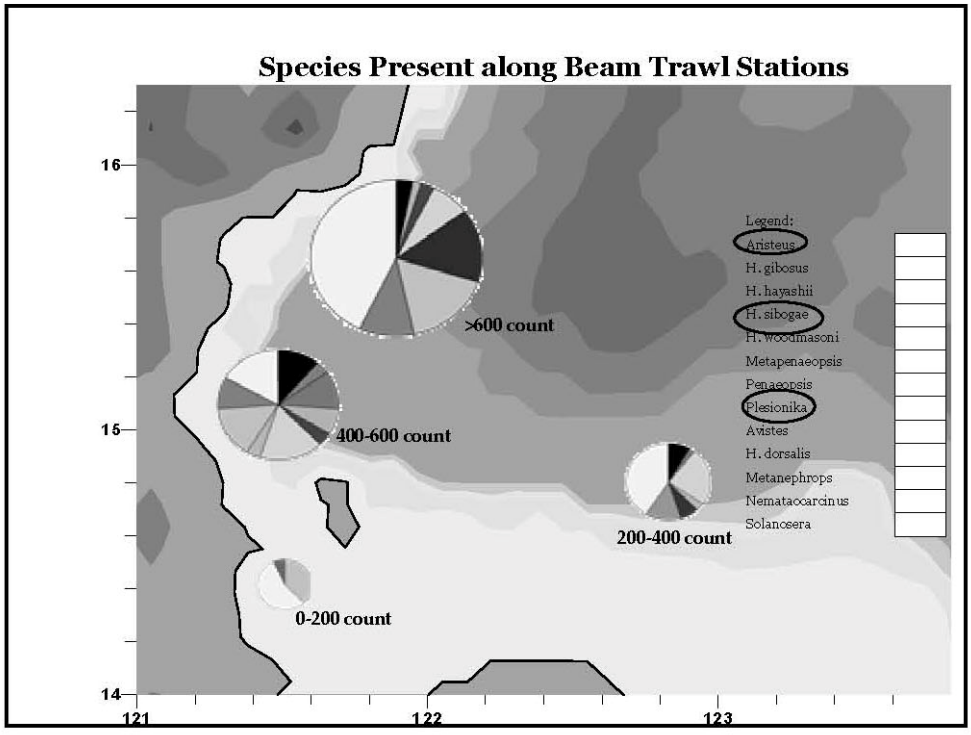
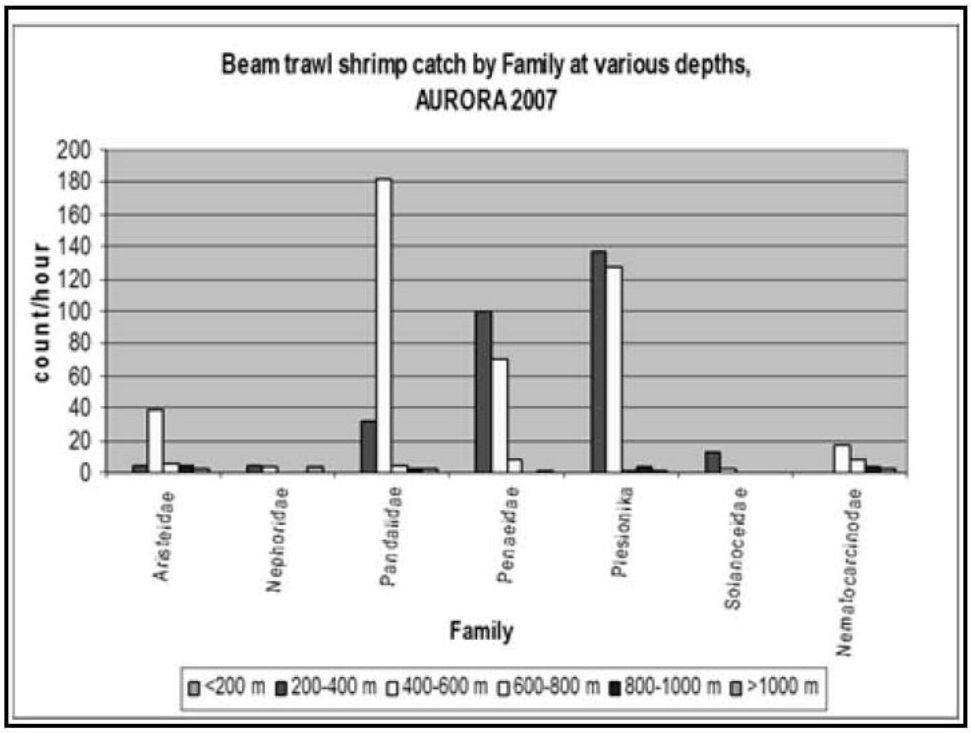
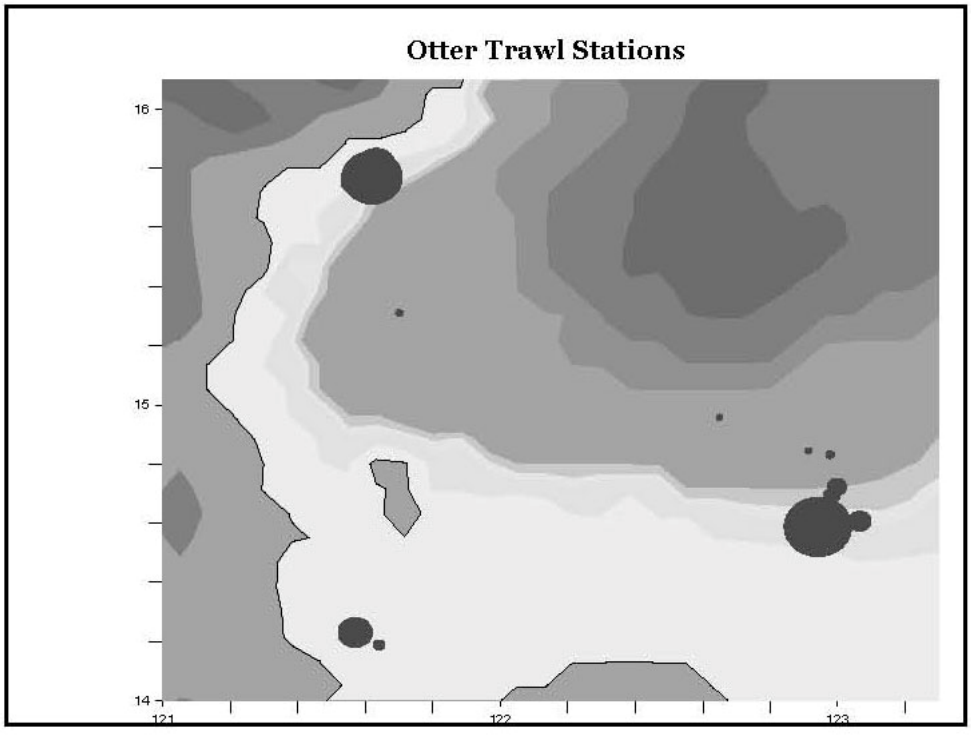


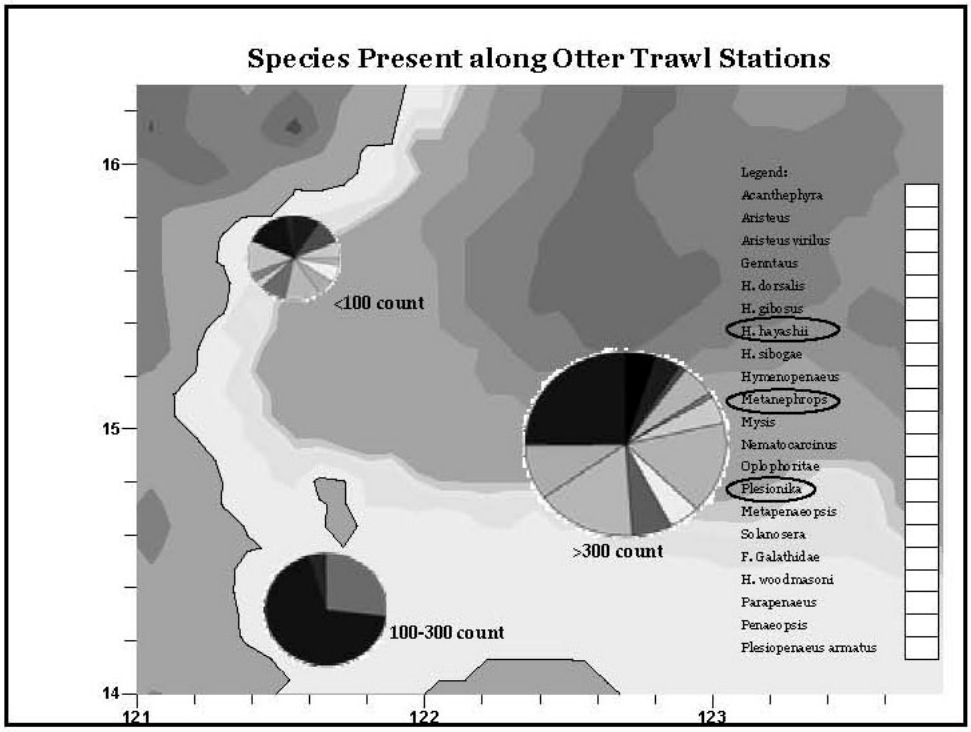


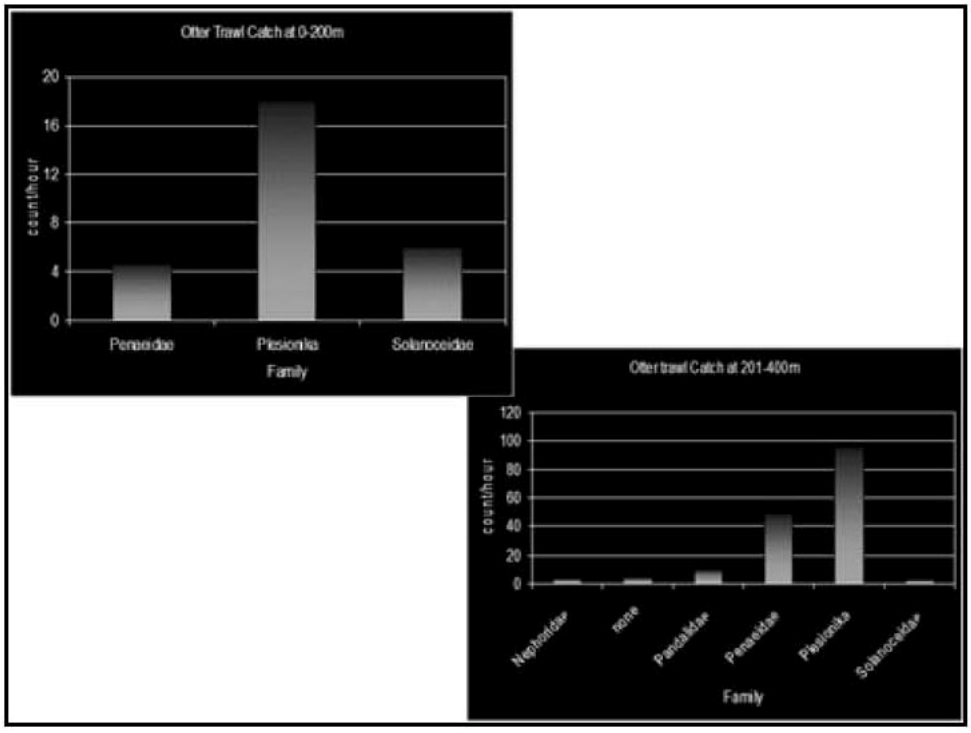
(continued) **Annex7**



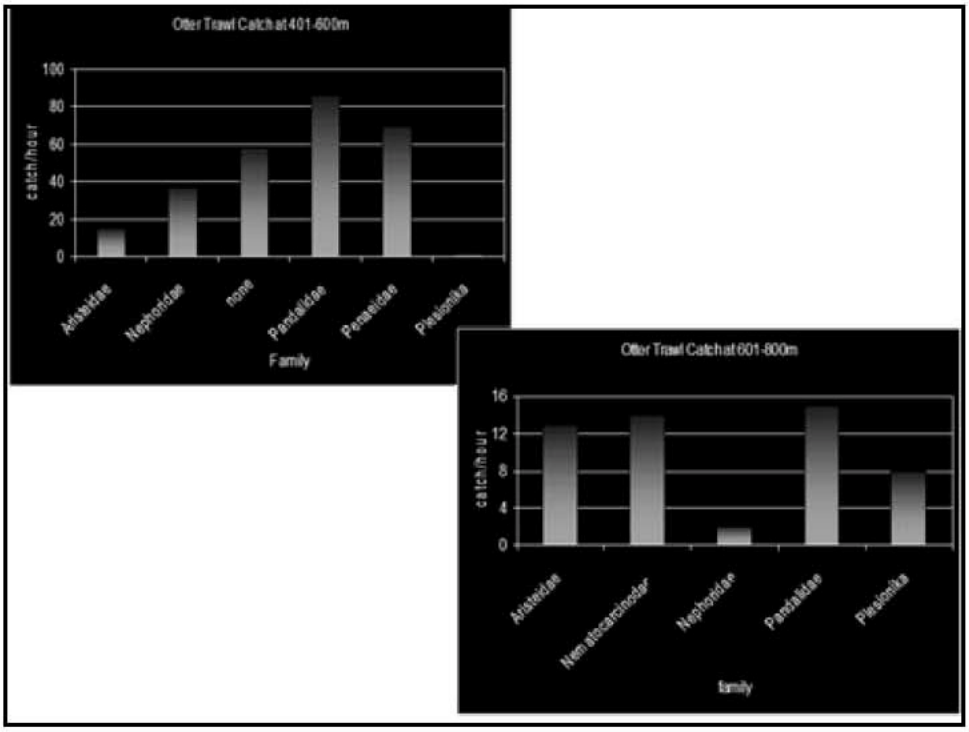


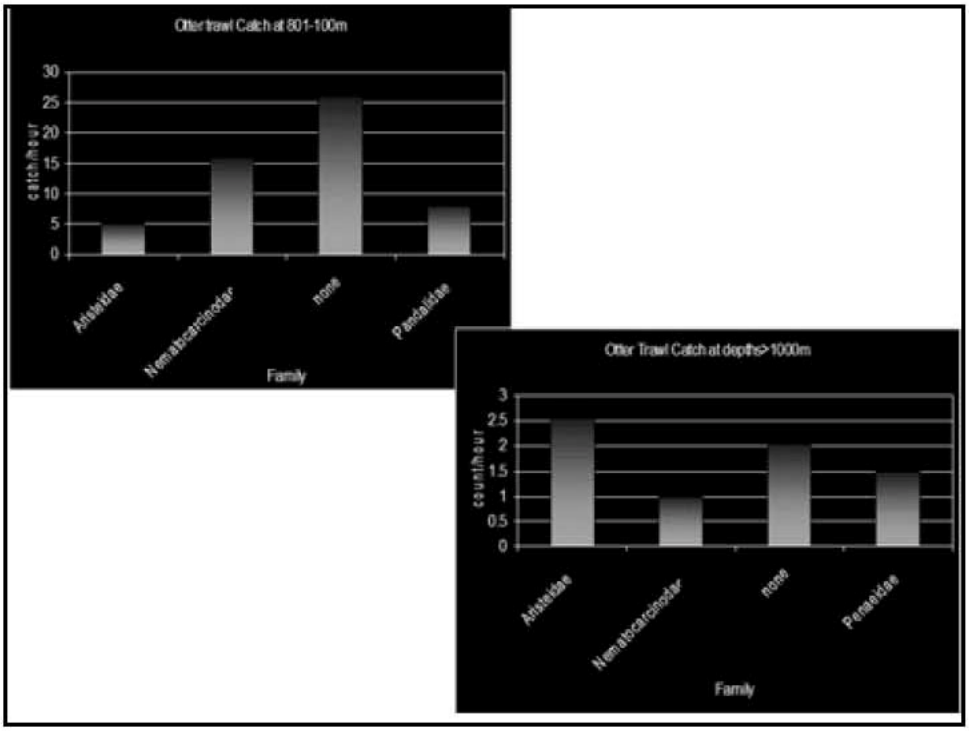
(continued) **Annex7**



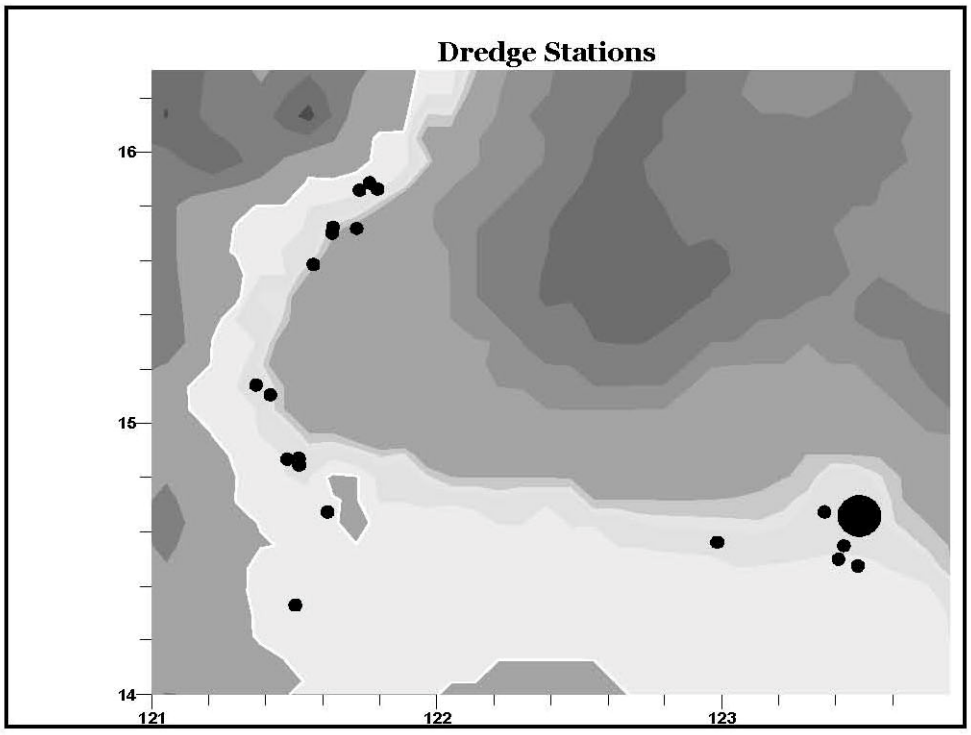


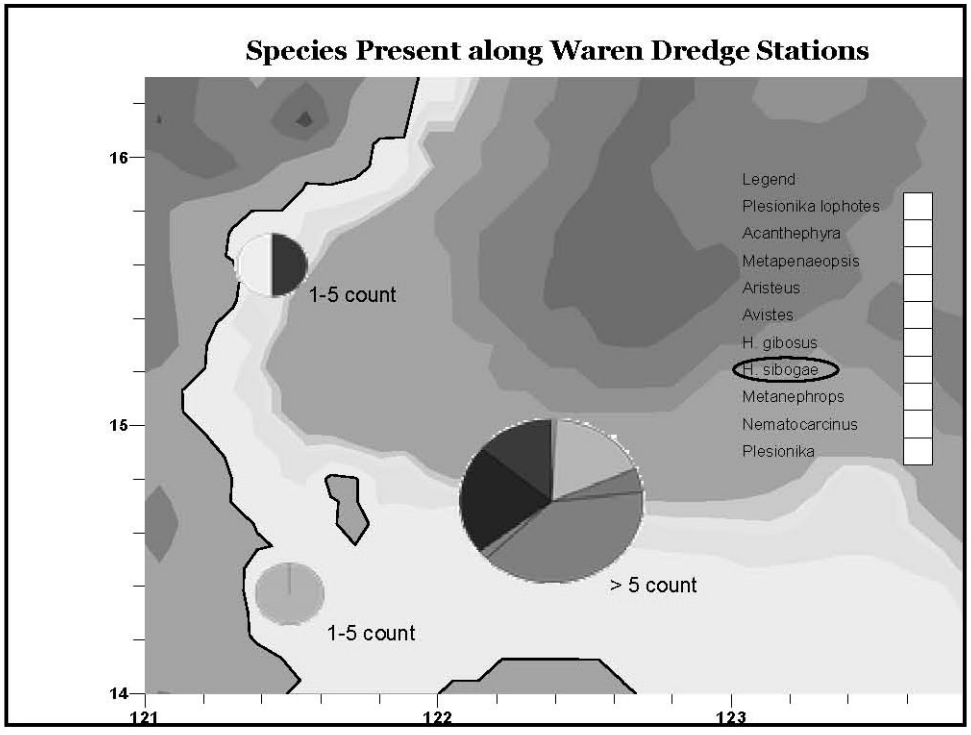
(continued) **Annex7**



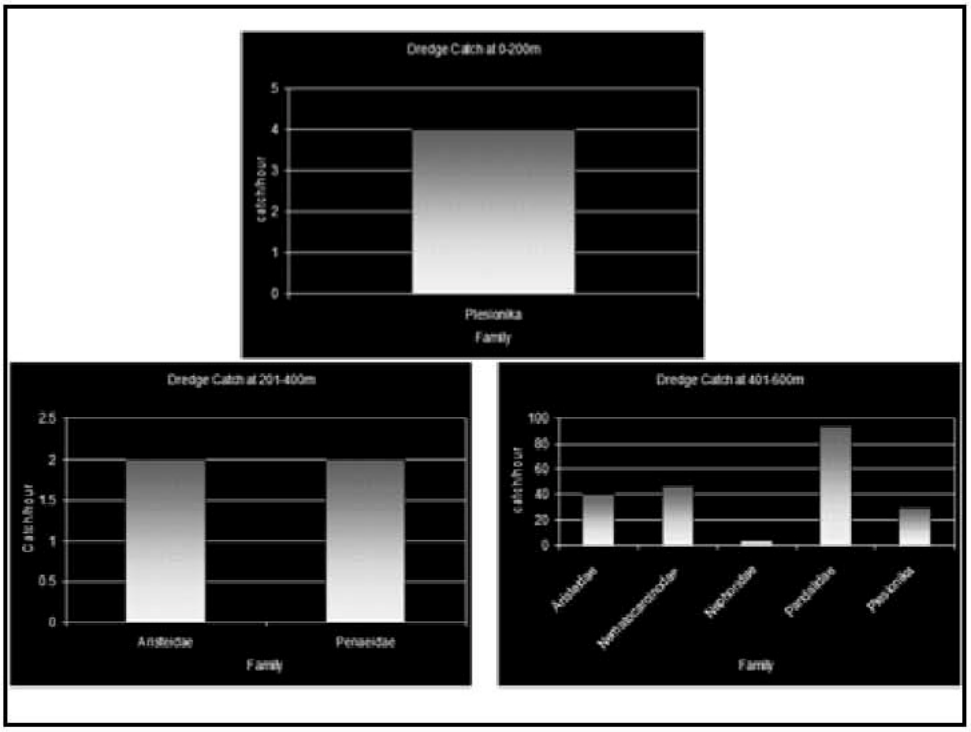


(continued) **Annex7**



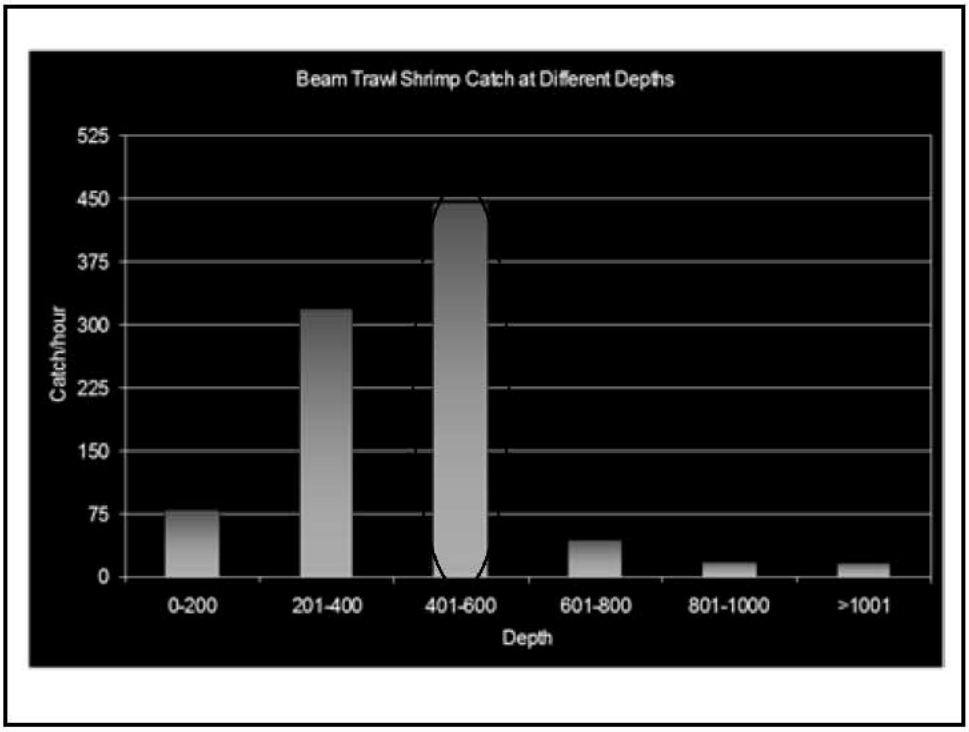


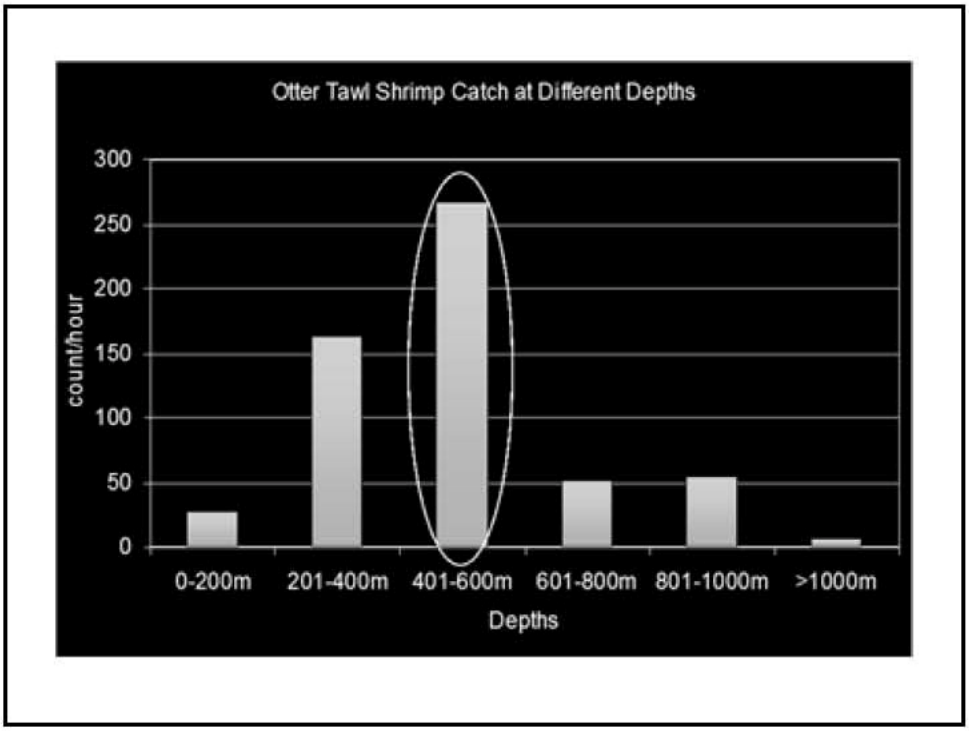
(continued) **Annex7**



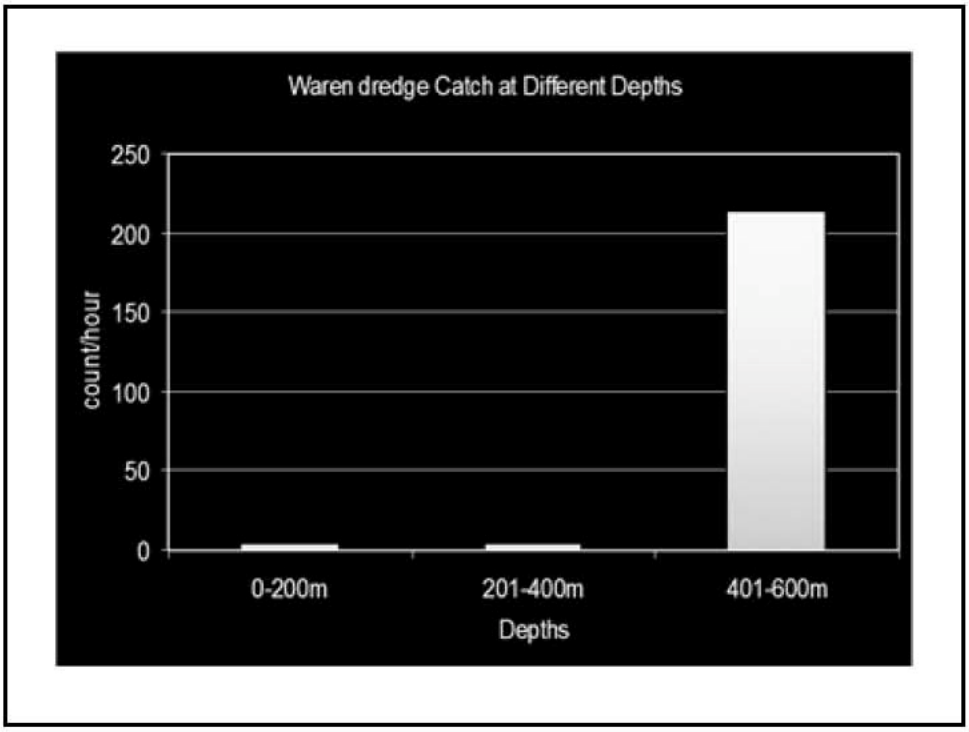
Shrimp catch by depth
by sampling gears

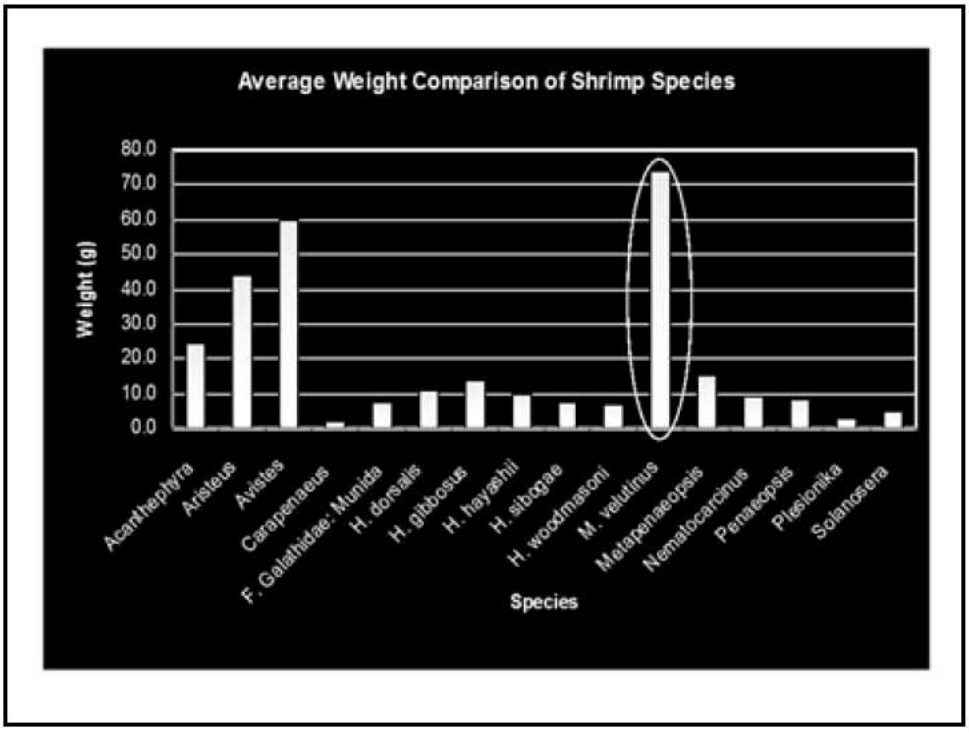
(continued) **Annex7**





(continued) **Annex7**





(continued) **Annex7**

LUMIWAN 2008

RESULTS | **TRAWLING**

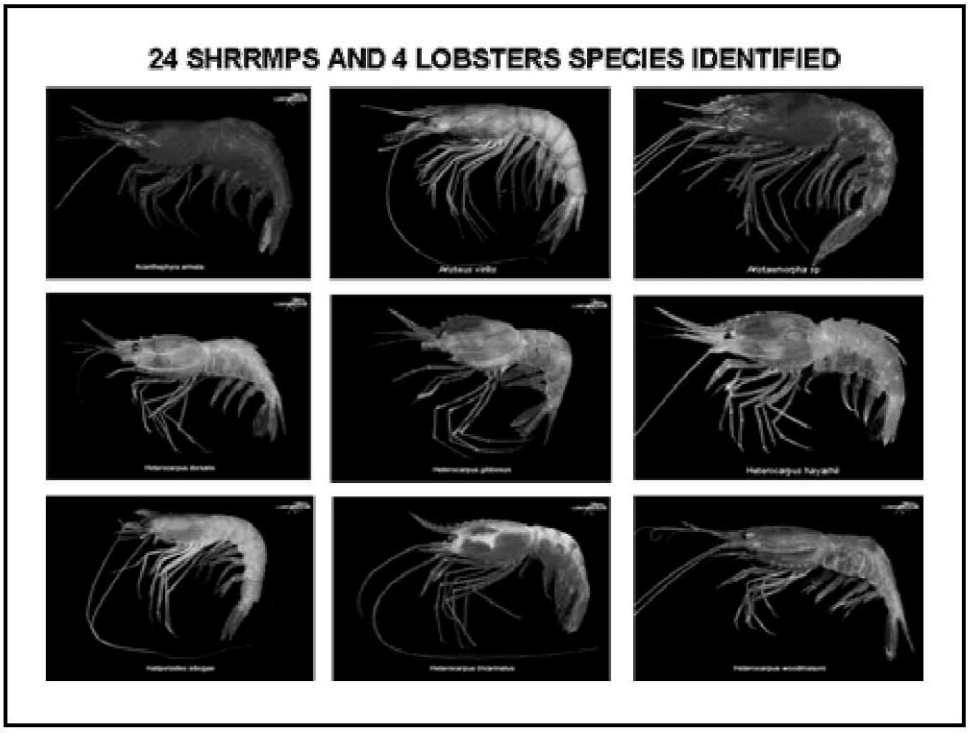
Shrimps and Lobsters Species Collected During the Expedition

