I. Introduction

1. The training workshop on identification of deep-sea benthic macroinvertebrate vulnerable to fishing gear was organized by the SEAFDEC Training Department (SEAFDEC/TD) and financed by SEAFDEC through the Japanese Trust Fund. The Training Workshop was held at the SEAFDEC Training Department in Samut Prakan, Thailand from 11 to 15 July 2011.

2. The workshop was attended by researchers and specialists in the field/area of marine biologist, taxonomist, and person who involved in benthic invertebrate identification from the SEAFDEC Member Countries, benthic ecological expert from England, Professor, lecturer, graduate students, and undergraduate students from Kasetsart University (Bangkok, Thailand). The list of participants and resource person appears as Annex 1.

3. This training provides a set of knowledge on the identification of deep-sea benthic macroinvertebrate with emphasis on the species found from the fishery resources survey aboard M.V. SEAFDEC 2 at the continental shelf and slopes of Southeast Asian waters. The training attempted on building the capacity of the participants to identify species captured at water depths between 100 and 400 m by using morphology and habitat preferences. The Workshop was carried out with the following specific objectives;
   - Participants’ ability on deep-sea benthic macroinvertebrate identification will be enhanced through practical works.
   - Deep-sea benthic macroinvertebrate specimens collected from fisheries resource survey by MV.SEAFDEC 2 will be identified to the lowest taxa.

II. Opening and Introduction of the Training Workshop

4. The workshop was officially opened on July 11, 2011 at SEAFDEC/TD, Samutprakarn, Thailand. On behalf of the SEAFDEC Secretary-General, Mr. Bundit Chokesanguan, welcomes the participants and resource persons to the Training Workshop. He underlined the needs of building human resources capacity in the region with regards to marine invertebrate biodiversity to support SEAFDEC member countries deep-sea fishery resources exploration efforts. He also expresses the wish of SEAFDEC for all participants to have strong interest in
gaining knowledge and experiences in benthic macroinvertebrate identification. His Message appears as Annex 2.

5. The introduction of the workshop was made by Mrs. Penjan Laongmanee, Fishing Ground and Fishery Oceanography Section Head of the SEAFDEC/TD. She provided the background of the project “Deep-Sea Fisheries Resources Exploration in the Southeast Asian Waters” including progress of various activities those conducted under the program since 2007. In order to respond the international concern on the impact of fishing on deep-sea ecosystem, the program of activity has been developed in line with the ecosystem-based approach. With that, the “Training Workshop on Identification of Deep-Sea Benthic Macroinvertebrate Vulnerable to Fishing Gear” is part of SEAFDEC commitment to assist the Member Countries in building their capabilities to support their deep-sea fishery resources exploration efforts. Her presentation appears as Annex 3.

6. The brief on workshop program and arrangement of the activities was made by Dr. Natinee Sukramongkol which appears as Annex 4 and presentation as Annex 5.

III. Resource Person Presentations

7. The workshop was facilitated by six resource persons who professional in benthic macroinvertebrate identification and marine macrobenthic survey. The presentations made by resource persons provided the basis knowledge to guided participants to identify the group/species commonly captured in the South China Sea and Andaman Sea at the sea depth between 100 and 400 m. The presentations of the resource persons included;

7.1 Dr. Mike Kendall, benthic ecologist and a consultant for Plymouth Marine Lab Application at Plymouth, United Kingdom. His presentation consist of;

- Patterns in the benthos (Annex 6)
- Sampling the benthos (Annex 7)
- Collection and identification of polychaete worms (Annex 8)
- Analysis and synthesis (Annex 9)

7.2 Mr. Teerrapong Duangdee, Assistant Professor at Department of Marine Science, Faculty of Fisheries, Kasetsart University, Bangkok, Thailand, gave a presentation on;

- Introduction to the taxonomy of Gastropods and Bivalves (Annex 10)

7.3 Dr. Sumaitt Putchakarn, Senior Scientist at Biodiversity Research Unit, Institute of Marine Science, Burapha University, Chonburi, Thailand, lecture on the topic;

