



# Training of Trainers Programme

3-7 August 2009

**Strengthening capacity of small holder  
ASEAN aquaculture farmers for competitive  
and sustainable aquaculture**



NACA Secretariat, Bangkok

[www.enaca.org](http://www.enaca.org)



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### **Strengthening capacity of the small holder ASEAN aquaculture farmers for competitive and sustainable aquaculture**

#### **Background**

Fish is an important source of animal protein in the diets of ASEAN people. The average per capita consumption of fish in ASEAN countries is much higher than the global average per capita consumption of 16 kg/person. In some countries such as Cambodia, the consumption is as high as 45 kg/person with people living around the Great lake area consuming even up to 70 kg/person. Fish consumption from an early child hood stage has many positive benefits including its influence on the healthy development of the child's brain.

Fish also provides livelihoods for millions of people engaged in capture, culture, processing and many other support activities in Asia. Recognising the increasing market requirements as well as the increasing competition, to help the small farmers to cope with the changes, the ASEAN Foundation provided support to NACA to undertake this project with focus on increasing the competitiveness of small farms, improving sustainability of the farming operations, promoting responsible farming practices and enhancing the profitability of the farming practices.

Five ASEAN countries and five commodities were targeted in order to demonstrate the purpose of the project. Each of the participating countries were given the freedom to chose the commodity based on the importance in their own country and develop programs that would not only help to scale up the activity, but also the principles and processes evolved for the commodity that could also be applied to other commodities cultivated in the aquaculture sector of their country. Accordingly, the Cambodian team selected snake head, while the Indonesians chose grouper and Asian sea bass in view of the increasing role of these commodities in the livelihoods of poor people. Vietnam opted for tiger shrimp and Thailand decided to focus on tilapia. The Philippines with a long record in sea weed farming and well established processing plants chose seaweeds as the commodity to build the capacity of farmers.

Following the inception workshop of the project, teams from all five countries carried out the needs assessment of the identified commodities. Taking the identified needs in to consideration, the training of trainers program was organised from 3-7<sup>th</sup> August, 2009 in Bangkok. Seventeen participants from five countries were trained by sixteen faculties with expertise in various fields and drawn from different institutions of the region. The program included presentations by each country, explaining the process adopted in needs assessment, identification of the issues and strategies evolved to address the identified issues. The subject matter experts tailored their presentations to meet the identified technical necessities of the countries for each commodity as well as the gaps prevailing in the social, economic and market areas. With the intensive debate and interaction on various issues, consensus was arrived at the end to improve or develop the training manual based on the additional knowledge gained from the training. On each commodity, with focus on the needs identified, each country would develop a training manual that would best serve the needs of farmers.

The TOT programme was graced by the participation of a Head of Programs of the ASEAN Foundation, Ms. Renelle Ivy Adan, a Director General of NACA, Prof. Sena S. De Silva and the Research and Development

Manager, Dr. C.V. Mohan. The ASEAN Foundation Head of Programs provided details of the Foundation's initiatives in the region and urged countries participating in the project to take full advantages of the project activities and develop meaningful outputs. The NACA Director General highlighted the organisation focus on small scale farmers and improving their livelihood by helping them to remain competitive by producing healthy and safe aquaculture commodities. The Research and Development Manager of NACA emphasised the need for participating countries to take ownership of the project so that activities and outputs will be sustainable in the long run. The Executive Director, Dr. Filemon A. Uriarte participated in the closing ceremony of the TOT programme and distributed the completion certificates to all the participants. In his closing remarks, the Executive Director emphasised the vision ASEAN to develop the ASEAN countries by improving greater awareness of ASEAN, greater interaction among the people of ASEAN and contribute for the equitable economic development and poverty alleviation. He also indicated that though the priorities of ASEAN Foundation have changed, the foundation would be interested in seeing the sustainability of the activities initiated under the project.

The topics covered under the TOT are broadly in to six categories: (a) Contribution of small scale aquaculture in Asia and the impact of climate change on aquaculture (b) Technological interventions to improve and sustain productivity levels (c) Mobilising small farmers to cope with the market requirements by developing and encouraging the adoption of the best management practices (d) Developing good marketing strategy and market links to improve profitability (e) Extension and communication approaches (f) Mainstreaming gender in development interventions (g) Developing training modules based on the identified technical needs.

## **I. Small farmers make big contribution to global aquaculture**

Prof. Sena S. De Silva presented the role of Asian aquaculture in the global aquatic food production system and made a well articulated presentation on how small scale aquaculture contributes in a big way to the total aquaculture production. More than 90% of the production not only comes from Asia, but most of this production also comes from small scale aquaculture. The role played by aquaculture in food security and in poverty alleviation is enormous, but much of these positive impacts are not captured to influence the negative impression created on aquaculture by some groups. Aquaculture has been contributing over 50% of the food fish production globally. With the declining production from the capture fisheries, almost all of the anticipated increase in demand for fish owing to increase in population has to be met from aquaculture.

