REPORT OF THE

EXPERT MEETING ON DEEP-SEA FISHING AND ITS IMPACT TO ECOSYSTEM

Bangkok, Thailand, 31 August - 2 September 2010

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Contents

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31 August - 2 September 2010

Bangkok, Thailand

1. The Expert Meeting on Deep-Sea Fishing and Its Impact on Ecosystem was organized by the SEAFDEC Training Department from 31 August to 2 September 2010 at Jasmine City Hotel, Bangkok, Thailand. The Workshop was attended by marine fisheries experts, fishing gear technologists and representatives from Brunei Darussalam, Indonesia, Japan, Malaysia, Myanmar, the Philippines, Thailand, United State of America, and Vietnam as well as from the SEAFDEC Secretariat and the Training Department. The List of Participants appears as **Annex 1**.

I. OPENING OF THE MEETING

2. The Deputy Secretary-General of SEAFDEC and Trust Fund Program Manager, Mr. Kenji Matsumoto, officially opened the meeting. He welcomed the participants and thanked them for their participation in the meeting. He attributed to the depletion of the region's coastal resources, fishery policy makers in the Southeast Asian countries searching the new fishery resources in the deep-sea area. The Japanese Trust Fund Program, through the SEAFDEC Training Department, has been earmarked for supporting deep-sea resources explorations in the Southeast Asian waters. He emphasized that the exploration is not only a search for a new fishing ground but also for improving information of deep-sea Vulnerable Marine Ecosystems (VMEs) in the Southeast Asian waters to support proper fishery management in the future. He expressed confidence that the Expert Meeting could pave ways for exchanging of knowledge and experience among countries in the region on deep-sea fishery resources exploration in order to mitigate the adverse impacts of deep-sea fisheries on marine ecosystem. His opening speech appears as **Annex 2.**

I. INTRODUCTION

3. The Project Director, Dr. Worawit Wanchana of the SEAFDEC Training Department (SEAFDEC/TD), presented the background as well as the rationale and objectives of the workshop (**Annex 3**). He mentioned that this Expert Meeting came under the Deep-sea Fisheries Exploration in the Southeast Asian Waters Project, endorsed by the ASEAN-SEAFDEC Strategic Partnership and FCG Mechanism, with the financial support from Japanese Government. The Expert meeting aims to provide a forum to discuss issues concerning deep-sea ecosystems, to review and update regional/national initiatives related to deep-sea fishery resources exploration

in the Southeast Asian Region, and to share experiences on studies of the impacts of fishing on deep-sea ecosystem among the experts.

4. He also informed the meeting that the May 2009 workshop on the Standard Operating Procedure (SOP) and Development of Sampling Gears for Deep-Sea Resources Exploration had agreed on the term "deep-sea" to denote a maritime area with the depth greater than 200 m. This definition also corresponds with that defined by the FAO/APFIC/SEAFDEC Workshop on Assessment and Management of the Offshore Resources of South and Southeast Asia held in 2008.

5. The agenda which appears as **Annex 4** was adopted.

6. Ms. Penchan Laongmanee summarized the SEAFDEC activities under the deep-sea fisheries resources exploration in the Southeast Asian Region Project since 2008 (**Annex 5**). She informed the meeting that five activities had been carried out under the program: 1) deep-sea fisheries resources survey by MV. SEAFDEC 2 and national research vessel; 2) the study on impact of fishing on deep-sea ecosystem inaugurated by this Expert Meeting; 3) development/improvement of sampling gear and exploration methodology; 4) human resource development (HRD) programs on deep-sea fisheries resources exploration; and 5) information bulletin.

7. Under the Project, the deep-sea fisheries resource surveys in the Brunei Darussalam waters and off-shore of Sabah and Sarawak of Malaysia were conducted aboard M.V.SEAFDEC 2, and around the continental slopes in the Lingayen Gulf aboard M/V DA-BFAR of the Philippines. The standard operating procedure for the deep-sea fisheries resource and sampling gears design was discussed and agreed in a workshop in 2009. The human resources development program was incorporated in the formal workshops, e.g. in the Shipboard Training on Deep-Sea Exploration on M/V DA-BFAR of the Philippines, the Training Workshop on Identification of Deep-Sea Fish at SEAFDEC/TD, and on-the-job training during the deep-sea fisheries resource survey cruise. Ms. Laongmanee further informed the meeting that more detailed information on the project can be accessed from the website http://map.seafdec.org/deepsea/ where manual, report, species checklist and poster can also be downloaded. The website also publishes the database of deep-sea fish in SEAFDEC collection.

8. During the discussion, it was suggested that deep-sea resources management should be science-based. As shown by a number of studies, the deep-sea fish stocks have largely been depleted, and most of them exhibited slow rates of recovery. Participants mentioned that it was timely that Member Countries participate in the deep-sea exploration/research prior to launching their deep-sea fisheries. As the deep-sea studies are costly, all Member Countries should support/share the relevant information to ensure its effective usage.

II. REVIEWING OF THE REGIONAL/NATIONAL INITIATIVES RELATED TO DEEP-SEA FISHERIES RESOURCES EXPLORATION, AND THE STUDY ON IMPACT OF FISHING ON DEEP-SEA ECOSYSTEM

2.1 Brunei Darussalam

9. Initiatives of Brunei Darussalam on deep-sea fisheries resources exploration was presented by Ms. Desimawati Haji Matali, Fisheries officer of Department of Fisheries, Brunei Darussalam **(Annex 6)**. She explained the fishing ground zonation within the EEZ that comprises four zones: zone 1 from 0 to 3 nm; zone 2 from 3 to 20 nm; zone 3 from 20 to 45 nm; and zone 4 from 45 to 200 nm from shore. The offshore area, about 75% of Brunei's territorial waters, falls into zone 4, a largely rugged seafloor, filled with plenty of troughs—some of which >3000 m deep. A narrow strip of about 2 nm^2 at 100-200 m depth locates 40 nm from the shoreline. The western seafloor is generally muddy, while the eastern one is rocky. The declivity of the continental slope drops sharply from the depths of 200 m down to about 3000 m towards the Palawan Trough that demarcates the Brunei Darussalam waters.

10. The demersal fish stocks in zones 3 and 4 were assessed for the purpose of science-based fishery management. Brunei Darussalam, in collaboration with SEAFDEC, has conducted an annual deep-sea fisheries resources survey from 2008 to 2010, covering the >100 m EEZ using the M.V. SEAFDEC 2.

11. The experimental fishing and oceanographic surveys revealed a relatively rich fish stock in the Brunei Darussalam waters. In year 2008, the catch per unit effort (CPUE) of deep water otter board trawl survey was 0.63-1.53 tonnes/km^2 and beam trawl was 0.64 tonne/km^2. Species compositions were analyzed according to the sampling depths. At the depths of 105-163 m, catch compositions were similar to that of the coastal water trawl; the preponderance of lizard fish and threadfin breams was found here. The different catch compositions at 215-374 m were made up largely by siverbelly, seaperch followed by lantern fish, beard fish and deep water shrimps (*Heterocapus* sp., *Plesionika* sp., *Parahempomades* sp. and *Metanephrops* sp.). The high composition of deep-sea shrimps showed a bright prospect for future exploitation of the Brunei Darussalam waters.

12. The Brunei Darussalam official also informed that a large collection of field data from various surveys has yet to be analyzed owing to the lack of competent staff and expertise in deep-sea resources. In October 2010, DOF Brunei Darussalam in collaboration with SEAFDEC had scheduled a demersal resource survey along the continental slope. The survey was planned to generate the necessary data/information on specific fishery resource and habitat for future management.

13. The workshop suggested the use of both beam trawl and otter-board trawl for the future surveys. The catchability of otter-board trawl is known to be higher than that of the beam trawl while the latter is capable of operating over rugged sea

bottom. Therefore, in order to compare CPUE and CPUA of these two fishing gears the catch efficiency coefficient is required.

2.2 Indonesia

14. The archipelagic state of Indonesia covers a vast area, two thirds of which over the sea. The deep-sea region lies within the 12 nm from shore and stretches towards the EEZ boundaries beyond the continental shelves. Most of Indonesia's deep-sea areas are in the Indian Ocean. Dr. Fayakun Satria, researcher of the Research Center for Fisheries Management and Conservation, Indonesia, reported to the meeting that his country had carried out deep-sea fishery resources surveys to assess the unexploited fish and shellfish stocks, and to identify the species of commercial importance as well as their habitat distribution **(Annex 7)**. Indonesia's deep-sea resource survey dates back to 1972 when the Korean research vessel Oh Dae San set out her expedition into the South Java Sea. Subsequent deep-sea explorations in the southern region were carried out by the Indonesian government with funding from various countries like Germany, Japan, Norway and the United States. Deep-sea expeditions around West Sumatra were carried out in 1991, 2004, 2005 and 2008; and in South Java in 1975, 2003, 2004 and 2005. More expeditions in the waters of South Sunda Lesser were carried out in 1979 and 1981; in Timore Sea in 1992 and 1993 and in Tanimbar & South of Papua New Guinea in 1991 and 1995. Only two areas, the Kei Island in the middle east of Indonesia, and the North of Indonesia came under the INDEX SATAL expedition; the former in 1991 and 1993 and the latter in 2010.

15. During 2008-2009, Indonesia carried out commercial deep-sea fishing surveys in the North West Simeulue and West Banda Aceh, using Japanese commercial fishing boats. The F/V Koshin Maru operated for five months in 2008 and the F/V Fukoyoshi Maru for four months in 2009, followed by the cessation owing to an unreadiness voiced by the Indonesian government. Notwithstanding the findings of the surveys, many fishermen have already venture out to exploit the deep-sea fish/shellfish resources. Currently, local fishermen in Pelabuhan Ratu fish with gill net, and in Banda with trawl that they operate under the ordinary fishing license.

16. According to the Indonesian representative, a commercial deep-sea fish resource survey was carried out in 2008-2009. Some 145 deep-sea demersal fish species from 62 families were identified. The rugged seafloor of the North West Simeulue, and the large sea mounts area of the West Banda were believed to exert some influences on the biodiversity and abundance of the living resources. In the North West Simeulue, the water depth displayed a positive relationship with biodiversity, and a negative relationship with the CPUE. The contrary was true for the West Banda. Size distribution of *Hoplostethus rubellopterus* showed a positive relationship with the depth.The first maturity length of this species is at 33 cm which mostly distributes at 800-900 m deep. Therefore, it is risky to utilize, since the fishing is usually at the depths shallower than the distribution of mature fish.

17. As much as 32% in wet weight from F/V Koshin Maru's overall experimental trawling was identified as 'by-catch.' It was inferred that such the exploitation of the diverse but low-valued species could lead to substantial biodiversity loss. Disturbance of the seafloor by trawling was also observed during the survey— considerable quantities of black coral, sponges and other epifauna were hauled in from fishing grounds adjacent to the Simeulue Island. With such the coral resources, the area was considered closed to demersal fishery.

18. The Indonesian representative was of an opinion that destructive impacts of deep-water trawl and other fishing gears should be minimized. Alternative fishing gears that inflict little or no such damages should be sought.

19. The biology of *Beryx splendens* (Splendid alfonsino) was discussed by Dr. Yoshinobu Konishi who observed its large assemblage on continental slope during Dr. Fayakun's survey. In Japan, there are many *Beryx splendens* fishing grounds along the Pacific coast from Okinawa to Izu Island. Their spawning ground is at seamount. Their egg's diameter is about 1.5 mm, covered with pink membrane and has large oil globule. Their eggs and newly hatched larvae are planktonic, drifting at the water depths between 20-50 m. Their pelagic mode will continue until they find an appropriate area for settlement. Understanding their biology, fishing could be regulated through proper fishing ground rotation that makes the sustainable exploitation of the species possible.

20. The meeting gave a considerable attention to the deep-sea fishing by local fishermen. According to Dr. Fayakun Satria, local fishermen fished with monofilament bottom gill net to the depth up to 300 m in Indian Ocean, near Pelabuhan Ratu, *for Hoplostethus* sp. (Orange roughy), *Nemipterus* sp. (Threadfin bream) and *etc*. Some local fishermen also used handline targeting deep sea demersal fish especially *Etelis* sp. (red snapper) at about 300 m deep. Novel deep-sea fishing gears that can be used by local fishermen, according to Dr. Satria, should be an area this Project could explore. Bottom vertical longline was suggested during the meeting as a type of fishing gear that should meet such the specification.

21. The meeting also suggested that the size at first maturity of some deep-sea fishes should be included in the future studies under this Project.

2.3 Malaysia

22. The Assistant Director/Head of Marine Resources Conservation Unit and Malaysian representative, Mr. Hj Sufian bin Sulaiman, provided the meeting with the information on Malaysian EEZ and fishing grounds. **(Annex 8)**. The Malaysian deep-sea fisheries contributed 311,715 and 293,532 tonnes to the national fisheries production in 2008 and 2009 respectively, as the demand for fish products continued to grow, the number of licensed vessels for deep-sea fishing gradually increased from 601 vessels in 2001 to 1,242 vessels in 2009.

23. The deep-sea fishing in Malaysia has been known since the declaration of EEZ in 1980. The definition of 'deep-sea' according to the Department of Fisheries, Malaysia is the maritime area beyond 30 nm of the national EEZ where the use of >70 GRT fishing boat is necessary. In 1987, Malaysia and Thailand augmented a joint venture in deep-sea fishing that was launched by both Prime Ministers on September 17, at Kuantan Port in Pahang State. After termination of the joint venture, Malaysia focused on training of local fishermen to enable them to enter the deep-sea fisheries, and developed facilities in Tok Bali (Kelantan), Batu Mauang (Penang), and Tanjung Maris (Sarawak) as hubs of fisheries deep-sea industries. The Government of Malaysia has a clear policy to promote deep-sea fishing industry under an ecosystem-based fisheries management approach. Currently, the Vessel Monitoring System (VMS) is operational to monitor fishing activities and their landings.

24. He also informed the meeting that Malaysia, in cooperation with SEAFDEC, conducted a deep-sea fisheries resources survey off Sabah and Sarawak in August 2010 using M.V. SEAFDEC 2. The result of the survey will be used to manage the deep-sea resource.

2.4 Myanmar

25. The status and potential of deep-sea fishery resources in Myanmar were presented by Mr. Myint Pe, Assistant Director and Head of Marine Resources Conservation Unit, Myanmar **(Annex 9)**. At present, Myanmar has no deep-sea fishing activities. The Union of Myanmar is blessed with 3,000 km coastline, several large estuaries, delta systems and numerous offshore islands, and they are rich in aquatic resources. The country's continental shelf covers an area of ~230,000 km^2.

26. As far back as 1982, an extensive deep-sea survey was conducted by R.V. Dr. Fridjof Nansen under a UNDP/FAO project in order to estimate the marine fish biomass in the EEZ of Myanmar as well as along the continental shelf. The survey gave the estimated maximum sustainable yield (MSY) of the pelagic and demersal fishes at 0.5 tonne and 0.3-0.5 tonne, respectively. In October 1982, Myanmar used a local research vessel, 24.25 m-long stern trawler No. 413 to operate shrimp trawl net (head line 33.8 m) and fish trawl net (head line 30.5 m) in deep-sea water (230-500 m deep) off the Thaninthary coast. The catch composition was dominated by three deep-sea fish species, *Peristedon weberi*, *Chlorophathalmus* sp. and *Palinurichtus pringiei*. Moreover, deep-sea lobster, *Puerulus sewelli* and deep-sea shrimp *Heterocarpus woodmasoni* and *Parapandalus spinipes* were also found. The deep-sea shrimp and lobster survey was repeatedly conducted in 1990 by a Russian research vessel, F.V. Poyarkovo in the Taninthary coastal area. Average catch rate of deep-sea lobster, shrimp and fish were 46.6, 6.5 and 191.7 kg/hr, respectively.

27. Myanmar also worked with SEAFDEC to conduct fisheries resource surveys. A joint research survey on pelagic fisheries resources survey was conducted in the

Andaman Sea by Myanmar, Thailand, Indonesia and SEAFDEC in 2004 in the waters 700 m. and beyond. In 2007, a collaborative marine fishery resources survey in Myanmar waters was carried out by scientists from Myanmar and SEAFDEC. The results indicated that swordfish (*Xiphias gladius*), yellowfin tuna (*Thunnus albacares*), striped marlin (*Tetrapturus audax*) and sailfish (*Istiophorus platypus*) were abundant enough to support commercial exploitation. Currently, there are only foreign fishing vessels operating offshore fisheries in Myanmar waters.

28. The Myanmar representative stated that major constraints to offshore and deep-sea fisheries development in Myanmar are the lack of appropriate fishing technology, fishing gear and fishing vessel. Good cooperation with international/regional organizations such as ASEAN, BIMSTEC, FAO, and SEAFDEC could benefit Myanmar in obtaining technologies, knowledge and experience to exploit and manage its fisheries resources. Moreover, Myanmar also welcomes investment and joint venture program from foreign partners to develop new fisheries in Myanmar.

29. To obviate the known destructive operation of trawling, the representative of Myanmar suggested that the less destructive fishing gear should be used in the fishery survey under the Project. As the meeting was informed that the experimental trawling was necessary, a smaller size was proposed as a means to mitigate the potential damages to maritime ecosystem. In fact, SEAFDEC had informed that experiments are underway to develop environmental friendly fishing gears, e.g. deep-sea trap, and bottom gill net, based on the experiences shown by local Indonesian fishermen.

2.5 The Philippines

30. The Philippines representative, Mr. Rafael Ramiscal, informed the meeting that as an archipelagic country the Philippines is surrounded by deep-sea waters **(Annex 10)**. However, the deep-sea resources are largely unknown. The Philippines has a long history of deep-sea explorations since the 18th and 19th centuries by the foreign expeditions (*e.g.* Samarang, 1843 to 1846; Novara, 1857 to 1859; Challenger, 1874 to 1875). About 18 deep-sea explorations and resources surveys were conducted in the Philippine waters. Lately, surveys of the deep-water benthic fauna in the Philippines waters were conducted and dubbed as Aurora 2007 and Lumiwan 2008.

31. During the AURORA 2007 and LUMIWAN 2008 surveys, the survey team aboard M.V. DA-BFAR employed three main sampling gears: bottom trawl, deep-sea beam trawl, and deep-sea trap. They found the seafloor at 400-600 m depth was flourished with variety of fishes and crustaceans. The prevalence of pandalid shrimp species (*Heterocarpus woodmasoni, H. hayashi, H. dorsalis*) in such the deep sea areas was noted and it was found that their maximum bathy threshold was 1000 m and perhaps greater. The pandalid shrimp resources could therefore be considered as the most promising resource for the development of deep-sea fisheries. However, in order to safeguard such the resource from over-exploitation, an in-depth feasibility

study and stock assessment should be carried out prior to offering the fishery resource to fishermen.

32. The results of AURORA 2007 and LUMIWAN 2008 explorations have encouraged the Philippines government to implement a pilot deep-sea shrimp trap fishery by modifying the sampling gears (*e.g.* deep-sea trap, beam trawl, and otter trawl) to improve efficiency, and to avoid negative impact on the deep-sea ecosystem. A cost-benefit study of the deep-sea shrimp trap fishery will also be conducted. Currently the pandalid shrimps have their market limited to some areas of Mindanao where a small trade has been made. Formulating of a management plan/policy on deep-sea fisheries is also an aim of the deep-sea project of the Philippines. Dr. Yoshinobu Konishi disclosed that pandalid shrimp fishery has been active in Kagoshima prefecture of Japan where small fishing boats deploy their gears to 400 - 600 m depth. Their catch is normally sold in the high market.

33. Moreover, Mr. Ramsical informed the meeting that the Philippines will launch a 2-month deep-sea fisheries resources survey in October 2010. They also schedule the test of the modified sampling gear (scaled-down bottom trawl) during the survey.

2.6 Thailand

34. Mr. Weera Pokapunt, Thailand's representative from Department of Fisheries (DOF), informed the meeting that the deep-sea fishing ground is exclusively located in the Andaman Sea on Thailand's west coast **(Annex 11)**. In 2006-2007, Thailand conducted demersal living resources surveys in the Andaman Sea at the water depths up to 200 m using BVL and deep-sea traps. The majority of fish species caught were snappers, groupers, sharks, lobsters, etc. However, in the past decades, two major explorations of deeper (200-550 m) maritime locations were conducted aboard R/V No.2 of DOF Thailand (1975-1976) and R/V Dr. Fridtjof Nansen (1980) under a jointed program with FAO and NORAD in the Andaman Sea.

35. The 1975-1976 survey aboard R/V Pramong No. 2, using standard otter board trawl net, showed 69 species of deep-sea fishes and 13 species of deep-sea shrimps and lobsters in the catch. It was inferred that the deep-sea shrimps and lobsters were a potential resource for local fishermen to exploit; nonetheless, fishing gear efficiency still needs to be improved. The Thai representative suggested that SEAFDEC and Member Countries should carry out joint deep-sea surveys in both the Andaman and the South China Seas.

36. In this context, Mr. Aussanee Munprasit of SEAFDEC/TD suggested that DOF researchers should analyze the data from the on-going bottom vertical longline survey that has been carried out at the depths of 150-400 m in order to identify any information gaps that future expeditions should tackle.

3.7 Vietnam

37. A review on the living deep-sea resources of Vietnam was presented by Ms. Nguyen Thuy Duong, Fisheries officer of Department of Fisheries, Vietnam **(Annex 12)**. For the management purposes, the Vietnamese maritime areas are divided into five administrative zones: Tonkin Gulf, Central, Southeast, Southwest and off-shore waters. The areas that fit the definition of 'deep-sea' are located mostly in the central zone and offshore. Intensive fishery resources survey using the bottom longline, bottom vertical longline, otter trawl, trap and pot was conducted during 1978-1988 by the Viet-Xo Joint surveys covering a total of 4,412 sampling stations; and during 1996-2005 by ALMRV surveys covering 1,312 deep-sea stations. A total of 154 deep-sea stations of the overall 1,000 sampling stations were surveyed during 1996-2005. In 2005-2007, Ministry of Fisheries (MOFI) in collaboration with SEAFDEC operated two survey cruises covering 32 stations along the Vietnamese continental shelf.

38. The surveys showed a total of 656 species of fishes/shellfishes that belong to 195 families. The bottom vertical longline CPUEs showed a seasonal variability under the influences of the prevailing NE and SW monsoons. Nonetheless, the bottom trawl CPUE along the continental slopes was noted to be high.

39. The Vietnamese representative expressed a need for further studies on resource assessment of its deep-sea waters. Greater information on the deep-sea living resources, deep-sea ecology, and gear improvement/development for deep sea fisheries is still needed. The fishery technological transfer under the collaboration with SEAFDEC was regarded as highly beneficial.

40. Mr. Bundit Choksaguan of SEAFDEC/TD recommended to the meeting that the use of a bathygraphic map should help locate more precisely the productive deep-sea fishing grounds from the survey stations.

3.8 Japan

41. Dr. Yoshinobu Konishi, former researcher of the Seikai National Fisheries Research Institute in Nagasaki, Japan gave the meeting his presentation on the Japanese seamount bottom trawl fishery and the trial research on its impact to the ecosystem under "the Regional Framework of High Sea Bottom Fisheries in the Western North Pacific". The current Framework members are Japan, South Korea, Russia and the United States **(Annex 13)**. The Framework missions are to sustain the management of resources and conservation of vulnerable ecosystems (in pursuance to the FAO International Guidelines). The review of Japanese high sea bottom fisheries in the Western North Pacific, data analysis, and method on the information collection of the fishery resources and identification of the vulnerable ecosystem in the fishing ground and impact were presented.

42. The Japanese high sea bottom fisheries in the North Western Pacific employ bottom trawl and bottom gill net, targeting Splendid Alfonsin (*Beryx splendens*) and

North Pacific Armorhead (*Pseudopentaceros wheeleri*). These fisheries date back more than 50 years. The small number of the fishing vessels could perhaps frustrate those interested in this fishery; there were 10, 4 and 7 vessels in 1992, 2002 and 2007, respectively.

43. The current status of commercial fisheries resources was derived from the commercial catch and effort, and the estimated biomass obtained by the Japanese research trawler using production model for Alfosin, and comparison between commercial catch data and estimated biomass for Armorhead. It was shown that Alfonsin was already overfished, while Armorhead resources were exhausted. From such the inference, the fisheries should be managed by freezing the number of fishing vessels, shifting the fishing ground to the Japan's EEZ, reducing the current fishing capacity, closing fishing grounds in November and December to reduce the 1997-2006 mean fishing pressure by 20% and limiting any future increase of fishing pressure by 10-30% after the detection of new batch of next year's recruits.

44. The identification of Vulnerable Marine Ecosystem (VME) in the fishing grounds and impact of fishing on VMEs were studied by seabed topography survey, remotely operated vehicle (ROV) survey, drop camera system (DCS) survey and data of coral fishery by Japanese fishing boats. Four orders of coral that are the element of potential VMEs were observed. However, the low densities at two areas made them difficult to be categorized as VME.

45. Dr. Konishi suggested that the deep-sea bottom fisheries resources exploration and the study on its impact in the EEZs of Southeast Asian countries should be conducted at the shelf-break area (100-200 m) and continental slope area (200-500 m), which are still underexploited. At the shelf-break, abundance of the living resources and related biological factors should be investigated, using a suitable sampling/fishing gear. Knowledge on their life-histories is necessary to enable detailed analysis of data obtained from shallower waters on their distribution/habitat at different stages of life. The development of commercial bottom fisheries should aim at large fishing boats that presently operated in the coastal area to help reduce the inshore fishing pressure. He insisted that it is necessary to monitor the catch and effort of commercial fishing boats if the management of living resources is to be successful.

46. Dr. Konishi also suggested that the research survey along the continental declivity (200-500 m), the distribution and abundance of commercially important fish, topographic characteristics, fishing ground mapping for future deployment of fishing gears, ecosystem vulnerability should be observed. The ROV has proved to be useful in detecting composition of fish larvae and juveniles. Concurrently, improved sampling and fishing methods that have little or no negative impacts on the VMEs should be developed.

47. In conclusion, Dr. Konishi noted that promising deep-sea fishery resources at shelf break areas in some Southeast Asian countries should be recognized: the deep-

sea shrimp fishery in the Philippines waters, and deep-sea demersal fishing by hand line and bottom gill net at the continental declivity in Indonesia, for examples. The meeting further suggested that a sound scientific-based plan should be formulated prior to embarking on any deep-sea fisheries. Moreover, the monitoring of fishing practices in those areas to compare with the coastal fishery should be conducted.

48. During the discussion, Dr. Fayakun Satria noted that despite the great biodiversity that exists in tropical seas, especially in Indonesian waters, exploitation should be limited to few target species that are of greatest abundance. Most seamount fishing grounds tend to be individually exclusive in terms of prevailing fish resources that are dominated by one or two species. Not all deep-sea areas are blessed with abundant fish/shellfish resources, sharing of the resources with the nearby sea mount pinnacles was found to be the case. Only few hot spot fishing grounds were identified during the INDEX-SATAL survey. Not all deep-sea waters in Southeast Asia that support the deep-sea fishery resources to the extent that they support a profitable fishing.

IV. SHARING OF EXPERIENCES AND INFORMATION RELATED TO DEEP-SEA FISHERIES RESOURCES EXPLORATIONAND THE STUDY ON IMPACT OF FISHING ON DEEP-SEA ECOSYSTEM

4.1 International initiatives related to deep-sea ecosystem and international guidelines for the management of deep-sea fisheries in the high seas

49. The international initiatives related to study on impact of fishing on deep-sea ecosystem and international guidelines for the management of deep-sea fisheries in the high seas were presented by Dr. Somboon Siriraksophon, Policy and Program Coordinator of SEAFDEC/Secretariat **(Annex 14)**. Due to the significant impacts of deep-sea fisheries on the deep-sea resources, request was made in 2007 at the 27th FAO COFI to protect the Vulnerable Marine Ecosystem (VMEs).

50. An international guideline had been prepared at various expert and technical consultations on deep-sea fisheries in the high sea during 2006-2008. It was submitted to the 28th FAO COFI in 2009. The objective of the guidelines is to provided the necessary tools and guidance on their application to facilitate and encourage the efforts of Regional Fisheries Management Organizations (RFMOs) and coastal States towards sustainable use of marine living resources, and to preclude any significant adverse impacts on vulnerable marine ecosystems (VMEs) and to safeguard marine biodiversity.

51. In conclusion, Dr. Siriraksophon suggested a careful study of the draft guidelines and participation in their finalization for a proper planning at the country level. The guidelines come in a voluntary nature, having been developed after a number of international binding instruments. Various opinions have been heard on how the deep-sea fisheries issues should be handled. The advantage point of the guidelines is that they could be used directly as a tool to implement the deep-sea

fisheries in either the high seas or within the EEZs. A proper management plan should be formulated before actual implementation of a new or on-going deep-sea fishery that may restrain future development as were the case of many developing countries.

52. Dr. Siriraksophon also informed that SEAFDEC has been cooperating with the National Fisheries University (NFU) to conduct fisheries resources survey in the Southeast Asian waters since 2006 and will continue until 2013 using M.V. Tenyo Maru and Koyo Maru. The cooperation is meant to enhance the human resources capacity on fisheries resources survey methodology and the transfer of technology from NFU to participants on boards.

53. The meeting was further requested to assess the future cooperation on the deep-sea fishery resources survey using the M.V. SEAFDEC and M.V. SEAFDEC 2, and their facilities (e.g. sampling gears, oceanographic equipment). Joint surveys could be conducted, for examples, in cooperation with territorial countries at a sub-area such as parts of the Andaman Sea. Fuller review of the past deep-sea surveys in the region should be conducted in order to identify a potential location. Project proposals should be formulated through all possible forums so that potential donors may be approach for their funding.

4.2 INDEX-SATAL: A US and Indonesia Partnership to explore Indonesia's Sea

54. An Indonesia and US Partnership in Exploring the Deep-Sea of Sangihe Talaud (INDEX-SATAL) was presented by Dr. Fayakun Satria (**Annex 15**). The survey was conducted at sea North of Manado, Sulawesi from 24 June to 7 August 2010 aboard RV "Okeanos" and "Baruna Jaya IV". The deep-sea demersal trawl was operated aboard Baruna Jaya IV in two substrata, ranging depths from 300m to 500m, and 500m to 1,000m. Greater understanding of undersea ecosystem was achieved, particularly those associated with submarine volcanoes and hydrothermal vents and first time ROV was operated in Sangihe Talaud region including the area within Coral Triangle Region.

55. The results from the "Okeanos" survey were several series of 100-hour video and some 100,000 photographs taken by a robotic vehicle and piped to shore in real time by satellite and high-speed internet. Successful mapping of several seamounts (some are active volcanoes) was made during the survey. The trawl survey of "Baruna Jaya IV" resulted in identification of various species of fishes, belonging to 32 families, of crustaceans to family level, and of cephalopods that belong to 5 families including their types of habitat.

4.3 Mesopelagic fish research—current trends and future directions

56. The mesopelagic fish research—current trends and future directions were presented by Dr. Andrey Suntsov, ichthyologist from Pacific Island Fisheries Science Center (NOAA), Hawaii **(Annex 16)**. In outlining the pelagic environment, it was

presented as the largest ecosystem on earth. Mesopelagic is the most extensive ecosystem and considered as potential resources (Gjoseater and Kawaguchi, 1980). The most important biological features of the mesopelagic fishes are the diurnal vertical migration and the bioluminescent capabilities. They also formed the deep-sea scattering layer (DSL).

57. As regards the development of sampling gears, Dr. Suntsov shared the experience on comparing of the catch composition of micronekton among three types of sampling gears (Cobb Trawl, IKMT, and Rectangular Frame Trawl). Different types of gears were used to collect different types of organism and the composition of catches between day time and night time were also significantly different. The cobb trawl mostly captured large animals and high diversity compared to those of IKMT and Rectangular Frame Trawl. IKMT was capable of collecting more individuals in term of abundance than other sampling gears while the species richness was similar between the Rectangular Frame Trawl and IKMT. Due to the large number of mesopelagic fishes that were collected, Dr. Suntsov was also interested in deep-sea fish otoliths as they could provide the information on age, growth, and identified species by the shape of otoliths.

58. Results from the micronekton research in the northern California Current during the year 2004-2006 and the midwater fish research in Southern California current during 2008 were presented to the meeting. The mesopelagic fishes are in the intermediate trophic level. They consume lots of zooplankton, at the same time they are the important food for the pelagic fishes such as tuna, oceanic squid and baleen whales. However the trophic ecology of many mesopelagic species still not very well known. Recently, the biomass of micronekton around Guam was estimated during the R/V Oscar Elton Sette cruise earlier this year (2010).

59. Regarding to the improvement of information on mid-water fish research in Southeast Asian waters, Dr. Suntsov emphasized the need to obtain the recent data on mesopelagic species in the region. Shallow water of the Southeast Asian region is rich in biodiversity and heavily it was utilized while the deep pelagic waters remain unexploited. Moreover, four of world large marine ecosystems (LMEs) are located in Southeast Asian waters. Dr. Suntsov highlighted the importance of midwater fishes the fact that they are prey of commercial species and also competitors for the same prey. The midwater fishes also influencing general community structure and enhance stability of the ecosystem. Over the continental slope, the midwater fishes also found near shore as distinct mesopelagic boundary community linking between nearshore and oceanic ecosystems.

60. In conclusion, Dr. Suntsov suggested the meeting to test efficiency of midwater sampling gear; estimates of midwater fish diversity; community oriented studies; taxonomic training to develop the local expert on the particular species; developing on database; and communicates results through scientific papers.

61. During the discussion, the meeting was requested that further studies on deep scattering layer in the Southeast Asian waters should be considered. However, the economic return of harvesting the micronekton resources and impact of utilization on those mesopelagic species as fish meal materials should also be taken into consideration as well as the stock estimation and mesopelagic larval origin particularly lantern fishes. Moreover, the HRD program aiming at young scientists to study on deep-sea fishes and/or mesopelagic fish taxonomy should also be considered.

V. REGIONAL PLAN ON THE DEEP-SEA FISHERIES RESOURCE EXPLORATION

5.1 Standard Operating Procedure (SOP) for deep-sea fisheries resources exploration

62. Dr. Natinee Sukramongkol presented the 2nd draft of SOP that was finalized after the "Regional Workshop on the Standard Operating Procedure and Development/ Improvement of Sampling Gears for the Deep-Sea Resource Exploration" organized by the SEAFDEC Training Department in Thailand from 26 to 28 May 2009 **(Annex 17)**. The details on scope of the terms according to 'deep-sea' were defined, the sampling gears standardized; the indicators for deep-sea resources survey, and operating procedure were given as information to the meeting.

63. During the discussion, it was noted that the objective stated in the SOP draft was developed for all Member Countries to refer to as practical tools to support the deep-sea exploration in the Southeast Asian waters. The meeting agreed to input all comments, and to attach the report of this expert meeting as an appendix of the SOP draft before circulating it at an early date to all workshop participants for further comments and finalization.

5.2 Key topics for the study on impact of fishing to deep-sea ecosystem

64. A list of ecosystem concerns and scientific challenges for the study on impact of fishing on ecosystem was presented to the meeting by Ms. Penchan Laongmanee **(Annex 18)**. The presentation was aimed to inform the participants prior to the brainstorming session. Main references of the information presented are drawn from FAO fisheries report no. 838 and reports and documentation of the expert consultation on deep-sea fisheries in the high sea. Ms. Laongmanee suggested that the methods and parameters for studying the impact of fishing on ecosystem, e.g. habitat and biodiversity impact assessment, and method should be included in the benthic organism studies.

65. Ms. Laongmanee also informed the meeting the human resource capacity activity. The training workshop on research methodologies for the study on impact of fishing on deep-sea ecosystem had been set for 16-20 October 2010 in Brunei Darussalam. The training program consists of lecture and shipboard training on

topographic survey, deep-sea sampling catches sorting, primary species identification, and underwater VDO camera operating. The training workshop is to present the practical works for studying the impacts of fishing on deep-sea ecosystem to the participants. Subsequently, the deep-sea sampling gears that will be used in the training workshop were presented by Mr. Sayan Promjinda for comments by the experts **(Annex 19)**.

VI. Other matters

66. Additional presentation on the deep-sea fisheries resources survey: experience in the Andaman Sea during 1975-1999 was made by Mr. Aussanee Munprasit **(Annex 20)**. He listed six major surveys and training cruises aboard M.V. Paknam of SEAFDEC and R.V. Fisheries Research No. II of Department of Fisheries. The results suggested that deep-sea shrimp fishing grounds in the Andaman Sea can be found at 300-400 meter depth; appropriate area for bottom trawl is at 350-400 meter depth, and bottom vertical longline may be profitably deployed in the Andaman Sea.

67. Mr. Bundit Choksaguan shared with the meeting the information on another SEAFDEC program of activities under the Responsible Fishing Technologies & Practices Project (Fishing in Harmony with the Nature) with the support of Japanese Trust Fund. This program is the Reduction of the Impacts of Fishing on Coastal and Marine Environment in Southeast Asian Water (IFCOME). He suggested that as the two projects are being implemented simultaneously, the deep-sea exploration project could run in parallel with IFCOME so that the impact of the fishing on the ecosystem could be minimized.

VII. CONCLUSION AND RECOMMENDATIONS

68. It was noted that most of Southeast Asian Countries recently implement deep-sea fishery resource survey targeting high value fish using trawl. Although few studies/surveys had been conducted, the preliminary outcomes have convinced all concerned that a great potential exists in the unexploited fishing grounds in the region. Given that most local fishermen operate at a small-scale, they appear to be unfamiliar with offshore (deep-sea) fisheries, the operation of deep-sea fishing gears, and post-harvest technology, the deep-sea development must take some more time to fruition. SEAFDEC member countries have made it clear that they intend to apply the ecosystem-based fisheries management (EBFM) approach, particularly by incorporating it into the national plan for deep-sea fisheries. Due to the high cost of deep sea exploration, the activities need to get support from donors.

69. Base on the discussion, the recommendations made by the meeting are as follows:

- Pertinent guidelines on deep-sea fisheries development should be developed;
- Analysis of oceanographic information and environment assessment should be done simultaneously with the resource assessment;

- Comparison of the catches obtained by different types of gear, e.g. fish/shellfish biomass in beam and otter-board trawl, should be made;
- Efforts to reduce the deep-sea fishing impact on biodiversity should be made;
- Efforts to minimize the deep-sea fishing impact on maritime ecosystem (e.g. through using novel or environmental-friendly fishing gears) should be made;
- Pilot deep-sea shrimp trap fishery should be implemented;
- To improve fishing efficiency, the design of current trap should be modified;
- Use smaller otter and beam trawl net for sampling/assessment; To avoid damage to the marine habitats, sampling gears, particularly beam and otter-board trawl, should be made smaller;
- Formulation of a national deep-sea fisheries plan and management strategies should be made;
- Inventory of deep-sea fishes found in the Southeast Asian waters should be compiled;
- Studies of the life history of important deep-sea fishes/shellfishes, as compared with the coastal species, should be carried out;
- Bathygraphic mapping should be carried out;
- The use of ROV or DSC for faster and more efficient detection of Vulnerable Marine Ecosystems should be made.