- Introduction to the taxonomy of Deep-Sea Echinoderm and Porifera (Annex 11)
7.4 Dr. Suriyan Tunkijjanukij, Dean of Faculty of Fisheries, Kasetsart University, Bangkok, Thailand, gave a presentation on;
- Introduction to the taxonomy of Deep-Sea Shrimps and Lobsters (Annex 12)

7.5 Ms. Puntip Wisespongpand, Assistant Professor at Department of Marine Science, Faculty of Fisheries, Kasetsart University, Bangkok, Thailand, lecture on three topics including;
- Guideline to identification of deep-sea crab (Annex 13)
- Classification of deep-sea crab (Annex 14)
- Deep-sea crab fisheries (Annex 15)

IV. Laboratory Practice on Macroinvertebrate Identification

8. During four days of practical work in laboratory, the participants were assigned to work in group (3-5 person/group). Each group was provided the specimens those collected by beam trawl and otter-trawl from Brunei Darussalam Waters at depth between 100 and 400 m during the collaborative survey aboard M.V. SEAFDEC 2 between 2008 and 2010. The specimens for identify both preserved in 70% ethanol and fresh (frozen) specimens were separated into five groups, i.e. Polychaete, Gastropods and Bivalves, Echinoderm and Porifera, Shrimps and Lobster, Crabs, for laboratory practice.

9. Participants were requested to identify the specimens up to family level or the lowest taxa. The practice on counting, measuring, and examining the pertinent external anatomical structures those necessary keys to be used in identifying the specimens. All laboratory practice were done under supervised by the resource persons and assistants resource persons who professional in benthic macroinvertebrate identification and marine macrobenthic survey.

10. During the laboratory work (11-14 July), participants were able to; describe the family characteristic of Gastropods and Bivalves specimens under supervised by Assist. Prof. Teerrapong Duangdee, identified the Polychaete specimens to the lowest taxa under supervised by Dr. Mike Kendall and Assoc. Prof. Dr. Chittima Aryuthaka; identify a group of echinoderm (i.e. sea cucumber, sea urchin, sea feathers, brittle stars, sea stars) and Porifera (sponges) under supervised by Dr. Sumaitt Putchakarn, identified on a group of deep-sea shrimps and lobster to the lowest taxa under supervised by Dr. Suriyan Tunkijjanukij and Assoc. Prof. Dr. Chittima Aryuthaka, and identified the crab specimens to the lowest taxa under supervised by Assist. Prof. Puntip Wisespongpand.

11. Moreover, participants were also experienced on the resin techniques to preserve the crab specimens as well as tissue (dermis) extracts technique using sodium hypochlorite (Clo-
bleach) to observe the spicule forms that most important of the diagnostic characters for identifying holothurians.

12. All specimens those identified by participants were took photos and each group was made presentation on the results of their identification. Then the discussion and clarification including advice on the results were made among the resource person and participants. The results presentation appears as Annex 16/1-16/5.

V. Discussion and Recommendations

13. Based on the discussion, the workshop was suggested for further activities at the Regional/National levels in the year 2012 and onward of the “Deep-Sea Fishery Resources Exploration in the Southeast Asian Waters” that;
   - SEAFDEC should keep continuing on the deep-sea resource survey in the region and disseminated the information to the SEAFDEC member countries
   - SEAFDEC should collaborate with the member countries on both exploration and identification (can be via an internet)
   - Exploration/study should be focus on species that potentially be fishery resources
   - Further study on both nutrition and marketable value (consider cost-effective) should be consider
   - A field guide book or a picture book of deep-sea benthic macroinvertebrate should be developed simplify identification guide (i.e. simple terms using, multi languages, online identification) to fulfill the taxonomic work in the region
   - Sharable information and dissemination on the results of the deep-sea survey should be shared through the website and database

VI. Summary of Workshop Evaluation

14. The workshop evaluation was summarized based on seventeen evaluations from participants and appear as Annex 17.

VII. Closing of the Training Workshop

15. Certificates of achievements were presented to the participants and resource persons by Mr. Bundit Chokesanguan on behalf of SEAFDEC Deputy Secretary-General. After expressed his appreciation to the participants for their active participated and willingness to apply and contribution what the participants have learned from the workshop, he declared the workshop closed. His Message appears as Annex 18.
Annex 1

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OPENING SPEECH

By Mr. Bundit Chokesanguan on behalf of SEAFDEC Secretary - General

Distinguished Resources Persons, participants and staffs of the SEAFDEC Training Department,
A very good morning!