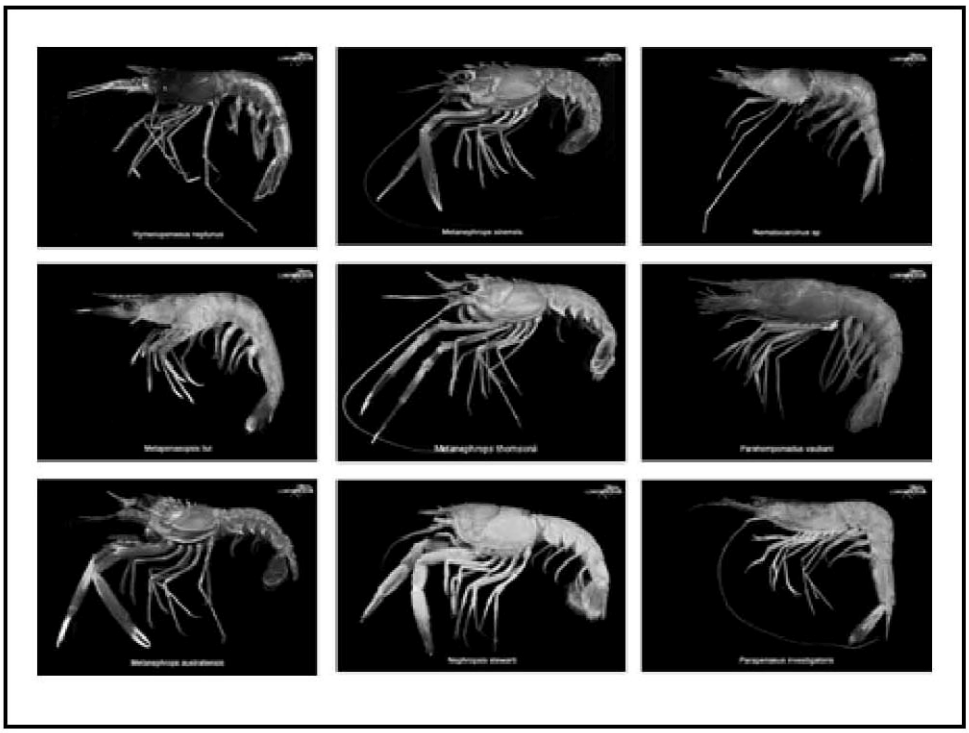
Family	Genus	Species
ARISTEIDAE	Parahemipenaeus	vaubani
ARISTEIDAE	Acantephyra	armata
ARISTEIDAE	Aristaemorpha	sp
ARISTEIDAE	Aristeus	virilis
NEMATOCARCINIDAE	Netatocarcinus	sp
NEPHROPIDAE	Metanephrops	sinensis
NEPHROPIDAE	Metanephrops	thomsoni
NEPHROPIDAE	Nephropsis	stewarti
NEPHROPIDAE	Metanephrops	australiansis
PANDALIDAE	Plesionika	grandis
PANDALIDAE	Plesionika	indica
PANDALIDAE	Plesionika	lephosis
PANDALIDAE	Plesionika	semilaevis

Family	Genus	Species
PANDALIDAE	Plesionika	sp
PANDALIDAE	Heterocarpus	dorsalis
PANDALIDAE	Heterocarpus	gibbosus
PANDALIDAE	Heterocarpus	hayashii
PANDALIDAE	Heterocarpus	sibugue
PANDALIDAE	Heterocarpus	tricarinatus
PANDALIDAE	Heterocarpus	woodmasonii
PENAEIDAE	Parapenaeus	investigatoris
PENAEIDAE	Parapenaeus	sextuberlatus
PENAEIDAE	Penaeopsis	sp
PENAEIDAE	Metapenaeopsis	sp
SOLENOCERIDAE	Haliopinoides	sibugue
SOLENOCERIDAE	Hymenopenaeus	aequis

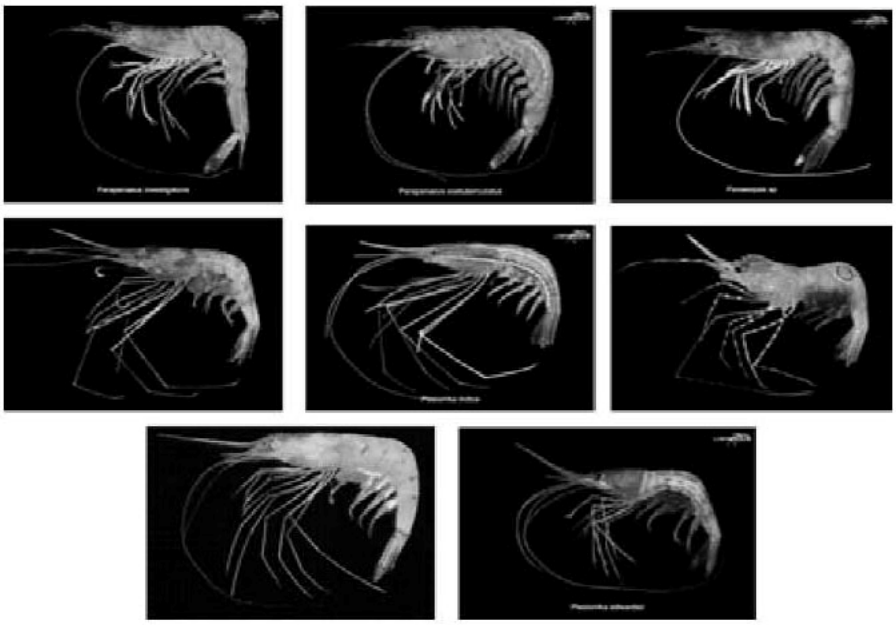
6 – Families 14 – Genus 26 – Species

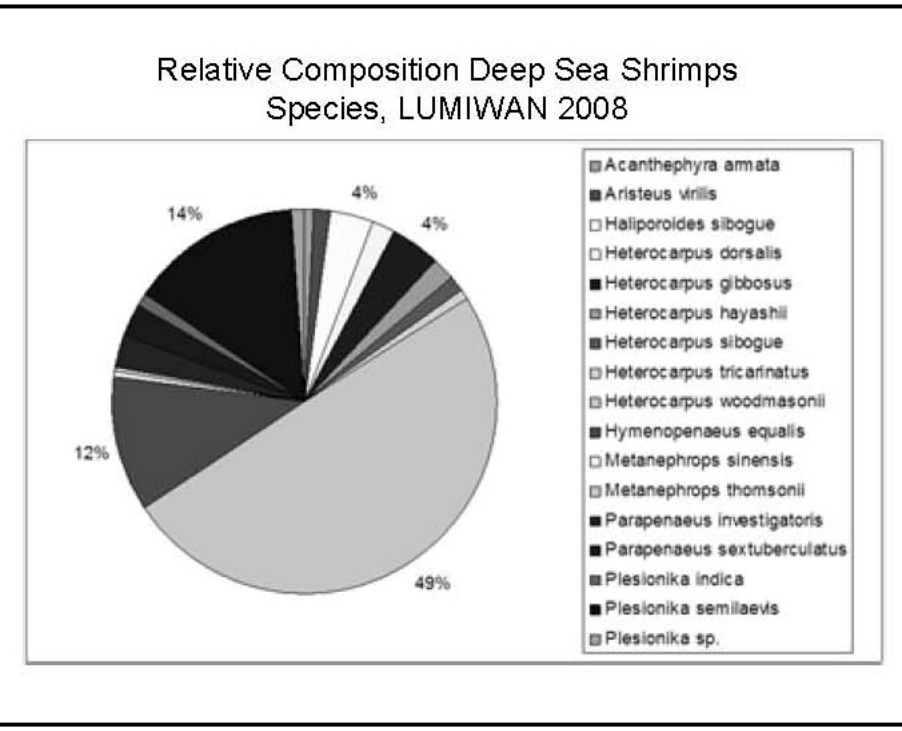
(continued) **Annex7**



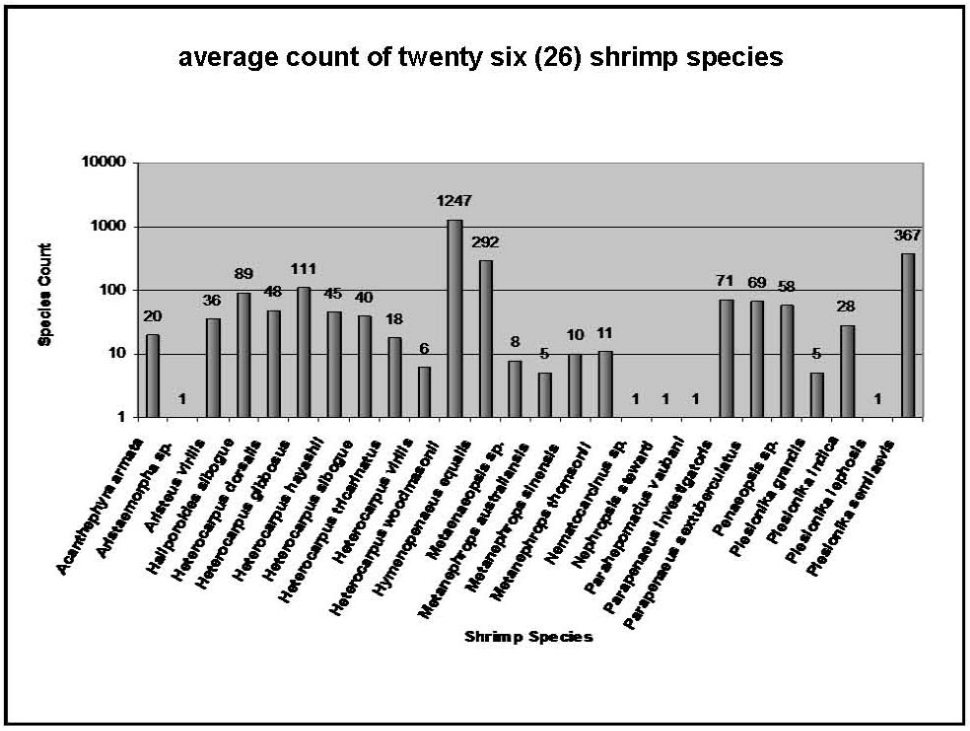


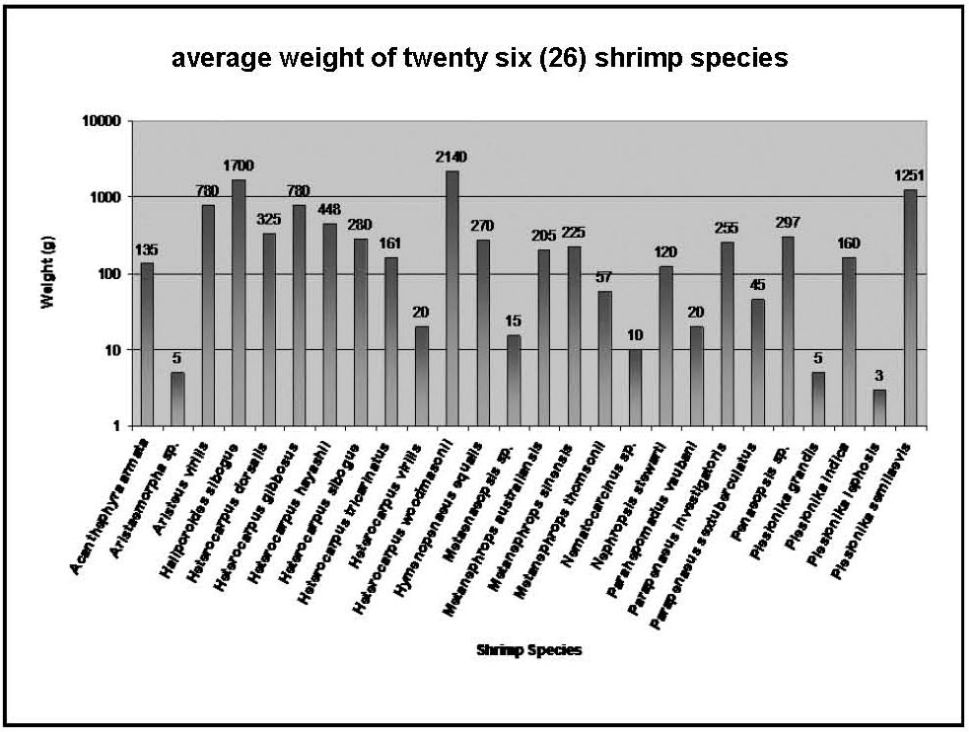
(continued) **Annex7**





(continued) **Annex7**





(continued) **Annex7**

RESULTS | **CRABS**

Brachyuran Crabs Collected During the Expedition

	FAMILY	GENUS	SPECIES
1	Aethridae	1	1
2	Atelecyclidae	1	1
3	Calappidae	5	5
4	Chasmocarcinidae	3	3
5	Cyclodorippidae	5	5
6	Dromiidae	1	1
7	Ethusidae	11	11
8	Goneplacidae	20	20
9	Homolidae	8	8
10	Homolodromiidae	2	2
11	Iphiculidae	2	2

	FAMILY	GENUS	SPECIES
12	Leucosiidae	22	27
13	Majidae	35	34
14	Palicidae	6	7
15	Parthenopidae	6	6
16	Pilumnidae	8	12
17	Portunidae	7	8
18	Raninidae	8	8
19	Retroplumnidae	4	4
20	Trapeziidae	1	1
21	Xanthidae	9	8
	total	165	174

21 – Families 165 – Genus 174 – Species

Dominating Families

Majidae

Leucosiidae

Goneplacidae

Ethusidae

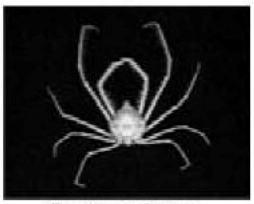
Xanthidae

(continued) **Annex7**

Dominating Genus

Ethusia sp.

Carcinoplax sp.

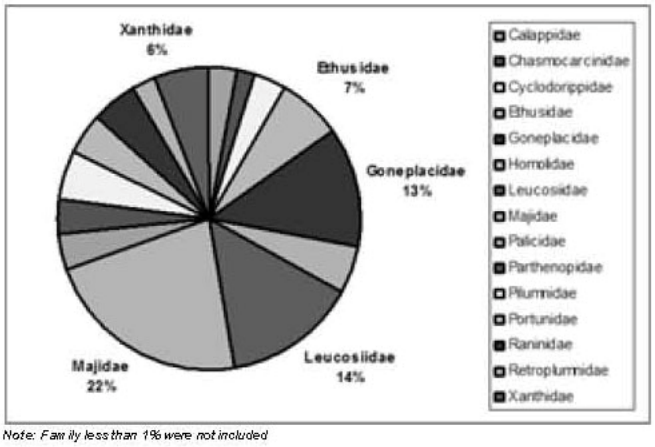


Cyrtomaia sp.

Goniplax sp.

Pilumnus sp.

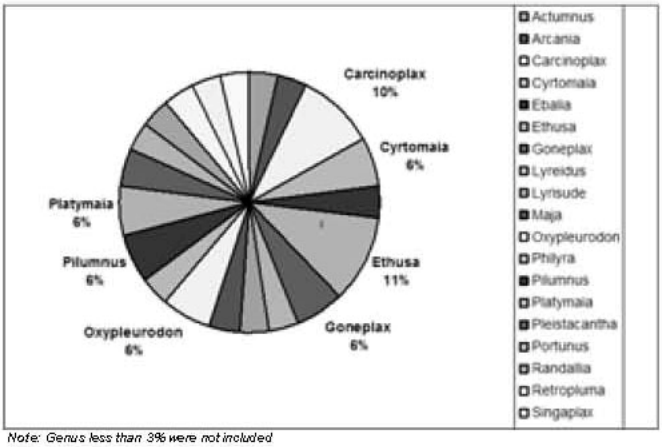
Catch Composition of Brachyuran Crabs According to their Family



Note: Family less than 1% were not included

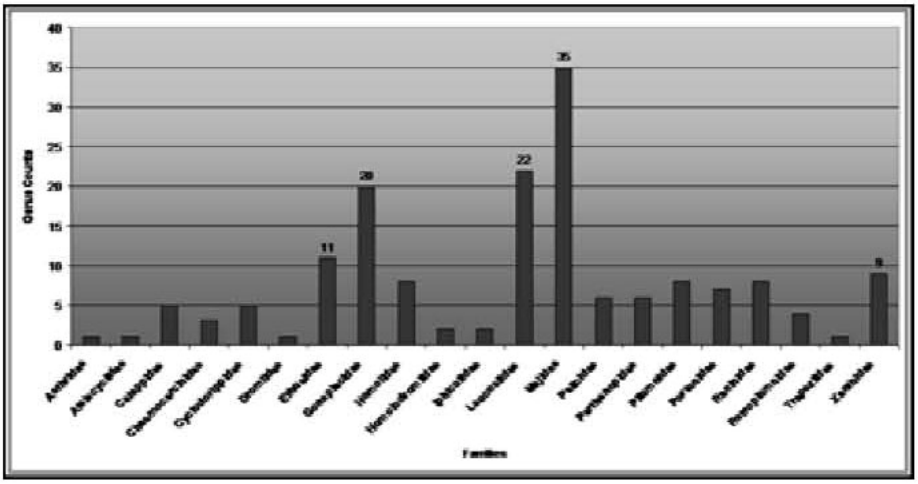
(continued) **Annex7**

Catch Composition of Brachyuran Crabs According to their Genus

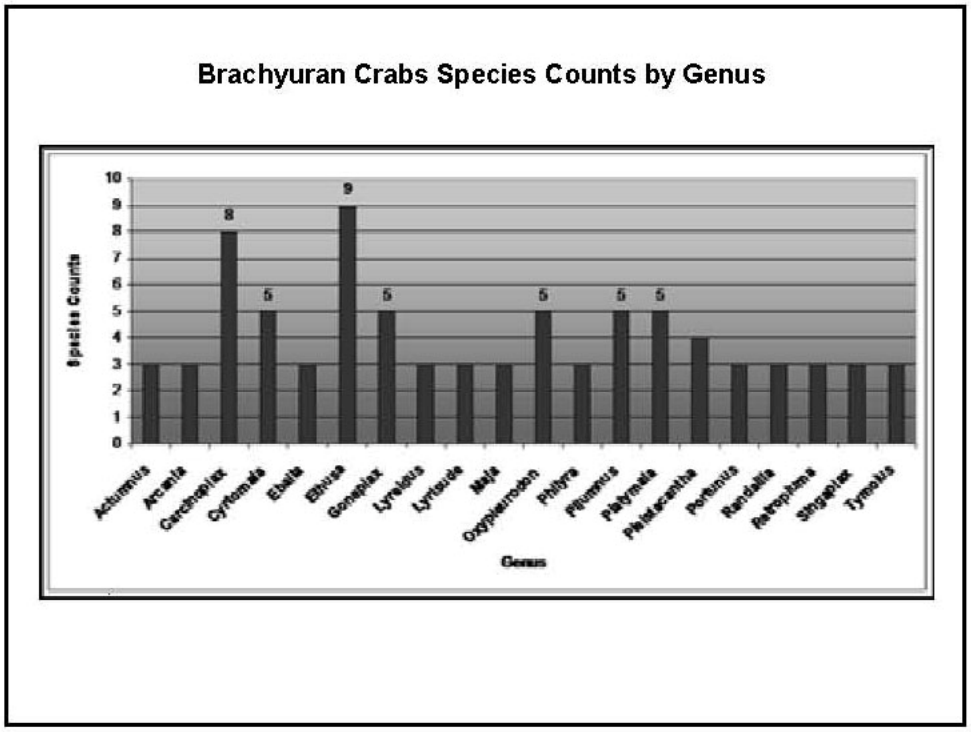


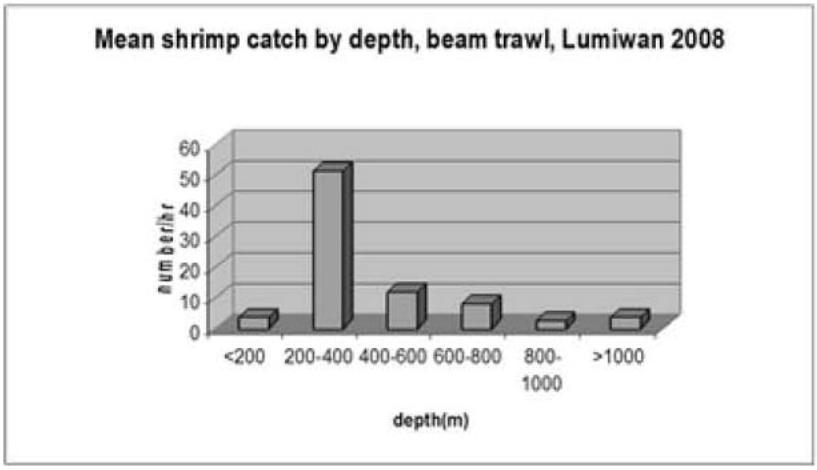
Note: Genus less than 3% were not included