70. In sum, the meeting suggested two major streams of following up actions. At the policy level, the formulation of a national management plan (for small-scale deep-sea fishery) should be made; and some initial implementation may be made as a small pilot project. At the research level, an extensive review of the past survey data and studies to rethink the biomass estimation. Follow-up should also be made in the following areas: development of regional guidelines for deep-sea fishery development; development of regional guidelines for fish identification; formulation of a capacity building program to prepare scientists in their regional deep-sea studies (in taxonomy, survey and analyses, etc.); exploration of new deep-sea fishing grounds; improvement of sampling gears; and socio-economic studies focusing on market demands and market values of the deep-sea resources. The meeting also recommended the establishment of a regional collaborative program that is attractive to funding agencies.

71. The meeting also suggested that a concise and easy-to-use format for data inputting for extensive review of the past deep-sea surveys should be developed and shared among member countries before submission to RAC meeting for consideration and suggestion at the February 2011 meeting.

72. In order to evolve and compile the study topics concerning the impact of fisheries on the deep-sea ecosystem, the following actions, initiatives/programs at the regional and national levels were proposed: (1) supporting of SEAFDEC on the deep-sea resources survey at the national level; (2) technical support on fish taxonomic should be provide to the Member Countries; (3) particular species on specific habitat such as fish assemblage, fish community should be study for the

future survey; (4) introducing and improving the sampling gear's design and technique e.g. mid-water trawl, mesopelagic sampling gear, gill net, bottom vertical longline ; (5) building resource person capacity on the fishing gear technology ; (6) focusing on the high-value deep-sea species (e.g. pandalid shrimp, lobster, alfonsino, deep scattering layer); (7) preservation technique on the deep-sea specimens should be included at the coming workshop in Brunei Darussalam during 16-18 October 2010; (8) Study on the vulnerable marine ecosystem; (9) Using private sector fishing boat for specimens sampling (e.g. fishing boat rental, private company's vessel); (10) encouraging the young scientists working on the particular research; (11) Alternative HRD capacity/building by learning from the expert and/or experience on the major resources survey (e.g. Koyo-Maru research vessel practical survey in South China Sea area since 2007).

VIII. CLOSING OF THE REGIONAL WORKSHOP

73. The SEAFDEC Deputy Secretary-General and Trust Fund Program Manager, Mr. Kenji Matsumoto, thanked the participants for their active participation during the meeting. He said the meeting had well to share/exchange and update the progress of deep-sea resources exploration project in the region on the study the impact on marine ecosystem. He also commended the participants' active participation and contribution during the meeting. For SEAFDEC, a greater effort to provide the participating countries with the necessary support to ensure success and sustainability of this important collaboration in the near future. After assuring the meeting that SEAFDEC would find ways and means to initiate and to implement the regional Plan of Action on Deep-Sea Resources Exploration as endorsed during the meeting, he declared the meeting closed. His Closing Remarks appears as **Annex 2**1.

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Annex 2

Opening Address
By SEAFDEC Deputy Secretary-General

The Expert Meeting on Deep-Sea Fishing and Its Impact to Ecosystem
31 August – 2 September 2010, Bangkok, Thailand

Representatives from the SEAFDEC Member Countries,
Distinguished guests,
Ladies and Gentlemen, Good Morning!

On behalf of SEAFDEC, I am very pleased to extend to each of you our warmest welcome to this 3-day Expert Meeting. The theme we are going to discuss is "*Deep-Sea Fishing and Its Impact on Marine Ecosystem.*" I am most grateful to you for the high priority that you have set for the participation here.

Fishery policy makers in the Southeast Asian Countries and elsewhere in the world have expressed their deep concerns over the widespread degradation and serious depletion of fishery resources in the coastal area. As an immediate remedy to the problems arising from the growing fishing efforts, they have suggested that a new and promising fishery resource must be found, most probably in certain deep-sea areas, through fishing exploration. In serving its member countries, SEAFDEC, particularly its Training Department, has been supporting the various national efforts, with the active financial and technical support of Japanese Government.

The ecosystem-based management is an approach that recognizes the full array of interactions within an ecosystem, including humans, rather than a single issue, species, or certain ecosystem services in isolation. It has been made known a few years before the turn of the century, and has been well accepted globally. As our interest in fishing has now been turned to the deep seas, we also need to apply the ecosystem approach as the fishing activities shall be carried out simultaneously with all activities in various other sectors. Fears have been expressed at different levels and at the United Nations that the multifaceted exploitation could easily render the deep sea areas a highly vulnerable ecosystem. Our interest in the sustainable development and in safeguarding of valuable fishery resources require that essential information must be compiled systematically in order that all stakeholders are well aware of the time series status of their target resources and the rates of exploitation. All these are essential to ensure that the valuable resources in the deep seas and their natural characteristics are managed sustainably and effectively by all their stakeholders.

Your representation in this meeting is highly expected indeed. Not only that we look forward to your technical strategies of the best deep-sea fishery resource exploration, your national viewpoints as reflected by other policy makers as well as fishermen

are also seen as valuable. Our staffs at the Training Department are expected to work very hard to synthesize all your views and contributions into a strategic proposal that will be actively discussed in the upcoming Regional Training Workshop on Fishing Impact Assessment in Deep-Sea Ecosystem, now scheduled to be held 16-20 October 2010 in Brunei Darussalam.

Ladies and Gentlemen, I now take great pleasure in declaring this expert meeting open. I very much look forward to your active discussion and valuable contributions during this meeting. I sincerely believe that the conclusions that you reach at the end of this meeting will be solid and pragmatic, something that meets with a high appreciation of not only SEAFDEC, but also of the national policy makers in all SEAFDEC member countries.

Thank you once again and have a good day !!!

Annex 3

PROSPECTUS

Keywords: deep-sea fishery exploration, fishery management, fishing, vulnerable marine ecosystem

1) Background

SEAFDEC has supported exploration of fishery/living resources in the deep-sea waters of the Southeast Asia through various programs in close collaboration with its Member Countries. The overall aims of this program are: to explore ways to collect the information on the deep-sea fishery resources in the Southeast Asian waters including the support on actual survey using SEAFDEC's research vessels or national research vessels; to encourage SEAFDEC's Member Countries to explore deep-sea fishery resources; and to build human resources capacity on deep-sea fishery resources exploration.

As far as ecosystem-based approach for fisheries management is international concerns, there is a need to know the impact of fishing to deep-sea ecosystem. This expert meeting provide opportunity to scientists from SEAFDEC's Member Countries for better understanding of knowledge on impact of fishing on deep-sea ecosystem (particularly on the seabed) and also to share their experience related to deep-sea fishery resources exploration.

The three-day Expert Meeting will be organized as the first initiative of the region to gather deep-sea scientist and fishery researchers to discuss on the topic focusing on the impact of fishing on the sea-bottom ecosystem considering Vulnerable Marine Ecosystems of the ocean. In addition, this Meeting will also provide a platform for upcoming regional important event "Regional Training Workshop on Research Methodologies for Study on Impact of Fishing on Deep-sea Ecosystem", scheduled during 16-20 October 2010 at Brunei Darussalam.

2) Objectives

1.1 Provide knowledge and better understanding of deep-sea ecosystem

1.2 Review and update regional/national initiatives related to deep-sea fishery resources exploration in the Southeast Asian Region*1*

1.3 Share experience and exchange view on the study on impact of fishing on deep-

[1] In following-up to the previous regional events:
- Regional Workshop on the Standard Operating Procedure and Development/Improvement of Sampling Gears for Deep-sea Resource Exploration organized by TD during 26-28 May 2009; and
- Regional Training/Workshop on Identification of Deep-sea Fishes organized by TD during 18-22 January 2010.

sea ecosystem among the experts

1.4 Identify topics for study on the impact of fishing on the deep-sea ecosystem.

3) Expected Outputs

2.1 A regional review on the initiatives activity/program related to the study on impact of fishing to deep-sea ecosystem.

2.2 Set of recommendations for regional study on impact of fishing on deep-sea ecosystem

2.3 Set of suggestion for the topics to be include in the upcoming training/workshop on the study on impact of fishing on deep-sea ecosystem

4) Time and Venue:

The proposed meeting is tentatively scheduled for the period of 31 August – 2 September 2010 at Jasmine City Hotel, Bangkok

5) Participants:

Participants of the Meeting include international/regional experts and scientist/researchers from SEAFDEC Member Countries, who has involved on issue related to deep-sea fishery resources exploration, particularly on impact of deep-sea fishing on the ecosystem.

6) Budget Supporters:

The program is initially supported by the Japanese Trust Fund Program through SEAFDEC. The participant will be provided with SEAFDEC/TD' standard; including international economy air-ticket, DSA, and accommodation.

Annex 4

Agenda and Timetable

Date/Time	Agenda	Facilitator/Presenter
31 Aug 2010, Tue		
Agenda 1 Opening of the meeting		
09:00-09:15	Opening of the meeting	Mr. Kenji Matsumoto (DSG/DTDC)
Agenda 2 introduction, Chair by **Mr. Aussanee Munprasit**		
09:15-09:30	Introduction of the meeting	Dr. Worawit Wanchana
09:30-10:00	Summary activities of SEAFDEC on the deep sea fisheries resources exploration in the Southeast Asian region	Ms. Penchan Laongmanee
Agenda 3 Review regional/national initiatives related to deep-sea fisheries recourses exploration and the study on impact of fishing to deep-sea ecosystem , Chair by **Mr. Aussanee Munprasit**		
10:00-10:30	Refreshment break, group photo	
10:30-11:00 11:00-11:30 11:30-12:00	Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem - Brunei Darussalam - Indonesia - Malaysia	Ms.Desimawati Haji Metali Dr. Fayakun Satria Mr.Mohd Sufian Sulaiman
12:00-13:30	Lunch break	
Cont.: Agenda 3 Review regional/national initiatives related to deep-sea fisheries recourses exploration and the study on impact of fishing to deep-sea ecosystem , Chair by **Dr. Somboon Siriraksophon**		
13:30-14:00 14:00-14:30 14:30-15:00	Cont.,Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem - Myanmar - Philippines - Thailand	Mr. Myint Pe Mr. Rafael Ramiscal Mr. Weera Pokapan
15:00-15:30	Refreshment break	
15:30-16:00 16:00-16:30	Cont., Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem - Vietnam - Japan	Ms. Thuy Duong Nguyen Dr. Yoshinobu Konishi
18:30	Welcome dinner	

Date/Time	Agenda	Facilitator/Presenter
1 Sept 2010, Wed		
Agenda 4 Sharing of experiences and information related to deep-sea fisheries recourses exploration and the study on impact of fishing to deep-sea ecosystem Chair by **Mr. Bundit Chokesanguan**		
09:00-10:00	International initiatives related to study on impact of fishing to deep-sea ecosystem and the International Guidelines for the Management of Deep-sea Fisheries in the High Seas	Dr.Somboon Siriraksophon (SEAFDEC/SEC)
10:00-10:30	INDEX-SATAL: A US and Indonesia Partnership to Explore Indonesia's Sea	Dr. Fayakun Satria
10:30-11:00	Refreshment break	
11:00-12:00	Mesopelagic fish research – current trends and future directions	Dr. Andrey Suntsov (Pacific Island Fisheries Science Center (NOAA)
12:00-13:30	Lunch break	
Agenda 5 Regional plan on the deep-sea fisheries resource exploration , Chair by **Dr. Worawit Wanchana**		
13:30-14:00	Standard Operating Procedure for deep-sea fisheries resources exploration	Dr.Natinee Sukramongkol
14:00- 14:30	List of ecosystem concern and scientific challenges for the study on impact of fishing to ecosystem	
14:30-15:00	Refreshment break	
15:00-17:00	Brainstorming on study topic and its priority for the study on impact of fishing on deep-sea ecosystem in the Southeast Asian Water	
2 Sept 2010, Thu		
Agenda 6 , Follow up action, Chair by **Dr. Worawit Wanchana**		
09:00-11:00	Brainstorming for follow up action at nation/regional level	
10:30-11:00	Refreshment break	
11:00-12:00	Other matters	
12:00-13:30	Lunch break	
Agenda 7 , Conclusion and closing ,Chair by **Dr. Worawit Wanchana**		
14:30-16:00	Conclusion and recommendation	
Agenda 8 , Closing of the meeting ,Chair by **Dr. Worawit Wanchana**		
16:00-16:15	Closing of the meeting	

Annex 5

Activities of SEAFDEC on Deep-Sea Resource Exploration in the Southeast Asian Region

Penchan Laongmanee and Natinee Sukramongkol
Southeast Asian Fisheries Development Center

Activities of SEAFDEC on Deep-Sea Resource Exploration in the Southeast Asian Region

Penchan Laongmanee
and
Natinee Sukramongkol

Background

Due to the depletion of the inshore/coastal fisheries resources in the Southeast Asian Countries , fishery policy makers in the Southeast Asian Countries respond to that problem by searching of new fishing ground targeting at **deep-sea area.**

In serving SEAFDEC Member Countries, SEAFDEC Training Department, with the active financial and technical support of Japanese Government start the "Deep Sea Fisheries Resources Exploration in the Southeast Asia" since 2007, with the aim to encourage member countries conducting the deep sea fishery resources survey in their EEZ.

2

Activities

- Activity1: Support deep-sea fisheries resources survey of Member Countries
- Activity2: Study impact of fishing to deep-sea eco-system
- Activity3: Development/Improvement of sampling gear and exploration methodology
- Activity4: HRD programs on Deep-sea fisheries resources exploration
- Activity5: Information Dissemination

3

Activity1: Support deep-sea fisheries resources survey

Support technical staff of SEAFDEC/TD to join the actual survey on M.V.SEAFDEC2 and national research vessel

-2008 Philippine (M.V.DA-BFAR) and Brunei
-2009 Brunei
-2010 Malaysia and Brunei

4

M.V.SEAFDEC2 Cr29-2/2008, Brunei water, 4 June-5 July 2008

Objectives: To assess demersal fish resources in zone 3 (100-550 m)

Sampling gears :

- Beam trawl/9 st (100-380 m)
- Bottom otter board trawl/11 st (100-160 m)
- IKMT/10 st,
- Bongo net/15 st
- Neuston net /15 st
- Acoustic survey : 20 track
- Oceanographic survey : 28 stations

IKMT net

5

M.V.SEAFDEC2 Cr29-2/2008, Brunei water, 4 June-5 July 2008

6

M.V.SEAFDEC2 Cr31-1/2009, Brunei water, 6 March-11 April 2009

Objectives: To assess demersal fish resources in zone 3 (100-550 m)

Sampling gears :

- Beam trawl /9 st.(100-350 m)
- Bottom otter board trawl /11 st. (100-130 m)
- IKMT/3 st
- Bongo net /12 st
- Neuston net /12 st
- Acoustic survey : 4 track (rough sea)
- Oceanographic survey : 21 st.

7

M.V.SEAFDEC2 Cr31-1/2009, Brunei water, 6 March-11 April 2009

8

M.V.SEAFDEC2 Cr35-3/2010, Sabah-Sarawak water, Malaysia, 28 June-11 August 2010

9

M.V.SEAFDEC2 Cr35-3/2010, Sabah-Sarawak water, Malaysia, 28 June-11 August 2010

Objectives: To assess demersal fisheries resources in off Sabah and Sarawak water

Sampling gears :

- Beam trawl/21 st (200-400 m)
- Bottom vertical longline/8st (200-450 m)
- Deep sea pot/8 st (200-425m)
- Bongo net/23 st
- Oceanographic survey : 23 stations

10

Activity2: Study impact of fishing to deep-sea eco-system

- Technical consultation meeting (This meeting)
- Training on research methodologies for study on impact of fishing on deep-sea ecosystem 16-20 October 2010, Brunei Darussalam

11

Activity3: Development/Improvement of sampling gear and exploration methodology

- Workshop on the Standard Operating Procedure (SOP) and Development of Sampling Gears for Deep-Sea Resource Exploration 26-28 May 2009 at SEAFDEC/Training Department

12

Workshop on the Standard Operating Procedure and Development of Sampling Gears for Deep-sea Resource Exploration

- 22 Participants: SEAFDEC/TD and MFRDMD, Brunei, Japan, Indonesia, Philippine, Malaysia, Myanmar Thailand and Vietnam
- Output

- Draft SOP for Deep-Sea Resources Exploration in Southeast Asian Region
- Suggestion for deep-sea fisheries resource sampling gear
- Network of scientist

13

Activity4: HRD programs on Deep-sea fisheries resources exploration

- Ship board training on deep sea exploration 11-25 May 2008
- Training Workshop on Identification of Deep-sea Fish during 18-22 January 2010
- Training on research methodologies for study on impact of fishing on deep-sea ecosystem 16-20 October 2010, Brunei Darussalam (coming event)

14

Ship board training on deep sea exploration on M.V.DA-BFAR (Philippine)

The training was co-organize with Bureau of Fisheries and Aquatic Resources, the Philippine

To enhance the human resources capacity on the deep sea resources exploration including

- Methodology for samplings of deep sea fisheries resources,
- Identification of deep-sea fish and larval fishers

15

Activities

- Topographic survey by Echo sounder
- Operated 11 Beam trawl (280-1000 m)
- Deep-sea trap 3 st (270-600 m)
- Preliminary identification of catch
- Specimen Photography
- Preservation technique

Participants from Member Countries : Brunei (1) , Indonesia (1), Malaysia (2), Philippine (5), Thailand (1) , Vietnam (1) and SEAFDEC staffs (5)
Resource person:
Fish taxonomist : Mr. Montri Sumontha
Invertebrate zoology: Associate Professor Kotaro Tsuchiya, Tokyo University of Marine Science and Technology

16

Ship board training on deep sea exploration on M.V.DA-BFAR

Training Workshop on Identification of Deep-sea Fish

- Enhance the human resources capacity on deep-sea fish species identification;
- Encourage the SEAFDEC Member Countries to initiate deep-sea resources exploration ensuring the accurate deep-sea fishes identification

Participants from Member Countries : Brunei (2), Indonesia (1), Malaysia (1), Philippine (1), Thailand (2) , Vietnam (1) and SEAFDEC staffs (2)
Resource person:
1.Dr. Yoshinobu Konishi
2.Dr. Fayakun Satria, Research Center for Capture Fisheries, Indonesia
3.Assistant Professor Dr. Toshio Kawai, Fisheries Science Center, The Hokkaido University Museum

18

Training Workshop on Identification of Deep-sea Fish

19

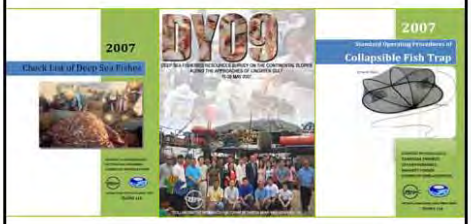
Training Workshop on Identification of Deep-sea Fish

Activity5: Information Dissemination

- Project Website: http://map.seafdec.org/DeepSea/

21

Activity5: Information Dissemination



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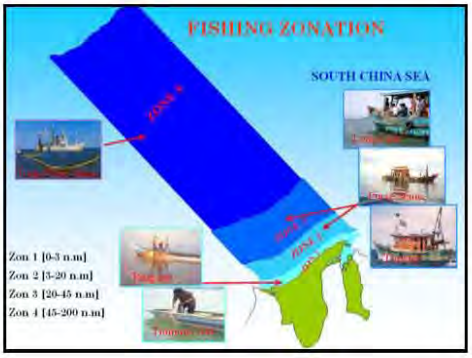
Activity5: Information Dissemination

Activity5: Information Dissemination

Annex 6

Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem in Brunei Darussalam

Desimawati Haji Metali
Department of Fisheries, Ministry of Industry and Primary Resource,
Brunei Darussalam



CHARACTERISTIC OF OFFSHORE AREA

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

INTRODUCTION – DEEP WATER SURVEY

- The survey is in line with the goal of the Department of Fisheries to assess and determine the fisheries potential of the offshelf marine areas of Brunei Darussalam from the continental edge onwards for sustainable fisheries development.
- Aims to provide the most recent information on the deep water demersal marine resources of Brunei Darussalam

GENERAL OBJECTIVES

- The main objective of the survey this time is to assess ecological resources including the **deep demersal fisheries resources** in the area that covers zone 3 and 4 and to achieve sustainable development of these resources through proper management via the use of scientific data generated by the systematic surveys.
- To assess the health of the marine environment of the demersal fish stocks in the offshelf marine areas by conducting oceanographic survey simultaneously with the demersal surveys

SPECIFIC OBJECTIVES

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

PROGRAMMES – MV SEAFDEC 2

- June, 2008
- March – April, 2009
- September – October, 2010
- Overall analysis and finding from above survey

FISHING STATION

Otter board trawl

FISHING STATION

Beam trawl

RESEARCH SURVEY AND RESULTS

- Annual surveys have been carried out regularly by Department on the shelf areas at depths of less than 100 m.
- Key results:
- Oceanographic data reveals healthy and normal conditions of the marine environment

RESEARCH SURVEY AND RESULTS - 2008

Deep-water otter-board trawl

- Survey indicates the fish density along the continental slope ranging from 0.63 to 1.53 mt/km2 among the valid hauls with an average of about **1.18 mt/km2**.
- The value is slightly lower than the value obtained in the 2006 survey at 1.21 mt/km2.
- The species composition from the deep-water demersal trawl is dominated by the lizard fish, *Saurida tumbil* and nemipterids with 15% and 12 % respectively of the total catch. The catch composition is almost similar with the 2006 survey.

RESEARCH SURVEY AND RESULTS - 2008

- The beam trawl survey on the other hand resulted in a lower density of fish at **0.64 mt/km2** mainly due to a smaller sampling gear coverage.
- The species composition of the beam trawl is analyzed according to the sampling depths. The species composition of the 105-163 meter depth is almost similar with the demersal trawl catch composition.

RESEARCH SURVEY AND RESULTS - 2008

The species composition from the lower continental slope from the 215-374m depth stations were almost entirely different consisting of deep-water fishes that were dominated by silverbelly seaperch at 12.4%. It is followed by other deep water species including lantern fish and beardfish at 9.8% and 9.7% respectively.

- Surprisingly, a significant amount of deep water **shrimps and** crustaceans (7.2%) were found in the 215-374 m depth catch. It includes *Heterocarpus sp, Plesionika sp., Parahempomadus sp., and Metanephrops sp to name a few.*
- These rare species were also found in the deep waters of the neighboring countries like the Philippines, Malaysia and Indonesia.

DEEP WATER SHRIMP

Plesionika sp.

Parahempomadus sp.

Metanephrops sp.1

Heterocarpus sp

Fishing operation results 2009

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

Result of Otter board trawl

Fish species (Otter trawl)

Nemipterus sp.

Saurida sp.

Priacanthus sp.

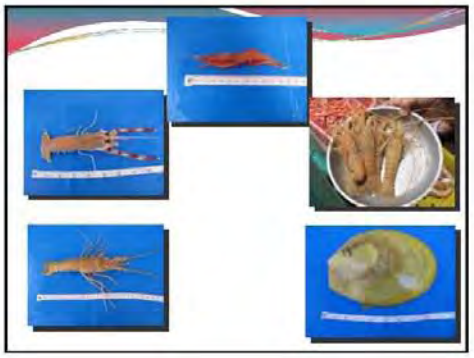
Lutjanus sp.

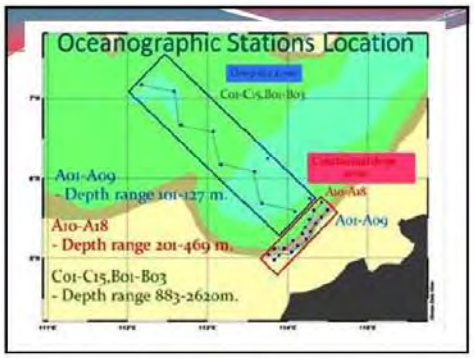
Capture (Otter trawl)

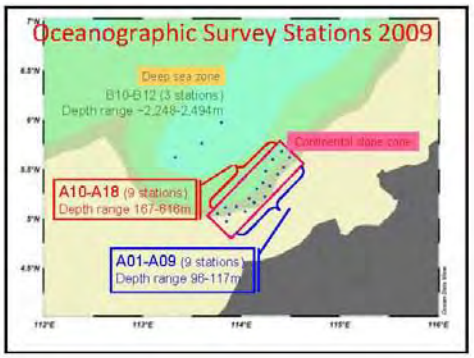

Result of Beam trawl

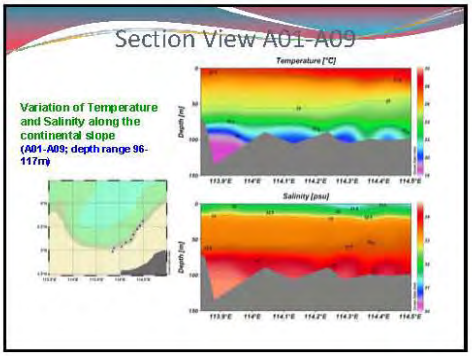

Result of Beam trawl
Flat fishes
Deep sea Shrimps

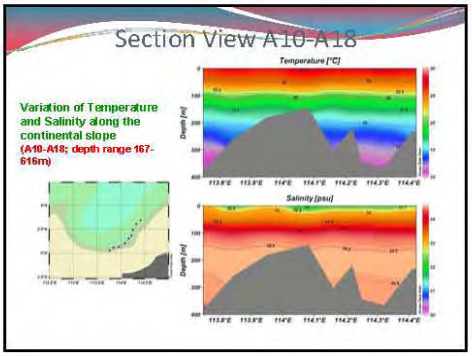

Deep sea fishes

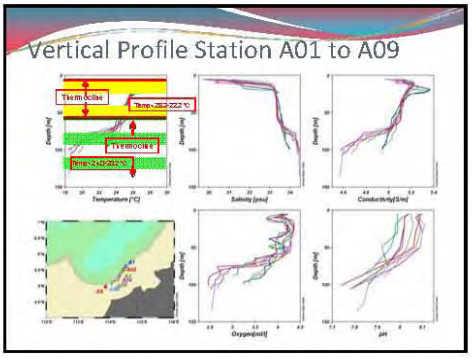


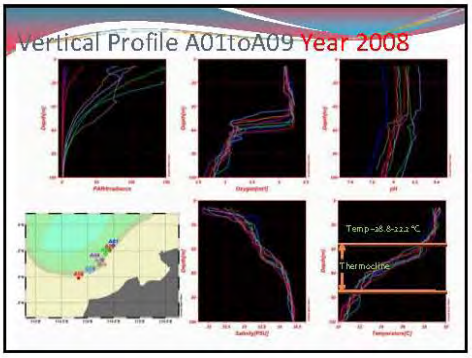

Oceanographic Stations Location
C01-C15,B01-B03
A01-A09
- Depth range 101-127 m.
A10-A18
- Depth range 201-469 m.
C01-C15,B01-B03
- Depth range 883-2620m.

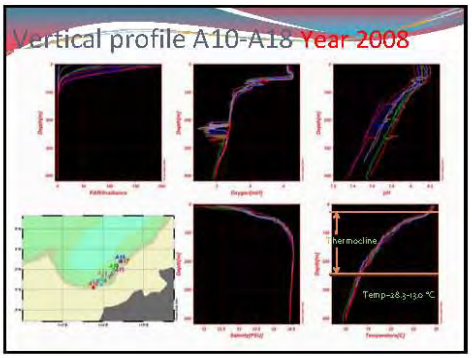

Oceanographic Survey Stations 2009
Deep sea zone
B10-B12 (3 stations)
Depth range ~2,248-2,494m
Continental slope zone
A10-A18 (9 stations)
Depth range 167-616m
A01-A09 (9 stations)
Depth range 98-117m

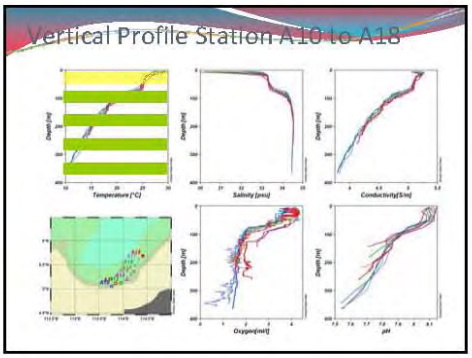

Section View A01-A09
Variation of Temperature and Salinity along the continental slope
(A01-A09; depth range 96-117m)
Temperature [°C]
Salinity [psu]

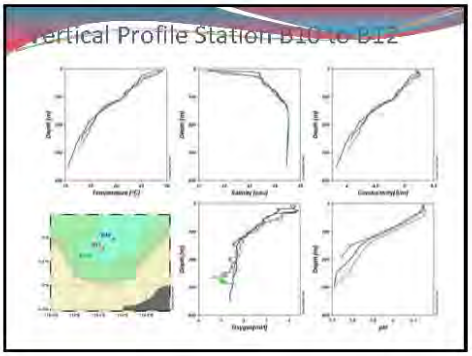

Section View A10-A18
Variation of Temperature and Salinity along the continental slope
(A10-A18; depth range 167-616m)
Temperature [°C]
Salinity [psu]

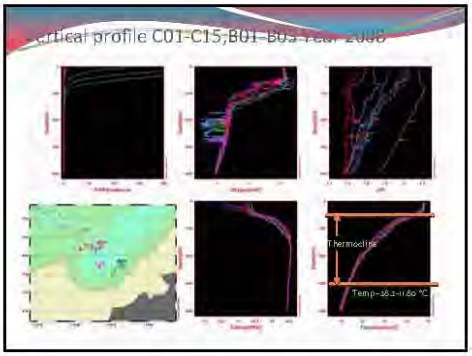

Vertical Profile Station A01 to A09
Thermocline
Thermocline


Vertical Profile A01toA09 Year 2008
Temp~28.8-22.2 °C
Thermocline


Vertical profile A10-A18 Year 2008
Thermocline
Temp~28.3-13.0 °C


Vertical Profile Station A10 to A18





CONCLUSION

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

CONCLUSION

- The general conclusion based on the preliminary examination of the data shows a good potential for deep water-shrimps in the area. The new discovery poses a challenge to the research group and in view of this, a follow-up survey is recommended to verify the results of the survey.
- The surveys albeit very limited has generated enormous amount of data that needs to be analyzed. However, a limitation on the number of expert to analyze water samples and locally to analyze acoustic and oceanographic data hinders the progress of the end results of the surveys.

CONCLUSION

- Valuable oceanographic data were generated to validate previous information collected in the past to determine any changes that can influence the plankton and fish biomass of the marine resources. Among these are the samples collected by IKMT that provides for the first time a sample of the **back scattering layer in Brunei Darussalam.**
- Another survey proposal for 2010 will be done in September to verify the results of the previous surveys specially the 2008 and 2009 survey along the continental slopes of Brunei Darussalam. The proposed survey will focus on deep water demersal resources along the continental slopes. And hopefully this will strengthen results from the previous surveys by focusing on important and specific fishery resources and the habitat for sustainable development.

RECOMMENDATION

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

Annex 7

Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem in Indonesia

Fayakun Satria
Research Center for Fisheries Management and Conservation, Indonesia

Initiatives/program on deep-sea fisheries resources exploration and the study on impact of fishing to deep-sea ecosystem INDONESIA

Fayakun satria

Research Center for Fisheries Management and Conservation

Bangkok, 31 August 2010

BACK GROUND

1. Human demand on fish → Increase
2. Conventional resources → Decrease
3. *Alternative → Untapped resources (Deep sea and high seas)*
4. To know the impact of fishing to the *deep sea* ecosystem → Sustainability

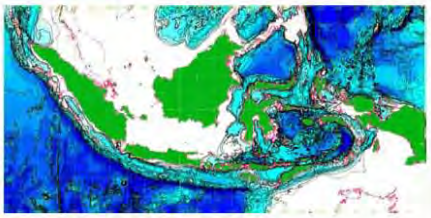
Deep Sea

Deep-sea → the biggest habitat on the earth. 53 % marine water has depth >4000 m (*FAO 2008*)

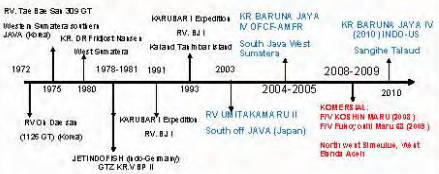
sumber : FAO 2008

Defentions→ *Deep sea* >200 m (*Thistle 2003; Jab dan Wilkinson 2008*)

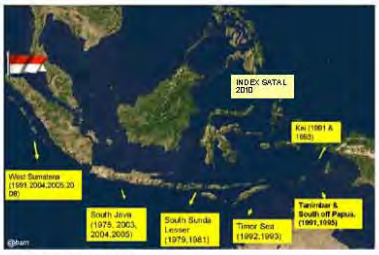
Bathymetry profile of Indonesian waters



Indonesia Deep sea resource research and exploration



DEEP SEA REASEARCH LOCATION : Mainly in the south (Indian Ocean)



Source Bambang sm bao , modified

DEEP SEA TRAWLER

Current status of deep sea fishing in Indonesia waters

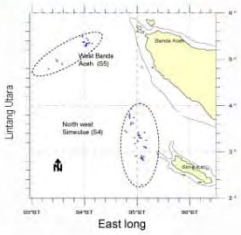
- The past exploration/expedition of the deep sea resources were mainly answer question of WHAT?
- The results of the study were published in the forms of poster, report , book and journals
- 2008 – 2009 was the bench mark of Indonesian commercial deep sea demersal fish started.
- 2010 The practice of deep sea commercial fishing (Pelabuhan Ratu (Gill net) and Banda (trawl) → Ordinary fishing licence

Shortage

- Indonesia currently do not have regulation specific regulate the deep sea fishing practice VS Demand to utilize the deep sea resource
- The impact of the practice of deep sea fishing in tropical waters not yet study→ lack knowledge
- The biological knowledge of deep sea species in Indonesia currently very limited.

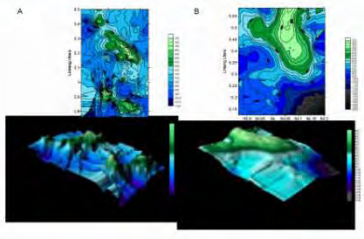
Fishing on Deep sea Demersal Resources and Indication on its Impact to the Deep Ecosystem

Research area



Sea bed Bathymetry

A. North west SIMEULUE B. West of BANDA ACEH

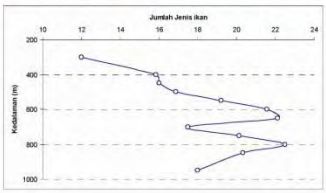


Deep sea demersal fishes

- 145 deep sea demersal species out of 62 family
- Distribution pattern → *clumped*

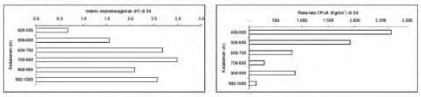
Family	spesies	Family	spesies
Acropomatidae	1	Melanostidae	1
Alepsauridae	1	Microstomatidae	2
Alepocephalidae	10	Moridae	5
Anoplogastridae	1	Muraenesocidae	2
Aplelegeidae	1	Nettastomatidae	1
Bathyclupeidae	1	Nomeidae	2
Benyidae	1	Notacanthidae	1
Bothidae	1	Notosudidae	1
Bregmacerotidae	1	Ogocephalidae	3
Caproidae	2	Ophidiidae	12
Carapidae	1	Ostracoberycidae	1
Centrolophidae	1	Pentedidae	3
Chaunacidae	3	Poecilopsettidae	1
Chlaenodontidae	2	Polymixiidae	1
Chimaeridae	2	Rajidae	4
Chlorophthalmidae	2	Rhinochimaeridae	2
Colocongridae	1	Scombrolabracidae	1
Congridae	2	Scorpaenidae	4
Cerocithyidae	1	Scyliorhinidae	2
Diretmidae	1	Serranidae	1
Epigonidae	2	Sominosidae	1
Etmopteridae	1	Squalidae	1
Gempylidae	1	Stomiidae	1
Grammicolepididae	3	Syriaphobranchidae	2
Hexanchidae	1	Torpedinidae	1
Hexatrygonidae	1	Trachichthydae	2
Hispidoberycidae	1	Triacanthodidae	7
Hoplichthyidae	2	Trichiuridae	1
Ipnopidae	2	Triglidae	1
Lophidae	1	Zeidae	3
Macrouridae	17	Zoarcidae	1

Trend of Biodiversity VS Depth



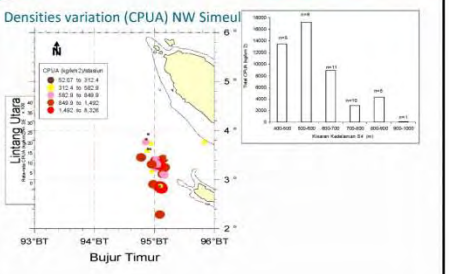
Biodiversity and CPUA

North West of Simeulue

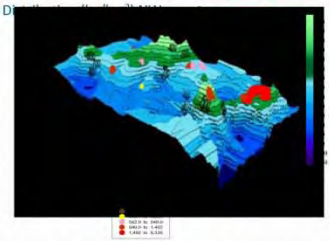


West of Banda Aceh

Densities variation (CPUA) NW Simeul

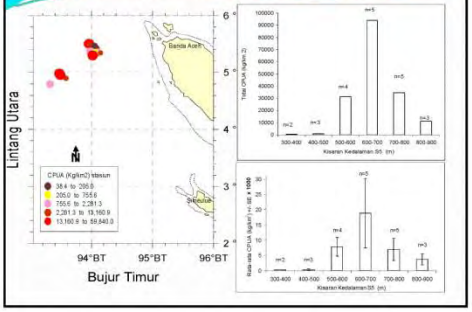


CPUA D

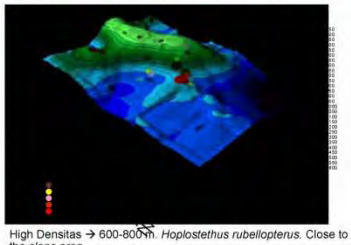


High densitas → 400 – 600 m. *Beryx splendens* → closed to the *slope* area

Densities variation (CPUA) West Banda Aceh

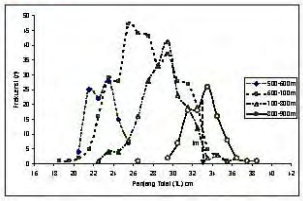


CPUA Distribution (kg/km^2) West Banda Aceh (S5)



High Densitas → 600-800 m. *Hoplostethus rubellopterus*. Close to the *slope* area

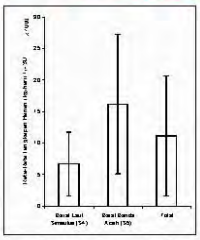
Size VS Depth



Size distribution FL (cm) *Hoplostethus rubellopterus* versus Depth

Coomercial fishing first attempted in Indonesian waters 2008

Several important deepsea demersal fishes Occurred in the area



Average of Daily catch F/V Koshin Maru No 01 on both North west Simeulue and West Banda Aceh.