NACA works on the principle of sharing experiences in sustainable aquaculture and membership of the organisation is growing, presently standing at 18 governments with the recent entry of Lao PDR. The impact of NACA in promoting sustainable and responsible aquaculture was appreciated by the trainees by listening to a number of projects undertaken by NACA and seeing the impact made by these projects to improve the livelihoods of people. The better management practices development process for shrimp, evolved in partnership with the Marine Products Export Development Authority in India has made global impact and has given way for other countries to adapt this method of BMP development process and develop their own set of practices based on the local circumstances. The work carried out on catfish in Vietnam has brought out a number of highly interesting facts in regard to production and the strategies evolved by farmers. However, the media campaign to present a negative picture on this fish has affected the market opportunities in many ways. Prof. Sena cautioned that unless the respective Governments take measures to counteract these types of negative comments by presenting the facts based on investigation, farmers would suffer very badly. Further, he added that even at present, farmers get only very small percent of the money paid by the consumers and efforts have to be made to evolve suitable policies that can help the farmers to get the best share from the price paid by the consumers. Based on the research results, NACA would now embark on developing BMPs for the catfish.

Prof. Sena also highlighted the efforts made by NACA and IDRC to document some of the most successful species and aquaculture systems with a view to provide an opportunity on how the success spreads and what steps need to be undertaken to scale up the success. The book to be published by Springer Company would present the ten most successful cases from Asia. The opportunity that is available to learn from each other experience with NACA serving as the facilitator is enormous. He concluded his presentation by focusing on the areas where research and developmental efforts are needed to improve the food quality, safety and productivity levels. By 2020, another 60-70 million metric tons of fish is needed and this huge amount of fish has to be produced from aquaculture sector without affecting the environment and ensuring sustainability to the activity. He concluded that as Lord Buddha said, "**the greatest disease of all is hunger**" and with the malnutrition growing all over the world, efforts are needed to produce quality food and make it available to all people.

### Aquaculture impact on climate change and impact of climate change on aquaculture

Another interesting presentation on how the carbon foot print and labeling is becoming important was presented by Dr. Rattanawan Mungkung of the Kasetsart University. While the energy sector is the major green house gas producer, agriculture was stated as another major contributor of green house gas emission in Thailand. Her presentation highlighted the fact that food products that undergo processing contribute more to green house gas than those consumed fresh. It is because of this, entire life cycle from production to consumption is emphasised in calculating carbon foot print. However, participants raised questions relating to agriculture, particularly paddy and indicated that utility of carbon dioxide in the food production system should also be considered, instead of only considering the emission. The process of labeling the food production systems and the products for the GHG emission has been started by several countries. Consumer awareness on carbon foot print left by each product can contribute in many ways to reduce the carbon emission. She gave examples and methodology to calculate carbon foot print for aquaculture products and the results obtained from her study on shrimp sector. Owing to the intensification and productivity levels obtained, white leg shrimp still contributes less to carbon emission.

Prof. Sena De Silva's talk on climate change and aquaculture helped the participants to understand on how the small scale farmers would be impacted with the climate change. It was indicated that the capture fisheries is likely to be affected by the climatic change, contributing to change in species composition and likely that some of the fisheries systems would collapse. This can have severe impact on the fish meal availability with pelagic fishery likely to be affected by the climate change. Fish being the poikilothermic, all the cultured organisms are likely to be affected by the climate change. While there may be negative effects in temperate areas, in tropical areas, there may be positive benefits. The increasing temperature will result in increased food demand due to the increased metabolism and this will result in increased discharge of wastes. All this may contribute to eutrophication of waters in the freshwater sector. In the marine areas, with the increased sea level, there is likely to be catastrophic effect on the human population as well as the food production systems. Saline water intrusion may result in increased salinity in many areas that are dominated by fresh water at present. Hence, there is a need to predict the tolerance limit of species to such variations that might be brought by climatic changes and develop mitigation strategies. Cage culture activity being carried out in many Asian countries, climatic changes may bring several changes and technologies would have to be evolved to cope with such drastic changes.

One of the measures suggested was to promote the cluster based insurance schemes to help the farmers in mitigating any potential risks. This being a good idea to help the poor farmers, insurance companies should be encouraged to explore various options to help the farmers. Another idea suggested was to produce varieties of fish that can withstand salinity in freshwater environment. For example, catfish in Vietnam will face major

salinity intrusion and if efforts could be made to develop salinity tolerant catfish varieties, it will benefit farmers in many ways. Assuming that fish meal availability will be further reduced, early efforts should be made to develop fish meal free diets.

NACA has initiated a major project with the support of the Norwegian and Australian Governments. The information that would be generated through the project in various participating countries will help to develop strategies to mitigate the problems. Considering the small scale nature of the farmers involved with the aquaculture activity, it is essential that suitable guidelines are developed to protect the interest of these small farmers and prevent them from the dangers of climate change.