First of all, on behalf of SEAFDEC, I would like to welcome all of you to the SEAFDEC/Training Department. Following the information provided by the Course Director of this Training, Dr. Worawit Wanchana on the background, you may know that this Training/Workshop is one of the regional initiatives implemented under the Japanese Trust Fund program on “Deep Sea Fisheries Resources exploration in the Southeast Asian Waters”. Various activities have been conducted under this program since in 2007. However, there is still a need to build human resources capacity in our region with regards to marine invertebrate biodiversity. This is part of our commitment to assist the SEAFDEC Member Countries in building their capabilities to support their deep-sea fishery resources exploration efforts.

During this training program, I am pleased to inform you that we have invited well known experts as our resource persons. We have with us Dr. Mike Kendal, senior expert from England, Dr. Sumaitt Puchakarn, senior scientist from Institute of Marine Science, Burapha University, Assistant Professor Dr. Suriyan Tunkijianukij, Associate Professor Dr. Chittima Aryuthaka, Assistant Professor Puntip Wisespong pand and Assistant Professor Teerapong Duangdee from Faculty of Fisheries, Kasetsart University. We are sure that with their expertise could provide our participants with the best knowledge in identification of benthic macroinvertebrate found in Southeast Asian water. Our resource persons are very pleased to share their knowledge and experiences with all of you during this training program.

So, even if you will have a hectic schedule during the next 5 days, I am sure you will enjoy the training with our experts and the staff concerned.