Discard estimation

RV Baruna Jaya IV tahun 2005
7,64 % - 13,42 % → Out of total catch
90,34 % - 94 β % → Out of overall species

Discard Estimation (F/V Koshin Maru No 01)

N Trip	Estimasi Total Catch (Ton)	(Ditahan) *Retained* Catch (Ton)	(Dibuang) *Discard* Catch (Ton)	% *Discard*
Trip 1	491,20	242,10	249,10	50,71
Trip 2	543,50	414,80	128,70	23,68
Trip 3	169,80	156,20	13,60	8,01
Total	1204,50	813,10	391,40	32,49

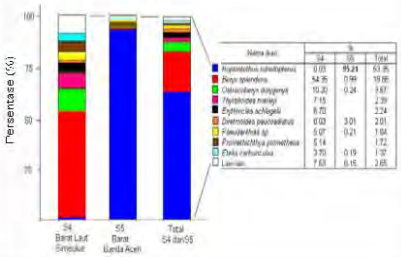
The Index value of importance
S4 (North west Simeulue) and S5 (West Banda Aceh)
Issue of lost biodiversity

Peringkat Penting	Area			
	S4	INP	S5	INP
1	*Ostracoberyx dorigerps*	141,42	*Hoplostethus rubellopterus*	249,86
2	*Beryx splendens*	36,55	*Ostracoberyx dorigerps*	19,12
3	*Diretmoides pauciradiatus*	35,09	*Diretmoides pauciradiatus*	18,94
4	*Hoplostethus rubellopterus*	23,19	*Coelorinchus divergens*	2,33
5	*Hoplostethus crassispinus*	12,67	*Beryx splendens*	1,15
6	*Coelorinchus divergens*	10,35	*Bittaxum a solitarium*	1,13
7	*Lampogramm us niger*	3,89	*Hoplostethus crassispinus*	0,85
8	*Glyptophidium sp.*	3,88	*Chloropithalm us sp.1*	0,84
9	*Helicrayon longirostra*	2,59	*Benthodesmus tenuis*	0,37
10	*Gram micolepis sp.1*	2,40	*Idiacanthus sp.*	0,28

Lowest INP (Issue of lost biodiversity)

No	Barat Bat Sime ulue (S4)		Barat Banda Ace h (S5)	
	Nama ikan	INP	Nama ikan	INP
1	*Alepocephalidae* sp.2	0,0099	*Zoarcidae* sp.	0,0023
2	*Bregmaceros* sp.	0,0100	*Leptoderma retropinnum*	0,0023
3	*Malthopsis annulifera*	0,0101	*Hyperoglypha japonica*	0,0025
4	*Congridae* sp.2	0,0105	*Triacanthodidae* sp.	0,0025
5	*Bathygadus* sp.	0,0107	*Halicmetus* sp.	0,0026
6	*Atrophacanthus japonicus*	0,0108	*Notacanthus abbotti*	0,0028
7	*Cubiceps pauciradiatus*	0,0109	*Narcetes* sp.	0,0029
8	*Poecilopsetta* sp.	0,0110	*Nessorhamphus ingolfianu*	0,0032
9	*Cyttomimus affinis*	0,0110	*Diptcrus* sp.	0,0045
10	*Bathyphylax bombiensis*	0,0112	*Physiculus* sp.	0,0046
11	*Ventrifossa* sp.3	0,0115	*Chascanopsetta* sp.	0,0047
12	*Scombrolabrax heterolepis*	0,0116	*Monomitopus* sp.2	0,0050
13	*Nessorhamphus ingolfianus*	0,0125	*Etmopterus* sp.	0,0052
14	*Anoplogaster cornuta*	0,0127	*Pyramodon* sp.1	0,0052
15	*Neobythites* sp.1	0,0138	*Pyramodon ?*	0,0052
16	*Pterygotrigla* sp.	0,0157	*Etmopterus* sp.	0,0052
17	*Bathyclupea argentea*	0,0157	*Chelidoperca* sp.	0,0053
18	*Ilyophis brunneus*	0,0158	*Scyliorhinus* sp.	0,0062
19	*Chloropithalmus acutifrons*	0,0196	*Neobythites* sp.1	0,0187

Species and proportion deep sea demersal caught and retained by F/V Koshin Maru No 01

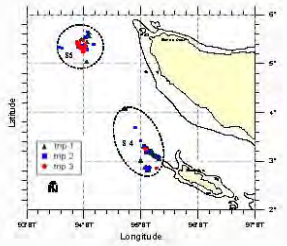


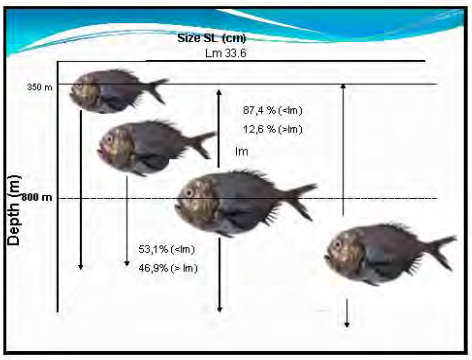
EXPORT TO THAILAND

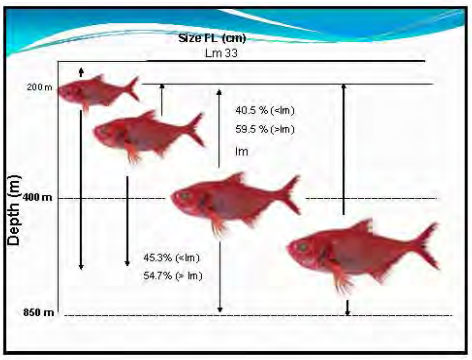
Beryx splendens

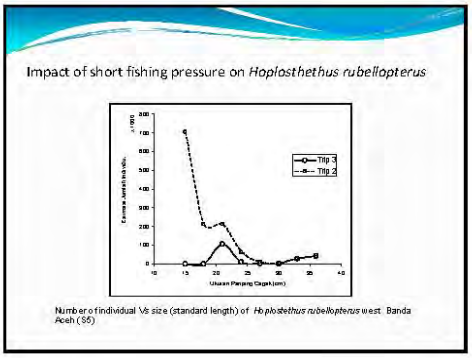
Phuket Thailand

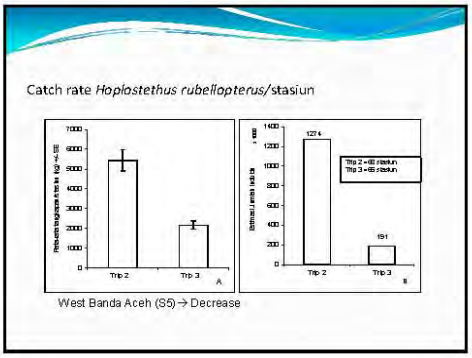
Fishing Ground of F/V Koshin Maru no 01

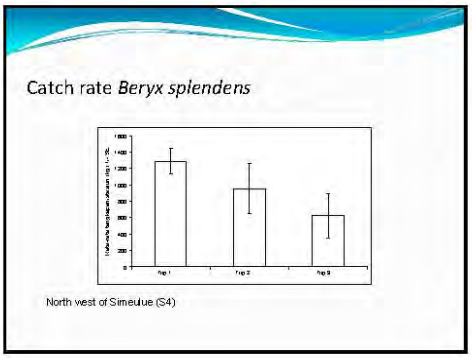


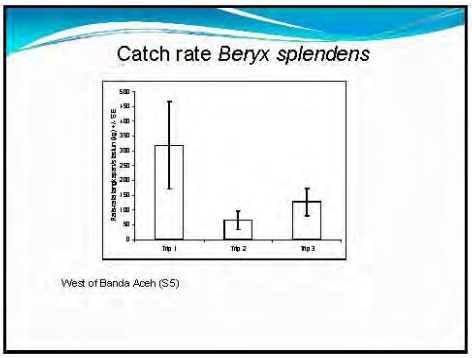

Size SL (cm)
Lm 33.6
350 m
800 m
Depth (m)
87,4 % (<lm)
12,6 % (>lm)
lm
53,1% (<lm)
46,9% (> lm)


Size FL (cm)
Lm 33
200 m
400 m
850 m
Depth (m)
40.5 % (<lm)
59.5 % (>lm)
lm
45.3% (<lm)
54.7% (> lm)


Impact of short fishing pressure on Hoplosthethus rubellopterus
Trip 3
Trip 2
Number of individual Vs size (standard length) of Hoplosthethus rubellopterus west Banda Aceh (S5)


Catch rate Hoplostethus rubellopterus/stasiun
Trip 2
Trip 3
A
1274
191
Trip 2
Trip 3
B
West Banda Aceh (S5)→ Decrease


Catch rate Beryx splendens
North west of Simeulue (S4)


Catch rate Beryx splendens
Trip 1
Trip 2
Trip 3
West of Banda Aceh (S5)

Destruction on habitat

Required further study

hammer sharks Incidentally caught by deep sea trawl

Conclusion

- Deep sea demersal fishes in Indonesia waters characterized by high diversity but most of the species are low in densities
- Only few species that quantitatively have a high densities.
- Catch rate of targeting species →decrease over time
- The practice of discard considerably high → Lost biodiversity
- Habitat destruction occurred in the trawling area
- Decision to utilize the resource should be very careful, very precautionary approach, well manage.

OUTLOOK

- Further Study on the impact of the practice of deep sea fishing (trawl and other gears)
- Further study on how to minimize the impact of the deep sea fishing practice
- Study on the best practices of the deep sea fishing (trawl and other gears)

ACKNOWLEDGEMENT

- The information provided in this presentation was from:
  - OFCF-AMFR Deep Sea Joint Exploration 2004-2005
  - Fayakun Satria Disertation
  - Koshin Maru No 01 Commercial fishing exploration 2008

Annex 8

Deep-sea fishing in Malaysia

Hj Sufian bin Sulaiman
Deep-Sea Fisheries Development Section,
Department of Fisheries, Malaysia

EXPERT MEETING ON DEEP-SEA FISHING
AND ITS IMPACT TO ECOSYSYTEM
31 AUGUST – 2 SEPTEMBER 2010
BANGKOK, THAILAND

DEEP-SEA FISHING IN MALAYSIA

General Over View

- Long coastline 4,900 km
- 13 states
- 47,000 sq nautical miles of maritime area
- EEZ declaration expanded to 162,000 sq nautical miles
- Rich marine resources

MALAYSIA

Geophysicals:

- Land area: 329,733 km²
  - Peninsular 40%
  - Sabah 22%
  - Sarawak 38%
- Coastline: 4,900 km
- Coastal area: 373,500km²
- EEZ area: 548,800 km²
  - Sarawak 29%
  - Sabah 16%

BACKGROUND

- Total Marine Fisheries Production 1,377,809 metric tonnes of the total fisheries production and contributed to RM 5,098.92 billion in 2008.
- Deep sea fisheries contributed to 311,715 metric tonnes in 2008 at of the national fisheries production.
- Demand on fish and fisheries product increases

BACKGROUND

- Fisheries provide a vital source of protein diet for Malaysian.
- Fisheries contribute 60 – 70 % of protein compare to others animal meat.
- Sea food consumption is very high in Malaysia.
- Each Malaysian consume about 50 kg of fish a year (year 2002).
- These figure will be increase to 56 kg in year 2010 and onward.

STATUS OF DEEP-SEA INDUSTRIES

- LANDING OF MARINE FISH BY THE DEEP-SEA INDUSTRIES CONTIBUTED ABOUT 10% TO 13% PER YEAR OF OVERALL NASIONAL MARINE FISH LANDED.
- MARINE FISH LANDING CONTRIBUTION BY DEEP-SEA VESSEL
  - 2008 - 311,715 MT
  - 2009 - 293,532 MT

DEEP-SEA FISHERIES

- Exploration of deep-sea fishing in Malaysia started upon the declaration of ZEE on 25 April 1980.
- Joint venture deep-sea fishing between Malaysia & Thailand officially launch by both Prime Minister on 17 September 1987 at Kuantan Port, Pahang.


DEEP-SEA DEFINATION

- Operating area - > 30 nautical miles to Malaysian Exclusive Economic Zone (EEZ).
- Salz of Vesel: > 70 GRT (Gross Registered Tonnage)
- Identified as Vessel C2


LICENCED VESSEL OF DEEP SEA FISHING UNTIL 2009

STRATEGIC FORECAST IN DEEP-SEA INDUSTRY

1. Management of the marine resources in a effective way.
2. Use modern technology selective methods of fishing
3. Ecosystem Based Management Approach.
4. Implemetation according to international requirement trade standard i.e Hygiene On Board (HOB), GMP, HACCP, Safety Equipment On Board, and issuing Catch Certificate.



STRATEGIC FORECAST IN DEEP-SEA INDUSTRY

5. Comprehensive resources analisis
4. Determine the number of fising vessels according to the status of resources.
5. Used of VMS to enhance the monitoring of resources and landing.
6. Train local people.
7. To explore International fisheries resources at high sea and will given priority.

STRATEGIC FORECAST IN DEEP-SEA INDUSTRY

8. Focusing on the chain of up stream and down stream activities
9. Complying on International Instruments.
10. Focus on developing
    a) Tok Bali, Kelantan
    b) Batu Maung, Penang
    c) Tanjung Manis, Sarawak
    as hubs of fisheries deep sea industries to enhance economic from this sector.

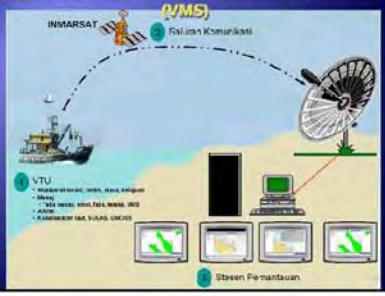
STRATEGIC FORECAST IN DEEP-SEA INDUSTRY

11. Introduce new technology especially on fishing technique.
12. To increase the skill and knowledge amongst the fishermen.
13. Explored new area which is rich in resources especially in international water/high sea.


INTRODUCTION OF VMS TO DEEP-SEA VESSEL

- A computerised system that uses information technology and satellite communication to track fishing vessel.
- Introduced by DOF since 2006 to monitor the deep-sea fishing vessels.
- VMS provide the information on positioning (longlitude, latitude), date, time and speed of the vessel on real time basis.
- This to ensure effectiveness in the management of the marine resources through responsible fishing.

VESSEL MONOTORING SYSTEM (VMS)



VMS OPERATIONAL CENTRE PUTRAJAYA


BENEFITS OF USING VMS
➢ To assist in managing the vessels of a company's vessel.
➢ Can be used as a communication device
➢ To assist DOF efforts in protecting fisheries resources.


CONCLUSION
Deep-sea fishing can be sustained
through the use of relevant technologies,
manageable fishing capacity;
research into deep-sea resources;
the institution of quota system into the
management strategy of the fishery


THANK YOU

Annex 9

Status and Potential of Deep-Sea Fishery Resources in Myanmar

Mr. Myint Pe
Marine Resources Conservation Unit, Research and Development Division,
Department of Fisheries, Myanmar

Status and Potential of Deep-Sea Fishery Resources in Myanmar

Presented by

Myint Pe
Department of Fisheries
Union of Myanmar

Introduction

- Coast line – nearly 3,000 km
- Continental shelf – approximately 230,000 sq.km
- Oceanographic condition – rough in southwest monsoon / calm in northeast monsoon
- Coral reefs – found in northern and southern part of the country
- Population – 55.5 million in the year 2007

Status of marine fisheries resources

- Numerous species
- Small species - Anchovy, Pony fish
- Large species – Grouper, Snapper
- Pelagic fish MSY – 0.5 m.t
- Demersal fish MSY – 0.3 to 0.5 m.t
- Total MSY – 1.05 m.t

Estimate of Biomass within 200-meter depth

Acoustic survey – 1979 –80
Small Pelagic – 975,000 M.T
Demersal Fish – 750,000 M.T

Bottom Description

1. **Even smooth bottom**
2. **Generally smooth bottom**
3. **Rough bottom**
4. **Very steep bottom**

Figure 6. Bottom conditions Delta Area: 1) even flat bottom, 2) uneven bottom, 3) rough bottom, 4) steep slope.

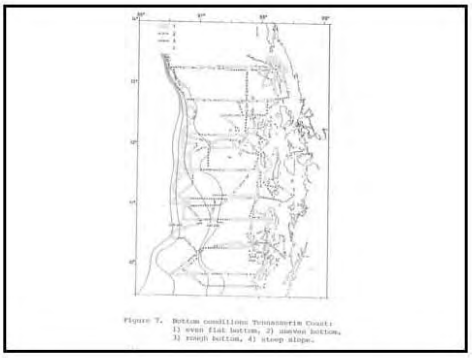
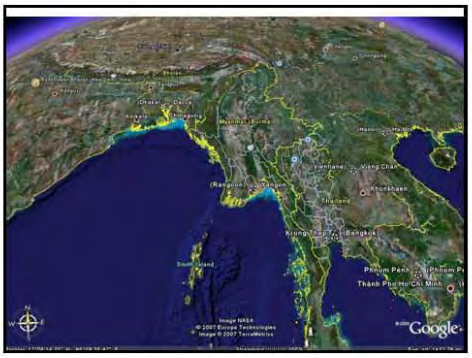
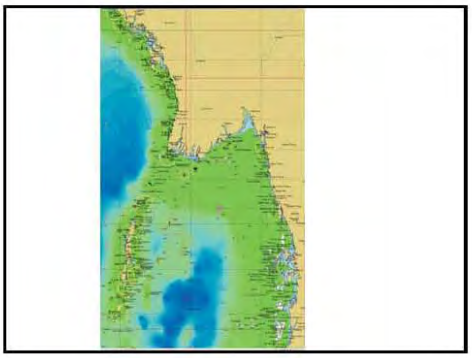
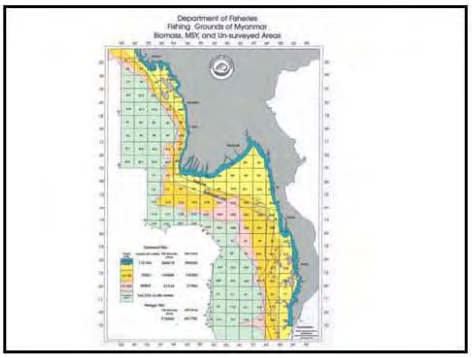


Figure 7. Bottom conditions Tenasserim Coast: 1) even flat bottom, 2) uneven bottom, 3) rough bottom, 4) steep slope.







Deep-Sea Fishery

- During the hydro-acoustic survey by R.V. Dr. Fridtjof Nansen, a very extensive deep sea trawlable ground was found south of 13 degree north between 230 and 500 meter depth.
- Experimental Fishing on Deep-Sea Resources was conducted in October 1982.
- Vessel No. 413, 24.25 m stern trawler was used for survey.
- Fishing gear : 18.5 fathoms (headline) shrimp trawl net and 16.7 fathoms (headline) fish trawl net were used.

- Fishing grounds : Deep-sea water off the Thanintharyi coast (Fishing ground no. 053,054, 059, 144 and 119)
- Deep-sea Lobster species
  - ***Puerulus sewelli***
- Deep-sea Shrimp species
  - ***Heterocarpus woodmasoni*** (Indian Nylon Shrimp)
  - ***Parapandalus spinipes*** (Oriental Narwal Shrimp)

- Deep-sea Fish species
  - ***Peristedion weberi***
  - ***Chlorophathalmus sp:***
  - ***Palinurichtus pringiei***

Species Composition of catches made by shrimp net

Species (Shrimp)	Total Catch (kg)	%	Catch/hr (Kg)
Heterocarpus woodmasoni	356	56.4	11.7
Parapandalus spinipes	255	40.4	8.4
Plesionika martia	15	2.4	0.5
Metapenaeopsis andamanesis	5	0.8	0.2
Total	631	100	20.7

Species Composition of catches made by shrimp net

Species (Lobster)	Total Catch (kg)	%	Catch/hr (Kg)
Puerulus sewelli (Deep-sea Lobster)	896	100	29.4
Total	896	100	29.4

Species Composition of catches made by shrimp net

Species	Total Catch (kg)	%	Catch/hr (Kg)
Deep-Sea Fishes (17 species)	5449.0	100	178.7
Total	5449.0	100	178.7

Species Composition of catches made by fish net

Species	Total Catch (Kg)	%	Catch/hr (Kg)
Heterocarpus woodmasoni	117	36.8	2.1
Parapandalus spinipes	166	52.2	2.9
Plesionika martia	15	4.7	0.3
Metapenaeopsis andamanesis	20	6.3	0.4
Total	318	100	5.6

Species Composition of catches made by fish net

Species (Lobster)	Total Catch (Kg)	%	Catch/hr (Kg)
Puerulus sewelli	1419	98.9	25.0
Linuparus gamniosus	14.0	1.0	0.2
Nephrops andamanicus	2.0	0.1	0.03
Total	1435.0	100	25.3

Species Composition of catches made by fish net

Species (Fishes)	Total Catch (Kg)	%	Catch/hr (Kg)
Deep-Sea Fishes (12 species)	4274.0	100	75.3
Total	4274.0	100	75.3

Deep-sea lobster & Deep-sea shrimp

- Some of the deep water resources (at the depth of more than 200 meter) were reported in the early survey off the continental shelf of Tanintharyi (Ternaserim) (Southern part of the country) which include deep sea lobster, ***Puerulius sewelii*** , penaeid shrimp of the genus ***Aristeus,*** and pandalid shrimp of the genus ***Heterocarpus***.
- It was estimated that the biomass of demersal stocks inhabiting the continental slope off Tanintharyi coast i.e. between 200 – 500 meters was about 9,000 tonnes, of which deep sea lobster accounted for one quarter of the biomass.

Deep-sea lobster & Deep-sea shrimp

- The experimental deep-sea lobster and deep-sea shrimp fishing was also conducted in the Tanintharyi coastal area in 1990.
- The results from these surveys indicated that nearly 20 species of deep-sea fish 3 species of deep-sea lobster and 5 species of deep-sea shrimp are existing in Myanmar waters.
- The results also indicated that the average catch rate of deep-sea lobster, deep-sea shrimp and deep-sea fish are 46.6 kg/hr, 6.5 kg/hr and 191.7 kg/hr respectively. (Table 2 & 3).

Deep-sea lobster & Deep-sea shrimp

Deep-sea Fish

Deep-sea Fish

Depth-wise catch and catch rate of Deep-sea lobsters & Deep-sea shrimp
F.V. POYARKOVO (24.6.90 – 10.7.90)

Depth (m)	Fishing hour	Catch (Kg)			CPUE (Kg/hr)		
		Lobster	Shrimp	Total	Lobster	Shrimp	Total
221-240	49.0	2450.0	115.0	2565.0	50.0	2.3	52.3
241-260	76.0	4020.0	520.0	4540.0	52.9	6.8	59.7
261-280	8.5	485.0	90.0	575.0	57.1	10.6	67.6
281-300	12.0	365.0	145.0	510.0	30.4	12.1	42.5
301-320	9.5	220.0	125.0	345.0	23.2	13.2	36.4
321-400	7.5	35.0	55.0	90.0	4.7	7.3	12.0
Total	**162.5**	**7575.0**	**1050.0**	**8625.0**	**46.6**	**6.5**	**53.1**

Research surveys and experimental fishing

- Since Andaman Sea is assumed as one of the areas where fisheries resources are under-exploited, to investigate potential of large pelagic fish resources in Andaman Sea for a new fishing ground is also one of the main objectives in this program.
- Therefore, SEAFDEC proposed to conduct the joint research survey on Pelagic Fisheries Resources in the Andaman Sea where depth of water beyond 700 meters in 2004.

Research surveys and experimental fishing

- Since the right of ownership of Andaman Sea belongs to 4 countries namely Indonesia, Malaysia, Myanmar and Thailand, the joint survey was conducted by scientists from theses countries except Malaysia.
- This survey aims to investigate potential of large pelagic fish by using pelagic long line gear together with proper fishing technique and oceanographic parameters consideration.
- Determine the relative abundance and size composition of the commercially important species.

Research surveys and experimental fishing

- The results from this survey indicated that some commercially important species, such as Swordfish (***Xiphias gladius***), Yellowfin Tuna (***Thunnus albacares***), Striped marlin (***Tetrapturus audax***) and Sainfish (***Istiophorus platypus***) are inhabiting in Myanmar offshore waters.
- Bigeye Thresher (***Alopias pelagicus***), Whit-tipped shark (***Carcharhinus longimanus***), Escolar, Pelagic stingray (***Dasyatis sp:***), Common dolphin (***Coryphaena bipinnulata***) and Snake mackerel (***Gympylus surpens***) were also found as by-catch in this survey.

Research surveys and experimental fishing

- The similar survey results were also found in 2007 when " The Collaborative Marine Fishery Resources Survey in Myanmar Water " was jointly conducted by scientists from SEAFDEC and Myanmar.
- From these two survey results, Swordfish is the most dominant species in Myanmar Offshore waters and it can be considered as one of the commercial fishes for offshore fisheries in future.

The 1st Dominant species
Lizard fish
(***Saurida undosquamis***)

The 2nd Dominant species
Squid
(***Loligo duvaucheli***)

The 3rd Dominant species
Goat fish
(***Parupeneus sp***)

The 4th Dominant species
Big-eye
(***Priacanthus macracanthus***)

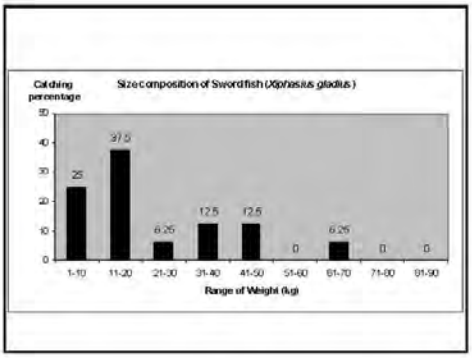
Chart of number of catches: Sword fish (fish symbol) and Thresher shark (shark fin symbol)

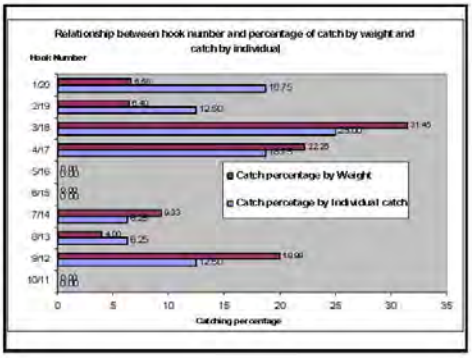
Caught
by
Pelagic Long-line

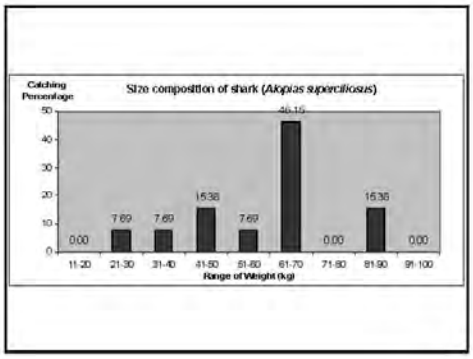
Bigeye thresher shark
(***Alopias superciliosus***)

Caught
by
Pelagic Long-line
Sail fish
( )

Caught by Pelagic Long-line
Sword Fish
(*Xiphius gladius*)







Deep-sea Squid

- SEAFDEC conducted the joint research survey on pelagic fisheries resources in Andaman Sea where the depth of water is deeper than 700 meters in 2004.
- The survey was determined distribution and examines the feasibility of harvesting squid with jig gear.
- The purpleback flying squid, ***Sthenoteuthis aualaniensis*** (Lesson, 1930) is only one species from 7 sampling stations of that survey.

Deep-sea Squid

- On the entire survey area, CPUE of the squid is average 5.57 squids/line hour).
- Minimum of the CPUE of the squid were 2.00 squids / line hour and 8.39 squids / line hour were the maximum.
- From the 7 sampling station it is found that mostly were high CPUE where the squid were caught more than 5 squids / line hour.
- This result indicated that deep-sea squid is also potential resource for offshore / deep-sea fisheries in Myanmar waters.

Results

From 7 stations show only one species Purpleback flying squid

Sthenoteuthis oualaniensis

Male = 17 : Female 113

CPUE / number of squid per line hour

average 5.57 squids/line hour

St 1 = 6.03
St 2 = 8.49
St 3 = 3.87
St 4 = 6.67
St 5 = 7.00
St 6 = 5.00
St 7 = 2.00

Commercial fishing

- ***Pelagic resource***
- The offshore fishery for large pelagic in Myanmar has initiated and developed gradually during the last decade, and is currently producing nearly 200 tons of fish per annum.
- Long lining in the Myanmar EEZ started with the issuing of experimental licenses to 12 freezer vessels in 1999-2000.
- . Initially the catch rates were good and in 2001-2002 the number of licensed vessels rose to 110.

Commercial fishing

- The license fee collected for this fisheries is 30 US $ / GRT / Month.
- Currently, 48 vessels from two foreign fishing companies were still operating for tuna in the EEZ of Myanmar and India.
- According to " Law Relating to Fishing Rights for Foreign Fishing Vessels" tuna long-ling fishing operation is permitted only in the outside of the territorial sea in Myanmar EEZ to all fishing vessels.
- The target species for this fishery is Yellowfin tuna, even sword fish, marlin and sharks are caught as by catch.

Current resource status

- ***Pelagic resources***
- Since there is no appropriate data on offshore fisheries (Deep-sea fisheries) of pelagic fisheries in Myanmar, the biomass of this fish is unknown.
- ***Demersal resources.***
- Since there is no Offshore fisheries (Deep-sea fisheries) for demersal fish in Myanmar, the biomass of this fish is unknown.

Technological feasibility

- Since only foreign fishing vessels is operating in the offshore zones of Myanmar, there is no fishing vessels and fishing gears which are suitable for offshore or deep-sea fishing in Myanmar yet.
- Currently, most of the fishing vessels are operating in the waters less than 100-meter depth, due to lack of technology, lack of suitable fishing gear, and lack of fisheries resources information.
- In this regards, appropriate fishing technology, fishing gear and fishing vessels are the major constraints for the development of offshore fisheries or deep-sea fisheries in Myanmar.

Livelihood benefits and impacts

- Not like coastal fisheries, there would be no negative impact on traditional or artisinal fisheries due to development of offshore / deep-sea fisheries.
- Since offshore / deep-sea fisheries is operating in sea areas which are away from the shallow waters, there would be no conflict with local fishermen who fish in the coastal areas.
- Due to our normal practice in fisheries, all stakeholders can have benefit from this fisheries, according to their investment and involvement .

Environmental concerns

- Environmental issues concerns with offshore / deep-sea fisheries is mainly depend on fishing gear and practices.
- If only using bottom long-line or pelagic long-line for fishing, there will be no negative impact on marine environment.
- Bottom trawl net would be the main fishing gear that could cause negative impacts on sea mounts, cold water corals and other vulnerable ecosystems.

Environmental concerns (cont:)

- In this connection, to maintain the environmental condition of the sea bottom as normal, bottom trawl operation should not be allowed for the development of offshore / deep-sea fisheries in this region.

Conclusion

- Since coastal fisheries is facing with over-fishing and over-capacity, offshore or deep-sea is the only promising area for sustainable fisheries development and food security for the people in future.
- Even offshore fisheries/deep-sea fisheries is not developed yet, results from series of fishery resources survey and experimental fishing indicated that Myanmar is rich in some commercially important big pelagic species such as sword fish and deep-sea lobster and deep-sea shrimp.

Conclusion (cont:)

- Groupers and Snappers are also believed to be existing in the continental slope areas of Myanmar waters.
- Since offshore / deep-sea fisheries areas are away from the shore, more advanced fishing technologies, modernized fishing gears, latest post harvest technologies, skillful fishers and more investments are needed.
- All these requirements are great challenges to all developing countries like Myanmar.

Conclusion (cont:)

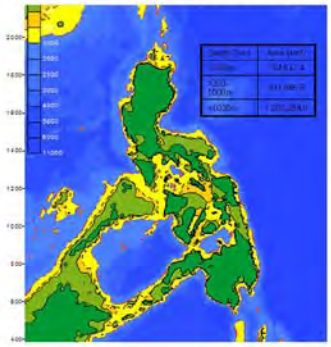
- To exploit underutilized fishery resources from offshore / deep-sea for sustainable fisheries development and food security for the people in this region, Myanmar would like to make good coordination and cooperation with international / regional organizations, such as ASEAN, BIMSTEC, FAO, SEAFDEC, etc., to obtain technologies, knowledge and experiences.
- Foreign investment and joint venture program with foreign fishing vessels will be also invited according to our fisheries laws and foreign investment law to develop this fisheries.

Annex 10

Deep-Sea Fisheries Surveys-Philippines

Mr. Rafael Ramiscal
Bureau of Fisheries and Aquatic Resources, the Philippines

DEEP WATER AREAS



Deep Sea Fisheries

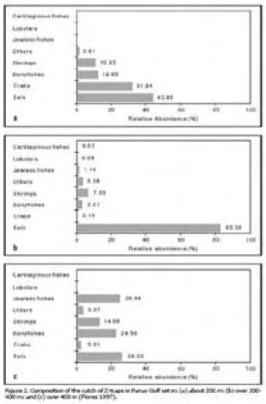
- Resources largely unknown
- Bottom set longline (dogfish sharks)
- Multiple hook and line
- Traps

EXPLORATION OF DEEP SEA FAUNA IN THE PHILIPPINES

- Early expeditions in the 18th & 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)
    - Many new crustacean species were described,
    - A living fossil of the glypheid *Neoglyphea inopinata*

EXPLORATION OF DEEP SEA FAUNA IN THE PHILIPPINES

- 70s-90s
  - 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
  - Deep water/assessment surveys (Ormoc, Panay, Marinduque)
- 21ST Century
  - Deep water surveys (Mindoro, Davao Gulf)
  - 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
  - LINGAYEN 2008, MV DA-BFAR, Lingayen Gulf



Survey of Deep-Water Benthic Fauna

CENSUS OF MARINE LIFE

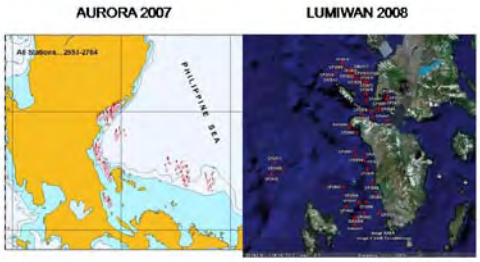
2005-2008

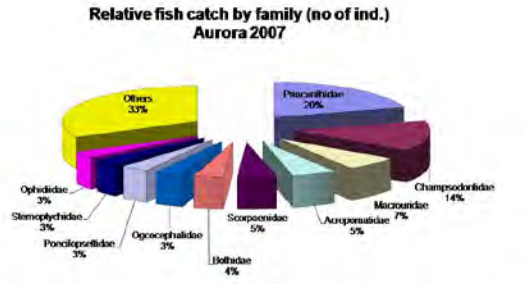
SAMPLING GEARS

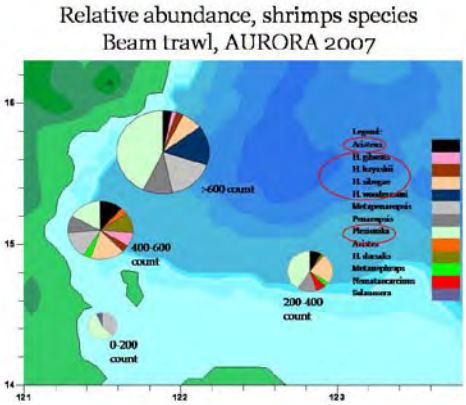
BEAM TRAWL

OTTER TRAWL

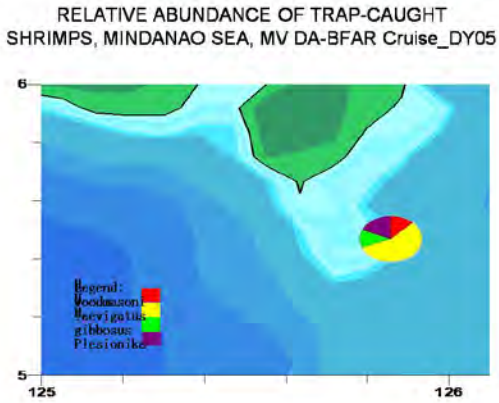
TRAP

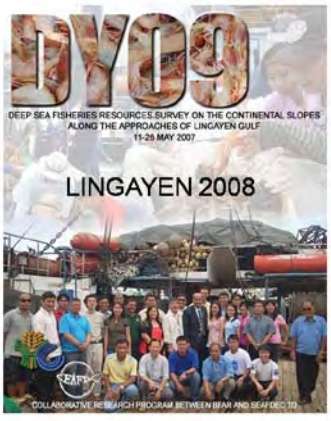

AURORA 2007
LUMIWAN 2008
PHILIPPINE SEA


Relative fish catch by family (no of ind.)
Aurora 2007
Others
33%
Pinnantiidae
20%
Champsodontidae
14%
Macrouridae
7%
Acropomatidae
5%
Scorpaenidae
5%
Bothidae
4%
Ogcocephalidae
3%
Pseudochromidae
3%
Stemoptychidae
3%
Ophidiidae
3%


Relative abundance, shrimps species
Beam trawl, AURORA 2007
>600 count
400-600 count
200-400 count
0-200 count
16
15
14
121
122
123


CRUSTACEAN DIVERSITY OF THE PHILIPPINES
NEW CRUSTACEAN SPECIES FROM THE PHILIPPINES


RELATIVE ABUNDANCE OF TRAP-CAUGHT
SHRIMPS, MINDANAO SEA, MV DA-BFAR Cruise_DY05
6
5
125
126


DY09
DEEP SEA FISHERIES RESOURCES SURVEY ON THE CONTINENTAL SLOPES
ALONG THE APPROACHES OF LINGAYEN GULF
11-26 MAY 2007
LINGAYEN 2008
COLLABORATIVE RESEARCH PROGRAM BETWEEN BFAR AND SEAFDEC/TD


LINGAYEN GULF
Santiago Island
Baguio
Cabarruyan Island
Beam trawl
Trap
Dagupan


LINGAYEN '08
BTR 514
996 - 1227m

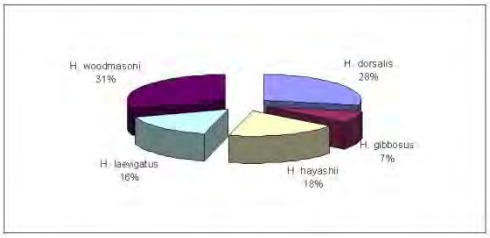
BEAM TRAWL STATIONS

Date	Stn Code	Stn Number	Depth_range (m)
13-May-08	BTR	512	Briddle line was cut
13-May-08	BTR	513	400-600
14-May-08	BTR	514	>1000
14-May-08	BTR	515	200-400
20-May-08	BTR	517	200-400
20-May-08	BTR	518	400-600
20-May-08	BTR	519	600-800
20-May-08	BTR	520	600-800
20-May-08	BTR	522	600-800
21-May-08	BTR	523	800-1000
21-May-08	BTR	524	400-600

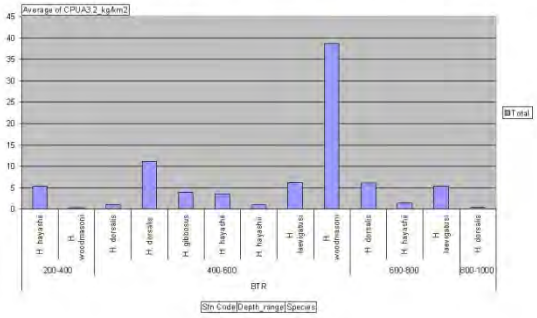
TRAP

Date	Stn Code	Stn #	Depth_range (m)
14-15 May-08	TRA	511	200-400
20-21 May-08	TRA	516	200-400
21-22 May-08	TRA	521	600-800

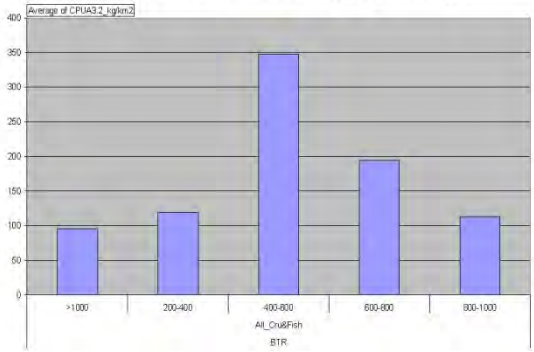
RELATIVE ABUNDANCE OF PANDALID SPECIES, BEAM TRAWL



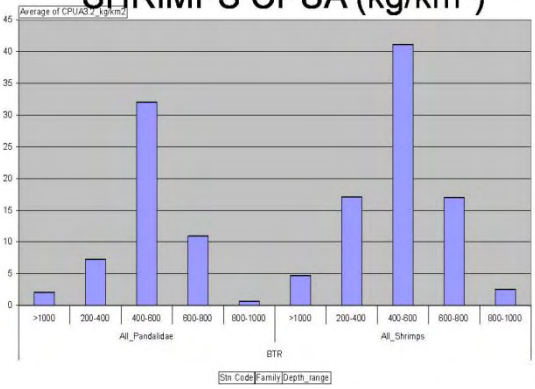
CPUA (kg/km²) PANDALID SPECIES BY DEPTH

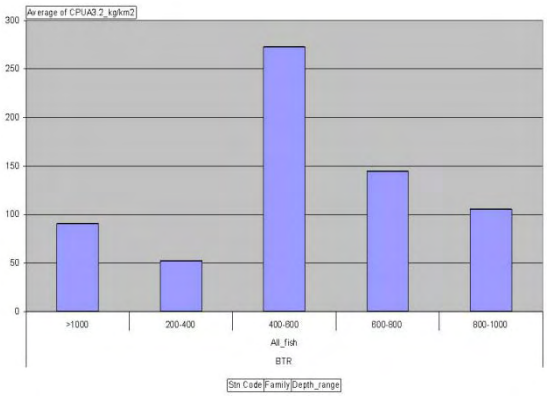


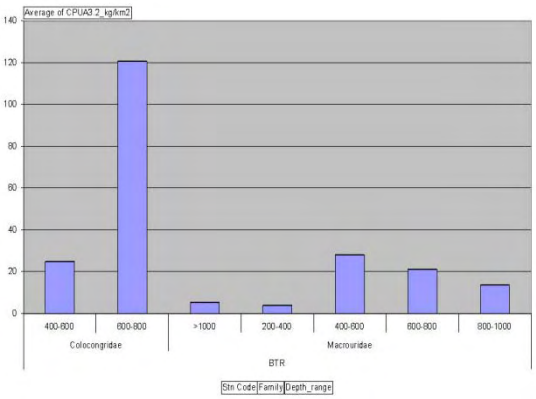
TOTAL CPUA (kg/km²)



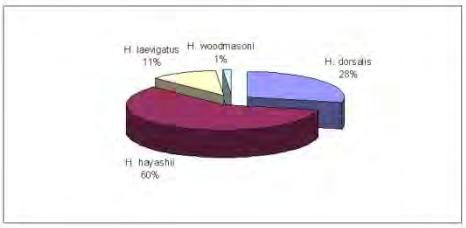
SHRIMPS CPUA (kg/km²)



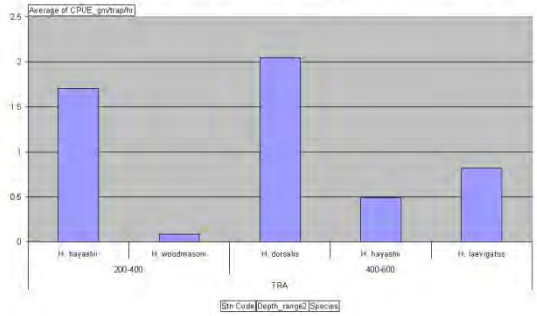




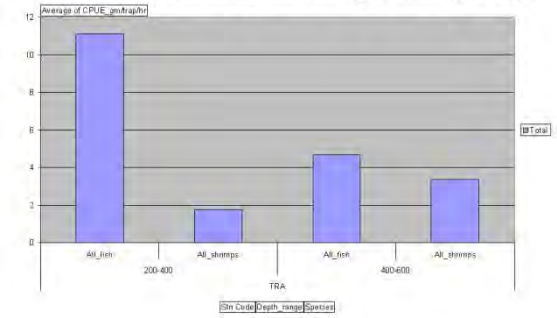
RELATIVE ABUNDANCE OF PANDALID SPECIES, TRAPS



AVERAGE CPUE (gm/trap/hr)



AVERAGE CPUE (gm/trap/hr)



SUMMARY/RECOMMENDATIONS

- Pandalid shrimps were perhaps the most significant to fisheries (mainly *Heterocarpus woodmasoni*, H. *hayashii, H. dorsalis H. laevigatus*
- Pandalid shrimps were caught at 200m to 800m; most abundant at 400-600m, probably limited distribution beyond 1000m
- CPUA for fish and crustaceans particularly pandalid shrimps was highest at 400-600m.