## **II. Technical interventions needed to improve and sustain the activity**

The TOT course contained lectures on the identified technical needs to address the problems of the identified commodities. Three major areas covered were genetics and quality seed production, nutrition needs of the growing organisms and provision of the appropriate food items to stimulate the best growth and management of health problems associated with the growing of cultured organisms. Experts were invited to make presentations to cover the areas identified by their countries and created an opportunity for the trainers to interact with experts to help them get answers to their questions.

### **Application of genetics without tears**

In aquatic science, several of the benefits available from the proper application of genetics have not been achieved since most people have not understood the way genetics can be effectively used. Good progress accomplished in plant science and also in animal science have benefited humanity in many ways. For example, in poultry, it has been largely possible to produce fast growing broilers and layers only through the application of genetics. As a result, today, a large amount of the meat needed is produced in many parts of the world using improved breeds. If the hatchery managers understand the genetics principles, they can apply techniques to produce high quality fish seed. As the statistics play key role in genetic quality maintenance and the selection process, most people believe it as complex and do not even make an attempt to understand before the disaster strikes. Dr. Thuy Nguyen helped the participants understand how the five commodities being tried through the project can be genetically improved by following basic procedures of genetics. Besides providing quality seed to farmers by following simple practices, it would be possible to prevent inbreeding and genetic drift in the farm by maintaining effective population size. Large hatcheries that can produce the quality brood stock and supply to small scale seed producers could be one of the options to reduce the inbreeding effects. Alternately, small farmers should be encouraged to work collectively and establish mechanisms to share brood stock between the hatcheries and adopt effective measures to build the brood stock population and prevent inbreeding.

### **Quality seed production strategies**

Dr. Wenresti Gallardo from the Asian Institute of Technology (AIT) provided detailed information on the methods to be adopted in quality seed production in the farm. He drew the attention of the participants that nutrition of the brood fish is the key not only for the breeding success, but also for the quality production of off springs that can grow healthily without facing the problem of disease. The importance of poly unsaturated fatty acids (PUFA), particularly in the marine species was emphasised and how the good success has been achieved in breeding of the marine fin fish species as well as crustaceans through better understanding of the requirement of the PUFA was presented. For breeding purpose, a number of hormones have also become available that can be used based on the necessity and the species concerned. After breeding, the larval survival and growth would depend on the quality of the food made available to the larvae. Several techniques have been developed to enrich the natural food with essential nutrients and feed such enriched food to larvae.

Artemia and rotifers have played crucial role in the success of the marine species larvae and techniques are available now for the enrichment process. The transportation of the seed is equally important for example the transportation of brood fish without stress to reduce mortality. Cool temperature is essential, in addition to proper conditioning of the larvae prior to transportation. Well conditioned seed, with proper packing can be easily transported over long distance involving even more than 24 hours.

### Natural food is like mother's milk

Artificial feed is playing major role in aquaculture of various species. However, in small scale aquaculture, natural food produced by using effective fertilisation can significantly reduce input cost through feed. Shrimp and tilapia culture have demonstrated the potential to reduce feed cost by adopting the process of natural food production. The highly carnivorous species like grouper and snake head may need special feeds that are complete in nature. However, even in these species, it is important to prevent the wastage of food by preventing the use of trash fish since they can be grown now using the compounded feed. Use of trash fish directly as feed not only results in a large waste of feed, but also causes large environmental pollution. Prof. Nandeeshya from the Centre for Aquaculture Research and Development under the St. Xavier's Bishramganj in India presented the feeds and feeding strategy, keeping in view the identified needs of the commodities.

Several strategies to reduce feed input costs were also discussed. The foremost among them was the use of alternate feeding schedules developed based on the daily variation in the digestibility of nutrients. The method clearly demonstrates that it is possible to reduce the nutrient input as well as save cost by adopting this simple method of providing fish with feeds containing different nutrient levels on different days. In tilapia and snake head, this method has proved to be very effective in saving protein input through feed. The method also has great applicability in shrimp as well as in carnivore fin fish species. In each case, feeds and feeding methods have to be evolved and this can be done easily by observing the feeding behaviour and digestibility of the nutrients in the feed by the animal. The periphyton production technology using the substrate is another approach that can be used effectively in shrimp as well as in tilapia. Extensive research in tilapia has already shown the positive benefits and in case of crustaceans, in freshwater prawn this technology has been effectively used. Balancing the carbon–nitrogen ratio has proved to be very effective to produce the heterotrophic food organisms that can provide large amount of nutrition by promoting the heterotrophic food production in the system. The technology of bioflocs is now becoming popular and would help small farmers immensely, if the effective extension approaches are used to bring these benefits to farmers. Gender appears to have linkage on growth even in shrimps like in fin fishes and this can be exploited through the development of unisex culture coupled with suitable feeding techniques. For example, in shrimp, it is observed that females eat less, but grow faster. Digestibility and nutrients assimilations appear to be better and this can be best taken advantage of in view of the increasing feed cost.

