

Participatory Action Learning for Freshwater Aquaculture - Cash Prizes Awarded

In early 2004, plans for participatory action learning (PAL) sessions on freshwater aquaculture were sought from people engaged in extension and training for farmers. This was done through an international competition advertised in a variety of trade journals, magazines, web sites and e-mails, with cash prizes totalling US\$ 1 500 pledged through the SUFA (Support to Freshwater Aquaculture) program in Vietnam (Danida and the Government of Vietnam funded) and DSAP (Development of Sustainable Aquaculture Project) in Bangladesh (funded by USAID and implemented by WorldFish).

A panel consisting of SUFA and DSAP staff and the competition coordinator completed judging the entries at the end of April 2004. For each theme, a Highly Commended prize of US\$ 50 was awarded for the entries that scored between 50-60 percent against agreed judging criteria and a First prize of US\$ 125 was awarded for entries with a score of more than 60 percent.

The prize winning entries together with the PAL sessions developed by SUFA will be included in a manual on Participatory Action Learning for aquaculture, which SUFA and DSAP will publish jointly in English, Vietnamese and Bengali.

SUFA and DSAP would like to thank the various institutions, agencies, projects and companies that assisted in promoting and advertising the international PAL competition and all those who took the time to submit entries.



Theme	First prize US\$ 125	Highly commended US\$ 50
1) Small-scale pond aquaculture	<i>The importance of correct stocking density</i> Arlene Nietes-Satapornvanit Senior Project Researcher Aquaculture Outreach Project AARM/SERD Asian Institute of Technology PO Box 4, Klong Luang, Pathumthani 12120 Thailand arlene@ait.ac.th	<i>How to recognise good quality fish larvae</i> Phan Tien Chuong Technical Department Nghe An Extension Centre Trang Thi Ward Vinh City Nghe An Province Vietnam Tel: +84 038 561 542 Nursing small fish fry Arlene Nietes-Satapornvanit (Details as before)
2) Integrated agriculture-aquaculture	No First prize awarded	<i>Planning and budgeting for rice-fish cultivation</i> Tran Thi Tuyet, Vu Thi Bich Ha and Nguyen Hien Thi Business Promotion and Service Center (BPSC) Alley 149 Giang Vo Hanoi Vietnam bpsc@netvam.vn
3) Group formation and development	No entries before closing deadline	No entries before closing deadline
4) Monitoring and extension	No First prize awarded	<i>Why keep records?</i> Arlene Nietes-Satapornvanit (Details as above)



The photograph above left shows the recently appointed SUFA Danida advisor, Don Griffiths, handing over US\$ 225 to Ms Arlene Nietes-Satapornvanit from the Asian Institute of Technology. Arlene won one First prize and two Highly Commended prizes for her PAL submissions (see table above).

The photograph on the left shows Mr Phan Tien Chuong from the Nghe An Extension Centre receiving a US\$ 50 cash prize from Dr Nguyen Cong Dan (SUFA National Director) for his Highly Commended PAL session entitled How to Recognise Good Quality Fish Larvae.

Tran Thi Tuyet and Nguyen Hien Thi are shown (top right) receiving the US\$ 50 prize for their Highly Commended PAL session on Planning and Budgeting for Rice-fish Cultivation.

CGIAR Science Award for Outstanding Scientific Support Team 2003

Winner - The FishBase Team

The widespread use and value of FishBase to developing countries as a global public good is significant and growing. International peer reviews and user feedback confirm this. No other natural or agricultural resource has a knowledge base equal in its scope, quality, scientific rigor, usability, or cost-effectiveness. It is also a model for other resource management systems to follow in its technical design, networking, mentoring, and use of leading-edge information technology.

The building of this unique asset would have been impossible without the dedication of the Scientific Support Team of WorldFish biologists and computer scientists. The team members have overcome institutional challenges, networked globally, and persisted in their efforts to ensure that the system expanded from its modest goal of 250

species to 28 585 species without sacrificing quality, usability or accessibility. In fact, as the knowledge base has grown, these critical features have improved significantly through tenacious scientific focus and widening of the base of international collaborators to more than 1 100 institutional and individual partners. The scientific quality has also improved due to the importance placed by the team on maintaining a creative working environment, team harmony, and sharing of skills.

The resulting scientific and human team effort has produced a valuable product – FishBase – that commands a unique status, providing a much needed resource to developing countries for the conservation and management of their aquatic resources. Visit FishBase at <http://www.fishbase.org> today.

Support Team

Boris Fabres, *Team Leader*
 Emily Capuli, *Senior Research Associate*
 Rodolfo Reyes, Jr., *Research Associate*
 Christine Marie V. Casal, *Research Associate*
 Crispina Binohlan, *Senior Research Assistant*
 Susan Luna, *Senior Research Assistant*
 Armi Torres, *Senior Research*
 Grace T. Pablico, *Senior Research Assistant*
 Pascualita Sa-a, *Senior Research Assistant*
 Rachel Atanacio, *Senior Artist*
 Arlene Sampang, *Senior Research Assistant*
 Cristina Garilao, *Research Assistant*
 Josephine Rius, *Senior Programmer*
 Eli Agbayani, *Senior Web Developer*

FishBase – A Global Public Good

Over the past 16 years the WorldFish Center has conceived, initiated and developed FishBase – internationally recognized as the premier database and information system on the world's fishes. FishBase is the most comprehensive knowledge source on any taxonomic group and contains a wide range of country and ecosystem-specific information. It also provides analytical tools to assess fishery impacts, especially for knowledge creation in data-poor situations, and online fora for technical advice – connecting users to enhance knowledge and learning. The knowledge content of FishBase includes fish taxonomy, morphology, images, ecology, ecosystem characteristics, trophic relationships and diet, reproduction, ontogeny, genetics, population dynamics, identification keys, diseases, local nomenclature (common names), geo-



Christine Casal receiving the award on behalf of the FishBase team.

referenced and environmental data, multi-lingual glossaries, and international agreements. Over 100 report types are available.

FishBase is also the largest collection of geo-referenced fish data in the world (1.91 million records), representing over 250 years of museum and survey data from 40 institutions worldwide.