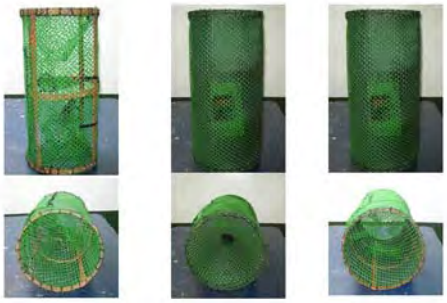
SUMMARY/RECOMMENDATIONS

- Implement pilot deep sea shrimp trap fishery
- Modify current trap design to improve efficiency.
- Use smaller otter and beam trawl nets as sampling/assessment gears
- Formulation of a management plan or national policy on deep sea fisheries.

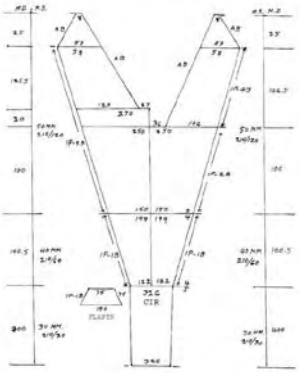
UPCOMING ACTIVITIES

- Deep sea fisheries survey, Oct-Nov 2010
- Use modified traps design to improve efficiency.
- Use smaller otter (shrimp) and beam trawl net designs

TRAPS



SHRIMP TRAWL NET DESIGN



Acknowledgements / References

Museum National d'Histoire Naturelle. Paris, France

National University of Singapore

Tin Yam Chan, National Taiwan Ocean University (shrimps ID/Photos)

Prof. Kwang Tsao Shao and Yunn Chi Liao (Research Center for Biodiversity, Academia Sinica, Taiwan (fish ID/photos)

Bagarinao, T. The USS Albatross Expedition in the Philippines, 1907-1910. *SEAFDEC Aquaculture Department Tigbauan, Iloilo, Philippines*

Flores, J.O. 2004. Fisheries in deep-water areas of the Philippines., p. 72078. In DA-BFAR. In turbulent seas:The status of Philippine marine fisheries. Coastal Resource Managmeent Project, Cebu City Philippines. 378p.

Annex 11

Deep-Sea Fishes in the Andaman Sea

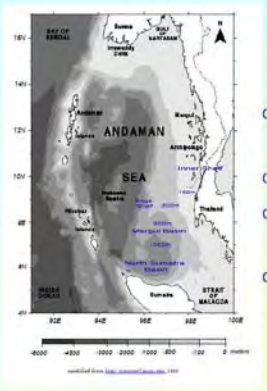
Mr. Weera Pokapunt
Department of Fisheries, Thailand

Deep-Sea Fishes

in the Andaman Sea

Weera Pokapunt
Department of Fisheries

Expert Meeting on Deep-Sea Fishing and its Impact to Ecosystem.
31 August -7 September 2010, Bangkok, Thailand



The Andaman Sea

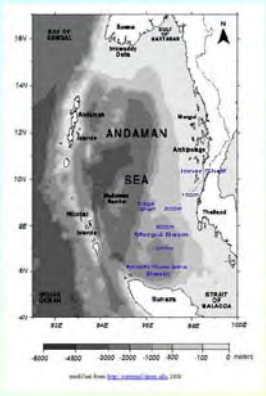
is located along the eastern side of the Indian Ocean.

On the west : by the Andaman Islands and Nicobar Islands.

On the north : by coast of Myanmar.

On the east : by coast of Myanmar, Thailand and Malaysia.

On the south : by north of Sumatra and Malacca Strait.



Topography of The Andaman Sea

Max. Depth > 3,000 m.

Wide continental shelf of ~300 m. depth

Andaman Basin

Mergui Basin

North Sumatra Basin

Andaman Seamounts

Submarine Bank

Deep-sea fishes survey

- In a past few year, we don't have any activities on deep-sea fishes survey at the depth >200 m.
- Only at 100-180 m. depth had been done for vertical bottom long-line and traps surveys in 2006-2007. The results had already presented in Regional Workshop on the Standard Operating Procedure and Development/ Improvement of Sampling Gears for the Deep-Sea Resources Exploration, during 26-28 May 2009 at SEAFDEC, Bangkok.
- Before 1981, some information on deep-sea fishes and ecosystem in the Andaman Sea at 200-550 m. depth were conducted.

In 1975-1976, the R/V No.2 of DOF of Thailand had conducted the deep-sea fishes survey along the continental shelf in the Andaman Sea, at the depth of 200 - 550 m.

In 1980, the DOF of Thailand had jointed programme with FAO and NORAD to investigate the deep-sea fish resources in the Andaman Sea at the depth between 200 – 380 m. by R/V "Dr. Fridtjof Nansen".

The survey area in 1975-1976 by R/V No.2

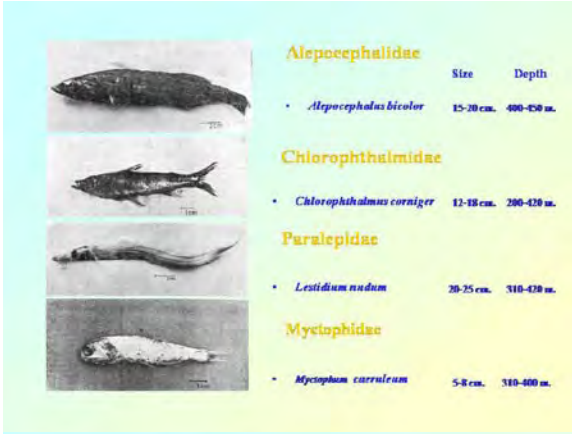
Using a otter board trawl net and deep-sea traps

At the depth of 200 - 550 meters.

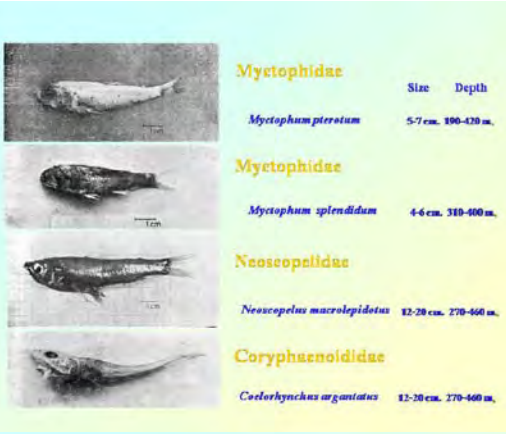
About 69 species of deep-sea fishes and 13 species of deep-sea shrimps and lobster were found

	Size	Depth
Heptranchidae		
• *Heptranchias perlo*	41-45 cm.	200-270 m.
Scyliorhinidae		
• *Halaeturus hispidus*	22-30 cm.	190-320 m.
Squalidae		
• *Squalus fernandinus*	20-45 cm.	200- 270m.
Squalidae		
• *Etmopterus spinax*	23-25 cm.	400-450 m.

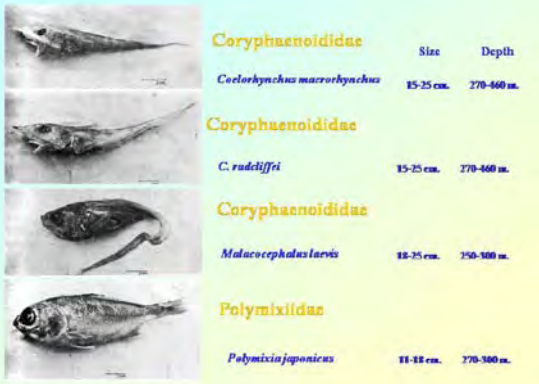
	Size	Depth
Sternoptychidae		
• *Polyipnus spinosus*	5-7 cm.	400-420 m.
Sternoptychidae		
• *Argyropelecus olfersi*	5-7 cm.	400-450 m.
Astronesthidae		
• *Astronesthes lucifer*	10-15 cm.	300-310 m.
Chauliodontidae		
• *Chauliodus sloanei*	10-20 cm.	310-500 m.



	Size	Depth
Alepocephalidae		
• *Alepocephalus bicolor*	15-20 cm.	400-450 m.
Chlorophthalmidae		
• *Chlorophthalmus corniger*	12-18 cm.	200-420 m.
Paralepidae		
• *Lestidium nudum*	20-25 cm.	310-420 m.
Myctophidae		
• *Myctophum carruleum*	5-8 cm.	310-400 m.

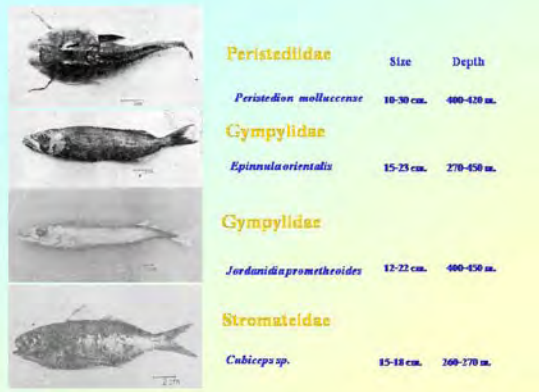


	Size	Depth
Myctophidae		
Myctophum pterotum	5-7 cm.	190-420 m.
Myctophidae		
Myctophum splendidum	4-6 cm.	310-400 m.
Neoscopelidae		
Neoscopelus macrolepidotus	12-20 cm.	270-460 m.
Coryphaenoididae		
Coelorhynchus argentatus	12-20 cm.	270-460 m.



	Size	Depth
Coryphaenoididae		
Coelorhynchus macrorhynchus	15-25 cm.	270-460 m.
Coryphaenoididae		
C. radcliffei	15-25 cm.	270-460 m.
Coryphaenoididae		
Malacocephalus laevis	12-25 cm.	250-300 m.
Polymixiidae		
Polymixia japonicus	11-12 cm.	270-300 m.

	Size	Depth
Ostracoberycidae		
Ostracoberyx dorygenys	10-12 cm.	400-460 m.
Ostracoberycidae		
O. tricornis	8-10 cm.	420-460 m.
Caproidae		
Antigonia rubescens	7-10 cm.	260-270 m.
Peristedidae		
Peristedion liorhynchus	18-20 cm.	450-460 m.



	Size	Depth
Peristedidae		
Peristedion molluccense	10-30 cm.	400-420 m.
Gympylidae		
Epinnula orientalis	15-23 cm.	270-450 m.
Gympylidae		
Jordanidia promethroides	12-22 cm.	400-450 m.
Stromateidae		
Cubiceps sp.	15-18 cm.	260-270 m.

	Size	Depth
Stromateidae		
Paliurichthys sp.	9-17 cm.	250-400 m.
Pleuronectidae		
Poecilopsetta colorata	10-11 cm.	400-420 m.
Bothidae		
Chascanopsetta lugubris	17-28 cm.	270-400 m.

List of deep-sea fishes caught along the continental shelf in the Andaman Sea west coast of Thailand during 3-23 Feb, 1976.

	Family	Scientific name
1.	Scyliorhinidae	*Halaelurus hispidus*
2.	Squalidae	*Squalus formosellus* Molina
3.	Rajidae	*Raja sp.*
4.	Muraenesocidae	*Muraenesox cinereus* (Forsk)
5.	Nettastomidae	*Venefica proboscidea* (Vaillant)
6.	Congridae	*Congrellus anago* (Schlegel)
7.		*Ariosoma balearica* (de la Roche)
8.	Nemichthyidae	*Nemichthys scolopaceus* Richardson
9.	Sternoptychidae	*Argyropelecus olfersi* (Cuvier)
10.		*Polyipnus spinosus* Gunther
11.	Astronesthidae	*Astronesthes cyaneus* (Brauer)
12.		*A. niger* (Richardson)
13.		*A. lucifer* (Gilb)
14.	Chauliodontidae	*Chauliodus sloani* (Bl Schn)
15.	Alepocephalidae	*Alepocephalus cicolor* (Alc.)
16.	Synodontidae	*Synodus sp.*
17.	Chlorophthalmidae	*Chlorophthalmus corniger* (Alcock)
18.	Paralepidae	*Lestidium nudum* (Gilbert)
19		*Lestidium sp.*
20.	Myctophidae	*Myctophum caeruleum* (Klaug)
21.		*M. spinosum* (Steind)
22.		*M. splendidum* Br.
23.	Neoscopelidae	*Neoscopelus macrolepidotus* (Johs)
24.	Ateleopodidae	*Ateleopus japonicus* (Bleeker)
25.		*Ateleopus sp.*
26.	Lophidae	*Lophiomus miacanthus* (Gilbert)
27.	Chaunacidae	*Chaunax pictus* (Lowe)
28.	Bregmacerotidae	*Bregmaceros nectabanus* (Whitley)
29.	Caelidae	*Physiculus nateleensis* (Gilchrist)
30.	Coryphaenoididae	*Coelorhynchus radcliffei* (Gilbt Hubbs.)

31.		*C. argentatus* (Smith & Radel)
32.		*C. macrorhynchus* (Smith & Radel)
33.		*Hymenocephalus leiognomus* (Jord & Gilb.)
34.		*Ventrifossa* sp.
35.	Chimaeridae	*Chimaera ricana* Cilkrist
36.	Trachichthyidae	*Gephyroberyx orbicularis* Smith
37.	Owstoniidae	*Owstonia* sp.
38.	Brotulidae	*Glyptophidium* sp.
39		*Dicrolene* sp.
40.		*Neobythites* sp.
41.	Polymixiidae	*Polymixia nobilis* (Lowe)
42.	Ostracoberycidae	*Ostracoberyx tricornis* (Maxabara)
43.		*O. dorygenys* (Fowler)
44.	Caproidae	*Antigonia rubescens* (Gunther)
45.	Scorpaenidae	*Plectrogenium nanum* (Gilb.)
46.		*Setaechas günther longicaps* (Gunther)

47.	Triglidae	*Peristedion malluccense* Blkr.
48.		*P. horhynchus* (Gunther)
49.		*Lepidotrigla natalensis* G&T
50.		*Lepidotrigla* sp.
51.		*Trigla* sp.
52.	Onchocephalidae	*Malthopsis lutea* Alcock
53.	Prionotidae	*Priacanthus hamur* (Forsk.)
54.	Apogonidae	*Synagrops japonicus* (Steindachner)
55.		*S. malayanus* Weber
56.	Champsodontidae	*Champsodon capensis* (Regan)
57.	Bembropidae	*Bembrop caudimacula* (Steindachner)
58.	Gempylidae	*Epinnula orientalis* (Gilchrist & Von Bonde)
59.	Lepidopidae	*Benthodesmus tenuis* (Gunther)
60.	Stromateidae	*Psenurichthys* sp.
61.		*Cubiceps* sp.
62.	Zeidae	*Zenopsis conchifera* (Lowe)
63.	Bothidae	*Chascanopsetta lugubris* (Alcock)

64.	Soleidae	*Cynoglossus xiphoideus* (Gunther)
65.		*Symphurus regalis* (nom.nov.)
66.	Plesronectidae	*Poecilopsetta colorata* Gunther
67.	Triacanthidae	*Tydemania navigatoris* (Weber)
68.	Triacanthodidae	*Halimochirurgus alcocki* (Weber)
69.		*Halimochirurgus* sp.

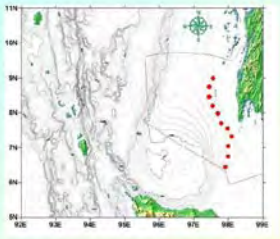
List of deep-sea shrimps and lobsters caught along the continental shelf in the Andaman Sea west coast of Thailand during 3-23 Feb, 1976.

1. *Puerulus sewelli*
2. *Linuparus trigonus*
3. *Heterocupus laevigatus*
4. *H. ensifer*
5. *H. tricarinatus*
6. *Aristaeomorpha foliacea*
7. *A. rostridentata*
8. *Solenocera alticarinata*
9. *Solenocera* sp.
10. *Nephropsis andamanica*
11. *Nephropsis acuteate*
12. *Polycheles typhlops*
13. *Plesionica martia*

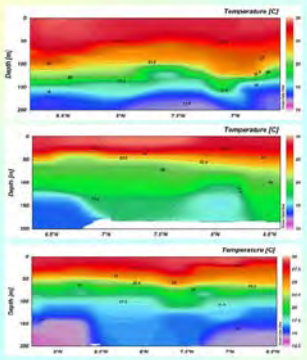
Oceanographic survey in 2006-2007

- Water Temperature
- Salinity
- Dissolved Oxygen

Oceanographic sampling stations



- along the continental shelf in EEZ of Thailand
- depth <200 m.
- vertical distribution of temperature, salinity and dissolved oxygen

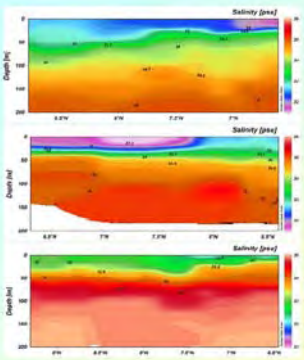


Water Temperature

Jun.-Feb.2006

Jun.-Feb.2007

Mar-Apr.2007

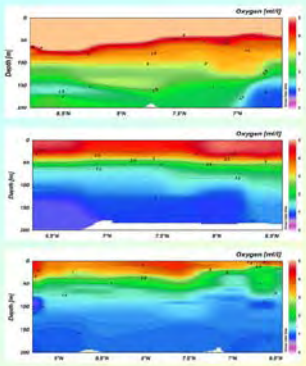


Salinity (psu.)

Jun.-Feb.2006

Jun.-Feb.2007

Mar.-Apr.2007



Dissolved Oxygen

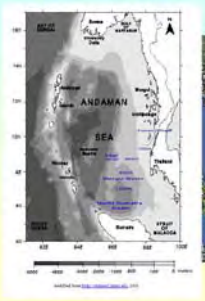
Jun.-Feb.2006

Jun.-Feb.2007

Mar.-Apr.2007

- Recommendations

Andaman Sea



South China Sea

- Thank you.

Annex 12

A review on the living marine resources in the deep sea of Vietnam

Mr. NGUYEN THUY DUONG
Department of Capture Fisheries and Resource Protection, Vietnam

A REVIEW ON THE LIVING MARINE RESOURCES IN THE DEEP SEA OF VIETNAM

NGUYEN THUY DUONG
DEPARTMENT OF CAPTURE FISHERIES AND RESOURCE PROTECTION

INTRODUCTION

- Vietnam is located in the Southeast Asia, with:
  - Long coastal line: 3,260km
  - Exclusive economic zone (EEZ): over 1 million square km
  - Large deep-sea area
- The Fishery plays an important role in the economics
  - provided about 40% animal protein in the Vietnamese diet,
  - created jobs for totally over 4 million laborers
  - contributed about 4% of the GDP (2004)
- High fishing pressure leads to over-exploitation of the resources, especially in coastal areas.
- Living marine resources in the deep sea is not estimated completely

→ It is a need to investigate these resources to develop high seas fisheries

DEEP SEA DEFINITIONS

- The deep layer below 200m is considered as deep sea (http://www.nwdc.navy.mil)
- The deep sea is the lowest layer in the ocean, existing below the thermocline, at a depth of 1000m or more (www.wikipedia.org)

DEEP SEA DEFINITIONS

In Vietnam, the sea is divided into 5 main management areas, namely:

I. Tonkin Gulf,
II. Central waters,
III. Southeastern sea
IV. Southwestern sea
V. Offshore waters

The deep sea is located mostly in the central and offshore waters

DEEP SEA FISHERY RESOURCES EXPLORATIONS

Viet-Xo Joint surveys (1978-1988)

- Gear used: Otter trawl
- Number of Surveys: 31 trips
- Number of stations:
  - 4,412 stations in total,
  - 1.312 stations in the deep sea

ALMRV surveys (1996-2005)

- Gear used: Otter trawl
- Number of Surveys: 16 trips
- Number of Stations:
  - 1,186 stations in total,
  - 154 stations in the deep sea

DEEP SEA FISHERY RESOURCES EXPLORATIONS

ALMRV surveys (*Cont'*)

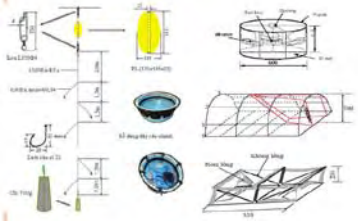
- Gear used:
  - ✓ Bottom Longline,
  - ✓ Bottom Vertical Longline
  - ✓ Traps
  - ✓ Pots
- Number of Surveys: 1
- Number of Stations: 28, both in the deep sea

MOFI & SEAFDEC collaboration (2005-2007)

- Gear used:
  - ✓ Bottom Longline,
  - ✓ Bottom Vertical Longline
  - ✓ Traps
  - ✓ Pots
- Number of Surveys 2 surveys with 32 stations
- Trial fishing: 3 surveys

FISHING GEARS USED

- Bottom Vertical Longline
- Traps
- Bottom Trawl



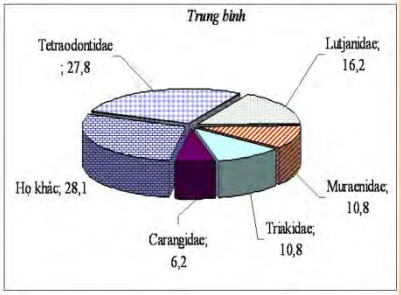
RESULTS

- Species composition
  - A total of 656 species, 195 families were statistically recorded, of which:
    - BVL: 65 species, 30 families
    - Traps: 130 species, 72 families
    - Bottom trawl: 537 species, 162 families

RESULTS (CONT')

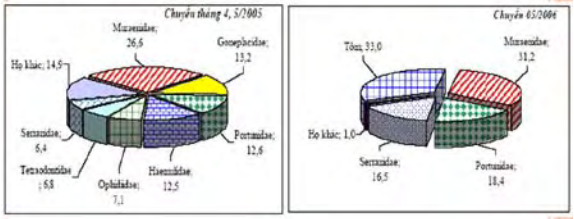
Catch composition (%)

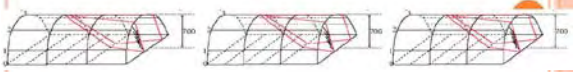
- Bottom Vertical Longline



RESULTS (CONT')

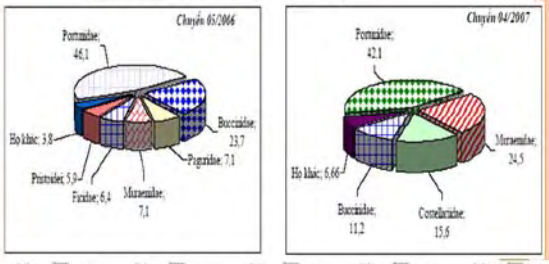
Grouper trap

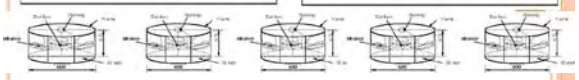




RESULTS (CONT')

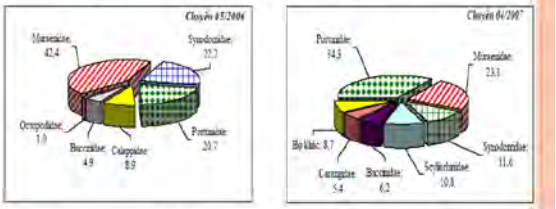
Cylinder swim. crab trap





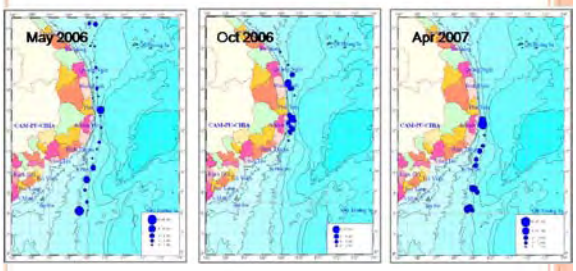
RESULTS (CONT')

Rectangular swim. crab trap



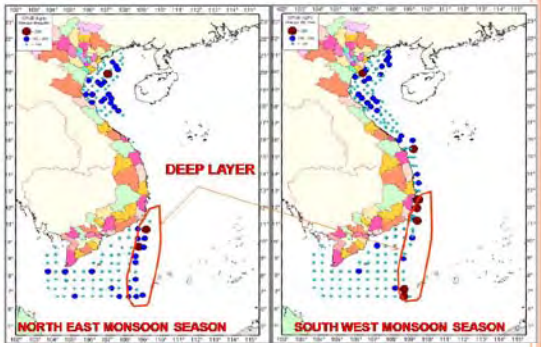
RESULTS (CONT')

CPUE distribution based on the Bottom Vertical Long-line surveys



RESULTS (CONT')

CPUE DISTRIBUTION BASED ON BOTTOM TRAWL SURVEYS



FUTURE NEEDS

- Collaboration with SEAFDEC and countries on:
  - Resources assessments of deep-sea waters
  - Deep-sea species identification
  - Deep-sea ecology
  - Gear improvement/development for deep-sea fisheries
  - Technology transfer
  - Impact of fishing on the deep sea ecosystem

THANK YOU FOR YOUR ATTENTION!

NGUYEN THUY DUONG
DEPARTMENT OF CAPTURE FISHERIES AND RESOURCE PROTECTION

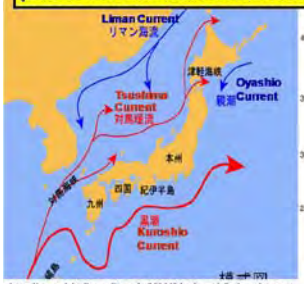
Annex 13

Japanese Seamount Bottom Trawl Fishery and the Trial Research on Its Impact to the Ecosystem

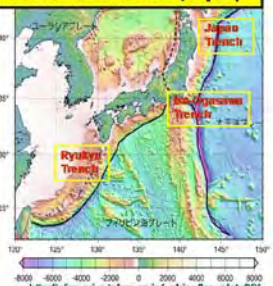
Dr. Yoshinobu KONISHI
Retired from the Seikai National Fisheries Research Institute, Japan

Japanese Seamount Bottom Trawl Fishery and the Trial Research on Its Impact to the Ecosystem

Yoshinobu KONISHI
(Retired from the Seikai National Fisheries Research Institute, Japan)



http://www1.kaiho.mlit.go.jp/KANB/sv/teach/kaisyo/stream4.html

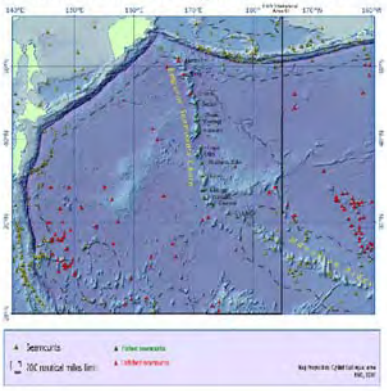


http://ocfgs.ori.u-tokyo.ac.jp/~okino/lec_pleis08/report1.pdf

From: Report on *"Identification of Vulnerable Marine Ecosystems in the Emperor Seamount and Northern Hawaiian Ridge in the Northwest Pacific Ocean and Assessment of Impacts Caused by Bottom Fishing Activities on such Vulnerable Marine Ecosystems on Marine Species as well as Conservation and Management Measures to Prevent Significant Adverse Impacts (Bottom Trawl)"*

Source: Fisheries Agency in Japan
(http://www.jfa.maff.go.jp/j/study/index.html)

Seamounts in the FAO Statistical Area No. 61



A Regional Framework of High See Bottom Fisheries in the Western North Pacific (1/3)

Mission
- Sustainable management of the resources
- Conservation of vulnerable ecosystems (pursuant to the FAO International Guidelines)

Participating countries
- Japan
- South Korea
- Russia
- USA

A Regional Framework of High See Bottom Fisheries in the Western North Pacific (2/3)

Conditional Measures
- Freeze of Fishing Efforts at the Current Status
- Fishing Gear Operation Only in the Exist Fishing Grounds (not permitted in the new)
- Stop of Gear Operation at Encounter with Vulnerable Marine Ecosystem

and so on

A Regional Framework of High See Bottom Fisheries in the Western North Pacific (3/3)

Scientific Group
- Information Collection
  - Catch, fishing effort and the related data (commercial vessels)
  - Biological, oceanographic, meteorological and ecosystem-survey data (research vessels)
- Sharing the Collected Information

Management of Fishing Vessels
- Management by the License System
- Collection & Sharing of Licensed Fishing Vessel Names and Registered Number
- Innovation of Vessel Monitoring System (VMS)

Japanese High Sea Bottom Fisheries in the Western North Pacific (1/3)

Fishing Gears
- Bottom Trawl
- Bottom Gill Net

Targeted Bottom Fishes
- Splendid Alfonsin (*Beryx splendens*)
- North Pacific Armorhead (*Pseudopentaceros wheeleri*)

Japanese High Sea Bottom Fisheries in the Western North Pacific (2/3)

Main Incidentally Captured Fishes
- Oreo (*Allocyttus verrucosus*)
- Mirror dory (*Zenopsis nebulosa*)
- Butterfish (*Hyperoglyphe japonica*)
- Rockfishes (Sebastinae spp.)

Oreo

Mirror dory

Butterfish

Photos: Fishbase

Japanese High Sea Bottom Fisheries in the Western North Pacific (3/3)

Item/Year	1992	2002	2007
No. of vessels	10	4	7
Gross tonnage of boats (mean)	870 - 1,483 (1,199)	901 - 1,483 (1,184)	883 - 1,483 (1,141)
No. of fishing days (mean)	16 - 168 (56)	96 - 270 (200)	78 - 250 (156)
Effort (trawling hours)	—	7,635	10,170
Catch 1 (ton)	—	2,543	3,016
Catch 2 (ton)	—	209	1,607

Catch 1: Alfonsin; Catch 2: Armorhead

Fishing grounds: Emperor Seamounts & North Hawaiian Ridge

Research Analysis (1/9)

Current Status of the Targeted Fisheries Resources and Their Management [1/3]

Data

- Commercial Catch (Japan, S. Korea, Russia)
- Fishing Efforts of Commercial Vessels (Japan)
- Estimated Biomass by Jap. Research Trawlers

Analysis Methods

- Production Model (Alfonsin)
- Comparison between Commercial Catch Data and Estimated Biomass (Armorhead)

Research Analysis (2/9)

Current Status of the Targeted Fisheries Resources and Their Management [2/3]

Alfonsin

- Present Status of the resources is overfished
- 20-28% Reduction of Fishing Pressure (F) for Maximum Sustainable Yield (MSY)

Armorhead

- Resources are exhausted
- Unexpected Occurrence of a Cohort with Higher Year Class Strength (e.g., 1992 & 2004 year class)
- Necessity of Fisheries Resources Management Depending on Recruitment of Dominant Cohort

Research Analysis (3/9)

Current Status of the Targeted Fisheries Resources and Their Management [3/3]

Fisheries Resources Management Measures

- Freeze of Number of Operating Fishing Vessels
- Shift of Fishing Grounds to the Japanese EEZ
- Reduction of Fishing Capacity
- Two-month Fishing Ban in November and December for 20% Reduction of F from the Average F in 1997 to 2006
- 10 - 30% Limit of Increasing F in the Next Year After Occurrence of Dominant Cohort

Research Analysis (4/9)

Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [1/6]

Methods

- Sea Bed Topography Survey
- Remotely Operated Vehicle (ROV) Survey
- Drop Camera System (DCS) Survey
- Data Analysis of Coral Fishery by Japanese Fishing Boats

etc.

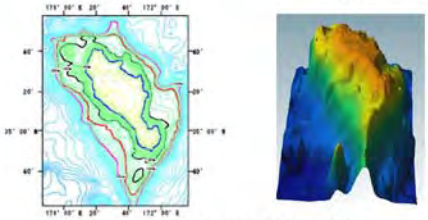
Drop camera system has light, video camera and digital camera

Research Analysis (5/9)

Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [2/6]

● Sea Bed Topography of a Seamount

2D 3D



Blue Line: 500 m, Black Line: 1000 m
Red Line: 1500 m, Purple Line: 2000 m

Research Analysis (6/9)

Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [3/6]

● Some Species of Corals Recorded by ROV

Alcyoniidae sp. (Order Alcyonacea)

Enallopsammia rostrata (Order Scleractinia)

Acanthogorgiidae sp. (Order Gorgonacea)

Antipatharia sp. (Order Antipatharia)

Date: Sep. 2006
Obs. Stations: 16
Time duration: 1 - 2 hrs/obs.
Obs. Distance: 1 - 4 km/obs.
Obs. Depth: 280 - 580 m

Research Analysis (7/9)

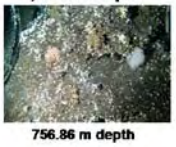
Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [4/6]

● Sea Bed Photos by Drop Camera System (DCS)

1,082.58 m depth

1,082.58 m depth

1,299.44 m depth



756.86 m depth

Date: Jun. – Aug. 2008
Obs. Stations: 28
Obs. Depth: 346 – 1,853 m

Research Analysis (8/9)

Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [5/6]

● Corals, Starfish and Sea Urchin Found by ROV & DCS Operations

Cnidaria		Echinodermata	
Anthozoa	Alcyonacea (softcorals)	Crinoidea	Conatulida (feather stars)
	Gorgonacea (hardcorals)	Asterodea (starfish)	
	Corallinorpharia	Ophiuroidea (brittlestars & basketstars)	
	Scleractinia (hardcorals)	Echinoidea (sea urchin)	
	Antipatharia (hardcorals)		
Hydrozoa			
Scyphozoa			

* Corals in the 4 orders above were found mostly as an individual, although the aggregation of corals was observed only at 2 points where are located in fishing grounds of the bottom trawlers.

