Report of the Grouper Hatchery Production Training Course
May 2003

Research Institute for Mariculture - Gondol
Bali, Indonesia
1st - 21st May, 2003

Prepared by:

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1. Background

In May 2002, the first regional grouper hatchery production training course was organised by the Asia-Pacific Marine Finfish Aquaculture Network under the coordination of Network of Aquaculture Centres in Asia-Pacific (NACA) in cooperation with Northern Fisheries Centre, Queensland, Australia (QDPI) and Research Institute for Mariculture - Gondol. Support for the training course came from the Ministry of Marine Affairs and Fisheries, Indonesia, the Network of Aquaculture Centres in Asia-Pacific (NACA), the Australian Centre for International Agricultural Research (ACIAR), the Asia-Pacific Economic Cooperation (APEC) and the Japan International Cooperation Agency (JICA). The training course was successfully conducted in the Research Institute for Mariculture at Gondol, northern Bali, Indonesia.

A second course was successfully completed in May 2003, with 14 participants from 6 countries, and a detailed report is presented below. NACA has been following the 2002 participants with interest, and the feedback from some participants summarized below gives an update on the accomplishment after the course.

2. Post 2002 Training Developments

The outcome from the 2002 training has been impressive. Three participants reported that they had applied the techniques learnt from the training course with successful larval rearing trials upon return to their own countries, and the course appears to have stimulated further successes in Indonesia.

In Thailand, green grouper (*Epinephelus coioides*) was the only grouper species that has been regularly produced in government hatcheries. However, in August 2002, Krabi Coastal Aquaculture Development Station of Department of Fisheries Thailand produced tiger grouper (*E. fuscoguttatus*) seed for the first time. Approximately 9,000 fingerlings were produced at 8 cm in length, with an estimated survival rate of around 1.9%. Mr. Samart Detsathits from this DOF Thailand station was funded by an APEC staff exchange program ('Collaborative APEC Grouper Research and Development Network' FWG 01/99) to attend the Gondol hatchery training.

In Vietnam, green grouper fingerlings were successfully produced in June 2002. Around 100,000 fingerlings were reared and sold to fish farmers by the Cat Ba Research Centre for Mariculture of Research Institute for Aquaculture No 1 (Ministry of Fisheries Vietnam). Mr Hoang Nhat Son from the

centre was funded by SUMA (Support to Brackish Water and Marine Aquaculture, a component of the DANIDA Fisheries Sector Programme Support) to participate in the Gondol grouper hatchery training.

In Malaysia, Mr Lu Kien Chee and Mr Yazid Bin Sahjinan of the Department of Fisheries Sabah reported that they were able to produce tiger grouper fingerlings (6 cm TL and above) in January 2003, and 1,200 fish were sent for grow-out trials. Mr Sanjinan was funded by the APEC staff exchange program ('Collaborative APEC Grouper Research and Development Network' FWG 01/99).

In Indonesia, Mr Jimmy Alfredo Bonilla Rivas, a private sector participant in the 2002 training course, came to pay a visit during the second training course in May 2003, and mentioned that he and Mr. Harri Saptoprabowo have seen their grouper larvae rearing techniques improved since the 2002 training course.

These success stories, following the training course, are a welcome development, and a credit to the staff at the Research Institute for Mariculture - Gondol in Bali, Indonesia, who put significant effort into delivering this well received course.

3. Training Course 2003

In 2003, the Network organized the second Regional Grouper Hatchery Production training course. The network received many enquiries for this second training course but the intake had to be limited for a more effective program. Only 14 participants from six countries were taken into this second training course, including participants from Australia, Brunei Darussalam, India, Malaysia, Singapore and Vietnam. The list of participants is in Annex 1. The training course for 2003 was another success.

The training course began on 1st May 2003 and started with a welcome address by Dr Adi Hanafi, Director of RIM Gondol, followed by a keynote speech delivered on behalf of NACA Director General (Mr Pedro Bueno) by Mr Sih Yang Sim (Coordinator – Regional Grouper Hatchery Production training course). Dr Ketut Sugama, Director of Research Center for Aquaculture delivered the opening speech and officially opened the training course for 2003.

There were 13 technical lectures delivered in the training course to provide the theoretical aspects and three general topics were presented (Annex 2). Practical components including hand-on work with grouper hatchery, broodstock hormone and microchip implantation, live feed production, disease

control and health management components such as illustration of PCR tests, artificial feed production and packaging were included. There were 3 field trips organized which included visits to commercial grouper and milkfish hatcheries, floating cages of grouper grow-out, fish markets and exporters.

4. Training Center Facilities Tour

After the opening ceremony participants toured RIM-Gondol facilities. The visit provided an opportunity to understand the facilities and activities that are being carried out by the institute. The tour began with a visit to the disease laboratories, nutrition and water quality lab, experimental area for artificial diet, broodstock facilities, super-intensive system, tuna facilities, and etc.

Picture 1: Participants visit RIM-Gondol feed trials facility for grouper species.

Picture 2: RIM-Gondol training course committee member explaining at the coral trout broodstock section.

Picture 3: Participants at the super-intensive recirculation system used for marine fish culture in RIM-Gondol.

Picture 4: Participants visit the new tuna breeding facility at RIM-Gondol.

