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FAO Aquaculture Newsletter

FAO AQUACULTURE NEWSLETTER

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EDITORIAL

In the morning of 26th December 2004, a devastating Tsunami of incredible magnitude struck 12 countries in South East and South Asia, East Africa and the Indian Ocean. This natural disaster caused varying degrees of damage to lives, livelihoods, infrastructure and economies in India, Indonesia (Sumatra), Malaysia, Maldives, Myanmar, Sri Lanka, Thailand, Somalia and the Seychelles. The countries worse hit were Indonesia and Sri Lanka; India and Thailand also suffered significant damage. The incident, which occurred for only a few minutes in each country, took more than 290 000 lives and devastated many fisheries and coastal aquaculture in all the affected countries. Reports indicate that in Sri Lanka over 70 percent of the coastal fishing capability has been lost, and in Banda Aceh in Indonesia, besides serious damage to fisheries, almost 50 000 ha of aquaculture facilities have been destroyed. The Thai and Indian marine cage culture and shrimp aquaculture (including hatcheries) sectors have also suffered significant damages.

The loss in human life is staggering and can never be adequately compensated, but rebuilding the fisheries and aquaculture sector is possible and necessary. In partnership with other agencies, FAO is helping affected countries by providing emergency assistance for relief, rehabilitation, planning and rebuilding of the fisheries sectors under an agency-wide, multilateral assistance programme supported by many countries and development agencies. In doing so, FAO will ensure that the relief and rehabilitation efforts will improve the capacity of the local people to be better prepared for similar natural disasters. The assistance programme is implemented in accordance with the national rehabilitation and rebuilding plans, and in collaboration and consultation with the stakeholders. The programme also address the possibilities of adopting a better livelihoods approach to development that couples rehabilitation and reconstruction with appropriate reforms.

In most of the affected countries, there are opportunities for integrated planning and rebuilding, recognizing that the livelihoods of fishers and fish farmers are not only multidimensional but also have strong socio-economic linkages to other activities and communities close by. The Fisheries Department of FAO is now working closely with several affected governments in providing the required technical assistance.

Visit http://www.fao.org/tsunami/ to learn more.

Rohana P. Subasinghe
Chief Editor

Cover photo courtesy of Md. Ghulam Kibria: A view of ethnic minority households along with VAC farming, Viet Nam

CONTENTS

THE USE OF LOCAL KNOWLEDGE IN RIVER FISHERIES RESEARCH

John Valbo-Jørgensen[1]

Introduction

River fisheries are extremely important for food security among the rural poor in many tropical countries. However, the growing populations and rapid industrialisation of these countries are continuously increasing the pressure on aquatic and other natural resources. In spite of riverine fish stocks being highly resilient to fishing pressure, they are extremely vulnerable to environmental degradation; the migratory habits of many riverine species, depending on both longitudinal and lateral connectivity among habitats, implies particular vulnerability to water management projects. The migratory nature of the fishes also means that any fisheries impact will have much more than local impact and may even extend beyond borders into neighboring countries. It is therefore of utmost importance that appropriate action be taken to sustain the fish resources for future generations.

However, the lack of detailed knowledge on the biology and sometimes even the taxonomy of many species combined with the dispersed nature of the fisheries in remote areas with difficult access and often lack of research funds make it difficult to get a manageable picture of the fisheries situation. For these nations to be able to manage their fisheries appropriately in the future, fundamental biological and ecological knowledge about the resource is crucial. In contrast the millions of people who live along the shores of the rivers and rely on the fishery for their daily survival, have a very intimate knowledge of the behaviour and biology of the fish. Gathering the fishers' knowledge can provide politicians or planners with baseline knowledge in a relatively quick and cheap way.

Basin-wide studies of the distributions, migrations and spawning habits of 50 commercial fish species in the Mekong River by the Mekong River Commission (MRC) from 1998 to 2000 (Poulsen & Valbo-Jørgensen, 2000; Valbo-Jørgensen & Poulsen, 2000) show the potential of this approach. These studies examined the knowledge of 355 fishers in 113 villages in four countries along 2 400 km of river from the estuary in the South China Sea in Viet Nam upstream to the border between Thailand and Myanmar. The stations were chosen based on a combination of the knowledge of experienced fisheries officers, information gathered during extensive pre-survey travelling in the region, review of scientific literature, and finally by spotting distinctive ecological reaches on detailed maps. An effort was made to cover all ecological reaches including upland as well as lowland parts of the basin and river segments above and below zoogeographical barriers. Sections where major tributaries join the mainstream were also given special attention. The surveys were carried out by teams of local

Box 1. The Mekong fisheries (Van Zalinge *et al*., 2004 and references)

The Mekong Basin in South East Asia sustains what are probably the largest freshwater fisheries in the world, with an annual yield in the range of 2.6 million tonnes. Most of the catch is harvested by small-scale fisheries and consumed locally. More than half of the daily protein is derived from fish with fish consumption rates averaging 57 kg per year and in certain areas as much as 98% of the population is involved in fishing. The fish fauna is extraordinarily rich with almost 1000 described species all of which to various degrees contribute to the catch. However, the taxonomic status of many species is still uncertain, with serious implications for studies of ecology and biodiversity; it is only in the last decade that fisheries research has gained momentum.

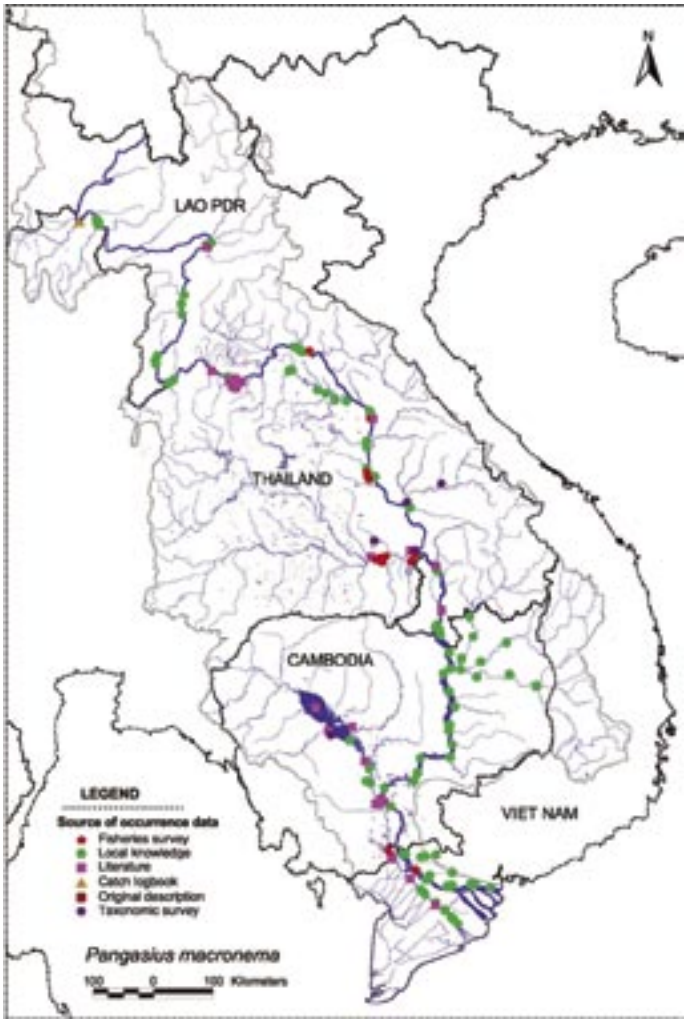
scientists working in their own countries. In order to ensure that reliable species-specific information was obtained, it was decided to use high quality photos of fishes as the main conversation objects during the surveys.

Species distributions

One of the areas where accessing local knowledge proved to be superior to any other methodology was in mapping the distribution of migratory fishes (Fig. 1). The method was especially useful in determining the range of endangered species, because rare species are not likely to show up in any sampling study of limited duration. On the other hand fishers, who set their gear in the same place day after day, will almost certainly know whether a particular species is there or not, and the fishers can also provide historical information about species that have disappeared within their lifetime.

However, the migratory nature of most fish species made the identification of stocks difficult. In order to get more detail it will be necessary to resort to supplementary methods such as sampling at fixed stations along the river, tagging (including electronic tags), and genetic population studies. Common for all these methods is that they are extremely expensive and nearly worthless without baseline data. Local knowledge data, therefore, will play a key-role in the formulation of hypotheses to be tested with these methods in the years to come.

Figure 1. Combining traditional taxonomic surveys with local knowledge. The map shows the distribution of the catfish *Pangasius macronema* in the Mekong Basin (Visser, Valbo-Jørgensen & Ratanachookmanee, 2003)



Spawning

The statement *"In June-July groups of the catfish Wallago attu larger than 2 kg gather in shallow water on flooded grassland to spawn. The eggs stick to the substrate and hatch within 3 days"* by a Thai fisherman at Chiang Khong illustrates the level of detail it is possible to obtain using this methodology.

Many fishers were able to provide information about the periods where the fish have eggs in the abdomen, which is an indication of the spawning period. However, the exact spawning grounds turned out to be much more difficult to identify than expected, probably because the Mekong is very turbid - especially during the flood season when most species are spawning. This also explains why the spawning grounds that were reported were mainly for species spawning in shallow water on the floodplain, i.e. the bronze featherback (*Notopterus notopterus*), cyprinids of the genus *Hypsibarbus*, the walking catfish (*Clarias batrachus*), large sheatfishes of the species *Wallago attu*, *W. leeri*, and the chevron snakehead (*Channa striata*).

Several spawning grounds could, however, be identified for the mainstream spawners sevenline barb (*Probarbus jullieni*) and thicklip barb (*P. labeamajor*), probably because these species are spawning in the dry season, when the water is clearer, and also because they make a lot of splashing during the spawning performance.

Dry season refuges

The question of deep pools was not specifically raised as an issue during the survey interviews, but fishermen still referred to deep pools as important habitats for certain fish species 230 times. Only a few species such as the smallscale croaker (*Boesemania microlepis*) are permanent residents in deep pools, while most species seem to use the deep pools in the dry season only.

Migrations

Although a detailed account of the migrations of individual species (see for example Poulsen & Valbo-Jørgensen (2000)) is outside the scope of this paper, some general patterns are provided below.

First of all there are two main migration periods (Fig. 2). The first is from May to July when the water is rising. During this period most fish are full of eggs, implying that this is a migration towards the spawning grounds. The second migration period is from October to December when the water level is falling rapidly thereby pushing the fish out of the nursery and feeding areas on the floodplain, from where they migrate to their dry season refuges.

It also became apparent that three different migration systems could be delineated, each with distinct ecological feature (Fig. 3). It is the relative position of the key habitats (spawning, nursery/feeding and dry season refuges) that governs the migratory patterns of the individual stocks or populations. For example, spawning areas and dry season refuges in the lower system are found in north eastern Cambodia and southern Laos, while the nursery areas are associated with the floodplains of the Great Lake. In the middle system spawning and growth takes place in tributaries with large floodplains while the fish spend the dry season in deep pools in the Mekong mainstream. In the third system, floodplains are scarce and lateral migrations therefore play a less prominent role. The most conspicuous feature here is, therefore, the movement between the dry season refuges in mainstream deep pools towards the spawning grounds. One example of such a migration is by the Mekong giant catfish (*Pangasianodon gigas*), one of the largest fishes in the world, which is the target of a traditional fishery during its spawning migration. Due to the rapidly declining stocks only a few individuals is caught every year and in some years none.

Experiences

From the above, it is obvious that large amounts of often surprisingly detailed life-cycle information can be obtained through semi-structured interviews with local fishermen. By combining results from a large number of species, it is possible to make conclusions about more general ecological parameters, such as determining the effect of hydrological factors on the fisheries ecology, or indicating the borders between different eco-regions. This would not have been possible through more conventional biological surveys such as sampling or tagging.

The critical issue here is that the survey is designed in a way that makes data collected from a number of sites comparable, so that each site act as one piece in the puzzle and when putting all pieces together, migration patterns for the species emerge.