It was concluded that feed is the single largest input cost in the production system. Also, the feed wastage due to ineffective ways of feeding practices and the faecal matter excreted are the largest aquatic polluting factors. Hence, it is necessary to evolve such practices that will prevent the wastage of resources and save feed input cost.

### Prevention is better than cure

In all the commodities identified by the participating countries, disease was identified as the major problem encountered. Shrimp culture has been severely impacted because of the devastating effect of virus infection. In tilapia too, in intensive cage culture operation, parasitic as well as bacterial diseases have become major menace. In seaweed cultivation, there has been no treatment for the disease encountered. In groupers and sea bass too diseases have become major concerns. Hence, the TOT focused heavily on disease prevention and

management of the disease when it strikes, even after preventive measures have been adopted. The team led by Dr. Mohan from NACA with the several experts from Aquatic Animal Health Research Institute of the Department of Fisheries, Bangkok, Thailand, namely Dr. Supranee Chinabut, Dr. Suppalak Lewis, Dr. Somkiat Kanchanakhan and Dr. Chalor Limsuwan from the Kasetsart University assisted in empowering participants on various aspects of disease prevention and management. Dr. Mohan dealt with the biosecurity aspects by which disease prevention as well as its spread can be controlled. As the aquaculture is expected to expand greatly to meet the increasing demand, the need for adoption of biosecurity measures at the farm level, country level and even at the regional level would help in preventing the spread of disease. He presented a list of major diseases that have affected the aquaculture industry in Asia and the amount of damage caused. Dr. Mohan concluded that through the adoption of the best management practices most diseases can not only be prevented, but also can be cured even if they occur by following the good practices.

Dr. Supranee presented the talk on finfish diseases encountered in Asia and the measures that can be adopted to manage those diseases. She focused on the need to identify the disease and its causative agent correctly. Based on the results by adopting suitable treatment measures, disease can be cured and at the least risk can be further reduced. She gave details of some of the major diseases and technologies available for managing them. The spread of EUS was shown as an example on how the disease could spread from continent to continent and at present how the disease has been affecting Africa in a massive way. Dr. Suppalak Lewis focused on vaccination and how vaccines developed from the antigens of the pathogens can be highly beneficial in preventing disease. Vaccines stimulate the immune system and thereby develop resistance against the disease. There are a number of vaccines developed for various species and for different diseases. In Norway now vaccination has become a norm wherein no one can culture fish without vaccination. Different methods of vaccination applications have also been developed and they can be adopted based on species and convenience. Dr. Somkiat Kanchanakhan provided the prevailing OIE and EU regulations in regard to the prevention and spread of the disease. The stringent guidelines set for the disease spread by OIE and EU would affect the farmers, if proper care is not taken from the early stage. Dr. Chalor Limsuwan of the Kasetsart University provided ideas on shrimp disease management in the field. He suggested to avoid growing tiger shrimp in particular during winter months since virus diseases can't be prevented. Also by following good management practices several of the diseases risks can be reduced substantially. He also provided the idea on the productive potential of white shrimp wherein up to one hundred tons has been possible under the super intensive systems. He also suggested in terms of naming of diseases carefully and in simplified form so that farmers can easily and immediately diagnose the disease.

### **III. Development of Better Management Practices**

The concept of better management practices (BMP) and the process adopted for evolving BMPs were lucidly presented by Dr. C.V. Mohan from NACA. He emphasised that BMPs are not standards, but guidelines for better managing the production systems. Further, these guidelines are not stationary and they keep changing and evolving with the generation of knowledge to ensure that health of environment and human beings are not compromised. The principles underlying BMP clearly state that it is the sustainability, environment protection, food safety, animal welfare, social responsibility, etc are the key criteria for evolving BMPs. He cited the example of ongoing BMP project for more than nine years in India with MPEDA. The programme is not only led to the generation of good aquaculture practices, but also the creation of a separate institution called, National Centre for Sustainable Aquaculture (NACSA) by MPEDA to promote such good practices evolved and reach them to larger section of the population. BMPs evolved with the active participation of the community are accepted socially and the people make further decision on how to improve these aquaculture practices to improve their own productivity without affecting the environment and sustainability of the activity. Such an

effort was unique in India and it is gradually helping the shrimp sector recovery that was totally devastated by the disease problems coupled with the market uncertainties.