5. Theoretical Components

The 13 technical topics presented during the training course in lecture format covered all the theoretical components of the training course. Additional topics covered the more general aspects of the course. The technical topics are listed below:

- Broodstock and Eggs Management
- Grouper Seed Production
- Induce Sex and Maturation
- Live Feed Production – I
- Live Feed Production – II
- Bacterial Diseases
- Parasitic Diseases
- Viral Diseases
- Nutrition and Feed Development
- Nutrition and Feed for Grow-out
- Morphological and Behavioral Development of Grouper Larvae
- Fish Farming on Floating Cages
- Packaging and Transportation of Seed

The general topics included:

- Introduction to RIM-Gondol
- Status of Mariculutre in Indonesia
- A Marine Finfish Aquaculture Network for the Asia-Pacific Region

Annex 3 provides a full list of resource speakers, lecturers and trainers.

6. Hatchery Practical Components

On-the-job or hand-on training has been considered as a very important component of the training course and there were many areas of on-the-job training that have been developed for the training course to provide full exposure to the management and operational skills needed in grouper hatchery production to participants.

The hatchery production practical components include the following:

- Preparation of larval rearing tanks
- Broodstock management
- Eggs collection, quality checking and treatment procedures
- Larviculture and hatchery management
- Live feed culture, enrichment and harvest
- Harvesting and transport
- Fish health

- Artificial feed production

i. Broodstock Management

During the training course, participants handled broodstock which include feeding, checking broodstock condition, post spawning treatment, microchip implantation and other operations. Picture 5 to 10 show some of the practical activities organized for the training course on broodstock components.

Picture 5: Broodstock feeding time, participants feed the* C. altivelis *broodstock.

Picture 6: Malaysian participant checking broodstock maturation.

Picture 7: Participants observing freshwater bath of* C. altivelis *for parasite treatment, post spawning.

Picture 8: Trainers explain to participants on where and how to inject mechanical implants into grouper broodstock.

Picture 9: Vietnam participants inject microchip into* E. coioides *broodstock for identification.

Picture 10: Trainer shows and explains the use of the various tools and materials used for broodstock management.

ii. Eggs Collection, Quality Checking and Treatment Procedures

Several practical components were organized for the training course on egg handling and management. These included harvesting eggs, transferring eggs in incubation area, checking egg quality and measuring hatching rate, etc. Picture 11 to 15 show some of the practical activities carried out during the training course.

Picture 11: Participants observe RIM-Gondol technician collecting eggs at broodstock tank.

Picture 12: Vietnam participant transfer eggs from incubation tank to holding tank before transfer to larvae tank or before they are sold to commercial hatcheries.

Picture 13: Indian participants observe the incubated eggs with glass beaker, while trainer explains to them the condition of the eggs.

Picture 14: Participants checking egg quality and density under trainer guidance.

Picture 15: Participants prepare eggs for observation under the microscope.

iii. Larviculture and Hatchery Management

Several practical components were arranged for larviculture and hatchery management section of the training course, including feeding, larvae tanks cleaning, spreading oil, observing larvae condition, microscope observation of larvae development, etc. Picture 16 to Picture 21 show some of the practical activities carried out.

Picture 16: Participants spraying disinfectant before enter into the hatchery training unit.

Picture 17: Singapore participant applying fish oil to the larvae tank, to prevent surface tension death during early larvae stage.

Picture 18: Indian participants checking larvae condition at the training hatchery unit.

Picture 19: Indian participants looking at the larvae tank to check for newly hatched larvae.

Picture 20: **E. fuscoguttatus** *larvae were collected by trainer for observation under a microscope in comparison with* **C. altivelis.**

Picture 21: Day 5 larva (top), and Day 9 larvae under microscope (bottom); Day 9 larvae already has a developed dorsal fin.

iv. Culture Tanks Cleaning

Some participants conducted some of the cleaning activities at the training hatchery unit. The cleaning activities include tank bottom cleaning and siphoning, and removed of surface foam and waste. Picture 22 to 23 show participants carrying out cleaning activities.

Picture 22: Australian participant collecting the wastes on the surface of the larvae tank.

Picture 23: Malaysian participant practicing pond bottom cleaning of larvae tank.

v. Harvesting Live Feed and Feeding Larvae

The practical component on this section have been developed to cover harvesting of live feed such as rotifer and artemia. It also including some food enrichment activities. Artificial diets were also fed to the larvae by participants. Picture 24 to Picture 31 below show some of the feeding and harvesting activities.

Picture 24: India and Brunei participants conducting on-the-job training, feeding larvae.

Picture 25: Singapore participant feeding larvae with artificial diet.

Picture 26: RIM-Gondol technician harvesting rotifer for enrichment, participants were provided the opportunity to observe the whole process.

Picture 27: Participants harvesting artemia for enrichment.

Picture 28: Australian participant harvesting enriched rotifer for feeding to Day 11 larvae.

Picture 29: Australian participant feeding the harvested enriched rotifer to small **C. altivelis** *larvae.*

Picture 30: Participants preparing rotifer sample for counting under microscope.