Although a certain rigidity of the survey is important, in order to compare results from station to station, it is equally important to allow room to include other information, which the survey designers did not take into account during the design of the survey. The issue about deep pools, for instance, was not

Figure 2. The relationship between fish migration and hydrology (based on Bouakhamvongsa & Poulsen (2000)). Dotted line: Monthly discharge at Pakse, Southern Laos (m3/sec). Solid line: Number of migration reports all stations and species

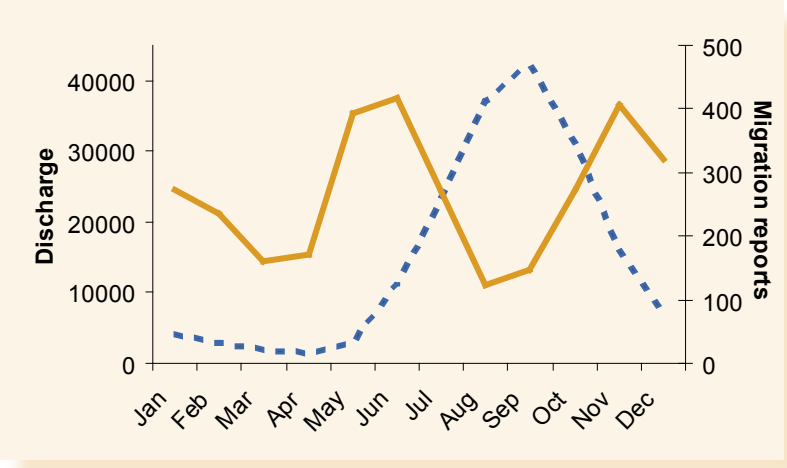
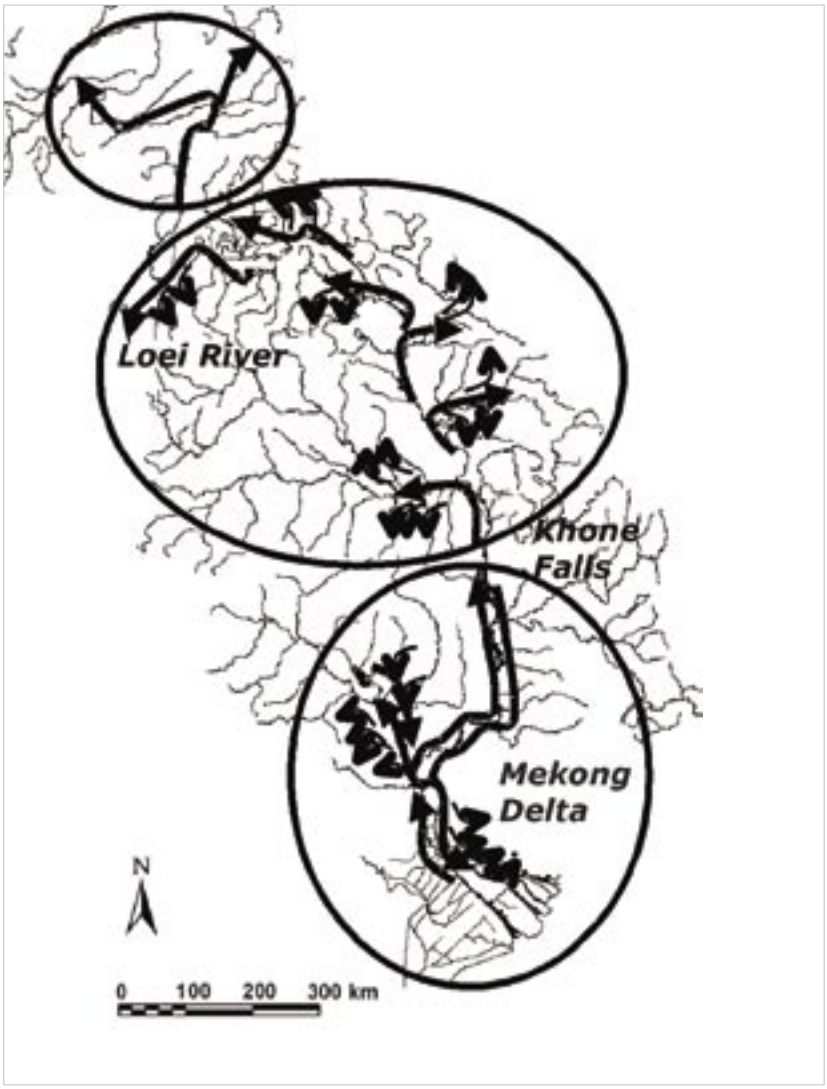


Figure 3. The movements of migratory fish stocks can be divided into three migration systems with distinct ecological features (based on Coates, Poulsen & Viravong, 2000). Large arrows represent longitudinal migrations small arrows lateral movements



considered specifically when designing the survey. However, the development of co-management systems for deep pool habitats may be a priority for future fisheries management in the Mekong Basin, and the survey provided an unexpected opportunity to map out important deep-pool areas and indicate which species are using deep pool habitats.

It is nevertheless essential to emphasize that the method cannot, and should not, stand alone, but should rather be used as the first step in a process enabling researchers to ask more specific questions, which can be answered through more focused studies. In the Mekong, local knowledge surveys have been followed up by studies using other methodologies such as tagging, hydroacoustics, sampling of individuals, and genetic population studies in order to test hypotheses formulated based on information gathered using local knowledge.

Conclusions

Collecting local knowledge is an inexpensive method to quickly obtain detailed biological information about riverine fish, especially when information about a large number of species is needed from a large area with difficult access. It also enables the researcher to get data on seasonal events such as fish migrations or spawning in a one-time visit.

The distribution of rare species that are extremely unlikely to be caught during a short-term sampling programme can be confirmed, and historical information about already extinct species can be gathered.

In the Mekong, local knowledge will be at the centre of future fisheries research, monitoring, management and impact assessments. Other methods will obviously be used to answer more specific questions, but will rely on local knowledge in order to formulate testable hypotheses.

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LIST OF FORTHCOMING MEETINGS

3-4 February 2005
11th Annual Whirling Disease Symposium
Denver, Colorado, USA
Information: Wanda McCarthy, e-mail: whirling@mcn.net

7-11 March 2005
FAO Committee on Fisheries (COFI)
FAO HQ, Rome, Italy
Information: Ndiaga Gueye, e-mail: ndiaga.gueye@fao.org

9-13 May 2005
World Aquaculture Society
Nusa Dua, Bali, Indonesia
Information: http://www.was.org/Meetings/ConferenceInfo.asp?MeetingCode=WA2005

10-12 June 2005
5th International Exhibition & Conference on Fisheries and Aquaculture
Piraeus Exhibition Center (OLP), Athens, Greece
Information: http://www.europartners.gr/page/default.asp?la=2&id=16

5-9 August 2005
Aquaculture Europe 2005 - Optimising the Future
Trondheim, Norway
Information: http://www.easonline.org/home/en/default.asp

5-8 September 2005
4th Fish & Shellfish Larviculture Symposium
Ghent University, Belgium
Information: http://allserv.ugent.be/aquaculture/larvi/index.htm

11-16 September 2005
12th International EAFP Conference on Fish and Shellfish Diseases
Copenhagen, Denmark
Information: http://www.eafp.org/EAFP2005.html

18-21 October 2005
Interactions between aquaculture and wild stocks of Atlantic salmon and other diadromous fish species: Science and Management, Challenges and Solutions
Bergen, Norway
Info: http://www.ices.dk/iceswork/Symposium-2005-culti.htm ; e-mail: hq@nasco.int

25-28 October 2005,
6th Symposium on Diseases in Asian Aquaculture: Aquatic Animal Health – Facing New Challenges
Colombo, Sri Lanka
Information: Melba.Reantaso@fao.org

FAO Fact Sheets on Aquaculture

Valerio Crespi[1]

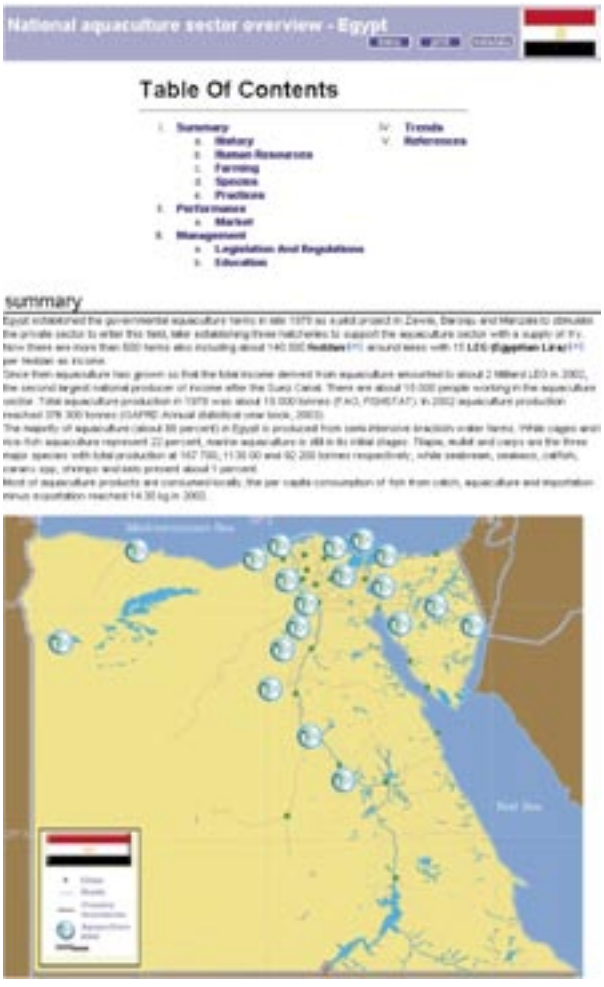
Aquaculture is the fastest developing food producing sector in the world and the exchange of information on all related subjects is becoming a key management issue. In recent years, demands for reliable aquaculture data and information as well as for reporting, accessibility and exchange of such information had increased. These requirements are greatly driven by the need to formulate and monitor sound policies and development plans; by new information and reporting requirements of international agreements and initiatives; and increasing public demand for transparency and accountability.

As an information resource centre, FAO compiles and integrates information coming from major centres of excellence, other international organizations, regional bodies and national institutions all over the world. Information is processed and disseminated through internet following high technical standards and using new technologies like Extended Mark-up Language or XML.

In this perspective, the Inland Water Resources and Aquaculture Service (FIRI) is developing a new series of Fact Sheets including specific subject information and profiles supported by graphics (GIS maps, images, line drawings, illustrations, charts, etc.). The Fact Sheets contain a synthesis of information tailored to illustrate the various characteristics of each broad aquaculture subject. Search, navigation and information tools are also accessible. The information domains included in the Fact Sheets are the *National Aquaculture Sector Overviews* (or NASOs), the *Aquaculture Legislation Overviews* and the *Cultured Aquatic Species Information Programme* (CASIP). Some of these fact sheets will be accessible within the month of February 2005 at the following internet address: http://www.fao.org/figis/servlet/static?dom=root&xml=aquaculture/index.xml.

The *National Aquaculture Sector Overview* (NASO), a concise and comprehensive cross-domain product, gives a general overview of the aquaculture and culture-based fisheries aspects at the national level. It is directly linked to the Fishery Country Profiles programme under the leadership of the FAO Fisheries Policy and Planning Division (FIPP). FIRI is currently preparing NASOs for the top 40 main producing countries of the world (see Table 1) as well as for other interested FAO member countries using a standardized structure with a limited number of pages. NASOs contain detailed information on the history of aquaculture; human resources involved in the sector; farming systems distribution and characteristics; cultured species contributing the most to national production; production statistics; description of the main domestic markets; promotion and management of the sector; development trends and issues at the national level (Fig. 1).

Figure 1. Example of a NASO webpage for Egypt



The *Aquaculture Legislation Overviews*, a series of comparative national overviews of aquaculture laws and regulations relevant to the top 40 aquaculture producing countries, are being prepared in collaboration with the FAO Development Law Service. The overviews reflect the multi-disciplinary character of aquaculture, the complex issues involved and the various regulations under a wide range of legislation governing the sector. Most of the issues are not unique to aquaculture and are often regulated in a more general legislative regime. Many of the laws and regulations in place today were developed without aquaculture in mind and thus may be applied to the sector in an inconsistent manner. The overviews focus largely on those legislative texts which have been drafted for the purpose of regulating aquaculture; expectedly, occasional problems of interpretation may often arise. Sometimes, it is difficult to relate the nature of the legal regime vs the importance of aquaculture in a particular country. For example, some countries have an advanced aquaculture sector, with virtually no direct legislation on aquaculture; others, on the other hand, may have an elaborate legal regime for aquaculture, but very little aquaculture activity. The preparation of the overviews primary relied on information available from FAO, supplemented by further materials received from a number of sources. The *Cultured Aquatic Species Information Programme* (CASIP), directed at those wishing to gain an understanding of the steps that should be followed to start to raise aquatic species (fish, mollusc, seaweeds and frogs) and learn about current techniques at the global level, provides a general overview of various cultural aspects (e.g. production systems, diseases and control measures, production statistics, market and trade) for the most important species in aquaculture (Fig. 2). A detailed and comprehensive bibliography as well as related links are also included. The main objectives of the programme are:

- improve the knowledge of marine and freshwater organisms of current and potential interest to aquaculture;
- provide and disseminate instruments to facilitate the exchange of information on aquaculture practices used to cultivate certain species with the aim to improve aquaculture data quality; and
- provide global information and a standard template for each cultured species.

It is hoped that an international network of experts (individual or institutes), in partnership with FAO, will become owners of the fact sheets and thus be responsible for providing updates. So far, 26 fact sheets have been developed and will be made available soon. The first series consists of the 40 most commercially important species (Table 2).

Experts who wish to contribute their professional knowledge to the compilation of a fact sheet for NASO or Cultured Species are cordially invited to participate in this endeavour.

Further details can be obtained by writing to Mr Valerio Crespi at FAO/HQ - e-mail: valerio.crespi@fao.org.