It is also available and updated monthly on the web in 13 languages at <http://www.fishbase.org> through CGNET (USA) and the mirror web sites of collaborators in France, Germany, Sweden, and Taiwan.

An international consortium of the WorldFish Center, Food and Agriculture Organization (United Nations), Fisheries Centre (University of British Columbia, Canada), Institut für Meereskunde (Kiel University, Germany), Muséum National d'Histoire Naturelle (Paris, France), Musée Royal de l'Afrique Centrale (Tervuren, Belgium), and the Swedish Museum of Natural History (Stockholm, Sweden) has been created to guide its growth, in addition to the active scientific contributions of 1116 institutional and

individual collaborators in over 100 countries. FishBase content and use have been reviewed formally in several high impact scientific journals including *Nature* and through online users. The FishBase website has been cited for its high scientific quality by the Institute for Scientific Information (ISI) Current Web Contents program. Over 450 publications have utilized and cited FishBase. The FishBase web site with over 11 million hits per month has become the premier fish information system for the world, and the leading web site within the CGIAR in terms of its global use.

These achievements represent the scientific creativity, productivity and industry of the FishBase Scientific Support Team of the WorldFish Center. The members of this scientific team include biologists and computer scientists. They have been the architects, engineers and builders of FishBase. The FishBase Scientific Support Team has also produced over 50 publications, presentations and posters, and has been instrumental in the organization

and delivery of international training and capacity-strengthening courses and workshops on applications of information technology in fisheries and biodiversity management in developing countries:

1. Noumea, Caledonia (20-31 October 1997). The course was attended by 13 participants from 8 countries in the Pacific region.
2. Port of Spain, Trinidad and Tobago (21 May-3 June 1998). The course was attended by 22 participants from 14 countries in the Caribbean.
3. Swakopmund, Namibia (30 November-11 December 1998). The course was attended by 14 participants from 8 countries of Southern Africa.
4. Dakar, Senegal (12-23 April 1999). The course was attended by 34 participants from 15 countries in West and Central Africa.
5. Nairobi, Kenya (23 August-3 September 1999). The course was attended by 30 participants from 10 East African countries.

6. Los Baños, Philippines (2-5 December 2003). Regional Workshop on Building Capacity for Developing National Aquatic Information Systems. The Workshop was attended by 16 participants from 6 countries.

The result of the FishBase Scientific Support Team's efforts is that the world community, especially developing country stakeholders involved in aquatic biodiversity and fisheries management, now has at its disposal as a Global Public Good a reliable, high quality, and growing knowledge compendium, unique in its comprehensiveness, usability and access. This is of special value for national aquatic research system (NARS) scientists, resource managers, and NGO's. This global capacity would not be possible without the FishBase Scientific Support Team, with each member responsible for incorporating and maintaining high quality data in specific areas of focus, developing reports and analytical tools that provide easy access to and use of the globally assembled knowledge.

CGIAR Science Award for Outstanding Partnership 2003

Winner - The Community Based Fisheries Management (CBFM) project

Executed by the WorldFish Center, in collaboration with several national partner organizations in Bangladesh, this project provides a highly visible, technologically appropriate and eminently replicable model for contemporary rural development. It has clearly demonstrated the significant benefits that can result from the creation of appropriate stakeholder institutions that allow for increased participation and control by the local communities of their natural resources.

The CBFM project has been a major factor in the empowerment of the local population through the formation of committees to manage the rivers, work together to build a consensus among the

different users and plan improvements to water bodies that will lead to increased fish diversity and productivity. Through its holistic and inclusive approach, the project is contributing significantly to CGIAR's goal of achieving poverty reduction and increased food security in developing countries, whilst also supporting the goals of the Convention on Biological Diversity through the re-introduction of endangered fish species. This exemplary model of sustainable management of freshwater fisheries has been developed over several years and the system is tried and tested. It is now being successfully exported, with the required adaptations, to new sites and new countries.

Partner Institutions:

WorldFish Center, CGIAR
 The Department of Fisheries (DOF), Ministry of Fisheries and Livestock, Bangladesh
 Banchte Shekha
 Bangladesh Environmental Lawyers Association (BELA)
 BRAC
 CARITAS
 Center for Natural Resource Studies (CNRS)
 Center for Rural and Environment Development (CRED)
 Grassroots Health and Rural Organization for Nutrition Initiative (GHARONI)
 FemCom Bangladesh
 PROSHIKA
 Shikkha Shastha Unnayan Karzakram (SHISUK)
 Society Development Committee (SDC)

Community Based Fisheries Management (CBFM) – Bangladesh

The central aim of this ongoing project is to empower communities to make informed and appropriate decisions on the use and management of the fisheries upon which they depend. It also works to improve equity and overall fishing community livelihoods both from fishing and from additional income sources.

The CBFM was born of a growing realization that community management of the wetland fisheries played an insignificant role despite the fact that these wetlands produced around 46 percent of all fish consumed in the country, and that more than 70 percent of households in the floodplain region catch fish either for income or food. It was also clear that fishers in Bangladesh were poor not only from low income, but because they lacked livelihood assets - including access to fishing grounds, education, finance and a role in decision-making.

Phase one of the project (1994-1999) involved the establishment of co-operative relationships between the WorldFish Center, the Bangladesh Department of Fisheries (DOF), five non-governmental organizations and more than 5,000 households living around 19 separate water bodies. The project is now in phase two and has expanded to include 11 NGOs and private organizations, and more than 23,000 households around 113 water bodies. It is being supported by the UK Department for International Development (DFID) through a grant to the WorldFish Center.

One of the major reasons for the CBFM's success has been its collaborative approach and the diverse range of skills available within the different partner organizations. The DOF provides the essential link to national government policy, local advice, support and facilitation; the Bangladesh Environmental Lawyers Association



Mr. A. Islam, from CNRS, accepting the award on behalf of the CBFM project.

(BELA) gives assistance with issues related to environmental protection legislation; FemCom Bangladesh – a professional women's media group – makes films and other audio visual materials to promote public awareness and participation in project activities; the large number of national NGOs provide skills for operating micro-credit facilities and to support local community management of their fisheries over a wide geographical range.