The above maiden effort made by NACA in partnership with the Marine Export Development Authority in India to develop "Better management practices" for the tiger shrimp culture in Andhra Pradesh was presented by the Chief Executive Officer of NACSA, Mr. N.R. Umesh. The recovery of the vast area of abandoned shrimp ponds due to disease and various other problems by demonstrating the benefits of better management practices enlightened the participants on the time and technical skills needed to pursue the path and achieve the success. Through the group approach, the activities initiated helped to demonstrate that it is possible to obtain 500 -1000 kg shrimp by following the good aquaculture practices without much risk, by reducing or eliminating the risk factors. These practices include, good pond preparation, procurement of the disease free seed through testing for the virus at various stages, following low stocking density, not exceeding 10 post larva /m<sup>2</sup>, maintaining the good color of water to produce adequate amount of natural food, feeding shrimp with quality feed, periodical monitoring for water quality and shrimp for health inspection, post harvest protection of quality of the harvested product to provide quality shrimp to the processors, etc. All these developments were made possible by using the group approach and helping the farmers to work together and learn together to resolve the common problems. Transparent discussion on various issues in the groups, making plans together and developing coping strategies to resolve the problems as they crop up helped farmers to achieve good crop yields. Even when there were failures, farmers knew the reasons and developed strategies based on results to overcome failures. Such groups would again make plans to resolve the problems and reach the goal of achieving the sustainable shrimp yield.

Based on the lessons learnt from developing shrimp BMP, NACA has ventured in to developing BMPs for cat fish culture in Vietnam. *Pangasius* culture in Vietnam has been popular in cages and methods were later developed for the large scale culture of catfish in ponds, which is now the predominant production system. These ponds are deep (> 4.0 meter) and fish are stocked at high density giving an average yield of over 400 tonnes /ha /year. Farmers have been exchanging large amounts of water (up to 30%) almost on daily basis towards the end of the culture period to maintain flesh quality. With quality pellet feed availability, most farmers use the pellets to feed the fish and because of the intensity of feeding and production, the profit margin obtained is very thin. Further, if there would be any mortality of fish due to disease or other factors such as price fluctuation, there could be disaster in terms of farmer income. The commodity being largely export dependent, international market price has tremendous influence on farmer profitability and success in the operation. In order to understand the culture practices and reduce the risk factors, a detailed study was undertaken of the seed producers, nursery operators as well as market fish producers. Based on the study, risk factors were identified for each of the stage of operation and the potential BMPs or remedial measures have been suggested for testing by farmers and adoption. For example, hatcheries maintain sometimes a small number of brood fish and sometimes a large number of brood stock without any genetic basis. Based on the generic principles, optimal numbers of brood fish that need to be maintained were suggested. Similarly, large exchange of water up to 30% had no relationship with the production and hence a minimal amount of 5% exchange of water has been suggested for testing. Hence, the BMPs suggested will look at the potential impact at varied levels of water exchange. Dr. Thuy made an elaborate presentation on the methodology adopted in evolving the BMPs and this greatly enhanced the knowledge of participants that they can also try similar approach to the commodities with which they are working.



## IV. Marketing strategy to improve profitability

### Bringing greater benefits to farmers through certification and labeling

With the increasing awareness of people on food safety, environment, social responsibility, etc., the need for producing safer food products through environmentally responsible and socially acceptable practices is becoming a necessity for the farmers to compete in the international markets. Mr. Koji Yamamoto from NACA made a detailed presentation on how the trend is changing and quality maintenance is becoming important. Seafood consumption, in general is increasing all over the world, but the people are demanding safer products than ever before. Further, because of the time factor, most buyers in the developed world desire fish being processed in to almost ready to eat product. In Japan, it was informed that fish consumption is declining because of the time needed for processing of fish and hence, if the people's habit of eating fish is to be retained, fish should be made available in processed form. However, this further enhances the responsibility as well as the risk and hence, greater responsibility of the producer to provide food commodities that are safer to people for consumption. Mr. Yamamoto presented a list of international agreements available and the certification process evolved by various companies taking these standards fixed through such agreements. Traceability is the key factor and the process has to be evolved to trace back to the products origin in case of necessity. He further showed that how NACA has successfully developed the system in Thailand through the European Union project to benefit a group of farmers who agreed to follow the best management practices for the shrimp. Twenty farmers who worked as a group could not only produce the quality shrimp, but also could get the premium price in the EU market. It is important that farmers get a price that is commensurate for the efforts they make in producing healthy product by following environmentally responsible practices.

Mr. Yamamoto's presentation was further supported by the presentation of Mr. Umesh from the National Centre for Sustainable Aquaculture in India on how MPEDA is now progressing further to the stage of certification and marketing of the product through labeling. His presentation focused on how poor farmers can be helped with certification through cluster approach. As the individual farmers will not be able to bear the cost as well as the long process involved in certification process, it is essential to develop this group approach to help the poor. In India all these farmer groups have been officially registered under societies of registration act and hence they will be eligible to get support from the Government. Also as all these societies are governed by the law allowing their accounts and activities being audited annually by the Government to retain their registration. In each group 20-30 farmers are encouraged to join and these farmers elect their own office bearers to manage the activities of the society. The Societies follow all the guidelines essential for the good aquaculture practices. While certification has already been accomplished in the case of freshwater prawn, for shrimp the process is underway and negotiations have also been made to label the products and market them in US. Fair-trade is also approaches for certification and marketing support. It was interesting to learn that the farmers are now making efforts to get the carbon foot print done for the activities carried out by them. Cluster approach has proved to be very effective to revive shrimp farming and bring benefits to small farmers. For example, supply of electricity has now become possible to many farmers through the societies only because of the group formation and willingness of the Government to help group of poor farmers since providing such benefit for an individual is not possible. If the group cohesion could be kept through transparency, benefits that can be brought to the farmers are unlimited.