Figure 2. Example of a Cultured Aquatic species Information Programme (CASIP) Fact Sheet for the Atlantic Salmon (*Salmo salar)*

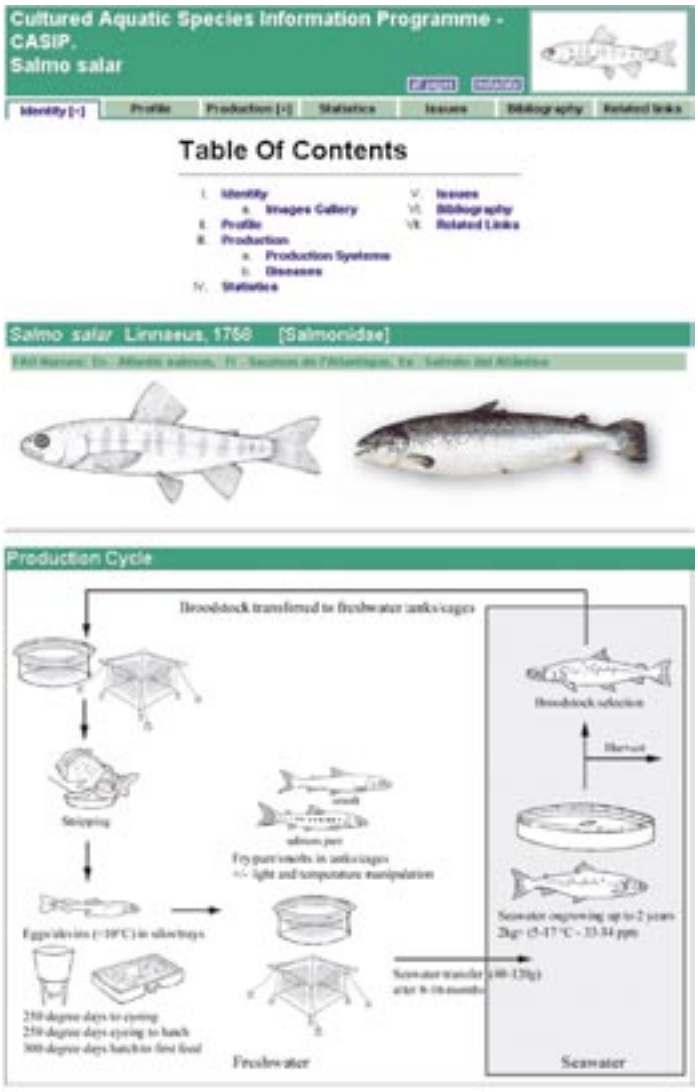


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Table 1. List of the first 40 Cultured Species Fact Sheets

	Common name	Scientific name		Common name	Scientific name
1	Japanese kelp	*Laminaria japonica*	21	Rainbow trout	*Oncorhynchus mykiss*
2	Pacific cupped oyster	*Crassostrea gigas*	22	Blood cockle	*Anadara granosa*
3	Silver carp	*Hypophthalmichthys molitrix*	23	Wakame	*Undaria pinnatifida*
4	Grass carp (= White mur)	*Ctenopharyngodon idellus*	24	Channel catfish	*Ictalurus punctatus*
5	Common carp	*Cyprinus carpio*	25	Chinese river crab	*Eriocheir sinensis*
6	Japanese carpet shell	*Ruditapes philippinarum*	26	Japanese eel	*Anguilla japonica*
7	Bighead carp	*Hypophthalmichthys nobilis*	27	Fleshy prawn	*Penaeus chinensis*
8	Crucian carp	*Carassius carassius*	28	Red seaweeds	*Rhodophyceae*
9	Yesso scallop	*Patinopecten yessoensis*	29	Mud carp	*Cirrhinus molitorella*
10	Nile tilapia	*Oreochromis niloticus*	30	Black carp	*Mylopharyngodon piceus*
11	Laver (Nori)	*Porphyra tenera*	31	Whiteleg shrimp	*Penaeus vannamei*
12	Atlantic salmon	*Salmo salar*	32	Japanese amberjack	*Seriola quinqueradiata*
13	Roho labeo	*Labeo rohita*	33	Giant river prawn	*Macrobrachium rosenbergii*
14	Catla	*Catla catla*	34	Mediterranean mussel	*Mytilus galloprovincialis*
15	Eucheuma cottonii	*Eucheuma cottonii*	35	Coho (= Silver) salmon	*Oncorhynchus kisutch*
16	Mrigal carp	*Cirrhinus mrigala*	36	Mandarin fish	*Siniperca chuatsi*
17	Giant tiger prawn	*Penaeus monodon*	37	Soft-shell turtle	*Trionyx sinensis*
18	White amur bream	*Parabramis pekinensis*	38	Flathead grey mullet	*Mugil cephalus*
19	Milkfish	*Chanos chanos*	39	Green mussel	*Perna viridis*
20	Blue mussel	*Mytilus edulis*	40	Gilthead seabream	*Sparus aurata*

Table 2. List of the top 40 producing countries for which FIRI is preparing the National Aquaculture Sector Overviews and the Aquaculture Legislation Overviews

Rank[1]	Country	2002 (t)	Status
1	China	27,767,251	done
2	India	2,191,704	done
3	Indonesia	914,066	in progress
4	Japan	828,433	..... [2]
5	Bangladesh	786,604	in progress
6	Thailand	644,890	.....
7	Norway	553,933	done
8	Chile	545,655	done
9	Viet Nam	518,500	in progress
10	USA	497,346	.....
11	Philippines	443,319	in progress
12	Egypt	376,296	done
13	Korea Rep	296,783	.....
14	Spain	263,762	in progress
15	France	249,699	.....
16	Brazil	246,183	done
17	Italy	183,962	in progress
18	UK	179,036	.....
19	Canada	172,336	.....
20	Malaysia	165,119	.....
21	Myanmar	121,266	done
22	Russian Fed	101,340	.....
23	Greece	87,928	in progress
24	New Zealand	86,583	.....
25	Iran	76,817	done
26	Mexico	73,675	done
27	Ecuador	70,181	in progress
28	Colombia	65,000	in progress
29	Korea D. P. Rp.	63,700	.....
30	Ireland	62,568	in progress
31	Turkey	61,165	in progress
32	Laos	59,716	.....
33	Netherlands	54,442	in progress
34	Faeroe Is	50,946	.....
35	Germany	49,852	in progress
36	Australia	38,840	in progress
37	Poland	32,709	.....
38	Denmark	32,026	in progress
39	Ukraine	30,819	

[1] Based on 2002 FAO-Aquaculture statistics
[2] Author not yet identified and/or contracted

HAKI

NACEE Directors at the Signing Ceremony of the Founding Document

First Meeting of Directors of the Network of Aquaculture Centres in Central-Eastern Europe (NACEE) Szarvas, Hungary, 21-24 November 2004

Péter Lengyel[1] and Uwe Barg[2]

The First Meeting of Directors of the **Network of Aquaculture Centres in Central-Eastern Europe** (NACEE) was held in Szarvas, Hungary between 21-24 November 2004, hosted by the Research Institute for Fisheries, Aquaculture and Irrigation (HAKI). Twenty-one institutions from 12 countries presented their institutes, their structure, programmes and activities. The objectives and expectations, basic functions, structure, organizational framework, networking mechanisms, contributions by NACEE members and next programme activities of NACEE were discussed and agreed by the participants. A Founding Document, formalizing the establishment of NACEE, was discussed and signed by the Directors of Institute Members of NACEE. The NACEE network membership presently involves 25 institutes from 13 countries of Central and Eastern Europe (see Box on page 14). HAKI at Szarvas was confirmed as the Coordinating Institute of NACEE.

The main purposes of NACEE are to facilitate the effective integration of the aquaculture R&D institutions in Central-Eastern Europe into the European Research Area and to develop an informal, flexible, and highly functional network to accomplish significant goals for aquaculture research and development. The goals of NACEE are to:

1. exchange of information among members (within the region);
2. facilitate the transfer of information relevant to aquaculture development of the region;
3. facilitate exchange of scientists with special regard to young ones;
4. initiate joint research, education and training programmes;
5. facilitate efforts aiming at the better involvement of Central-Eastern European institutions in European-level aquaculture development programmes;
6. assist the organization of regional aquaculture meetings and conferences;

7. facilitate the improvement of partnership between science and practice, with special regard to SMEs and producers associations;
8. enhance the capacity of Central-Eastern European institutions to be able to initiate and run regional aquaculture research and development projects supported by the EU, FAO and other international organizations; and
9. develop collaboration between the "Network" and other regional networks/ organizations with special regard to NACA (Network of Aquaculture Centres in Asia-Pacific).

During the meeting in Szarvas, NACEE Members were informed of, and invited to contribute to, FAO/FIRI's initiatives on the National Aquaculture Sector Overviews (NASOs) and the forthcoming regional and global reviews of aquaculture development trends. It was agreed that the Second Meeting of NACEE Directors should be organized in conjunction with the envisaged FAO Expert Meeting on the Regional Review of Central and Eastern European Aquaculture Development, and that both meetings would be held during 5-9 September 2005.

The initiative to promote the establishment of the NACEE network was started in the context of the European Aquaculture Society (EAS). This initiative has also been presented and discussed in the framework of EIFAC, the European Inland Fisheries Advisory Commission, in particular its Sub-Commission on Aquaculture.

Noting the apparent success of the Network of Aquaculture Centres in Asia-Pacific (NACA), the FAO Committee on Fisheries (COFI) in 2003, and its Sub-Committee on Aquaculture in its Sessions in 2002 and 2003 have reiterated the need for promotion of regional networking and cooperation on aquaculture. Based on these calls, FIRI, servicing the COFI Aquaculture Sub-Committee, has undertaken to support efforts of aquaculture networking in Africa and the Americas, in particular through commissioning of studies on the feasibility of establishing aquaculture networks similar to NACA. In line with these efforts in Africa and the Americas, FIRI is undertaking to support the NACEE regional aquaculture networking initiative in Central and Eastern Europe.

Uwe Barg, FAO

Mr Jiansan Jia, Chief, FIRI, signing the NACEE Founding Document

NACEE Network Members

Members of NACEE

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A view of ethnic minority households along with VAC farming

Gender Roles in Aquaculture: some findings from the Aquaculture Development in the Northern Uplands of Viet Nam Project

Md. Ghulam Kibria[1]

Introduction

Recently, an important pilot project **"Aquaculture Development in Northern Uplands"** (VIE/98/009/01/NEX) was completed. This project was an example of efficient cooperation between the Ministry of Fisheries of the Socialist Republic of Viet Nam, provincial authorities of Son La, Lai Chau and Hoa Binh provinces, the Research Institute for Aquaculture No. 1 (RIA 1), the United Nations Development Programme (UNDP), and the Food and Agriculture Organization of the United Nations (FAO). It aimed at alleviating poverty in the three provinces by diversifying rural development through: (a) the promotion of sustainable aquaculture activities; (b) building capacity of the local population and project staff in addressing household food security issues; and (c) reducing malnutrition of disadvantaged ethnic minorities and especially women. The project gave high concern towards the empowerment of women – their families, the communities and the whole society - mainly through prioritizing gender education and women's involvement in all activities of the project. The specific approach of the project included resource assessments, participatory planning and implementation of an action plan for the development of aquaculture activities. Based on the findings of the project, extension network was strengthened and the delivery of the extension services improved. In addition,

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The project woman Result Demonstration Farmer (RDF) is feeding in her fishpond in Hao Ly commune under the Hoa Binh province

a micro-credit and savings scheme were established to provide direct support, to the upland ethnic minority farmers living in remote and isolated areas, for aquaculture activities. A total of 50 communes from 3 pilot provinces were covered under the project. One hundred and fifty one Result Demonstration Farmers (RDFs) and more than 5 900 poor ethnic fellow farmers (FFs) were involved in the extension of the aquaculture models produced by the project. These RDFs and FFs included people involved in various aquaculture activities such as grow-out, hatching, nursing and integrated farming methodologies (e.g. VAC (integrated agriculture-aquaculture-livestock), rice-fish, and cage culture farming).

Gender Roles

Fish farming in the uplands was traditionally viewed as a male activity. Women were only slightly involved, had no say in what techniques to be used, nor investments to be made nor ideas on how benefits could be increased. Project intervention, through a training course on "Aquaculture Techniques" for ethnic women at commune level, increased their awareness on pond, cage and rice-fish culture techniques**.** These women learned how to identify the pros and cons of aquaculture, including issues such as household nutritional status and income, division of labour between man and women, potential use of by-products, and time available for social/community activities.

A gender evaluation study among the project beneficiaries at the project area showed (Table 1) that women play a vital role in aquaculture activities, although they are not involved in any activity without the support from the men. Nevertheless, in areas such as marketing, feeding and fertilization, women are significantly more involved than men. Aside from household work, many women are involved in aquaculture activities and other on-farm activities (such as arable farming and animal husbandry). The total time spent by women in aquaculture production were found to be generally comparable to the time spent by men. Nevertheless, the power of women in decision making was much lower.