Ladies and Gentlemen, I wish to take this opportunity to express the wish of SEAFDEC for all participants to have strong interest in gaining knowledge and experiences in benthic macroinvertebrate identification. With that note ladies and gentlemen, I now declare this training/workshop on Identification of Deep-Sea Benthic Macroinvertebrate Vulnerable to Fishing Gear, open. Thank you and Good Day!
<table>
<thead>
<tr>
<th>Date/Program</th>
<th>Details of Activity/Topic</th>
<th>Facilitator</th>
</tr>
</thead>
</table>
| Day 1, (Sunday 10 July)         | • Arrival of resource persons and participants  
                              | Airport pick up arrangement will be provided                                     | SEAFDEC personnel                                                          |
| Day 2, (Monday 11 July): Opening, Introduction, and Lecture | 0900-0930  
0930-0945  
0945-1000  
• Opening ceremony/Group photo  
• Introduction to the workshop  
• Workshop program and arrangement of activities | Mr. Bundit Chokesanguan (on behalf of the SEAFDEC Secretary-General)  
SEAFDEC personnel & Participants |
|                                 | 1000-1015  
Break                                                                      |                                                                            |
|                                 | 1015-1230  
Lecture on:  
• Distribution and structure of benthic macroinvertebrate assemblages on the continental shelf and slopes  
• Sampling methodologies | Dr. Mike Kendall                                                             |
|                                 | 1230-1330  
Lunch break                                                                |                                                                            |
|                                 | 1330-1730  
Lecture and practice on:  
• Introduction to the taxonomy of Gastropods and Bivalves (emphasis on those found in the South China Sea and the Andaman Sea)  
• Identification practice on Deep-sea Gastropods and Bivalves specimens in laboratory | Mr. Teerapong Duangdee                                                      |
| Day 3, (Tuesday 12 July)        | 0900-1230  
Lecture and practice on:  
• Introduction to the taxonomy of deep-sea Polychaete  
• Identification practice on Polychaete specimens in laboratory (emphasis on those found in the South China Sea and the Andaman Sea) | Dr. Mike Kendall  
Dr. Chittima Aryuthaka                                                      |
|                                 | 1230-1330  
Lunch break                                                                |                                                                            |
|                                 | 1330-1730  
Lecture and practice on:  
• Introduction to the taxonomy of Deep-sea Echinoderm and Porifera specimens  
• Identification practice on Echinoderm and Porifera specimens in laboratory | Dr. Sumaitt Putchakarn                                                    |
<p>| Day 4, (Wednesday 13 July)      |                                                                                     |                                                                            |</p>
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<tr>
<th>Date/Program</th>
<th>Details of Activity/Topic</th>
<th>Facilitator</th>
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<tbody>
<tr>
<td>0900-1230</td>
<td>Lecture on:</td>
<td>Dr. Suriyan Tunkijjanukij</td>
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<tr>
<td></td>
<td>• Introduction to the taxonomy of Deep-sea Shrimps and Lobsters</td>
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<td></td>
<td>(emphasis on those found in the South China Sea and the Andaman Sea)</td>
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<tr>
<td>1230-1330</td>
<td>Lunch break</td>
<td></td>
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<tr>
<td>1330-1730</td>
<td>• Identification practice on Shrimps and Lobsters specimens in laboratory</td>
<td>Dr. Suriyan Tunkijjanukij</td>
</tr>
<tr>
<td><strong>Day 5, (Thursday 14 July)</strong></td>
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<tr>
<td>0900-1230</td>
<td>Lecture on:</td>
<td>Ms. Puntip Wisespongpond</td>
</tr>
<tr>
<td></td>
<td>• Introduction to the taxonomy of deep-sea Crabs</td>
<td></td>
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<tr>
<td></td>
<td>(emphasis on those found in the South China Sea and the Andaman Sea)</td>
<td></td>
</tr>
<tr>
<td>1230-1330</td>
<td>Lunch break</td>
<td></td>
</tr>
<tr>
<td>1330-1730</td>
<td>• Identification practice on Crabs specimens in laboratory</td>
<td>Ms. Puntip Wisespongpond</td>
</tr>
<tr>
<td><strong>Day 6, (Friday 15 July)</strong></td>
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<tr>
<td>0900-1000</td>
<td>Lecture on:</td>
<td>Dr. Mike Kendall</td>
</tr>
<tr>
<td></td>
<td>• Detecting change due to fishing</td>
<td></td>
</tr>
<tr>
<td>1000-1100</td>
<td>• Results presentation of the works from laboratory practice</td>
<td>Participants and Resource person</td>
</tr>
<tr>
<td>1100-1130</td>
<td>• Discussion and conclusion</td>
<td>Participants and Resource person</td>
</tr>
<tr>
<td>1130-1200</td>
<td>Closing ceremony</td>
<td>Mr. Bundit Chokesanguan (on behalf of the SEAFDEC Secretary-General)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SEAFDEC personnel &amp; Participants</td>
</tr>
<tr>
<td><strong>Day 7, (Saturday 16 July)</strong></td>
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</tr>
<tr>
<td></td>
<td>Participants leave for their home countries</td>
<td>SEAFDEC Personnel</td>
</tr>
</tbody>
</table>
Evaluation Summary
Training Workshop on Identification of Deep-sea Benthic Macroinvertebrate Vulnerable to Fishing Gear, 11-15 July 2011, SEAFDEC/TD

This summary is based on the 17 evaluations received comprising of:
10 Biologists, 1 Administrator, 1 Student, 1 Researcher, 1 Officer, 1 Biologist/Policy Maker, 2 Non-specified
Highly favorable will rates = 5. Not so favorable will rates from 4 to 1;

<table>
<thead>
<tr>
<th>Rating: 1 (lowest) to 5 (highest):</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>I. The training met my expectations</td>
<td></td>
<td>2</td>
<td>6</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. I will be able to apply the knowledge learned</td>
<td></td>
<td>2</td>
<td>12</td>
<td>3</td>
<td></td>
<td>- Need more integrated info. To manage fishing gear</td>
</tr>
<tr>
<td>III. Do you have a better understanding of</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Distribution of benthic animal, disturbance and benthic diversity</td>
<td></td>
<td>7</td>
<td>8</td>
<td>2</td>
<td></td>
<td>- Structure of distribution is very important</td>
</tr>
<tr>
<td>• Sampling the benthos</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td></td>
<td>- Methods and gears maybe better if done actual</td>
</tr>
<tr>
<td>• Introduction to the taxonomy of Gastropod and bivalve</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>4</td>
<td></td>
<td>- Need more time - Should elaborate more during presentation</td>
</tr>
<tr>
<td>• Collection and identification of Polychaete worms</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>5</td>
<td></td>
<td>- Interesting with online identification</td>
</tr>
<tr>
<td>• Introduction to the taxonomy of Echinoderm and Porifera</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td></td>
<td>- Should elaborate more during presentation</td>
</tr>
<tr>
<td>• Introduction to the taxonomy of Shrimps and Lobsters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>• Introduction to the taxonomy of Crabs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>• Biological and analysis decisions for detecting change due to fishing (on 15 July)</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV. Overall, how would you rate the course?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>V. How much you can transfer knowledge gain from this training course?</td>
<td>3</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
<td>- 75% - To be used as the basis to develop database and species identification</td>
</tr>
</tbody>
</table>