On-the-ground benefits have been remarkable. Led by different groups within the partnership (highlighted in the brackets), a raft of new initiatives and activities has produced measurable increases in productivity and reductions in poverty. On the Fatki river (DOF/ Centre for Natural Resource Studies [CNRS]), fishing by split bamboo barricades has been reduced to allow migratory fish stock to escape with the aim of enhancing the future overall fish catch from the river and canals.

New fish sanctuaries have been established in 49 project water bodies for the protection of brood fish over the winter and a voluntary freeze on fishing

in the early monsoon period has allowed native fish to breed. This has also led to an increase in fish diversity – by 30 percent or more in some cases.

The CBFM project has helped local communities to restore the condition of degraded habitats. In 2003 when a link channel between the Sinharagi beel (small lake) and the Dhaleswari river was reopened the total catch of fish increased by six times and the diversity soared from 46 to 63 species (CNRS and PROSHIKA).

The restocking of water bodies has proven particularly effective with production increased by 70-200 percent due to community management and improved techniques (Center for Rural and Environment Development).

During the second phase of the community based project CNRS reintroduced six locally threatened fish species thereby contributing to protection and maintenance of national biodiversity.

Through the CBFM project the national NGO BRAC helped a fishing community

in the Rangpur district to organize themselves and raise a pollution problem with the local Member of Parliament. Discussions with the polluter led to the industry taking new measures to treat its effluent and divert it away from the water body used for fish production.

The NGO partners have been especially successful in the provision of new skills and in the support of health and education. Micro-credit facilities have formed a small but vital part of this project. Revolving loan funds provide credit that covers fish processing as well as non-fisheries dependent income generating activities that help to diversify

and improve livelihoods within the community.

Just as importantly, the project has shown that it has significant potential for application in the floodplain regions of other developing countries, and has been adapted and extended to deeper flooded areas in the Mekong Delta in Vietnam and to other regions of Bangladesh.

The experiences and lessons learned from phase one of the project led to a variety of new community-based management schemes. These have been disseminated widely to inform and influence fisheries policy stakeholders.

Phase two of the project is now adding to this body of knowledge by generating a policy dialogue and helping to find agreement on a process for policy formulation for pro-poor sustainable fisheries management.

The WorldFish Center plays a pivotal role in this community partnership project. It is the glue that binds the players together providing motivation, coordination, and communication, facilitating a participation process that has led one elderly person from the Rangpur district to say: "we had hard times ... but it is wise to have a better future."

CGIAR Science Award for Outstanding Journalism 2003

Winner - Natasha Loder - '*The promise of a blue revolution*'

Natasha Loder, journalist for *The Economist* (London) was selected by the CGIAR panel to receive the 2003 Science Award for Outstanding Journalism.

Her article '*The promise of a blue revolution*' clearly expressed the issues and problems that are being faced by the global fish industry. The imbalance between the demand for fish and fish products and its supply in the marketplace is increasingly being met by the aquaculture industry, which now accounts for 30 percent of total fish production. It is also a major contributor to the economies of developing countries and forms an important livelihood for the poor.

However, the continued development of aquaculture will increasingly rely on the development of improved strains of fish with faster growth and better survival rates. The introduction of new strains requires strong regulatory environments for monitoring and enforcement, a pre-requisite often lacking in both developed and developing countries.

The escapes of farmed salmon and their threat to native wild populations through interbreeding and competition are well-documented. Pollution from food waste, antibiotics and other chemicals threatens the environment and human health. The consequence of this fundamental shift in the source of fish for human consumption has profound policy implications, especially in developing countries.

Ms Loder believed these important issues demand a platform for expression. They need to be placed centre stage and discussed at the highest levels; the general public needs to be aware of the changes taking place and the policy makers need to understand both sides of the arguments. She clearly and succinctly broadcast this message through her article in *The Economist* in August 2003.

The WorldFish Center nominated the author on account of the global impact created by this particular article and the level of debate it has raised, witnessed through citations and discussions on the



Ms N. Loder - *The Economist*.

World Wide Web. There is no doubt that this article has clearly made the desired impact.

Workshop on Charting Multidisciplinary Research and Action Priorities Towards the Conservation and Sustainable Management of Sea Turtles in the Pacific Ocean: A Focus on Malaysia

16-17 August 2004, Terengganu, Malaysia

The WorldFish Center; Department of Fisheries, Malaysia; National Oceanography Directorate, Malaysia; Maritime Institute of Malaysia; University College of Science and Technology of Terengganu, Malaysia; and WWF Malaysia co-organized a Workshop on Charting Multidisciplinary Research and Action Priorities Towards the Conservation and Sustainable Management of Sea Turtles in the Pacific Ocean: A Focus on Malaysia in Terengganu on 16-17 August 2004.

Over 40 specialists from Malaysia and resource persons from the Philippines, Indonesia, Thailand, Australia and the US met at the two-day conference to chart new directions in the conservation of sea turtles in Malaysia. The workshop

provided an important forum for linking the Roundtable Discussion on the Conservation of Turtles in Malaysia organized in 2003 with the follow up actions of the Bellagio Conference on the Conservation and Sustainable Management of Sea Turtles in the Pacific Ocean organized in 2003 (Box 1). A Blueprint for Action on Pacific Sea Turtles has been published by the WorldFish Center – ‘What can be done to restore Pacific turtle populations?’ (Downloadable from www.worldfishcenter.org)

The Workshop was hosted and given strong support by the State Government of Terengganu. Representing the Chief Minister of Terengganu, Datuk Seri Idris bin Jusoh, the workshop was officiated



Launching of the Bellagio Blueprint for Action in conjunction with the sea turtles workshop in Malaysia on 16 August 2004.

by the Director of the Terengganu State Economic Planning Unit and Deputy State Secretary (Development), Tuan Haji Mazlan Bin Ngah.

Box 1. Bellagio Conference on the Conservation and Sustainable Management of Sea Turtles in the Pacific Ocean.

A unique group of 25 specialists met from 17-21 November 2003 at the Bellagio Conference Center in Italy to create a much-needed blueprint for the conservation of sea turtles in the Pacific Ocean. The group included economists, marine policy experts, fisheries professionals, natural resource management specialists and researchers from government, non-government agencies and private institutions.