### Linking to good markets for better economic benefits

Like growing aquatic products in a healthy and sustainable way, it is also equally important in finding better markets to get the good profit margins. People being aware of the quality, food safety and environmental aspects, they now prefer to buy quality products by providing premium price for the product. Dr. Dharendra Kumar Thakur from the Asian Institute of Technology (AIT) presented a detailed account on finding access to

markets using the Thai shrimp case study as an example. Fluctuation in prices are high with many countries competing to produce the same commodity. In view of this, product produced has to be internationally competitive in terms of price, but at the same time, its quality should be the best. Provision of market information to farmers and helping them to produce commodity that can meet the international food safety, environmental and social standards are the best ways to assist farmers.

Profitability is the key factor for the farmers to continue the production activity. Dr. Varunthat Dulyapurk from Kasetsart University presented a lecture on how to be economically conscious to make sure that aquaculture operation is making profits to continue the activity. Markets being sensitive and producers being competitive, each producer has to be intelligent to understand the market demand and produce the commodity that is in demand in the market. However, farmer must ensure that the revenue received covers all the operational and fixed costs and yet bring acceptable profit margin with which they can continue the activity.

## V. Extension and communication strategies

### Knowledge at the bottom of the pyramid

Farmers have been engaged in innovation since time immemorial. Because of their involvement in innovation and keen observations on the farm level problems have helped to solve many of the problems by themselves. However, with the development of agricultural science and academic qualification being essential to be recognised officially as a scientist, these farmer innovators were ignored. The high input technologies developed by the scientific community, though contributed to increased yield and production, they are now proved to be unsustainable. It is now increasingly felt that transfer of technology approach adopted in the past wherein the technology developed in the institution is just transferred to farmers for adoption is not a useful approach. Instead, it is now recognised that farmers should be educated to understand the principles and science of the technologies and encourage them to develop technologies appropriate to their own environment. Here the farmers have to be treated as active participants in technology evolution and not considered as just the recipients like in the past. Prof. Nandeeshha from CARD in India highlighted that this requires a complete change in extension approaches and change in the mindset of people to believe that "knowledge is at the bottom of the pyramid" and it would be possible to evolve a number of technologies, if large number of farmer innovators are made as partners in the innovation process. Among the new approaches tried, farmer participatory research has been found to be an effective tool for research and generation of new technologies and also as an effective extension tool by encouraging farmers to be active participants in the process rather than making them as passive recipients of information. With this background, Prof. Nandeeshha made a presentation on "Knowledge at the bottom of the pyramid". According to the Nobel Laureate, Sir Mademeyer, commonsense and curiosity are the two essential characters for anyone to be a successful researcher. All those who possess these qualities in abundance would be successful as researchers in any field they choose. Several examples were drawn from the commodities participants are dealing to demonstrate on how farmers have made innovations and made brilliant contributions for the development of the sector. If the scientists and development professionals work closely with the farmers most of the problems can be solved and sustainable technologies can be evolved. Development of culture techniques for the culture of tiger shrimp almost in zero salinity, now popularly known as Zero tiger is a good example to demonstrate farmer innovation capacity. In the case of tilapia, farmers have evolved several technologies from breeding to culture and this has made the species to be very successful candidate species in aquaculture.

### Cost effective communication strategies

Mr. Simon Wilkinson, Communication Manager of NACA educated participants on effective ways of communication with the tools available now like print media (papers), television, radio and electronic communication methods. Efforts already made by the ASEAN and other countries to use tools like radio and

television with dedication of separate time slot for agriculture have proved to be a boon to inform farmers of new developments and create platforms for the exchange of information between scientific community and farmers. He dealt extensively on how electronic communications can be used at little cost to disseminate the information. Asia was already the world's number one region in terms of total number of internet users and growing rapidly, although the percentage of penetration amongst the population was below world average, and still lower in rural areas. China had overtaken the US as the country with the most internet users. The emergence of free social networking services such as Facebook were now serving as a highly effective tools to link people of common interest. Creating a blog using free online services and drawing attention of people with similar interest is another approach that can be used. Electronic networking is another area that is already helping very effective exchange of information. Skype, Google talk, yahoo, etc have also created opportunity for the people from all over the world to build network, talk freely and even see the pictures of objects of other places by being in their own place. A book written by him and made available through NACA and FAO on "Guidelines on digital publishing: a practical approach for small organizations with limited resources" was provided to all the participants. Since many service providers have developed technologies to provide such services in the local language, electronic communication will have great impact and NACA is willing to help the participating countries to assist in any way possible to improve the communication system.