Ideas/Suggestions on Deep-sea *Bottom* Fisheries Resources Exploration and the Study on Impact of *the Fisheries* to *Vulnerable Marine Ecosystems in EEZs of some Southeast Asian Countries* [1/3]

1. Shelf-break Area (100 – 200 m depth)

2. Continental-slope Area (200 – 500 m depth)

Ideas/Suggestions on Deep-sea..... [3/3]

2. Continental-slope Area (200 – 500 m depth)

- ● Implementation of research surveys to obtain the following information and data
  - Fish fauna, their distributions and abundances, and biological factors for commercially important fishes by suitable sampling/fishing gears (including incidental catch of corals)
  - Sea bottom topography (2 D & 3D) and fish-school echo by echo sounder
  - Mapping of potential fishing grounds for each sampling/fishing gear
  - Species composition of fish larvae and juveniles and their abundances by Bong net and IKMT net
  - Detection of vulnerable marine ecosystem (corals, sponges and other organisms) by ROV and/or DCS
- ● Development and improvement of sampling/fishing for reduction of impact to VME

Research Analysis (9/9)

Identification of Vulnerable Ecosystem in the Fishing Grounds and Impact of Fishing to VMEs [6/6]

● Conclusion

Identification of VME

- Four-Order corals observed are the consisting element of potential VMEs.
- The aggregated corals at 2 points are complicatedly categorized as VME due to the low density.

Impact of Bottom Trawl Fishing to VMEs

- Data and information obtained so far are too insufficient to analyze the impact.
- Additional efforts of ROV & DCS operation, resolution of their limits for verification of species identification, and implementation of studies on population structures and life-history factors of the consisting elements of VMEs are strongly needed.

Ideas/Suggestions on Deep-sea..... [2/3]

1. Shelf-break Area (100 – 200 m depth)
   - Implementation of research surveys to investigate fish fauna, and abundances and biological factors of main commercially important fishes using with suitable sampling/fishing gears (including sea environment surveys near the sea bottom)
   - Integrated analyses on life-history factors for the fishes with their information and data obtained from investigations in shallower sea areas
   - Development into commercial bottom fisheries by shifting some large-scaled fishing boats, which are presently operated in coastal zones, to the shelf-break area for reduction of high fishing pressure to coastal fisheries resources (scale-up of boat size and facilities)
   - Collection of catch and effort data by commercial fishing boats to monitor and manage the targeted fisheries resources

Annex 14

International initiatives related to study on impact of fishing to deep - sea ecosystem and International Guidelines for the Management of Deep - sea Fisheries in the High Seas

Dr. Somboon Siriraksophon
Policy and Program Coordinator, SEAFDEC/SEC

International initiatives related to study on impact of fishing to deep-sea ecosystem and International Guidelines for the Management of Deep-sea Fisheries in the High Seas

SOMBOON SIRIRAKSOPHON
Policy and Program Coordinator
SEAFDEC/SEC

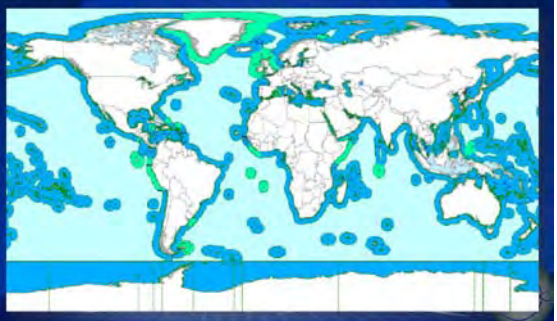
Introduction > Development of DS fishing

Outline

- Introduction >Impact of DS Fishing
- International Guidelines for the Management of Deep-sea Fisheries in the High Seas
- Perceived Concerns to Southeast Asia
- Recommendations for Future Actions
- **Collaborative Arrangements**
- **Future Cooperation on Deep sea Exploration**

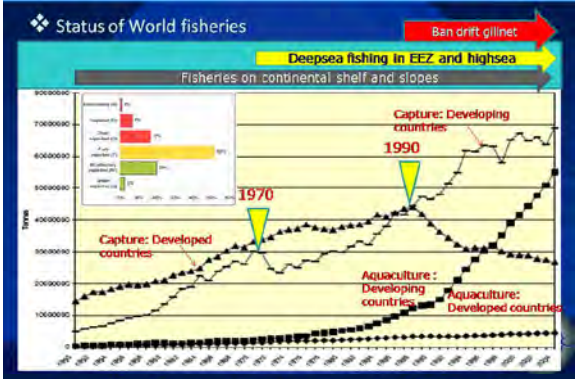
Introduction > Development of DS fishing

- 64% of World's Oceans lie beyond national jurisdictions (FAO)



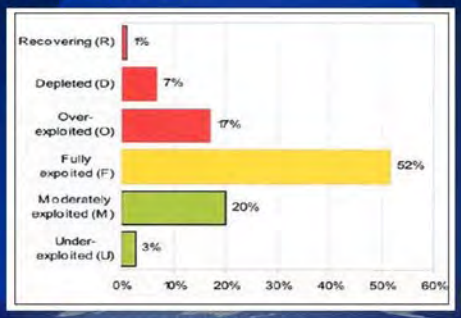
Introduction > Development of DS fishing

- Status of World fisheries



Introduction > Development of DS fishing

- Status of World fisheries



Introduction > Development of DS fishing

- Decadal Trends in Deep Sea Catches >IO & WPO

NW Pac. – pollock, cod and hairtails

WC Pac. – scabbards and Hairtails

SW Pac. – hoki (and orange roughy & alfonsino)

W & E IO. – hairtail, (grenadiers, orange roughy & alfonsino)

Introduction > Impact of DS Fishing

INTERNATIONAL FISHERY INSTRUMENTS

- 1982 United Nations Convention on the Law of the Sea
- 1990s ..attempts to enhance and develop the legal framework for fisheries management
- 1992 Rio Declaration : Environment and Development
- 1993 Agreement to promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas
- 1995 Code of Conduct for Responsible Fisheries
- 1995 Kyoto Declaration and Plan of Action on the Sustainable Contribution of Fisheries to Food Security
- 1995 under UNCOLS: Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stock (UN Fish Stocks Agreement)..

- Concerns on vulnerability of deep sea resources - maturation at relatively **old ages, slow growth, long life expectancies, low natural mortality rates, low productivity**, able to sustain only very low exploitation rates, recovery is expected to be long and is not assured, etc.

Introduction > Impact of DS Fishing

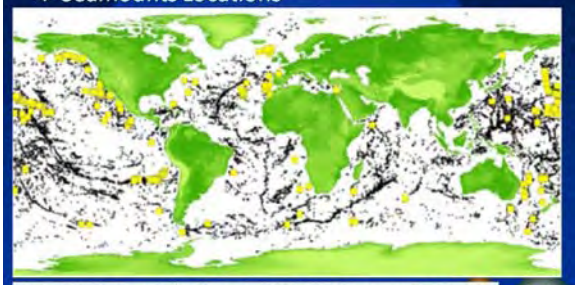
- Significant impacts of deep-sea fishing to **vulnerable marine eco-systems** (habitats, resources, environment) i.e. seamounts, hydrothermal vents, cold seeps, sponge grounds, etc.

Introduction > Impact of DS Fishing

- Deep Sea Trawl

Introduction > Current Situation

- Seamounts Locations



Square indicate seamounts have been sampled biologically (from seamounts.sdsc.edu)
Small lack dots indicate predicted seamounts from Kitchiman and Lai, 2004

Introduction > Current Situation

- Availability of data as well as gaps and shortcomings in the current legal and institutional regimes in the management of deep-sea fisheries in the high seas
- Conservation and environmental pressures

Introduction > Development Process

- Request of 27FAO COFI (2007) - to assist States and RFMOs/As to protect vulnerable marine ecosystems (VMEs) through achieving "Responsible Fisheries in the Marine Eco-system" (UNGA Resolution 61/105)

Introduction > Development Process

- **The Guidelines should include:**
  - Standards and criteria for identifying VMEs in areas beyond national jurisdiction
  - Identifying potential impacts of fishing activities on such ecosystems

Introduction > Development Process

- **Expert Consultation** on Deep-sea Fisheries in the High Seas (Bangkok, Thailand, 21-23 November 2006)
- **Expert Consultation** (Bangkok, Thailand, 11-14 September 2007)
- **Two Technical Consultations** in Rome, Italy, from 4-8 February 2008 and 25–29 August 2008, where the FAO International **Guidelines were reviewed and adopted**
- Submission to 28FAO COFI (2009)
- A further review of the progress of actions identified in the UNGA Resolution 61/105 at the UNGA's Session in 2009

Introduction > Development Process

- **Other related process**
  - Workshop on Vulnerable Marine Ecosystems and Destructive Fishing (Rome, Italy, 26-29 June 2007)
  - Workshop on Knowledge and Data on Deep-sea Fisheries in the High Seas (Rome, Italy, 5-7 November 2007)
- **Guidelines –** to provide tools and guidance on their application to facilitate and encourage the efforts of RFMOs/As and States towards sustainable use of marine living resources, the prevention of significant adverse impacts to vulnerable marine ecosystems (VMEs) and the protection of marine biodiversity.

International Guidelines : Compositions (1)

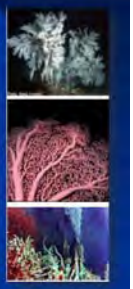
- Preamble & Background Considerations
- Scope and Principles
  - Fisheries in areas beyond the national jurisdiction that
    - Catch includes species that can only sustain low exploitation rates and/or suffer incidental mortality; and
    - Fishing gear is likely to contact the seafloor, whether intended or not.
  - States and RFMOs/As should
    - Adopt and implement measures in conformity with the relevant rules of international laws and instruments
    - Identify areas where VMEs are known or likely to occur; and
    - Take action using the best information available

International Guidelines : Compositions (2)

- Descriptions of Key concepts
  - **Vulnerable Marine Ecosystems** - Vulnerability is the likelihood that a population, community, or habitat will experience substantial alteration from short-term or chronic disturbance (physically or functionally fragile), and are very slow to recover, or may never recover. Vulnerable
  - **Significant Adverse Impacts** - Adverse impacts caused by fishing gear to VMEs that are more than minimal and not temporary in nature.
  - **Adverse impacts** become significant when the harm is serious or irreversible (take two or more generations of the impacted populations or communities or ~ 20 years).

International Guidelines : Compositions (3)

- Governance and Management
  - **Adopt conservation plans** as well as plans for the prevention of significant adverse impacts on VMEs and the protection of marine biodiversity;
  - **Identify areas or features** where VMEs are known or likely to occur, and the location of fisheries;
  - **Develop data collection and research programs** to assess the impact of fishing;
  - Base the management of deep sea fisheries on the **best information available** taking into account fisher's knowledge;



International Guidelines : Compositions (4)

- Governance and Management (cont'd)
  - **Use the most selective fishing methods** possible, recognizing the difficulties of managing fisheries with mixed species or high bycatch;
  - Implement and enforce conservation and management measures through **MCS;**
  - **Eliminate subsidies** that contribute to IUU fishing and to over-capacity**;**
  - **Ensure transparency, public dissemination** of information and enable participation of all relevant stakeholders.

International Guidelines : Compositions (5)

- Governance and Management (cont'd)
  - States should **ensure** that activities under their jurisdiction or control **do not cause damage** to the marine environment of other States or areas beyond the limits of national jurisdiction.
  - States should **establish** and implement **national policy, legal and institutional frameworks** for the effective management of DSF and to prevent adverse impacts on VMEs.
  - States should **strengthen existing RFMOs/As** with the competence to manage and regulate DSF and their impacts on VMEs.

International Guidelines : Compositions (6)

- Governance and Management (cont'd)
  - States should urgently cooperate in the **establishment of new RFMOs/As** with such competence where no such organization or arrangement exists.
  - **RFMOs/As should develop mechanisms** for communication, cooperation, and coordination among themselves, as well as with relevant regional and international organizations, scientific bodies, and NGOs, as appropriate..

International Guidelines : Compositions (7)

- Management and Conservation Steps
  - Data collection, reporting and assessment
  - Identifying Vulnerable Marine Ecosystems and Assessing Significant Adverse Impacts
  - Enforcement and compliance
  - Application of management and conservation tools
  - Processes for the Application of Management Tools (Environmental assessments and harvesting plans Fishery management plans)
  - Assessment and Review of **Effectiveness of Measures/Adjustment** of Measures

International Guidelines : Compositions (8)

- Additional Considerations on Implementation
- Annexes – Data Collection and Reporting, and Management Tools

Perceived Concerns to Southeast Asia (1)

- ✓ Pressure and movement against bottom trawls in the high seas (and in EEZs), including under UNGA framework
- ✓ In Southeast Asia, the exist limited areas of deep-sea fisheries resources in the high seas (i.e. off-east coast of the Philippines), and in countries' EEZs (i.e. Thailand and Indonesia).
- ✓ However, there may be direct impacts to the countries where their fleets are currently conducting or planning to expand deep-sea fisheries in the high seas.

Perceived Concerns to Southeast Asia (2)

- ✓ The Guidelines has **voluntary nature** but developed based on a number of several international binding instruments
- ✓ As indicated in the UNGA Resolution 61/105, the Guidelines once adopted will be used as a reference in **dealing with issues related to deep-sea fisheries in the high seas**. Thus, compliance by States and RMFOs/As to the Guidelines could be expected.
- ✓ **Various views** have been expressed on how the deep-sea fisheries issues are currently handled.
  - ✓ **Good** → the issue is back for discussion by international competent agency/forum like FAO.
  - ✓ **Bad** →burden and overwhelming requirements particularly to developing countries.

Perceived Concerns to Southeast Asia (3)

- ✓ **Although**, the Guidelines **focus** on the bottom fisheries in the **high seas** but it does **not "exclude"** those within national jurisdiction.
- ✓ Thus, the extent of implication of management requirement for **deep-sea fisheries in EEZs should be carefully studied**.
- ✓ **Flag States'** responsibility particularly to ensure that sound assessment of deep-sea fisheries resources and proper management plans should be conducted before allowing new or continuation of deep-sea fisheries may be constraint to many developing countries.

Perceived Concerns to Southeast Asia (4)

- ✓ **Current capacity limitation** of the Member Countries in meeting requirements in conducting stock assessment, obtaining data/information/research/ reporting needs, identification of vulnerable marine ecosystems (VMEs) and assessing significant adverse impacts (SAIs).
- ✓ **MCS requirements** and applicability in the regional fisheries context.
- ✓ Deadlines for States and RFMOs/As to adopt and implement measures to regulate bottom fisheries adopted in the UNGA Resolution 61/105 (This is not directly related to the Guidelines proper).

Recommendations for Future Action (1)

- ❖ Careful study on the draft Guidelines, noting the requirements and potential concerns
- ❖ Take part in the finalization of the Guidelines (4-8February 2008) for submission to FAO COFI at the 28th Session in March 2009
- ❖ Prepare follow-up actions for both national and regional levels In addition, SEAFDEC/TD is currently embarking into research/studies on deep sea fisheries resources. This should be seen in light of assisting many Member Countries in rationalizing their policy of promoting strategic development of off-shore fisheries (within EEZ of the country or other countries, and in the high seas).

Recommendations for Future Action (2)

- ❖ Mobilizing relevant available data and information collected over the year and outcome of existing and future regional programs, SEAFDEC/TD could seriously consider clarifying goals and target of embarking into this issue.
- ❖ This could lead to a solid policy advice on off-shore fisheries development to ensure that they are sustainable and economically feasible and do not create a "bounce back" effect to near-shore fisheries..

SEAFDEC Arrangements with NFU (1)

- ❖ **Objectives :**
  - Enhancing human resources capacity
  - Collaborative Fisheries Resources Survey

SEAFDEC Arrangements with NFU (2)

- ❖ **SEAFDEC Cooperation with NFU**
  - 2006 : Offshore Sarawak, Malaysia by Tenyo maru
  - 2007 : Brunei Darussalam waters by Tenyo maru
  - 2008 : Gulf of Thailand by Tenyo maru
  - Off central Vietnam by Koyo maru
  - 2009 : Off central Vietnam by Koyo maru
  - 2010 : Off central Vietnam by Koyo maru
  - 2011-13 : >>>to be determined

SEAFDEC Arrangements with NFU (2)

Future Cooperation

Consideration:

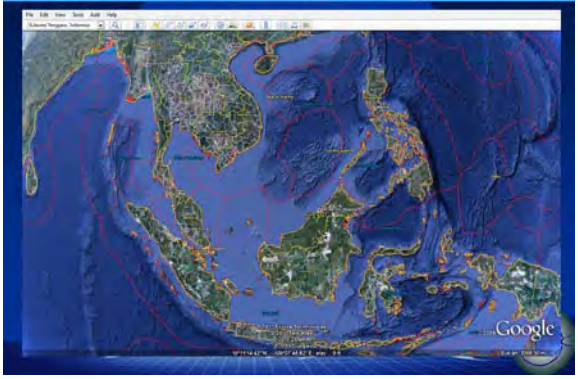
- ✓ Use of SEAFDEC Vessel based on Country requests
- ✓ Lack of human resources on deep sea research, fish identification,
- ✓ Appropriate fishing gears for fish samplings
- ✓ Supports for conducting the Deep sea Exploration
- ✓ Southeast Asian Region as a high biodiversities, Lack of deep sea data available

Future Cooperation

Possible Cooperation:

- ✓ Use of potential research vessels in/outside the Region under Bi-tri lateral agreement, SEAFDEC-As
- ✓ Encourage members to conduct the deep sea survey in each Sub-regional areas, sharing information, experiences under cost share policy
- ✓ Reviewed all deep sea surveys in the region to identify the potential resources, appropriate fishing gears, management contexts, etc.
- ✓ Work together and Develop the Regional proposal through consultation with relevant member countries then seek funding support from other donors

Future Cooperation



FISH FOR THE PEOPLE 2020
ASEAN - SEAFDEC

ASEAN-SEAFDEC Conference 2011
Sustainable Fisheries and Food Security towards 2020
"Fish for the People": adaptation to the changing environment"

Annex 15

INDO-US Collaboration
INDEX SATAL 2010
BARUNA JAYA IV

Dr. Fayakun Satria
Research Center for Fisheries Management and Conservation, Indonesia

INDO-US COLLABORATION
INDEX SATAL 2010
BARUNA JAYA IV

Fayakun satria

Research Center for Fisheries Management and Conservation

Bangkok, 1 September 2010

Background

- Indonesia-USA Deep-Sea Exploration of Sangihe Talaud Region (INDEX Satal 2010)
- To improve the understanding of undersea ecosystem, particularly those associated with submarine volcanoes and Hydrothermal vents
- First time ROV operated in Sangihe talaud region, the area within Coral triangle region
- Okeanos Explorer , RV. Baruna Jaya IV plus Exploration Command Center ashore
- http\\: Oceanexplorere.noaa.gov/okeanos/

Research Vessel involved in INDEX SATAL 2010

Okeanos Explorer

RV. Baruna Jaya IV
1219 GT
60.40 m
BPPT-Indonesia

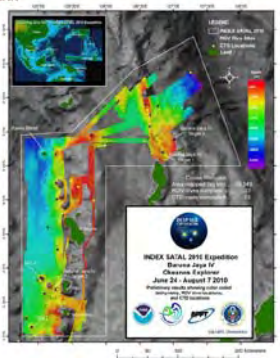
Sampling Gear : Bottom Trawl HR: 33 m and GR: 45 m

Teleconference

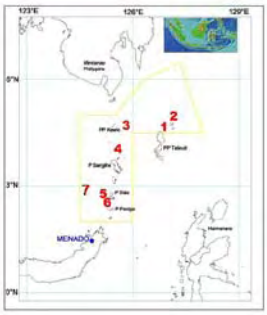
RESULTS

- Okeanos explorer
  - More than 100 hours of video and 100,000 photographs were captured using a robotic vehicle with high-definition cameras, and piped to shore in real time by satellite and high-speed Internet
- Baruna Jaya IV
  - CTD, Plankton net
  - Bathymetry
  - Trawl
  - ARMS

Map summarizing work completed by both NOAA Ship *Okeanos Explorer* and Indonesian Research Vessel *Baruna Jaya IV* during the INDEX SATAL 2010 Expedition



TRAWL
Location of trawl station in the survey area.



RESULTS

6 trawl stations (Around 98 specimens deposited in RIMF Jakarta)

FISH: 32 families (53 species of fishes),

SHRIMPS AND CRUSTACEANS: 10 families (19 species of shrimps)

CEPHALOPODS: 5 families (7 species of cephalopods)

Table 1. The Catch of Baruna Jaya IV in INDEX SATAL Expedition 2010

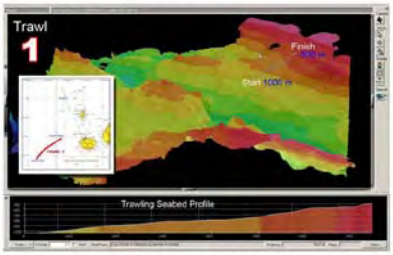
Group	Trawl Station Number													
	7		6		4		3		2		1		TOTAL	
	W (kg)	N	W (kg)	N	W (kg)	N	W (kg)	N	W (kg)	N	W (kg)	N	W (kg)	N
Fish	2.28	21	3.56	10	3.93	19	0.12	19	0.23	16	15.83	70	25.96	165
Crustacean	0.35	12	3.57	12	0.27	33	0	0	0.01	1	0.23	15	4.42	73
Cephalopods	0	0	0	0	0.11	3	0.01	3	0	0	0.98	11	1.09	17
TOTAL	2.63	33	7.13	22	4.31	55	0.13	22	0.24	17	17.03	96	31.47	245

Demersal	Mesopelagic	Crustacean
Acropomatidae	Neoscopelidae	Caridea
Berycidae	Myctophidae	Chirostylidae
Caesionidae	Paralepididae	Galatheidae
Cepolidae	Sternoptychidae	Glyphocrangonidae
Chaunacidae	Alepocephalidae	Majidae
Chiasmodontidae	Chauliodontidae	Pandalidae
Chimaeridae	Gonostomatidae	Sergestidae
Chloropthalmidae	Muraenosocidae	Solenoceridae
Congridae		Aristidae
Giganthiidae	**Cephalopods**	
Grammicolepididae	Histiotteathidae	
Lophiidae	Loliginidae	
Macrouridae	Ommasthrephidae	
Macrouroididae	Mastigoteuthidae	
Nemipteridae	Octopodidae	
Ogcocephalidae	Cranchiidae	
Ophidiidae		
Scorpaenidae		
Trachichthyidae		
Triacanthodidae		
Trichiuridae		
Plesiobatidae		
Pleuronectidae		
Rhinochimaeridae		

Family name of the Demersal, Mesopelagic, Cephalopods and Crustacean caught during the survey

Trawl Station 1.

North of Talaud Island.
Position of trawl : Starting from 04° 41' 32.7"N/ 125° 57'7.92"E and End 02° 41'40.08" N /125° 17' 7.36"E. Distance trawl hauling 7 km. Zone 2, water depth from 1000 – 500 m.



Seabed profile and trawling track on trawl station No 1

Catch composition trawl station no 1,

No	Tentative Name	Scientific Name	Catch Weight	Catch Number	Proportion (%) Weight	Proportion (%) Number
FISHES						
1	Acropomatidae	*Synagrops spinosus*	0.775	14	4.55	14.58
2	Acropomatidae	*Synagrops philippinensis*	0.02	1	0.12	1.04
3	Chimaeridae	*Chimaera phantasma*	4.45	1	26.13	1.04
4	Chlorophthalmidae	*Chlorophthalmus acutifrons*	0.205	1	1.20	1.04
5	Chlorophthalmidae	*Chlorophthalmus nigromarginatus*	0.385	9	2.26	9.38
6	Ichthyuridae	*Benthodesmus tenuis*	0.07	1	0.41	1.04
7	Bericidae	*Beryx splendens*	0.48	2	2.82	2.08
8	Congridae	*Ariosoma shiroanago*	0.165	3	0.97	3.13
9	Ophidiidae	*Glyptophidium japonicum*	0.06	2	0.35	2.08
10	Ophidiidae	*Monophidoua bunnje*	0.06	3	0.35	3.13
11	Pleuronectidae	*Poecilopsetta praelonga*	0.05	1	0.29	1.04
12	Pleuronectidae	*Poecilopsetta sp.*	0.01	1	0.06	1.04
13	Macrouridae	*Malacocephalus sp.*	0.74	10	4.35	10.42
14	Ogcocephalidae	*Halieutaea reticulatus*	0.015	1	0.09	1.04
15	Lophiidae	*Lophiodes inquilus*	0.265	1	1.56	1.04
16	Muraenosocidae	*Muraenosox cinereus*	0.05	1	0.29	1.04
17	Paralepididae	*Stemonosudis sp.*	0.01	2	0.06	2.08
18	Chaunacidae	*Chaunax sp.*	1.225	8	7.19	8.33
19	Chauliodontidae	*Chauliodus sloani*	0.055	6	0.32	6.25
20	Plesiobatidae	*Plesiobatis davosi*	6.720	1	39.46	1.04
21	Myctophidae	*Myctophiliger sp.*	0.02	1	0.12	1.04
SUB TOTAL			15.83	70	92.96	72.92
CRUSTACEANS, SHRIMPS						
22	Aristidae	*Plesiopenaeus edwardsianus*	0.125	3	0.73	3.13
23	Sergestidae	*Acetes sp.*	0.015	6	0.09	6.21
24	Pandalidae	*Heterocarpus sp.*	0.025	3	0.15	3.13
25	Pandalidae	*Pandalidae sp.*	0.05	2	0.29	2.09
26	Galatheidae	*Galathea sp.*	0.005	1	0.03	1.04
27	Majidae	*Majidae sp.*	0.005	1	0.03	1.04
SUB TOTAL			0.225	15	1.32	15.63
CEPHALOPODS						
26	Histioteuthidae	*Histioteuto celetera pacifica*	0.495	7	2.85	7.29
27	Mastigoteuthidae	*Mastigoteuthis sp.*	0.145	1	0.85	1.04
28	Loliginidae	*Loliolus sp.?*	0.035	2	0.15	2.08
29	Octopodidae	*Octopus sp.*	0.32	1	1.88	1.04
SUB TOTAL			0.975	11	5.73	11.45
TOTAL			17.03	96	100.00	100.00

An 8cm long gastropod snail crawling on a wood fall (log) at 1525 depth. Image captured by the *Little Hercules* ROV at a site referred to as "Baruna Jaya IV - Site 1" on August 1 (Hercules – ROV)

Some Photos of selected Fish caught at trawl station no 1




Habitat Description around Trawl sites no 1

Igneous rocks
Andesitoid, dark-grey, porphyritic, subhedral-euhedral, groundmass mafic, phenocrysts plagioclase, hornblende, biotite

Sedimentary rocks Sandstone, light grey, fine grain, , rounded, good porosity and permeability, compact.

Sedimentary rocks
Claystone, dark-grey, compact

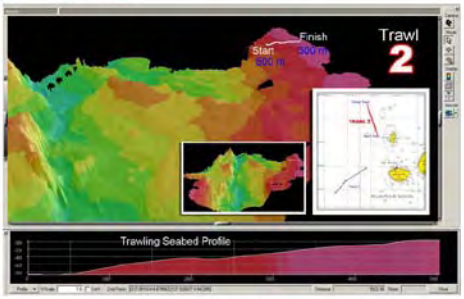
Sedimentary rocks
Sandstone, light grey, fine grain, rounded, good porosity and permeability, compact

Igneous rocks
Andesitoid, light grey, subhedral-euhedral, porphyritic, groundmass mafic, phenocrysts plagioclase, hornblende, biotite, massive.

Catch composition trawl station no 2,

No	Tentative Name	Scientific Name	Catch		Proportion (%)	
			Weight	Number	Weight	Number
FISHES						
1	Scorpaenidae	*Setarches guentheri*	0.115	1	48.94	5.88
2	Giganthiidae	*Symphysanodon* Sp 1	0.03	1	12.77	5.88
3	Giganthiidae	*Symphysanodon* Sp 2	0.005	1	2.13	5.88
4	Nemipteridae	*Scolopsis* Sp	0.015	1	6.38	5.88
5	Nemipteridae	*Parascolopsis* sp	0.005	2	2.13	11.76
6	Cepolidae	*Owstonia* Sp	0.025	1	10.64	5.88
7	Triacanthodidae	*Atrophacanthus japonicus*	0.015	5	6.38	29.41
8	Caesionidae	*Pterocaesio* sp1	0.005	2	2.13	11.76
9	Caesionidae	*Pterocaesio* sp2	0.01	2	4.26	11.76
SUB TOTAL			***0.225***	***16***	95.74	94.12
CRUSTACEANS, SHRIMPS						
10	Galatheidae	Galathea sp	0.01	1	4.26	5.88
SUB TOTAL			***0.01***	***1***	4.26	5.88
TOTAL			0.235	17	100	100

Trawl Station 2.
North of Talaud Island.
Position of trawl: Starting from 04º 48' 12.90"N/ 127º 01' 54.84"E and End 04º 51'39.59" N /127º 00' 44.85"E. Distance trawl hauling 5 km. Zone 1, water depth from 500–300 m.



Seabed profile and trawling track on trawl station No 2

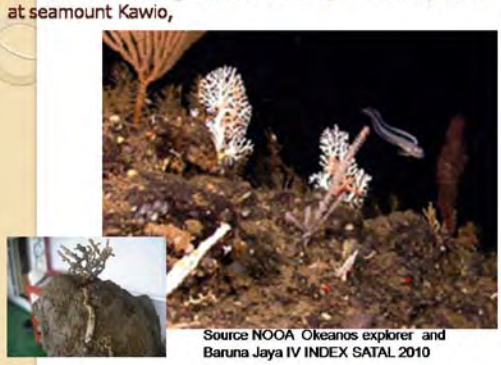
Some Photos of selected Fauna caught at trawl station no 2

Sedimentary rocks
Siltstone, light grey, very find grain, rounded, , good porosity and permeability, compact.

Sedimentary rocks
Siltstone, light grey, very fine grain, , rounded, good porosity and permeability, compact

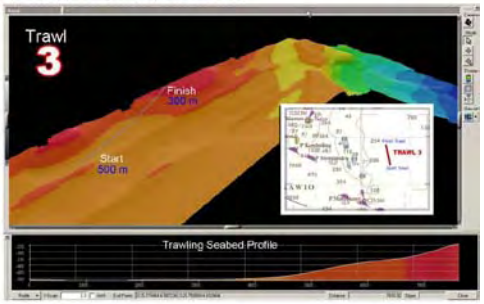
Sedimentary rocks
Clay stone, dark-grey, compact.

An overview showing the extraordinary biodiversity found at seamount Kawio,



Source NOOA Okeanos explorer and Baruna Jaya IV INDEX SATAL 2010

Trawl Station 3.
East of Kawio Island.
Position of trawl : Starting from 04o 39' 52.5"N/ 125o 45' 49.6"E and End 04o 35'43.82" N /125o 46' 38.02"E. Distance trawl hauling 7 km. Zone 1, water depth from 500–300 m.



Seabed profile and trawling track on trawl station No 3

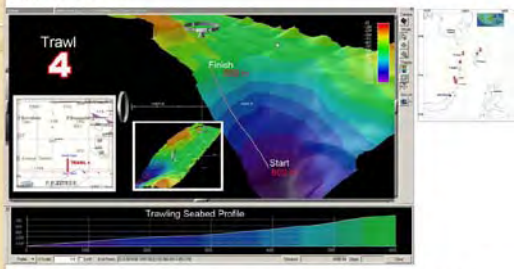
Catch composition trawl station No 3 (3/A1),

No	Tentative Name	Scientific Name	Catch		Proportion (%)	
			Weight	Number	Weight	Number
FISHES						
1	Trichiuridae	*Benthodesmus tenuis*	0.065	2	51.10	9.09
2	Sternoptychidae	*Polyipnus stereope*	0.0101	4	7.94	18.18
3	Sternoptychidae	*Argyropelecus affinis*	0.0023	1	1.81	4.55
4	Chauliodontidae	*Chauliodus sloani*	0.0022	1	1.73	4.55
5	Myctophidae	*Cerastoscopelus warmingii*	0.0034	2	2.67	9.09
6	Myctophidae	*Taaningichthys minimus*	0.0358	7	28.14	31.82
7	Myctophidae	*Myctophidae* sp	0.002	2	1.57	9.09
SUB TOTAL			***0.1208***	***19***	94.97	86.36
CEPALOPODS						
8	Cranchiidae	*Heliocranchia* sp	0.0021	1	1.65	4.55
9	Ommastrephidae	*Ommastrephidae* sp	0.0043	2	3.38	9.09
SUB TOTAL			***0.0064***	***3***	5.03	13.64
TOTAL			0.1272	22	100	100

PHOTOS of Some fihes caught in trawl station no 3

Trawl Station 4.

North of Sangihe Island.
Position of trawl : Starting from 04º 00' 0"N/ 125º 33' 38.86"E and End 04o 03' 43.95" N /125º 33' 58.86"E. Distance trawl hauling 6 km. Zone 2, water depth from 800 – 500 m.

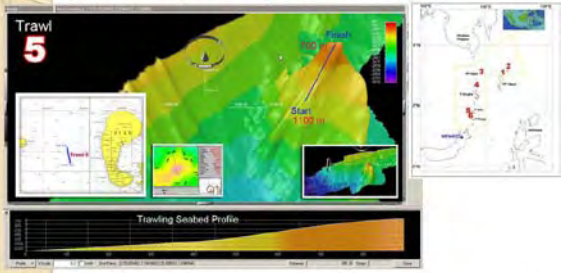


Seabed profile and trawling track on trawl station No 4

PHOTOS of Some fauna caught in trawl station no 4

Trawl Station 5 /6.

West of Siau Island.
Position of trawl : Starting from 02o 45' 31.70"N/ 125o 16' 24.65"E and End 02o 41' 40.08" N /125o 17' 7.36"E. Distance trawl hauling 1 km. Zone 2, water depth from 1000 – 500 m.



Seabed profile and trawling track on trawl station No 5 and No 6

Photos of Explorer close to the trawl station no 3
The vehicle captured the underside of this galatheid crab clinging to a coral on July 12.

Image of the sea spider seen during the dive on July 11

Catch composition trawl station No 4

No	Tentative Name	Scientific Name	Catch		Proportion (%)	
			Weight	Number	Weight	Number
FISHES						
1	Ophidiidae	*Lamprogrammus* sp	0.77	1	17.85	32.45
2	Ophidiidae	*Lamprogrammus niger*	0.095	1	2.20	4.00
3	Sternoptychidae	*Sternoptyx pseudobscura ?*	0.0004	2	0.06	0.10
4	Macrouridae	*Pseudonezumia oetorunopis*	0.2	1	4.64	8.43
5	Macrouridae	*Macrouridae* sp	0.01	1	0.23	0.42
6	Macrouridae	*Malacocephalus* sp	0.115	1	2.67	4.85
7	Macrouridae	*Trachonurus villosus*	0.25	1	5.80	10.54
8	Macrouridae	*Hymnocephalus papiraceus*	0.03	2	0.70	1.26
9	Macrouridae	*Nezumia propinqua*	0.01	1	0.23	0.42
10	Macrouridae	*Glyptophidium* sp	0.025	1	0.58	1.05
11	Macrouridae	*Abyssiola macrochir*	0.325	1	7.53	13.70
12	Gonostomatidae	*Gonostomatidae* sp	0.0047	1	0.11	0.20
13	Rhinochimaeridae	*Rhinochimaera africana*	1.92	1	44.51	80.92
14	Alepocephalidae	*Rouleina guentheri*	0.16	3	3.71	6.74
15	Chaulisotidae	*Chaulodus sloani*	0.015	1	0.35	0.63
SUB TOTAL			**3.9221**	**19**	91.15	165.72
CRUSTACEANS, SHRIMPS						
16	Glyphocrangonidae	*Glyptocrangon* sp	0.0089	2	0.21	0.38
17	Solenoceridae	*Solenocera* sp	0.015	1	0.35	0.63
18	Pandalidae	*Heterocarpus* Sp.4	0.035	8	0.81	1.48
19	Caridea	Caridea Sp.	0.055	1	1.27	2.32
20	Pandalidae	*Heterocarpus* Sp.1	0.07	5	1.62	2.95
21	Pandalidae	*Heterocarpus parvispina*	0.03	8	0.70	1.26
22	Pandalidae	*Pandalidae* Sp.	0.015	5	0.35	0.63
23	Pandalidae	*Parapandalus* Sp	0.025	2	0.58	1.05
24	Pandalidae	*Parapandalus* Sp. 2	0.01	2	0.23	0.42
25	Shrimps Ui	Un identified shrimp 1	0.008	1	0.19	0.34
SUB TOTAL			**0.2719**	**37**	6.30	11.46
CEPALOPODS						
26	Mastigoteuthidae	*Mastigoteuthis corditormis*	0.075	1	1.74	3.16
27	Cranchidae	*Cranchidae* Sp.1	0.035	2	0.81	1.48
SUB TOTAL			**0.11**	**3**	2.55	4.64
TOTAL			**4.314**	**55**	100.00	100.00

04º 40.590'N 125º 05.236' E. At a depth of about 1850m a sulfur vent. Surrounding the vent was a large amount of yellow and black molten sulfur, multiple species of hot-vent shrimp, a 10cm scale worm, and a small patch of stalked barnacles.

hydrothermal vents found during the second ROV dive on Kawio Barat. The yellow deposits are molten sulfur. Multiple species of hot-vent shrimp are also visible

Catch composition of trawl stations No 5/6

No	Tentative Name	Scientific Name	Catch		Proportion (%)	
			Weight	Number	Weight	Number
FISHES						
1	Ophidiidae	*Lamprogrammus niger*	2.55	1	71.47	8.33
2	Macrouridae	*Squalogadus imlaiceps*	0.865	1	24.24	8.33
3	Serrivomeridae	*Serrivomer sector*	0.105	1	2.94	8.33
4	Chaulidontidae	*Chaulodus sloani*	0.03	3	0.84	25.00
5	Sternoptychidae	*Sternoptyx obscura*	0.0072	3	0.20	25.00
6	Chiasmodontidae	*Chiasmodontidae* sp	0.006	1	0.17	8.33
SUB TOTAL			3.5632	10	99.87	83.33
CRUSTACEANS, SHRIMPS						
7	Pandalidae	*Heterocarpus* Sp 5	0.0028	1	0.07	8.33
8	Pandalidae	*Heterocarpus* Sp 6	0.0021	1	0.06	8.33
SUB TOTAL			0.0047	2	0.13	16.67
TOTAL			3.5679	12	100	100

PHOTOS of Some fauna caught in trawl station no 5

- This decided since the echo sounder indicates that a large schooling occur just above the top of the *seamount* at the depth range 700- 800 m.
- The trawlwas broken prior to hauling to the deck.
- Ophiidids fish , *Lamprogrammus niger* with size SL 73.2 cm, *Squalogadus inflaticeps* (SL 48 cm) →deep demersal fish that known normally distributed on the depth 800-1200 m.
- *Lamprogrammus* → known normally occurred in a large schooling, this species might be the one of dominant species that shown by the echo sounder forming a schooling on the top of seamount.
- Several mesopelagic fish were also caught by the gear such as: *Sternoptyx obscura, Chauliodus sloani* and *Chiasmodontids fish.*

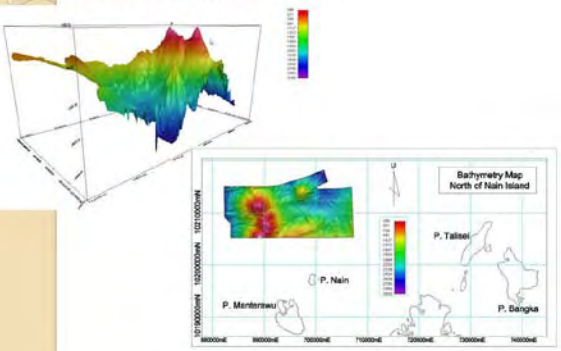
HABITAT DESCRIPTION of Trawl Station No 5/6

Sedimentary rocks
Sandstone, light brown, medium grain, rounded-subrounded, good porosity and permeability, compact.