The participants provided a diverse range of disciplines and international involvement that resulted in a vital and revolutionary platform for identifying and establishing workable solutions to address cross-sectoral and complex problems relating to the conservation of sea turtles.

The specialists concluded that the blueprint must address: (1) the protection of all nesting beaches; (2) reduction of turtle-take at sea and in coastal fisheries; (3) stimulation of pan-Pacific policy actions; and (4) encouragement of sustainable traditional use of sea turtles.

The Bellagio Blueprint for Action on Pacific Sea Turtles was published and officially launched on 16th August 2004.

Report from the Bellagio Sea Turtles Steering Group Committee

The main objectives of the Workshop were to:

- consolidate existing work and identify multidisciplinary research priorities for the effective conservation and management of sea turtles in Malaysia;
- review and examine national and regional policy instruments for the effective conservation and management of sea turtles; and
- develop a multisectoral action plan and strategy for implementation by key agencies and stakeholders.

The meeting suggested a 15-point action strategy that included participation by local people, effective laws, strategic policies and management-oriented research. This multi-pronged approach emphasizes the need for research, policy and action in charting new conservation efforts. The central premise of the Workshop was that there is still hope

for protecting sea turtle populations in Malaysia through concerted efforts to apply multidisciplinary solutions and effective management at the local, national, regional and global levels.

At the Workshop, the State Government of Terengganu reaffirmed its commitment to take a comprehensive approach to conserve and manage sea turtles. In the opening speech, the establishment of a 60 ha sanctuary in the beach and coastal habitat at the Ma'Daerah rookery was announced. The rookery attracts nesting green turtles and is jointly managed by the Department of Fisheries (DOF), BP

Petronas Acetyls Malaysia and WWF-Malaysia.

The Workshop received a wide coverage in the press, with reports in the national, regional and international media. Dr Mahfuzuddin Ahmed, Director of Policy, Economics and Social Sciences at the WorldFish Center, was also interviewed on BBC radio.

Following the workshop, the national media (News Straits Times, 2 September, 2004) reported that four more turtle nesting sites in Redang, Terengganu will be brought under protection. The workshop event and subsequent actions by the State

Government of Terengganu reaffirmed the commitment of the state government and reflected the outcomes from the long-term collaborative efforts of a number of agencies in Malaysia, the Sea Turtle Research Unit of University College of Science and Technology of Terengganu and the State Government of Terengganu towards sea turtles conservation and management.

The proceedings of the workshop are being compiled by the organizers to provide the basis and framework for the development of a detailed national action plan for the conservation and sustainable management of sea turtles in Malaysia.

Speaker of the Philippine Congress is Guest of Honor at Milkfish Project Inception Workshop

The Honorable Jose De Venecia Jr., Speaker of the House of Representatives of the Philippines, was the special guest during the opening ceremony of the inception workshop for the project entitled Dissemination and Adoption of Milkfish Aquaculture Technology in the Philippines. The workshop was held on 12-13 July 2004 at the National Integrated Fisheries Technology Development Center of the Bureau of Fisheries and Aquatic Resources in Bonuan Binloc, Dagupan City, Philippines. Research partners from the Bureau of Fisheries and Aquatic Resources, Bureau of Agricultural Research, University of the Philippines in the Visayas, Aquaculture Department of the Southeast Asian Fisheries Development Center, Philippine Council for Aquatic and Marine Research and Development, as well as representatives from local government units, the milkfish industry and fishers' organizations attended the workshop.

The objectives of the workshop were to: (a) discuss the project among

partners and stakeholders and agree on roles, responsibilities, activities and targets; and (b) identify key persons and institutions to be responsible for project implementation. Using the analogy of a baby's christening, Dr. Mahfuzuddin Ahmed of the WorldFish Center said that the workshop was the venue to talk about how the project (the baby) was going to be raised by the parents and godparents (project partners and other stakeholders).

The Department of Agriculture's Bureau of Agricultural Research will fund the milkfish aquaculture project through the Philippine Government's contribution to CGIAR funds. The project sites are Pangasinan and La Union. The three-year long project will analyze the production, market and policy structures of the milkfish industry in the Philippines. It will identify the constraints and opportunities for the future growth of the industry, with emphasis on the adoption and impact of technological development, using case studies of hatchery and grow-out



Honorable Speaker of the House of Representatives, Jose De Venecia Jr., receiving a plaque of appreciation from the workshop organizers. From left: BFAR RFO 1 Director N.D. Domenden; BFAR Director M.I. Sarmiento; WorldFish Center's Dr. M. Ahmed; Honorable Speaker Jose De Venecia Jr.; NIFTDC Chief Westly R. Rosario; two visitors from Taiwan; DABAR's Ligaya Santos; and BFAR-IFAD Chief N.A. Lopez.

production systems and processing. It will also identify techniques that can be profitably transferred or replicated in other parts of the Philippines.

“Give a man a fish, and he will eat for a day. Teach a man how to fish, and he will eat for a lifetime.”

Modadugu V. Gupta, Assistant Director General, International Relations and Partnerships at the WorldFish Center and Research Coordinator at the International Network on Genetics in Aquaculture (INGA) is an outstanding scientist and global leader in the development of sustainable strategies for feeding the world's poor.

Over the course of four decades of innovative research, Modadugu V. Gupta has brought the promised fruits of this ancient Chinese proverb to poor people in developing countries by showing them — not how to *capture* fish — but how to *grow* fish.

Dr Gupta has been tremendously influential in regional efforts to bring the science of aquaculture to bear on problems of hunger, malnutrition, poverty and environmental destruction. At a time when altered weather patterns, urban development, erosion of natural resources, and over-fishing are emptying the seas and affecting rivers, there is a critical need for alternative dependable sources of fish. This need is especially acute in many countries of Asia and Africa, where poor people already find it difficult to obtain a regular supply of high-protein food and many are dependent on fishing for their livelihood.