Brachyuran Crabs Genus Counts by Family

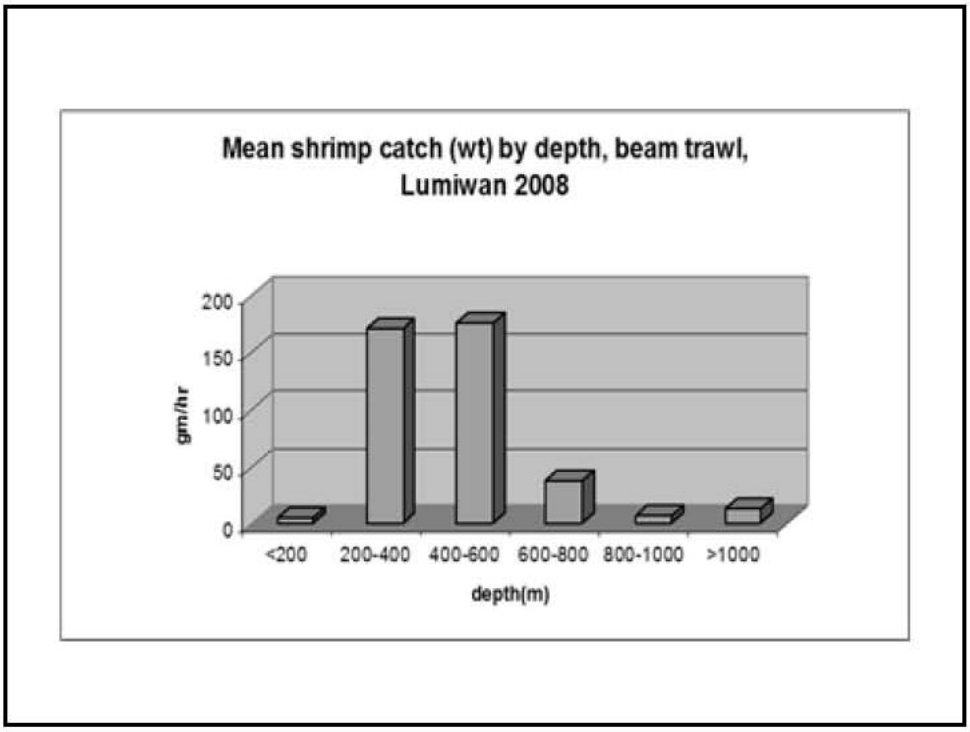


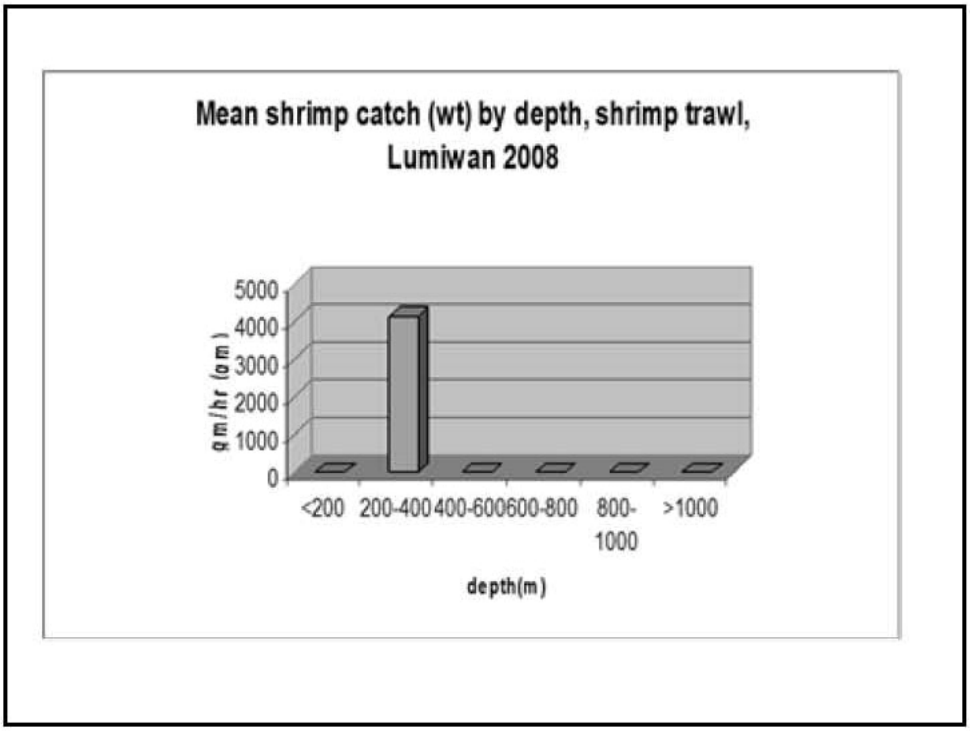
(continued) **Annex7**



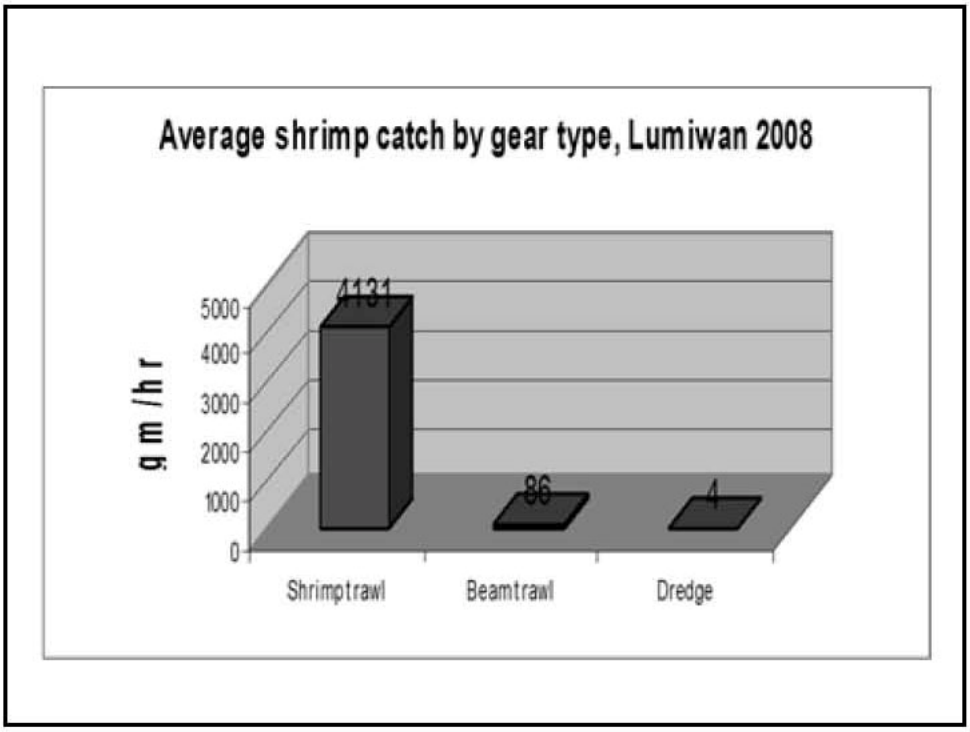


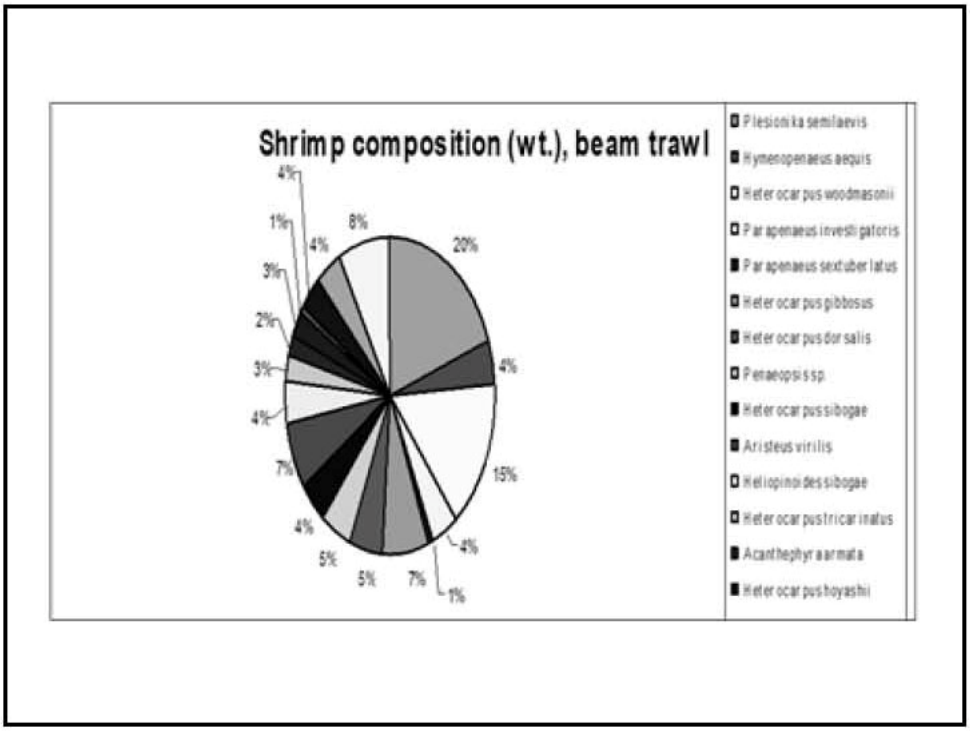
(continued) **Annex7**



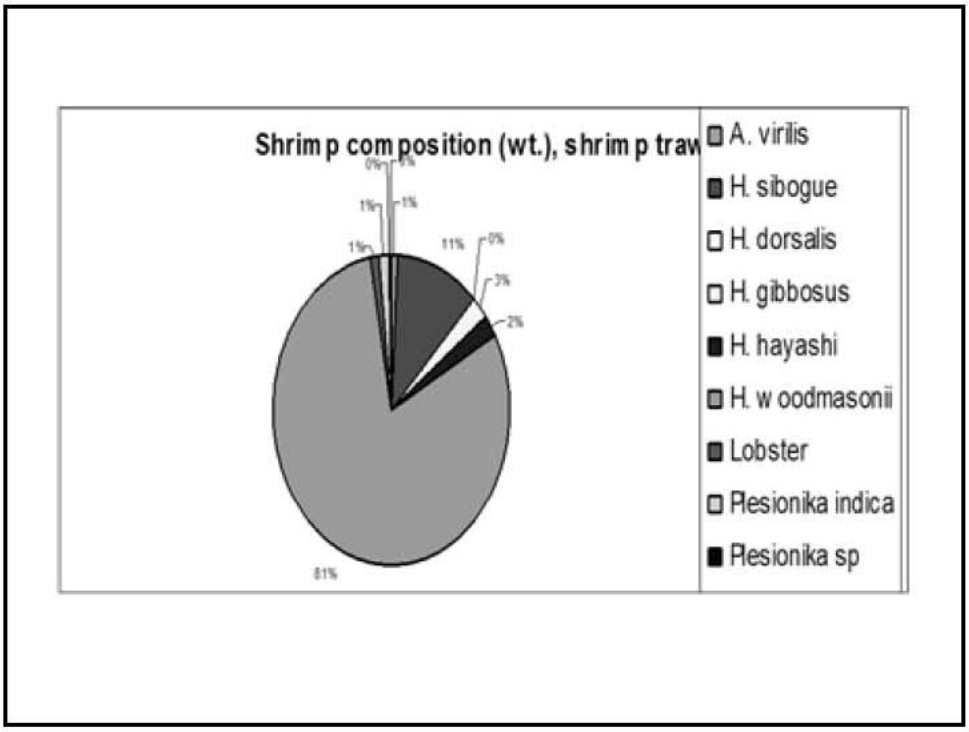


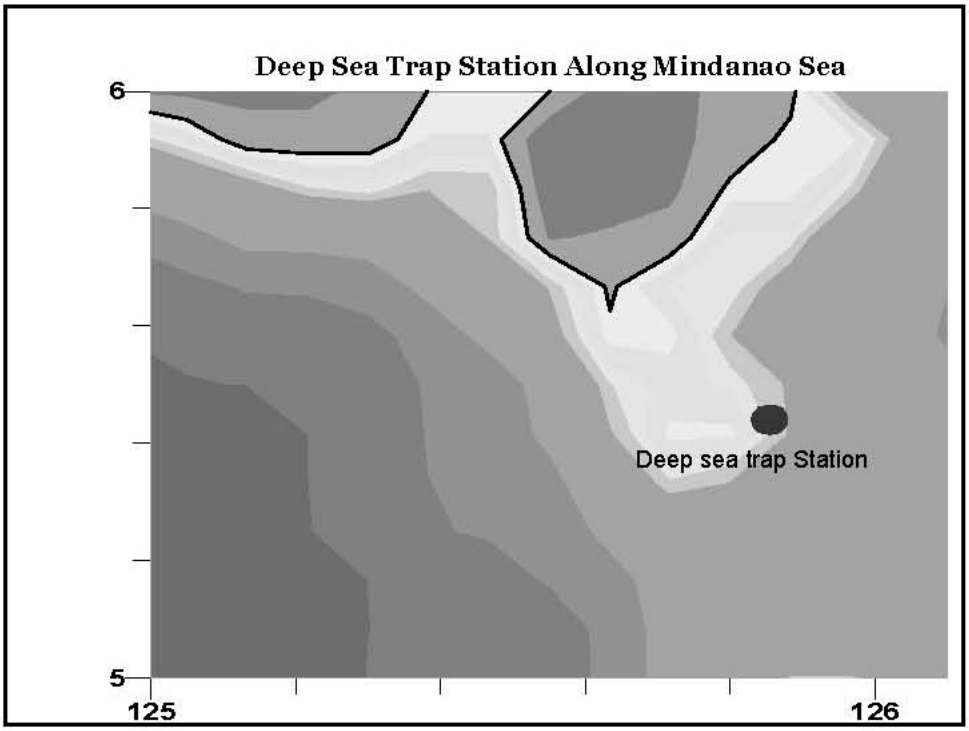
(continued) **Annex7**



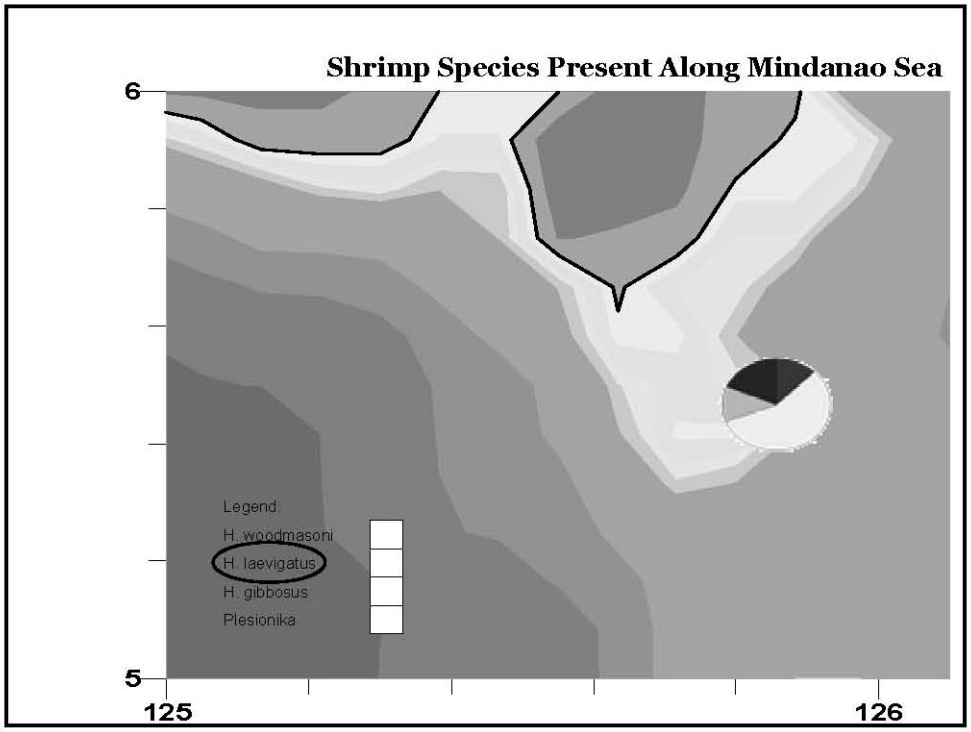


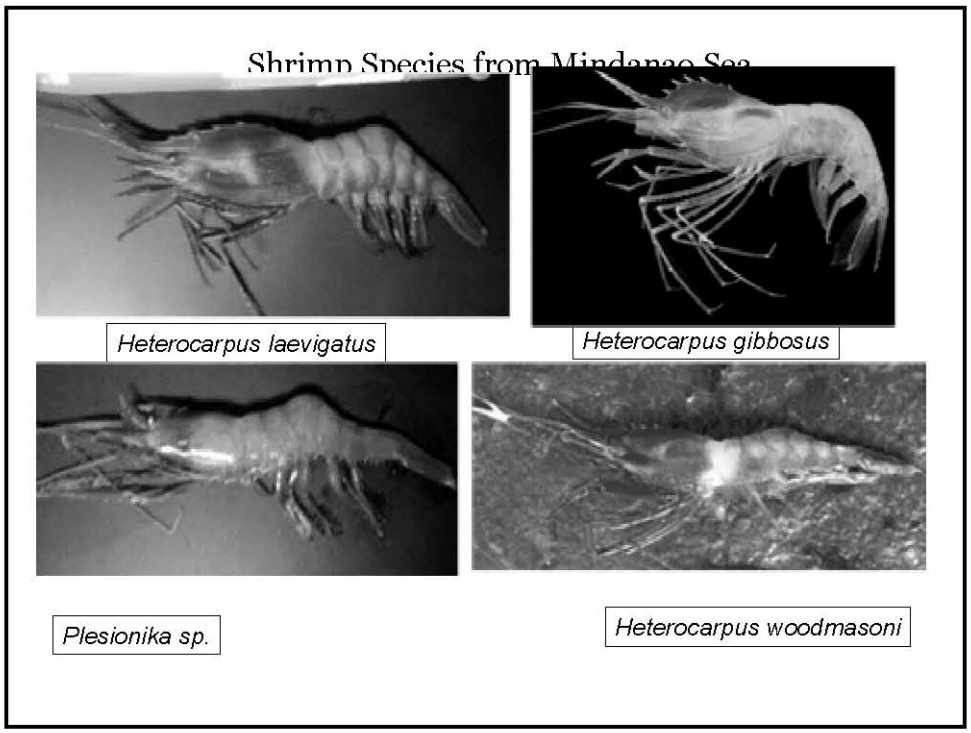
(continued) **Annex7**



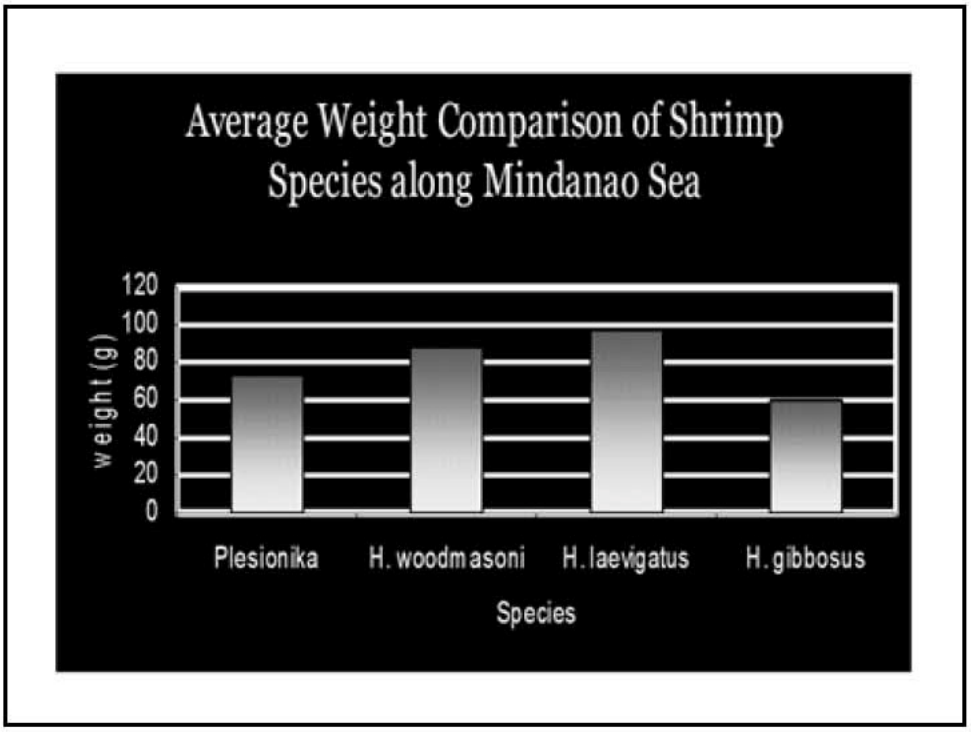


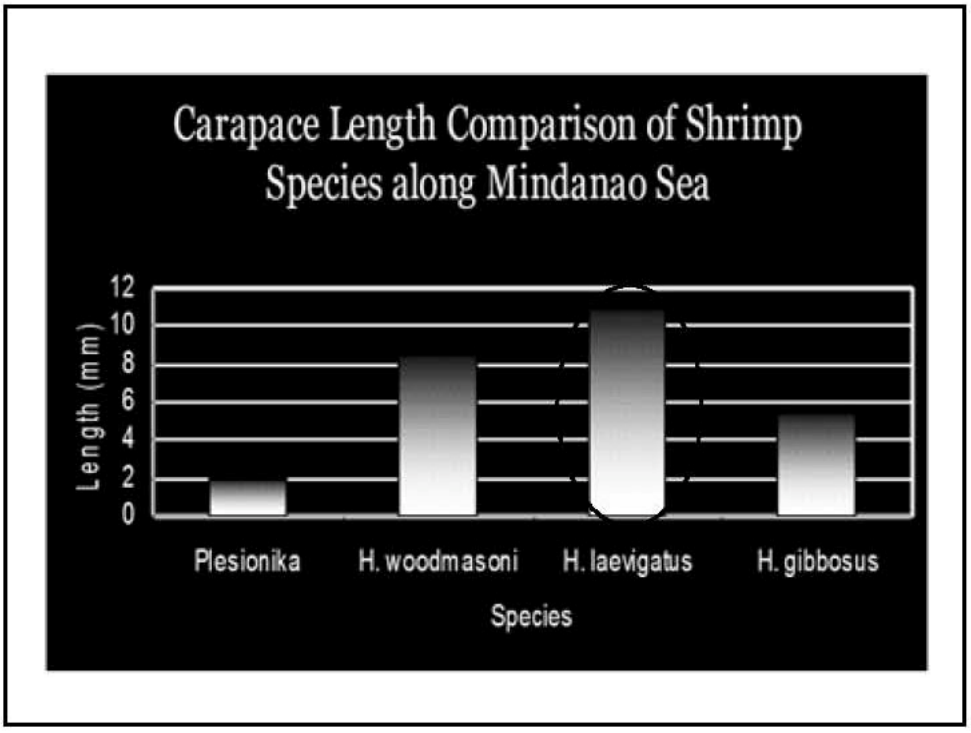
(continued) **Annex7**





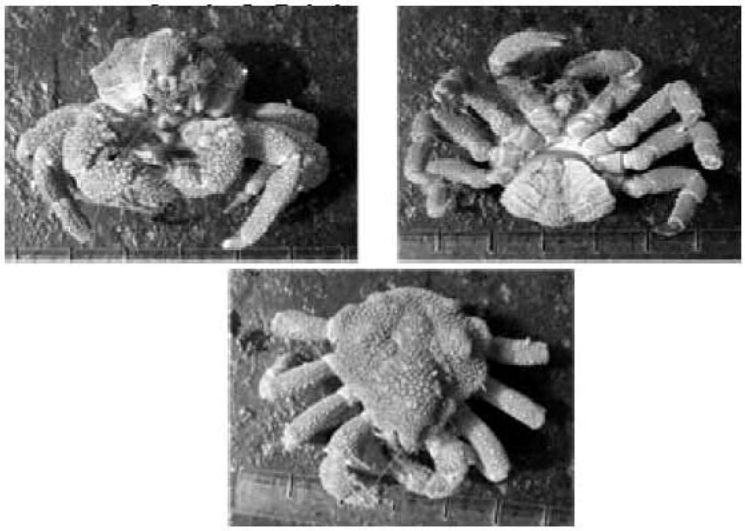
(continued) **Annex7**





(continued) **Annex7**

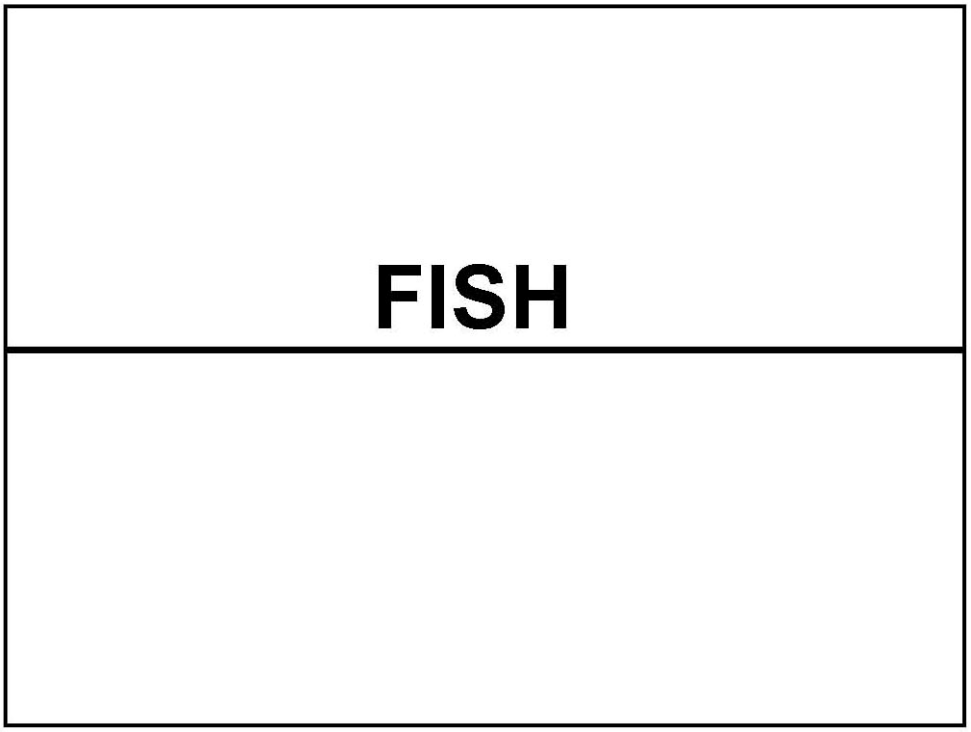
Crab Species found along Mindanao Sea

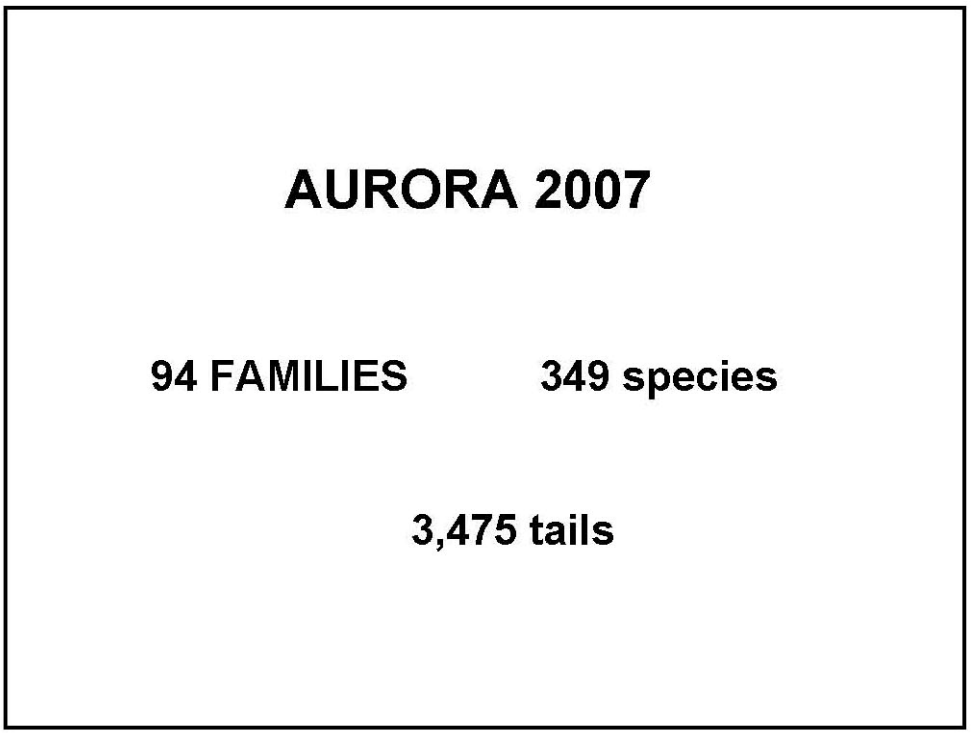


Conclusion

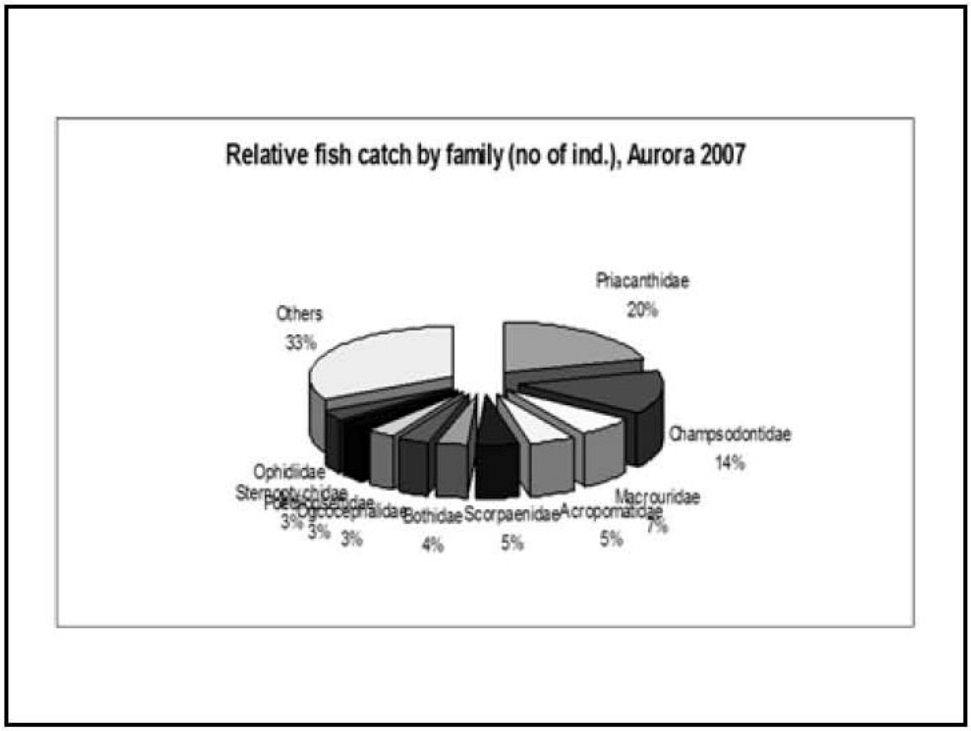
- **Deep sea shrimps fish relatively more abundant at 200-600 m deep**
- **Several species belonging to genus *Heterocarpus* indicated potential for fisheries**

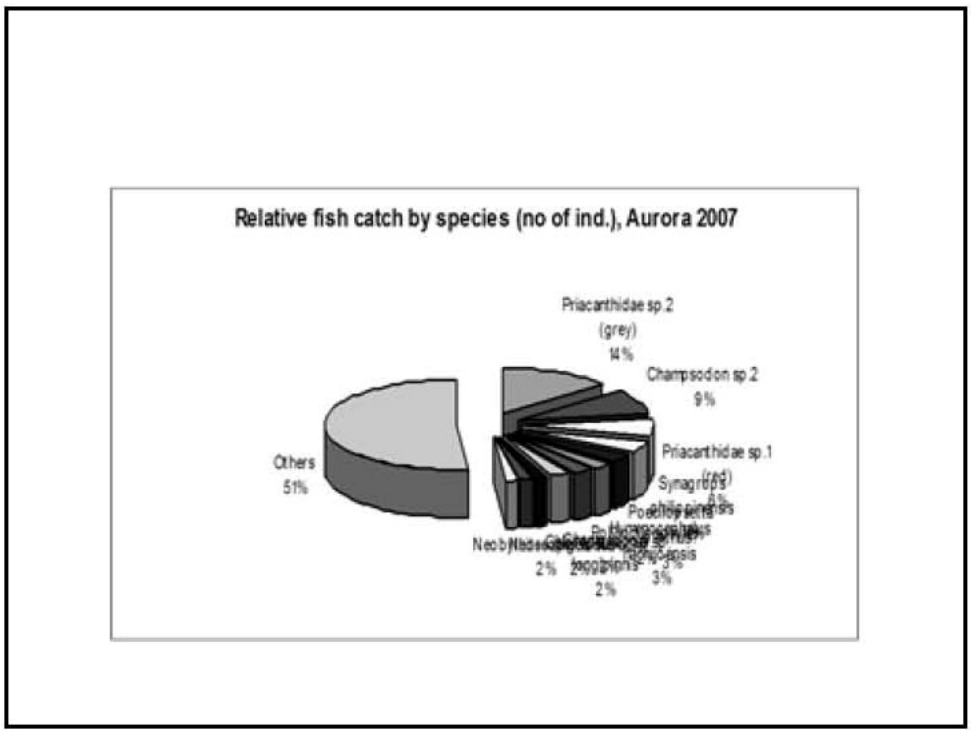
(continued) **Annex7**





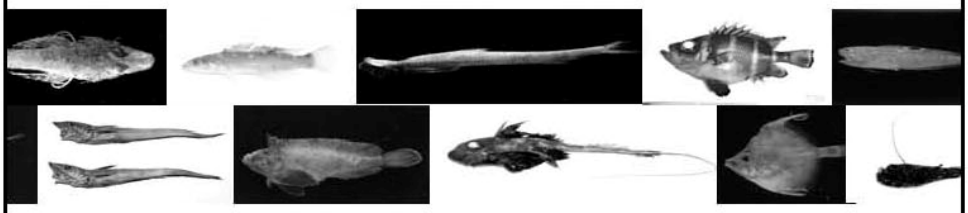
(continued) **Annex7**





(continued) **Annex7**

LUMIWAN 2008 Catch



84 families `

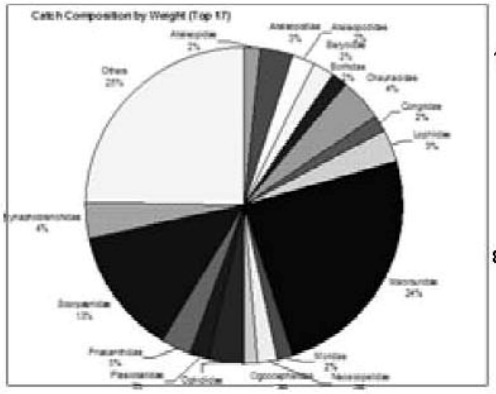
197 species

1,787 tails

94.78 kilograms

Note: Only for 61 out of 68 stations (excluding 4 otter trawl drags)

Composition

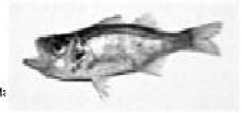


Note: Only for 61 out of 68 stations (excluding 4 otter trawl drags)

Notably…

16% by number & 24% by weight (Macrouridae)

8% by number & 13% by weight (Scorpaenidae)

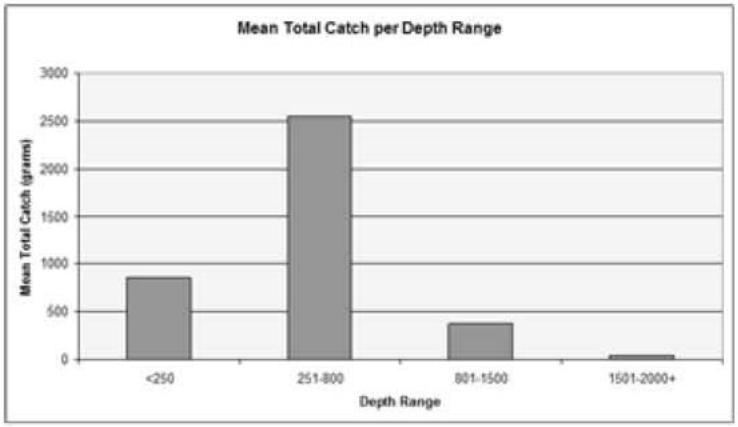


11% by number (Acropomatidae)

4% by number & 4% by weight (Ophidiidae))

(continued) **Annex7**

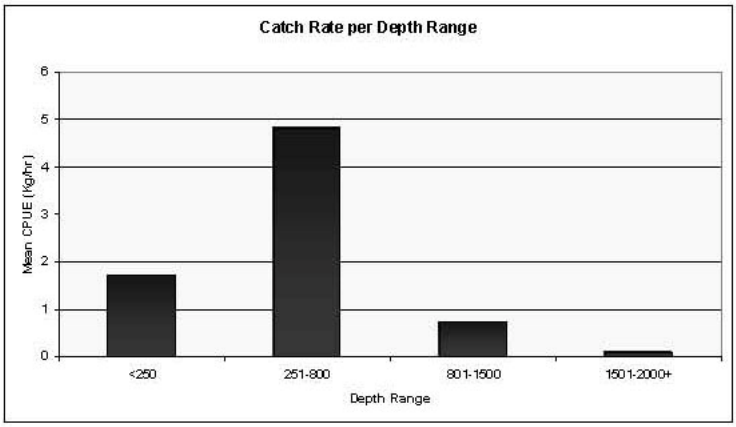
Distribution: Weight Composition by Depth



Coverage

<250 m = 20 stations
251-800 m = 29 stations
801-1500 = 10 stations
1,501-2,000+ = 9 stations

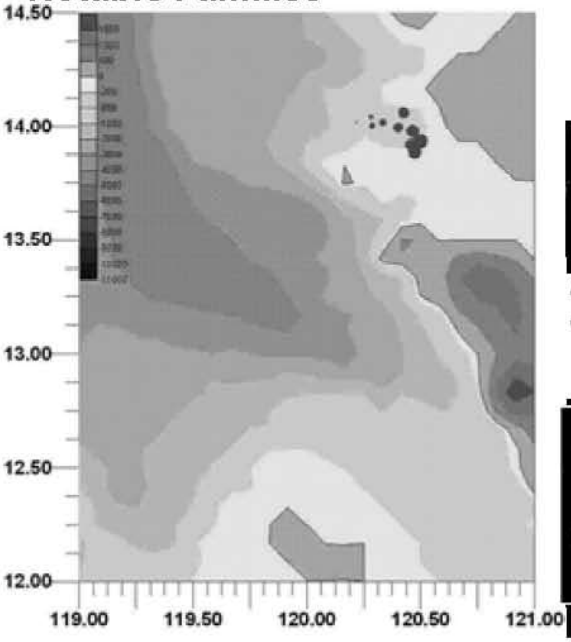
Distribution by depth



Coverage

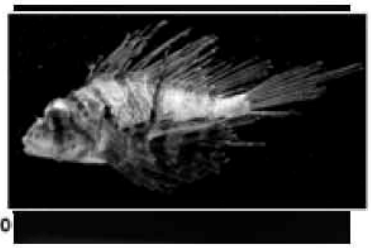
<250 m = 20 stations
251-800 m = 29 stations
801-1500 = 10 stations
1,501-2,000+ = 9 stations

Notable Families



Scorpaenidae:

- Identified 8 species in 12 stations



Conclusion

- Deep sea fish catch diversity high but relatively low volume possibly due to sampling gear efficiency
- Relative higher catch observed at 251 to 800 meters
- Species belonging to family *Scorpaenidae* and *Ophipidiidae* may exhibit potential for fisheries

Annex 8/1: Experiences and Lessons Learned from Fishing Trials: Deep Sea Beam Trawl

By Mr. Sayan Promjinda, SEAFDEC/TD – Fishing Gear Researcher

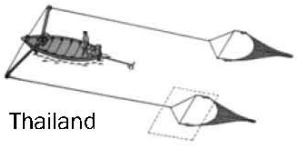
DEEP SEA BEAM TRAWL FISHING TRIAL IN THE ANDAMAN SEA

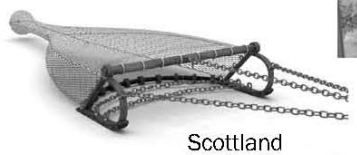
Sayan Promjinda
Southeast asian fisheries development center/TD

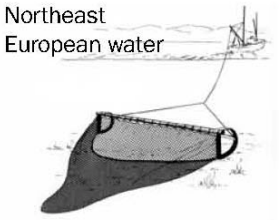
Training Workshop on the Deep Sea Fishery Resources Exploitation on the Continental Shelf Slopes in Southeast Asian Waters
MV DA-BFAR, Philippines
11-25 May 2008

TYPE OF BEAM TRAWL

Beam trawl category



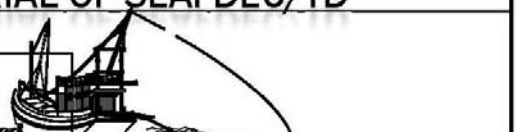




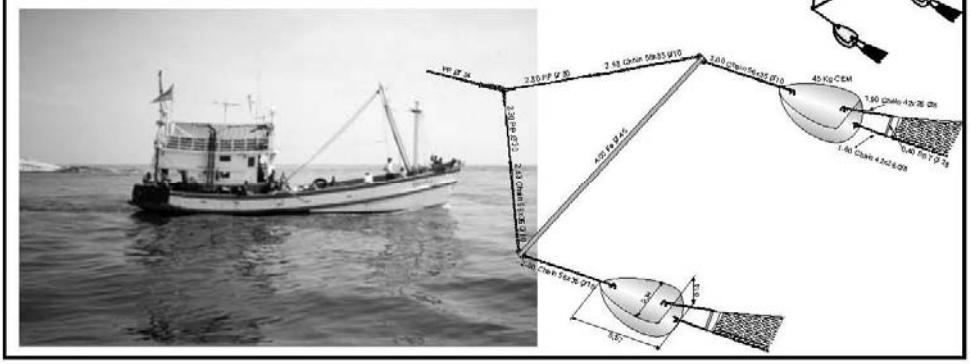
(continued) **Annex8/1**

BEAM TRAWL FISHING TRIAL OF SEAFDEC/TD

-SEAFDEC/TD has been experimented on Beam trawl fishing operation carried out by M.V. Plalung at inner zone of Gulf of Thailand on March 2003
- Sea depth 16- 20 meter



Fishing gear accessories and Deck machineries

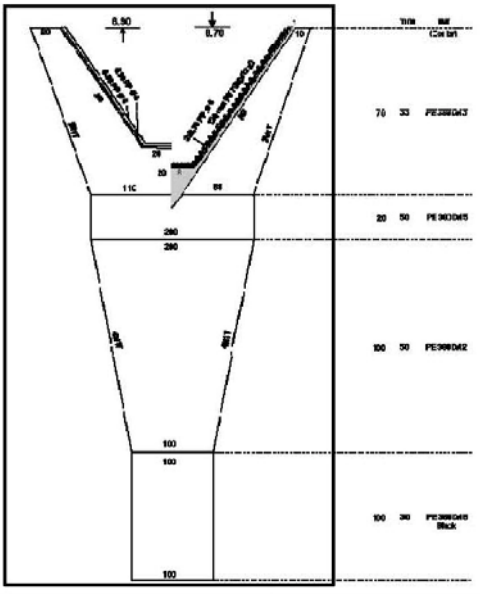


GEAR CONSTRUCTION

TRAWL	VESSEL: M.V.PLALUNG	LOCATION
Beam Trawl	Lbp 19 m	GULF OF THAILAND
Shrimp, Crab	hp 270	Samutsakhon

Net design

M.V. PLALUNG Modification
- Frame : 4 meter
- Float rope 8 m PP Ø 8 mm
- Ground rope 9 m PP Ø 8 mm
- Towing warp 120 m PP Ø mm

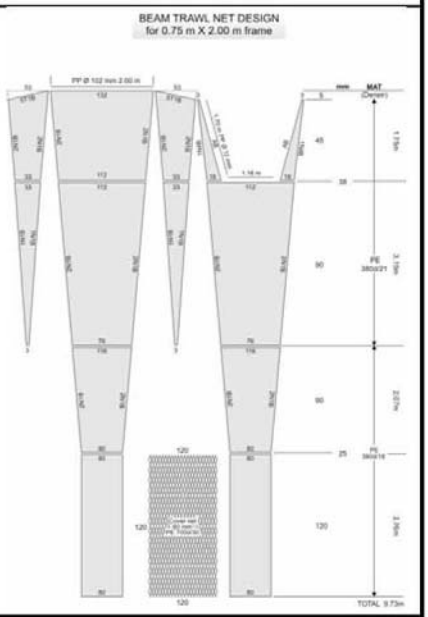


(continued) **Annex8/1**

GEAR CONSTRUCTION

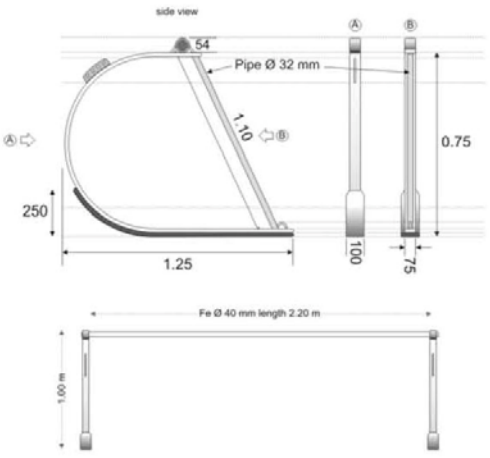
Net design

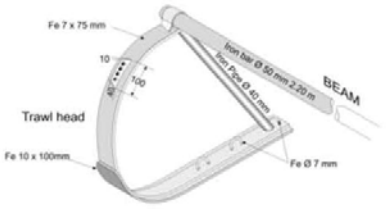
M.V. SEAFDEC 2 Modification
- **Frame : 2 meter**
- **Head rope 2 m (Length)**
- **Ground rope 4.4 m**
- **PE 380 d/21, 380 d/18**
- **Mesh size 38 mm / 25 mm**
- **Total length 9.73 m**



GEAR CONSTRUCTION

Fishing gear Accessories, Beam



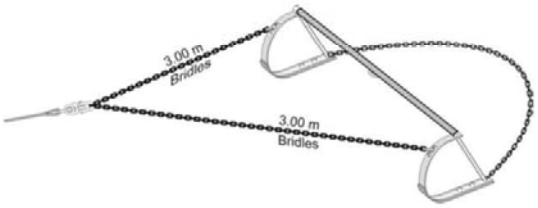


(continued) **Annex8/1**

GEAR CONSTRUCTION

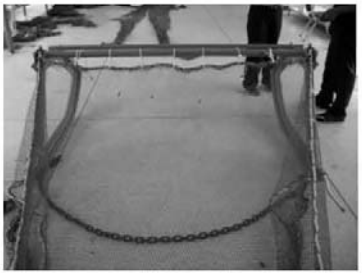
Fishing gear Accessories,
Chain matrices

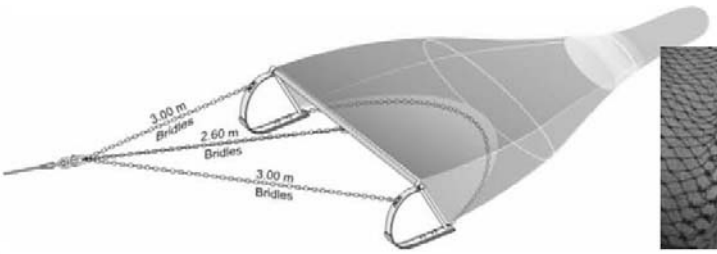
-Chain between the beam was 3.3 meter in length and diameter 9 mm
-Tickler chains was 4.4 meter and 9-10 kg. In weight
- STT hoop sinkers diameter 6 mm, 44 pieces .
-Towing warp is duty heavy chain diameter 9 mm and 3 meter in length

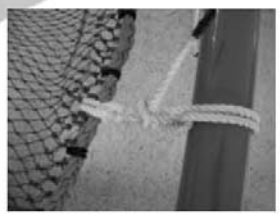


GEAR CONSTRUCTION

Fishing gear Accessories





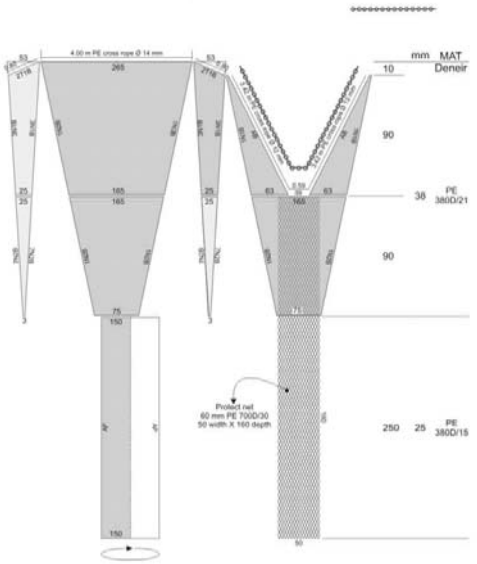


(continued) **Annex8/1**

GEAR CONSTRUCTION

Net design

M.V. SEAFDEC 2 Modification
- **Frame : 4 meter**
- **Head rope 4 m (Length)**
- **Ground rope 7.4 m**
- **PE 380 d/21, 380 d/15**
- **Mesh size 38 mm / 25 mm**



GEAR CONSTRUCTION

Fishing gear Accessories,
Beam (4 meter)

FISHING OPERATION

Fishing trials of Beam Trawl on M.V. SEAFDEC2, Deck arrangement

Under water camera

FISHING OPERATION

Shooting operation

FISHING OPERATION

Hauling operation

RESAULT

Beam trawl fishing summary

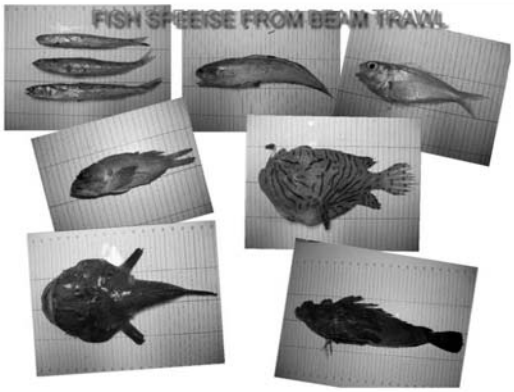
Op. No	Ship speed (kt)	Towing time	Sea depth(m)	Warp length (m)	Total catch in weight(kg)	CPUE (Kg/hr)
1	2.5	55 mn.	73	200	6.72	7.33
2	2.0	30 mn.	80	180	1.47	2.94
3	2.3	30 mn.	82	140	1.27	2.54
4	2.7-3.8	~ 40 mn.	183	450	Was loosed	-
	Total	2.35 hrs.			9.46	4.02

(continued) **Annex8/1**

RESAULT

Fish species

Family	: Apogonidae	: Lophiidae	: Parailchthyidae
	: Synodontidae	: Bothidae	: Shrimp
	: Nemipteridae	: Synancellidae	: Crab
	: Batrachoididae	: Pinguipedidae	: Cephalopod



CONCLUSION AND RECOMMENDATION

1. Although the beam trawl had introduce to Thailand more than 50 years, fishing gear technologists of SEAFDEC/TD have not any experience yet. Deep sea Beam trawl Fishing trial of beam trawl was very important for understanding the fishing gear and fishing operation mechanism. Knowledge and experience gained from the preliminary experiment is the tools for understanding beam trawl fishing that possible to be options on the development selectivity fishing gear and practices for sustainable fishing in the future

2. If the sea bottom is soft muddy, optimum towing speed of beam trawl should be 3.5-4.5 knots, ground rope was dragged and easily to sunk under the soft muddy fishing ground, high towing speed make the beam and ground rope rise up at the surface of sea bottom. In case the sea bottom is rock and coral the towing speed should be reduce to 2-3 knots, and be able to reduce the damage of the trawl net.