Picture 31: SS-rotifer under microscope.

vi. Harvesting Larvae, Grading and Sorting Sizes

This practical component covered harvesting of larvae from culture tanks, grading and size sorting. Day 42 larvae (2 cm size) were harvested and participants fully participated in the harvesting process and size grading. During the training course participants were also provided with the opportunity for sorting of larger size larvae (> 5 cm size) and checking of deformities and abnormalities in larvae. Picture 32 to Picture 37 show the practical activities.

Picture 32: Participants carrying out harvesting of Day 42 larvae with RIM-Gondol technician.

Picture 33: Trainer demonstrates size sorting for Day 42* C. altivelis *larvae.

Picture 34: Participants grading Day 42 larvae.

Picture 35: Participants doing size sorting of > 5* cm C. altivelis*, for transportation.

Picture 36: Trainer explaining about abnormal and rejected* C. altivelis *during size sorting activity.

Picture 37: Participants looking at deformed* C. altivelis *during sorting training period.

vii. Packaging and Transportation

Training course participants were also involved in the full process of packaging for size >5 cm juveniles. They also had observed open transportation by truck for *C. altivelis* fingerlings to Lampung. Picture 38 to 40 below illustrate the activities for packaging and transportation of grouper fingerlings.

Picture 38: Participants packing the grouper juveniles.

Picture 39: Participants carrying out the whole packaging process under supervision of trainers and technicians.

Picture 40: Indian participant observes the open transport system for* C. altivelis *to Lampung, Sumatera.

Picture 41: Trainer shows disease causing organisms in health laboratory with video, microscopic slices and manual.

viii. Disease Laboratories Illustration

The training group attended a disease laboratories illustration session delivered by a specialist parasitic diseases. The illustration included microscope identification of pathogens and video illustration.

ix. PCR Tests Illustration

Two PCR tests were carried out for the training course with full procedures explained by trainers. The first PCR test was carried out to test for VNN disease and it showed negative. A second PCR test was carried out to detect whether the grouper larvae managed by the trainees have any viral infection. The result was again negative.

Picture 42: Disease laboratory technician showing participants the procedures for PCR testing.

Picture 43: Participants looking at the result of the PCR test.

x. Artificial Feed Production

A full process artificial feed production was conducted for the training course. A feed formula was given and participants were shown how to measure and mix raw materials before they are placed into the feed machine. Explanation of feed machineries and processes were also given by trainers. After production the feed were spread for oven-drying.

Picture 44: Trainer explaining the type of and operation of the feed machineries used in RIM-Gondol.

Picture 45: Trainer showing and explaining the feed ingredients for artificial feed production.

Picture 46: Participants observe weighing and preparation of feed ingredients for the training.

Picture 47: Participants looking at the process of mixing of the feed ingredients in the machine.

Picture 48: Vietnam participants examining the extruded artificial feed.

Picture 49: Participants spread the artificial feed produced on trays before they are oven-dried.

xi. Live Feed Production

Participants were brought to the live food laboratory for algal culture. The practical component started with participants conducting agar preparation and drying process. Algae spores were transferred to the agar plates prepared earlier. Participants carried out this practical task.

Picture 50: Participants tour the algae laboratory before practical work.

Picture 51: Participants practice plate culture of algae.

Explanation of various lab activities were also carried out and participants observed various microalgae species under the microscope. Participants also had the opportunity to identify various types of rotifer including SS-rotifer, S-rotifer, and L-rotifer under the microscope.

Picture 52: Preparation of alga plate for microalgae plate culture.

Picture 53: Participant observing various types of rotifers under microscope, such as SS-, S-, and L-rotifer.

Participants were also shown the procedures to prepare fertilizers and batch culture of algae before transfer to outdoor large volume culture. Outdoor culture and condition were explained.

Picture 54: Trainer and technician show the process of microalgae culture with adding fertilizer to culture water before adding algae.

Picture 55: Technicians adding microalge to the culture tank after adding fertilizer.

7. Field Trips

There were 3 field trips arranged for the training course. The first field trip was a visit to commercial grouper hatcheries near RIM-Gondol area. Three grouper hatcheries were visited. Participants also had a chance to visit nearby milkfish hatcheries.

Picture 56: Field trip to small commercial grouper hatchery.

Picture 57: Technician at a large-scale commercial grouper hatchery feeding tiger grouper, participant observes feeding activity.

Picture 58: Indian participants examine the packaging of grouper fingerlings at commercial grouper hatchery.

Picture 59: Field trips included a visit to a milkfish hatchery.

Additional field activities such as visiting traders and exporters of milkfish fry near RIM-Gondol were arranged. Participants visited two milkfish fry traders and exporters, and observered the trading system and activities in this area.

Picture 60: Participants observe milkfish fry before they are packed and delivered to traders.

Picture 61: Participants looking at the packaging of milkfish fry in a trader business premise.

The second field trip was arranged to visit the floating cages of RIM Gondol, which is currently used for grouper grow-out trial. The trial results are considered encouraging and RIM Gondol will introduce the technology to farmers in the future.

Picture 62: Participants boarding a speedboat for the visit to floating cages.

Picture 63: Indian participants feeding the groupers in the floating cages to observe the condition of the fish.

The third field visit was organized to Denpasar/Kuta which included the quarantine office near the airport, local traditional fish market and fishing port, all exporters of lobster, marine ornamental fish, and live reef food fish. Due to SARS many live food fish exporters were not operating during the time of visit.