As a specialist in fisheries, Dr Gupta has been highly instrumental in helping several developing countries boost their production of fish through aquaculture to compensate for the precipitous declines seen in fish from the wild. As a result of these efforts, freshwater fish production has risen dramatically over the last two decades (by as much as three to five times) in several Asia-Pacific countries including India, Bangladesh, Thailand, the Lao PDR and Vietnam.

Poor farmers and rural families across large tracts of South and Southeast

Asia have turned abandoned ponds, roadside ditches, seasonally flooded fields and other bodies of water as small as 300–400 m² into “mini-factories” growing fish for food and income, using techniques based on the work of Dr Gupta and his colleagues. For example, over 150 000 seasonal ponds in Bangladesh, which were lying fallow before Dr Gupta's intervention, are now blooming with fish.

Keen to duplicate the successes seen in Asia, a growing number of African countries (among them Cameroon, Egypt, Malawi, Mozambique and Zambia) are clamoring to implement similar techniques for growing fish for the poor.

Dr Ayyappan, Deputy Director General of the Indian Council of Agricultural Research, sees this innovative “pond aquaculture” as “a major instrument for poverty eradication.” Many governments and non-governmental organizations are incorporating the results of Dr Gupta's work into agriculture and development programs. They find the approach especially appealing because it can bring the poor and hungry several benefits simultaneously: greater food security, improved nutrition, economic opportunities, higher agricultural productivity and environmental protection.

Millions are benefiting already, and the potential impact is huge. Dr Ayyappan says widespread adoption of localized, low cost fish farming has been a major force driving the diversification of agriculture in Asia today. The approach is popular with farmers, he says, because “it adds value to agriculture.”

Early Vision

Dr Gupta began his career in his native India at a time when aquaculture was not well known in that country. When he

enrolled for a master's degree at Banaras Hindu University in India in 1958, he wanted to study fisheries. As there were no relevant programs he had to major in zoology instead. He recalls, “The very idea of fish research – teaching people how to manage wild fish catches or farm fish – was not regarded as a science.” Several years later, as a newly trained scientist, he had a strong sense of what he wanted to accomplish. “I wanted to use my research in development, to change people's lives,” he says.

Subsequent research in Calcutta in India, in Thailand's poor northeastern region, in the war-scarred countryside of the Lao PDR and the monsoon-flooded fields of Bangladesh gave him a first-hand look at the considerable obstacles the world's rural poor faced every day in their quest to provide for themselves and their families. These experiences strengthened his determination to make the results of his work as widely useful as possible.

Low Cost, High Impact

That goal is reflected in the “aquaculture” practices developed by Dr Gupta, which are designed to be adaptable and effective under many different local conditions and to entail minimal start-up and operational costs. Fish and pond nutrients, for example, come from native vegetation and organic farm wastes instead of expensive feed and fertilizers. This means that even the most impoverished people or those who are landless can engage in modest fish-farming.

On a wider scale, hundreds of thousands of poor farmers are learning – thanks to Dr Gupta's expertise in fish genetics and aquaculture – how to increase agricultural productivity by growing fish alongside crops and livestock.

In Bangladesh, for example, farmers in flood-prone areas have found they can benefit handsomely by raising large quantities of fish in their rice paddies. Although the water that covers the rice fields is too shallow for raising the popular native carps, Dr Gupta has shown that short-cycle species, such as tilapia and silver barb, can thrive and grow well under these conditions. "By integrating fish cultivation with rice production, you increase profit and also reduce the risks of rice cultivation alone," he notes.

He has demonstrated that while monoculture aquaculture (raising a single fish species) can be very profitable, polyculture often brings even greater rewards. "Raising compatible species of fish with complementary feeding habits results in the complete utilization of pond productivity, thus increasing fish production," he explains.

The trail-blazing work by Dr Gupta has had a huge impact in terms of major increases in fish production across the region over the last two decades, as the following figures show: in Vietnam freshwater aquaculture production increased from 91 000 tonnes in 1979–81 to 402 000 tonnes in 2001. And during the 1990s, Bangladesh boosted its production of fish through aquaculture by 300 percent—a growth from 177 000 tonnes in 1989–91 to 588 000 tonnes in 2001. Freshwater fish production in India increased from 63 000 tonnes in 1979–81 to more than 2 million tonnes in 2002. Today, yields continue to increase, thanks in large part to many of the measures that were implemented under Dr Gupta's guidance. According to Dr Ayyappan, the annual growth rate of aquaculture fish production in India is between 6 and 8 percent, a level not seen in any other farming sector."

Although Dr Gupta never designed his research specifically to address the needs of poor rural women, they

have been among the most ardent and skillful practitioners of his "aquaculture technologies."

Women have participated in trials and pilot projects, and their feedback has been valuable; many of their ideas have led to better and cheaper methods. Surveys show that rural women often make the best fish farmers, achieving significantly higher levels of fish production and greater profits than men do in comparable operations.

In Bangladesh, and other areas where poor women are usually confined to the home and have few means of generating income, backyard fish farms are becoming a promising avenue for their personal and economic empowerment. Today, about 60 percent of all those engaged in rural aquaculture activities in Bangladesh are women. Some are organizing themselves as groups to become local entrepreneurs.

Dr John Swanson, an agricultural extension team leader at the U.S. Agency for International Development (USAID), witnessed Dr Gupta's influence in making this happen when they worked together in Bangladesh in the mid-1990s. "Sometimes the work he did with women was so successful that pond owners no longer wanted to rent to them because they saw the potential to benefit from this activity themselves" Dr Swanson recalls.

Capacity Building for Progress

Apart from his many scientific accomplishments, Dr Gupta has been highly effective in building partnerships, strengthening institutions, and inspiring and guiding the next generation of fisheries researchers.

Many current and former colleagues say his strong professional track record reflects his skill in promoting collaboration among diverse groups such as national research institutes, international development agencies, local NGOs and farmer groups. "From the very beginning of his work

in India," Dr Ayyappan remembers, "he was always the one building teams and groups. He's successful because he's an excellent communicator who believes in teamwork and partnerships, in building complementarities."

Dr Gupta has always regarded grassroots-based NGOs as an important bridge between researchers and people in the countryside. His tradition of building these connections paid high dividends especially during his work in Bangladesh, a Muslim country, where a strong NGO network was critical in reaching rural women.