A. What did you like most about the course?
1. Diversification of specimens
2. The impact of fishing gears operation to benthic organism
3. The basis to identify the shrimp, lobster, crab, polychaete, gastropod
4. To improved knowledge and practical ability about identification of benthic macroinvertebrate
5. New subject for study the deep-sea specimens
6. The laboratory/actual works was very much helpful in learning process
7. The keys provided for shrimps and lobster as well as online key for annelids/polychaete were good
B. What presentations or topics were you expecting to hear, but were not presented?
   1. Octopus identification
   2. Taxonomy of marine fishes
   3. Other group of Crustacean such as Isopod
   4. Introduction to sensory organs of the animals in correspond to responsible fishing technology application
   5. Corals (deep-sea) particularly endangered species under CITES
   6. The existing deep-sea fisheries (shrimps and crabs) of the world (e.g. Alaska king crab fishing), the example on sustainable utilization

C. What would you recommend changing about the course?
   1. Need more time (e.g. 2 weeks for the course or more than 5 days)
   2. Technical terms is very important in taxonomy studies, should give priority and more time to this aspect
   3. Morning session lecture and evening laboratory
   4. Training materials should be collected earlier and distributed electronically to participants before the training course
   5. More samples to practice will be better and the program will be perfect if participants can join during the collecting sample
   6. Since time was limited in identification practice for five taxa groups. More emphasize may give to taxa groups w/c have fisheries potential/economic importance

D. Other comments, observations, suggestions for this course and the “Deep-Sea Fishery Resources Exploration in the Southeast Asian Water” program:
   1. Deep-sea fishery resources exploration should be conducted to explore new resources and more information on deep-sea animals. Collaborative work among member countries is much helpful
   2. The program should divided into 3 session;
      - Lecture
      - Identification of specimens together with the lecture use the same specimens
      - Self identification (sample provided by the lecturer)
   3. Poor English ability may the problem to gained and transfer knowledge
   4. Number of participants for this training should be at least two or three person/country
   5. The exploration/study should focus on taxa/species with fishery potential. Palatability study, nutritional value, and other related experimentation on deep-sea shrimps, lobsters and crabs in comparison to market-available equivalents may be considered
CLOSING REMARKS
By Mr. Bundit Chokesanguan on behalf of SEAFDEC Secretary - General

Distinguished Resource Persons, participants, and staff of SEAFDEC Training Department,
Good afternoon!

First of all, I wish to inform you that I am most impressed by your active participation during the 5-day training workshop, especially your strong sense of interest and the efforts you exerted in both lecture and laboratory practice. I am wish this event is a first step of you to share/exchange and update the progress of macro invertebrate study that support future scientific base management in our region especially for deep-sea fishery.

As this regional training workshop comes to a close today, I would like to thank our resource persons and experts: Dr. Mike Kendal, Dr. Sumaitt Puchakarn, Assistant Professor Dr. Suriyan Tunkijjanukij, Associate Professor Dr. Chittima Aryuthaka, Assistant Professor Puntip Wisespong pand and Assistant Professor Teerapong Duangdee for sharing their knowledge and skills with the participants. We are also thankful to the organizing team for your efforts in providing the best support to this training workshop. We are also grateful for the continued financial support from the Japanese Trust Fund through SEAFDEC, for making this training workshop possible.

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

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