This presentation was further supported by Mr. Derun Yuan, Training Manager of NACA, talk that emphasised the need to look at providing hands on experience to extension professionals to gain confidence and encourage them to get actively involved in solving the field problems. While scientists may be good in doing laboratory research, field problems being entirely different, they need the application of technologies through suitable modifications including developing effective message delivery methods. Communicating with farmers requires patience and understanding their problems. Once the bondage is established, farmers would develop trust and explore options to resolve problems and improve productivity levels.

The above presentations received boost by the live model presentation by Mr. Koji Yamamoto, developed under the Aceh project supported by Asian Development Bank (ADB) and operated by NACA in Indonesia. Through this project new message delivery approaches were explored besides encouraging farmers to evolve technologies appropriate to their farms. The Aceh Livelihood Service Centre and Aceh Aquaculture Communication Centre developed with the participation of farmers and linked through electronic communication system have helped in reaching large number of farmers to address the larger livelihood issues as well the specific technical issues. Using the new communication tools available freely like Skype, the extension person could also see the samples of objects of the farmers and help them with the remedial measures. These centers managed with the active participation of farmers have also helped the farmers in getting the necessary farm inputs. The lessons learnt clearly demonstrate that by adopting appropriate extension strategies and by working closely with farmers, most problems can be resolved and sustainable ways can be evolved.

## **VI. Mainstreaming gender in aquaculture development programs**

Both women and men play equally important role in aquaculture development. For example, in many ASEAN countries, it is well known that women have played and continue to play major role in aquaculture development programs. Yet, while planning and implementing the aquaculture development activities, women are ignored and in all the training, credit support and other development initiatives, it is generally men alone who receive attention and support. Prof. Nandeeshya of CARD impressed the participants that such an imbalanced approach has impacted negatively, the growth of aquaculture and hence, it is important to recognise both men and women in the family and use family approach for all development interventions. It is also important to note here that women are involved in maintaining household activities as well as well as

providing support to agricultural activities. Hence, any development interventions must recognise the multiple roles of women and adjust the interventions to suit the convenience of women. For example, if the women are not able to attend the long days of training programs, it would be useful to organise trainings close to the place of their residence and at a time when women would be free to spare their time for participation in such programs. As the commodities identified under the ASEAN project have been known to have involvement of women, to be gender sensitive, it was suggested to focus on involving both husband and wife in all the training and other development support interventions.

### **Training needs assessment by the participating countries on identified commodities**

All the five countries made presentation on the training necessities as identified by the farmers for each of the commodity. Cambodia has banned the use of trash fish for the culture snake head fish with a view to help the poor people obtain this trash fish for their consumption. However, recently, the Government has permitted under the project to explore the possibility of the culture of snake head fish with the use of processed feed to help farmers who would be dependent on snake head culture for their livelihood. The Cambodian team presented an account of the existing status and the farmer necessities in terms of seed as well as feed to grow the snake head fish. The Indonesian team highlighted the need on developing quality feed for the culture of Asian sea bass as well as tiger grouper. While the seed production of these species has become commercial reality, farmers require support in terms of quality feed and access to market. In addition, farmers have also expressed need for training on business planning for the commodity in order to make sure that they do not run under loss without valuing their time. The Philippines team highlighted the need to evolve disease management strategy in sea weed culture along with the need for evolving mechanisms to organise farmers in to groups to get the required technical and other necessary support. The Thailand team presented the experience of farmers in tilapia culture and the problems confronted by them to remain competitive. Disease problems coupled with the high cost of feed have contributed for the suffering of farmers. Hence, the team indicated the need to educate farmers on developing strategies to prevent the diseases and use the feed efficiently to get the good market output. In Vietnam, tiger shrimp farming has almost collapsed with the farmers facing the serious problems of white spot virus disease as well as other diseases. There is a need to develop good aquaculture practices that can help these farmers to revive the activity and help them improve their livelihood by adopting good management practices. Since NACA has already developed good practices and processes for evolving BMPs in shrimp in India and Indonesia, Vietnam can derive immense benefits from these experiences.

### **Conclusion**

The presentations made in the TOT covering the wide range of topics would help the country teams to develop the draft training manual on the commodities based on the needs expressed by farmers. The TOT was designed taking in to consideration of the needs identified by the five participating countries and each of the presentation would help them in developing the training manual. These training manuals have to be tested in the field before advocating them for wider adoption.

Participants expressed their satisfaction on the training for the depth of coverage of the issues identified and clarity provided for the development of training manuals. All have agreed to develop the draft training manuals that aim at developing better management practices through participatory approaches. These manuals would be tested for their applicability and modified suitably for adoption. All the experience gained and the impact made would be brought for sharing in the regional workshop proposed to be held in 2010 at the end of the project.