Picture 64: Field trip to local fish market with trainer and quarantine officer, looking at the species found in the market.

Picture 65: Trainers and participants at a shop selling swimming crabs.

Picture 66: Lobster exporter explaining the holding facilities and the species of lobsters available here.

Picture 67: Workers at the lobster exporter were processing the fresh lobster tails for export.

Picture 68: Participants at a marine ornamental fish exporter.

Picture 69: Participants at a live reef fish exporter, however only one tank contained reef fish species.

8. Closing Ceremony

The closing ceremony was held on 20th May. It began with Mr Sih Yang Sim delivered a closing remark on behalf of NACA and followed by participants' representative giving a speech to thank the organizers and the trainers. On behalf of the organizers Mr Shogo Kawahara (JICA Expert) handed out certificate of successful completion to participants. The closing ceremony ended with Dr Adi Hanafi (Director of RIM Gondol) delivering a closing speech and officially closed the training course.

Picture 70: Representative of training course participants gives a speech to thank trainers and organizers.

Picture 71: Director of RIM-Gondol gives closing speech.

Picture 72: JICA Expert handing certificate to a participant.

Picture 73: JICA Expert handing certificate to a participant.

9. Feedback Analysis from Participants

The following section is the evaluation provided by participants based on a questionnaire (Annex 4) distributed on the last day of the training course. Overall the responses are positive.

1. ***Do you think the lectures cover all aspects of grouper hatchery production?***

All 14 participants considered the lectures organized cover all aspects of grouper hatchery production.

2. ***Do the lectures provide sufficient knowledge and information on grouper hatchery production to participants?***

Thirteen participants think that the lectures of the training course provide them with sufficient knowledge and information on grouper hatchery production. One participant did not provide any answer.

3. ***Do you think the practical components cover all aspects on grouper hatchery production?***

Ten participants considered the practical components organized by the training course cover all aspects on grouper hatchery production. Four participants though that the practical components should be further improved. Some comments were provided by participants:

- *In the area of lab work, we can have more practical work like culturing or preparation of algae or rotifer collection*
- *Need more practices*
- *This practical components so general and no guide and support with good equipment and suitable place*

4. ***Do you think it is necessary to have daily routine on-the-job training throughout the whole course for participants?***

Twelve participants considered daily routine on-the-job training is necessary throughout the training course. Some participants think it will be more appropriate for each group to be given a larvae tank to manage through out the training course. The 4 groups were given one tank each to manage, however it seems to be less organized due to various activities involved and sometimes participants need to leave the training place for other activities. Some comments that provided by participants are given below:

- *Be located closer to the hatchery for after hour work*
- *A separate larval rearing tank has to be allocated to a group of trainees and day-to-day activities can be done by them. It is necessary to attend daily hatchery works such as cleaning, feeding, algae* adding, etc.
- *The tank area is a bit cramp, difficult for movement, each group should be given 1 tank to culture the fry/larvae*

- *Each of the 4 groups trainees could be allocated a larval tank each and individual trainees could made to attend the routine jobs turn by turn during the whole duration of the training under the guidance of the efficient staff at the institute*
- *Need facilities and 'hand-on' expert organizer*
- *A separate tank has to be given for each group so that there will be closer and more active involvement by the participants to enable them to learn individually*

5. ***Do you think that you have received sufficient level of technical support throughout the course?***

All 14 participants think that they have received sufficient level of technical support throughout the training course.

6. ***What do you think of the field trip arrangements?***

There were three field trips arranged, the backyard hatchery and floating netcages field trips were considered by many participants as a good arrangement and provides good experiences. However, the feed back for field trip to live fish exporters, fish market and ornamental fish exporter was not given, as these trips were scheduled at the end of the training course after the feedback form was returned. However, based on observation the participants were generally satisfied with the trip.

Backyard hatchery			***Live fish exporters & fish market***			***Floating netcages***		
Good	***Average***	***Poor***	***Good***	***Average***	***Poor***	***Good***	***Average***	***Poor***
12	*2*	*0*	*Not applicable as the field trip was carried out after the questionnaire*			*13*	*1*	*0*
						A visit to commercial farm would also be interesting		

7. ***Do you think the training and the field trips have provided you with good future contacts?***

It appears that all participants were able to gather some contacts for their future aquaculture activities after they returned home. The training course and the field trips had provided an opportunity for the participants to obtain future contacts for supplies and marketing; all 14 participants were able to develop some contacts.

8. ***Do you think overall the training course is satisfactory and meets your expectation? Please pick the following level of satisfactory:***

Overall the training course met participants' expectation. Five considered the training course was excellent, 9 said it was well organized.