Dr Gupta has been a driving force in building capacity among scientists and development workers in countries where he has worked, and the force behind the International Network on Genetics in Aquaculture (INGA), for which he was the Research Coordinator till August 2004¹. Dr Gupta also coordinated the Group of Fisheries and Aquatic Research (GoFAR), a fisheries arm of the 19-country Asia-Pacific Association of Agricultural Research Institutions (APAARI).

The member countries and scientific institutions of INGA work to increase fish production through genetic research and conservation of aquatic biodiversity. The support he provided to member countries led to the development of several improved breeds for aquaculture production, mainly carp and tilapia that are attractive to farmers and well suited to low-intensity fish farming.

As Assistant Director General of International Relations and Partnerships at the WorldFish Center till August 2004, Dr Gupta worked to create aquaculture development networks on a global scale.

¹ Since August 2004 Dr A.G. Ponniah has assumed the position and responsibilities of INGA Research Coordinator.

Creating a Win-Win Situation for Oceans, Fisheries and The Poor

Sometimes the most well intentioned of actions can have unexpected consequences.

Few who care about the environment would argue with the spirit behind recent international moves to protect the world's dwindling fish stocks from over-exploitation. Over the past three decades, international treaties and agreements have helped to ease pressure on marine life and protect once plentiful species from extinction. However, all actions have consequences. As laudable as such initiatives have been, they have inadvertently helped to fuel an environmental disaster in many parts of the developing world, resulting in increased disease, environmental degradation and the further alienation of the world's poor.

One might have expected a limiting of access to the world's fish reserves to result in a drop in demand for fish stocks. Quite the contrary. Research by the Worldfish Center and the International Food Policy Research Institute (IFPRI) has shown a dramatic increase in the demand and production of aquaculture products as natural ocean and river stocks decrease. This boom in aquaculture production is the direct result of a widening worldwide gap in the supply and demand for fish. Despite clear evidence of smaller ocean and river catches, there has been an unprecedented rise in the production, consumption and trade of fish over the past three decades. Total fish production between 1971 and 2001 doubled to 130 million tons. While fish production in the developed world has remained largely stagnant during this period, the major increase has occurred in the developing world, in particular Asia.

The most important factors driving the increasing fish consumption in developing

countries are urbanization, increase in incomes and population growth. In the past three decades, the consumption of fish and animal protein has nearly doubled in the developing countries. China experienced a remarkable 455 percent growth rate in per capita consumption during the period and it is in China and India where the expansion in aquaculture has been at its most intense.

While many in the West would see the development of fish farming as a safer environmental alternative to ocean fishing, and as a way of filling the gap between the demand and supply of fish, the intensive aquaculture practices employed over the past three decades have created serious and ongoing problems. Research shows that shrimp and salmon farming, in particular, can have a damaging impact on ocean and coastal resources through the destruction of wild fish habitats. It can also be detrimental to human health due to the increased production of waste and a build-up of pesticides and antibiotics in the food chain. Added to this is the risk of microbial contamination and reduced biodiversity because of increased competition and genetic interaction between escaped fish and wild stocks.

Intensive aquaculture can also lead to outbreaks of disease that threaten aquatic organisms and the productivity of water resources. High stocking density and poor water and seed quality can often lead to disease outbreaks that easily spread to other ponds and open water areas. Research indicates that intensive shrimp farming in Asia, for instance, has resulted in the destruction of hundreds of hectares of mangrove forest over the last few decades.

Worse still, the dramatic rise in fish production in the developing world has not resulted in better food for the

world's poor. Why? Because developing countries currently export almost 50 percent of their total production to developed nations, with exports of high-end shrimps, lobster tails and Nile perch seen as lucrative money earners. The higher demand for fish in the world markets and the consequent higher prices of fish products result in the production of high-value fish for export at the cost of domestic consumption. The poor subsistence farmer's diet usually includes low-value food fish. This can have a significant impact on the food security of people in developing countries. Added to this is the fact that low-value fish products, traditionally available to the poor, are now being diverted for the production of fish feed to service the aquaculture plants, while more land and capital is being reallocated to aquaculture instead of the production of cereals, vegetables, and oil seeds.

So what can we do to help? For a start, there is a need for governments to be more aware of the flow-on consequences of intensive aquaculture farming and to ensure that those at the bottom of the socioeconomic scale are not left out. Developing countries need to be careful in formulating their trade policies and related issues to seek a balance between fish for trade and domestic consumption. The question many developing countries face is how to make the best use of liberalized trade in fish products and to develop efficient and transparent systems for the management of their inland and marine resources.

There is also a role for developed countries in helping to establish such systems and in furthering advances in aquaculture technologies. The application of selective breeding technology to tilapia by the Worldfish Center and to salmon in Norway has opened up the

opportunity for increasing fish production through genetic research. The productivity increase for genetically improved tilapia is 85 percent and for salmon 60 percent.

Finally, it is time for governments and producers to look at the size of their aquaculture operations. The WorldFish Center research clearly shows that large-scale intensive farming is actually highly economically inefficient and environmentally unsafe, while semi-intensive practices are often low-cost and environmentally friendly.

International fishing bans have not caused the current problems with aquaculture farming. The problem has been caused by the closure of one avenue of fish production without clearly determining the scope and nature of its alternative. Aquaculture production can be a beneficial tool for meeting the world's food needs, but in its current form and practice, it is complicit in the further impoverishment of both people and nature. There is time to act, but there must also be the will to act. Without redress, the trends I have outlined are

likely to continue well into the future. Poverty reduction, inclusive development and environmental protection must continue to become more central to the dialogue between advocates for the poor and for the environment, representatives of the fish industry, political leaders and international policy makers.

Dr Stephen Hall, Director General
The WorldFish Center

Sustainable Coastal Fisheries Management in Asia

Fish – a traditional, and highly valuable, ingredient in the diet of hundreds of millions of Asian people – a critical source of protein, calcium and other nutrients. Over the past 30 years developing countries have increased their fish consumption by as much as 50 percent. Asia alone consumed over half of the world's fisheries products in 2000; as the population of the region continues to increase, so will the demand for fish. So, where will all the new fish come from? Although aquaculture has a key role to play, much of the fish will still need to come from wild capture fisheries appropriately managed to meet the increasing demand but within sustainable limits.