Table 1. Aquaculture division of labour within a family in the project areas

Tasks	Men	Women	Children
Pond dyke construction	√		
Feeding	√	√	√
Water draining	√		
Drying pond bottom	√		
Liming	√	√	
Stocking	√		
Fertilization	√	√	
Fish health check & disease control	√		
Harvesting	√	√	√
Marketing	√	√	

Source: Authors' field survey, 2000-2002

Figure 1. Ratio of men and women participation in the project training course on aquaculture techniques

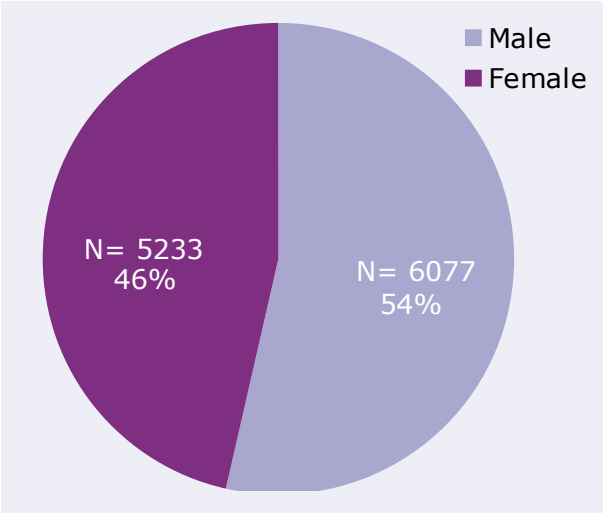
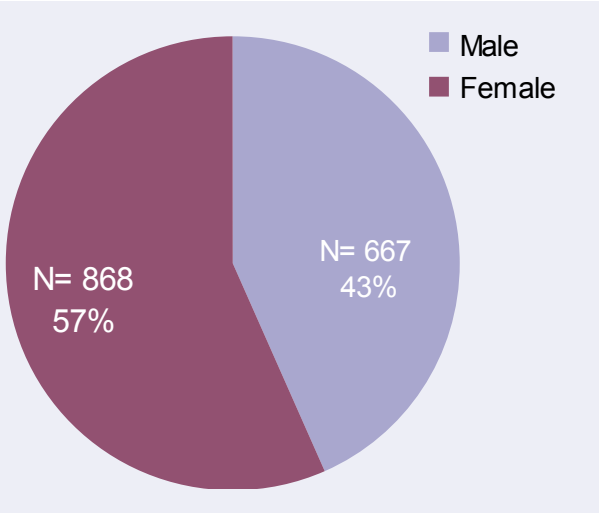


Figure 2. Ratio of men and women participation in the project training course on micro-credit and savings



By emphasizing the need for capacity building of women, for example, in aquaculture techniques (Fig. 1) and micro-credit (Fig. 2), and increasing their access to credit via the Viet Nam Women's' Union (VWU), the project empowered these women significantly. Their opinions were taken more seriously within their households and within the community. Participation in meetings, workshops and study-tours supported their self-esteem, decreased their feeling of being dependents, and increased their interest in aquaculture and the opportunities it can provide in terms of income, and access and availability of good quality food for household consumption.

Lessons learned from the project

Important lessons learned from this project include:

1. Gender roles are important to aquaculture development and participation of both men and women is essential for sustainable development of the sector.

2. Existing community-based mass organizations, such as the VWU should be used as much as possible, and setting up parallel structures should be avoided. The VWU was an efficient partner who assisted in the management of the micro-credit/savings scheme training course and implemented the credit scheme smoothly and effectively during the project period. Access to the micro-credit scheme was related to women participation in the training courses on aquaculture techniques micro-credit. Thus, capacity building ensured successful results of the micro-credit scheme. Repayment ratios of 100% were obtained in most of the communes.

3. The application of participatory planning exercises allows local people to become more perceptive and responsible for their own resources. The use of a range of criteria and participatory methods makes it possible to identify different types of poor people, who could be targeted inclusively rather than exclusively, thus, ensuring that the benefits reach them most effectively.

4. Group formation, with support of mass organizations, allows backward communities to get a voice at the national level. The various groups established under the project advocated the importance of aquaculture in rural development, poverty alleviation and women empowerment, and played an important role in mobilizing external support.

5. Partnerships between key institutions active in the field of aquaculture with institutions from other sectors should be promoted as much as possible, to create a base for development and mutual understanding of what specific activities can or cannot contribute to the rural development.

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6. On-farm training made aquaculture more accessible for women; brought information and skills to both male and female farmers (especially low-investment, low-risk, small-scale, low-technology, low-input aqua-culture practices).

7. In the development of extension and training materials and tools, gender issues should also be taken into consideration.

Apart from all the above, the project confirmed a widely-known Viet Namese proverb:

"To be rich – raise fish,
to be poor – play cards"

Photo top left: A project official demonstrating a rice-fish farming technique among the project farmers where more than 50% are women from the project area.

Photo top right: A view of a newly built house belonging to a woman member of the RDFs.

Photo below: A view of smiling harvesting fish farming group of the project (with minimum participation of women).

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STOCKING OF OXBOW LAKES IN SOUTHWEST BANGLADESH AND ITS IMPACT ON BIODIVERSITY AND ENVIRONMENT

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It is generally agreed that any significant increase in yield from inland capture fisheries can possibly be achieved from fisheries enhancement activities. Fisheries enhancement through stocking often synonymously used as "culture-based fisheries" is one of the most commonly practiced management interventions in lakes, reservoirs and floodplains in different parts of the world to augment fish production. In culture-based fisheries, the young fish are regularly stocked in open or semi-closed waters and recaptured at a larger size without aiming to establish a self-recruiting population. The stocking size of fish will generally vary depending on the type of water bodies to be stocked and the fish species being raised while the harvest size will greatly be influenced by the market demand and the consumption pattern of fish in the locality/region.

Bangladesh has the rich and diversified history of fisheries enhancement through stocking, dating back to early sixties when the Bangladesh Fisheries Development Corporation (BFDC) initiated the stocking programme in Kaptai Lake (largest man-made reservoir in Bangladesh). Further, over the last two decades or more (1978-2004), the government's Department of Fisheries (DoF) implemented a number of development projects dealing with floodplain stock enhancement and culture-based fisheries management with variable success.

Culture-based Fisheries Management in Oxbow Lakes

Oxbow lakes (local name: baors) are semi-closed water bodies, which occupy the dead channels of the rivers in the moribund delta of the Ganges. An oxbow lake normally is still part of the floodplain of the river, to which it is connected by inlets and outlets. During dry season, most of the oxbow lakes become converted to fully closed water bodies. There are approximately 600 oxbow lakes in southwest Bangladesh with an estimated combined water area of 5488 ha. Most of the oxbow lakes are located in five districts of southwest Bangladesh (Khulna division: Jessore, Jhinaidah, Chuadanga and Kushtia districts and Dhaka division: Faridpur district). It is generally estimated that around 14 000 fishers (2.5 fishers/ha water body) are directly involved and nearly 70 000 rural people are the direct beneficiaries of this fishery (Hasan, 2003).

Fish culture in oxbow lakes is a practice by which an open water fisheries is converted, by screening the inlets and outlets, into a culture-based fisheries. This culture-based fishery as practiced in Bangladesh essentially includes fingerling stocking, fish harvesting and regular deweeding. The fisheries management of oxbow lakes can, therefore, be summarized as stock management, species management, fishing effort management, and organizational/infrastructural support. Three species of Indian major carps (*rohu Labeo rohita*, *catla Catla catla* and *mrigal Cirrhinus cirrhosus*,) and three Chinese carps (silver carp *Hypophthalmichthys molitrix*, grass carp *Ctenopharyngodon idella* and common carp *Cyprinus carpio carpio)* are regularly stocked and harvested.

Six oxbow lakes were brought under culture-based fisheries management (CBFM) during Phase I of the Oxbow Lakes Development Project (OLP I, 1978-1985) and further twenty lakes were brought through Phase II of the Oxbow Lakes Small-Scale Fishermen Project (OLP II, 1988-97) (Hasan, 2001). Six oxbow lakes brought under CBFM are presently

A schematic drawing of an oxbow lake to show the screening of its inlets and outlets (after OLP II, 1997b)

Mohammad Hasan, FAO

A young girl and a woman collecting water chestnut from a floodplain, Rangpur, Bangladesh

managed under direct supervision of the DoF with a reported average yield of 403 kg/ha during 1995-96 (Sattar and Khan, 1997). During OLP II, the average yield of stocked carps of 20 oxbow lakes under culture-based fisheries management increased from 121 kg/ha/year in 1991-92 to 700 kg/ha/year in 1996-97 (Hasan and Middendorp, 1998).

Traditionally, oxbow lakes and other similar water bodies have been used as common property resources, allowing unrestricted access to members of the surrounding communities. Although open access to water bodies is not conductive to sustainable management, mass participation can still be achieved through participatory management. The OLP II successfully transferred and institutionalized the fisheries management to the fishers themselves by ensuring their participation in the management process, through guaranteeing long-tern security of tenure and by developing appropriate institutions for implementation of the biological and social tools (Middendorp *et al*., 1996; Apu *et al.,* 1999; Hasan *et al.,* 1999a). Stocking process initiated through the OLP-II intervention has continued to be implemented in most lakes until now by the fishers/ groups controlling the lakes; sustainability of co-management of oxbow lakes fisheries remains to be evaluated in many cases after the project support was withdrawn in 1997. There has been an indication that in many of the oxbow lakes, brought under culture-based fisheries during OLP-II, institutional management (e.g., leadership rotation, share of the cost and benefits among the fishers) are not effectively working as envisaged.

The biological sustainability of stocking of culture-based fisheries in oxbow lakes has been demonstrated from a recent investigation carried out in 15 lakes by Hasan & Talukder (2004). Mean data of 15 oxbow lakes for two years (2001-02 and 2002-03) showed that stocking density ranged from 1 672 to 9 621 fingerlings/ha and the yield ranged from 91 to 1 465 kg/ha. Average carp yield was 663 and 762 kg/ha in 2001-02 and 2002-03, respectively, which compares favourably to that achieved during the OLP-II intervention period (Hasan & Middendorp, 1998; Hasan *et al*., 1999b; OLP II, 1997a; Hasan & Talukder, 2004a).

Impact of Stocking on Biodiversity and Environment

Oxbow lakes are the natural habitat and breeding ground of different indigenous fishes, which are naturally occurring fish species other than major carps. Non-stocked indigenous fishes available in oxbow lakes consist mainly of clupeids, catfishes, goby, perches, minor carps, minnows, snakeheads, mullets, pipe fishes, loaches, eels, freshwater prawns and other naturally occurring group of fishes (Haque

et al., 1999a; Hasan & Talukder, 2004a, b). These fish are generally harvested freely by the rural poor living around these water bodies and provides an important part of the protein in their diet.

Although biological sustainability and cost-effectiveness of stocking programme in oxbow lakes has proven to be sustainable, concern has often been raised about the ecological and social equity implications (Minkin & Boyce, 1994; Naqui *et al*., 1994; Rahman *et al*., 1999; Hasan, 2001). There is apprehension that the introduction of large-scale stocking of carps in the oxbow lakes might have imbalanced the lake ecosystem and lake biodiversity leading to an adverse impact on non-stocked indigenous fish (Ali, 1997). Eventhough the importance of environmental and biodiversity issues has been recognized for the eventual sustainable management of culture-based fisheries, the overriding concern of all stakeholders towards increasing the fish yields and sharing the benefits in a socially equitable manner often obscured the necessity for environmental protection. Middendorp & Bala (1999) listed three major types of environmental degradation of oxbow lakes. These are: (a) non-reversible environmental degradation caused by agricultural encroachment in the shallow fringe land of oxbow lakes, construction of embankments around the oxbow lakes to prevent stocked carps from escaping and unplanned construction of fish ponds in the fringe lands of lakes for fingerling raising; (b) environmental impacts of agricultural intensification caused by the increased use of pesticides in the paddy fields around the oxbow lakes; and (c) impacts of culture-based fisheries management resulting from large-scale deweeding and fingerling stocking.

So far only few studies report the impact of the stocking and related management measures on the environment and biodiversity of oxbow lakes and floodplains (FRI, 1996; Haque *et al*., 1999a, b; Hossain *et al*., 1999). Hossain *et al* (1999) reported a limited impact study of carp stocking on fish species diversity in three selected floodplains stocked under the Third Fisheries Project (TFP) and noted that Shannon-Weaver biodiversity indices calculated for three floodplains did not indicate any loss of fish biodiversity in terms of richness and evenness due to stocking. However, the stocking density used by TFP ranged between 14.4 and 24.3 kg/ha (Islam, 1999) which is apparently lower than the minimum stocking density normally used in most of the oxbow lakes.

Haque *et al*. (1999a, b) conducted a preliminary investigation on the impact of carp stocking on the biodiversity, yield and recruitment of non-stocked indigenous fish species (NIFS) and their contribution to the total fish production in oxbow lakes under culture-based fisheries management. The investigation showed that the oxbow lakes with stocking density ranging from 2 500–3 000 fingerlings/ha/year apparently did not affect yield of NIFS when compared with oxbow lakes with no carp stocking. The above preliminary findings thus indicated that subsistence fishing might not have been affected in case of lakes with low-density carp stocking. In contrast, the yield of NIFS was adversely affected when some of the oxbow lakes were multi-stocked with a stocking density of 2 000-3 000 carp fingerlings during each stocking period, the annual stocking

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A fisher with his catch of non-stocked indigenous fish using box trap from a oxbow lake, Jessore, Bangladesh

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An oxbox lake with partially broken metallic screen in the outlet, Jessore, Bangladesh

M. Kamal, (Mymensingh, Bangladesh)

Fishing in oxbow lake using purse-seine net, Jhenaidah, Bangladesh

frequency being 4 to 5. Haque *et al*. (1999b) further reported 43 species in two OLP lakes with high stocking density, 58 species of fish in two OLP lakes with low stocking density and 60 species in two control lakes (no carp stocking) in 1997-1998.