9. ***Is there a need for the training course to be improved? If so in what aspects?***

Ten participants considered the training course need to be improved in some aspects. A few participants suggested to conduct some sort of test or exam so that participants will be more involved in the training activities. Below are some of their comments:

- *After end of the training an examination should be conducted in order to evaluate each participants this will enhance the more involvement*
- *By providing more "hands-on" aspect the training with the trainees having to shoulder more responsibilities to look after the day-to-day management of larval rearing tank etc.*
- *Examination can be conducted at the end of the training course, so that each trainee can attend the training sincerely and seriously from the beginning*
- *Perhaps we can attempt to organize the on the job training in a more organized manner so that each and everyone will have a chance to work on each aspect of the practical. Example: one group assign to each tank for management*
- *Need more individual presentation*
- *Need more practical works in hatchery*
- *It'd better to make presentation and group works*
- *Perhaps more opportunity for later observations*

10. ***Do you think your knowledge and practical experience on grouper hatchery production have increased after this training course?***

Thirteen participants believed they have increased their knowledge and practical experience on grouper hatchery production after the course. One participant did not provide feedback on this.

11. ***Did the training course provide you with knowledge and skills sufficient to train other technical staff or farmers in your country / region?***

Except one participant, all others felt that the training course has provided them with knowledge and skills sufficient to train other technical staff and farmers at their home lands. One participant did not respond on this. Additional comments from some participants are listed below:

- *The training course provide me sufficient knowledge to give training to own staff and farmers*
- *Specially on larvae rearing and broodstock management*
- *This training course is very useful to improve the overall seed production activities in our country*
- *No, I think I need to put into practice what I have learned in Gondol before I can teach others*

12. ***When you return home, how will you pass on the knowledge and skills that you acquired during this course?***

The answers to this question vary; some said they will conduct seminar to disseminate technical knowledge, some will conduct short term training courses. The details of the responses are listed below:

- *I will definitely modify the existing hatchery and improve the facilities of the same which shall enable me to do grouper hatchery production*
- *Yes, through short course and hands-on training*

- *To begin with the knowledge will be shared with my colleagues and peers. Later can take the lead in implementing a grouper hatchery/farming project back in my country as encouraged by my department*
- *First I will share the knowledge that I acquired during this course with my colleague*
- *Do practices in hatchery*
- *I will give presentation to the staff, eve to officers in my department on what I had seen and done during this training course*
- *Yes, I can definitely adopt some techniques learned here and suitably modify the facilities for successful hatchery seed production of grouper*
- *Get hatchery technique on grouper*
- *Get more knowledge on grouper hatchery*
- *Know more about grouper*
- *I will train my staff and students in these techniques*
- *Discussion/exchanges*

13. ***Would you like to participate in a network/discussion group after this training course to facilitate discussion and future activities and contacts?***

All participants would like to participate in a network to facilitate discussion and future activities and contacts, only one participant does not provide respond on this. All participants who would like to participate in network activities indicated they would like the Asia-Pacific Marine Finfish Aquaculture Network to facilitate the activities for them.

10. Annexes

Annex 1: Participant List for Regional Grouper Hatchery Production Training Course May 1 – 21, 2003

No	Name	Address	Field, Specialization and Experiences
1	Dr Trevor Anderson	**GFB Fisheries Ltd** PO Box 5804 Townsville Qld 4810 Australia Tel: 61-7-4771 5550; 61-4-1760 4214 (mobile) Fax: 61-7-4771 5152 Email: Trevor@gfbfisheries.com	• Aquaculture of seabass and grouper • Fish nutrition • Endocrinology • 22 years study of fish farming and physiology • 15 years teaching and research at university level • 1 year General Manager of seabass farm • 35 scientific publications and 1 monograph
2	Mr Jon Ng Wee Beng	**East Star Aquaculture Holdings Pte Ltd** 133 New Bridge Road #09-06 Chinatown Point Singapore 059413 Tel: 65-6737 5588; 65-9616 0494 Fax: 65-6737 6694 Email: domain@singnet.com.sg	• Live seafood • Marine finfish fingerlings and broodstock supply • Aquaculture
3	Mr Patrick Tan Chwee Teck	**East Star Aquaculture Holdings Pte Ltd** 133 New Bridge Road #09-06 Chinatown Point Singapore 059413 Tel: 65-6737 5588 Fax: 65-6737 6694 Email: rajawang@starhub.net.sg	• Hatchery - groupers
4	Mr Ali Awang	**National Prawn Fry Production and Research Centre** Fisheries Department of Malaysia Pulau Sayak Kedah Malaysia Tel: 6-04-437 4021 Fax: 6-04-437 4470 Email: pppbuk@po.jaring.my	• Marine fish breeding, including seabass, grouper (*E. coioides, E. fuscoguttatus*) and snapper (*L. argentimaculatus, L. johnii*) • Rotifer culture • Copepod culture
5	Mr Sufian B.Mustafa	**Marine Finfish Production and Research Centre** Department of Fisheries Malaysia Tg. Demong Besut Terengganu Malaysia Tel: 6-09-695 6778 Fax: 6-09-695 8626 Email: sufnor96@hotmail.com	• Eel diseases diagnosis • Marine finfish breeding (seabass, tiger grouper, pompano, *L. johnii* and *L. argentimaculatus*).