Igneous rock
Porphyritic basalt, dark grey-black, euhedral-anhedral, porphyritic, fined grain matrix, phenocrysts pyroxene and glass, and contained Mn (Mangan).

Scleractinian hard coral imaged by the *Little Hercules* ROV at 1382 meters depth. Based on published results, this coral may be 1,000 to 6,000 years old.

Trawl Station 7
North of Nain Island.



Catch composition trawl station No 7 (*deep sea seamount near the Bunaken Island*)

No	Tentative Name	Scientific Name	Catch		Proportion (%)	
			Weight	Number	Weight	Number
FISHES						
1	Berycidae	*Beryx splendens*	1.45	3	55.07445	9.090909
2	Grammicolepididae	*Xenolepidichtys dalgleishi*	0.25	4	9.495594	12.12121
3	Ophidiidae	*Glyptophidium japonicum*	0.215	7	8.166211	21.21212
4	Scorpaenidae	*Setarches longimanus*	0.0096	1	0.364631	3.030303
5	Trachichthyidae	*Hoplostethus crassispinus*	0.085	1	3.228502	3.030303
6	Chauliodontidae	*Cahuallodus sloani*	0.02	1	0.759648	3.030303
7	Neoscopelidae	*Neoscopelus macrolepidatus*	0.065	2	2.468854	6.060606
8	Neoscopelidae	*Neoscopelus porosus*	0.19	2	7.216651	6.060606
SUB TOTAL			2.2846	21	86.77454	63.63636
CRUSTACEANS, SHRIMPS						
7	Pandalidae	*Heterocarpus laevigatus*	0.285	7	10.82498	21.21212
8	Pandalidae	*Plesionika martia*	0.02	1	0.759648	3.030303
9	Pandalidae	*Plesionika longirostris*	0.02	1	0.759648	3.030303
10	Galatheidae	*Galatheidae Sp 3*	0.0094	1	0.357034	3.030303
11	Galatheidae	*Galatheidae Sp 2*	0.0024	1	0.091158	3.030303
12	Chirostylidae	*Chirostylidae Sp 1*	0.0114	1	0.432999	3.030303
SUB TOTAL			0.3482	12	13.22546	36.36364
TOTAL			2.6328	33	100	100

Some photos in Station No 7

Trachichthydae, *Hoplostethus crasisspinus*

Berycidae, *Beryx splendens*

Pandalidae, *Heterocarpus laevigatus*

Source index satal 2010 habitat group

Description on station no 7

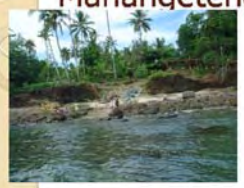
- This site has a health habitat with many of corals, antiphatarian, gorgonians and sponges suggesting a good site for schooling of fish inhabit the area. There were no uncommon and new fish or crustaceans found in this site but occupied by commercial fish such as The Alfonsino and Indonesian Red roughy.

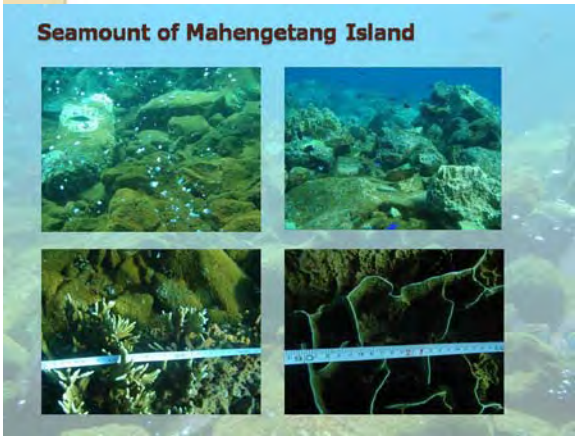
at 5º 04 678'N 126º 39.125'E an octopus that was purple with large glassy eyes. Okeanos/Hercules Photo.

Actieve sea mount

- There are evidence that within the survey area there are active seamount such as : Kawio barat and east bunaken, Mahangeteng (Vent, volcanic stones, sulfur, Bubles)

Mahangeteng Island





Finding

- There are several seamount identified and succesfully mapping in the survey area
- The trawl catch quantitatively can not determined the abundance of fish, but quantitatively describe what fish under the sea
- Site 1, 4, 5, 7 indicate species that exist commonly in a large school of fish
- Site 7 has a unique habitat (Black coral, Coral bamboo, and sponges occurred around the active seamount)
- Required a more extensive survey assuring the abundance of the resources

ACKNOWLEDGEMENT

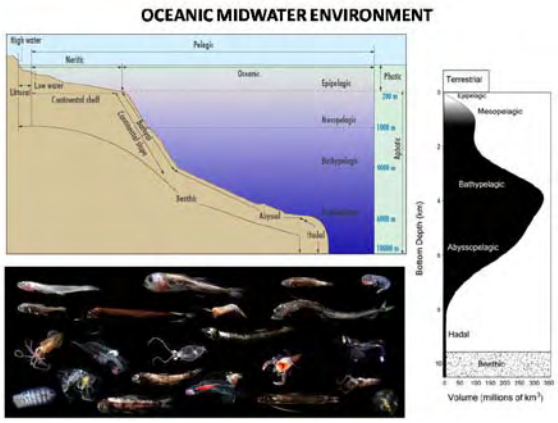
- The Information given on this presentation was from the INDEX SATAL 2010 : A joint research between Indonesia and USA.

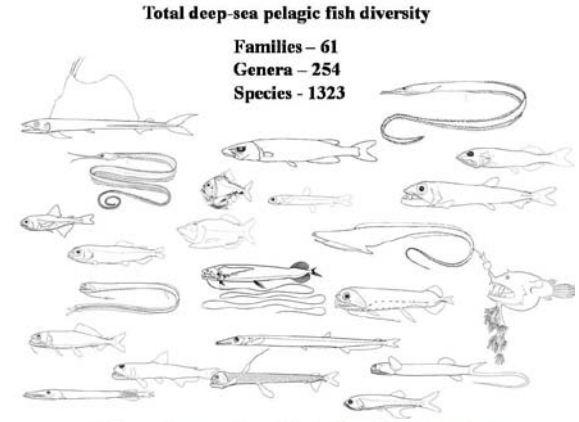
Annex 16

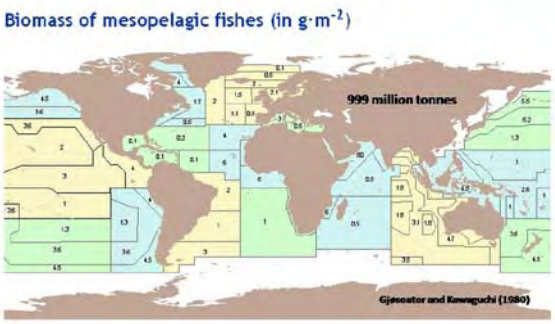
Mesopelagic fish research
Current trends and future directions

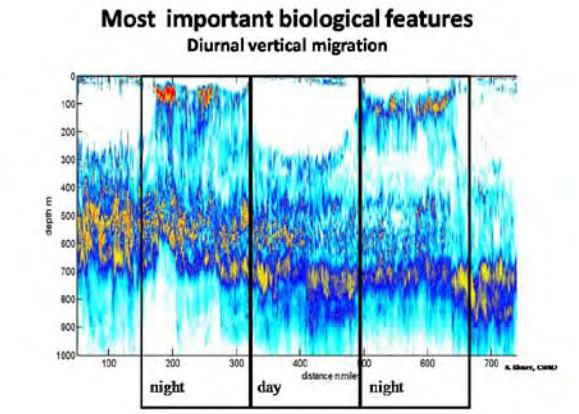
Dr. Andrey V. Suntsov
Pacific Island Fisheries Science Center (NOAA), Hawaii

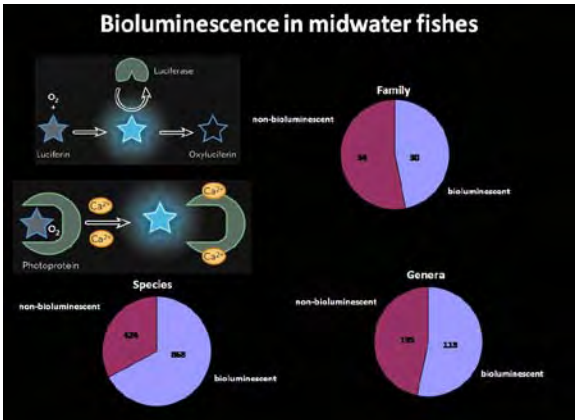

Mesopelagic fish research – current trends and future directions
Andrey V. Suntsov

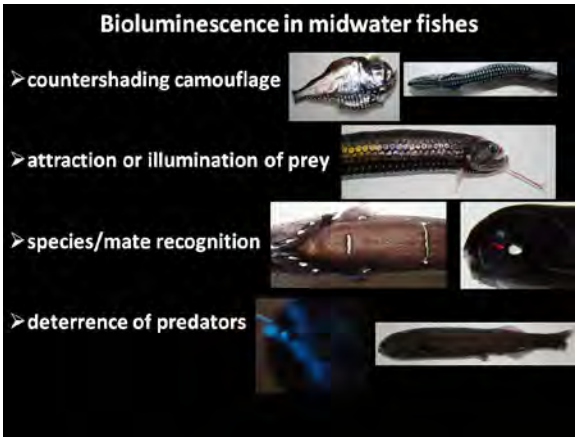

OCEANIC MIDWATER ENVIRONMENT
Pelagic
Neritic
Oceanic
Epipelagic
Mesopelagic
Bathypelagic
Abyssopelagic
Benthic
Abyssal
Hadal
Terrestrial
Bottom Depth (km)
Volume (millions of km³)

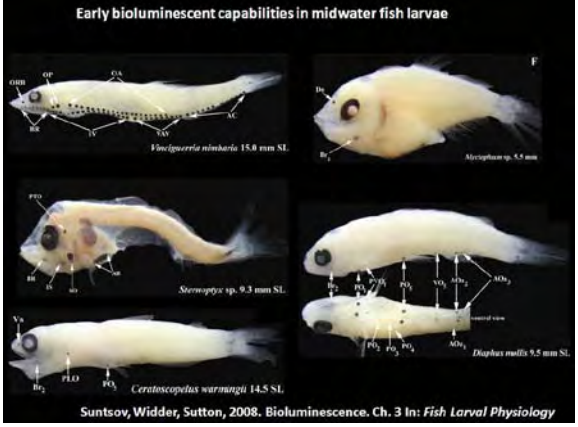

Total deep-sea pelagic fish diversity
Families – 61
Genera – 254
Species - 1323

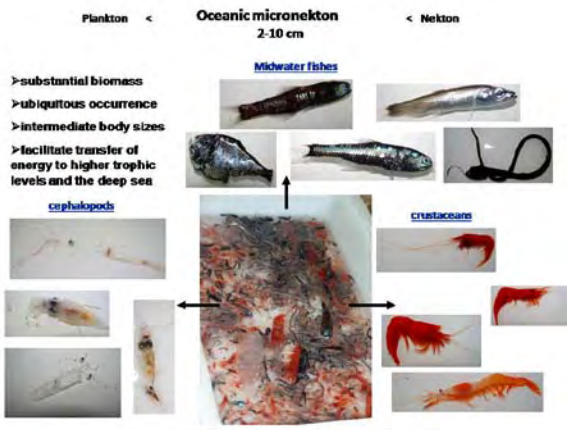

Biomass of mesopelagic fishes (in g·m⁻²)
999 million tonnes
Gjøsæter and Kawaguchi (1980)

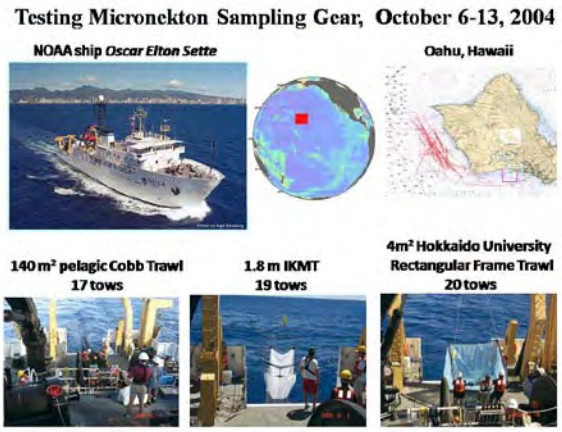

Most important biological features
Diurnal vertical migration
depth m
distance n.mile
night
day
night

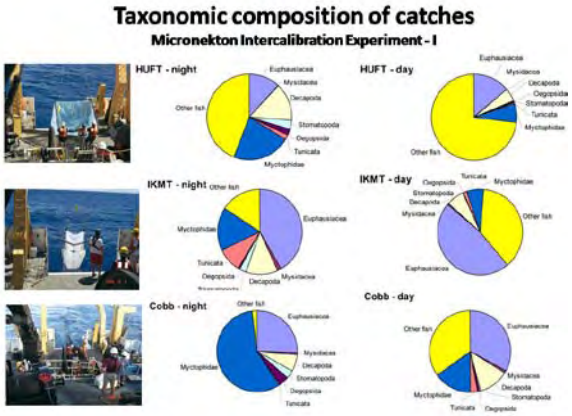

Bioluminescence in midwater fishes
Luciferase
Luciferin
Oxyluciferin
Photoprotein
Family
non-bioluminescent
bioluminescent
Species
Genera

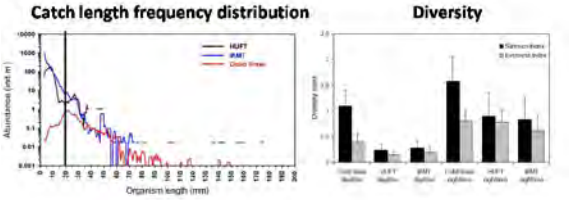

Bioluminescence in midwater fishes
countershading camouflage
attraction or illumination of prey
species/mate recognition
deterrence of predators

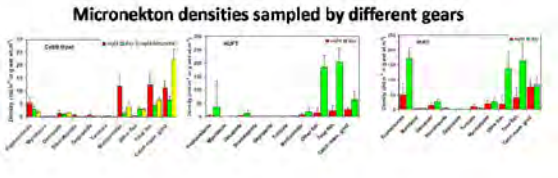

Early bioluminescent capabilities in midwater fish larvae
Vinciguerria nimbaria 15.0 mm SL
Sternoptyx sp. 9.3 mm SL
Ceratoscopelus warmingii 14.5 SL
Diaphus mollis 9.5 mm SL
Suntsov, Widder, Sutton, 2008. Bioluminescence. Ch. 3 In: Fish Larval Physiology


Plankton <
Oceanic micronekton
2-10 cm
< Nekton
Midwater fishes
➢substantial biomass
➢ubiquitous occurrence
➢intermediate body sizes
➢facilitate transfer of energy to higher trophic levels and the deep sea
cephalopods
crustaceans

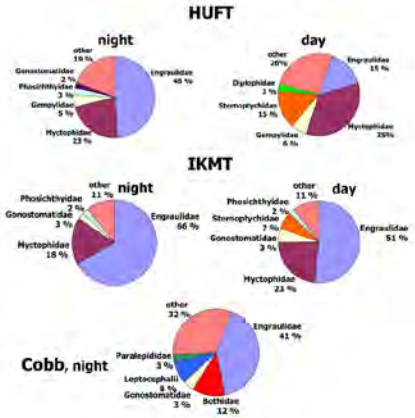

Testing Micronekton Sampling Gear, October 6-13, 2004
NOAA ship Oscar Elton Sette
Oahu, Hawaii
140 m² pelagic Cobb Trawl
17 tows
1.8 m IKMT
19 tows
4m² Hokkaido University
Rectangular Frame Trawl
20 tows

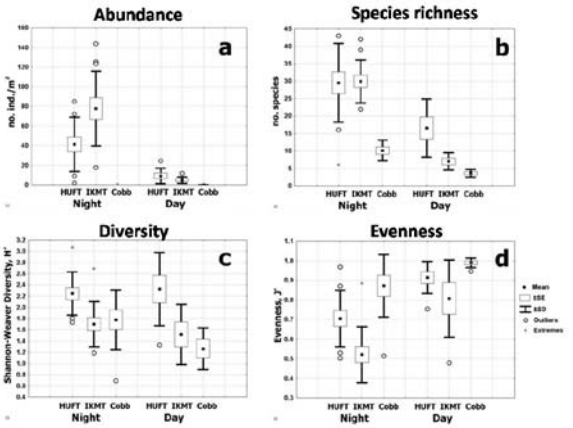

Taxonomic composition of catches
Micronekton Intercalibration Experiment - I
HUFT - night
HUFT - day
IKMT - night
IKMT - day
Cobb - night
Cobb - day


Catch length frequency distribution
Diversity

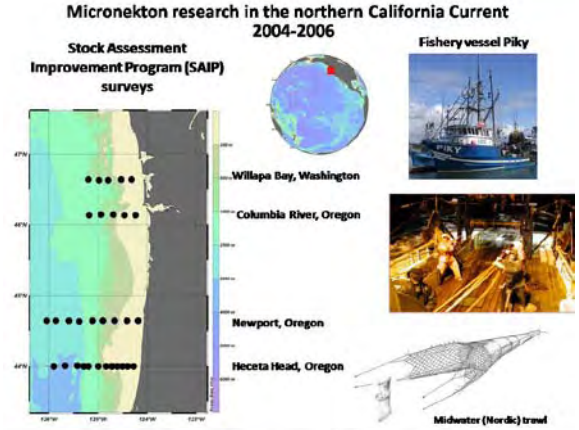

Micronekton densities sampled by different gears

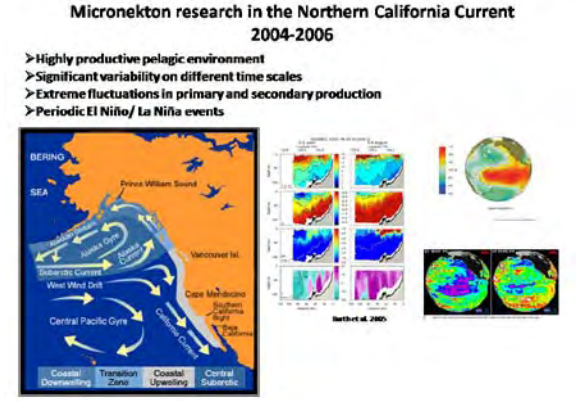

Ichthyoplankton sampled by different gears

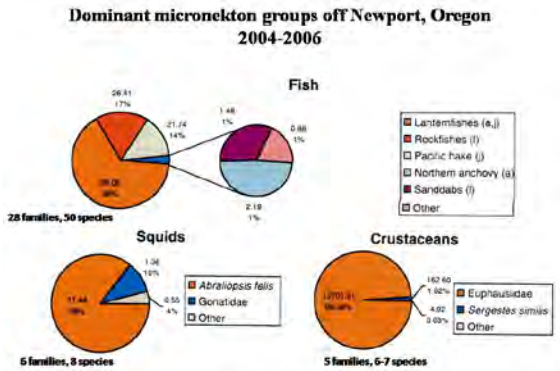

HUFT
night
day
IKMT
night
day
Cobb, night

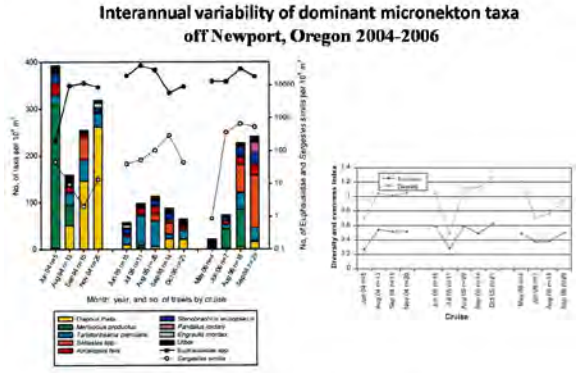

Abundance
a
Species richness
b
Diversity
c
Evenness
d
HUFT IKMT Cobb
Night
Day


Diversity in deep-sea fish otoliths
a. saccular otoliths
Composition – calcium aragonite
Argyropelecus gigas
(Sternoptychidae)
Sigmops elongatum
(Gonostomatidae)
Diplophos taenia
(Gonostomatidae)
Bregmaceros mcclellandi
(Bregmacerotidae)
Xenodermichthys copei
(Alepocephalidae)
Lestrolepis intermedia
(Paralepididae)
Stomias boa
(Stomiidae)
Synaphobranchus kaupii
(Synaphobranchidae)



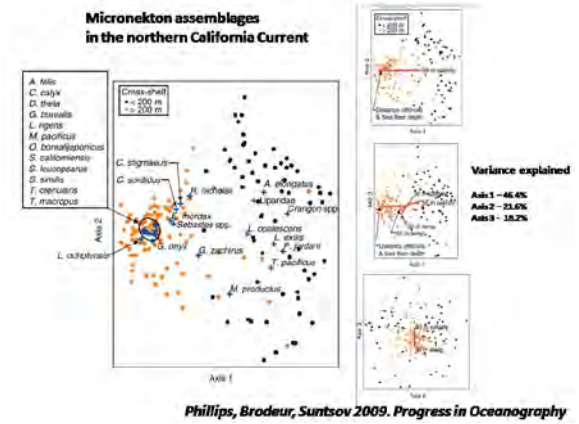


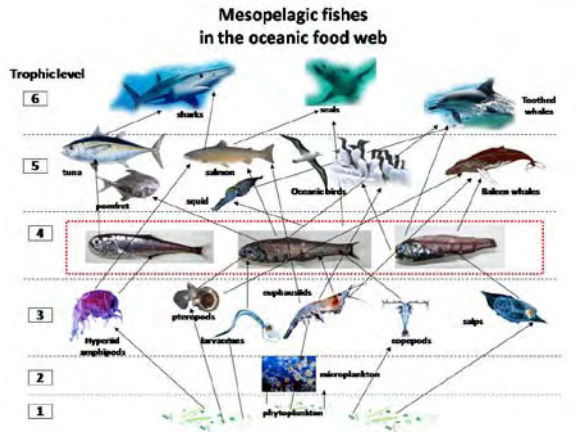




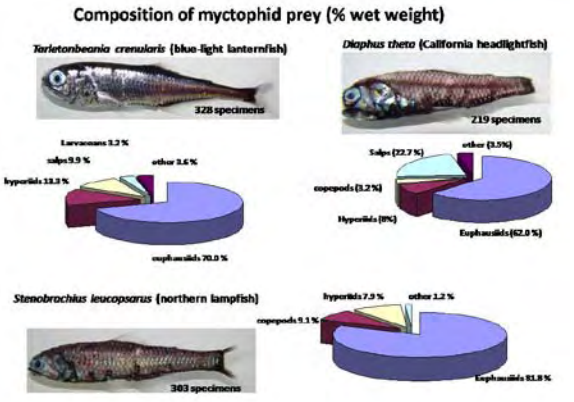
Phillips, Brodeur, Suntsov 2009. Progress in Oceanography

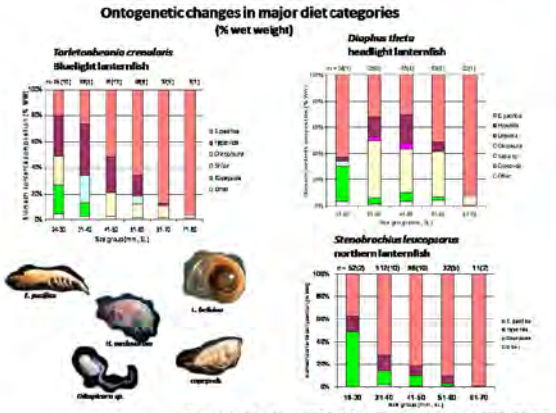
Phillips, Brodeur, Suntsov 2009. Progress in Oceanography



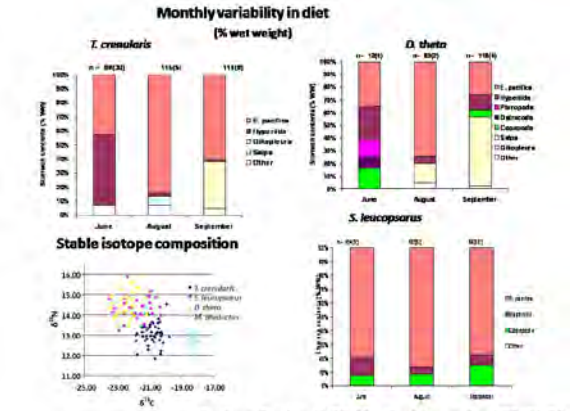


Phillips, Brodeur, Suntsov 2009. Progress in Oceanography





Suntsov, Brodeur 2008. Mar. Ecol. Progr. Ser. 373: 81-96



Suntsov, Brodeur 2008. Mar. Ecol. Progr. Ser. 373: 81-96

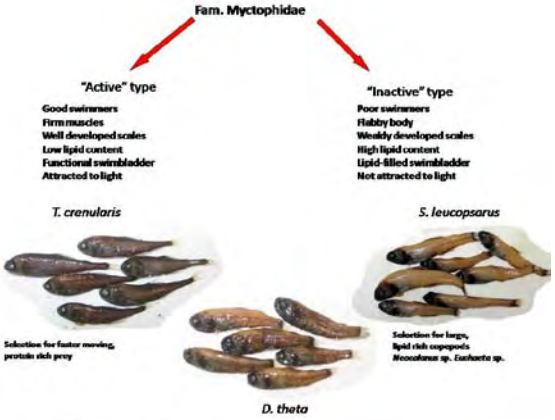
The importance of major food categories

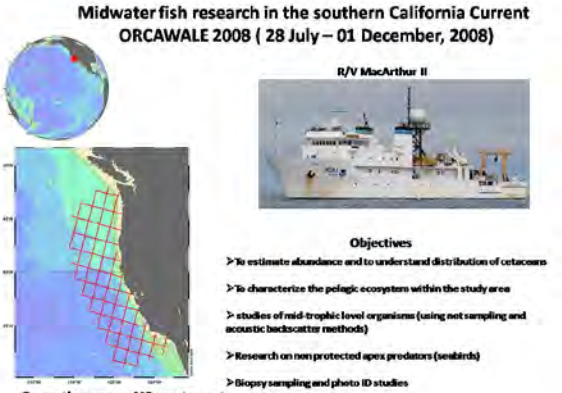
Index of Relative Importance (IRI)

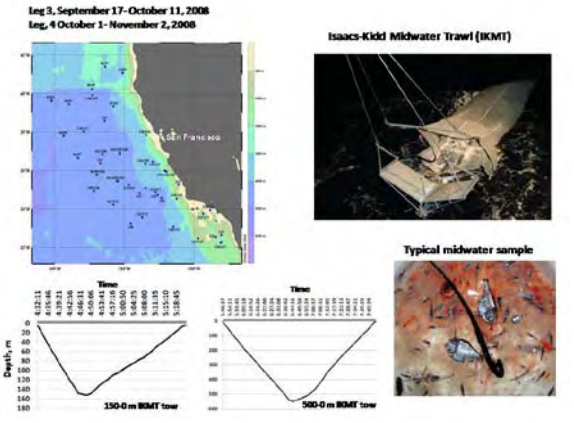
- % frequency of occurrence (F_i)
- % number (Cn)
- % wet weight (WW$_i$)

$$IRI_i = F_i \times (Cn_i + WW_i)$$

	T. crenularis		*D. theta*		*S. leucopsarus*	
Euphausiids	3532	1	3331	1	6881	1
Hyperiids	595	3	275	5	261	3
Salps	410	4	1606	2	-	
Larvaceans	1173	2	321	4	5	
Copepods	143	5	706	3	2307	2
Pteropods	<1		158		3	
Ostracods	<1		42		9	

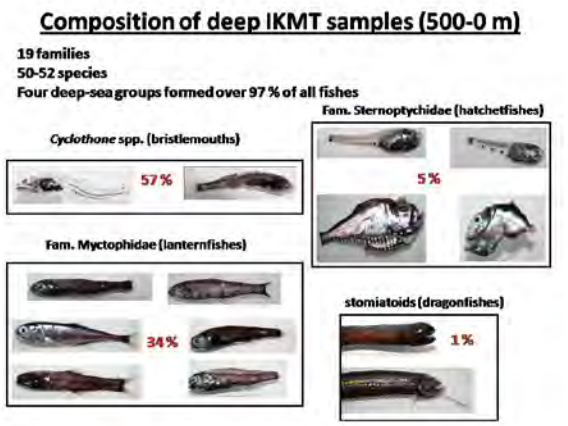


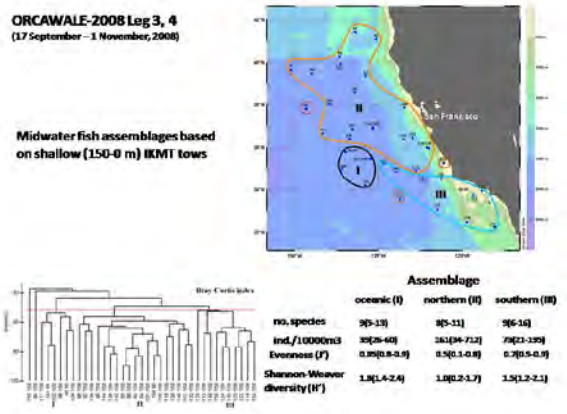


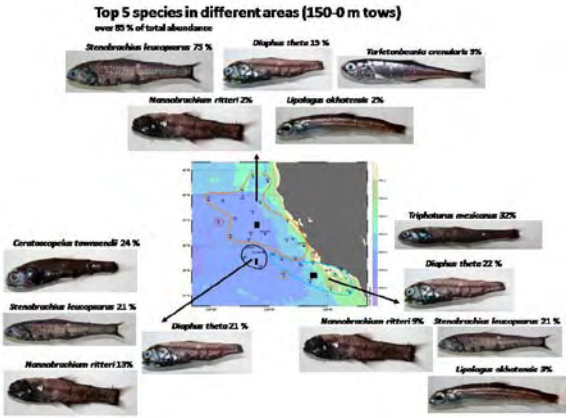


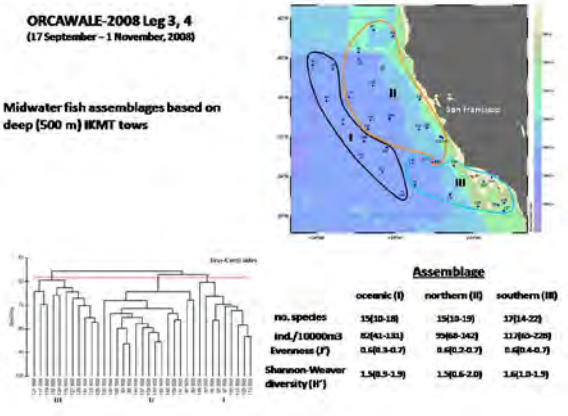
Composition of shallow IKMT samples (150-0 m)

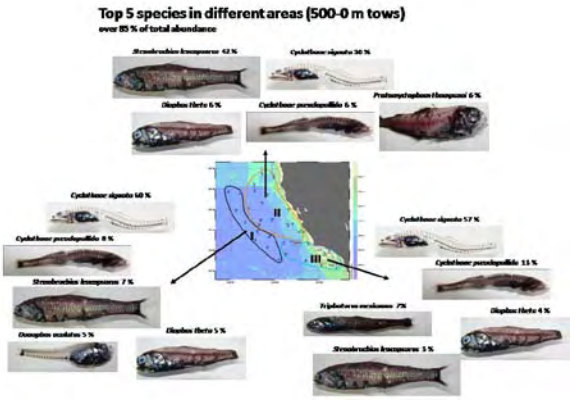
17 families
32-34 species
Lanternfishes (Fam. Myctophidae) – 94 % of total midwater fish specimens

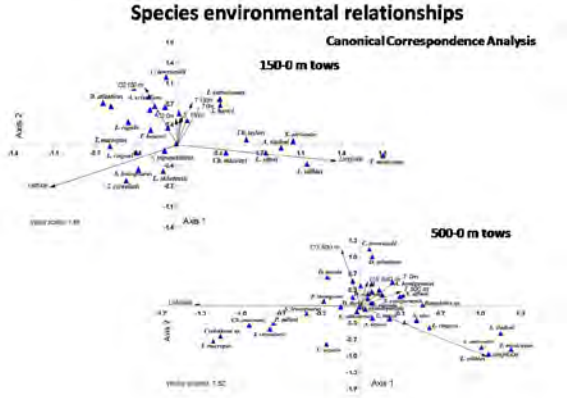

Composition of deep IKMT samples (500-0 m)
19 families
50-52 species
Four deep-sea groups formed over 97 % of all fishes
Cyclothone spp. (bristlemouths)
57 %
Fam. Sternoptychidae (hatchetfishes)
5 %
Fam. Myctophidae (lanternfishes)
34%
stomiatoids (dragonfishes)
1%

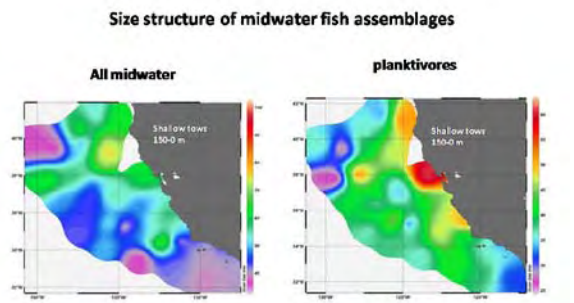

ORCAWALE-2008 Leg 3, 4
(17 September – 1 November, 2008)
Midwater fish assemblages based on shallow (150-0 m) IKMT tows
San Francisco
Assemblage
oceanic (I)
northern (II)
southern (III)
no. species
ind./10000m3
Evenness (J')
Shannon-Weaver diversity (H')

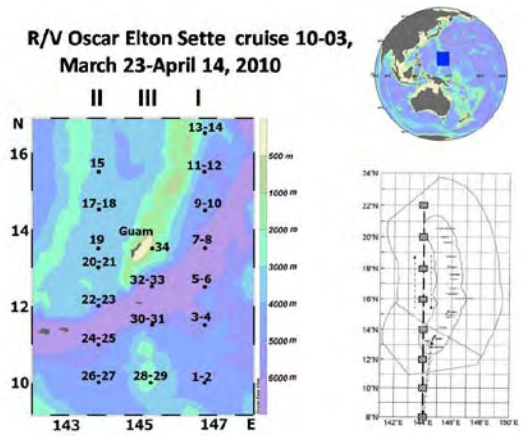

Top 5 species in different areas (150-0 m tows)
over 85 % of total abundance
Stenobrachius leucopsarus 75 %
Diaphus theta 15 %
Tarletonbeania crenularis 3%
Nannobrachium ritteri 2%
Lipolagus ochotensis 2%
Ceratoscopelus townsendi 24 %
Stenobrachius leucopsarus 21 %
Nannobrachium ritteri 13%
Diaphus theta 21 %
Triphoturus mexicanus 32%
Diaphus theta 22 %
Nannobrachium ritteri 9%
Stenobrachius leucopsarus 21 %
Lipolagus ochotensis 3%

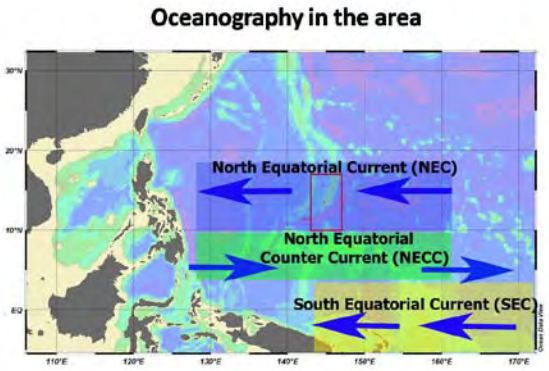

ORCAWALE-2008 Leg 3, 4
(17 September – 1 November, 2008)
Midwater fish assemblages based on deep (500 m) IKMT tows
San Francisco
Assemblage
oceanic (I)
northern (II)
southern (III)
no. species
ind./10000m3
Evenness (J')
Shannon-Weaver diversity (H')

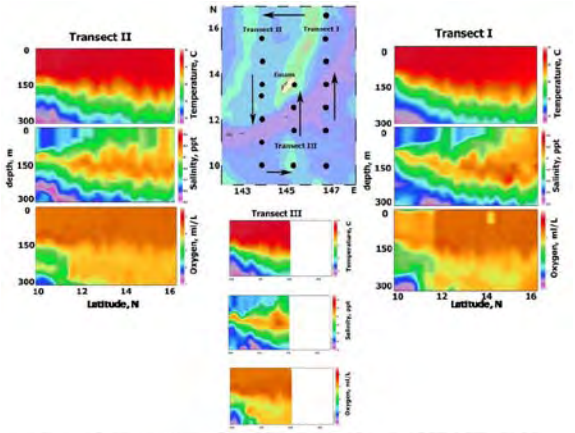

Top 5 species in different areas (500-0 m tows)
over 85 % of total abundance
Stenobrachius leucopsarus 42 %
Cyclothone signata 30 %
Diaphus theta 6 %
Cyclothone pseudopallida 6 %
Protomyctophum thompsoni 6 %
Cyclothone signata 60 %
Cyclothone pseudopallida 8 %
Stenobrachius leucopsarus 7 %
Diaphus theta 5 %
Cyclothone signata 57 %
Cyclothone pseudopallida 11 %
Triphoturus mexicanus 7%
Diaphus theta 4 %
Stenobrachius leucopsarus 5 %

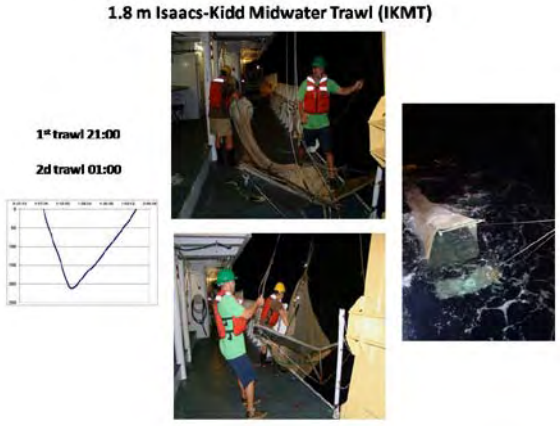

Species environmental relationships
Canonical Correspondence Analysis
150-0 m tows
Axis 2
Axis 1
500-0 m tows
Axis 1