Based on the findings of studies carried out by Haque *et al*. (1999a, b), a further detailed study on the impact of level and periodicity of carp stocking on yield and species diversity of non-stocked indigenous fish species (NIFS) was carried out in nine selected oxbow lakes with different stocking and harvesting regimes (Hasan & Talukder, 2004a). These management regimes include high, moderate & low stocking, multiple, continuous & single stocking, continuous and periodic harvesting.

The lakes have been categorized as high, medium and low stocking regime based on the history of their stocking density over the past seven years (1994-2003) (Table 1). Stocking data for 1999-2000 and 2000-2001 were not available and therefore were not included for analysis of stocking history.

As presented in Table 1, Nasti, Porapara and Marufdia lakes were considered to be high stocking density lakes where the average stocking density over the past seven years ranged between 4 560 and 5 982 fingerlings/ha; Saster, Benipur and Kaliganga have been categorized as medium density lakes where stocking density ranged between 2 796 and 3 961 fingerlings/ha while low density lakes Bukbhara, Khatura and Bahadurpur had the average stocking density which ranged between 1 856 and 2 133 fingerlings/ha. Species diversity (no. of species) and estimated yield (kg/ha) of these studied lakes during the study period (August 2002 – July 2003) are given in Table 1. For comparison of species richness between high, medium and low density lakes, data were further analyzed to show the species assemblage by common groups of related fish and prawn species (Figs. 1, 2 and 3). The results and observations as summarized by Hasan & Talukder (2004a,b) are as follows:

- Yield of non-stocked indigenous fish in the nine selected lakes varied between 65 kg/ha (Sastar) and 407 kg/ha (Bukbhara).

Table 1. Seven years (1994-2003) stocking density of stocked fish and NIFS yield and species diversity in nine oxbow lakes during study period (August 2002 to July 2003)

Sl. No.	Lakes	SWA (ha)	NIFS (kg/ha)	Diversity (no. of species)	Stocking density (nos./ha)							Av. SD*
					1994-95	1995-96	1996-97	1997-98	1998-99	2001-02	2002-03	1994-2003
1	Nasti	54	98	21	1,504	5,496	9,018	8,607	3,270	5,993	2,119	5,144
2	Sastar	140	65	24	844	1,732	4,639	3,616	2,475	3,514	2,756	2,797
3	Porapara	88	66	23	1,782	3,743	4,008	7,210	5,637	6,977	2,565	4,560
4	Benipur	45	217	37	1,345	4,806	3,795	3,136	4,029	4,636	5,979	3,961
5	Marufdia	25	181	18	2,677	7,263	4,994	8,082	6,210	4,893	7,754	5,982
6	Bukbhara	138	407	39	2,601	2,049	1,193	1,355	2,045	2,804	1,377	1,918
7	Khatura	69	100	38	35	3,054	6	2,816	3,740	2,992	352	1,856
8	Bahadurpur	110	257	43	751	4,691	2,710	178	1,992	1,803	2,808	2,133
9	Kaliganga	15	142	22	2,088	1,870	1,837	2,968	2,765	4,142	3,905	2,796

**Average stocking density; the recommended fingerling stocking size varies between 10 and15 cm (weighing about 30-40 g) depending on the fish species stocked.*

- Except for Kaliganga Lake in Kushtia, the single dominant species was Indian River shad (local name: chapila), *Gudusia chapra*, accounting for 10.75 to 72.37 percent of total NIFS catch. The other dominant species harvested by different gears were giant river catfish (*Arichthys seenghala*), a variety of prawn species (Macrobrachium spp.), tank goby (*Glossogobius giurus*), glassy perchlet (*Parambassis spp*.), barb (*Puntius spp*.), snakehead (*Channa spp*.), catfish (*Mystus spp*.), freshwater eel (*Mastacembelus* and *Macrognathus spp*.), mola carplet (*Amblypharyngodon mola*) and Gangetic leaffish (*Nandus nandus*).

- The species diversity varied between lakes and the maximum of 43 species was recorded in Bahadurpur Lake and 18 species in Marufdia Lake.

- In lakes where high stocking densities (≥5000 fingerlings/ha) have been used over the last 7 years, the number of NIFS recorded during the study period were between 18 and 23 (Marufdia, Nasti and Porapara Lakes), and where the average stocking densities were ≤2000 fingerlings/ha, species diversity varied between 38 and 43 (Khatura, Bukbhara and Bahadurpur Lakes).

- Higher yield and biodiversity of NIFS were associated with lakes rich in submerged aquatic vegetation.

- Intensively managed (with high density stocking) culture-based fisheries in oxbow lakes led to the restriction of community access for subsistence fishing.

Although the trend is not very conclusive, the study indicates that high density (≥5000 fingerlings/ha) multiple stocking and continuous harvesting practised for longer duration (≥7 years) in some of the lakes have apparently led to the reduction of yield and biodiversity of non-stocked indigenous fish.

Figure 1. Species assemblage by common groups of related fish and prawn species in three lakes with high stocking density maintained during last 7 years. Data collected from August 2002 to July 2003

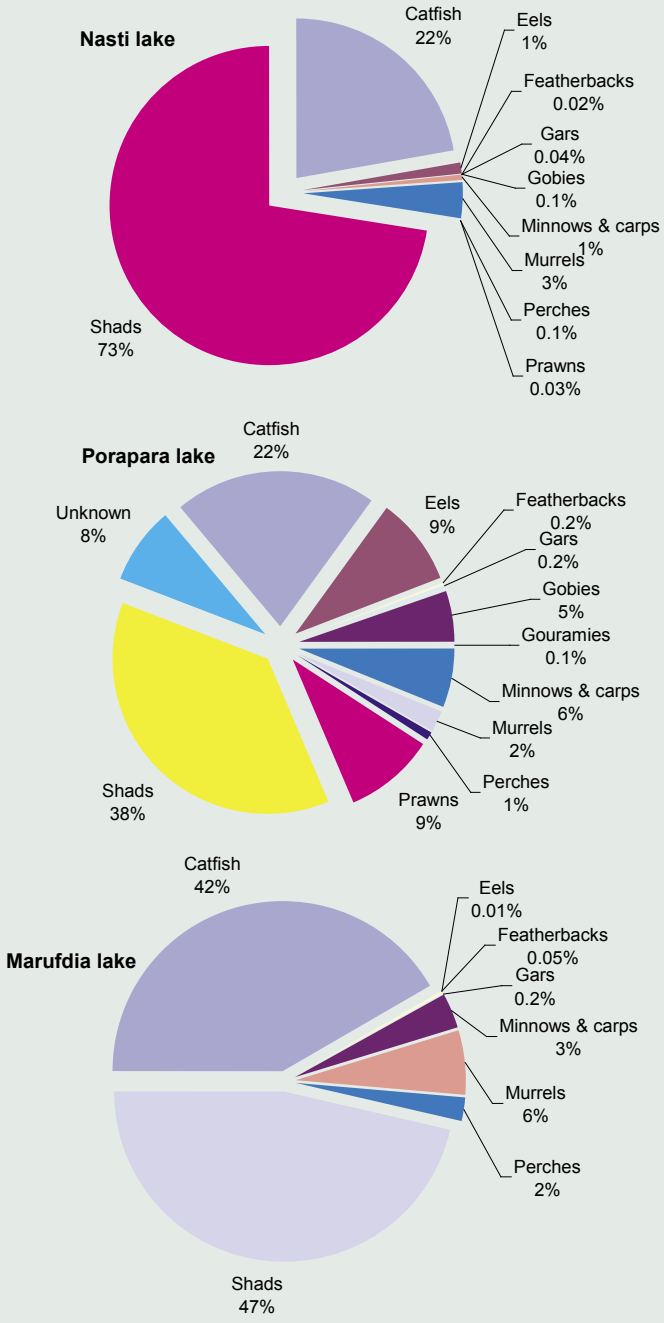


Figure 2. Species assemblage by common groups of related fish and prawn species in three lakes with medium stocking density maintained during last 7 years. Data collected from August 2002 to July 2003

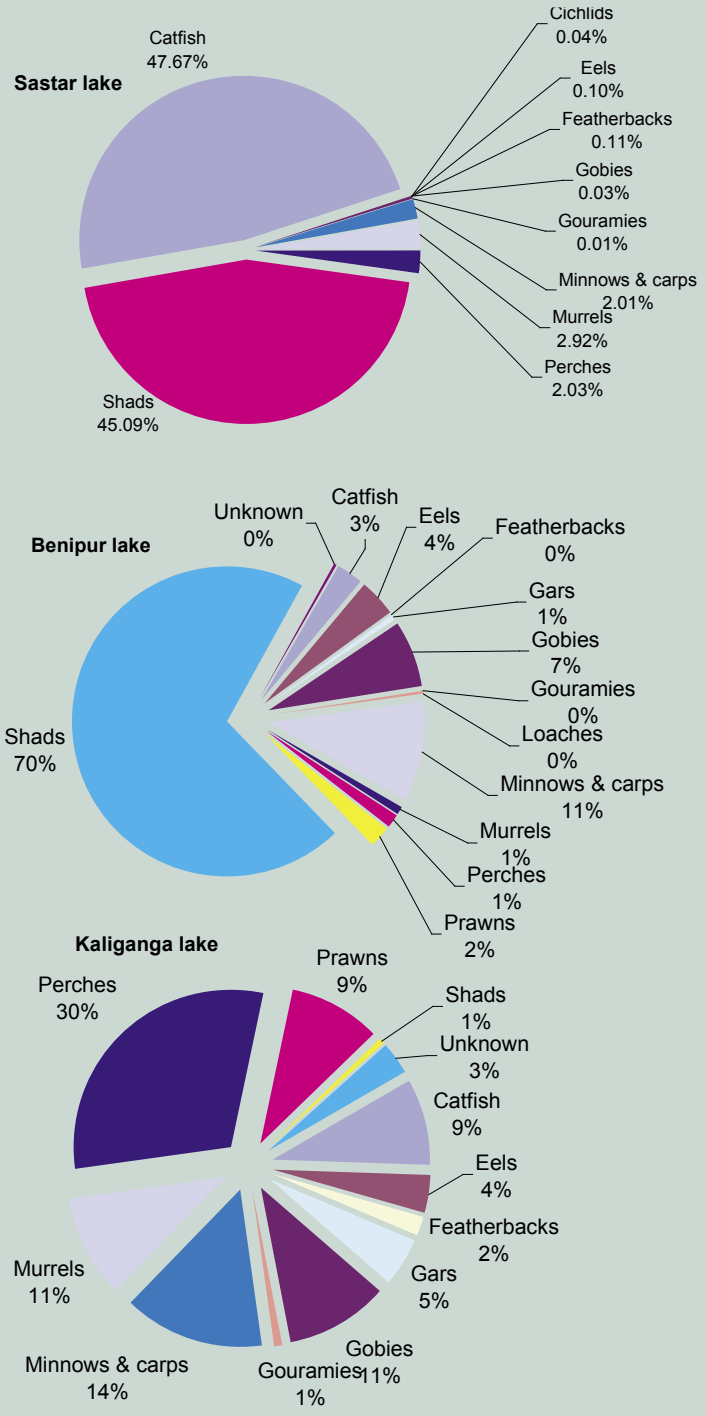
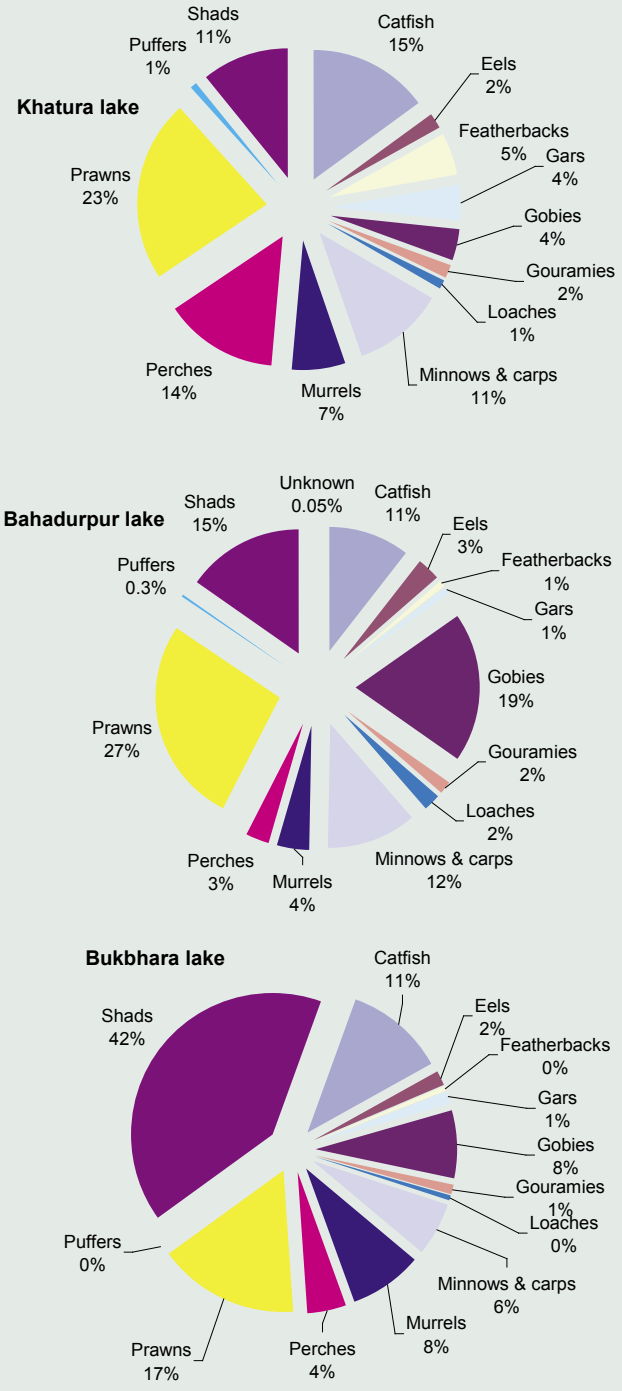