6	Mr Nedunilath Xavier George	**The Marine Products Export Development Authority (MPEDA)** MPEDA House Panampilly Nagar Kochi 682036 India Tel: 91-484-231 1979; 231 7762 Fax: 91-484-231 3361 Email: mpeda@mpeda.nic.in	• Shrimp culture • 19 years service experience in aquaculture extension, implementation of development schemes
7	Mr Madhavakamath Viswakumar	**The Marine Products Export Development Authority (MPEDA)** MPEDA House Panampilly Nagar Kochi 682036 India Tel: 91-484-231 1979; 231 7762 Fax: 91-484-231 3361 Email: mpeda@mpeda.nic.in ; viswakumar@lycos.com	• Shrimp culture • 5 years research experience in shrimp ecophysiology • 14 years service experience in aquaculture extension, implementation of development schemes
8	Ms Le Thi Thu Hien	**American Technologies, Inc. (ATI)** 26 Pham Van Dong Cau Giay Hanoi Vietnam Tel: 84-4-768 1524 Fax: 84-4-768 1568 Email: hienle@ativietnam.com	• Business management • Corporate development management • Marketing strategies
9	Mr Hoang Ouoc Viet	**American Technologies, Inc. (ATI)** Thon 2, Halong Van Don Quang Ninh Vietnam Tel: 84-4-3379 3156; 84-91-202 0745 (mobile) Fax: -- Email: baidai@ativietnam.com	• Technical expert on aquaculture of groupers, cobia, reddrum, tiger shrimp and white leg shrimp
10	Mr Tran Huynh Cuong	**Research Institute for Aquaculture No 3** 33 Dang Tat Nha Trang Khanh Hoa Vietnam Tel: 84-58-831138; 84-913-417315 Fax: 84-58-831846 Email: marinecuong@dng.vnn.vn ; trhcuong752005@yahoo.com	• Marine fish seed production • Broodstock handling and larval production of seabass
11	Mr Nguyen Van Hong	**Department of Fisheries Quang Ninh** Km 8 Hong Ha Halong City Quang Ninh Vietnam Tel: 84-33-838032 Fax: -- Email: nguyenhongria@yahoo.com	• Technical expert on aquaculture of black tiger shrimp, grouper, cobia and mollusk

12	Mr Dharmakumar Thinesh Santhar Lejeune Mouroubain	**Rajiv Gandhi Centre for Aquaculture (RGCA)** No 5/134-A Main Road Tirumullaivasal 603113 Sirkalitk Bagapattinam Dist. Tamilnadu India Tel: 91-4364-264903 Fax: 91-4364-264902 Email: rgcamym-kmb@sancharnet.in ; bassrgca-kmb@sancharnet.in ; thineshsanthar_69@yahoo.com	• Fish and shrimp seed production • Worked as technician in *P. monodon* shrimp hatchery for 8 years and than entered into marine finfish fingerlings production especially seabass and also involved in pond cage culture of seabass and achieved a production of 2 tons per hectare
13	Dr K. Kailasam	**Central Institute of Brackishwater Aquaculture** No 75 Santhome High Road R. A. Puram Chennai 600028 India Tel: 44-2461 8817; 2461 6948 Fax: 44-2461 0311 Email: ciba@tn.nic.in ; kailu66@hotmail.com	• Doing research for the past 9 years on brackishwater finfish broodstock development, induced breeding, seed production and culture of seabass (*Lates calcarifer*), grouper (*E. tauvina*) and grey mullet (*Mugil cephalus*)
14	Ms Siti Norjuriah Hj Tengah	**Department of Fisheries, Brunei Darussalam** Jln Menteri Besar Bandar Seri Begawan Brunei Darussalam Tel: 673-2-383067; 673-8-765367 (mobile) Fax: 673-2-382069 Email: bruneifisheries@brunet.bn ; ctjuriah@hotmail.com	• Shrimp hatchery (*Litopenaeus stylisastris*) operation manager • Working in aquaculture section for 7 years, experience in natural food production, seabass and shrimp hatchery

Annex: 2: Training Course Program

Date	Day	Time Schedule and Contents		
		08:00 – 10:00	**10:15-12:00**	**13:00-15:00**
Apr 30	**Wed**	**Arrival of participants in Bali**		
May 1	Thu	• Participant registration • Welcome address (Adi Hanafi) • Keynote speech (NACA - Sih Yang Sim) • Opening Address (Ketut Sugama)	• Introduction to RIM-Gondol (Adi Hanafi) • Brief information on NACA (Sih Yang Sim) • Status of Mariculture in Indonesia (Ketut Sugama)	• Visit RIM facilities and discussion (Adi Hanafi & Jhon H)
May 2	Fri	• Introduction to Hatchery Unit and its activities (Suko Ismi, Bejo, S.)	• Broodstock and Eggs Management (Tridjoko)	• Visit small-scale hatcheries around Gondol (Suko Ismi & Jhon, H)
May 3	Sat	• On-the-job training at hatchery unit (Suko Ismi & Jhon, H)	• Field trip to hatcheries and nurseries (Suko Ismi & Jhon, H)	• On-the-job training at hatchery unit (Suko Ismi & Jhon, H)
May 4	**Sun**	**Rest Day**		
May 5	Mon	• On-the-job training at hatchery unit (Bejo, S & Kt. Maha)	• Grouper Seed Production (Shogo Kawahara & Suko Ismi)	• Grouper Seed Production (Shogo Kawahara & Suko Ismi)
May 6	Tue	• Induce Sex and Maturation (Agus Prijono)	• Live Feed Production (Haryanti)	• On-the-job training at live feed unit (Haryanti)
May 7	Wed	• On-the-job training at broodstock unit (Tridjoko & Agus, P)	• Live Feed Production (Titiek Aslianti)	• On-the-job training at live feed unit (Titek Aslianti)
May 8	Thu	• On-the-job training at hatchery unit (Bejo, S. & Tony, S.)	• Bacterial Disease (Zafran)	• On-the-job training at pathology unit (Zafran & Des Rosa)
May 9	Fri	• On-the-job training at hatchery unit (Jhon, H. & Tony, S.)	• Parasitic Disease (Fritz Johny)	• On-the-job training at hatchery unit (Jhon, H. & Tony, S.)
May 10	Sat	• On-the-job training at hatchery unit (Jhon, H. & Bejo, S.)	• Packaging and Transportation (Suko Ismi)	• Field trip to Floating Cages (Suko Ismi & Jhon H)
May 11	**Sun**	**Rest Day**		
May 12	Mon	• On-the-job training at hatchery unit (Bejo S & Tony S)	• Viral Disease (Des Rosa & Mahardhika)	• On-the-job training at Pathology unit (Mahardhika & Fritz Johny)