## Annex 1: List of participants

Country	#	Name and address	Email
Cambodia	1.	Mr. Neang Savuthdy, Officer of the Department of Aquaculture Development Fisheries Administration, No. 186 Norodom Blvd, Sangkat Tonic Bussae, Hhan Chancai Mon, Phnom Penh, Cambodia P.O. Box 582	savuthdy@yahoo.com
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## Annex 2: Agenda

Date	Time	Presentation by	Title of the talk
3.8.09	9.00-10.00	ASEAN Head of programs Director General NACA R and D Manager NACA	Opening session
	<b>10.00-10.30</b>	<b>Coffee break</b>	
	10.30-11.30	Sena S. De Silva	Aquaculture successes in Asia, contributing to Sustained Development and Poverty Alleviation
	11.30-12.30	C.V. Mohan	Bio-security and health management in aquaculture systems
	<b>12.30-13.15</b>	<b>Lunch</b>	
	13.15-14.15	M.C. Nandeessa	Knowledge at the base of the pyramid
	14.15-15.15	Koji Yamamoto	Communication and networking mechanisms for improving services to small farmers (Aceh Model)
	<b>15.15-15.30</b>	<b>Coffee break</b>	
	15.30-16.30	Thuy Nguyen	Maintaining genetic quality of fish and shell fish under small holder farmers in ASEAN countries
	16.30-17.30	Derun Yuan	Training small scale farmers –challenges and opportunities
4.8.09	8.30-9.30	Supalak Lewis	Disease diagnosis and prevention strategies in aquaculture including vaccination
	9.30-10.30	Supranee Chinabut	Major diseases of finfish in Asia and practical measures adopted in controlling the diseases
	<b>10.30-11.00</b>	<b>Coffee break</b>	
	11.00-12.00	Dhirendra Thakur	Accessing better markets – improving competitiveness of small scale farmers
	<b>12.00-13.00</b>	<b>Lunch</b>	
	13.00-14.00	Varunthat Dulyapurk	Profit VS Profitability: helping farmers to improve economic sustainability of aquaculture operations
	14.00-15.00	Somkiat Kanchanakhan	OIE and EU standards for trade in live aquatic animals and their products
	<b>15.00-15.30</b>	<b>Coffee break</b>	
	15.30-16.30	Sena S. De Silva	Climate change and aquaculture: potential impacts, adaptations and mitigations
	16.30-17.30	Cambodian team	Culture of snakehead in Cambodia : Opportunities and constraints

5.8.09	8.30 –9.30	C.V. Mohan	Principles of developing, validating and adopting better management practices in aquaculture - Shrimp case study
	9.30-10.30	Simon Wilkinson	Developing communication and networking mechanisms for improving services to small scale farmers
	<b>10.30-11.00</b>	<b>Coffee break</b>	
	11.00-12.00	Thuy Nguyen	Principles of developing, validating and adopting better management practices in aquaculture – Catfish case study
	<b>12.00-13.00</b>	<b>Lunch</b>	
	13.00–14.00	M.C. Nandeeshha	Feeds and feeding strategies to improve production in small holder farms of ASEAN countries
	14.00–15.00	N.R. Umesh	Organization of small scale farmers and its benefits
	<b>15.00-15.30</b>	<b>Coffee break</b>	
	15.30–16.30	Vietnam Team	Shrimp culture in Vietnam and ways to revive the activity
	16.30-17.30	Philippines Team	Seaweed cultivation in Philippines and building capacity of farmers to enhance productivity and profitability
6.8.09	8.30-9.30	Koji Yamamoto	Certification and traceability : emerging requirements for international and domestic markets
	9.30-10.30	N.R. Umesh	Farmer organization as models for promoting adoption of BMPs and accessing markets
	<b>10.30-11.00</b>	<b>Coffee break</b>	
	11.00-12.00	Indonesia team	Sea bass and grouper culture in Indonesia and proposed strategies to improve profitability from the systems
	<b>12.00-13.00</b>	<b>Lunch</b>	
	13.00-14.00	Chalor Limsuwan	Shrimp diseases and their management
	14.00-15.00	Wenresti G. Gallardo	Strategies to produce and distribute quality seed
	<b>15.00-15.30</b>	<b>Coffee break</b>	
	15.30-16.30	M.C. Nandeeshha	Enhance women participation in aquaculture to ensure sustainability
	16.30–17.30	Thailand team	Tilapia culture in Thailand : issues and strategies proposed
7.8.09	8.30-9.30	C.V. Mohan	Opened discussion – further project activities
	9.30-10.30	Rattanawan Tam Mungkung	Carbon foot-printing and labeling: Opportunity or barrier for aquaculture
	<b>10.30-11.00</b>	<b>Coffee break</b>	
	11.00-12.00	Dr. Filemon A. Uriarte, ASEAN Executive Director	Closing Ceremony
	<b>12.00-13.00</b>	<b>Lunch</b>	
	12.00–18:00	Derun Yuan	Field visit to tilapia cage culture and pond culture units



### Annex 3: List of resource persons

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