Figure 3. Species assemblage by common groups of related fish and prawn species in three lakes with low stocking density maintained during last 7 years. Data collected from August 2002 to July 2003



Conclusion

The major concerns for culture-based fisheries in oxbow lakes, semi-closed beels (=natural depressions in floodplain) and similar other waster bodies are listed below:

a. Restriction on the community access once the water bodies are leased to a group of fishers/society for culture-based fisheries management (CBFM). This eventually deprives the community from subsistence fishing thus depriving them from probably the only source of protein they have been getting for generations.

b. With apparent profitability as demonstrated through stocking, there has been a general tendency for government agencies to declare "an open access fishery (e.g., beels, oxbow lakes, dead rivers)" to "closed or semi-closed fishery" for the sole purpose of leasing to the influentials/elites, the ultimate objectives were to generate revenue and other associated benefits. Leasing of these open access fishery thus prevents the poorer section of the community from subsistence fishing.

c. Once closed and semi-closed water bodies are brought under CBFM, water bodies are cleared of aquatic vegetation thus depriving the poorer section of the community from their share of aquatic plants they have been using as food, fuel, fodder, etc.

d. Except for lakes managed with very high stocking density, stocking itself may not be main reason for the loss of biodiversity as has been reported (Haque *et al*. 1999a, 1999b, Hossain *et al*. 1999; Hasan & Talukder 2004a, b), but the practices associated with stocking may lead to such loss. For example, cleaning of aquatic vegetation leads to a general reduction in abundance and diversity of plant species, followed by habitat loss for certain small indigenous fish. This may lead to loss in biodiversity and/or changes in the species composition. Further drying of aquatic habitats for complete harvest of the stocked fish before new stocking, may also lead to the loss in biodiversity. Oftentimes, these water bodies are leased to the groups or the individuals for a particular time period and it is a general practice for the lease holders to harvest the water body completely by any means before it is leased to someone else.

Based on the foregoing discussion and observations, the following two recommendations are made:

a. There should be clear policy guidelines so that water bodies brought under culture-based fisheries management (CBFM) through stocking do not restrict community access to subsistence fishing of non-stocked indigenous fish.

b. Stocking programmes should consider as essential the rational balance between increasing fish yield and maintaining environmental integrity of the water body brought under CBFM. This is to ensure that high stocking density and associated management practices does not lead to loss of biodiversity and decrease the yield and abundance of non-stocked indigenous fish.

Nevertheless, with all its perceived negative impacts on social equitability and biodiversity, stocking and such interventions has positive impacts in addition to the increased production. If a wetland does not provide a measurable economic benefit, wide adoption of crop production in the wetland area is likely to take place, which may eventually lead to the destruction of aquatic habitats. Over the last few decades a major change has occurred in the quality of floodplain environments, as many typical wetland areas as well as grazing pasture lands have been converted into rice fields (Nuruzzaman, 1998). Therefore, rational management of oxbow lakes, semi-closed beels and similar water bodies through stocking and other interventions (e.g., sanctuaries, habitat restoration) may be encouraged within the broader framework of aquatic resource management.

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Mohammad R. Hasan, FAO

A fisher with his catch of small prawn, Jessore, Bangladesh


Mohammad R. Hasan, FAO

An oxbow lake partly covered with water hyacinth, Jessore, Bangladesh

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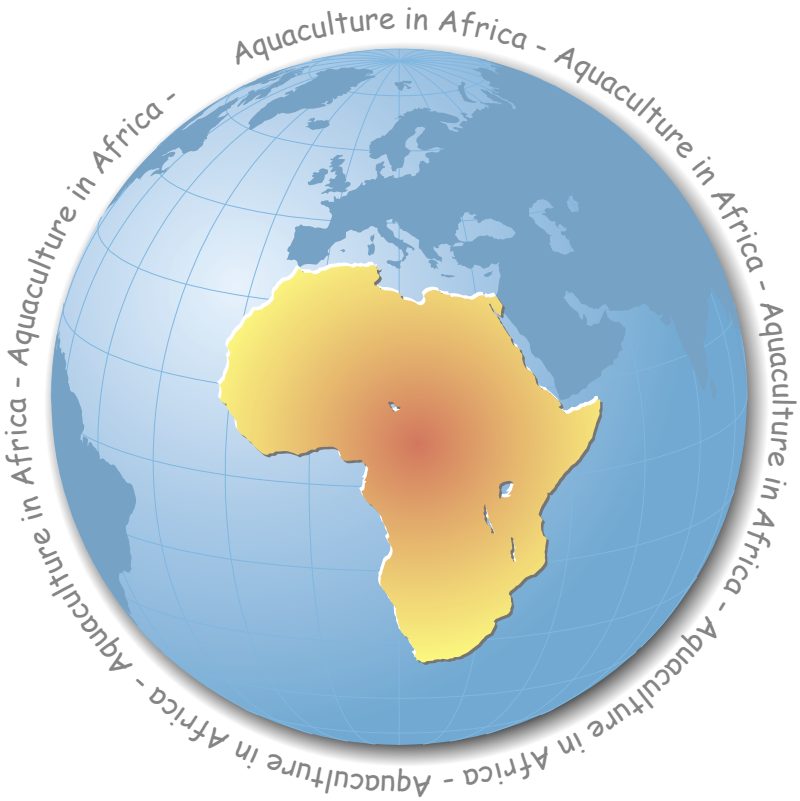

Aquaculture Extension in Sub-Saharan Africa

John Moehl[1]

As part of a regional review of aquaculture being undertaken by the Food and Agriculture Organization of the United Nations (FAO) Regional Office for Africa in Accra, Ghana, a review of the recent history of aquaculture extension in five representative countries of sub-Saharan Africa was undertaken. The activity was initially done in collaboration with the World Fish Centre (WFC) with the original text prepared by Mr R. E. Brummett and V. Poumogne. This text was revised by Mr A. E. Coche and is now available as FAO Fisheries Circular No. 1002. In this process, country reviews were commissioned, analyzed and synthesized. A number of extension guides, field manuals and dissemination tools were compared.

Each of the reviewed countries has a similar history of aquaculture development, beginning with colonial experiments in the 1950's, through a period of neglect following independence in the 1960's, a period of intense international involvement in small-scale rural development (including aquaculture) in the 1970's and 1980's ending in a period of reflection on results in the 1990's. Many of these past projects were driven by foreign donors interested primarily in poverty alleviation and working on the basis on national food security targets, ignoring the desires and constraints faced by would-be producers and beneficiaries. Working within the broader context of rural development, rather than the somewhat simpler world of commercial aquaculture, technology has created problems for poorly trained and motivated extension agents. New participatory paradigms have been incorporated into policy and planning, but are generally not reflected in the day-to-day work of either research or extension, leading to low rates of adoption and project sustainability.

As the predominant research/extension methodology in sub-Saharan Africa, the Training and Visit (T&V) approach must be considered the baseline against which to compare and contrast newer approaches. The T&V approach relies heavily on good quality and properly equipped extension staff that can transfer technical information generated at research stations or universities to less well educated farmers. These extension agents must be able to read technical journal articles and then condense the key elements based on personal experience with local farm conditions into information packages that are understandable by farmers.

Unfortunately, this critical component of the system is usually lacking or available only for short periods of time while donor-supported projects are fully functional. Only a complete reform of the extension service that would substantially improve remuneration packages and reward extension agents for success by promoting them within the field of extension rather than moving them up and away from contact with farmers is likely to render this system functional. Cosmetic alterations based on short-term, in-service or overseas training have made no fundamental changes to the productivity of aquaculture extension.

On the other hand, progress has been made in several countries based on a re-structuring of the relationship between research, extension and farmers. In Madagascar, instead of attempting to directly assist large numbers of small-scale rice farmers to add fish, attention was focused on a much smaller number of individuals who: 1) had some experience with aquaculture, 2) had some education and capital assets, and, 3) were interested in assisting their fellow farmers. Working with these individuals was much easier and more effective because the number of extension agents could be effectively reduced and those remaining were better trained and equipped. With this approach, both numbers of farmers and production per farm has increased, albeit at the cost of a relatively long-term commitment from external donors.

In Zambia, a longer-term commitment to participatory development paradigms has paid off in terms of steady, if not staggering, progress. Without large training or equipment budgets, highly generalized and relatively simple technology was easier for extension agents and impoverished farmers to implement. This focus on process rather than technology is now coming to the fore in many countries. However, most of the gains have been in terms of numbers of farmers, each of whom produces relatively few fish with minimal overall impact on national poverty alleviation and food security objectives.

A third approach that has shown promising results in Cameroon is based on the adaptation of more advanced technology to increase both adoption and yield, while remaining within the national budget. In this system, researchers who normally concentrate on controlled experiments and journal articles, are attached to small teams of extension agents who carry-out participatory trials and/or experiments aimed at adapting aquaculture to fit specific farming situations. Rather than working with farmers to comprehend complex systems and then adopting them wholesale, participatory research is evolutionary and comes up with a slightly different technology for each farm. This approach can be highly flexible and usable under a wide range of conditions. By enlisting the direct engagement of researchers, the cost of the overall extension system is somewhat higher, but only marginally so when compared to the low cost-effectiveness of the T&V system currently in place.

Based on this review, a number of key issues have been identified that should be considered when planning aquaculture development:

- Accurate and current information on aquaculture technology must be available to research and extension. Libraries and information access are crucial components.
- General extension materials have limited usefulness for extension. More illustrations make them better for farmers, but the emphasis should be on adaptation of technology rather than memorization.
- If credit is a constraint, commercial bankers and/or local credit agencies should be enlisted as partners; extension *per se* should not be engaged in allocating or monitoring credit.
- Research must be actively engaged with both farmers and extension agents to ensure that: 1) research relevant to user's needs is being conducted; and 2) the best available information and technology are made available to farmers.
- Experiential learning and participatory methods can be effectively used to improve the adoption of technology and should be compared for cost-effectiveness.
- Rural development is good for business and opportunities should be found to link the private sector with public development goals.

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The Limbé Workshop on Small-scale Aquaculture and the Limbé Declaration

John Moehl[1]

John Moehl

Small-scale systems can be very extensively managed and in the forest zone have native vegetation encroaching closely on the levees

In response to an increasing interest in sustainable aquaculture among governments and international donors, FAO, with the collaboration of the World Fish Center, organized a regional workshop on the subject of small-scale aquaculture. The workshop was held in Limbé, Cameroun, in March 2004. The principal objective of the workshop was to develop a consensus on the current status and way forward for small-scale aquaculture in Africa. With this aim, the participants reviewed how aquaculture is targeted in sub-Saharan Africa as a first step in the identification of appropriate extension approaches and production strategies that would suit the various technology user-groups.

The workshop assembled representatives of senior fisheries management agencies from nine countries in the region to discuss progress, opportunities and key constraints to aquaculture development. Through thematic presentations, working group sessions and plenary discussions, broad consensus was achieved on the way forward for African aquaculture. In an effort to realize the goals of aquaculture, an attempt was made to develop a set of practical guidelines that can be used by national governments to insure that the major constraints are being addressed and that the major opportunities for aquaculture are capitalized upon to increase the contribution of aquaculture to food security and economic growth. The participants elaborated the ***Limbé Declaration*** (see Box 1) to encapsulate this pioneering approach to aquaculture development in the African region.

This Declaration was influenced by the key lessons learnt identified by the workshop, which include:

- Fish culture can be introduced and established in new sites without any external assistance beyond the provision of technical information (e.g. no credit, gifts, incentive, subsidies, etc.);
- Aquaculture development projects are generally of too short a duration (1 or 2 years); and,
- Most recent aquaculture development projects have usefully and successfully taken socio-economic aspects into consideration in project design and implementation.