Asia is currently responsible for over 40 percent of world fisheries production. The fisheries sector is central to the economy of many countries, and is therefore key to trade and political stability. Forty percent of global fish production is traded internationally at a value of over US\$55 billion; of this, US\$18 billion goes to developing countries. For economic

as well as cultural reasons, conflicts over fisheries resources continue to increase, often escalating to a national political scale. The socioeconomic implications of substandard fisheries management are immense. Fisheries provide livelihoods to an estimated 22 million people in the region: fishing is one of the few employment options for the landless poor. Women often play a traditional role in processing and marketing of the catch, providing a vital source of income to their families.

The WorldFish Center and partners in eight developing countries in the region (Bangladesh, India, Indonesia, Malaysia, Philippines, Sri Lanka, Thailand and Viet Nam) have been working to address the sustainability of the coastal fisheries resources that will need to continue to serve as a primary source of food and economic stability for millions of people.

A number of issues are consistently identified as being the key factors preventing these countries from enjoying sustainable production from fisheries.

They are:

- over-fishing, meaning too many boats and fishermen taking too many fish;
- inappropriate fishing techniques, including nets with fine mesh that capture juveniles;
- post-harvest losses, where the catch spoils or reduces in value due to poor handling at sea and during marketing;
- conflicts between large- and small-scale fisheries where there are overlaps in 'preferred' fishing areas and types of target species;
- habitat degeneration, where the habitats that fish rely on are being degraded;
- lack of information to develop appropriate policies to maintain the supply of fish, and
- institutional weaknesses and constraints within the governance of fisheries.

These issues have a direct impact on the biological resources, on the supply and price of fish to consumers, the income of fishers, and the welfare of coastal communities.

The WorldFish Center and its partners have been helping to address the issue of “information”, or the lack of it, through the *Sustainable Management of Coastal Fish Stocks in Asia* project (1998–2001) funded by the Asian Development Bank, the partner countries and the WorldFish Center. Several important achievements have been realized. The first, perhaps appropriately, was the development of a new regional database known as F_{IRST} – Fisheries Resource Information System and Tools – and the input of historical trawl research survey data.

Trawl surveys have long been considered the most straightforward way of determining the abundance of the fish and shrimp species that live in/on or near the seabed. Valuable information on stocks, their population structure, fishing grounds and optimal gear can be collected. Surveys have been carried out by countries in the region for nearly 80 years but the data has been seriously under-used due to its inaccessibility – held by multiple agencies in several countries and not in an electronic format.

Though national data is held in each country, WorldFish is now the custodian of a regional database that currently holds species abundance data from over 21 000 locations in the coastal waters of South and Southeast Asia collected from the 1920s onwards. For the first time it is possible to look at data trends at a macro level, on a regional or ecosystem level rather than purely from the standpoint of national coastal resources. This is important as fish stocks straddle national boundaries and they may require different habitats at various stages of their life history, a point that emphasizes the need for cooperative international management.

The F_{IRST} software addresses the need for flexible usage based on different languages and species identification. The system stores scientific names and country-specific species codes and detects synonyms through a module linked to FishBase. The F_{IRST} software is



designed not only to store trawl survey data but also to assist in its analysis. One key tool can estimate biomass (species abundance) over areas and through time and, as data are georeferenced, prepare maps for illustration. This information assists national and regional decision-makers to assess the status of fisheries and to address concerns such as over-fishing and environmental impacts.

In fact, data analysis using F_{IRST} has already produced dramatic illustrations

of substantive degradation and over-fishing of coastal fish stocks in formerly productive fishing grounds managed by the participating countries. Catch rates in some fishing areas (and hence resource biomass) have declined to values between 5 and 30 percent of their levels prior to the expansion of fisheries. In the future F_{IRST} will be an important resource during efforts to restore capture fisheries, providing baseline information and historical data against which to test the outcomes of new strategies.

But the *Sustainable Management of Coastal Fish Stocks in Asia* was much more than a database project. It involved strengthening the capacity of selected national institutions to analyze, assess and manage their coastal fisheries, prepare management plans and examine their implications. These plans lie at the interface between the science (abundance of natural resources as estimated using FiRST) and the socioeconomic effects of policy and institutional changes, each affecting the other along a series of interconnected pathways, some not always clearly understood.

Socioeconomic and bioeconomic analyses of coastal fisheries in region have provided a brand new source of valuable information for decision-makers. Some selected quotes from the abstracts of papers (Silvestre et al. 2003) say, for example:

Bangladesh, *S.M. Khan and M.S. Haque:*

The current catch of 2 444 t at an effort of 7 491 SFD indicates over-fishing. Precautionary measures should be adopted by the government to prevent over-exploitation... The present number of large trawlers and boat owners should not be allowed to increase. Artisanal fishers should

abandon destructive fishing gear like estuarine set bag nets, push nets and current jall that kill small fish.

Central and northern Java, *B.E. Priyono:*

It is recommended that in large scale fisheries the volume of fuel/day should be increased, while the total number of boats should be reduced. ... [This] would increase offshore operations, which would lessen the fishing pressure in near-shore waters.

Thailand, *P. Boonchuwongse and W. Dechboon:*

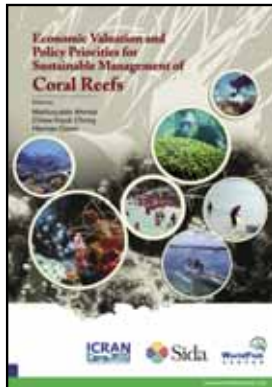
The 1999 Census of Marine Fishery showed that the total number of fishery households, including fisheries employees' households in the country was 109 635... The average per capita fish consumption is 24 kg annually.... Results [from the Schaefer Model] indicate that the present catch and the corresponding effort of demersal fishing in the Gulf of Thailand surpassed both maximum economic yield (MEY) and maximum sustainable yield (MSY). In order to obtain the maximum net benefit in the long run, the present fishing effort ... must be reduced to about 50% of present levels.