May 13	Tue	• On-the-job training at hatchery unit (Suko Ismi & Kt. Maha)	• Nutrition and Feed Development (I. N. A. Giri)	• On-the-job training at hatchery unit (Suko Ismi & Kt. Maha)
May 14	Wed	• On-the-job training at hatchery unit (Bejo S & Jhon H) • Nutrition and Feed for Grow-Out (K. Suwirya)	• On-the-job training at feed preparation unit (I.N.A. Giri, K. Suwirya & Marzuki)	• On-the-job training at feed preparation unit (I.N.A. Giri, K. Suwirya & Marzuki)
May 15	**Thu**	**Indonesia public holiday**		
May 16	**Fri**	**Indonesia public holiday**		
May 17	Sat	• On-the-job training at hatchery unit (Kt. Maha & Jhon H)	• Morphological and Behavioral Development of Grouper Larvae (Jhon H)	• On-the-job training at hatchery unit (Suko Ismi & Kt. Maha)
May 18	**Sun**	**Rest Day**		
May 19	Mon	• On-the-job training at hatchery unit (Bejo S & Suko Ismi)	• Fish Farming (Adi Hanafi & Tatam S) • A Marine Finfish Aquaculture Network for the Asia-Pacific Region (Sih Yang Sim)	• On-the-job training at hatchery unit (Suko Ismi & Jhon H)
May 20	Tue	• Closing remark (NACA – Sih Yang Sim) • Speech from representative of participants • Presentation of certificate to participants (Shogo Kawahara) • Closing speech (Adi Hanafi)	• Depart for Kuta at around 11:30	• Trip to Tanah Lot to see Balinese temple at the beach site.
May 21	Wed	• Field trip to quarantine office near airport • Field trip to lobster exporter • Field trip to marine ornamental fish exporter	• Field trip to live fish exporters • Local fish market and fishing port	• Shopping trip
May 22	Thu	• All participants depart for home		

Annex 3: Resources Speakers and Trainers List

No	Name	Address	Field, Specialization and Experiences
1	Dr Ketut Sugama	Director **Research Center for Aquaculture** Jl. Petamburan VI, Slipi PO Box 6650 Jakarta Indonesia Tel: +62-21 570 9160 Fax: +62-21 570 9159 Email: crifidir@indonet.id ; sugama@indosat.net.id	• Fish breeding and genetic • Research on fish genetic, breeding, larval rearing and pond culture of marine fish and shrimp (1991-present) • Research on genetic improvement by chromosome manipulation in marine fish, red snapper (1988-1990) • Research on fish genetic assessment in the coastal water of Japan and China (1958-1987) • Research on natural food, breeding, larviculture, growth of marine fish in floating net-cages (1980-1985)
2	Dr Adi Hanafi	Director **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278; 62-081-2365 0155 (mobile) Fax: +62-362 92272 Email: grim@indosat.net.id ; ahanaf2001@yahoo.com	• PhD (land use planning for coastal aquaculture) • 1970-1978: Institute for Brackish Water Aquaculture (Shrimp project) Jerapa, collaboration between DGF and FAO • 1979-1983: Research Institute for Freshwater Aquaculture, Bogor • 1984-1989: Pursuing MS and PhD program • 1990-2001: Research Institute for Coastal Fisheries, Maros • 2001-now: Research Institute for Mariculture, Gondol, Bali
3	Mr Shogo Kawahara	Expert on Mariculture Development **Japan International Coopertaion Agency (JICA)** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92271 Email: kawaharashogo@yahoo.co.jp	• Research marine fish culture in Arab (1987 – 1997) • JICA Team Leader of Multispecies Hatchery Project (1999-2001) • JICA Expert on Marine Technology (2001-now)
4	Dr Nyoman Adiasmara Giri	Fish Nutrition Section **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Breeding and seed production of milkfish • Nutrition aspects on shrimp seed production • Fish nutrition