The workshop concluded that farmers with a commercial orientation were the "motors" of aquaculture development. For these producers to function in this essential way, they must have a critical mass – this is a density dependent factor requiring an economically viable "weight" (e.g. surface area, tonnage, etc.) be present in an economically viable zone. Viable commercial producers will pull-down benefits to non-commercial framers who will inevitably share the same economic zone.

While many early aquaculture development theorists felt the successful establishment of aquaculture enterprises was best be reflected by a continuum along which a given framer would move, aquaculture development is now not seen as a series of vertical leaps as farmers reach higher and higher levels of production. It is rather viewed as a set of discrete enterprises where the farmers' motives for adoption remain basically the same and increases are only those that can be easily obtained within the specific range of production technologies near the level where the farmer entered. In this context, it is understood that the delineations between classifications of producers require knowing enough about farmers' motives; this in turn needs a new set of priorities and methodologies for those whose objective is to aid these farmers in gaining efficiency. For these reasons, the revised title to the workshop became: ***Small-scale Aquaculture in sub-Saharan Africa: revisiting the aquaculture target group paradigm*.** For a more focused and efficient developmental approach, farmers should no longer be viewed chiefly from a perspective of size, scale or even intensity. The critical aspect is the producer's motivation and ability to invest in aquaculture as a viable economic enterprise, regardless of its scale.

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Small-scale aquaculture systems can be very extensive, such as small ponds used in seed production enterprises (Madagascar)

John Moehl

Small-scale systems can be integrated with a variety of other plan and animal crops, here with a chicken coop built over the fishpond (Cameroon)

Box 1: Limbé Declaration

Aquaculture development in sub-Saharan Africa is at a crossroads. Burgeoning population growth and declining natural sources of fish make it imperative that aquaculture make as substantial contribution to continental fish supply as possible. The region is the only one in the world where per capita fish consumption is declining and is project to decline further. Reasons for this situation include: civil conflict, weak management structures, low levels of investment in rural economies and lack of economic growth. At the same time, however, new opportunities exist that brighten the prospects for aquaculture development.

In many countries, policies of privatisation and decentralization provide incentives for increased investments in the sector from private and public sources as domestic markets, especially in urban areas, become more accessible and trade expands. At the global level, the ever-growing demand for fish has created opportunities for export-oriented aquaculture production. The challenge today is to make use of these opportunities for the sustainable development of aquaculture in the region. There is a need for a type of development that contributes to national food security and poverty reduction objectives and pays attention to the scope for expansion that the nature resource base allows.

Sub-Saharan Africa must, therefore, make a choice, either for "business as usual" and things continue as they are, and people live with the dire consequences, or it is "time to make hard choices", institute relevant policies and strategies, bring aquaculture into the formal cash economy and stem the tide that is undermining aquaculture's future. To this effect, many governments, cooperating partners as well as bilateral and multilateral development agencies are developing a new strategy for aquaculture development in sub-Saharan Africa.

The meeting recognized a number of constraints to the development of aquaculture, which include seed and feed production, as well as inefficient extension and outreach. The delegates to the workshop further acknowledge that:

• Support to a knowledge development and delivery structure to provide essential assistance for aquaculture from government and those providing external aide requires convincing demonstrations of impact on national development priorities such as poverty reduction, food security, nutrition, HIV/AIDS and sustainable environmental management;

• Institutional stability and durability will be achieved through structures that rely first and foremost on private sector investments as well as on output-orientated and accountable use of public revenue which aims at enhancing sustainable development of aquaculture; and

• Public/private partnerships between investors and knowledge delivery structures can facilitate sectoral growth by making available to farmers the highest quality technological, managerial and marketing information while public/civil society connections in such structures can help ensure the optimisation of public goods from the perspective of producers at all levels.

While appreciating the need to address the three major constraints identified (seed, feed, extension), the meeting called upon the governments and cooperating partners as well as research agencies to focus on the likely development impact of investment in these areas. In order to ensure optimum impact of the three development strategies, there is a need to examine other areas, such as market development, access to capital and other policy issues that might be deemed relevant and equally important.

Furthermore, participants propose that SSA governments should seek to develop public/private partnerships within the growing number of aquaculture enterprises, by creating cost-effective financial and institutional arrangements that can compliment government and donor resources to deliver a limited number of critical research, advisory and technological services to high potential farmers.

Participants further pronounced that the approach to national aquaculture development, based upon the Cameroonian Strategic Framework for Aquaculture development addresses the major constraints to expansion of the sub-sector in the region, facilitates the necessary public/private and public/civil society linkages as well as proposes mechanisms to maximize returns to the investment of both public and private sector resources.

While endorsing this approach as an appropriate tool to foster aquaculture development, participants noted that such strategic approaches can only achieve their expected goals when efforts make use of existing national strategies, master plans and investment plans for aquaculture development in order to harmonize, building synergies and eliminating redundancies. These efforts involve national partners and stakeholders, but also aquaculture producers, support services, local authorities and investors from the public and civil society sectors, cooperating partners (donors), international and multilateral organizations.

The meeting envisages that aquaculture in SSA will grow into an important pillar of development in many areas in the region. It will be able to provide high quality food for rural and urban consumers, generate employment and general commercial activities in otherwise impoverished local economies, and contribute to national wealth through increased revenue from markets and trade. In order to achieve this vision, the countries in the region need to work together to increase their knowledge base, exchange best practice experiences and speak with one voice in the global marketplace.

Building capacity to combat impacts of aquatic invasive alien species and associated transboundary pathogens in ASEAN countries

Reported by
Michael J. Phillips[1], Jeffrey P. Fisher[2], Thalathiah Saidin[3],
Rohana P. Subasinghe[4] and A.G. Ponniah[5]

Invasive alien species (IAS) — non-native plants, animals or pathogens that may cause economic or environmental harm or human health problems — can negatively impact sustainable development in countries that depend on agricultural, fishery, and forestry resources for economic prosperity. Aquatic IAS, in particular, do not respect geopolitical borders and can negatively affect the international trade and transport of aquaculture products. To address these impacts, a workshop "Building capacity to combat impacts of aquatic invasive alien species and associated transboundary pathogens in ASEAN countries" was held in Penang, Malaysia, on the 12th-16th July 2004. The workshop was supported by a U.S. Department of State (State) grant, hosted by the Department of Fisheries of the Government of Malaysia and organized by the Network of Aquaculture Centres of Asia (NACA) in collaboration with ASEAN, FAO, the WorldFish Center, and State. Seventy-five delegates from ASEAN[6] member countries participated, including resource persons with experience in aquatic invasive alien species (IAS) and aquatic animal pathogens, and representatives of regional and international organizations, research institutes, universities and the private sector[7].

Responding to recommendations of two other meetings held in the region in 2002 and 2003[8,9] the workshop was intended to assist ASEAN countries in building their national capacities to combat the impacts of aquatic IAS and the pathogens associated with aquaculture and the transboundary shipment of live aquatic organisms. Aquatic IAS are of increasing concern in ASEAN because of the social and economic importance of the fishery and aquaculture sectors. Aquatic animal diseases in particular have caused significant damage in recent years, and are now recognised as a major risk and a primary constraint to the growth of the ASEAN aquaculture sector. The aquaculture industries alone provide several billion dollars of export earnings to ASEAN economies, so the economic and social risks are substantial. Therefore cooperation among ASEAN countries in addressing the issue was considered essential.

Workshop objectives

The specific objectives of the workshop were to:

- Review progress in implementing recommendations from an earlier Global Invasive Species Program Workshop[8] and the FAO/NACA, "Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals and Beijing Consensus and Implementation Strategy[10] and identify further actions to support their implementation in ASEAN, and examine other relevant regional and international initiatives on aquatic invasive species and identify specific actions for their possible implementation in ASEAN.

- Examine relationships among trans-boundary aquatic animal pathogens and aquatic invasive alien species in the ASEAN region, including long-term impacts of alien diseases in the region.

- Review national policies and legislation as well as compliance to international treaties and conventions dealing with aquatic IAS, and identify specific actions for their implementation in ASEAN.

- Identify current gaps in knowledge and information for dealing with aquatic IAS and aquatic animal pathogens, and develop national and regional decision support tools, focusing on design and incorporation of information and other communication media pertaining to invasive species and the risks of their introduction to ASEAN.

- Support national and regional awareness and capacity building for aquatic species at various levels, focusing on risk analysis measures, improving information sharing, surveillance and reporting and networking.

Workshop Findings: The Way Forward

Based on the results of technical and country-specific presentations (*see* Table) participants concluded that aquatic invasive species in ASEAN negatively impact aquatic biodiversity, and may affect the social and economic well being of people in the ASEAN region. However, participants also recognized the positive social and economic benefits that have come from the introduction and farming of some alien aquatic species in the region. Participants agreed that the best way forward is to minimize the risks and costs associated with negative impacts of aquatic IAS and aquatic animal pathogens whilst capturing the social and economic benefits possible through responsible aquaculture of alien species. Specifically, they recommended:

- Management of aquatic IAS and associated pathogens is imperative and should be encouraged and implemented in all ASEAN countries.
- National strategies should be developed consistent with obligations under existing international treaties and instruments[11] and in harmony with strategies for other IAS, including aquatic plants and ornamental fish. National strategies, coordinated through national focal points, should be based on impact assessment and management of alien species, where they are already established, and use of ecological and environmental risk analysis for proposed new introductions.
- National strategies should be implemented within a legitimate regional framework supported and endorsed by ASEAN.
- ASEAN member countries should have the necessary institutional and human resources to adopt a harmonized regional strategy. Bridging development gaps and capacity building across member countries is therefore necessary. Special attention should be given to capacity building among Cambodia, Lao PDR, Myanmar and Vietnam.

M. Shariff

More than 70 officials from Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam, USA and representatives from the Asian Institute of Technology (AIT), Asia-Pacific Economic Cooperation (APEC), ASEAN Secretariat, AusVet-Australia, CAB International, Deakin University (Australia), FAO, IUCN, MRC, Multimedia Asia, NACA, OIE, PhilRice, SakhNIRO-Russia, SEAFDEC-AQD, Universiti Putra Malaysia and World Fish Centre successfully participated in this pioneering initiative to better understand the relationship between aquatic invasive alien species (IAS) and associated transboundary pathogens in ASEAN countries. The workshop, held at the Grand Plaza Parkroyal Penang, Batu Ferringhi Beach on 12-16 July 2004, was funded by the US Department of State and implemented by NACA in cooperation with Malaysia's Department of Fisheries, FAO, World Fish Centre and various other regional partners

- In-country IAS impact assessment and risk analysis training should be promoted and implemented to establish core expertise in these practices in all ASEAN countries. Experiences in risk analysis and impact assessment should be shared among ASEAN.

- Networking, information exchange and cooperation among concerned agencies, industry, trading partners and countries sharing common watersheds or waterways is recommended for cost-effective use of resources in support of ASEAN in achieving the goal of effective management of aquatic IAS and associated aquatic animal pathogens.

- Assistance should be sought from regional and international organizations to implement the workshop recommendations, including from the organizers and participants of this workshop and other regional and international organizations. Progress in implementing the workshop recommendations should be assessed in three years.

These recommendations in this Way Forward summary were presented to the ASEAN Secretariat as a starting point for coordinated regional action, through the ASEAN Sectoral Working Group on Fisheries and other bodies. Final proceedings, including full text of the technical and country papers, will be published by NACA in January 2005.

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[8]Recommendations from the Regional Workshop on "Prevention and Management of Invasive Alien Species: Forging Cooperation throughout South and Southeast Asia", 14-16 August 2002, Bangkok, Thailand. www.usa.or.th/embassy/reo/reo-wrkshp.htm.

[9]Workshop on International Mechanisms for the Control and Responsible Use of Alien Species in Aquatic Ecosystems, held 27-30 August 2003, in Xishuangbanna, People's Republic of China.

[10]www.fao.org/DOCREP/005/X8485E/X8485E00.HTM

[11]These include the Convention on Biological Diversity (CBD), International Maritime Organisation (IMO), World Trade Organisation (WTO), World Animal Health Organisation (OIE) and Food and Agriculture Organisation of the United Nations (FAO).