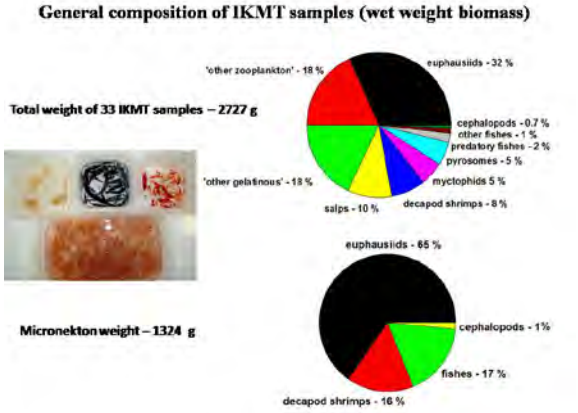

Size structure of midwater fish assemblages
All midwater
planktivores
Shallow tows
150-0 m
Shallow tows
150-0 m

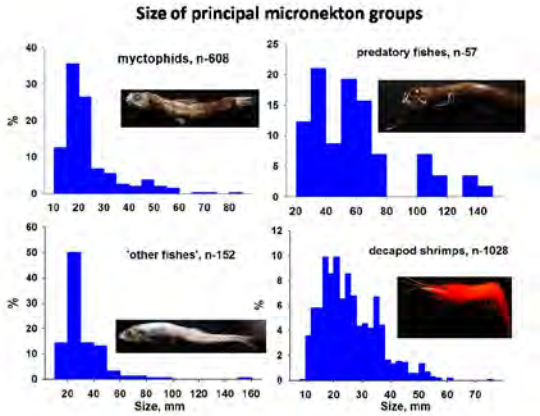

R/V Oscar Elton Sette cruise 10-03,
March 23-April 14, 2010
II
III
I
N
16
14
12
10
13-14
15
11-12
17-18
9-10
19
Guam
34
7-8
20-21
32-33
5-6
22-23
30-31
3-4
24-25
26-27
28-29
1-2
143
145
147
E
500 m
1000 m
2000 m
3000 m
4000 m
5000 m
6000 m

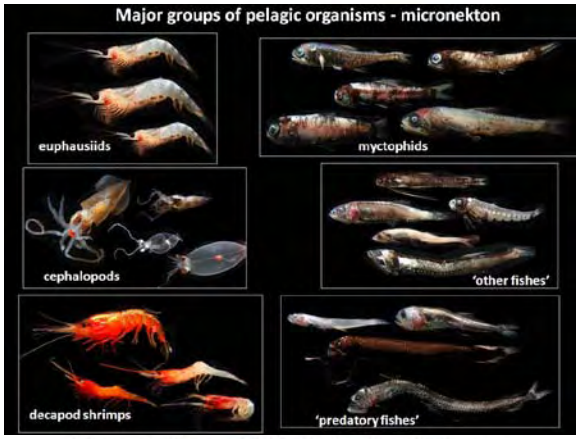

Oceanography in the area
North Equatorial Current (NEC)
North Equatorial
Counter Current (NECC)
South Equatorial Current (SEC)

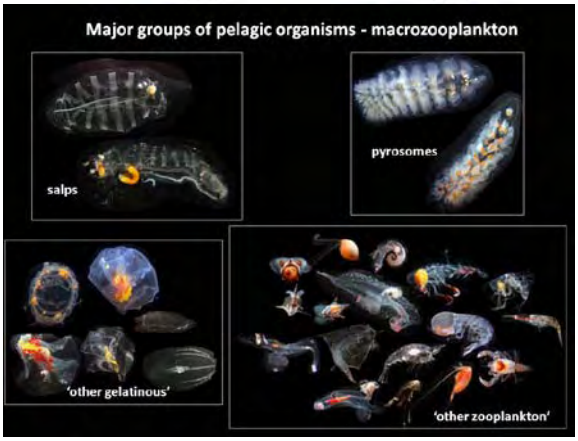

Transect II
Transect I
Transect III
Temperature, C
Salinity, ppt
Oxygen, ml/L
depth, m
Latitude, N

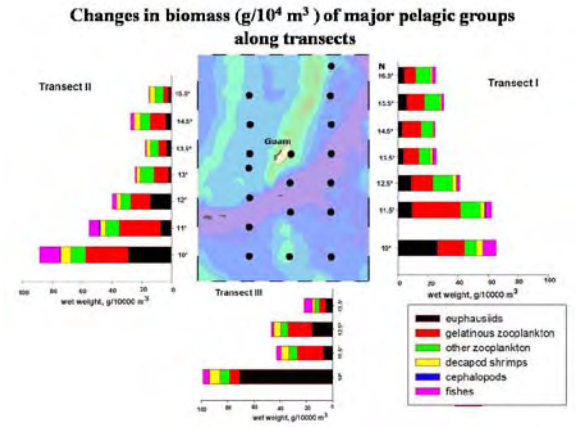

1.8 m Isaacs-Kidd Midwater Trawl (IKMT)
1st trawl 21:00
2d trawl 01:00


General composition of IKMT samples (wet weight biomass)
Total weight of 33 IKMT samples – 2727 g
'other zooplankton' - 18 %
euphausiids - 32 %
cephalopods - 0.7 %
other fishes - 1 %
predatory fishes - 2 %
pyrosomes - 5 %
'other gelatinous' - 18 %
myctophids 5 %
salps - 10 %
decapod shrimps - 8 %
Micronekton weight – 1324 g
euphausiids - 65 %
cephalopods - 1%
fishes - 17 %
decapod shrimps - 16 %

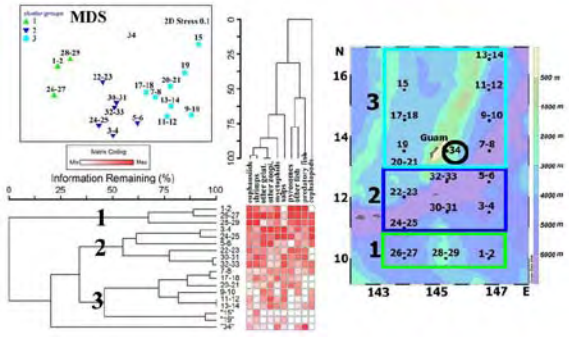

Size of principal micronekton groups
myctophids, n-608
predatory fishes, n-57
'other fishes', n-152
decapod shrimps, n-1028
%
Size, mm


Major groups of pelagic organisms - micronekton
euphausiids
myctophids
cephalopods
'other fishes'
decapod shrimps
'predatory fishes'

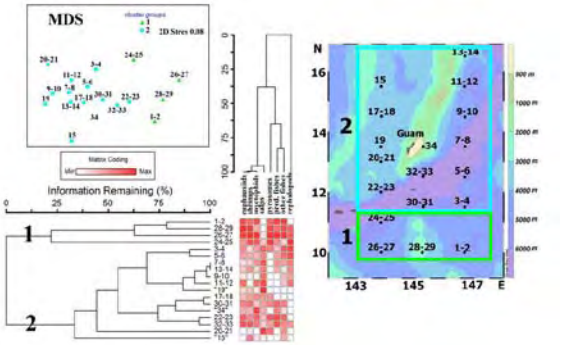

Major groups of pelagic organisms - macrozooplankton
salps
pyrosomes
'other gelatinous'
'other zooplankton'


Changes in biomass (g/10⁴ m³) of major pelagic groups
along transects
Transect II
Transect I
Transect III
Guam
wet weight, g/10000 m³
euphausiids
gelatinous zooplankton
other zooplankton
decapod shrimps
cephalopods
fishes

Assemblages based on biomass (g/10⁴ m³) of major micronekton/macrozooplankton groups



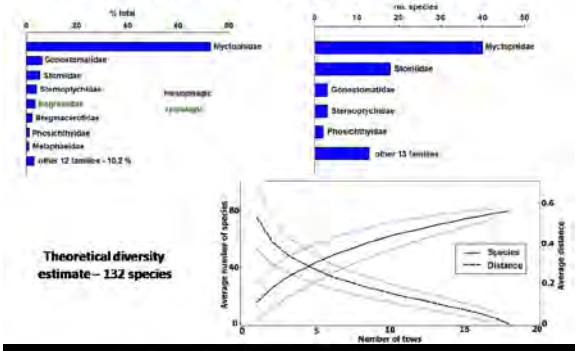
Assemblages based on abundance (no./10⁴ m³) of major micronekton/macrozooplankton groups

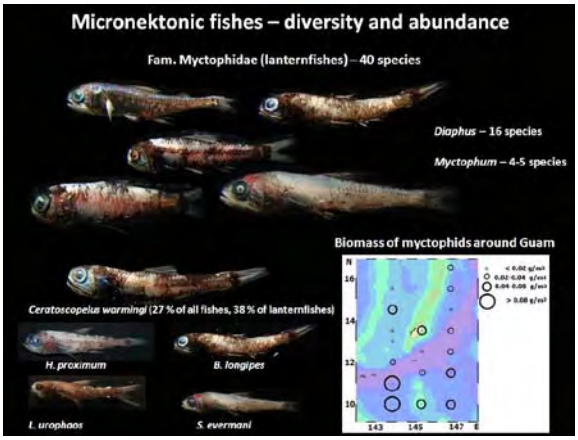


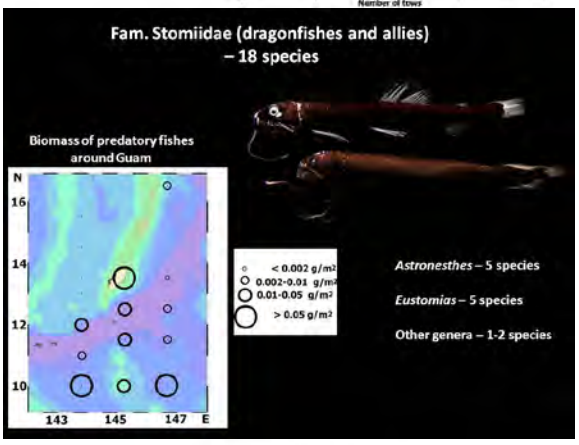
Micronektonic fishes – diversity and abundance

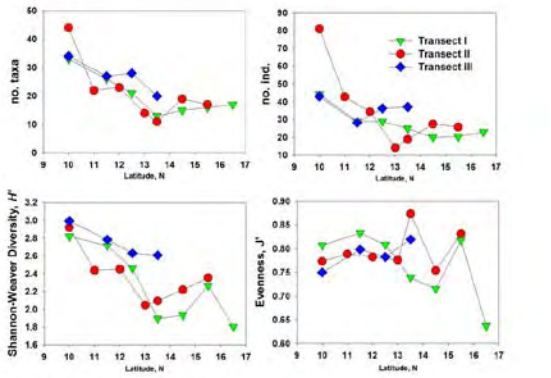
847 specimens from 20 families and minimum 85 species

Mesopelagic species (95.4%) - 14 families, 79 species

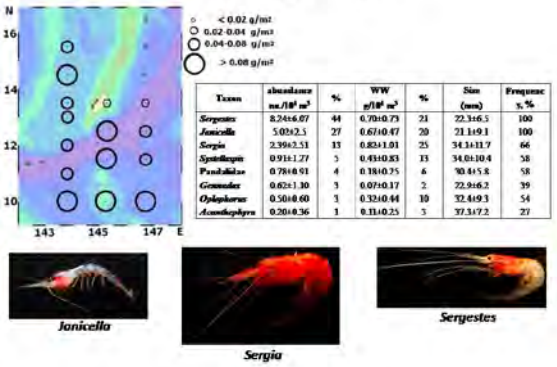








Mesopelagic shrimps



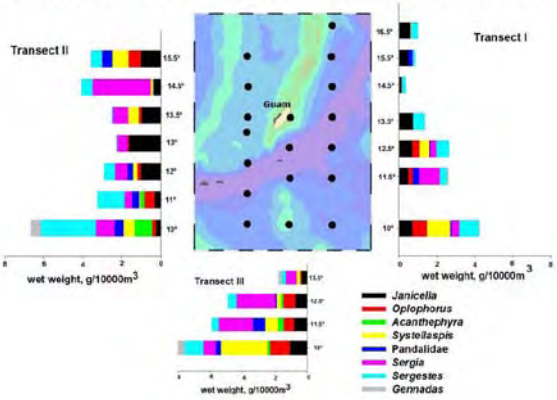
Taxon	abundance no./10³ m³	%	WW g/10³ m³	%	Size (mm)	Frequenc y, %
Sergestes	8.24±6.07	44	0.70±0.73	21	22.3±6.5	100
Janicella	5.02±2.5	27	0.67±0.47	20	21.1±9.1	100
Sergia	2.39±2.51	13	0.82±1.01	25	34.1±11.7	66
Systellaspis	0.91±1.27	5	0.43±0.83	13	34.0±10.4	58
Pandalidae	0.78±0.91	4	0.18±0.25	6	30.4±5.8	58
Gennadas	0.62±1.30	3	0.07±0.17	2	22.9±6.2	39
Oplophorus	0.50±0.60	3	0.32±0.44	10	32.4±9.3	54
Acanthephyra	0.20±0.36	1	0.11±0.25	3	37.3±7.2	27

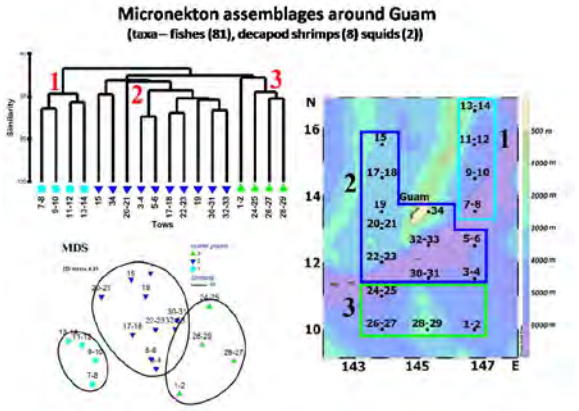
Janicella

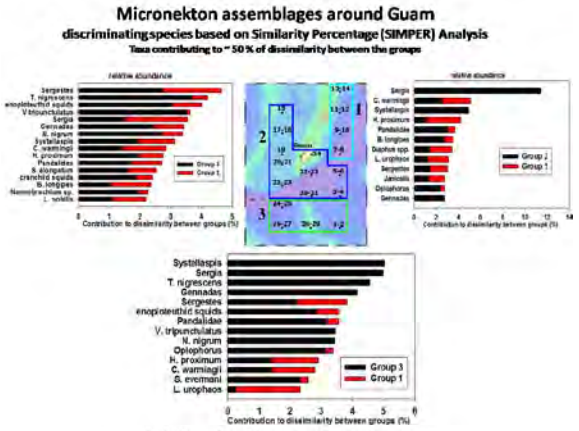
Sergia

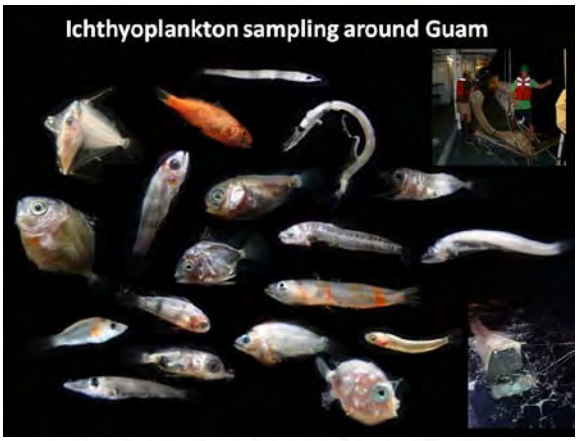
Sergestes

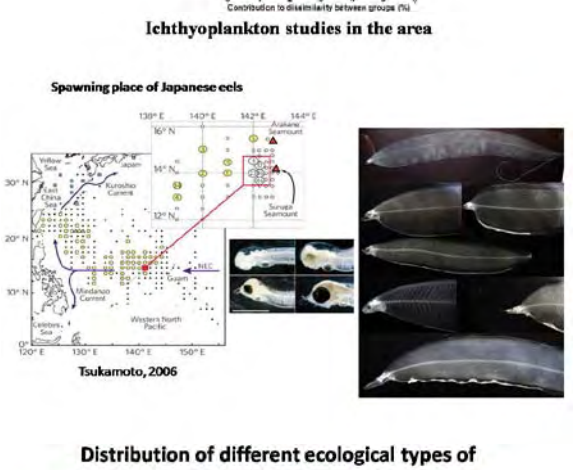
Changes in biomass (g/10⁴ m³) of decapod shrimps along transects

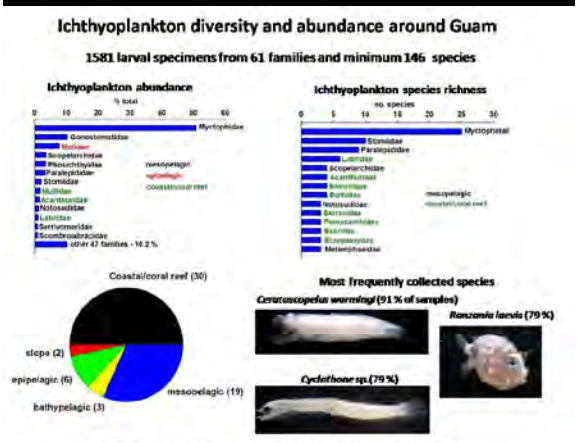


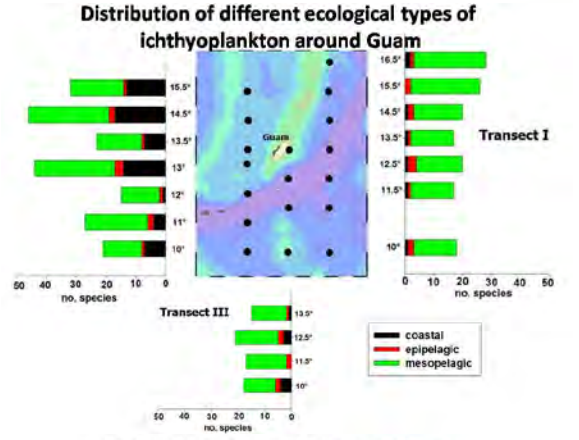

Micronekton assemblages around Guam
(taxa – fishes (81), decapod shrimps (8) squids (2))
Tows
MDS
Guam
143
145
147
E

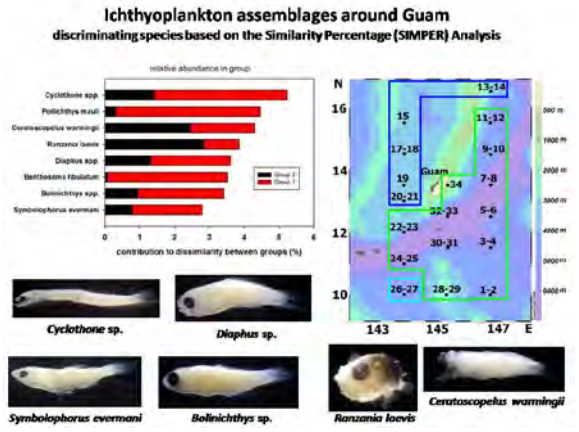

Micronekton assemblages around Guam
discriminating species based on Similarity Percentage (SIMPER) Analysis
Taxa contributing to ~ 50 % of dissimilarity between the groups
Group 1
Group 2
Group 3
Contribution to dissimilarity between groups (%)

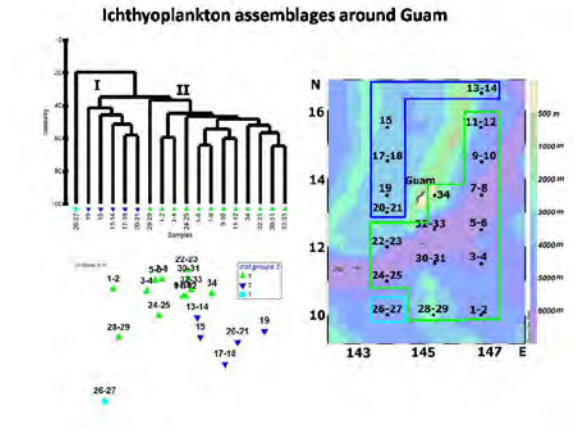

Ichthyoplankton sampling around Guam

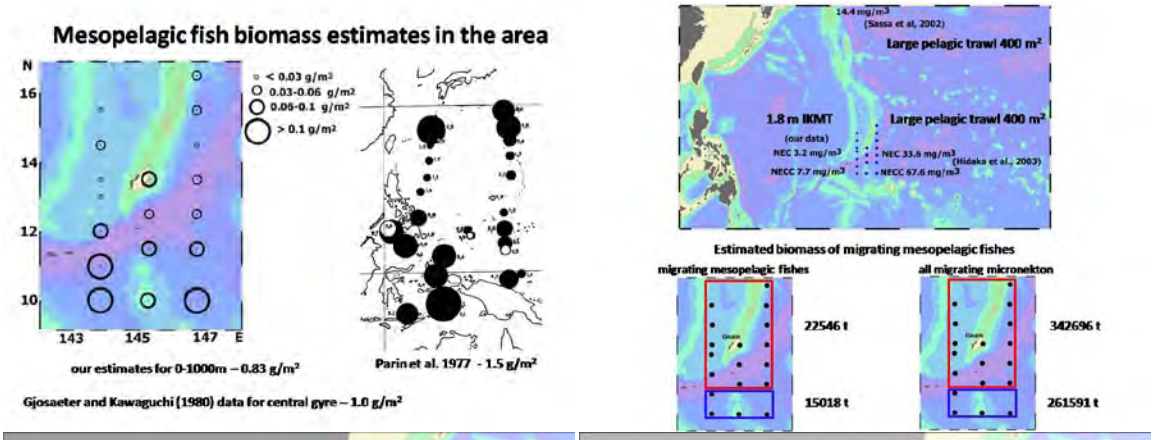

Ichthyoplankton studies in the area
Spawning place of Japanese eels
Tsukamoto, 2006

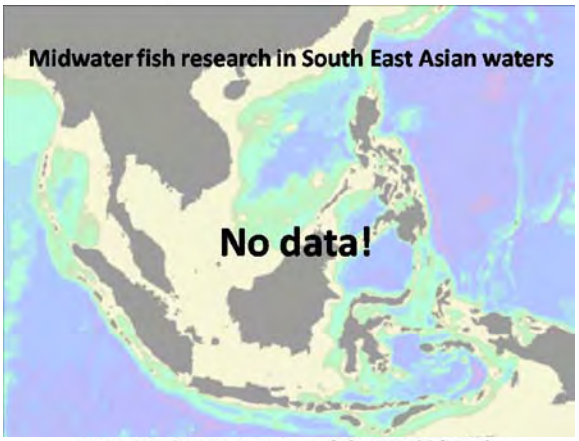

Ichthyoplankton diversity and abundance around Guam
1581 larval specimens from 61 families and minimum 146 species
Ichthyoplankton abundance
Ichthyoplankton species richness
Coastal/coral reef (30)
slope (2)
epipelagic (6)
mesopelagic (19)
bathypelagic (3)
Most frequently collected species
Ceratascopelus warmingii (91 % of samples)
Ranzania laevis (79 %)
Cyclothone sp. (79 %)

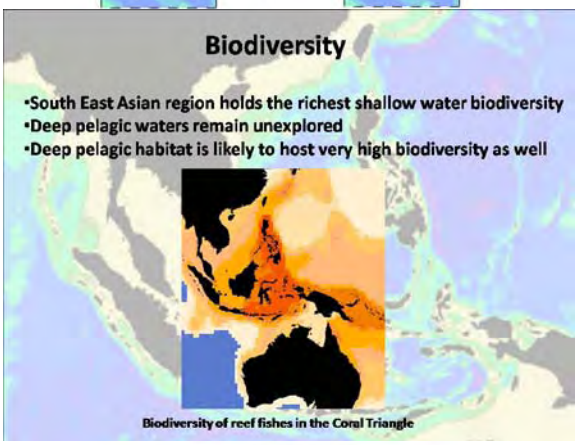

Distribution of different ecological types of ichthyoplankton around Guam
Guam
Transect I
Transect III
no. species
coastal
epipelagic
mesopelagic

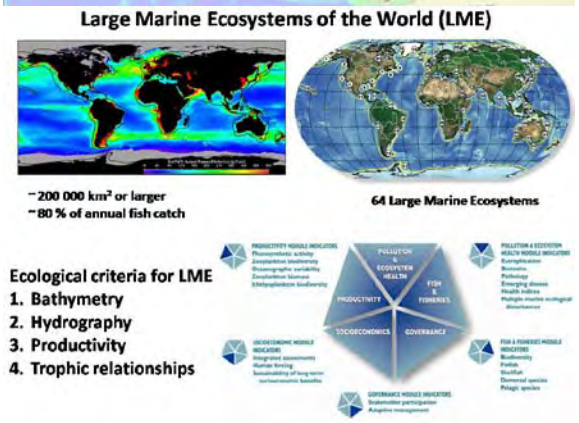

Ichthyoplankton assemblages around Guam
discriminating species based on the Similarity Percentage (SIMPER) Analysis
contribution to dissimilarity between groups (%)
Guam
143
145
147
E
Cyclothone sp.
Diaphus sp.
Symbolophorus evermani
Bolinichthys sp.
Ranzania laevis
Ceratascopelus warmingii

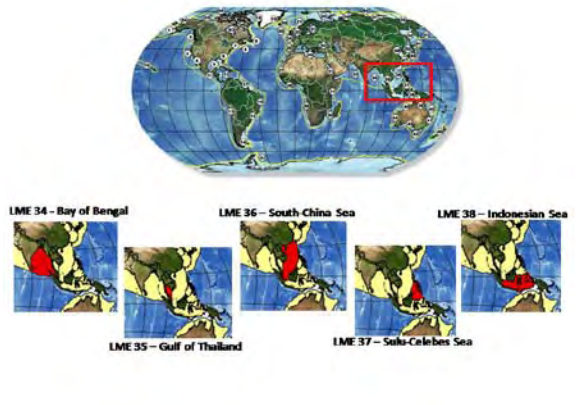

Ichthyoplankton assemblages around Guam
I
II
Guam
143
145
147
E

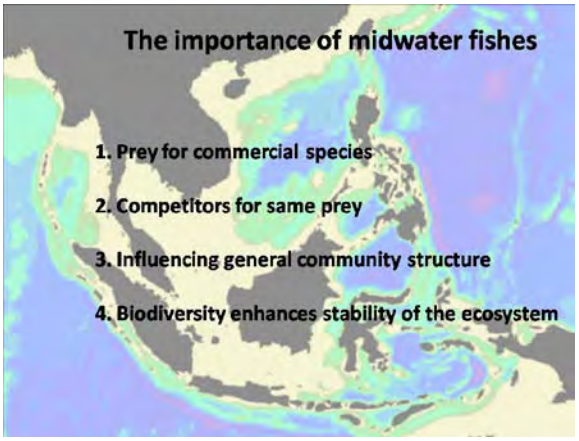

Mesopelagic fish biomass estimates in the area
N
16
14
12
10
143
145
147
E
< 0.03 g/m²
0.03-0.06 g/m²
0.06-0.1 g/m²
> 0.1 g/m²
our estimates for 0-1000m – 0.83 g/m²
Parin et al. 1977 - 1.5 g/m²
Gjosaeter and Kawaguchi (1980) data for central gyre – 1.0 g/m²
14.4 mg/m³
(Sassa et al, 2002)
Large pelagic trawl 400 m²
1.8 m IKMT
(our data)
NEC 3.2 mg/m³
NECC 7.7 mg/m³
Large pelagic trawl 400 m²
NEC 33.8 mg/m³
(Hidaka et al., 2003)
NECC 67.6 mg/m³
Estimated biomass of migrating mesopelagic fishes
migrating mesopelagic fishes
all migrating micronekton
22546 t
15018 t
342696 t
261591 t

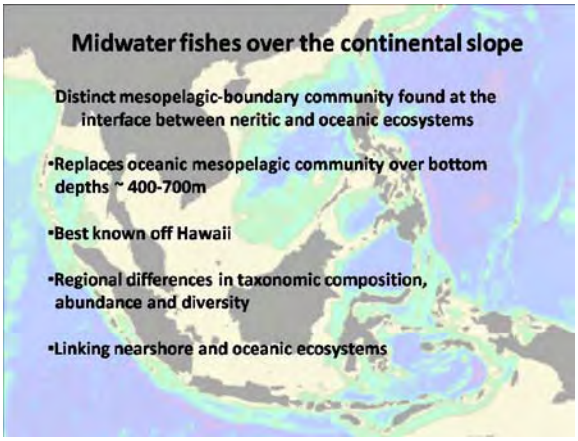

Midwater fish research in South East Asian waters
No data!

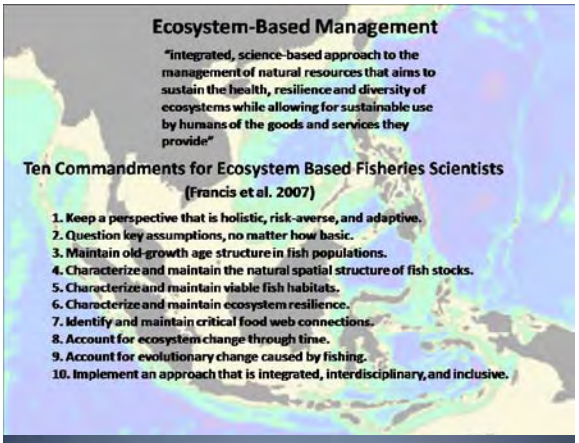

Biodiversity
•South East Asian region holds the richest shallow water biodiversity
•Deep pelagic waters remain unexplored
•Deep pelagic habitat is likely to host very high biodiversity as well
Biodiversity of reef fishes in the Coral Triangle


Large Marine Ecosystems of the World (LME)
~ 200 000 km² or larger
~ 80 % of annual fish catch
64 Large Marine Ecosystems
Ecological criteria for LME
1. Bathymetry
2. Hydrography
3. Productivity
4. Trophic relationships
POLLUTION & ECOSYSTEM HEALTH
FISH & FISHERIES
GOVERNANCE
SOCIOECONOMICS
PRODUCTIVITY

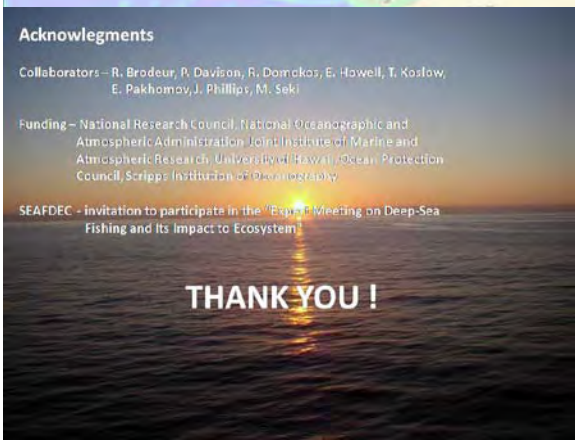

LME 34 – Bay of Bengal
LME 36 – South China Sea
LME 38 – Indonesian Sea
LME 35 – Gulf of Thailand
LME 37 – Suka-Celebes Sea


The importance of midwater fishes
1. Prey for commercial species
2. Competitors for same prey
3. Influencing general community structure
4. Biodiversity enhances stability of the ecosystem


Midwater fishes over the continental slope
Distinct mesopelagic-boundary community found at the interface between neritic and oceanic ecosystems
•Replaces oceanic mesopelagic community over bottom depths ~ 400-700m
•Best known off Hawaii
•Regional differences in taxonomic composition, abundance and diversity
•Linking nearshore and oceanic ecosystems


Ecosystem-Based Management
"integrated, science-based approach to the management of natural resources that aims to sustain the health, resilience and diversity of ecosystems while allowing for sustainable use by humans of the goods and services they provide"
Ten Commandments for Ecosystem Based Fisheries Scientists
(Francis et al. 2007)
1. Keep a perspective that is holistic, risk-averse, and adaptive.
2. Question key assumptions, no matter how basic.
3. Maintain old-growth age structure in fish populations.
4. Characterize and maintain the natural spatial structure of fish stocks.
5. Characterize and maintain viable fish habitats.
6. Characterize and maintain ecosystem resilience.
7. Identify and maintain critical food web connections.
8. Account for ecosystem change through time.
9. Account for evolutionary change caused by fishing.
10. Implement an approach that is integrated, interdisciplinary, and inclusive.


Future Research Agenda
1. Testing different types of midwater gear
2. Estimates of midwater fish diversity
3. Community oriented studies
4. Taxonomic training
5. Databases
6. Communicate results through scientific papers


Acknowlegments
Collaborators – R. Brodeur, P. Davison, R. Domokos, E. Howell, T. Koslow, E. Pakhomov, J. Phillips, M. Seki
Funding – National Research Council, National Oceanographic and Atmospheric Administration Joint Institute of Marine and Atmospheric Research, University of Hawai'i, Ocean Protection Council, Scripps Institution of Oceanography
SEAFDEC - invitation to participate in the "Expert Meeting on Deep-Sea Fishing and Its Impact to Ecosystem"
THANK YOU !

Annex 17

Draft on Standard Operating Procedures (SOPs) On Deep-Sea Resources Exploration In Southeast Asian Region

Dr. Natinee Sukramongkol
SEAFDEC/TD

Standard Operating Procedures (SOPs) On Deep-Sea Resources Exploration In Southeast Asian Region

TD/XX/XXX

TABLE OF CONTENTS

A. PURPOSE AND APPLICABILITY

The purpose of this Standard Operating Procedure (SOP) is to establish a uniform procedure for deep-sea resources exploration on the continental shelf in the Southeast Asian Region for the analysis of the potential of resources in the deep sea areas. This Standard Operating Procedure (SOP) was finalized during the **"Regional Workshop on the Standard operating procedure and Development/Improvement of Sampling Gears for the Deep-Sea Resources Exploration"** held in SEAFDEC Training Department in Thailand from 26 to 28 May 2009. The SOP should not be considered as minimum requirement for deep-sea resources exploration as the data to be gathered depends on the objectives of the respective country's resources survey.

B. TERMS AND DEFINITIONS

- **Scope of deep-sea area**
  The "*deep-sea area*" in the context of the Southeast Asian Region could be considered from the continental shelf downwards to the water deeper than 200 meters.

- **Deep-sea resources**
  "*Deep-sea fishery resources*" could include the demersal species which are close to, or in contact with, the sea floor most of the time, and benthopelagic species that are associated with the sea floor, without excluding the deep scattering layer.

- **Deep-sea sampling gears**
  "*Deep-sea fishery resources sampling gears*" could be include; beam trawl, bottom trawl, mid-water trawl, agassiz trawl, demersal longline, vertical longline, traps/pots, bottom gill net, and rectangular dredge. However, for trawl-able area, the priority gears to be used should be trawl, while for untrawl-able area the priority gears could include the demersal longline, vertical longline, trap, and pot or bottom gill net.

- **Indicator for the deep-sea resources survey**
  "*Fisheries Indicator*" for the deep-sea resources survey are generally referred to as a practical tools to support management of fisheries and also provide information on status and trend of fisheries and resources that can support decision-making process. The resource indicators for capture fisheries management could include; CPUE (catch per unit effort) or CPUA (catch per unit area), catch composition, number of species caught, average landing size (average catch size), and size of mature resource.

The unit to be used for the "Fishing Indicators" should be standardized for the standard fishing gears using in the deep-sea survey as follows;

Fishing gear	Indicator	Unit
Trawl	CPUE	kg/hr
	CPUA	kg/km^2
Line: Bottom Vertical Longline; Vertical Longline	CPUE	kg/1000 hooks and/or no/1000 hooks
Trap/Pot	CPUE	kg/100 traps and/or no/100 traps
Bottom Gill Net	CPUE	kg/km net

- **Indicator for the impact of fishing to the eco-system**

  Based on the FAO Guidelines for the management of deep-se fisheries in the high seas, the indicators for the impact of fishing to the ecosystem could include; uniqueness or rarity, functional significance of the habitat, fragility, life history traits, and structural complexity. Moreover, it was also agreed that a networking should be established with biologists, the academe, museum reference collectors, etc. in order to compare and standardize data collected from resources surveys using such standard indicators.

C. STANDARD EQUIPMENTS AND APPARATUS

a. Sampling/Fishing gears

Gears	Point to be Considered	
	Advantage Point	Impact
Bottom Trawl: - otter trawl - beam trawl	Operating characteristic can be altered for use on various types of bottom and for many species of fishes	- The area impacted is a function of the width of the trawl and the distance it is towed - The otter boards scar the seabed, and the trawl only sweep smoothly the seabed removing small bedforms that regenerated in a relatively short period of time. - On hard bottom, trawls will roll-over the larger rocks, and scrape off attached, emergent, epibenthic organisms including sponges and corals

a. Sampling/Fishing gears (cont.)

Gears	Point to be Considered	
	Advantage Point	Impact
Trap	Aquatic animals can enter the gear voluntarily	- If traps are lost on the seabed, they will induce ghost fishing - Large number of traps on the seabed has a larger footprint than a longline, and several traps are attached together the mainline will encounter and entangle hard and soft corals on the seabed
Bottom longline	Considered fixed and passive gear because once deployed the gear does not move and the fish voluntarily takes the hook	- The impact to seabed of this gear is minimal as only the anchor touches the bottom
Gill net	Shellfish and large fish are easily entangled in bottom set enmeshing gear	- On soft substrates the effects will be minimal, while attached on hard bottoms, the nets will entangle with corals and other organisms and remove them from the seabed

b. Hydro-acoustic apparatus (integral part of resource assessment although not major tools in resource assessment)

Hydro-acoustic apparatus	Techniques	Output
Echo sounder	- Fixed-location techniques use stationary transducers to monitor passing fish and bottom depth	- Evaluate fish biomass and spatial distributions - Bottom topography
Scientific echo sounder for fishery research applications	- Scientific Single and Multibeam Echo Sounders	- Real time echo integration and target strength analysis in an unlimited number of layers - Storage of raw data for replay or analysis in one of several post-processing software packages.
Side-scanning sonar	- Sonar device emitting fan-shaped pulses down toward the seafloor which may be towed from a surface vessel or mounted on the ship's hull.	- Bathymetry of the survey area. - Efficiently create an image of large areas of the sea floor.
ADCP (Acoustic Doppler Current Profiler)	- A sonar as the sound energy leaves and arrives at the transducer face.	- Current velocities for a range of depths

c. Oceanography apparatus

Parameter	Equipment apparatus	Topic to study
Oceanography	iCTD with auxiliary sensors (Dissolved oxygen, pH, Chlorophyll fluorometer, PAR, data logger)	Real-time oceanographic data (e.g., temperature, salinity, dissolved oxygen, chlorophyll concentration (when required),etc.
Water sampling	Water sampler (e.g. Niskin bottles, Van Dorn water sampler)	Primary productivity, Environmental studies
Plankton sampling	Bongo net attached with zooplankton net and larvae net, small mid-water trawl with single mesh size (based on the target)	Species composition and diversity, distribution, abundance, of zooplankton, larval fishes and juveniles
Current	Current meter, ADCP	Water current velocities, tides and flow, long term current and wave studies
Deep scattering layer	Mid-water trawl (e.g. IKMT, LC-net depend on target)	Distribution, composition, and biomass of marine organism e.g. macrozooplankton, micronekton, mesopelagic fishes, at mid-water or deep-scattering layer
Sediment sampling	Grab, Core	Grain size and composition, Bottom type, Environmental Issues
Benthic fauna sampling	Box core, Grab, Sledge, Dredge	Species composition and diversity, distribution, abundance, of benthic invertebrate,

d. Biotechnology apparatus

Parameter	Equipment apparatus	Topic of study
DNA sampling	Tissue sampling for DNA analysis	Phylogenetics study (evolutionary or tree of life), species and stock identification
Sediment sampling	Extraction and Purification of DNA from Marine Sediments	Benthic Prokaryotic Diversity

D. PROCEDURAL STEPS

1. Location selection

a. The survey is focused on the area covered within the boundaries of the deep-sea area described during the May 2009 Regional Workshop in the context of Southeast Asia as the area from continental shelf down to more than 200 m.

b. The survey stations will be the randomly and/for fishable areas determined on the stratified depth areas (zone).

c. At each survey station where sampling takes place, the latitude/longitude in decimal minutes of the station will be determined by global positioning system (GPS).

d. Mapping of sampling area should be based on the shooting-to-hauling information.