(continued) **Annex8/1**

CONCLUSION AND RECOMMENDATION

3. Trickle chain of beam trawl is to short and far from ground rope, so fish and shrimp can be escape to the mount of trawl when it was disturbed by chain. weight of chain at the ground rope should to be increase. The warp length should be 1.5 -2.5 times of sea depth for ship speed 2-3 knots. However if increasing the towing speed, the warp length must to be increase and if reducing of ground rope weight, the towing speed must be reduced. Related to the quantity of total catch.

4. Accidents are occurred by rock bottom sea. Recommend not to tow more than an hour, in order to prevent the beam trawl to the rock bottom or coral caused damage of towing line in the forth operation.

5. For the next experiment, beam trawl should reduce number of the End ring and replace the shackle to the joint of towing line. As well as the dragging characteristic of beam trawl due to the heavy ground rope and ski must be investigated in order to reduce effect to sea bottom and benthic fauna.

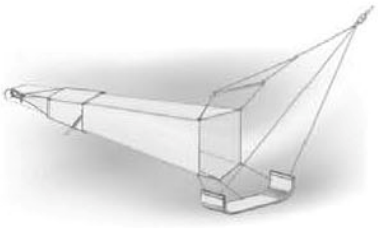
Annex 8/2: Experiences and Lessons Learned from Fishing Trials: IKMT Survey in Andaman Sea

By Mr. Nakaret Yasook, SEAFDEC/TD – Fishing Gear Researcher

Fishing trials of IKMT on MV SEAFDEC2 in the Andaman Sea

Nakaret Yasook

What is IKMT ?



- IKMT : Isaacs-Kidd midwater trawl is an oceanography tool designed specifically to collect biological specimens larger than those taken by standard plankton nets in the midwater zone

Why do we use IKMT ?

- Large mouth opening
- Capacity for fast towing speeds enables it to capture a wider range of relatively large and more active organisms.
- Its fine mesh allows it to snag animals that are not retained in the large trawl nets that are used for commercial fishing.

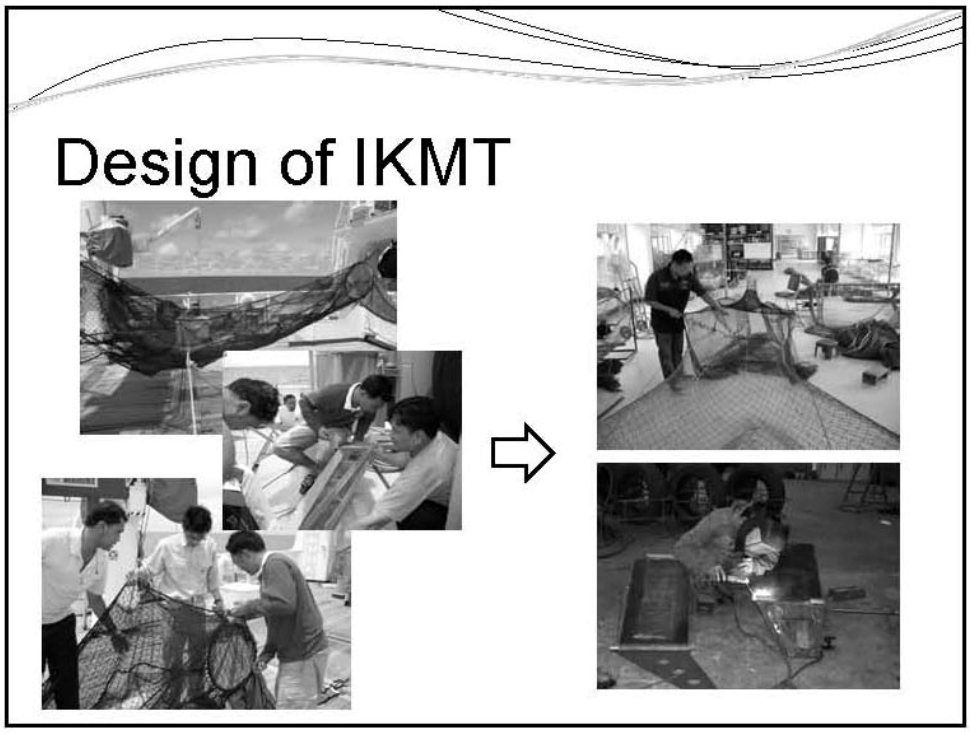
IKMT is well suited for capturing an array of fishes, squids and shrimp that inhabit the midwater zone.

IKMT is always used in conjunction with echosounders.

To provide a target area for the researchers to sample.

Deep Scattering Layer

horizontal zone of living organisms occurring below the surface in many ocean areas, so called because the layer scatters or reflects sound signals. This was found to be caused by organisms in the water column. Much of the phenomenon is produced by the air bladders of fishes, but animals as small as microscopic zooplankton may also contribute to it. The layer has been observed to move down towards greater depths during the day and towards the surface at night. - a movement known as vertical migration.


Design of IKMT

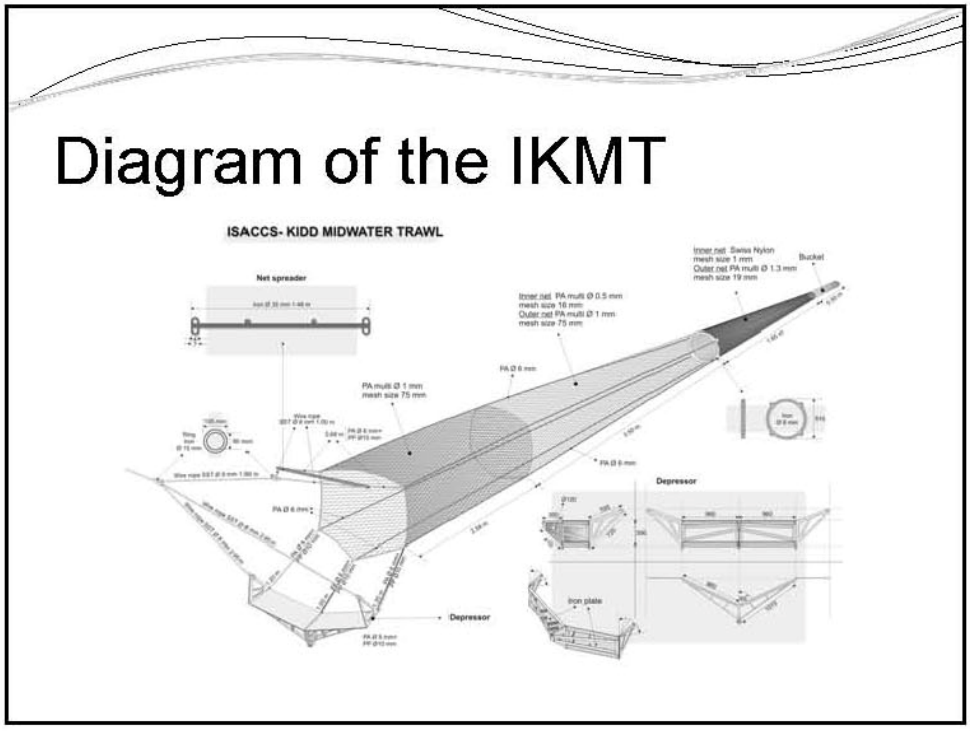
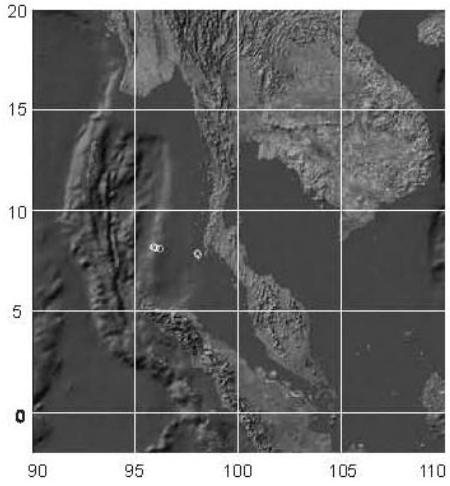


Diagram of the IKMT
ISACCS- KIDD MIDWATER TRAWL
Net spreader
Depressor
Depressor
Iron plate
Bucket

Fishing Trials Stations



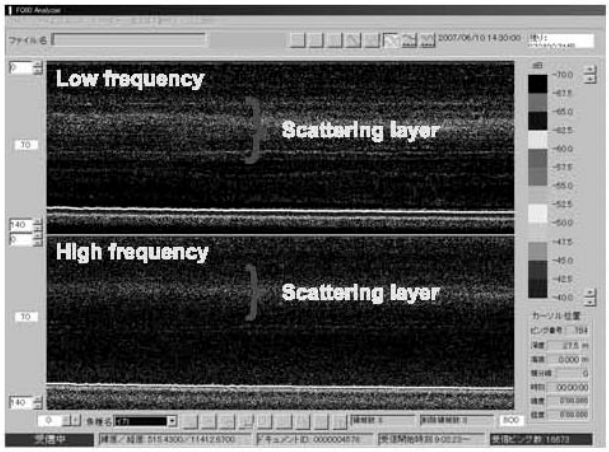
Sea depth 600 – 800 m

- St. 1 : Operation depth 30 m
- St. 2 : Operation depth 30 m
- St. 3 : Operation depth 350m
- St. 4 : Operation depth 140-80 m

Sea depth 80 - 100 m

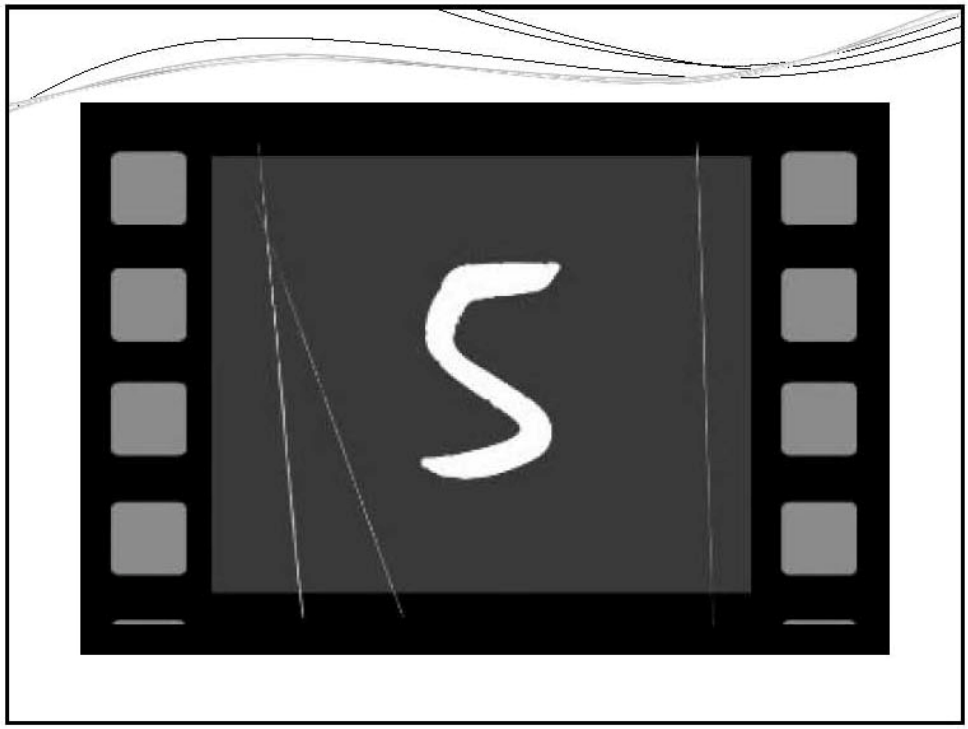
- St. 5 : Operation depth 30 m
- St. 6 : Operation depth 30 m

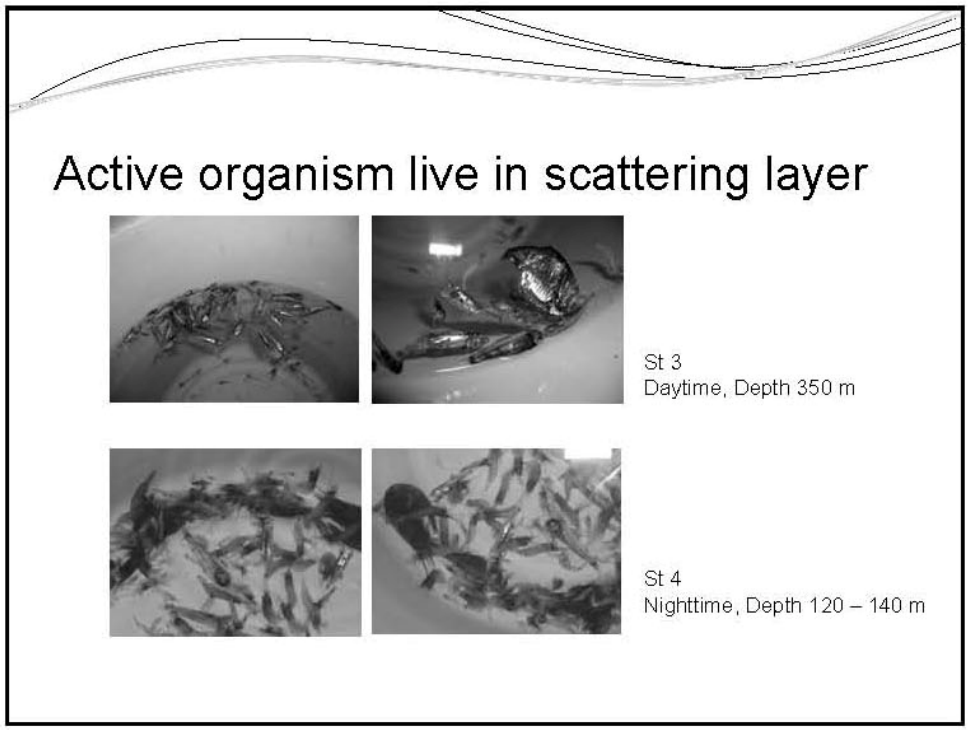
Operation



Using scientific echo-sounder provide a target area before operation

Furuno FQ80 onboard MV SEAFDEC2

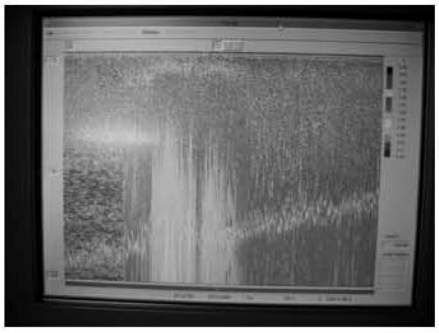



Active organism live in scattering layer
St 3
Daytime, Depth 350 m
St 4
Nighttime, Depth 120 – 140 m

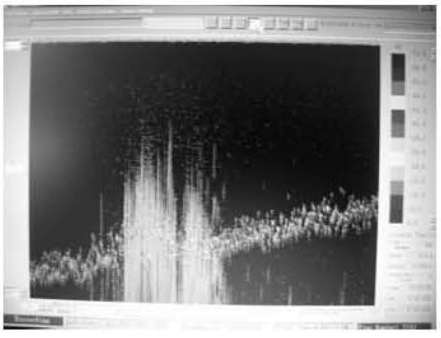
Suggestions

- A half hour is optimum towing time to prevent the sample stuff in the codend.
- Optimum towing speed of IKMT should be 2-3 knots. Because of the high level of drag will be exerted by the net in the water.
- If the echogram and volume backscattering strength (S V) are wanted to record, Turn off acoustic equipments onboard that have the same or nearest frequency of scientific echosounder to prevent the interference.

Wave interference by netsonde



Processer unit



Analyzer unit

Annex 9/1: Country Report of Brunei Darussalam

By Mr. Abdul Hamid Haji Zainin

Head Fisherman Department of Fisheries

Annex9/1

Overview of initiatives/project related to deep sea resources survey and exploitation, Brunei Darussalam.

Fishing Zone.

Zone 1 - (0-3 n.m) - Traditional fishing gear.

Zone 2 - (3 -20 n.m) - Traditional enterprise fishing gear, commercial (trawlers/purse seine/ long line)
< 60 GT 180hp - 350hp

Zone 3 - (20 - 45 n.m) - Traditional enterprise fishing gear, commercial (trawlers/purse seine/ long line)
60 GT - 150 GT, 351hp - 600hp

Zone 4 - (45 - 200 n.m) - Commercial (purse seine/ long line)
150 GT - 600 GT, 600hp - 800hp

Offshore or Deep sea survey conducted.

2004 - 2006.

Collaborative study with SEAFDEC using M.V. SEAFDEC 2.

2007.

Collaborative study with SEAFDEC using M.V. TENJU MARU.

2008.

Collaborative study with SEAFDEC using M.V. SEAFDEC 2.

Conclusion.

Brunei deep sea areas is larger compared to coastal areas that have been exploited for its marine resources. Most past and recent studies and survey conducted has only been focusing on taxonomy and bio-diversity.
Embarking into understanding the potential deep sea resources to be exploited in a sustainable manner is always been priority objective of the Department of Fisheries Brunei Darussalam in fact it is part of the Department National Work Plan for 2008.

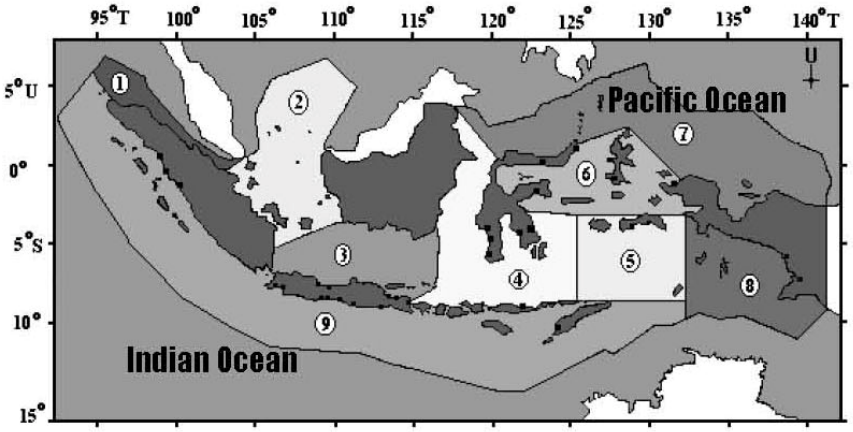
So hopefully with the collaborations of Southeast Asian member countries in terms of sharing technology know how expertise and experience with regards to our deep sea resources, our effort in reducing the pressure to our coastal marine resources will be achieved, by God will.

Annex 9/2: Country Report of Indonesia

By Mr. Muhammad Taufik,

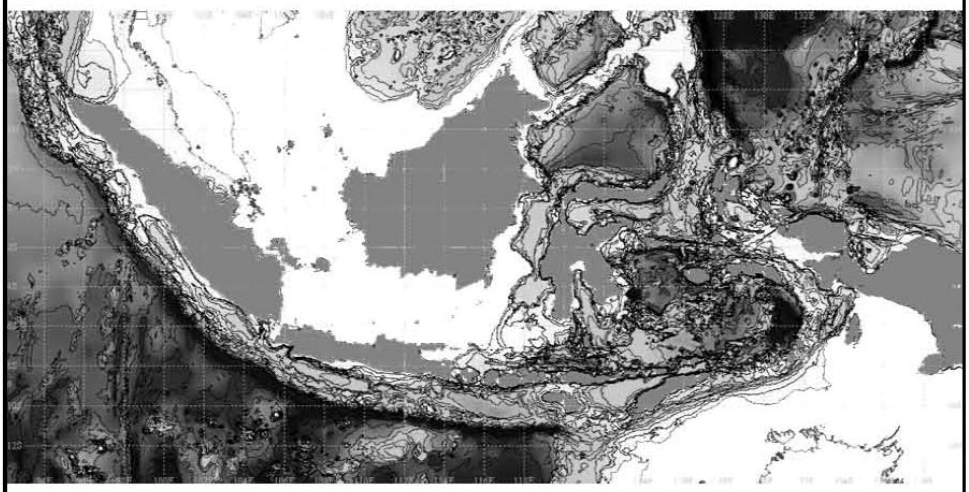
First Researcher of Research Center for Marine Fisheries

9 FISHERIES MANAGEMENT AREA IN INDONESIA



1. Malacca Strait, 2. South China Sea, 3. Java Sea, 4. Flores Sea, 5. Banda Sea, 6. Maluku Sea, 7. Celebes Sea and Pacific Ocean, 8. Arafura Sea, 9. Indian Ocean

Bathymetry profile of Indonesian waters



REF : GEBCO

II. HISTORICAL DEEP SEA RESEARCH IN INDONESIA

- 1992, KARUBAR I & II Expedition (with FRANCE)
  use trawl, bottom trawl&traps on 200-800 m depth
- 2004, in West Sumatera waters-South of Java-South of Nusa Tenggara Timur (with SPAIN)
  use deep sea bottom longline on 200-400 m
- 2004-2005, IPB, in Pelabuhan Ratu
  use trap & bottom gill net on 100-200 m
- 2005, West Sumatera & South of Java (with JAPAN)
  use bottom trawl, search for pharmacological not economic species
- 2008, West Sumatera to Andaman Sea (with JAPAN)

All of the surveys are aimed for species identification&fishing gear experiment

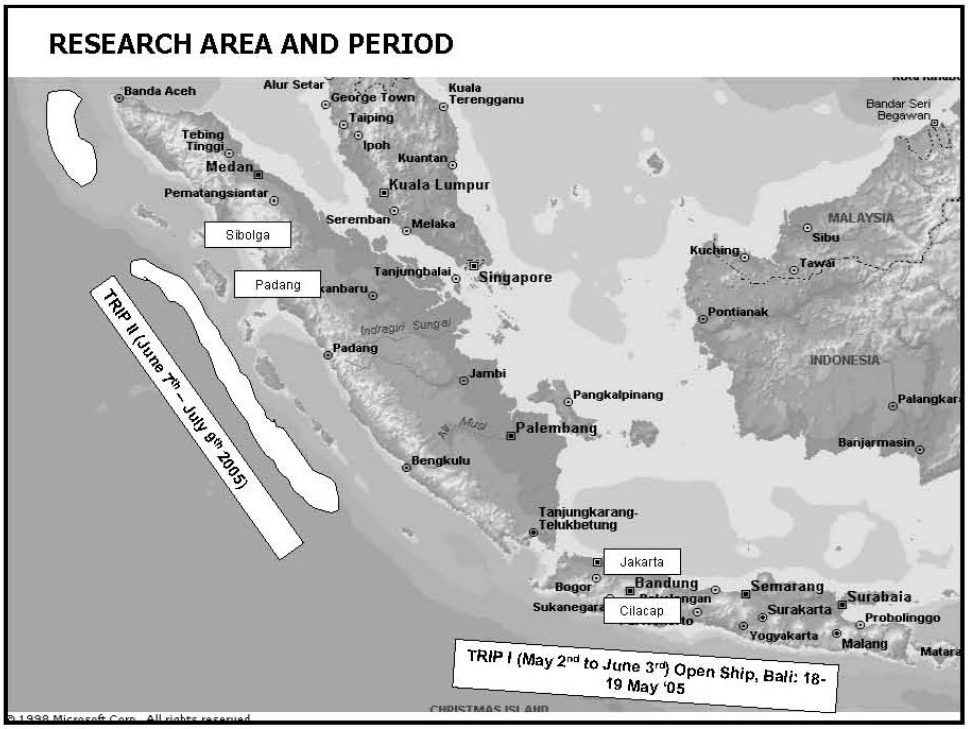
III. SOME RESULT OF DEEP SEA RESEARCH IN INDONESIA

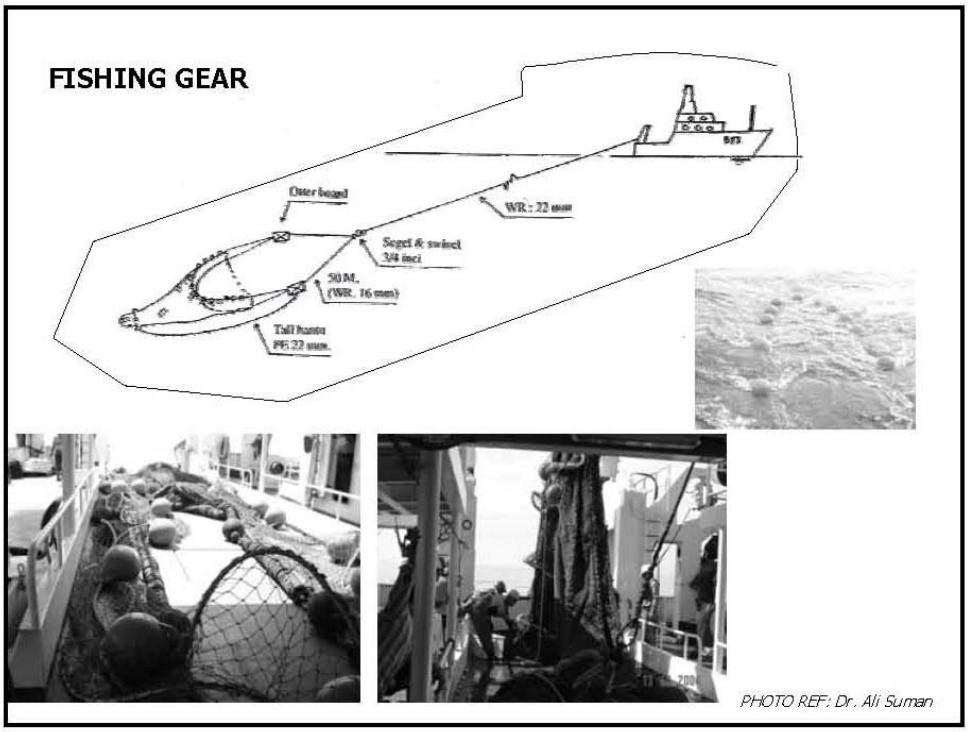
The Japan - Indonesia Deep Sea Fisheries Resources
Joint Exploration Marine Research 2005

Research Center for Capture Fisheries (RCCF)-Indonesia & OFCF (Overseas Fisheries Cooperation Foundation)-Japan

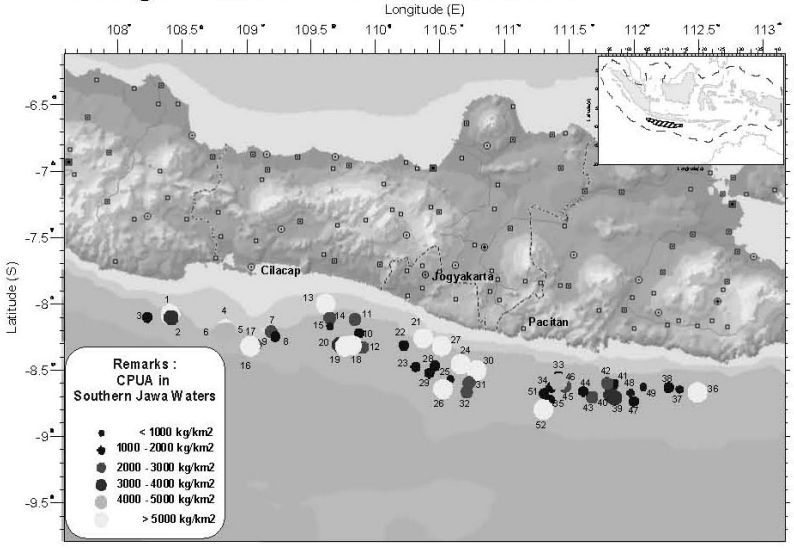
Team leader : Dr. Keiichiro Mori (OFCF) & Dr. Ali Suman (Indonesia)

Location :Wester Sumatera & South of Java

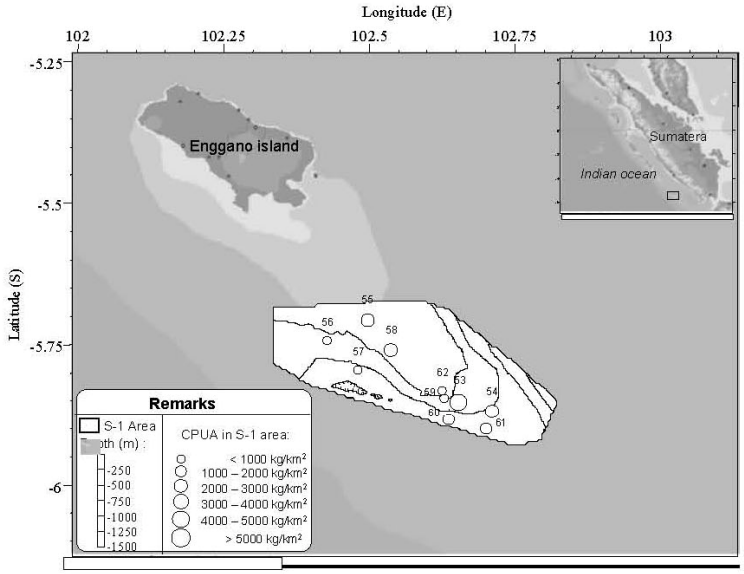

RESEARCH AREA AND PERIOD
Banda Aceh
Alur Setar
George Town
Kuala Terengganu
Taiping
Tebing Tinggi
Ipoh
Medan
Kuantan
Pematangsiantar
Kuala Lumpur
Seremban
Melaka
Sibolga
Padang
Tanjungbalai
Singapore
Bandar Seri Begawan
MALAYSIA
Sibu
Kuching
Tawai
Pontianak
INDONESIA
Indragiri Sungai
Padang
Jambi
Pangkalpinang
Palembang
Banjarmasin
Bengkulu
Tanjungkarang-Telukbetung
Jakarta
Bogor
Bandung
Semarang
Surabaia
Sukanegara
Cilacap
Surakarta
Probolinggo
Yogyakarta
Malang
TRIP II (June 7th – July 9th 2005)
TRIP I (May 2nd to June 3rd) Open Ship, Bali: 18-19 May '05


FISHING GEAR
Outer bagel
WR : 22 mm
Segel & swivel 3/4 inci
50 M. (WR. 16 mm)
Tali hanta PE 22 mm
PHOTO REF: Dr. Ali Suman

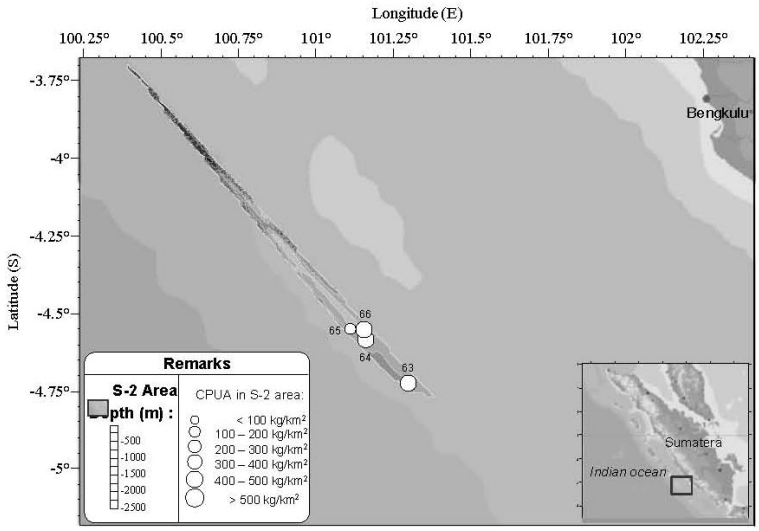
CPUA in South of Java waters was 249 kg/ km^2 (st. 48) to 39608 kg/km^2 (st. 26) (125 -960 m), the high CPUAs were found in the area J-3



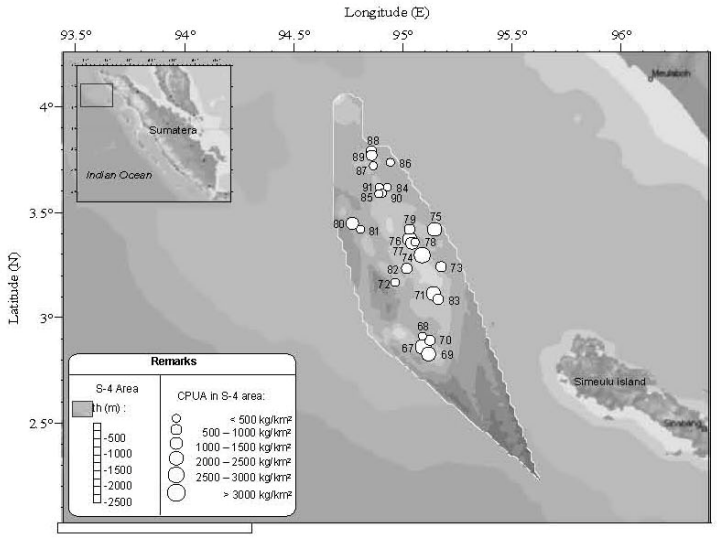
CPUA in S-1 area (around off Enggano Island) was 502 kg/km^2 (st. 59) to 4207 kg/km^2 (st. 53)