5	Mr Zafran	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Fish Pathology • Researcher at Research Institute for Coastal Aquaculture, Maros (1985-1990) • Researcher at Research Institute for Mariculutre, Gondol (1990-present) • Conduct research on fish diseases
6	Mr Tridjoko	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Biologist Master degree • Research on marine fish reproduction
7	Dr Haryanti	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; haryanti@indosat.net.id	• Aquatic biotechnology • Mt DNA analysis on shrimp and fish • Studies on shrimp seed production (natural feed, environment) • Studies on probiotic bacteria for shrimp seed production
8	Mr Fris Johnny	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; frisjravael@kompascyber.com	• Pathology
9	Mr Ketut Suwirya	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Breeding and seed production of milkfish • Nutrition aspect on milkfish breeding and seed production
10	Mr Jhon Harianto Hutapea	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; hutapea@nangura.net	• Master degree - Marine science

11	Mrs Suko Ismi	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; sukoismi@yahoo.com	• Natural food • Grouper seed production
12	Mrs Des Roza Fris	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Pathology
13	Mr Bejo Slamet	Senior Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Marine fish seed production • Training on marine fish breeding, Japan (1991) • Training on marine seed production (1998) • Training on mariculture, China (1997) • Research on seabass and spin lobster (1986-1990) • Research on grouper seed production (1991-present)
14	Mr Agus Priyono	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; agus-priyono@telkom.net	• Fish Physiology • Milkfish broodstock management (hormone, feed, environment) • Milkfish larvae rearing and management • Grouper broodstock and larvae management • Consultant for milkfish and grouper hatchery
15	Ms Titiek Aslianti	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; agus-priyono@telkom.net	• Fish Physiology • Research on live food (1986-1990) • Research on milkfish larval rearing (1991-1994) • Research on finfish larval rearing (1995-1998) • Research on finfish physiology (1999-now)

16	Mr Tony Setia Dharma	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Fish seed production and broodstock management for tiger grouper • Training for cage culture technology and grow-out • Training for fish seed production in Japan • Trainer for milkfish fry production and broodstock management in the Philippines
17	Ms Des Roza	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id ; frisjravael@kompascyber.com	• Pathology
18	Mr Ketut Mahardika	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Pathology • Work in the Pathology laboratory in Gondol Research Institute for Mariculture since 2000
19	Ms Ni Ketut Maha Setiawati	Researcher **Gondol Research Institute for Mariculture** PO Box 140 Singaraja, Bali 81101 Indonesia Tel: +62-362 92278 Fax: +62-362 92272 E-mail: gondol@singaraja.wasantara.net.id	• Aquaculture • Larval rearing (tiger and polkadots groupers) • Live food production (algae and copepods)
20	Mr Sih Yang Sim	Coordinator – Regional Training Course on Grouper Hatchery Production **Network of Aquaculture Centres in Asia-Pacific (NACA)** PO Box 1040 Kasetsart Post Office Bangkok 10903 Thailand Tel: 66-2-561 1728 (Ext 120) Fax: 66-2-561 1727 Email: sim@enaca.org ; grouper@enca.org	• Marine finfish program in NACA • Commercial shrimp hatchery and grow-out in East Malaysia • Marine finfish activities under the Asia-Pacific Marine Finfish Aquaculture Network which is coordinated by NACA

Annex 4: Feedback Questionnaire for Grouper Hatchery Production Training Course, May 2003

1. Do you think the lectures cover all aspects of grouper hatchery production?
   Yes
   No
   If "No" which area you think should be included or improved?
   _____
   _____

2. Do the lectures provide sufficient knowledge and information on grouper hatchery production to participants?
   Yes
   No
   If "No" which lecture you think should be improved?
   _____
   _____

3. Do you think the practical components cover all aspects on grouper hatchery production?
   Yes
   No
   If "No", which area you think should be improved?
   _____
   _____
   _____

4. Do you think it is necessary to have daily routine on-the-job training throughout the whole course for participants?
   Yes
   No

   If necessary, how would you improve the 'hands-on' aspects of the course.
   _____
   _____
   _____

5. Do you think that you have received sufficient level of technical support throughout the course?
   Yes
   No
   If "No" please elaborate.
   _____
   _____
   _____

6. What do you think of the field trip arrangements?
   - Backyard hatchery

   Good Average Poor

   - Live fish exporters and fish markets

   Good Average Poor

- Floating Netcages

Good Average Poor

7. Do you think the training and the field trips have provided you with good future contacts?
   Yes
   No

8. Do you think overall the training course is satisfactory and meet your expectation? Please pick the following level of satisfactory:
   Excellent Good Average Poor

9. Is there a need for the training course to be improved? If so in what aspects?
   Yes
   No
   If "Yes" please provide details
   _____
   _____
   _____

10. Do you think your knowledge and practical experience on grouper hatchery production have increased after this training course?
    Yes
    No

11. Did the training course provide you with knowledge and skills sufficient to train other technical staff or farmers in your country / region?
    _____
    _____
    _____

12. When you return home, how will you pass on the knowledge and skills that you acquired during this course?
    _____
    _____
    _____

13. Would you like to participate in a network/discussion group after this training course to facilitate discussion and future activities and contacts?
    Yes
    No

    If "Yes", would you like the Asia-Pacific Marine Finfish Aquaculture Network to facilitate this activity?
    Yes
    No

    If "No" who do you think would be a better option?
    _____

THE END