The improvement in national capacities within the eight participating countries to assess and analyze national and regional

data and then apply the conclusions to policy analysis and planning has been a major success for the project. It has led to reviews of existing programs at both national and regional levels that have identified new challenges and opportunities. Identification of trends in coastal fisheries management has led to specific plans for rehabilitating resources and reinforcing sustainable fisheries practices.

Towards the end of the project, an "International Workshop on Management of Tropical Coastal Fisheries in Asia" was organized (20-23 March 2001) in Penang, Malaysia. The proceedings from this workshop have been prepared and are available in a "CD + abstracts" publication.

Prepared from WorldFish Center documents with particular reference to Silvestre, G. et al. 2003. Assessment, Management and Directions for Coastal Fisheries in Asian Countries. WorldFish Center Conference Proceedings 67. 1110 p.



ISBN 983-2346-29-0

Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs

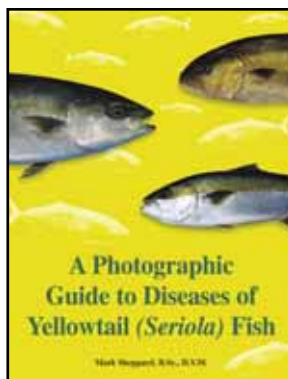
Edited by Mahfuzuddin Ahmed, Chiew Kieok Chong and Herman Cesar

This publication is an outcome of the International Consultative workshop for Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs held at the WorldFish Center's Headquarters in Penang, Malaysia over the period 8-10 December 2001.

The overall goal of the workshop was to identify future directions for economic and policy research relevant to the sustainable management of coral reefs. This publication contains the workshop's overview of current issues and problems relating to coral reef management. It also includes keynote papers, case studies of the economic valuation and socioeconomics of coral reefs, and policy

instruments and management techniques for coral reefs and marine resources. The final section of this publication consists of the recommendations for future research made by the workshop participants.

The workshop was the final activity of the Valuation and Policy Analysis for Sustainable Management of Coral Reefs project. The Center's donors and the Swedish International Development Cooperation Agency (Sida), with additional support from the International Coral Reef Action Network (ICRAN), sponsored the workshop. It also received support for selected participants from Southeast Asia from the Economy and Environment Program for Southeast Asia (EEPSEA) and the Australian Center for International Agricultural Research (ACIAR). Forty-eight participants from 15 countries of Southeast and East Asia, the Caribbean, East Africa and the South Pacific Regional Seas contributed to the workshop.



ISBN 0-920225-14-4

A Photographic Guide to Diseases of Yellowtail (*Seriola*) Fish

Dr. Mark Sheppard

This 65-page guidebook, with 30 pages of high resolution photographs, covers 29 disease-related topics typically observed in the yellowtail, kingfish, and amberjack (*Seriola*). The topics range from farm-hygiene to bacterial, viral, parasitic and complex disease syndromes. Each topic includes one page of easy-to-read information, descriptions and diagnostics. The book is designed as a basic, hands-on, "what am I looking at now?" diagnostic field guide for farm staff, laboratory technicians and students. For more details visit <http://oberon.ark.com/~sys> or email svsbook@oberon.ark.com

About the author: Mark Sheppard B.Sc., D.V.M. received his Doctorate of Veterinary Medicine from the Western College of Veterinary Medicine in Canada. His professional career has included roles as the veterinary service manager of an international salmon production company, and a multi-national aquaculture feed company. He now provides fish health management services as an international veterinary consultant. Dr. Sheppard's unique interests and years of field experience as an active veterinary practitioner in finfish aquaculture have nurtured the development of his expertise of both cold-water salmonids and warm-water aquaculture fishes. He has provided veterinary fish health management, pathology and pharmaceutical expertise to fish culturists in Canada, United States, Ireland, Chile, Japan, Philippines, South China, New Zealand and Australia.



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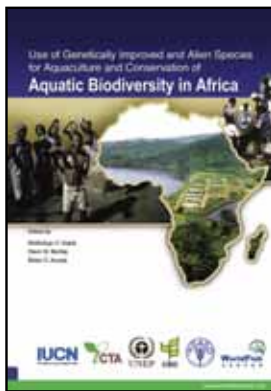
What can be done to restore Pacific turtle populations? The Bellagio Blueprint for Action on Pacific Sea Turtles

The Steering Committee, Bellagio Conference on Sea Turtles

The Bellagio Blueprint for Action on Pacific Sea Turtles is an outcome of the Bellagio Conference on the Conservation and Sustainable Management of Sea Turtles organized jointly by the WorldFish Center and U.S. NOAA-Fisheries. During 17-21 November 2003, a multi-disciplinary group of 25 experts met in Bellagio, Italy to draft an Action Plan on Pacific Sea Turtles. The group recognized the seriously endangered state of sea turtle populations in the Pacific and the escalating nature of human threats to the turtles. They examined cases of successful sea turtle conservation programs from

around the world and reviewed a broad suite of promising policy and management actions in the Pacific. They concluded that it was possible to save the threatened and endangered species. The actions recommended in the Blueprint are: protecting all nesting beaches; reducing turtle-take at sea and in coastal fisheries; stimulating pan-Pacific policy actions; and encouraging the sustainability of the traditional use of sea turtles. In addition to this description of the Blueprint, the experts are developing a full policy brief and other literature for wide dissemination.

The individuals on the Steering Committee for the Conference coordinated this publication. The Blueprint described in this publication is a collective output of the experts who participated in the Bellagio Conference on Sea Turtles.



ISBN 983-2346-27-4

Use of Genetically Improved and Alien Species for Aquaculture and Conservation of Aquatic Biodiversity in Africa

Edited by Modadugu V. Gupta, Devin M. Bartley and Belen O. Acosta

Aquaculture species are being domesticated and improved through genetic enhancement. Despite the benefits of improved fish in terms of increased production, there are risks associated

with conservation of biodiversity when the introduced strains/species escape into natural waters. This is especially important in Africa, which is one of the world's largest repositories of diverse freshwater fish fauna and home to native tilapias. This publication is a useful tool in building awareness among African institutions, agencies and planners of the issues involved in improving production through introductions of improved strains/alien species while sustaining natural biodiversity.