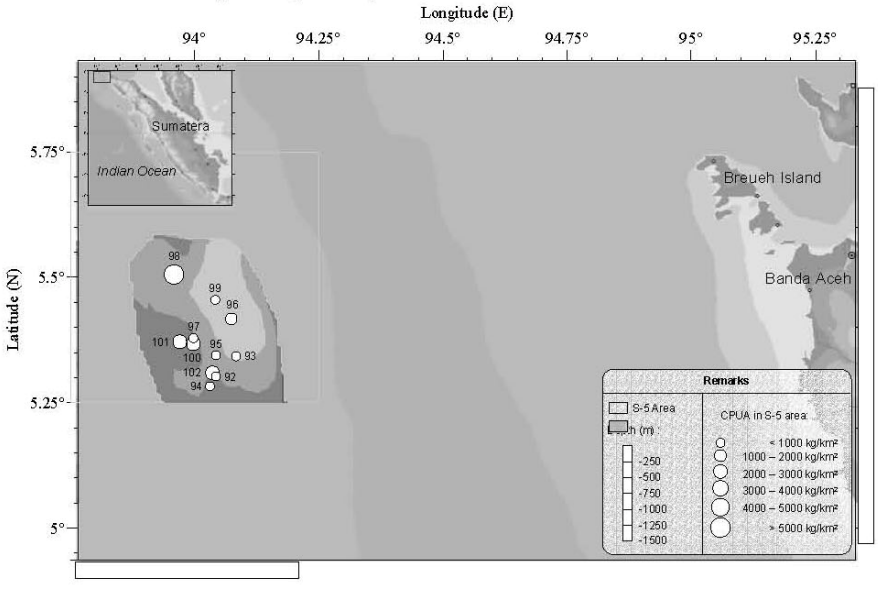
CPUA in S-2 area (around off Bengkulu) was 198 kg/km^2 (st. 65) to 479 kg/km^2 (st. 64)



CPUA in S-4 area (around off Simeulu island) was 71 kg/km² (st. 91) to 2073 kg/km² (st. 74)

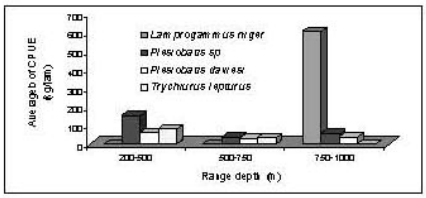


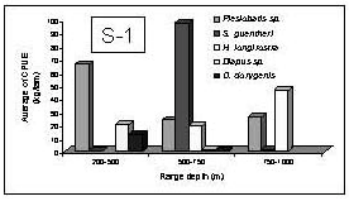
CPUA in S-5 area (around off Aceh) was 136 kg/km² (st. 99) to 13315 kg/km² (st. 98)

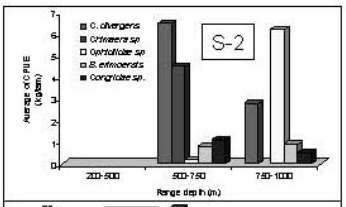


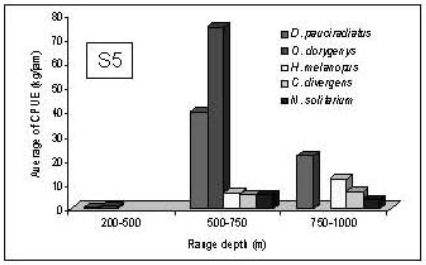
(continued) **Annex9/2**

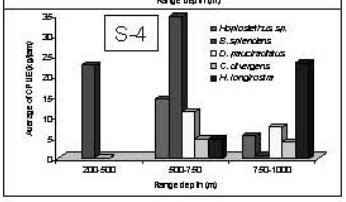
The highest CPUE of dominant species in South of Java waters on the depth 750 – 1000 m and in West of Sumatera waters on the depth 500-750 m



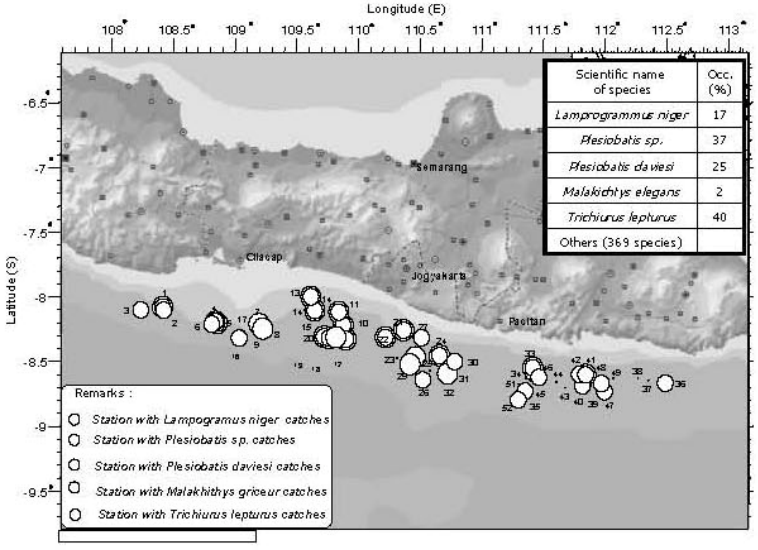


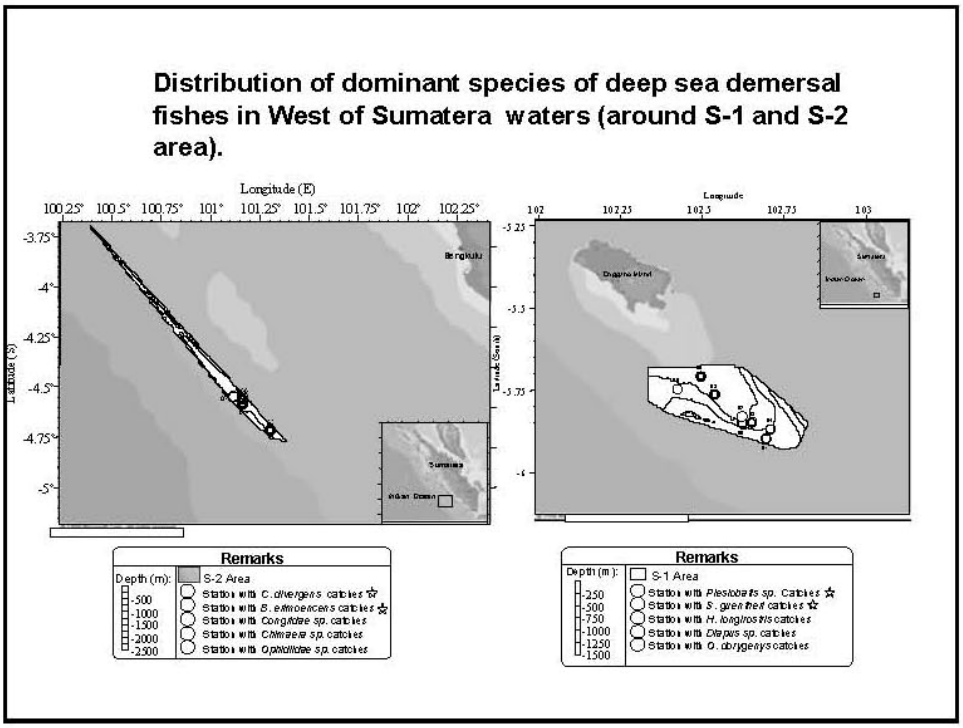


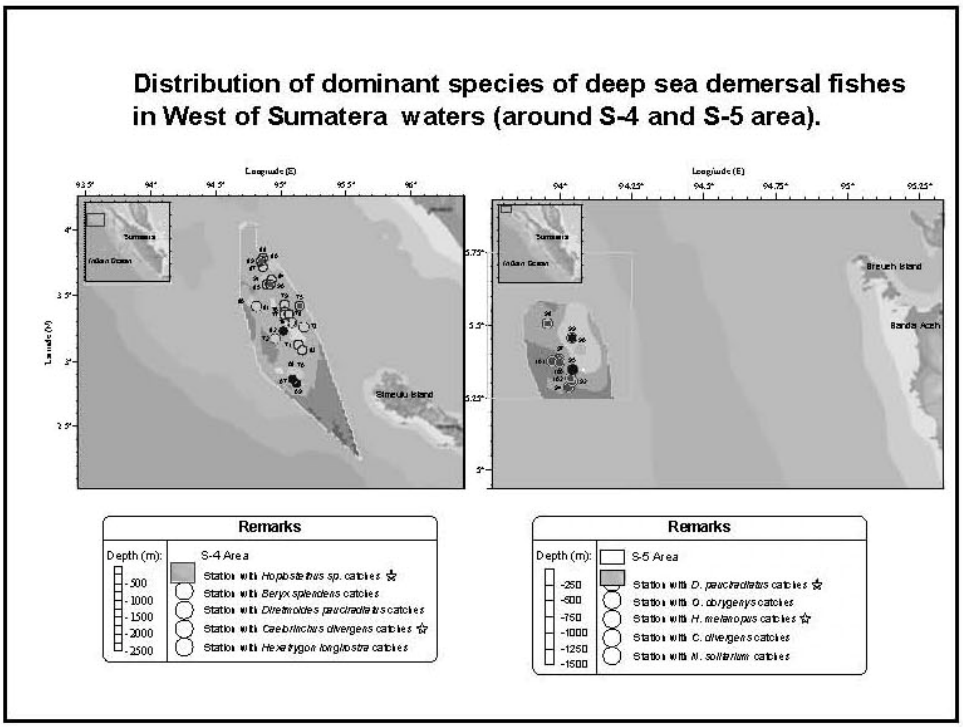




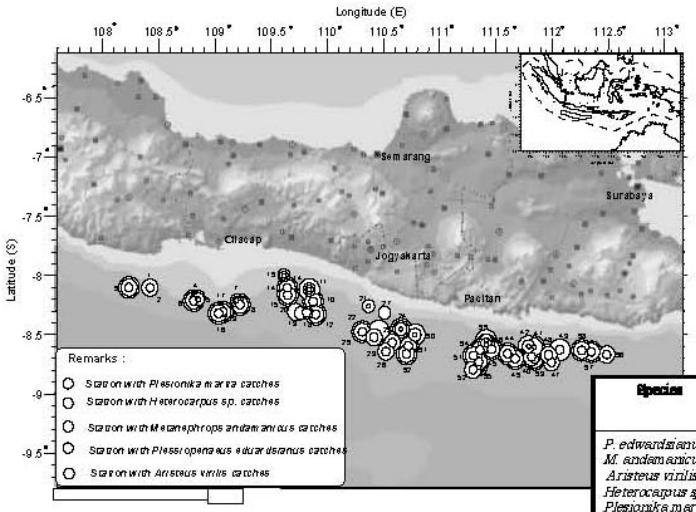
Distribution of dominant species of deep sea demersal fishes in South of Java waters.




Distribution of dominant species of deep sea demersal fishes in West of Sumatera waters (around S-1 and S-2 area).
Longitude (E)
Bengkulu
Remarks
Depth (m):
S-2 Area
Station with C. divergens catches
Station with B. elmoncens catches
Station with Congiidae sp. catches
Station with Chimaera sp. catches
Station with Ophidiidae sp. catches
Remarks
Depth (m):
S-1 Area
Station with Plesiobatis sp. Catches
Station with S. griethi catches
Station with H. longirostris catches
Station with Diapus sp. catches
Station with O. obrygenys catches

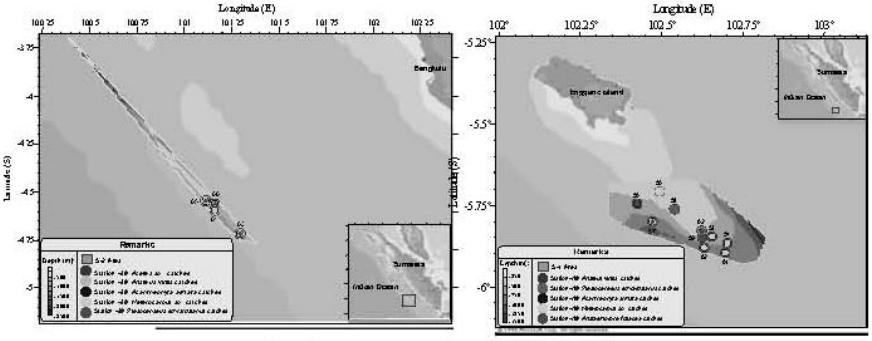

Distribution of dominant species of deep sea demersal fishes in West of Sumatera waters (around S-4 and S-5 area).
Longitude (E)
Simeulu Island
Breuch Island
Banda Aceh
Remarks
Depth (m):
S-4 Area
Station with Hoplostethus sp. catches
Station with Beryx splendens catches
Station with Diretmoides pauciradiatus catches
Station with Caebrinchus divergens catches
Station with Hexanygon longirostra catches
Remarks
Depth (m):
S-5 Area
Station with D. pauciradiatus catches
Station with O. obrygenys catches
Station with H. melanopus catches
Station with C. divergens catches
Station with N. solitarium catches

Distribution of shrimp dominant species in South of Java waters.



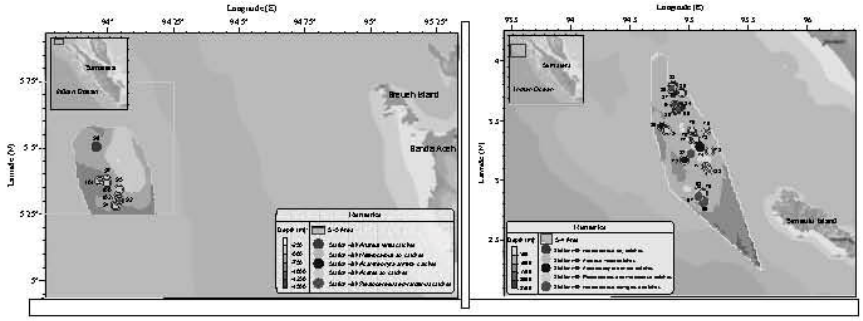
Species	Total catch		Occ. (%)
	kg	%	
P. edwardsianus	36.3	21	69
M. andamanicus	17.5	10	25
Aristeus virilis	15.9	9	62
Heterocarpus sp.	15.3	9	62
Plesionika martia	9.3	9	21
Others (43 species)	77.1	-	-

Distribution of shrimp dominant species in West of Sumatera (S-1 and S-2 area).



Area	Species	Total catch.		Occurrence (%)
		kg	%	
S-1	*Aristeus virilis*	3.62	34	90
	P. edwardsianus	1.82	17	80
	Heterocarpus sp.	1.58	15	70
	Acanthephyra armata	0.69	6	60
	Aristaemorpha foliacea	0.57	5	40
S-2	*Heterocarpus sp.*	0.79	41	100
	Acanthephyra armata	0.29	15	100
	P. edwardsianus	0.17	9	75
	Aristeus virilis	0.15	8	100
	Acetes sp.	0.05	3	100

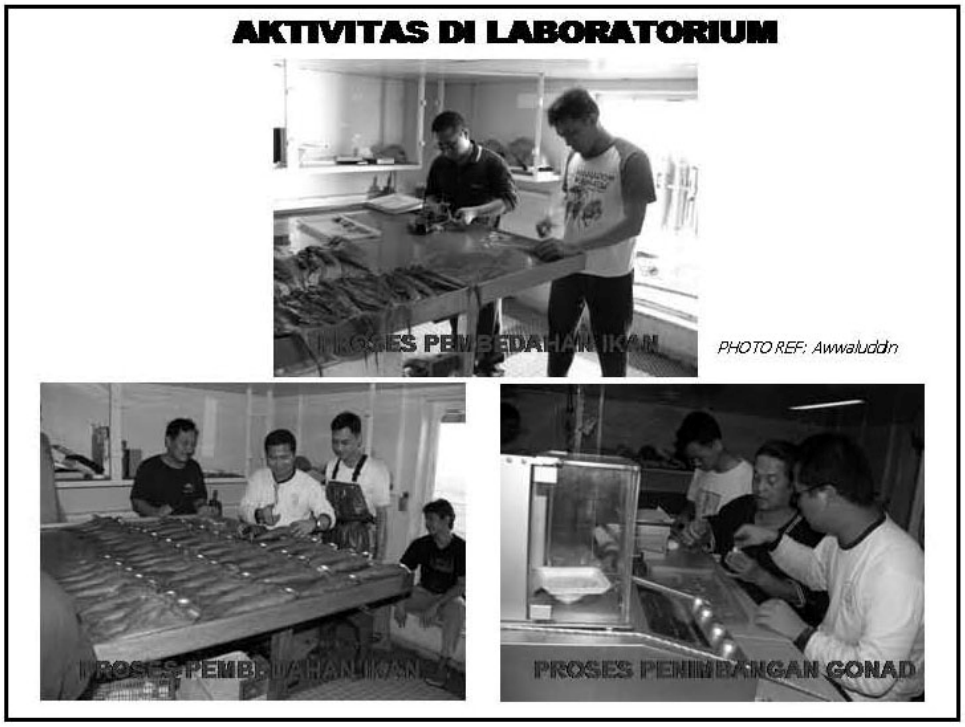
Distribution of shrimp dominant species in West of Sumatera (S-4 and S-5 area).



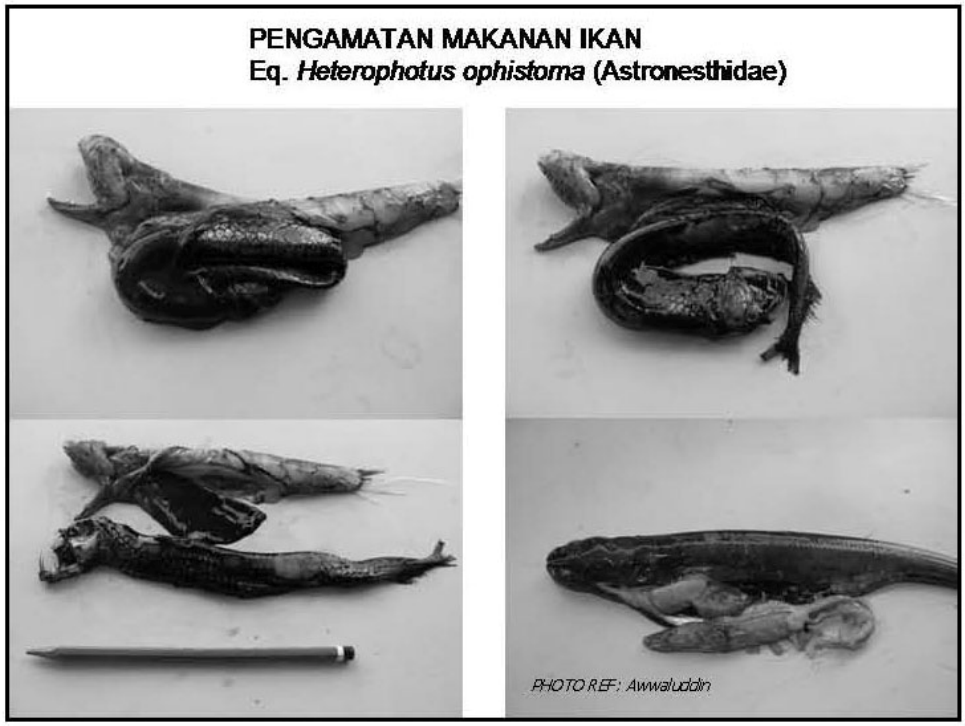
Area	Species	Total catch		Occ. (%)
		kg	%	
S-4	*Heterocarpus sp.*	5.2	34	84
	Aristeus virilis	2.9	19	88
	P. edwardsianus	1.3	9	80
	A. armata	1.1	7	36
	H. laevigatus	0.7	5	36
S-5	*Aristeus virilis*	1.7	39	73
	Heterocarpus sp.	1.2	28	64
	A. armata	0.3	7	64
	Acetes sp.	0.2	5	55
	P. edwardsianus	0.2	4	27

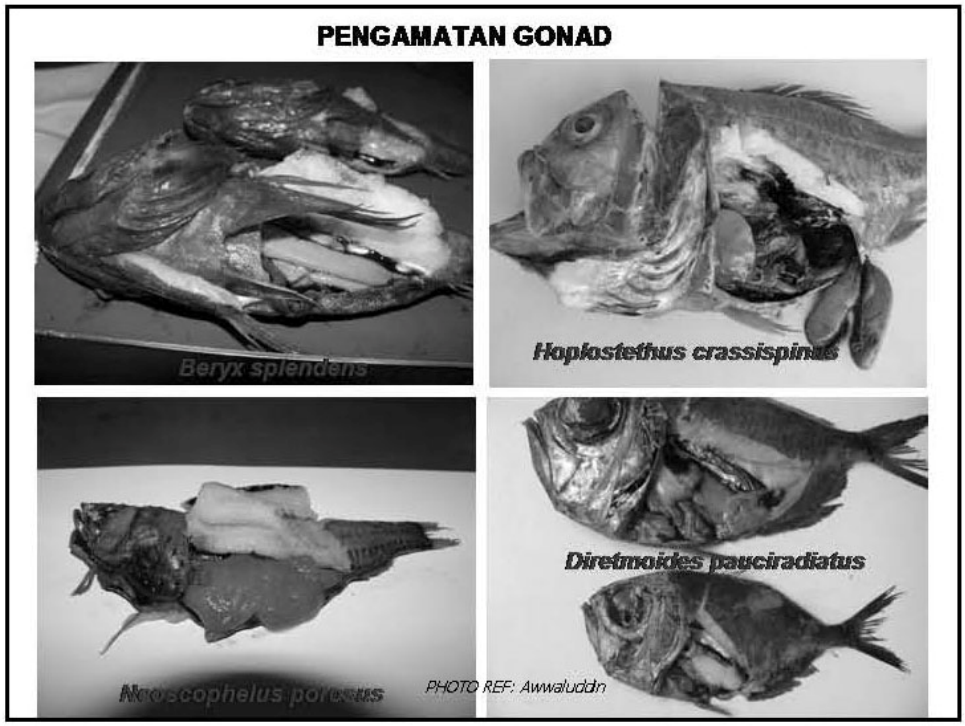
AKTIVITAS DI BRIDGE DAN DECK

(continued) **Annex9/2**

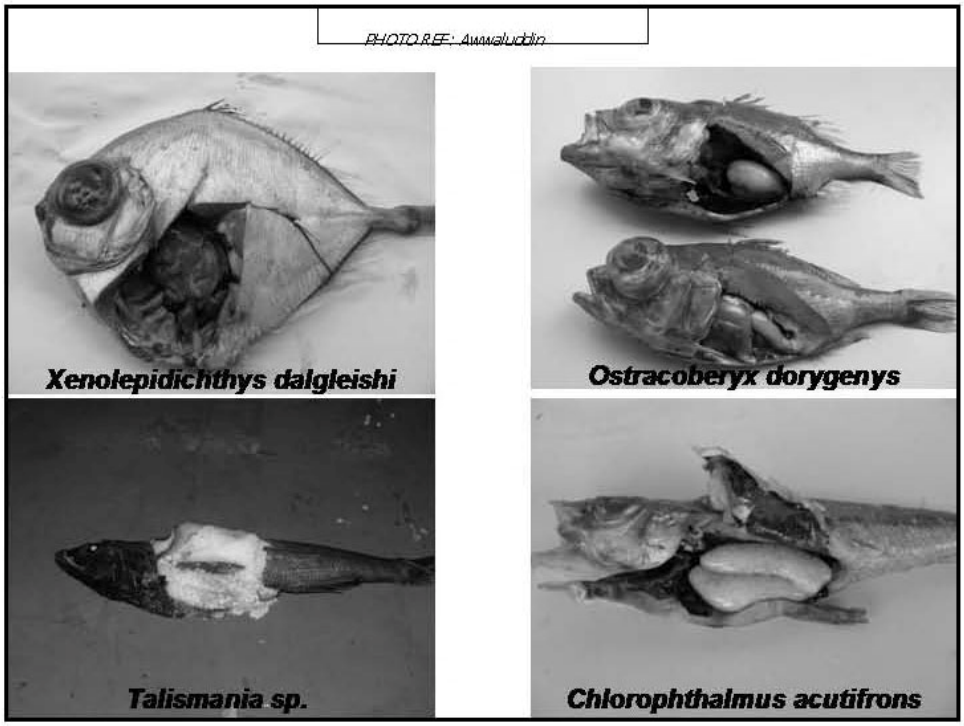


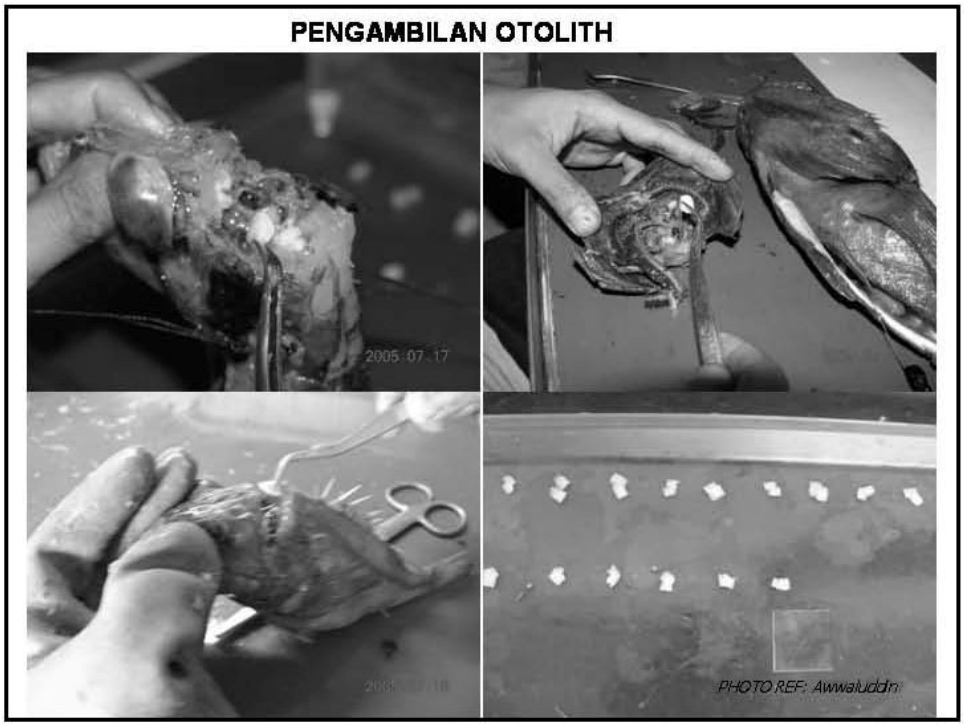
(continued) **Annex9/2**





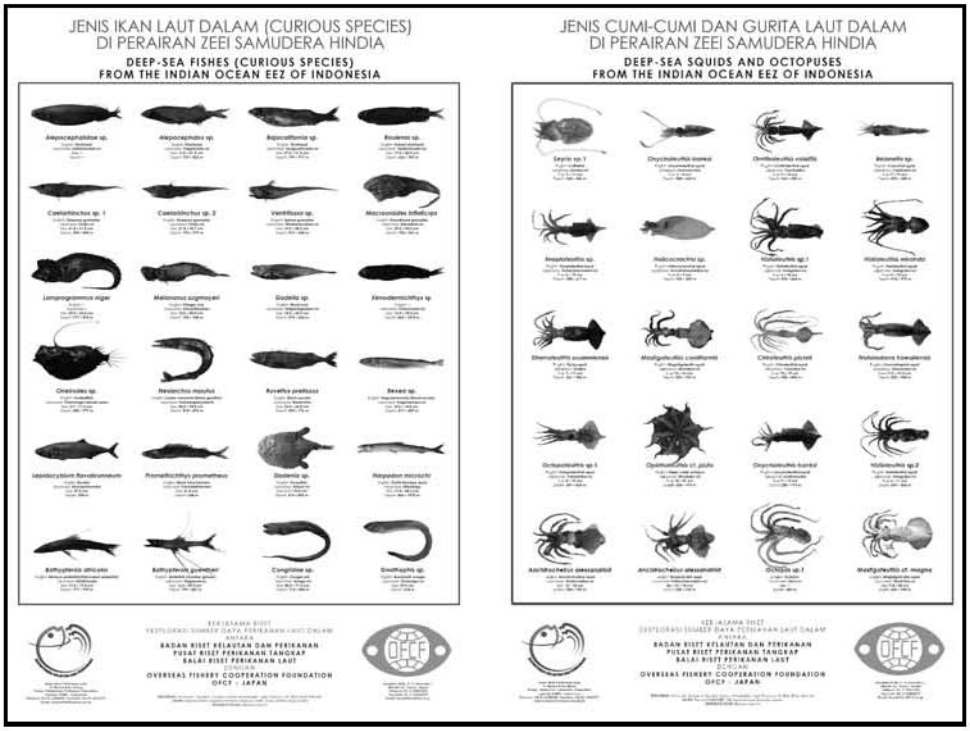
(continued) **Annex9/2**

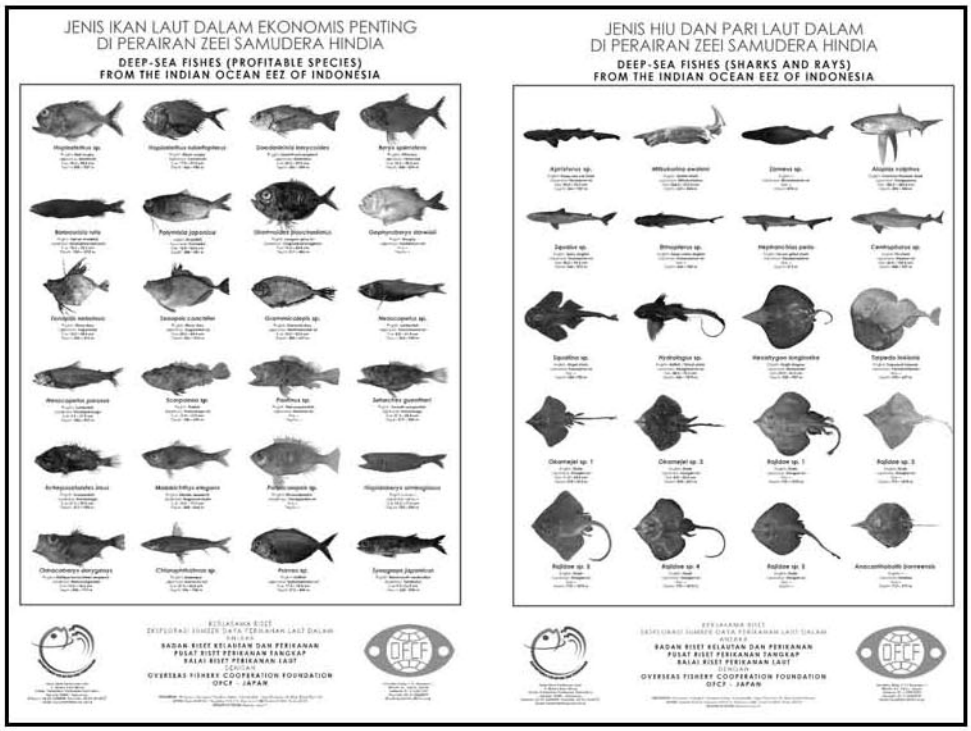


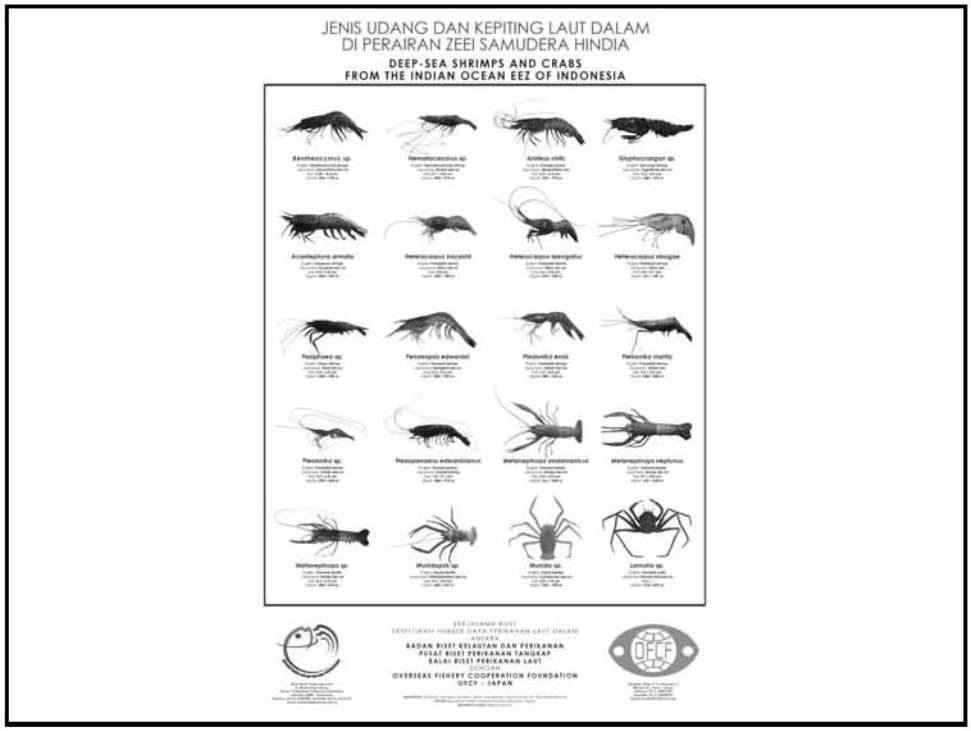


(continued) **Annex9/2**

POSTERS OF CAPTURED DEEP SEA FISHES




JENIS IKAN LAUT DALAM EKONOMIS PENTING
DI PERAIRAN ZEEI SAMUDERA HINDIA
DEEP-SEA FISHES (PROFITABLE SPECIES)
FROM THE INDIAN OCEAN EEZ OF INDONESIA
JENIS HIU DAN PARI LAUT DALAM
DI PERAIRAN ZEEI SAMUDERA HINDIA
DEEP-SEA FISHES (SHARKS AND RAYS)
FROM THE INDIAN OCEAN EEZ OF INDONESIA
BADAN RISET KELAUTAN DAN PERIKANAN
PUSAT RISET PERIKANAN TANGKAP
BALAI RISET PERIKANAN LAUT
DENGAN
OVERSEAS FISHERY COOPERATION FOUNDATION
OFCF - JAPAN


JENIS UDANG DAN KEPITING LAUT DALAM
DI PERAIRAN ZEEI SAMUDERA HINDIA
DEEP-SEA SHRIMPS AND CRABS
FROM THE INDIAN OCEAN EEZ OF INDONESIA
BADAN RISET KELAUTAN DAN PERIKANAN
PUSAT RISET PERIKANAN TANGKAP
BALAI RISET PERIKANAN LAUT
DENGAN
OVERSEAS FISHERY COOPERATION FOUNDATION
OFCF - JAPAN

FUTURE COLLABORATING PROJECT

- SEAFDEC & Indonesia
- Location : Sunda Strait in Indonesia
- Probability to use deep sea traps in South Java, because it's environmental friendly and good for small scale fisheries

Thank You Very Much For Your Attention

Muhammad Taufik, 2008

Annex 9/3: Country Report of Malaysia

By Mr. Mohamad Faisal Bin Md. Saleh, Research Office of SEAFDEC/MFRDMD

and

Mr. Mohamad Azmi bin Abdullah, Captain KK Senangin

Annex9/3

Country Report of Malaysia

The Government of Malaysia formally declared an Exclusive economic Zone (EEZ) in 1981. Fishing ground were extended beyond traditional areas. The EEZ waters strictly lie outside the territorial waters and may stretch up to a distance of 200 nautical miles from the baseline.