2. Sampling method

A variety of sampling methods will be employed for different target species based on the primary habitats such as hard bottom, soft bottom, and rocky/un-trawlable bottom. An example of sampling gears description and method of M.V. SEAFDEC 2 is given in Appendix 1.

Recommendation for the sampling method of:

Bottom trawl *(as the first priority gear)*: towing period should be at least 60 minutes depending on the topographic condition (if this is not suitable towing period could be at least 40 minutes as the case may be)

Pots/Traps: emersion time (minimum) should be 12 hours, set during the feeding time of samples (usually at night time) (CPUE would remain as kg/100 pots or traps)

Bottom longline: emersion time should be from 2 to 6 hours (CPUE would remain as kg/1000 hooks)

Gill net: (although suitable only for some deep-sea species distributed in the mesopelagic zone, it is not suitable for operation in deep areas). One set of gill net should be less than 3 km long for drift gill net; mesh size of net (depends on target species)

Agassiz trawl: An iron frame suitable tool for collect deep-sea organism. A symmetrical construction allows any side of frame dragged along the sea floor. Towing should be at least 15-30 minute (depending on the topographic condition).

Rectangular dredge: Recommended to used on rough and variety sea floor. A heavy metal frame designed for breaking off pieces of rock, scraping organisms off hard surfaces.

3. Sorting the catch and sub-sampling

a. The catch should be transferred to the designated sorting area on deck.

b. The entire catch should be sorted in order to ensure that rare species are properly accounted for. The aim is to obtain abundance data (and biomass, when required) for each taxa in the catch.

c. Sub-sampling (FAO, 1992) should be made for each of the highly numerous species or large catches. The purpose of sub-sampling is to obtain an accurate estimate of abundance of the catch which achieved by fully sorting one or more sub-sampling of known catch volume.

d. It is not acceptable to discard any portion of the catch that has not been sorted.

4. Species identification

a. During the sorting individual taxa into separate container, it may more convenient to temporarily sort taxa by higher taxonomic groups, such as Family (e.g. Paguridae – hermit crabs), order (e.g. Octopoda – Octopuses), Class (e.g. Bivalvia – bivalves), Phylum (e.g. Bryozoa) etc. These can then be taken into the wet-lab for more rigorous identify.

b. When the entire catch has been sorted, each taxa should be identified to the lowest taxonomic level practicable in the field.

c. The upgrading of the taxonomic level on catch data after identification in field is required.

E. DATA RECORD

1. Hydro-Acoustic and Oceanography

a. Survey should identify the areas of fishing/sampling operation such as the bottom depth along the survey track of each fishing operation.

b. The vessels can continuously record the depth information from the echo-sounders giving bathymetry along the cruise track.

c. Oceanography at the location of each fishing event, and other oceanographic information considered relevant to the fishing area should be collected during the fishing survey.

2. Fishing Activity

a. Data should be collected according to the operational characteristics of each fishing method (e.g., each individual for trawl, each set for traps or setting, soaking and hauling times for bottom longline) which include fishing location, depth of fishing, date and time at the start and end of every haul. An example of fishing logsheet of the M.V. SEAFDEC 2 is given in Appendix 2.

b. Direct fishing effort during the exploratory fishing appropriate for each fishing method should be collected (e.g., haul-by-haul catch, catch per effort by total catch and by species, haul-by-haul length frequency of common species) to evaluate the fishery potential and the ecological relationships among harvested, dependent and related populations and the likelihood of adverse impacts.

c. The spatial details of the navigation and environment conditions should be collected such as weather and sea condition, wind and current speed and direction, barometric pressure, humidity.

3. Catch Data

a. Volume of catch should be measured (in kilograms) and entered into the logsheet.

b. The catches should be identified to the lowest taxonomic level and the data on the length, weight, sex of fish, and/or maturation and fecundity should be collected.

c. The sufficient data to facilitate effective stock assessment (when required) and assess the impact on the ecosystem should include the catch by species both target and non-target, retained and discarded. Analysis on stock assessment is given in Appendix 3.

d. Distribution, abundance, and species composition, should be documented in order to estimate the fishery's potential yield.

4. Benthic Habitat Data

a. Data should be collected on all aspects of the biology and ecology of the benthic fauna found in the survey areas.

b. The communities that composed of dense benthic or emergent fauna e.g., sponge ground (e.g., sponge dominated communities); invertebrates (e.g., hydroids and bryozoans) should be documented for measure the effects of fisheries to the ecosystem.

5. Labeling

The identity, date, depth of capture, operation number, cruise information should be labeled on the bucket or container where the samples preserved in formalin or alcohol solution are placed.

6. Photography and Preservation

Collection of deep-sea fauna should be documented by taking photograph of the fresh specimens and preservation of rare or uncommon species for further confirmation and study.

7. Data Reporting and Networks

a. All data collected should be reported and made available for further purpose of scientific analyses

b. Database and network

F. REFERENCES

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G. APPENDICES

Appendix 1: Example of sampling/fishing gears description and method of M.V. SEAFDEC 2

Appendix 2: Example of fishing logsheet of the M.V. SEAFDEC 2

Appendix 3: Analysis on stock assessment

Annex 18

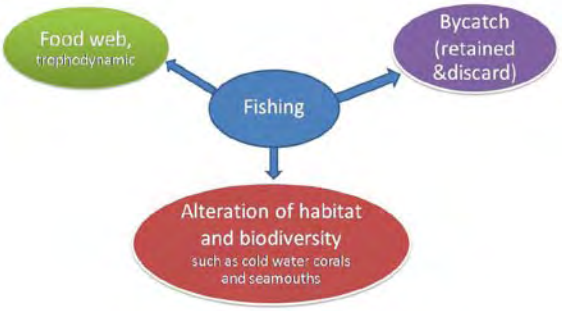
list of ecosystem concerns and scientific challenges for the study on impact of fishing on ecosystem

Ms. Penchan Laongmanee
SEAFDEC/TD

List of scientific challenges for the study on impact of fishing to deep-sea ecosystem

- Report and documentation of the Expert Consultation on Deep-Sea Fisheries in the High Seas, ftp://ftp.fao.org/docrep/fao/010/a1341e/a1341e00.pdf
- Methods for the Study of Deep-Sea sediments, Their Functioning and Biodiversity, 2010, Edited by Roberto Danovaro.
- Final report comparison of rapid methodologies for quantifying environmental impacts of otter trawls, www.imbc.gr/institute/eco_bio/fep2/OTIP2.pdf

Impact of fishing to ecosystem



Scientific Challenge of Deep-Sea Fisheries (FAO Fisheries Report No.838)

1. Stock assessment
2. Habitat and biodiversity impact assessment

Habitat and biodiversity impact assessment

- Habitat change caused by gear contract
  - Characterize habitat alteration in the functional aspects
  - Damage to biogenic communities, such as cold water coral reefs
- Recovery time of habitat
  Example: cold water coral, growth rate ~ 1mm/year, however not all habitats are as fragile and slow to recover
- Habitat mapping
- Degree of endemic (living in specific area)

Habitat and biodiversity impact assessment (cont.)

- Spatial overlap between fishing and unique elements of deep-sea ecosystems. The degree of overlap between fishing and endemic species is probably a key factor in determining the risk of extinction
- Functional value of habitat and biodiversity
  - habitat such as how important are coldwater coral reefs as habitat for young fish, how might the loss of this habitat adversely impact production of fisheries?
  - biodiversity such as its importance in term of ecosystem stability

Habitat and biodiversity impact assessment (cont.)

- Mitigation options
  such as develop by catch reduction device. The mitigation should success both in conservation engineering and incentive to apply the mitigation technique

Habitat and Biodiversity Impact Assessment Method

- Remote acoustic sensing method
  - Side scan sonar
  - Single beam echo-sounder
  - Multi-beam echo-sounder
- Underwater television method
  - Video sledge
  - Remote Operation Vehicle (ROV)
- Sedimentological method (Study sediment type)
- Stomach content method (Food web)
- Benthic organism sampling method

Benthic organism study

Benthic organism study

Benthic group	Method	Field equipment
Prokayotic (A group of organisms that lack a cell nucleus)	Molecular methods	Multicorer, ROV
Archaeal a group of single-celled microorganisms	Molecular methods	Multicorer, ROV
Benthic Bacterial	Molecular methods	Multicorer, ROV

Multicorer

http://www.ops.mcgill.ca/~sundby/MarineGeochemistry/Ocean%20Inumbs1.html

TRAINING WORKSHOP ON RESEARCH METHODOLOGIES FOR STUDY ON IMPACT OF FISHING ON DEEP-SEA ECOSYSTEM,
16 20 October 2010, Brunei Darussalam

- Enhance the human resources capacity in research methodologies to study the impact of fishing on the deep-sea ecosystem;
- Encourage the SEAFDEC's member countries on the initiation of deep-sea resources exploration

On board activities

- Topographic survey (Echo sounder)
- Sampling by Fishing Trap, Beam trawl and Agassiz trawl
- Entire catch sorting
- Primary species identification
- Preservation
- Underwater VDO camera

Benthic organism study

Benthic group	Lab equipment	Field equipment
Meiofauna (0.05-0.5 mm)	Sieve, Steriomicroscope, Identification book	Multicorer, Box corer
Macrofauna (< 0.5 mm)	Sieve, Steriomicroscope, Identification book	Multicorer, Box corer
Megafauna (4.2 > cm)	Steriomicroscope, Identification book	Beam trawl, Agassiz trawl

Tentative program

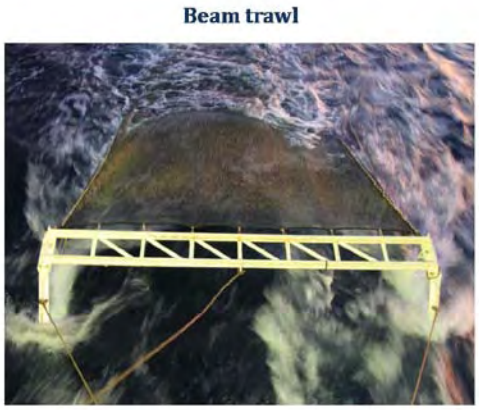
Date	Activity
16 Oct	Lecture on: - Research Methodologies for Study on Impact of Fishing on Deep-sea Ecosystem; and - Structure, diversity, and geographic distribution of the benthic focusing on species found in the South China Sea and Andaman Sea.
17 -19 Oct	Onboard M.V. SEAFDEC2 Actual Survey and Training
20 Oct	Result discussion ,conclusion and recommendation

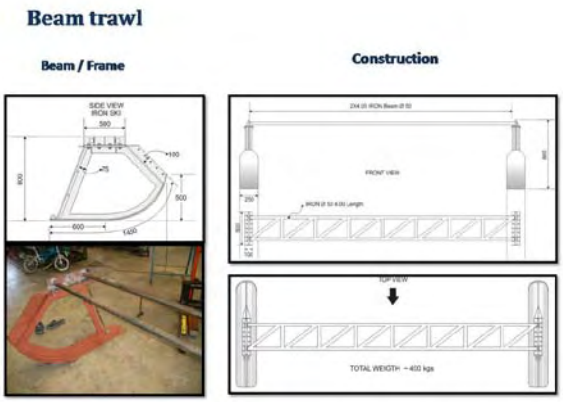
Annex 19

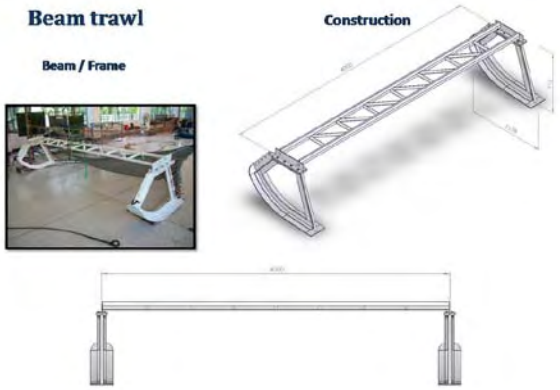
Deep-sea sampling gears for the Training Work shop

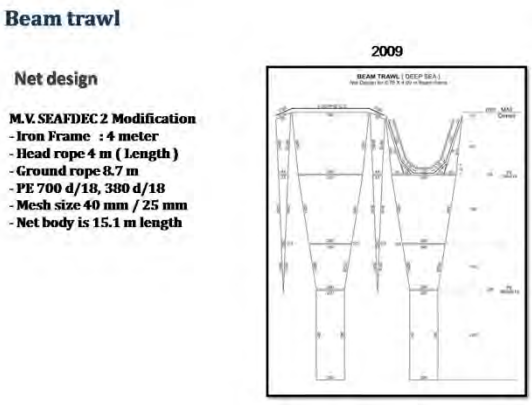
Mr. Sayan Promjinda
SEAFDEC/TD

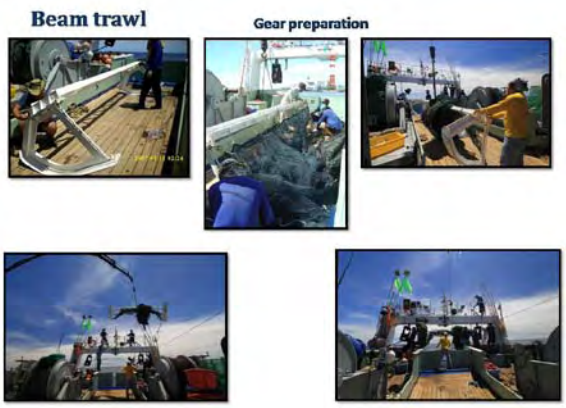

Deep-sea sampling gears for the
Training Work shop
Beam Trawl
Agassiz Trawl
Deep sea Trap
Sayan Promjinda
Capture Fisheries Technology Division
Southeast Asian Fisheries Development Center
Training Department


Beam trawl

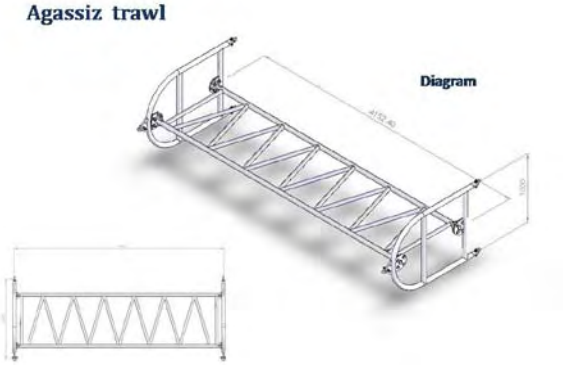

Beam trawl
Beam / Frame
Construction


Beam trawl
Beam / Frame
Construction


Beam trawl
Net design
M.V. SEAFDEC 2 Modification
- Iron Frame : 4 meter
- Head rope 4 m (Length)
- Ground rope 8.7 m
- PE 700 d/18, 380 d/18
- Mesh size 40 mm / 25 mm
- Net body is 15.1 m length
2009


Beam trawl
Gear preparation

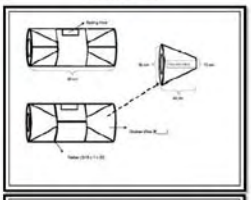

Agassiz trawl
The Agassiz trawl is used to collect organisms, particularly invertebrates, living on the ocean bottom.
www.kc-denmark.dk

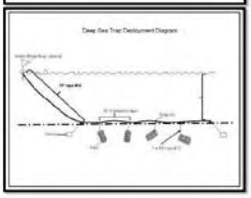

Agassiz trawl
Diagram

Deep SeaTrap

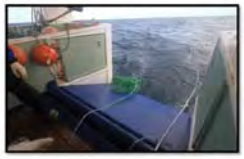
Deep Sea Trap

Construction





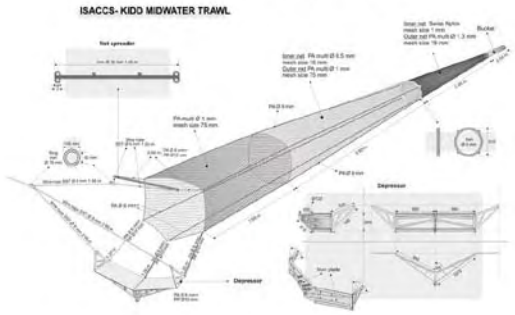
Deep SeaTrap



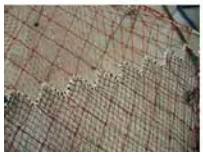
Deep SeaTrap

The sampling from DST

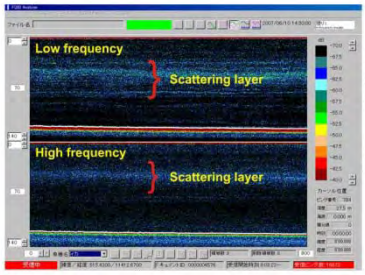
Diagram of the IKMT



IKMT construction



Before and During Operation



Using scientific echo-sounder provide a target area

Furuno FQ80 onboard MV SEAFDEC2

Annex 20

Deep Sea Fisheries Resources Survey Experience in Andaman Sea 1975-1995

Mr. Aussanee Munprasit
SEAFDEC/TD

Deep Sea Fisheries Resources Survey Experience in Andaman Sea 1975-1995

By

Aussanee Manprasit

SEAFDEC/TD

March 1975

R.V. Fisheries Research No. II/DOF

GT - 380 T

Hp - 1,000 Ps

Deep sea demersal resource survey by bottom trawl

Trawl net

Japanese type with 22-32 head rope and ground rope and 30 mm mesh size at cod-end

Fishing ground

200-500 meter depth,

latitude 6 °N - 12 °N

Results

Average catch 175 kgs./hrs.

Maximum catch 586 kgs./hrs.

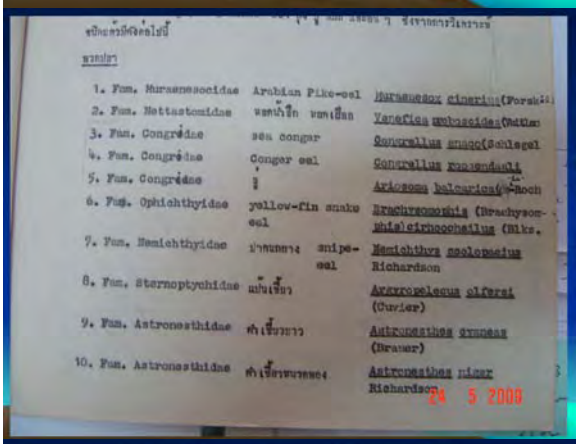
75 species of fish, 12-15 unknown samples

30 species of Shrimp

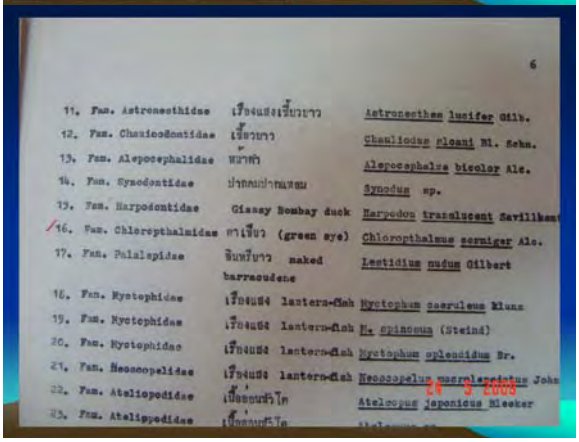
5-6 species of Squid and Crab

Main catch

- Fish *Chloroptalmus Corniger, Synagrops malaynus, Palinurichthys sp., Cubiceps sp.*
- Shrimp *Heterocapus laevigatus, H. ensifer*
- Spiny lobster *Puerulus sewelli*

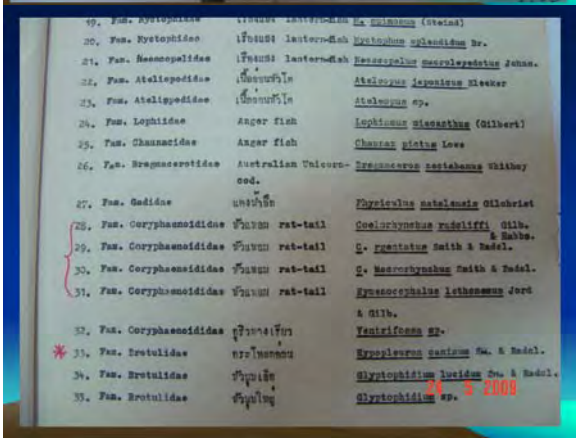


1. Fam. Muraenesocidae Arabian Pike-eel
2. Fam. Nettastomidae
3. Fam. Congridae sea conger
4. Fam. Congridae Conger eel
5. Fam. Congridae
6. Fam. Ophichthyidae yellow-fin snake eel
7. Fam. Nemichthyidae snipe-eel
8. Fam. Sternoptychidae
9. Fam. Astronesthidae
10. Fam. Astronesthidae

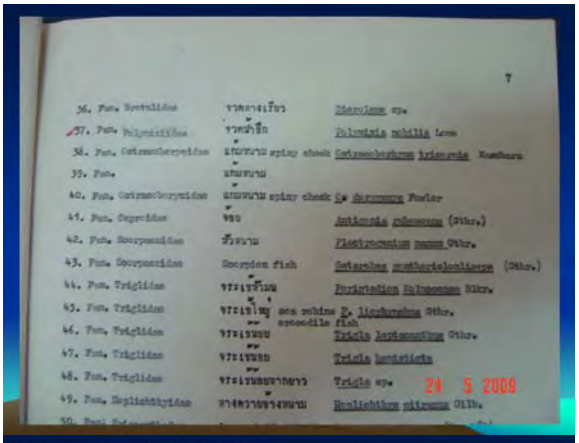


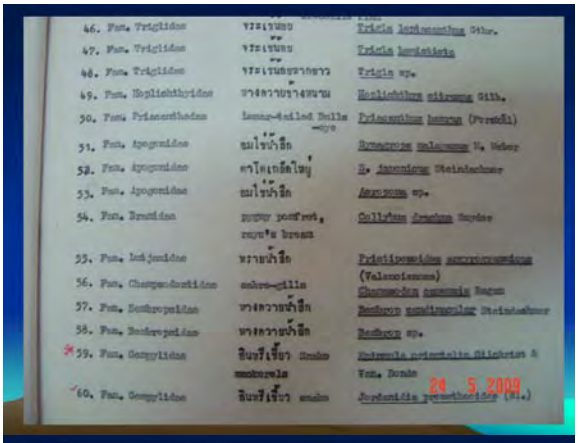
6

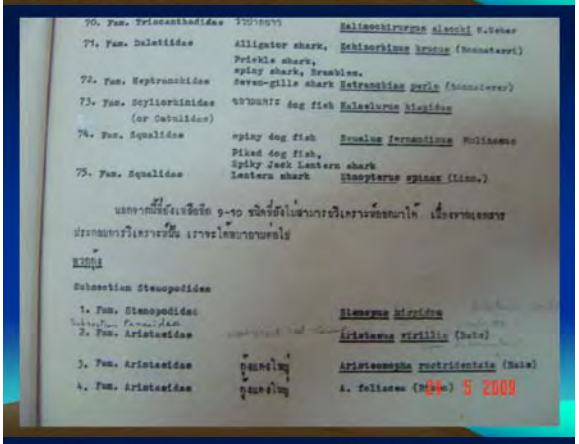
11. Fam. Astronesthidae — Astronesthes lucifer Gilb.
12. Fam. Chauliodontidae — Chauliodus sloani Bl. Schn.
13. Fam. Alepocephalidae — Alepocephalus bicolor Ale.
14. Fam. Synodontidae — Synodus sp.
15. Fam. Harpodontidae Giassy Bombay duck — Harpodon translucent Sevillhan
16. Fam. Chloropthalmidae (green eye) — Chloropthalmus corniger Ale.
17. Fam. Paralepidae naked barracudene — Lestidium nudum Gilbert
18. Fam. Myctophidae — Myctophum caeruleus Klunz
19. Fam. Myctophidae — M. spinosum (Steind)
20. Fam. Myctophidae — Myctophum splendidum Br.
21. Fam. Neoscopelidae — Neoscopelus macrolepidotus Johan.
22. Fam. Ateliopodidae — Ateliopus japonicus Bleeker
23. Fam. Ateliopodidae

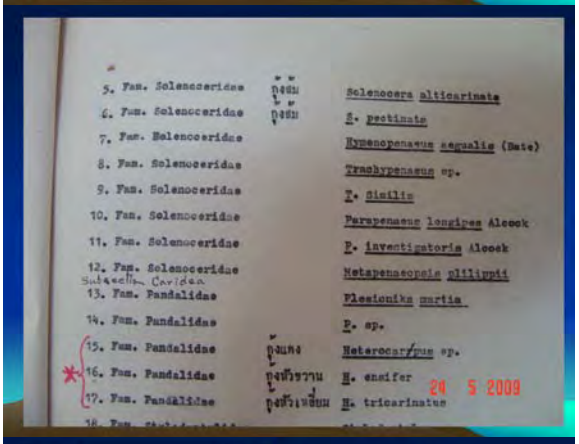


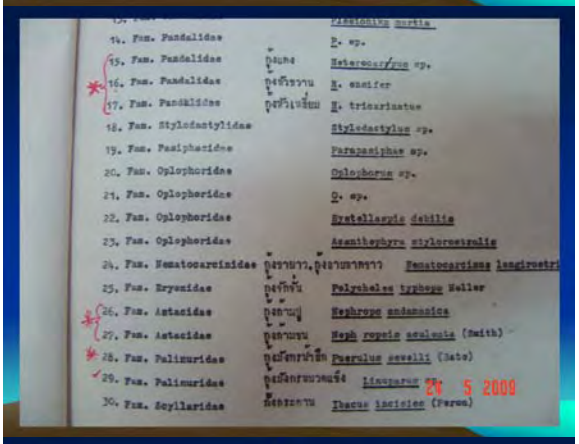
20. Fam. Myctophidae — Myctophum splendidum Br.
21. Fam. Neoscopelidae — Neoscopelus macrolepidotus Johan.
22. Fam. Ateliopodidae — Ateliopus japonicus Bleeker
23. Fam. Ateliopodidae — Ateliopus sp.
24. Fam. Lophiidae Anger fish — Lophiomus miscanthus (Gilbert)
25. Fam. Chaunacidae Anger fish — Chaunax pictus Lowe
26. Fam. Bregmacerotidae Australian Unicorn-cod. — Bregmaceros australianus Whitley
27. Fam. Gadidae — Physiculus australensis Gilchrist
28. Fam. Coryphaenoididae rat-tail — Coelorhynchus rudeliffi Gilb. & Hubbs.
29. Fam. Coryphaenoididae rat-tail — C. rigentatus Smith & Radel.
30. Fam. Coryphaenoididae rat-tail — C. macrorhynchus Smith & Radel.
31. Fam. Coryphaenoididae rat-tail — Kyneococephalus lethonemus Jord & Gilb.
32. Fam. Coryphaenoididae — Ventrifossa sp.
33. Fam. Brotulidae — Dypoleuron cautosus Gu. & Radel.
34. Fam. Brotulidae — Glyptophidium luciduc Gu. & Radel.
35. Fam. Brotulidae — Glyptophidium sp.

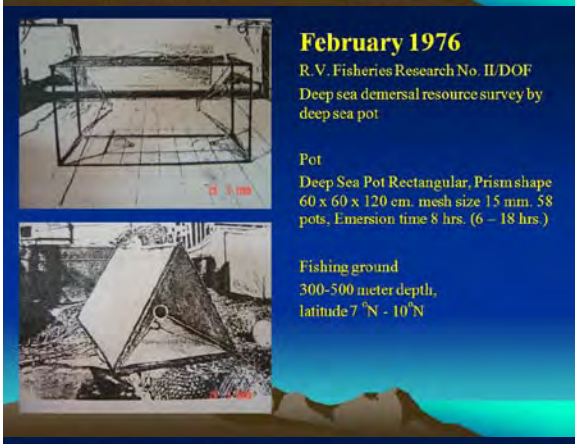


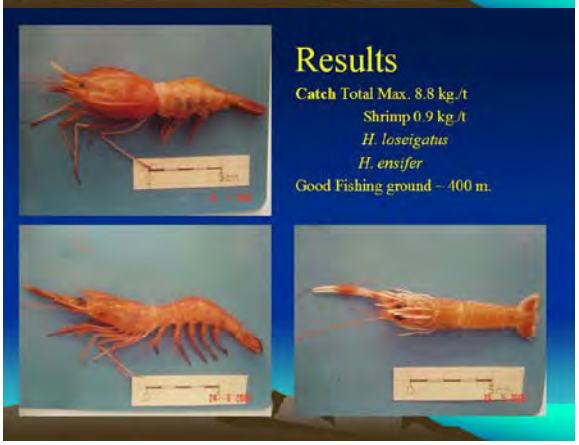


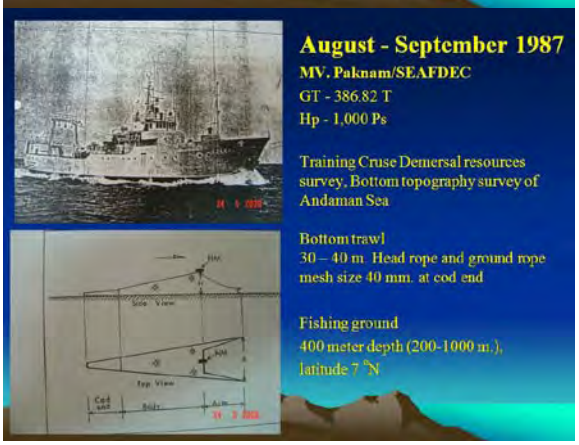






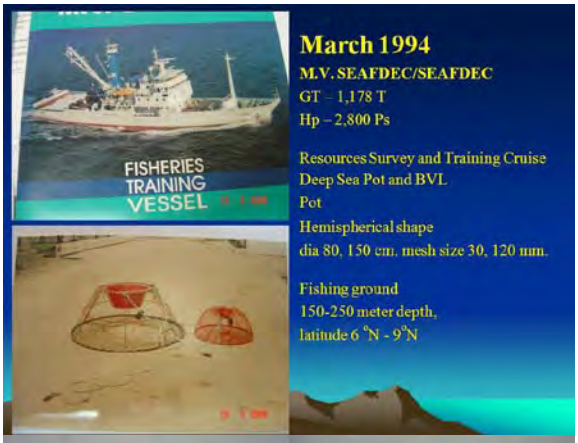

February 1976
R.V. Fisheries Research No. II/DOF
Deep sea demersal resource survey by deep sea pot
Pot
Deep Sea Pot Rectangular, Prism shape 60 x 60 x 120 cm. mesh size 15 mm. 58 pots, Emersion time 8 hrs. (6 – 18 hrs.)
Fishing ground
300-500 meter depth,
latitude 7 °N - 10°N


Results
Catch Total Max. 8.8 kg./t
Shrimp 0.9 kg./t
H. loseigatus
H. ensifer
Good Fishing ground – 400 m.


August - September 1987
MV. Paknam/SEAFDEC
GT - 386.82 T
Hp - 1,000 Ps
Training Cruse Demersal resources survey, Bottom topography survey of Andaman Sea
Bottom trawl
30 – 40 m Head rope and ground rope mesh size 40 mm. at cod end
Fishing ground
400 meter depth (200-1000 m.),
latitude 7 °N


4 seam rough bottom trawl net
THAILAND
SURVEYED AREA
INDONESIA
MALAYSIA
Topography Survey
200 – 350 slope
350 – 500 smooth (flab)
500 over slope
350 – 450 most appropriate for bottom trawl
Results
Catch
150 – 300 kg./hrs. of deep sea fish and shrimp
New species of deep sea crab had found
Dairoides seafdeci
January - March 1988
M.V. Platoo/SEAFDEC
GT - 67 T
Hp – 500 Ps
Resource Survey and Training Cruise
Bottom Vertical long line (BVL)
Fishing ground
100-250 meter depth,
latitude 6 °N - 7°N
Catch
Snapper, Grouper, Spiny dogfish (Squalus spp.)

February 1990
MV. Paknam/SEAFDEC
GT - 386.82 T
Hp - 1,000 Ps
Resource Survey and Training Cruise
Pot
Deep Sea Pot Hemispherical shape
Dia. 100 cm. mesh size 30 mm. 30 – 90 pic/l ET. 12 – 14 hrs.
Fishing ground
200 - 400 meter depth
latitude 6 °N - 9 °N
Catch
Shrimp caught at most appropriate 300-400 m.
Heterocapus siboge
H. lepidns



March 1994
M.V. SEAFDEC/SEAFDEC
GT – 1,178 T
Hp – 2,800 Ps
Resources Survey and Training Cruise
Deep Sea Pot and BVL
Pot
Hemispherical shape
dia 80, 150 cm. mesh size 30, 120 mm.
Fishing ground
150-250 meter depth,
latitude 6 °N - 9°N

Results
Catch
Deep Sea shrimp
Hag fish.
Rat tail
Conger eel

M.V. SEAFDEC II Cruise No. 16-2/2007
15 Mar. – 23 Apr. 2007

Operation trial for Bottom otter trawl
In Andaman Sea
(Under Japanese Trust Fund)
At sea deep of 100- 200 meters

4 seams trawl net , 28/32 m (H R/G R)
with 50 mm of cod end mesh size

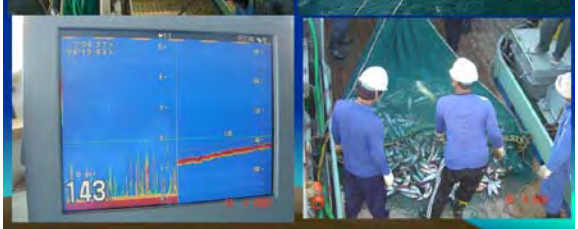


Table of Deep Sea Fisheries Survey Experience in Andaman Sea 1975-1955

Month/Year	Survey Vessel	Depth (m)	Location	Survey Fishing Gear	Objective	Result
March 1975	"	200 – 500	8°N - 13°N	Bottom trawler 22/32 m. Headrope and Groundrope, mesh size 50 mm. at cod end	Demersal Fisheries Resources Survey	"
February 1976	R.V. Fisheries Research No. II/DOF GT - 380 T Hp - 1,000 Ps	300 - 500	7°N - 10°N	Deep Sea Pot Rectangular, Prism shape 60 x 60 x 120 cm. mesh size 15 mm. 15 pots, Emersion time - 1 hrs. (6 – 18 hrs.)	Deep Sea Shrimp Resources Survey	Catch Total Max. 5.0 kg/t Shrimp 0.5 kg/t *H. hoogarus* *H. sculpta* Good Fishing ground - 400 m.

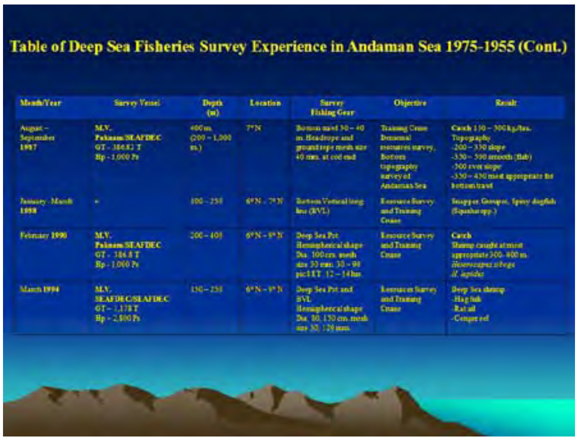


Table of Deep Sea Fisheries Survey Experience in Andaman Sea 1975-1955 (Cont.)

Month/Year	Survey Vessel	Depth (m)	Location	Survey Fishing Gear	Objective	Result
August – September 1987	M.V. Paknam/SEAFDEC GT - 386.82 T Hp - 1,000 Ps	400 m. (200 – 1,000 m.)	7° N	Bottom trawl 30 – 40 m. Headrope and ground rope mesh size 40 mm. at cod end	Training Cruise Demersal resources survey, Bottom topography survey of Andaman Sea	Catch 130 – 300 kg./hrs. Topography -200 – 330 slope -330 – 390 smooth (flat) -500 over slope -330 – 430 most appropriate for bottom trawl
January - March 1988	"	100 - 250	6° N - 7° N	Bottom Vertical long line (BVL)	Resource Survey and Training Cruise	Snapper, Grouper, Spiny dogfish (Squalus spp.)
February 1990	M.V. Paknam/SEAFDEC GT - 386.8 T Hp - 1,000 Ps	200 – 400	6° N - 9° N	Deep Sea Pot Hemispherical shape Dia. 100 cm. mesh size 30 mm. 30 – 90 pics ET. 12 – 14 hrs.	Resource Survey and Training Cruise	Catch Shrimp caught at most appropriate 300- 400 m. *Heterocarpus sibogae* *H. laevigatus*
March 1994	M.V. SEAFDEC/SEAFDEC GT – 1,178 T Hp – 2,800 Ps	150 – 250	6° N - 9° N	Deep Sea Pot and BVL Hemispherical shape Dia. 80, 130 cm. mesh size 30, 120 mm.	Resources Survey and Training Cruise	Deep Sea shrimp -Hag fish -Rat ail -Conger eel

Annex 21

Closing Remarks
By Mr. Kenji Matsumoto
SEAFDEC Deputy Secretary-General and
Trust Fund Program Manager
2 September 2010

Distinguished participants and colleagues, Good afternoon!

First of all, I wish to inform you that I am very happy to note the success of this Expert Meeting on Deep-Sea Fishing and Its Impact to Ecosystem. I must say that I am most impressed by your active participation during the 3-day meeting. I am also recognizing this as a very useful avenue to share/exchange and update the progress of deep-sea resources exploration project in our region, SEAFDEC would be willing to provide assistance for the sustainability of this network.

As this expert meeting comes to a close today, I would like to thank to all participants for sharing your knowledge and skills in this meeting. I am also thankful to the organizing team for your efforts in providing the best support to this meeting. We are also grateful for the continued financial support from the Japanese Trust Fund through SEAFDEC, for making this expert meeting possible.

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

Finally, I wish you all the best and every success in your future challenges. May you have a safe journey back home. With that Ladies and Gentlemen, I now declare the expert meeting on Deep-Sea Fishing and Its Impact to Ecosystem closed. Thank you very much.