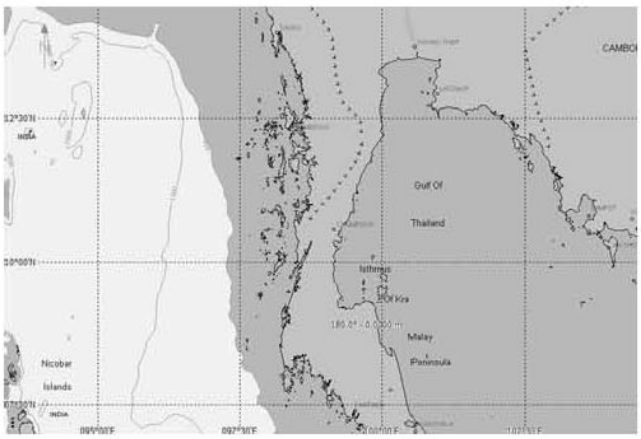
The first fisheries resources survey in the EEZ of Malaysia was conducted from 1985-1987. This first survey estimated the demersal and semi-pelagic/pelagic fish biomass and potential in the waters of the Malaysian EEZ, covering the west and east coast of Peninsular Malaysia, as well as in the South China Sea area off Sarawak and Sabah. The results obtained provided the Department Of Fisheries with baseline resource information for the formulation of plan for the development of offshore fisheries.

The second survey in the EEZ of Malaysia was conducted from September 1997 to November 1998. These second survey assess the status of offshore fishery resources, 10 years after the first survey was conducted. In this second survey, the demersal and pelagic fish biomass and potential were determined.

Annex 9/4: Country Report of Thailand

By Mr. Narupon Darumas, Fishery Biologist
Deep Sea Fishery Technology Research and Development Institute
Marine Fisheries Research Development Bureau

Thai waters



Deep Sea Fishery Resources Exploration in Thailand

Introduction

Main problem for Thai capture fishery :

- Declination of coastal fishery resources
  - To many fishing gears, boat
  - Impact from fishing gear to bottom habitat
  - Conflict between fisher and other sector

DOF's projects on deep sea resources survey

- Since 1988 : M/V Chulabhorn constructed with the aim to conduct :
  - Fishing gear survey : Tuna purse seine, longline and Drift gillnet
  - Oceanographic survey
  - Topographic survey
- Since 1994 : M/V Mahidol constructed specific to tuna purse seine

Out put from activities of M/V Chulabhorn and M/V Mahidol

- HRD : for fishing techniques and operations in deep sea
- Annual oceanographic data collection and dissemination
- Preliminary result on potential resources in deep sea area BVL, TLL(PLL), Purse seine

Way forward

- Develop an appropriate fishing gear for deep sea
- Support private sector on deep sea fishery

Facility of Andaman Sea Fishery Resources Survey

Central office :

- Deep Sea Fishery Technology Research and Development Institute

Local office :

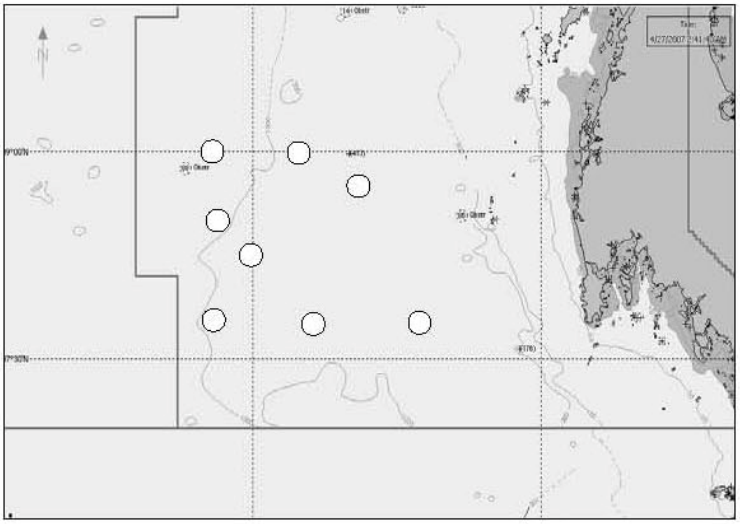
- Andaman Sea Fishery Research and Development center

DOF's research vessel

M/V Mahidol

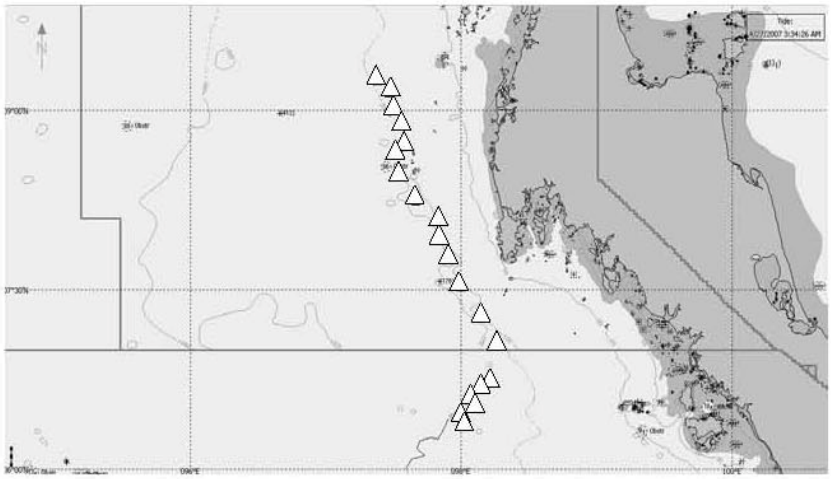
M/V Chulabhorn

Stations of Pelagic longline in Andaman Sea, Thai Waters

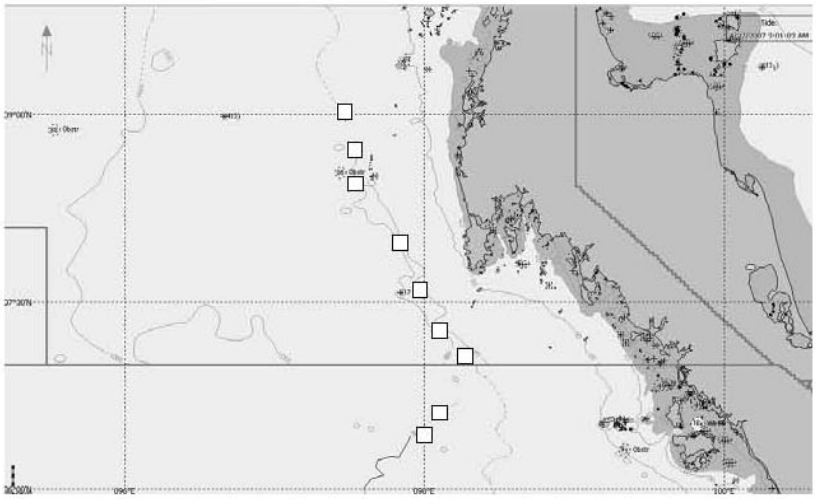


(continued) **Annex9/4**

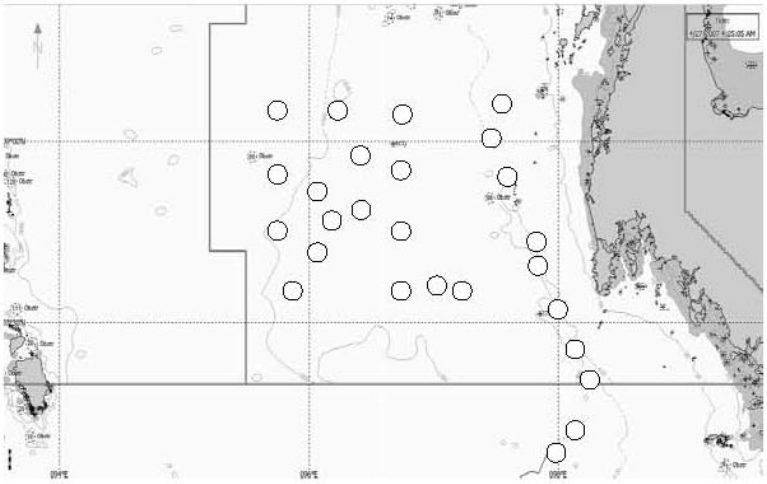
Stations of Bottom Vertical longline in Andaman Sea, Thai Waters



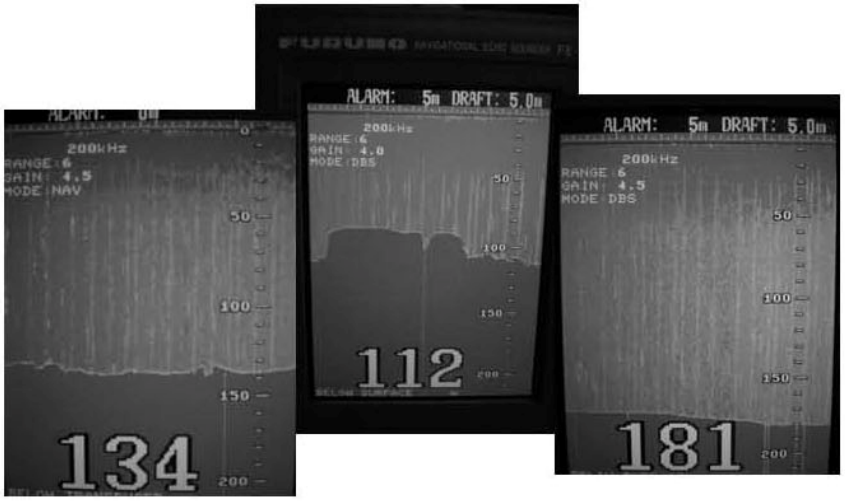
Stations of Deep Sea Trap in Andaman Sea, Thai Waters



Stations of Oceanographic survey in Andaman Sea, Thai Waters

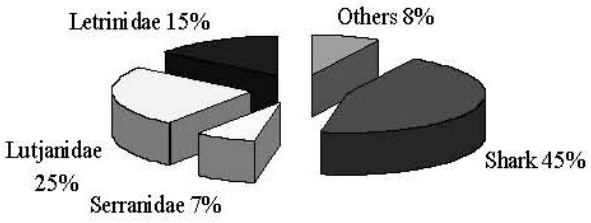


Topography of Fishing ground in Andaman Sea



BVL and DST survey

Demersal fish composition from BVL



Economic fish

HRD activity

Annex 9/5: Country Report of Vietnam

By Mr. Pham Quoc Huy, Researcher

Fisheries Resources Research Division, Research Institute for Marine Fisheries

REPORT

Some results of research on species composition, catch in fishing gears experiments in continental slope area of Vietnam

DO VAN KHUONG
NGUYEN BA THONG
Present: PHAM QUOC HUY

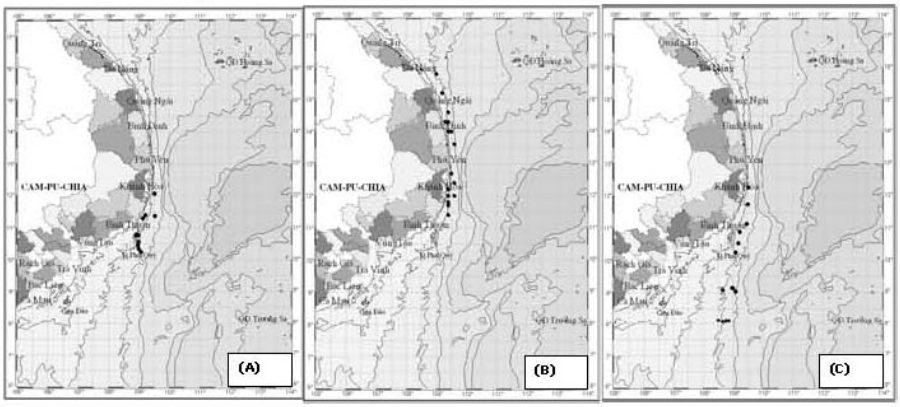
RESEARCH INSTITUTE FOR MARINE FISHERIES - VIETNAM

1. Introduction

- Despite facing the fact that the coastal fisheries resources was sharply declined Generally, the marine fisheries resources was reduced in quality, which has been reflected by the replacement of commercial value species by "trash fish".
- Nevertheless, the potential fisheries resources in offshore area and particularly in deep sea, bottom and sub-bottom layers of the continential slope area has not been fully estimated. The fisheries resources in the continental slope area were almost neglected. There was not any research specializing in investigation and survey of demersal and sub-demersal species in the continental slope area. It was not until 2005, the research project "*Assessment of reef fish resources in proposed marine protected areas and some highly commercial value species in the continental slope area of Vietnam, proposal of solutions for sustainable use of fisheries resources*" had been approved by the Ministry of Fisheries.

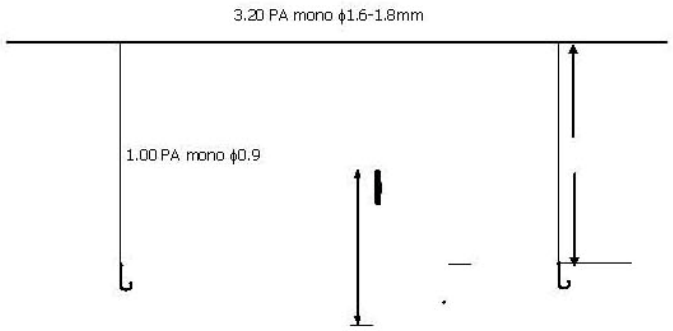
2. Materials and methods

- There have been three fishing gears experiments in total conducted in the continental slope area of Vietnam during 2005 – 2007. The first and second one were carried out in May and July 2006 respectively, and the third one in April 2007.



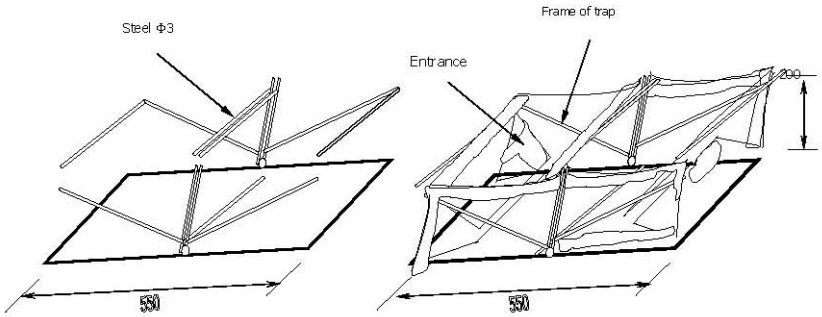
3. Gears

- Specifications and bottom long line model used for the fishing gears experiments in the continental slope area of Vietnam during 2005 – 2007



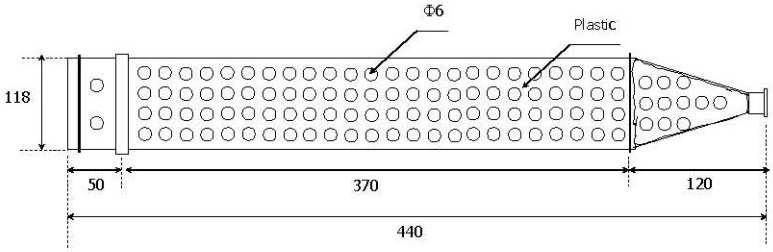
3. Gears

- Main specifications of swimming crab trap with rectangular parallelepiped frame used for experiments in the continental slope area of Vietnam during 2005 – 2007



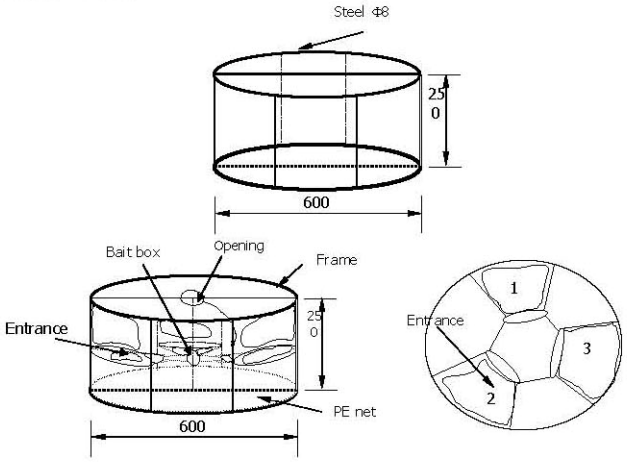
3. Gears

- Main specifications of eel trap used for experiments in the continental slope area of Vietnam during 2006 – 2007



3. Gears

- Main specifications of swimming crab trap with cylindrical shape used for experiments in the continental slope area of Vietnam during 2005 – 2007



4. Data collection and catch rate

- Longline fishing was operated in early morning (at 4 – 5 a m.) and late afternoon (4 – 5 p.m) for an immersion period of about 5 hours. Trap fishing was conducted both daytime and night-time, each night-time operation consisted of about 10-12 hours. All kinds of traps were randomly placed along the main line at different intervals. The catch of each longline, trap fishing operation was classified by species group, number and weight corresponding to species , species group recorded in the survey forms. Commercial fishes and species were measured in length

- Catch-per-unit-effort (CPUE) for trap fishing was standardized and calculated at kg/100traps/10 hours of immersion. CPUE for longline fishing was calculted using the catch (kg) of 100 hooks in a 5-hour immersion period. Descriptive statistics were usually used to estimate the avarage CPUE, the catch composition (%) of species groups

5. Study results

5.1. Species compostion

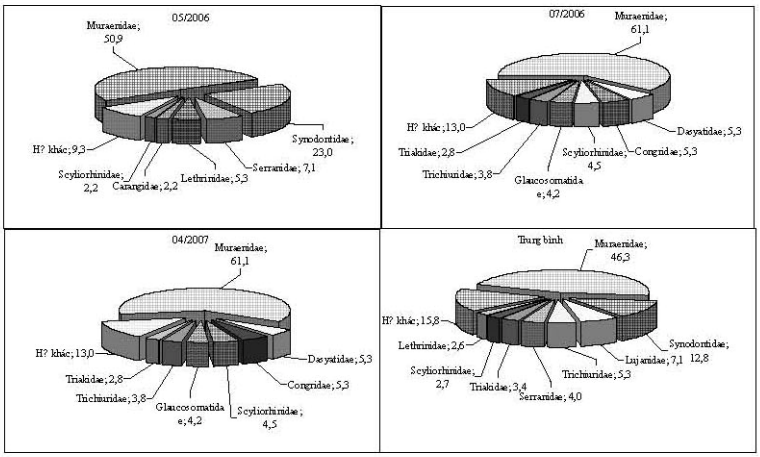
Number of families, species caught by different fishing gears in experiments in the continental slope area of Vietnam during 2006 - 2007

Fishing gears	*Family Species*	*Survey*			*Total*
		May 2006	*July 2006*	*April 2007*	
Bottom longline	*Family*	13	22	22	33
	Species	22	35	37	71
Swimming crab trap in cylindrical shape	*Family*	13	14	13	26
	Species	19	20	17	41
Swimming crab trap in rectangular parallelepiped shape	*Family*	6		9	11
	Species	8		13	20
Eel trap	*Family*	2	1	4	5
	Species	2	1	6	7

5. Study results

5.2. Catch composition

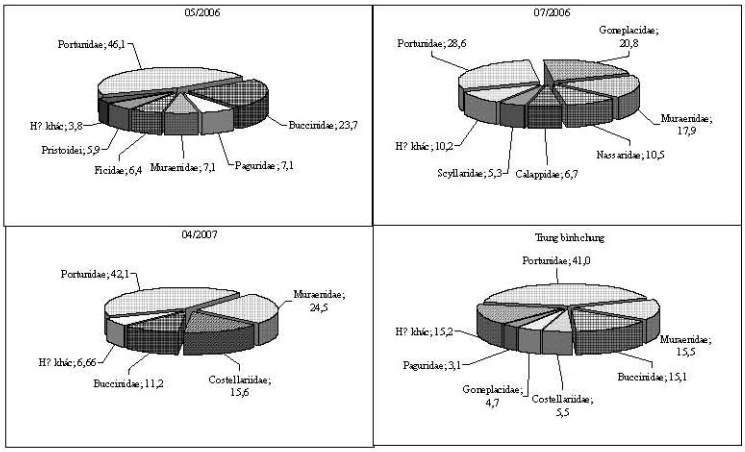
Average catch compositon in total and by survey of bottom longline fishing in the continental slope area in 2006 and 2007



5. Study results

5.2. Catch composition

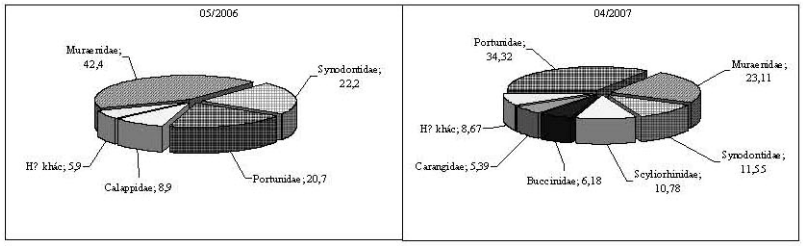
Average catch compositon in total and by survey of cylindrical trap for swimming crab fishing in the continental slope area in 2006 and 2007



5. Study results

5.2. Catch composition

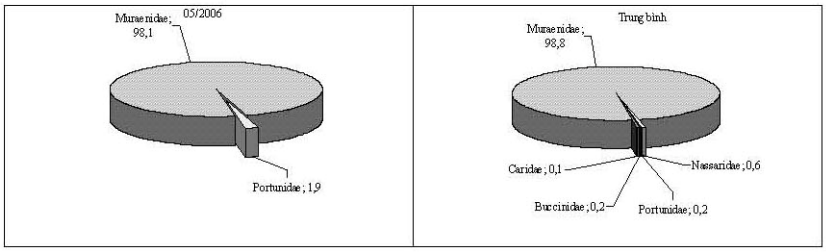
Catch compositon by survey of rectangular parallelepiped trap for swimming crab fishing in the continental slope area in 2006 and 2007



5. Study results

5.2. Catch composition

- Catch compositon by survey of eel trap fishing in the continental slope area in 2006 and 2007



5. Study results

5.3. Catch rate (CPUE)

- Average CPUE per longline survey was rather stable, ranging from 2 to 3 kg/100hooks/5 hours. The results of statistic analysis showed no statistic difference of CPUE among experiments with a reliability at 95%.
- CPUE of cylindrical trap for swimming crabs ranged from 1 to 3 kg/100 traps/10 hours. The results of statistic analysis showed that the CPUE of the first experiment was higher the second one with a reliability at 95%. There was not significant difference between the first experiment and the third one, between the second one and third one. Most traps gained CPUE at below 3 kg/100 traps/10 hours.
- Rectangular parallelepiped traps for swimming crab fishing operation in the continental slope area obtained CPUE at about 1.5 kg/100 traps/10 hours. The highest average CPUE was 1.6 kg/100 traps/10 hours and the lowest one was 1.4 kg/100 traps/10 hours. Moreover, there was no statistic difference of this index among the experiments with a reliability at 95%.

6. Discussion

- The species composition (caught species groups) of bottom longline fishing was rather abundant, including highly commercial value species belonging to Lutianidae, bathy- Sparidae, Synodidae ... and especially eel group. In addition, bottom longline fishing also obtained some endemic demersal and sub-demersal species within highly commercial value in the continental slope area such as *Cookeoulus japonicus, Priacanthus boops, Pargus major* ... These species are considered as high value species in countries which have developed deep sea fishery like Japan ... Crab traps fishing also caught various species, mainly crab and swimming crab (cylindrical trap); crabs and fish (rectangular parallelepiped trap). The eel trap showed a high selectivity, over 90% catch were eel group belonging to Muraenidae.
- The catch rate of experimental fishing gears showed a relatively high variation. It may be due to the difference in topographical features of area of the continental slope and especially the difference in some oceanographical characteristics such as currents, topography of the sea bed ... Besides, gear selectivity, color, form and particularly baits should be studied to estimate the fishing coefficient for important species groups as well as serving for collection of species composition data.

Annex 10: Overview of the Deep Sea Fish Taxonomy in the South China Sea

By Mr. Montri Sumontha, Fish Taxonomist

Department of Fisheries Thailand

Overview of the Deep Sea Fish Taxonomy in the South China Sea

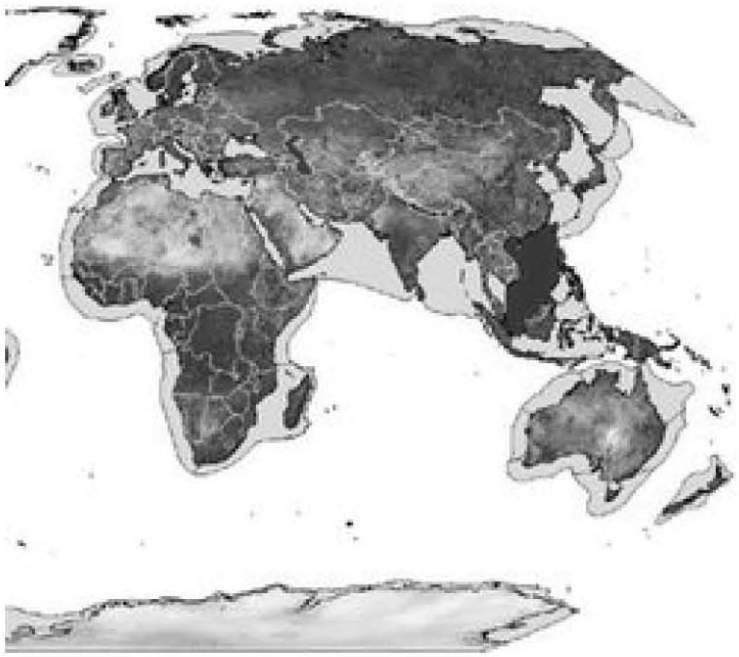
MONTRI SUMONTHA
DEPARTMENT OF FISHERY,
THAILAND

Ranong Marine Fishery Station

157 M.1 Paknam Sub-diatrict Muang Ranong
THAILAND 85000

E-mail : montri_sumontha@yahoo.com
montri.sumontha@gmail.com

The South China Sea (SCS) lies in the tropical zone of the western Pacific Ocean off the southeast corner of the Asian continent and covers a total area of about **3,400,000** square kilometers, consists of the Sunda Shelf which is less than 200 metres in depth, the northern part includes the South China Sea Basin, which in some areas are more than 5,000 metres deep.



There are workshops on SCS biodiversity. This workshop and subsequent discussions brought together biodiversity scientists from throughout the SCS region, as well as international experts from Australia, Europe, Japan, Singapore and the United States. Some **3,365** species in **263** families of marine fishes recorded from the area.

Number of Deep-water Fishes

-South China Sea ~ 458 species
-Philippines Waters ~ 348 species
fishes composed of 30 families
94 genera

Major family :

Macrouridae (Grenadier)	42 species
Myctophidae (Lanternfish)	35 species
Ophidiidae (Assfish)	24 species

What is Taxonomy?

Taxonomy is the study of life's organismal diversity. It involves knowledge of genetic and/or ecological diversity, but its focus is on the organism.

The job of the taxonomist is to perceive, describe, and explain organismal diversity in a sensible manner.

There are 4 essential tasks involved in taxonomy inquiry.

1) identification (placing names on specimens or photo observations that refer to previously named groups)

2) naming (following a code of nomenclature to provide formal names to species or groups of species that have not previously been named in the scientific literature)

3) description (publishing formal accounts/definitions for species or groups of species that have not previously been recognized)

4) classification (grouping sets of organisms according to some organized and logical method)

Problematics of Fishes Taxonomy

There is often extensive misidentification of key organisms in existing literature, outdated publications can lead to much confusion with synonyms and generic placements of species. This is also made more difficult by the fact that new species are still being described at a steady rate.

Misidentification :

Human errorneus

-Counting

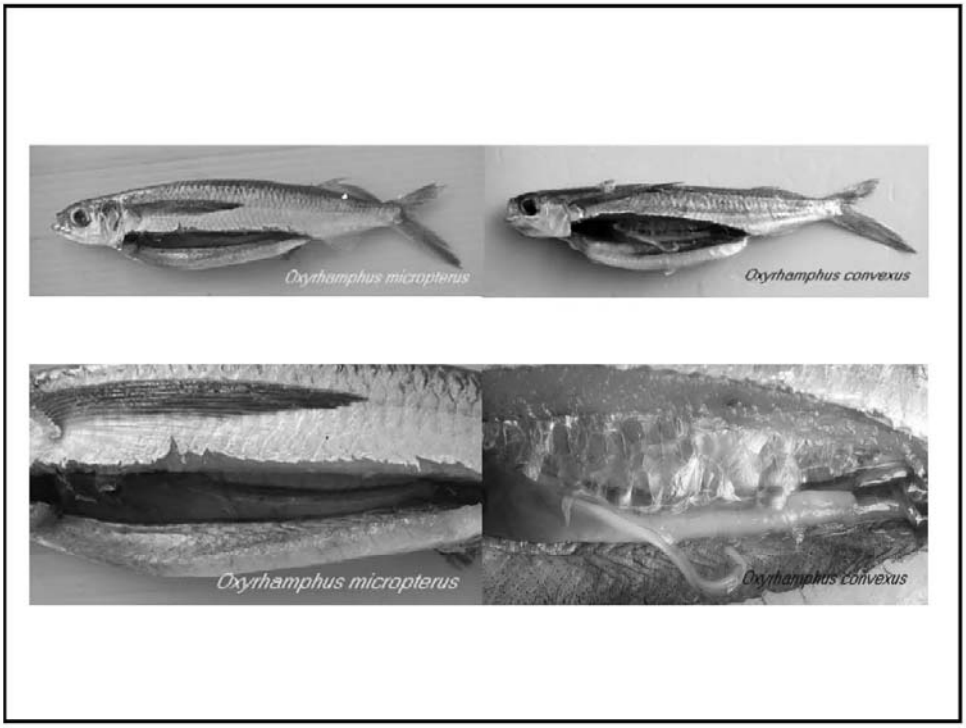
-Measurement

Technical

-Binary artificial key

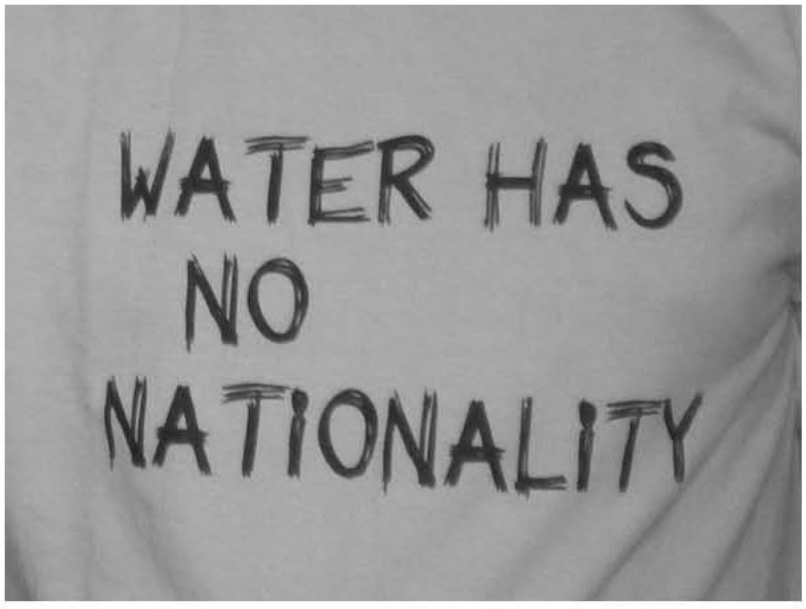
-Status in oldated key

(continued) **Annex10**



(continued) **Annex10**

Myxi/prisps tmr/estrsns/s	1	2	3		1	2	3
Sex	M	F	M				
Measurement	MS990	MS991	MS992				
Total length	251.00	251.00	251.00	Longest anal ray	44.60	44.60	44.60
Fork length	224.00	224.00	224.00	Caudal-fin length	61.00	61.00	61.00
Standard length (mm)	190.00	190.00	190.00	Caudal concavity	27.00	27.00	27.00
Body depth	91.40	91.40	91.40	Pectoral-fin length	43.55	43.55	43.55
Body width	44.75	44.75	44.75	Pelvic spine length	36.50	36.50	36.50
Head length	63.15	63.15	63.15	Pelvic-fin length	47.90	47.90	47.90
Head depth	87.40	87.40	87.40	Base of dorsal-fin	109.80	109.80	109.80
Head width	48.40	48.40	48.40	base of anal-fin	44.00	44.00	44.00
snout length	8.35	8.35	8.35	Longest opercular spine	10.90	10.90	10.90
Orbit diameter	32.00	32.00	32.00	Counting	9.55	9.55	9.55
Pupil diameter	15.10	15.10	15.10	Lateral-line scales	28	28	28
Interorbital width	14.05	14.05	14.05	Scales above lateral-line	3	3	3
Upper-jaw length	38.80	38.80	38.80	Scales below lateral-line	6	6	6
Upper-jaw hight	17.85	17.85	17.85	Scales between lateral-line and pectoral-fin	2	2	2
Caudal-peduncle depth	20.00	20.00	20.00	Preopercular scale rows	4	4	4
Caudal-peduncle length	25.50	25.50	25.50	Opercular scale rows	2	2	2
Predorsal length	77.95	77.95	77.95	Predorsal scales	IV, 4	IV, 4	IV, 4
Preanal length	134.05	134.05	134.05	Prepelvic scales	20	20	20
Prepelvic length	71.70	71.70	71.70	Preanal scales	10	10	10
First dorsal spine	20.95	20.95	20.95	Circumpeduncle cales	10	10	10
Second dorsal spine	30.05	30.05	30.05	Dorsal-fin rays	XI, 14	XI, 14	XI, 14
Third dorsal spine	32.30	32.30	32.30	Anal-fin rays	IV, 12	IV, 12	IV, 12
Fourth dorsal spine	33.00	33.00	33.00	Pectoral-fin rays	15	15	15
First anal spine	4.85	4.85	4.85	Pelvic-fin rays	I, 7	I, 7	I, 7
Second anal spine	8.50	8.50	8.50	Caudal- fin rays	V, 20	V, 20	V, 20
Third anal spine	25.50	25.50	25.50	upper lobe	III, 10	III, 10	III, 10
Fourth anal spine	23.50	23.50	23.50	lower lobe	II, 10	II, 10	II, 10

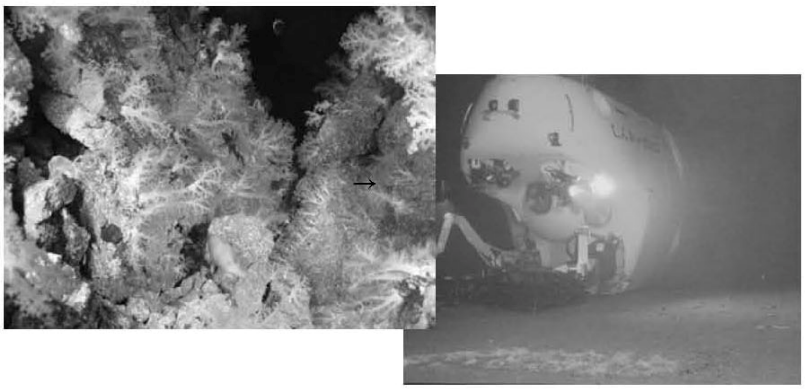


Annex 11: Study on Deep Sea Ecosystem and Its Impacts from Fishing Activities

By Dr. Tsuchiya Kotaro

Tokyo University of Marine Science and Technology

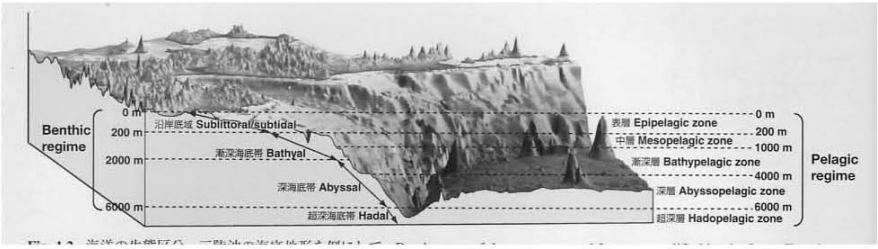
Study on Deep Sea Ecosystem and Impact from Fishing Activities



Kotaro TSUCHIYA
Tokyo University of Marine Science & Technology

What's the Deep Sea ?

Sublittoral	0 ~ 200m	continental shelf
Bathyal	200 ~ 2000m	continental slope
Abyssal	2000 ~ 6000m	ocean floor
Hadal	> 6000m	



(continued) **Annex11**

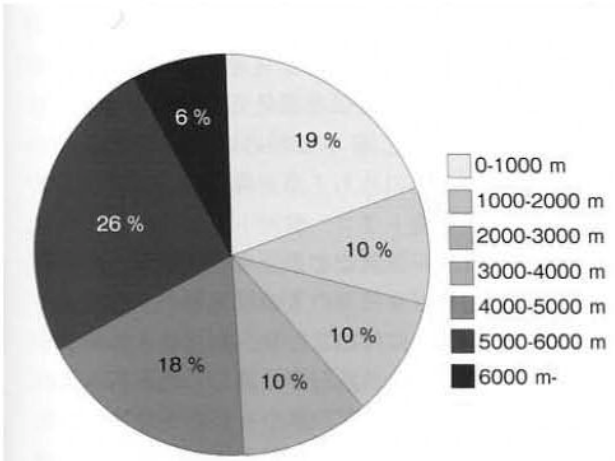
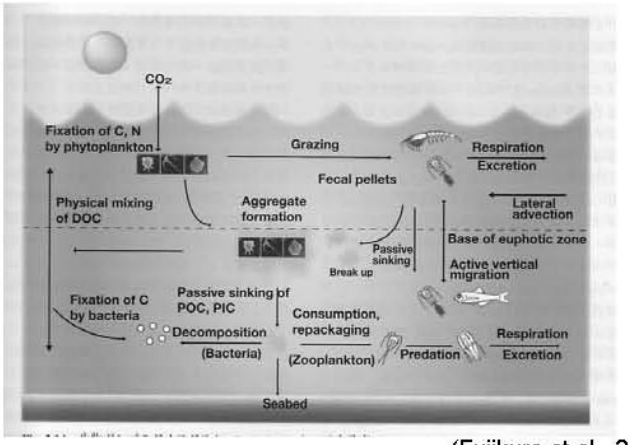


Fig. 1.1. 日本の排他的経済水域内における水深帯の面積比. 松沢(2005)を改変. Areal ratio of each 1000 m depth zone in the Japanese EEZ. Modified from Matsuzawa (2005).

Characteristics of Deep Sea Ecosystem

Usual Deep Sea - ocean floor
Aphotic zone - no photosythesis primary production
Depending by fraction sinking from shallow water
- marine snow?, fecal pellet of copepods, crustaceans



(Fujikura et al., 2008)

Inhabitant in Deep Sea Floor

High species diversity? max. at 2000-3000m N Atlantic
500-1000m in NW Pacific

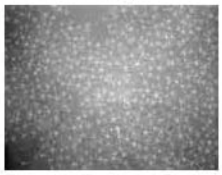
Low biomass - 22.5g/m^2 in 1000m N Atl.

Small size - Long life span – calcified animals
Ledella pusturosa SL 4mm →8yr old

Primary consumer detritus/suspension feeder
Echinoderms dominant

Usual suspension feeders flexibly change carnivore

Broad distribution area – no distinct biogeographic boundary

Hydrothermal Vent, Seepage



Chemosynthetic by
Synbiotic bacteria
Bacteria mat-food resource
→primary production

$$6CO_2+6H_2S+9O_2 \rightarrow C_6H_{12}O_6+6SO_4^{-2}$$

Large biomass
(450-830 ind./m^2 Galapagos)
Isolated population
High endemism

Hard bottom in steep slope
Cannot study with fishing gear
Need ROV or submarsible

1977 Discovering Galapagos Rift
Over 700 new species were reported from the world in 30yrs

(continued) **Annex11**

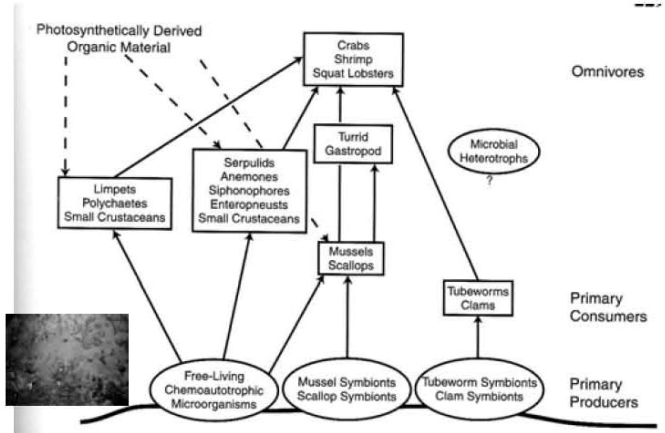
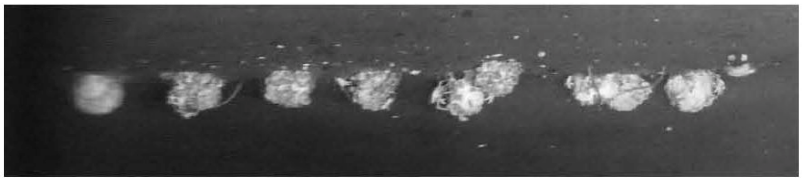


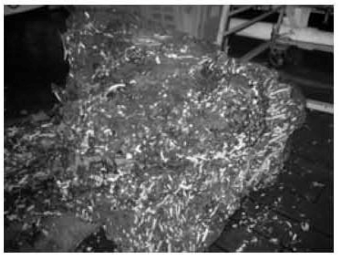
Figure 8.2. The food web at the Rose Garden hydrothermal vent. Vertical height reflects trophic level. From Hessler and Smithey 1983; Fisher et al. 1994; and C. L. Van Dover, personal observations.

Whale bone, Sunken wood communty



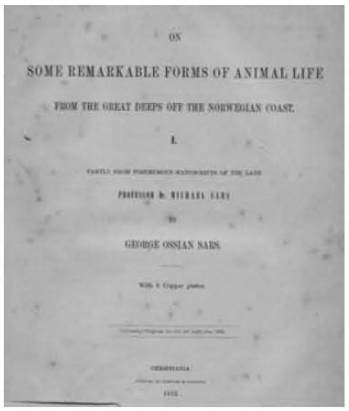
Large organic remains support accidentally
from surface
Whale bone, sunken wood, perm leaves,
coconut shell, etc

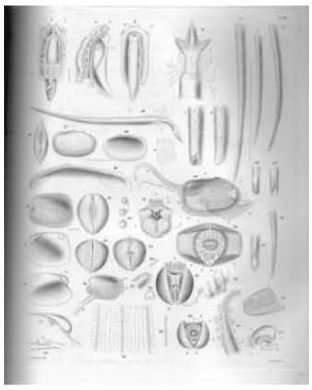
Pecuriar benthic community similar to
Hydrothermal vent or seepage
Or peculiar community



Short History of Deep Sea Fauna Survey

1839 E. Forbes (Eng.) proposed "Azoic Zone" deeper than 550m
1851 G.O Sars (Nor.) first published scientific report on 13 spp. Deep sea animals from 550m deep of Norwegian water.


ON
SOME REMARKABLE FORMS OF ANIMAL LIFE
FROM THE GREAT DEEPS OFF THE NORWEGIAN COAST.
I.
GEORGE OSSIAN SARS.



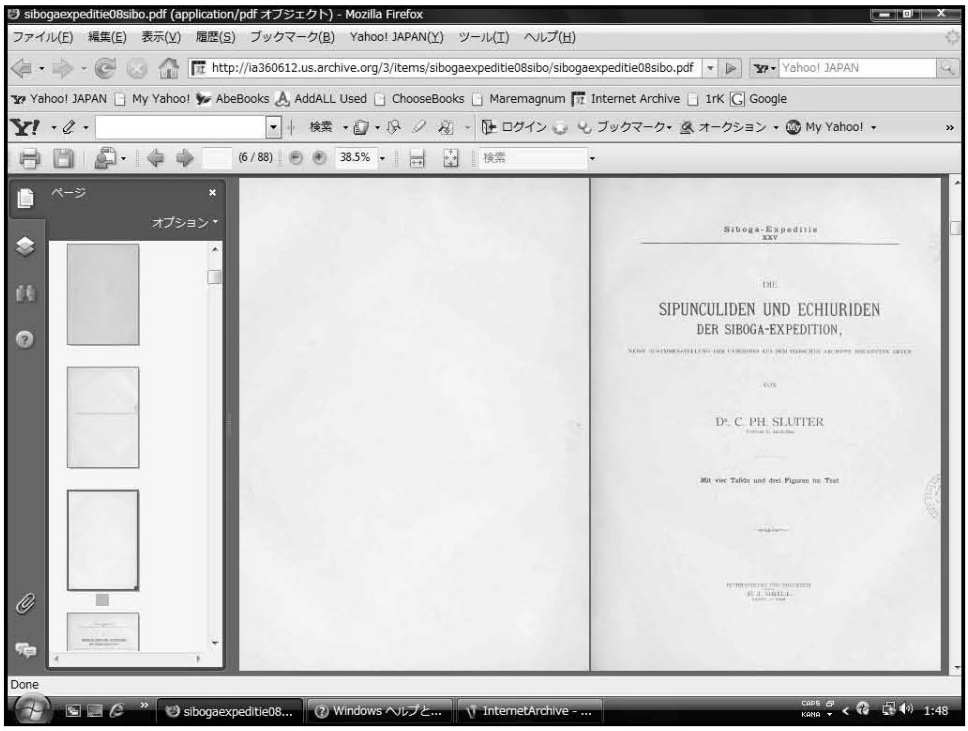
Historical Deep Sea Fauna Survey

1872-1876 Challenger Expedition (UK)
1899-1900 Siboga Expedition (Dutch)
1899-1925 Albatross Expedition (USA)
1928-1930 Dana Expedition (Denmark)


Siboga Expedition

(continued) **Annex11**

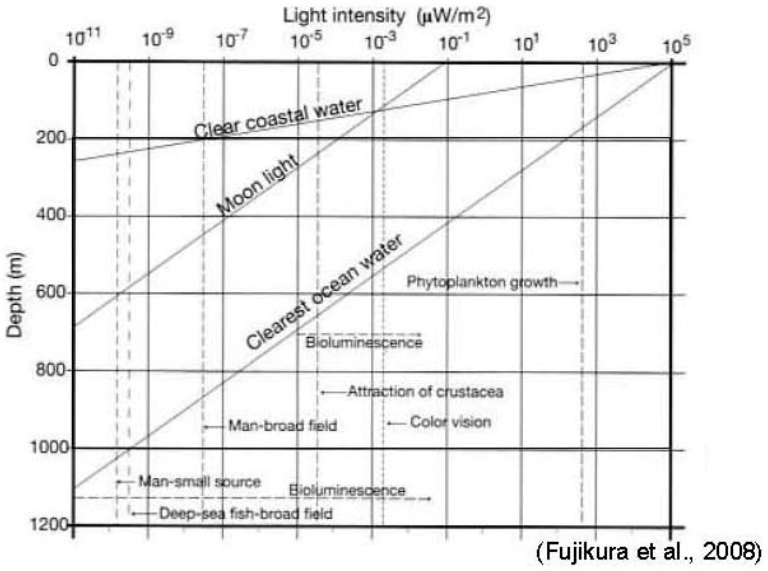
Useful resource for studying deep sea fauna



(continued) **Annex11**

Our target ?

200 to 1000m deep in
Continental shelf margin to slope



(Fujikura et al., 2008)

Our target ?

Not typical deep sea
- high biomass
- high biodiversity – center of biodiversity

Many fishery target species
Crustaceans: *Parapenaeus*, *Metanephrops*, *Pandalus* shrimps
Fishes: sebasteds, serranid, scorpaenid, *Beryx*
synaphobranchid (deep sea eel)

High endemism
in the water shallower than 1000m

Very small numbers of deep sea surveys
in this area

(continued) **Annex11**

MUSORSTOM Expedition

- more than 1,300 new finding of species from tropical IP only in recent 20 yrs

We need detailed information of background

for fishery development? conservation? taxonomical interest?

Tropical West Pacific – Center of Biodiversity
200-1000m in WPac shows highest species diversity

On deep sea fish fauna, information is very fragmental in study area
Possibly 20-30% of caught species will be "NEW"!?
- especially in small-sized species !

Excluding few specific group (e.g. crustaceans, mollusks)
most of deep sea invertebrate fauna are poorly surveyed in study area after Siboga Exp.

Still remains huge unexplored fields for taxonomy in tropical W Pac

Problem: scarce number of "busy" taxonomists
shortage of their post, fund & time
able to foster next generation of taxonomist ?

Effective sharing of taxonomical materials is badly needed

Impact from the Fishing Activity ?

Deep sea bottom – usually stable
Bottom trawl – turbulence effect to direct development larva?
[Over 2000m, ca. 50% of gastropods non-planktotrophy]

TABLE 3.4 *Mode of Development of Deep-Sea Gastropods in the Eastern and Western Atlantic Inferred from Characteristics of the Protoconch*

	Total No. Spp.	No Spp. with Non-Planktonic Development	No. Spp. with Planktonic Development
Bathyal[a] (200–2000 m)			
Archaeogastropoda	16	15	1**
Mesogastropoda	27	15	12
Neogastropoda	27	14	13
Total Prosobranchs	70	44 (63%)	26 (37%)
Abyssal[b] (2000–5000 m)			
Archaeogastropoda	14	14	0
Mesogastropoda	8	5	3
Neogastropoda	29	7	22
Total Prosobranchs	51	26 (51%)	25 (49%)

SOURCE: Data compiled from Bouchet 1977; Rex and Wareń 1982.
[a]Data from Rex and Wareń are based upon 20 stations but only seven are from bathyal depths. A possible bias may be therefore introduced when making comparisons between bathyal and abyssal depths.
[b]*Iphitus tuberatus* a species of uncertain systematic affinity.

(Scheltema, 1994)

Beryx splendens

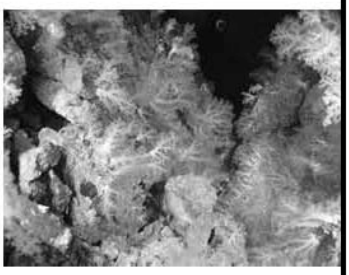
Habitat:
100-800m in World ocean
island slope, seamount,
submarine bank

Fishing gear:
Hook, Seine, Bottom trawl

Life span: 20yr
Minimum size for maturation:
ca. 30cm, 4-5yr old
in S Japan

Impact from the fisheries activity ?
Many problems on resource management,
Effect to seamount area by fishing activity !

SEAMOUNT ECOSYSTEM - vulnerable Eden



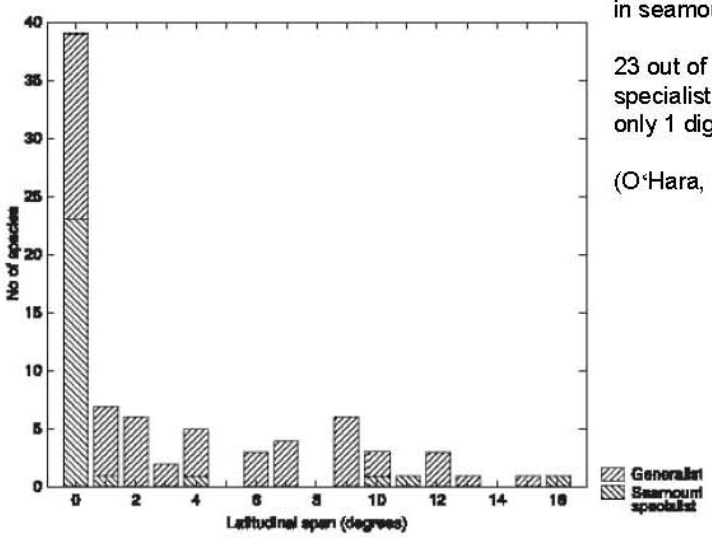
50,000 seamounts in the Pacific Ocean and about 100,000 globally.

Hard bottom texture
High diversity of sessile animals
produce complex habitat

Topologically isolated environment
produces high endemism of fauna (10-30%) (Stocks,2005)

Boundary with pelagic realm
Mesopelagic boundary community (Hirota et al., 1998)
(e.g. *Beryx, Anguilla japonica* - aggregate for spawning)

Ophiuroidea Endemism in Western Australia-Norfolk Seamount



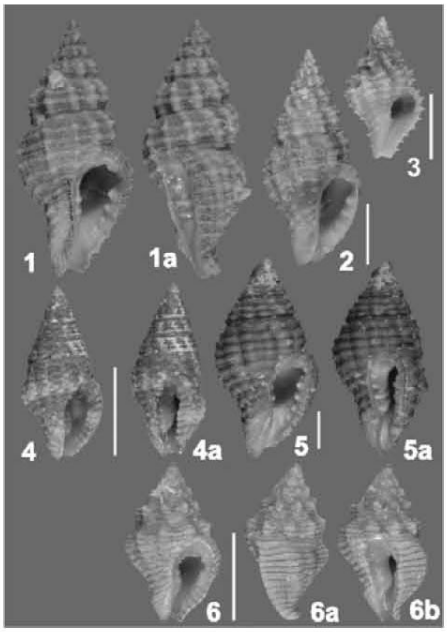
28 out of 82 spp. endemic in seamount

23 out of 28 spp. seamount specialist distribute within only 1 digree latitude

(O'Hara, 2007)

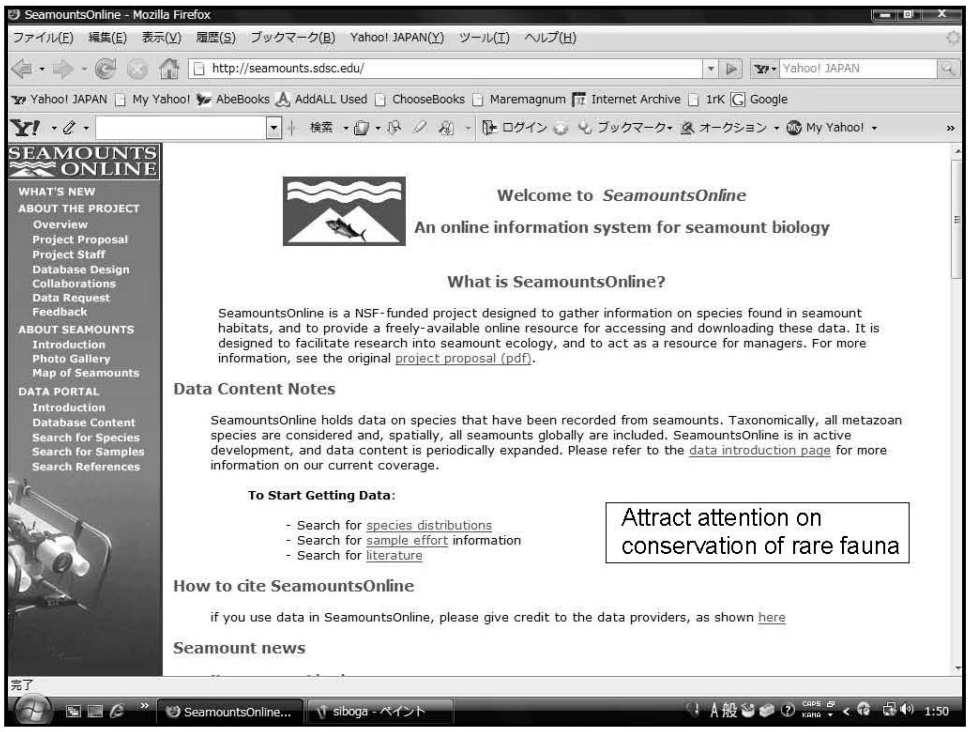
(continued) **Annex11**

Endemic gastropods
from oceanic island
of Ogasawara Ids.
Southern Japan

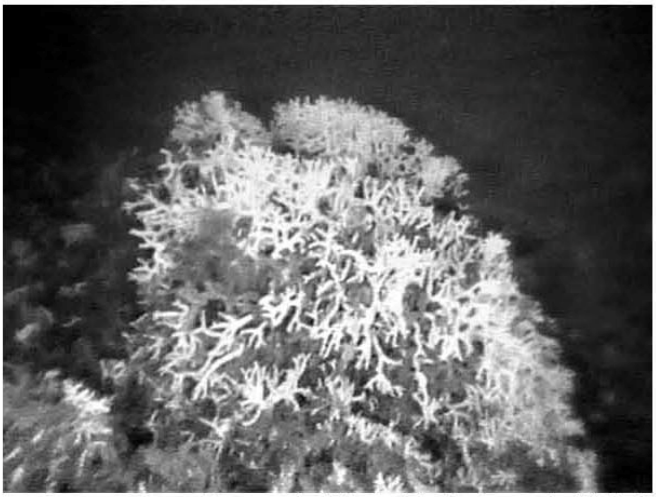


1-3. *Crivipollia* n.sp
4. *Enginopsis* n.sp.
6. *Engina* n.sp.

From off Ogasawara
200m



Deep sea cold water coral reef



Some colonial coral in deep-sea habitats have been aged at 1000-6250 (!) years old (Wilson, 1979).

Bottom trawl impact

Grazing bottom texture
→ Damage sessile benthic fauna
→ Destroy microhabitat produced by sessile fauna
→ risk of extinction on endemic species

Deep sea trawl fishing evokes a great deal of criticism now

Necessary the research benthic fauna diversity
And planning conservation policy

Same in steep continental shelf area !

Ghost Fishing

Lost fishing gears catch continuously
observed fish pot, gill net

Queen crab (*Chionesetes*) pot fishing in Japan Sea
Ghost fishing was observed by
underwater camera

not small damage for slow growing, long lifespan animals

We need:
the detailed faunal survey to understand
the background deep sea ecosystem
urgently
planning how to conserve rare endemic fauna
and
understanding the life history and habitat of
fishery target species in deep for minimize
the impact of fishing activity

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fishery target species in deep for minimize
the impact of fishing activity

Understanding species diversity first

and urgently before full-scale deep sea fishery start

* Exhaustive sampling – how to plan
  combination use of gear covering mesh size, towing speed
  covering habitat with adequate gears
* Making well-preserved specimens every in groups
  not only in fishery target group & size keep first !
* Keep the information of living animals
  possibly both morphology and molecular
  Photographs / tissue samples
* Build a museum collection with standard protocol
  databasing total information

Just MUSORSTOM expedition is good example

Problem: scarce number of taxonomists;
shortage of their fund & time
able to foster next generation of taxonomist

Useful references for tropical deep sea benthos

Annex 12: Collection and Preservation of the Deep Sea Fauna Specimens for Museum Documentation

By Dr. Natinee Sukramongkol, Researchers – SEAFDEC/TD

Annex12

Collection and Preservation of the Deep Sea Fauna Specimens for Museum Documentations

Training Workshop on the Deep Sea Fishery Resources Exploration on the Continental Slopes in Southeast Asian Waters, MV DA-BFAR, Philippines, 11-25 May 2008

Capture Fisheries Technology Division
Training Department, Southeast Asian Fisheries Development Center

Type Specimens

- Vertebrates
  - Fishes
  - Larval fishes
- Invertebrates
  - Molluscs
    - Cephalopoda
    - Gastropoda
    - Bivalvia
  - Other Invertebrates
    - Meiofauna
    - Macrofauna
    - Annelida
    - Arthropoda
    - Etc.

Site: http://invertebrates.si.edu/

Specimens Processing

Procedure, Guideline

1. Prefixation
   - Freshly dead specimens
   - Live specimens
   - Photography
2. Fixation
   - Why fix specimens?
   - How many specimens should be fixed?
3. Transfer to preservative
   - Fixed specimens
   - Frozen specimens
4. Packing and Shipping

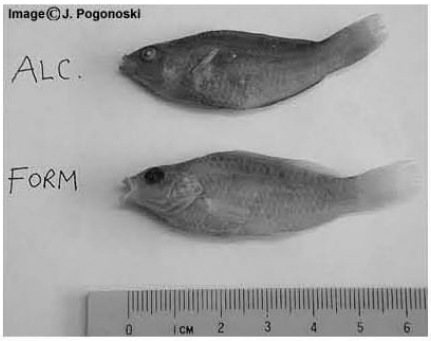
Site: http://www.mcn.edu/conference/mcn####/sessionpapers

Fixation-Fishes

Solutions, Procedures

- Fixatives
  - Formalin 10 to 15%
  - Ethyl Alcohol 70 to 75% (Advantage in using Ethanol for fixed specimens)
  - Freezing incase no containers available or large specimens
- Process 7 to 10 days
- Larval fishes

  5 to 10% Formalin for a minimum of 1 week



Site: http://www.austmus.gov.au/fishes/faq/index.cfm

Fixation-Invertebrates

Solutions, Procedures

- Fixatives
  - Formalin 10%
  - Ethyl Alcohol 70 to 75%
- Process an hours to days in duration
- There are recommended fixation and preservation procedures for various invertebrates animal (in hard copy)

Site: http://www.aad.gov.au

Buffers

Prevent tissue damage, Solution stabilize

- Formalin and alcohols develop low pH (range 2.5 to 5)
- Need Buffer to stabilize solution at acceptable pH
- Sometime sea water is use as a buffer
- Short term storage
  - Calcium Carbonate ($CaCO_3$)
  - Borax (Sodium Borate)
- For long term storage of invertebrate animal, a phosphate buffer is prefer

10% Phosphate Buffered Formalin

$NaH_2PO_4 . H_2O$ ..... 4 g
Na_2HPO_4 ..... 6 g
Formaldehyde (40 %) ..... 100 ml
Sea water or distilled water ... 900 ml

Site: http://invertebrates.si.edu/usap/usapspec.html

Preservation

Specimens long term storage

- Fishes
  - Ethanol 70-75%
  - Isopropanol 50%
- Larval fishes
  - Ethanol 70-75%
- Molusce
  - Ethanol 70-75%
  - Isopropanol 45-50%
- Other Invertebrate (as recommended in hard copy)

Site: http://www.flmnh.ufl.edu/fish/collection/UMML.htm

Packing, Shipping

Specimens long term storage

- Small specimens (i.e. from ikmt) and lots with few specimens should be sealed in a PP bag with a volume of fluid twice that of volume of specimens
- Large specimens should be saturated in preservative and wrapped before double bagged.
- Very small or delicates specimens should shipping in glass container (vials) and wrapped with kind of bubble sheet

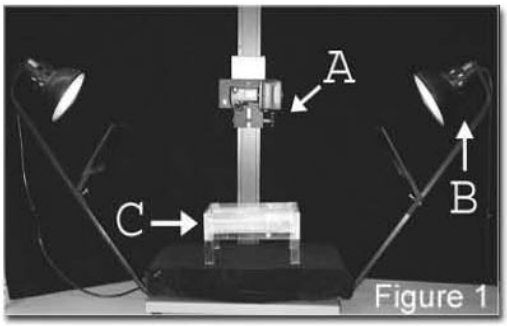
Site: http://www.flmnh.ufl.edu/fish/collection/UMML.htm

(continued) **Annex12**

Digital Imaging-I

Camera Setting, Positioning Specimens, Copy Stand, Lighting, Backgrounds, Post-capture Image

- Camera setting
  - Take several images (Try different shutter speeds and variety of exposures especially small specimens) and then select the best image after viewing on the computer
  - Tripod or copy stand needed for use shutter speeds of 1/30 second or slower
  - White balance setting if using incandescent light sources
  - Using flash can yield unpredictable results when imaging wet specimens



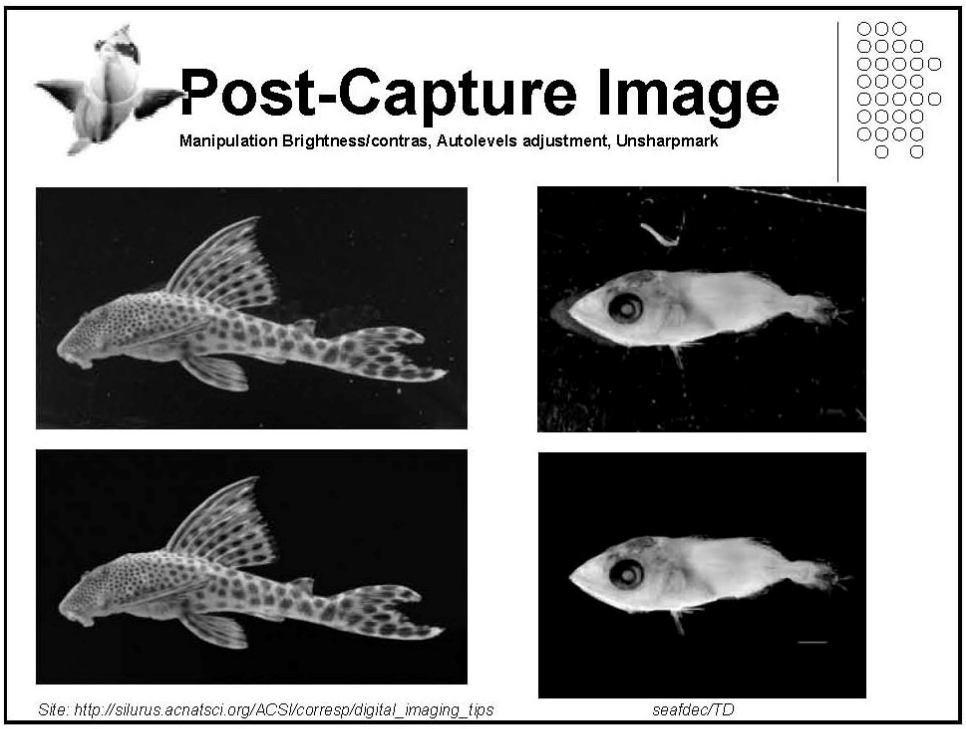
Site: http://www.mcz.harvard.edu/Departments/Fish/camera.jpg

Digital Imaging-II

Camera Setting, Positioning Specimens, Copy Stand, Lighting, Backgrounds, Post-capture Image

- Copy stand and lighting is recommended (2-4 high-watt bulbs)
- Background-black, dark gray or dull blue is recommended
- Polarizing filter can minimizes such glare
- Positioning specimens- Full lateral view is needed by select the region closet to specimen's eye.

Site: http://silurus.acnatsci.org/ACSI/corresp/digital_imaging_tips


Post-Capture Image
Manipulation Brightness/contras, Autolevels adjustment, Unsharpmark
Site: http://silurus.acnatsci.org/ACSI/corresp/digital_imaging_tips
seafdec/TD


Collection Management
Mixed Species
Sorted and I.D.
Field data recording
-Locality
-Collection date
-Water depth
-Capture depth
-Collection method
-Collector
-etc.
Registration
-Unique field no.
-Unique catalog no.
Curating
-Label with apiece of alcohol resistant
-Arranged specimens by Family name
using alphabetically

(continued) **Annex12**

Collection Management

Mixed Species

Sorted and I.D.

Field data recordin
-Locality
-Collection date
-Water depth
-Capture depth
-Collection metho
-Collector
-etc.

Registration
-Unique field no.
-Unique catalog no.

Curating
-Label with apiece of alcohol resistant
-Arranged specimens by Family name using alphabetically

Awaiting Jar Label

Collection Management

Fish Types

Matches: 10

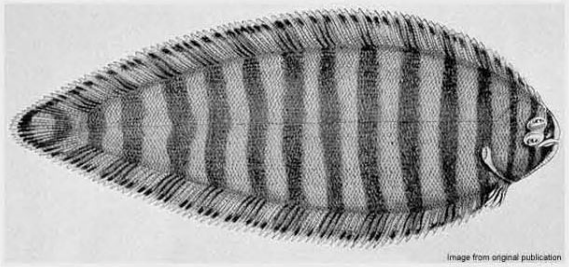
Image	Family	Type name	Type Status	Author/Publicn. Date	Registration No.
image	Soleidae	*Synaptura cancellata*	Holotype	McCulloch 1916	I.13199
image	Soleidae	*Synaptura cancellata*	Paratype	McCulloch 1916	E.2486
No	Soleidae	*Synaptura cancellata*	Paratype	McCulloch 1916	E.2487
image	Soleidae	*Synaptura craticula*	Holotype	McCulloch 1916	E.2700
No	Soleidae	*Synaptura craticula*	Paratype	McCulloch 1916	I.13616
No	Soleidae	*Synaptura fasciata*	Holotype	Macleay 1882	I.16281-001
No	Soleidae	*Synaptura fitzroiensis*	Syntype	De Vis 1882	I.373
No	Soleidae	*Synaptura nigra*	Syntype	Macleay 1880	I.16280-001
No	Soleidae	*Synaptura sclerolepis*	Holotype	Macleay 1878	I.16279-001
No	Soleidae	*Synaptura selifer*	Holotype	Paradice 1927	IA.1535

Perform another query
Go to the online mapping page

Collection Management

Fish Types

Family:	Soleidae (462)
Type name:	*Synaptura cancellata*
Type status:	Holotype
Author(s):	McCulloch
Publication Date:	1916
Registration Number:	I.13199
Number of specimens:	1



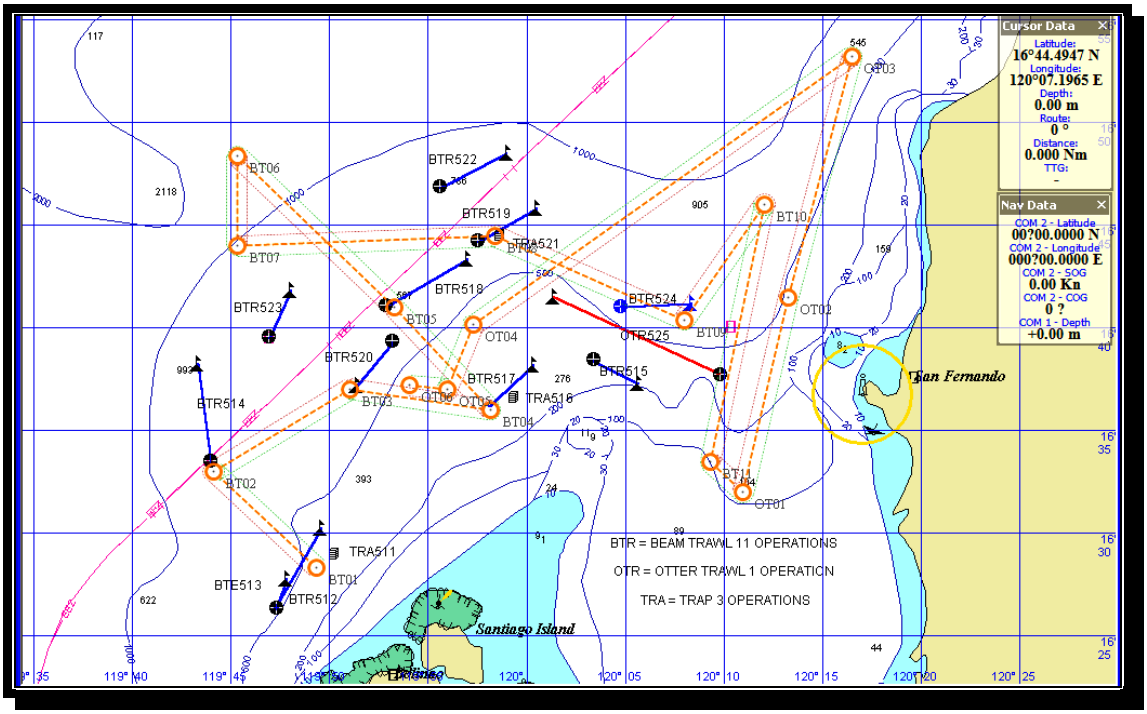
References

http://silurus.acnatsci.org/ACSI/corresp/digital_imaging_tips
http://www.mcz.harvard.edu/Departments/Fish/camera.jpg
http://www.flmnh.ufl.edu/fish/collection/UMML.htm
http://www.mcn.edu/conference/mcn2006/sessionpapers
http://www.austmus.gov.au/fishes/faq/index.cfm
http://tonmo.com/science/public/squidfixingnotes
http://www.ansp.org/research/biodiv/ichthyology/
http://research.calacademy.org/research/ichthyology/
http://vertebrates.si.edu/fishes/fishes_collections.html
http://acsmith.si.edu/emuwebvzfishesweb/pages/nmnh/vz/
http://artedi.fish.washington.edu/
http://fishbase./

Annex 13/1: Survey and operation stations

Annex 13/1

Survey map of the Collaborative Research Program between BFAR and SEAFDEC Deep Sea Fisheries Resources Survey on the Continental Slop along the Approaches of Lingayen Gulf, the Philippines. During 11 – 25 May, 2008.



BTR = Beam Trawl (total 11 operations)

TRA = Deep Sea Trap (total 3 operations)

OTR = Otter Board Trawl (total 1 operation)

Annex 13/2: Partials details of survey stations

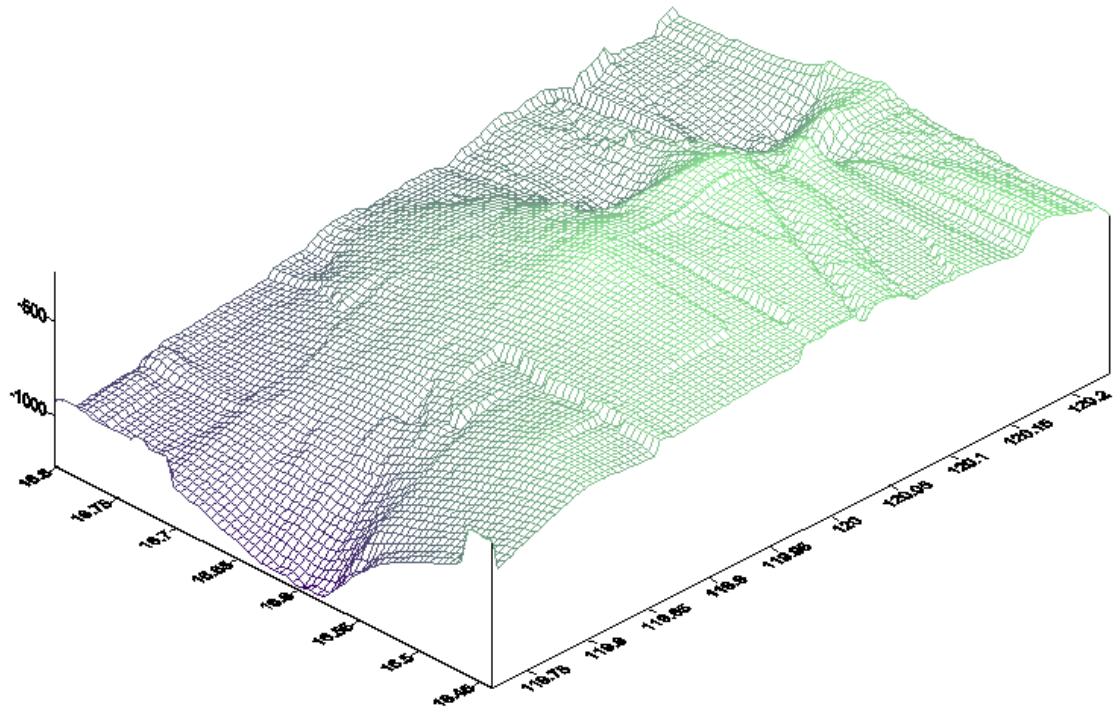
Date	Station Code	Setting					Fishing					Hauling									Remarks
		Time Start	Position		Depth (m)	Cable Length (m)	Time Start	Position		Depth (m)	Cable Length (m)	Time Start	Position		Start Depth (m)	Time Finished	Finished Position		Finish Depth (m)	Drag Duration	
			Latitude	Longitude				Latitude	Longitude				Latitude	Longitude			Latitude	Longitude			
13 May 08	TRA 511	14:10	16_28.91N	119_50.16E	335	-	-	-	-	-	-	07:49	16_29.30N	119_49.90E	381	08:45	16_28.60N	119_49.60E	405	-	
13 May 08	BTR 512	15:20	16_27.82N	119_47.79E	472	1,500	15:50	16_27.25N	119_47.36E	486	1.5	16:20	16_26.39N	119_47.19E	473	16:50	16_26.30N	119_47.25E	464	30min	small catch/ cable snapped
13 May 08	BTR 513	17:05	16_26.29N	119_47.56E	450	1,500	17:30	16_28.30N	119_48.38E	452	1.5	18:00	16_29.27N	119_48.93E	447	18:20	16_29.98N	119_49.38E	440	30min	
14 May 08	BTR 514	10:10	16_33.48N	119_43.90E	996	2,500	10:55	16_36.61N	119_43.54E	1227	1.9	11:25	16_37.59N	119_43.39E	1200	12:00	16_38.23N	119_43.27E	1318	30min	
15 May 08	BTR 515	12:00	16_38.40N	120_03.32E	342	900	12:15	16_37.95N	120_04.28E	283	1.7	12:50	16_37.52N	120_05.36E	253	13:05	16_37.34N	120_05.60E	249	30min	
19 May 08	TRA 516	23:50	16_36.14N	119_58.69E	267	-	-	-	-	-	-	14:45	16_36.54N	119_59.17E	280	15:50	16_36.86N	119_59.52E	289	-	
20 May 08	BTR 517	05:40	16_36.18N	119_58.03E	278	900	06:05	16_36.95N	119_58.99E	302	2.7	06:35	16_37.88N	120_00.08E	343	06:50	16_38.15N	120_00.24E	362	30min	
20 May 08	BTR 518	07:45	16_41.03N	119_52.79E	653	1,800	08:20	16_42.26N	119_55.49E	571	2.5	08:55	16_42.98N	119_56.76E	553	09:15	16_43.33N	119_56.91E	568	35min	
20 May 08	BTR 519	09:45	16_44.21N	119_57.48E	589	1,800	10:10	16_45.03N	119_59.28E	607	2.5	10:40	16_45.57N	120_00.43E	678	11:00	16_45.87N	120_00.52E	687	30min	damaged buoy
20 May 08	BTR 520	12:15	16_39.35N	119_53.17E	561	1,700	12:40	16_38.30N	119_52.17E	587	1.7	13:10	16_37.69N	119_51.39E	608	13:30	16_37.92N	119_51.32E	628	30min	damaged buoy
20 May 08	TRA 521	16:45	16_44.51N	119_58.59E	584	-	-	-	-	-	-	18:45	16_45.07N	119_59.31E	607	10:15	16_45.97N	119_59.58E	648	-	
20 May 08	BTR 522	18:10	16_46.88N	119_55.50E	800	1,900	18:40	16_47.27N	119_57.11E	722	2.3	19:10	16_47.91N	119_58.74E	722	19:30	16_48.50N	119_58.90E	749	30min	damaged buoy
21 May 08	BTR 523	06:05	16_39.50N	119_46.80E	927	2,200	06:35	16_41.80N	119_47.90E	869	2.0	07:05	16_43.20N	119_48.39E	884	07:35	16_43.90N	119_48.50E	877	30min	
21 May 08	BTR 524	11:10	16_41.05N	120_04.77E	638	1,600	11:25	16_40.85N	120_06.39E	489	2.4	12:00	16_41.06N	120_07.82E	509	12:20	16_41.29N	120_08.24E	529	35min	
22 May 08	OTR 525	06:00	16_37.70N	120_09.70E	806	1,575	07:00	16_40.86N	120_05.42E	570	3.5	07:30	16_40.84N	120_03.03E	630	08:20	16_41.45N	120_01.33E	464	30min	broken net

Annex 14: Sea floor topography of the survey area at Lingayen Gulf

Annex 14

Sea floor topography of the survey area at the Lingayen Gulf, the Philippines.

The topographic survey aboard M/V DA-BFAR was conducted at the Lingayen Gulf during 11-25 May 2008. The depth and position were recorded using the color video sounder model Furuno FCV-292 aboard. The recording was every 1 minute before and during the trawling. A total of 12 transect lines there are 11 lines from beam trawl and 1 line from otter trawl. The result of this survey found the maximum depth is 1270 m, the minimum depth is 230 m and the average depth is 617 m. The sea floor topography of survey area is irregular substrate that shown in the following figure.



Annex 15: List of crustaceans collected from beam trawl, Deep sea trap, and otter trawl during 11-25 May 2008.

	Survey Station															Total number (ind.)	Size range (mm)	Total Weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Subphylum Crustacia																		
Class Malacostraca																		
Order: Decapoda																		
Suborder: Dendrobranchia																		
Family Aristeidae																		
Aristeus virilis		1	5					2	1					4	7	20	100-700	340
Aristeus sp.				3												3	200-250	20
Aristaeomorpha sp.		1														1	850	55
Parahempomadus sp.								1								1	750	10
Family Solenoceridae																		
Hymenopenaeus sp.		1			3											4	200-400	40
Family Penaeidae																		
Metapenaeopsis sp.							29									29	50-100	30
Parapenaeus sp.					1											1	400	20
Penaeopsis sp.					20		3									23	100-450	45
Penaeidae sp.									2							2	250-300	5
Family Sergestidae																		
Acetes sp.												2				2	100-150	1
Sergestoidea sp.													1	2		3	100-150	2
Family Solenoceridae																		
Solanocera sp.							3		3	2		1		1	1	11	200-550	100
Suborder Pleocyemata																		
Family Goneplacidae																		
Goneplax sp.							1									1	-	20
Family Homolodromiidae																		
Homolodromia sp.													1	1		2	-	20
Homolodromiidae sp.												1				1	-	1
Family Raninidae																		
Raninoides sp.					2											2	-	10
Family Calappidae																		
Calappidae sp. (Box crabs)					12		3									15	-	180
Family Majidae																		
Cyrtomaia sp.						1								9		10	-	490
Pleistacantha sp.														6		6	-	10
Platymaia fimbriata												1				1	-	10
Platymaia sp.													1	3		4	-	30
Pugettia sp.														1		1	-	10
Majidae sp.					1											1	-	80

Remarks: TRA = Deep Sea Trap; BTR = Beam Trawl; OTR = Otter Trawl

	Survey Station															Total number (ind.)	Size range (mm)	Total Weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Family Leucosiidae																		
Randalia sp. (purse crabs)							1			2				1		4	-	30
Family Lithodidae																		
Lithodidae sp. (King crabs)					1		1		1							3	-	105
Family Oplophoridae																		
Acanthephyra armata										1	1		5			7	350-650	23
Acanthephyra sp.								1	6			3				10	130-600	75
Family Scyllaridae																		
Scyllaridae (slipper lobster)					1											1	-	270
Family Galatheidae																		
Galatheidae sp.1									6					21		27	-	55
Galatheidae sp.2									2					2		4	-	10
Galatheidae sp.3									5							5	-	5
Galatheidae sp.4					15		15			6	1					37	-	106
Family Glypheidae																		
Glypheidae sp.1					2											2	-	40
Glypheidae sp.2					4											4	-	30
Glypheidae sp.3					3											3	-	30
Family Glyphocrangonidae																		
Glyphocrangon sp.1												2				2	200-350	5
Glyphocrangon sp.2												1				1	300	5
Glyphocrangon sp.3								8	14	8			4	5		39	150-350	60
Family Nephropidae																		
Metanephrops sinensis					1											1	500	45
Nephropsis sp.1										3		3	5			11	150-700	75
Nephropsis sp.2												1	1			2	-	2
Nephropsis sp.3			2	2				1	1					1		7	100-350	27
Metanephrops sp.1								1								1	750	120
Metanephrops sp.2									1							1	650	100
Nephropidae sp.1							1									1	200	2
Nephropidae sp.2		1	3											1		5	200-600	70
Nephropidae sp.3		2	3													5	150-300	30
Nephropidae sp.4		3														3	180-200	5
Nephropidae sp.5		1														1	100	2
Nephropidae sp.6										2						2	187-628	5
Family Nematocarcinodae																		
Nematocarcinus sp.1								13		3						16	150-350	55
Nematocarcinus sp.2									3	2						5	150-450	15
Nematocarcinus sp.3									11					1		12	150-400	81

(continued)

	Survey Station															Total number (ind.)	Size range (mm)	Total Weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Family Pandalidae																		
Heterocarpus hayashii	329	1	12		17	11	6	3		1	22			4	1	407	200-600	2840
Heterocarpus dorsalis			1					18	18	6	76	1	4	5		129	200-650	1562
Heterocarpus gibbosus			4											6		10	300-500	80
Heterocarpus woodmasoni	9		168				3									180	100-650	393
Heterocarpus laevigatus								8		1	17			1		27	350-800	675
Heterocarpus sp.1				1			5									6	200-450	30
Heterocarpus sp.2				1												1	200	2
Heterocarpus sp.3				1												1	150	4
Heterocarpus sp.4									5	2						7	150-300	15
Plesionika grandis						3										3	350-500	10
Plesionika sp. 1							1			1				16		18	150-400	124
Plesionika sp.2							1									1	400	3
Plesionika sp.3	4		6						7			8		1		26	250-550	105
Pandalidae sp.1					2								1	1	1	5	150-300	17
Pandalidae sp.2													1	4		5	100-250	6
Pandalidae sp.3										1						1	200	2
Family Palinuridae																		
Panulirus sp.										4				2	3	9	1,200-2,700	590
Family Polychelidae																		
Polychelidae								2	10	4		1	1	4	1	23	100-300	71
Family Pylochelidae																		
Pylocheles sp.												3	2	1		6	-	15
Unclassified Decapods			4				1	20	1	5			1	10		42	-	189
Order: Isopoda																		
Isopods	10				3						41		1			55	200-1,300	1791
Total no. of specimens	**352**	**11**	**208**	**8**	**88**	**15**	**74**	**78**	**97**	**54**	**158**	**28**	**29**	**114**	**14**	***1,328***		***11,536***

Annex 16: List of deep sea fishes collected from beam trawl, Deep sea trap, and otter trawl during 11-25 May 2008.

	Survey Station															Total number (ind.)	FL range (mm)	Total weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Order																		
Albuliformes																		
Family Halosauridae																		
Halosaurus sp.										1						1	225	75
Androvandia sp.													3			3	216-407	95
Order																		
Anguilliformes																		
Family Colocongridae																		
Colocongridae sp.1			1													1	214	50
Colocongridae sp.2								1						2		3	326-443	740
Colocongridae sp.3										1						1	538	890
Family Congridae																		
Gnathophis sp.					2			1	5	1						9	41-420	334
Leptocephalus larva sp.															1	1	213	5
Family Moringnidae																		
Moringnidae sp.1			1													1	420	80
Family Nattastomatidae																		
Nattastomatidae sp.1													1			1	691	55
Nattastomatidae sp.2														1		1	170	1
Venefica multiporosa				1												1	720	120
Family Nemichthyidae																		
Nemichthys sp.1															1	1	860	30
Family Synaphobranchidae																		
Synaphobranchidae sp.1	8															8	470-705	2,650
Synaphobranchidae sp.2												1				1	510	210
Family Ophichthidae																		
Ophichthidae sp.1	1															1	455	100
Ophichthidae sp.2	1															1	710	1,100
Ophichthidae sp.3						9										9	378-615	955
Ophichthidae sp.4							1									1	421	48
Order																		
Ateleopodiformes																		
Family Ateleopodidae																		
Ateleopus sp.															2	2	813-827	2,000
Order																		
Aulopiformes																		
Family Chlorophthalmidae																		
Chlorophthalmus sp.					4											4	68-150	60

Remarks: TRA = Deep Sea Trap; BTR = Beam Trawl; OTR = Otter Trawl

	Survey Station															Total number	FL range (mm)	Total weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Order																		
Beryciformes																		
Family Diretmidae																		
Diretmichthys sp.															5	5	133-215	1050
Family Trachichthyidae																		
Hoplostethus sp.												1				1	184	110
Order																		
Carcharhiniformes																		
Family Scyliorhinidae																		
Apristurus verweyi									1							1	268	55
Apristurus sp.				1												1	245	70
Cephaloscyllium fasciatum	3					2										5	170-653	3,277
Order																		
Gadiformes																		
Family Bathygadidae																		
Bathygadidae sp.1								1								1	325	145
Bathygadidae sp.2												1				1	312	80
Family Bregmacerotidae																		
Bregmaceros japonicus			1				1							1		3	47-75	5
Family Macrouridae																		
Caelorinchus sp.1		1	2													3	118-178	65
Caelorinchus sp.2					2											2	38-115	32
Caelorinchus sp.3										1				7		8	125-423	1,225
Caelorinchus sp.4															3	3	257-297	300
Cetonurus sp.								1								1	386	160
Macrouridae sp.1		1	3													4	195-290	280
Macrouridae sp.2		2														2	194-202	45
Macrouridae sp.3			4													4	165-340	310
Macrouridae sp.4			3													3	108-150	25
Macrouridae sp.5				1												1	222	40
Macrouridae sp.6								1		2						3	125-150	30
Macrouridae sp.7								6								6	115-345	488
Macrouridae sp.8									2							2	144-172	18
Macrouridae sp.9									1							1	161	3
Macrouridae sp.10									3							3	300-321	340
Macrouridae sp.11										5						5	161-355	722
Macrouridae sp.12												1	1			2	213-336	121
Macrouridae sp.13												1				1	185	10
Macrouridae sp.14													1			1	355	210
Macrouridae sp.15														2		2	310-433	490
Macrouridae sp.16														4	1	5	85-285	269

	Survey Station															Total number	FL range (mm)	Total weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Order																		
Lampridiformes																		
Family Trachipteridae																		
Trachipteridae sp.															1	1	559	120
Order																		
Lophiiformes																		
Family Chaunacidae																		
Chaunax sp.1		1						2		2				4		9	88-229	284
Chaunax sp.2			1						1	1		1				4	51-260	650
Family Lophiidae																		
Lophiomus setigerus									1	1						2	81-98	25
Lophiodes gracilimanus														2		2	190-268	410
Family Ogcocephalidae																		
Dibranchus sp.1			1													1	74	5
Dibranchus sp.2								1								1	44	2
Halicmetus sp.1								3						2		5	58-60	14
Halicmetus sp.2														2		2	39-64	2
Halicmetus sp.3														1		1	55	1
Halieutopsis micropa													1			1	89	15
Halieutopsis sp.1				3					1					2	1	7	44-643	23
Halieutopsis sp.2									1							1	52	4
Halieutopsis sp.3													1	3		4	62-99	24
Malthopsis sp.1					1		1									2	76-193	55
Order																		
Myctophiformes																		
Family Myctophidae																		
Lampanyctus sp.1								1							1	2	46-122	7
Benthosema sp.1														1		1	42	1
Myctophidae sp.1			1						1							2	48-80	7
Myctophidae sp.2			1													1	108	3
Myctophidae sp.3													1			1	48	2
Family Neoscopelidae																		
Neoscopelidae sp.1			4											1		5	150-231	440
Neoscopelidae sp.2			5													5	125-207	110
Neoscopelidae sp.3								6		4						10	128-167	315
Order																		
Myxiniformes																		
Family Myxinidae																		
Eptatretus sp.1											15					15	333-670	3,630
Eptatretus sp.2														1		1	407	150

	Survey Station															Total number	FL range (mm)	Total weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Order																		
Ophidiiformes																		
Family Aphyonidae																		
Aphyonidae sp.1				1												1	90	5
Aphyonidae sp.2								1								1	167	40
Family Ophidiidae																		
Ophidiidae sp.1		1												1	1	3	113-220	90
Ophidiidae sp.2					1											1	276	130
Ophidiidae sp.3					1			2						4		7	122-254	168
Ophidiidae sp.4								1	2			2	1			6	123-164	75
Ophidiidae sp.5								1	1	3						5	133-210	140
Order																		
Osmeriformes																		
Family Microstomatidae																		
Microstomatidae sp.1										1						1	388	45
Microstomatidae sp.2														2		2	165-172	45
Order																		
Perciformes																		
Family Cepolidae																		
Owstonia sp.							1									1	53	10
Family Champsodontidae																		
Champsodon guentheri			1		1		6	1								9	50-116	38
Family Epigonidae																		
Epigonus atherinoides															4	4	170-205	285
Epigonus macrops														1		1	125	21
Family Nomeidae																		
Cubiceps sp.															1	1	116	20
Family Notograptidae																		
Notograptus sp.1				1												1	595	360
Notograptus sp.2				1												1	397	80
Family Percophidae																		
Bembrops caudimacula					3											3	74-223	105
Bembrops sp.							2									2	42-43	8
Family Trichiuridae																		
Benthodesmus tenuis								1				1			2	4	691-950	640
Family A Type A															2	2	230-255	540

	Survey Station															Total number	FL range (mm)	Total weight (g)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525			
Order																		
Pleuronectiformes																		
Family Cynogrossidae																		
Cynoglossus sp.				1												1	805	5
Poecilopsetta colorata					1											1	174	45
Order																		
Polymixiiformes																		
Family Polymixiidae																		
Polymixia sp.1					4											4	85-166	195
Polymixia sp.2							1									1	147	48
Order																		
Rajiformes																		
Family Anacanthobatidae																		
Anacanthobatis sp.												1				1	63	5
Order																		
Scorpeaniformes																		
Family Scorpeanidae																		
Setarches cf. guentheri		1			5			4		1						11	40-89	71
Order																		
Squaliformes																		
Family Etmopteridae																		
Etmopterus cf. molleri		1												1		2	220-248	95
Family Squalidae																		
Deania quadrispinosa									1						2	3	340-504	690
Squalus megalops	1															1	735	1,500
Squalidae sp.															1	1	309	125
Order																		
Stephanoberyciformes																		
Family Barbourisiidae																		
Barbourisia rufa													1			1	350(SL)	680
Order																		
Stomiiformes																		
Family Idiacanthidae																		
Idiacanthidae sp.															1	1	320	5
Family Chauliodontidae																		
Chauliodus sp.									1						1	2	138-194	23
Family Gonostomatidae																		
Gonostoma sp.														1	3	4	108-125	13

	Survey Station															Total number	FL range (mm)	Total weight (g)
	TRA511	**BTR512**	**BTR513**	**BTR514**	**BTR515**	**TRA516**	**BTR517**	**BTR518**	**BTR519**	**BTR520**	**TRA521**	**BTR522**	**BTR523**	**BTR524**	**OTR525**			
Family Malacostidae																		
Malacostidae sp.1															1	1	191	25
Malacostidae sp.2															4	4	165-227	135
Malacostidae sp.3															1	1	141	5
Family Sternoptychidae																		
Polypnus stereope		17	139													156	50-83	1,430
Polypnus sp.														1		1	75	5
Family Stomiidae																		
Stomiidae sp.		2														2	-	40
Order																		
Zeiformes																		
Family Macrurocyttidae																		
Zenion hololepis					1											1	346	5
Total no. of specimens	**14**	**27**	**168**	**10**	**26**	**11**	**13**	**35**	**22**	**24**	**15**	**10**	**11**	**47**	**40**	***473***		***33,805***

Annex 17: List of molluscs collected from beam trawl, Deep sea trap, and otter trawl during 11-25 May 2008.

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Class Bivalvia																	
Subclass: Anomalodesmata																	
Order Pholadomyoida																	
Family Cuspidariidae																	
Cuspidaria sp.									1							1	607-678
Family Poromyidae																	
Cetomya sp.			1						2							3	450-678
Family Verticordiidae																	
Verticordiidae sp.				1												1	990-1,227
Subclass: Heterodonta																	
Order Myoida																	
Family Anomalodesmacea								2								2	553-571
Order Veneroida																	
Family Tellinidae																	489-509
Aloha sp.														1		1	489-509
Astarte sp.														1		1	489-509
Baraytoma sp.														8		8	489-509
Capulus sp.														30+		30+	489-509
Eosipho sp.														1		1	489-509
Leptochiton sp.														2		2	489-509
Mitra sp.														1		1	489-509
Xenophora sp.														15		15	553-571
Tellinidae sp.								2		3				5		10	489-608
Subclass: Pteriomorpha																	
Order Arcoida																	
Family Arcidae																	
Arca sp.								1								1	553-571
Arcidae sp.										1						1	587-608
Order Mytiloida																	
Family Mytilidae																	
Amygdarum sp.			1							2				3		6	489-608
Docorys sp.														3		3	489-509
Fusinus sp.														6		6	489-509
Order Ostreoida																	
Family Propeamussidae																	
Propeamussium sp.			7				2									9	302-452
Order: Pterioida																	
Family Pectinidae																	
Daerydiam sp.								9								9	553-571
Pectinidae sp.					2											2	283-253

Remarks: TRA = Deep Sea Trap; BTR = Beam Trawl; OTR = Otter Trawl

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Class Bivalvia (cont.)																	
Unclassified Bivalve								1								1	553-571
Class Cephalopoda																	
Order Octopoda																	
Family Octopodidae																	
Octopus sp.					1				1		1					3	253-607
Order Sepiolida																	
Family Sepiolidae																	
Heteroteuthis sp.							2									2	302-342
Order Teuthida																	
Family Ctenopterygidae																	
Ctenopteryx sicula															1	1	570-630
Family Histioteuthidae																	
Histioteuthis meleagroteuthis															1	1	570-630
Family Mastigotheuthidae																	
Mastigoteuthis cordiformis									1			3				4	607-922
Family Octopoteuthidae																	
Octopoteuthis sp.															1	1	570-630
Family Ommastrephidae																	
Ornithoteuthis volatilis															1	1	570-630
Sthenoteuthis eualaniensis															7	7	570-630
Family Pyroteuthidae																	
Pyroteuthis sp.															1	1	570-630
Class Gastropoda																	
Clade: Euctenidiacea																	
Family Doridida e																	
Plathydoris sp.								2								2	553-571
Clade: Littorinimorpha																	
Family Cassidae																	
Cassis sp.							2									2	302-342
Echinophora sp.							1									1	302-342
Family Naticidae																	
Eunatica sp.			4													4	450-452
Natica sp.			1					1								2	450-553
Family Xenophoridae																	
Xenophora sp.		*3*	1					3		2						9	450-608

(continued)

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Clade: Neogastropoda																	
Family Buccinidae																	
Nassa sp.					6											6	253-283
Kanamarua sp.								1								1	553-571
Buccinidae sp.							2									2	302-342
Family Cancellaridae																	
Admete sp.				1												1	990-1,227
Family Coralliophilidae																	
Babelomurex sp.										1						1	587-608
Family Fasciolariidae																	
Fusinus sp.			7		2		2	2		3						16	253-608
Fusolatirus sp.					1											1	253-283
Granulifusus sp.							2									2	302-342
Fasciolariidae sp.										1						1	587-608
Family Melongenidae																	
Melongenidae sp.								1								1	553-571
Family Muricidae																	
Traphon sp.										1						1	587-608
Babelomurex sp.														1		1	489-509
Family Olividae																	
Amalda sp.			9													9	450-452
Family Turridae																	
Admete sp.												1				1	922-722
Astarte sp.													1			1	869-886
Bathytoma sp.			6										1			7	450-886
Cerithium sp.												1	7			8	722-886
Dacrydium sp.														30+		30+	489-509
Dentallium sp.1														21		21	489-509
Dentalium sp.2													2			2	869-886
Gemnula sp.1					1		3						2			6	253-886
Gemnula sp.2			148		3		1									152	253-452
Gemmula sp.3			1		4		20+									25+	253-452
Gemmula sp.4								2	9	54				20		85	489-678
Granulifusus sp.														1		1	489-509
Gymnobela sp.1				2												2	990-1,227
Gymnobela sp.2				1												1	990-1,227
Gymnobela sp.3				1												1	990-1,227
Gymnobela sp.4													5			5	869-886
Oernopota sp.													3			3	869-886

(continued)

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Family Turridae (cont.)																	
Splendrillia sp.			2	5												7	450-1,227
Spergo sp.								1								1	553-571
Ooconys sp.													1			1	869-886
Veprecula sp														3		3	489-509
Trophon sp.													1			1	869-886
Turridae sp.1												1	6			7	922-722
Turridae sp.2												1	1			2	922-722
Turridae sp.3													2			2	869-886
Turridae sp.4													1			1	869-886
Turridae sp.5									3							3	607-678
Turridae sp.6														12		12	489-509
Turridae sp.7			5		1											6	253-452
Turridae sp.8				2												2	990-1,227
Turridae sp.9				1												1	990-1,227
Turridae sp.10								2		2				5		9	509-608
Family Volutidae																	
Aloha sp.							2			1						3	302-608
Clade: Nudipleura																	
Nudibranchia sp.	2							2			1					5	335-607
Clade: Vetigastropoda																	
Family Fissurellidae																	
Emarginula sp.								2						2		4	553-571
Family Trochidae																	
Astarte sp.												1				1	922-722
Calliostoma sp.								1				2		2		5	489-922
Ginebisu sp.												1				1	922-722
Hybochirus sp.									5							5	607-678
Kanamarua sp.														1		1	489-509
Propeamussium sp.												1				1	
Vexillam isasi														1		1	489-509
Trochidae sp.							1									1	302-342
Clade: ???																	
Family Scaphandridae																	
Scaphander sp.														1		1	489-509
Family Vasidae																	
Vasidae sp.							1									1	302-342

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Class Polyplacophora																	
Order Chitonida																	
Family Ischnochitonidae																	
Lepidozona sp.					1		3									4	253-342
Order Lepidopleurida																	
Family Leptochitonidae																	
Leptochiton sp.			1													1	450-452
Lepidochiton sp.								2	11	2						15	553-678
Class Scaphopoda																	
Order Dentaliida																	
Family Dentaliidae																	
Dentallium sp.								9	12	13						34	553-678
Dentaliidae sp.1			11													11	450-452
Dentaliidae sp.2			2													2	450-452
Dentaliidae sp.3								7								7	553-571
Order ???																	
Family Pentaliidae																	
Pentaliidae sp.			2													2	450-452
Total no. of specimens	**2**	**3**	**209**	**14**	**22**	**0**	**44+**	**53**	**45**	**86**	**2**	**12**	**33**	**176+**	**12**	***713+***	

Annex 18: List of benthic-invertebrate collected from beam trawl, Deep sea trap, and otter trawl during 11-25 May 2008.

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Phylum Annelida																	
Annelid (Segmented worms)		1					1	3	2	2				5		14	302-678
Phylum Cnidaria																	
Class: Anthozoa																	
Subclass Alcyonaria																	
Soft corals			2	3	2		4	24	4	5			2	2		48	253-1227
Order Pennatulacea																	
Sea pens					4											4	283-253
Order Gorgonacea																	
Sea fans								17		6		1		2		26	489-922
Sea feathers		2		1												3	472-1227
Subclass Zoantharia																	
Sea anemones		6	3	2			2	7	3	1			4	6		34	302-1227
Hard corals		1	1	6	29		4	128	138	44		20	5	15		391	283-1227
Class: Hydrozoa																	
Hydroids				2												2	996-1227
Class: Scyphozoa																	
Jellyfish						1	1									2	267-434
Phylum Echinoderamata																	
Subphylum Crinoizoa																	
Class: Crinoidea																	
Subclass Articulata																	
Sea lilies (Crinoid)						1		29	5	22		1	46	17		121	267-1227
Crinoid					21											21	283-253
Subphylum Asterozoa																	
Class: Asteroidea																	
Sea stars (Asteroid)		7	8	10	2		2	11	24	11		10	5	4		94	253-1227
Class: Ophiuroidea																	
Brittle stars (Ophiuroid)		2	19	41	130	2	59	18	19	10		14	272	33	2	621	253-1227
Subphylum Echinozoa																	
Class: Echonoidea																	
Sea urchins (Echinoid)		2	4	11	201	14	159	16	52	12		31	33	19	2	556	253-1227
Class: Holothuroidea																	
Molpadida sp.							44									44	302-343
Sea cucumbers (Holothuria)		6	11	2	4			10	15	9		5	2	12	4	80	253-1227

Remarks: TRA = Deep Sea Trap; BTR = Beam Trawl; OTR = Otter Trawl

	Survey Station															Total number (ind.)	Sampling Depth (m)
	TRA511	BTR512	BTR513	BTR514	BTR515	TRA516	BTR517	BTR518	BTR519	BTR520	TRA521	BTR522	BTR523	BTR524	OTR525		
Phylum Porifera																	
Sponges					254		85	98	5	30		2	8	22	2	506	253-922
Sponge spicules									5							5	607-678
Phylum Sipuncula																	
Sipunculid (Peanut worms)					1											1	283-253
Phylum Chordata																	
Tunicate	1			1	46	4	84	22	17					43	26	244	253-1227
Total no. of specimens	**1**	**27**	**48**	**79**	**694**	**22**	**445**	**383**	**289**	**152**	**0**	**84**	**377**	**180**	**36**	***2817***	

SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

THE SECRETARIAT (SEC)
P.O. Box 1046, Kasetsart Post Office,
Chatuchak, Bangkok, 10903 Thailand
Tel:(66-2) 940-6326, Fax: (66-2) 940-6336
E-mail: secretariat@seafdec.org
www.seafdec.org

TRAINING DEPARTMENT(TD)
P.O.Box 97, Phrasamutchedi,
Samut Prakan 10290, Thailand
Tel:(66-2) 425-6100, Fax:(66-2) 425-6110 to 11
E-mail: td@seafdec.org
http://td.seafdec.org

MARINE FISHERIES RESEARCH DEPARTMENT (MFRD)
2 Perahu Road, off Lim Chu Kang Road,
Singapore 718915
Tel: (65) 6790-7973, Fax: (65) 6861-3196
E-mail: mfrdlibr@pacific.net.sg
http://www.fishsafetyinfo.com

AQUACULTURE DEPARTMENT (AQD)
Main Office:
Tigbauan, 5021 Iloilo, Philippines
Tel (63-33) 511-9171, 336-2965
Fax (63-33) 335-1008, 511-8709, 511-9070
Manila Office:
17 Times Street, West Triangle, 1104 Quezon City, Philippines
Tel (63-2) 372-3980 to 82; Fax (63-2) 372-3983
E-mail: sales@aqd.seafdec.org.ph,
library@aqd.seafdec.org.ph (for Journal papers)
http://www.seafdec.org.ph

MARINE FISHERIES RESOURCES DEVELOPMENT
AND MANAGEMENT DEPARTMENT (MFRDMD)
Taman Perikanan Chendering,
21080 Kuala Terengganu, Malaysia
Tel: (609)617-5940 Fax:(609)617-5136
E-mail: mfrdmd@seafdec.org.my
http://www.seafdec.org.my