Table 1. List of technical papers presented during the Workshop on "Building capacity to combat impacts of aquatic invasive alien species and associated transboundary pathogens in ASEAN countries", 12-16 July 2004, Penang, Malaysia

Session II – Workshop objectives, and selected technical overviews of invasive alien species and Associated transboundary pathogens
Introductory remarks on objectives and organisation of the workshop – Michael J. Phillips (NACA)
CBD COP-7 Decisions on alien species that threaten ecosystems, habitats or species - Chan Han Hee (Department of Agriculture, Malaysia)
An overview of international initiatives, treaties, agreements and management actions addressing invasive alien species – Jeffrey P. Fisher (US-State Department)
Place of transboundary aquatic animal pathogens (TAAPs) within the invasive alien species (IAS) category: a review" – Rohana P. Subasinghe (FAO) and Melba B. Reantaso (Maryland Department of Natural Resources, USA)
Current knowledge of aquatic invasive alien species in ASEAN and their management in the context of aquaculture development" – A.G. Ponniah and Norainy Mohd Husin (World Fish Centre)
Transboundary aquatic animal pathogens in ASEAN and their management" – CV Mohan, Brett Edgerton, and Michael J. Phillips (NACA)
Aquatic alien species and their contribution to aquatic production, food security and poverty alleviation" – Devin Bartley, Valerio Crespi, Isabel Fleischer and Rohana P. Subasinghe (FAO)
Session III – Country Status Paper Presentations. Part I: Aquatic Invasive Alien Species Part II: Associated Trans-boundary Aquatic Animal Pathogens
Brunei Darussalam - Hajah Laila Haji Hamid
Cambodia - Bun Racy and Hav Viseth
Indonesia - Hardjono and Agus Sunarto
Lao PDR - Nivath Phanaphet
Malaysia - Thalathiah Saidin and V. Palanisamy
Myanmar - Minn Thame and Myat Myat Htwe
Philippines - Simeona E. Regidor and Joselito R. Somga
Singapore - J.J. Loo
Thailand - Supranee Chinabut and Somkiat Kanchanakhan
Vietnam - Phan Thi Van
Session IV: Case Studies
Case study on the invasive Golden Apple snail in ASEAN - Ravindra C. Joshi, A.G. Ponniah, Christine Casal and Norainy Mohd Husin (World Fish Centre)
Tilapias are alien to Asia: But are they friend or foe? - Sena De Silva (Deakin University, Australia)
Movements of economically important penaeid shrimp in Asia and the Pacific - Simon Funge-Smith and Rohana P. Subasinghe (FAO) and Michael J. Phillips (NACA)
The special danger of viral infections in crustaceans - Tim W. Flegel (Mahidol University, Thailand)
Key freshwater crustacean pathogens of concern to ASEAN - Brett Edgerton and CV Mohan (NACA)
Mollusc pathogens of concern to ASEAN - Melba B. Reantaso (MD Department of Natural Resources, USA) and Franck C.J. Berthe (IFREMER, France)
Marine and freshwater finfish pathogens of concern - Mohamed Shariff (UPM, Malaysia)
Need for an Institutional Network for managing aquatic exotic species in Indochina - Amara Yakuptiyage (AIT, Thailand)
Risk Analysis as a Tool for the Management of Alien Aquatic Animal Diseases - Kevin Amos (US Department of Commerce and Interior)
Risk Analysis for determining invasive potential, risks, and appropriate management for non-native aquatic species – Jeffrey P. Fisher (US-State Dept.)
Risk analysis frameworks and tools for management of aquatic invasive alien species and associated transboundary pathogens - Infrastructure and Capacity Requirements – Chris Baldock (AusVet, Australia)
Special Presentations
Tracking pathogens through species introductions: a database mapping approach **-** Christine Marie V. Casal, Allan N. Palacio, Melba Reantaso, Aldus Ponniah, Norainy Mohd Husin, Boris Fabres and Rainer Froese (World Fish Centre and MD Department of Natural Resources, USA)
CAB International: its activities related to information on invasive alien species - S.S. Sastroutomo, K.Y. Lum and W.H. Loke (CABI, Malaysia)
FishBase: towards building a tool to assess species invasiveness - Christine Marie V. Casal (World Fish Centre)
The Global Invasives Species Information Network (GISIN), expert meeting summary and the way forward" - Annie Simpson and Soetikno S. Sastroutomo (USGS and CABI Malaysia)

Large Rivers provide sustainable social and economics benefits

Publication of the Second International Symposium on the Management of Large Rivers for Fisheries: Sustaining Livelihoods and Biodiversity in the New Millennium (also know as LARS 2)[1]
Edited by Robin L. Welcomme[2] and T. Petr[3]

The following are summary excerpts from the publication

Background

The Second International Symposium on the Management of Large Rivers for Fisheries (LARS 2) was held on 11 – 14 February 2003 in Phnom Penh, Kingdom of Cambodia. It had three primary objectives: to provide a forum to review and synthesise the latest information on large rivers:to raise the political, public and scientific awareness of the importance of river systems, the living aquatic resources they support and the people that depend on them; and to contribute to better management, conservation and restoration of the living aquatic resources of large rivers. Over 220 river scientists and managers from around the world attended the Symposium. Contributed papers represented 96 rivers from 61 river basins from all continents and climatic zones.

Devin Bartley, FAO

Tonle Sap River, Phnom Penh, Cambodia - venue for LARS2

Summary conclusions

Importance of river fisheries and biodiversity

Large rivers harbour a disproportionate share of the world's aquatic biodiversity, including over 50 percent of all freshwater fish species. Riverine biota are also among the most threatened components of biological diversity, with a much higher proportion of organisms classed as endangered or threatened than in most other ecosystems. A significant proportion of the world's people use the living aquatic resources of rivers for food and recreation. Recent evidence indicates that the number of people dependent on these resources is far larger than previously thought. Studies further show fish to be particularly important in the livelihoods and diets of the poor, providing an inexpensive source of animal protein and essential nutrients not available from other sources.

Valuation of river fisheries

Inland fisheries are generally undervalued in terms of their contribution to food security, income generation and ecosystem functioning. Conventional economic approaches aim to provide detailed quantification using a cost-benefit framework, which may not sufficiently value the role and function of rivers. Socio-economic approaches and livelihood analysis can help to highlight the complex contributions of fisheries to rural livelihoods. Better valuation of living river resources is necessary to ensure the equitable sharing of benefits and for proper placing of the

Devin Bartley, FAO

Fish from Cambodia's large rivers being processed into "prohoc", a national food staple

fishery in the context of the many other uses of rivers. It is important to recognise that fishers themselves have largely been excluded from valuation exercises.

State of knowledge

The first systematic expression of how rivers function dates from the first LARS in 1986 and many of the concepts arising from that meeting have proved extremely robust. The flood-pulse concept, the integral nature of the river-floodplain system, relationships between flood strength and catch, and the fishing down process in complex fisheries all continue to apply in many areas and conditions around the World. The general understanding of how river fish communities function is now sufficiently refined to permit broad management decisions concerning the river environment for fish and fisheries.

Despite a sound general understanding, detailed knowledge of the biology and ecology of individual species and ecosystems remains poor. Further studies on individual species, communities and ecosystems are urgently needed. However, in view of the large number of species living in most rivers, management based on requirements for individual species is often impractical (except for flagship endangered species). General concepts of migration and food web structure are now emerging to allow for a better understanding of the impact of human interventions. Research on flow-ecological relationships in large rivers is an urgent priority. However, sufficient knowledge exists to set interim conservation measures including environmental flow prescriptions, and the need for further research should not be used as an excuse to delay much needed action. Adaptive management will often be the most effective means of improving outcomes and knowledge. Conventional methods for studying large rivers are generally inadequate and new approaches are being developed to gain understanding of the processes underlying fish ecology and fisheries. In particular, local knowledge held by traditional fishing communities has provided a wealth of information.The effort put into the study and collection of data from rivers depends on national perceptions as to the value of rivers and their fisheries. Given the high cost of collecting data, programmes should concentrate on variables that are carefully selected to support desired research and management objectives.

Social, economic and institutional aspects

Study of the social, economic and institutional aspects of fisheries is a relatively recent development. However, the current global emphasis on rural poverty and sustainable livelihoods, together with deeper understanding of fisheries, has shown that knowledge of the human dimension of fisheries is essential for proper management. Understanding of the social organization of the fishery and the relationships between fisheries and other livelihood strategies is poor in most cases. However, the recent establishment of co-

management arrangements for fisheries in some river basins and the involvement of users and other stakeholders in decision-making are forming the basisfor better recognition of the relationship between people's livelihoods and their aquatic resources.

Management of river fisheries

A number of issues have emerged as particular concerns at this stage in our attempts to manage river fish, fisheries and their environment. A tension continues to exist between use and conservation. It is impossible to catch fish without influencing the composition of the fish community. However, the goal of fishery management should be to maintain or establish conditions consistent with the continued survival of all species. It has become increasingly clear that most river fisheries are not managed effectively**.** This is largely due to the old pattern of centralized Government agencies applying a one-size-fits-all approach. This pattern has failed worldwide, largely due to inflexibility, insufficient funding for agencies, and lack of stakeholder collaboration. In some cases this failure has led to a laissez faire approach to policy and enforcement. Sometimes state-owned river resources are in practice treated as open access systems and are vulnerable to overexploitation. Where systems of limiting access are being contemplated they have to take into consideration the needs of community members who might be excluded. Management alternatives are being developed that attempt to bridge the gap between centralized government and traditional, locally enduring participatory management systems. Such strategies are being tried in most climatic zones and continents and are compatible with a livelihoods focused approach that considers other stakeholder activities. Participatory approaches depend strongly on cultural, social and political environments. After more than a decade of innovative schemes and experiments, there are many international examples of how to enable users and other beneficiaries of resources to assume more significant control. It would be appropriate to make greater use of these experiences in policy formulation.

Major conflicts between the various users of river systems can only be resolved if there are appropriate mechanisms at national and basin levels to enable negotiation for the needs of the living aquatic resources. River basin organizations are an essential instrument for managing such conflicts, especially for rivers flowing through more than one nation

Devin Bartley, FAO

Past (Dick Nyeko) and present (Roger Kanyaru) chairmen of the CIFA on the source of the Nile River, Lake Victoria

or province. Appropriate legislation must be formulated to encourage more equitable treatment of living aquatic resources and the fisheries that depend on them. In some areas water quality, quantity and mechanisms for fish passage around obstacles are already the subject of legislation. But further regulations are needed to protect general ecosystem diversity and provide for environmental flows. In addition, the involvement of user groups in management decision-making should be legally supported and/or mandated.

General degradation of the resource

Most river basins support intensive fisheries and yields in some basins are still increasing. River fisheries continue to provide large catches, even in the face of intensive exploitation, although changes in species composition and size are occurring and some large and late-in-life maturing species have become rare as a result of fishing pressure. In contrast to marine and lake fisheries, there are no proven cases of a river fishery as a whole having collapsed from fishing pressure alone. Where collapses have occurred, they have always been linked to degradation in environmental quality. Indicators on all continents show that there is a general decline in the physical, chemical and ecological quality of rivers from source to mouth. This decline is typically associated with rising population pressures. The form and function of rivers have changed in response to dams and channelization, and changing land use practices and marginal agriculture have resulted in deforestation leading to increased siltation. The increasing demand for water is altering the timing and magnitude of flow

regimes in many rivers. There is a need for improved understanding of the ecological flow requirements of river-floodplain systems, taking into account the seasonality of the system and the environmental cues needed by fishes for migration and reproduction. This will allow definition of the timing and amount of water that should be reserved for fish in the context of other developments in the river basin. Strategic assessments, such as the ecosystemsbased approaches, freshwater eco-regions approach, and the guidelines for water allocation suggested by the World Commission on Dams provide some possible mechanisms for the conservation of river habitats. A number of conventions provide additional supporting frameworks including, in particular, the Ramsar Convention and the Convention on Biological Diversity. Frameworks for making decisions on water management should include assessment of options and environmental and social impacts, and involve full public participation.

Mitigation, rehabilitation and enhancement

There is an urgent need to rehabilitate degraded ecosystems. Technical options do exist for amelioration and mitigation of adverse impacts. Several examples of successful rehabilitation are already emerging, but they are often expensive and time consuming. The eventual cost of rehabilitating a resource is likely to far exceed the benefit derived from its destruction and it is clear that conservation is better than rehabilitation. There have been attempts on all continents to mitigate problems caused by dams, levees and polders which bar fish migrations. The success of these mitigating structures is extremely variable since they cannot cope with the numbers of fish migrating or be used by all fish species, and they generally focus only on facilitating upstream movements, ignoring the downstream drifting of fry and juveniles. Research is needed to develop ways to allow less obstruction to fish movement that are significantly broader in their application. Aquaculture is frequently seen as mitigation for declines in wild fisheries or as providing an alternate activity. Although stocking of juvenile fish and fish farming have shown promise in some areas, there is often a policy conflict where the benefits of enhancement do not accrue to those formerly dependent on wild fisheries, and their access to land, water and feed resources may be jeopardized by enhancements.

Prospects

Maintenance of healthy rivers and restoration of degraded rivers and their fisheries will only be achieved if there is political will at all levels of society to do so. Those responsible for managing riverine resources need a collective approach that is sensitive to the needs of resource users and society at large. Adequate and accurate information on the value and the functioning of rivers, as well as on the impacts of other users on the resource, is required. The fisheries sector must not continue in isolation but must communicate clearly with the public and other users of inland water resources in order to arrive at equitable solutions for sustaining the fishery. There are some encouraging developments. The international community is slowly becoming aware of the value of living inland aquatic resources as evidenced by the European Union Water Directive, the World Water Forum, the high priority awarded to it by the Convention on Biodiversity, the decommissioning of dams in North America and Europe, and the reestablishment of keystone species such as salmon through large scale rehabilitation of some damaged rivers. It is unfortunate that inland fisheries received such a low profile from the World Summit on Sustainable Development and this situation needs urgent redress.

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[1]This article is a compilation of work from several people and organizations involved with LARS2. The work of the members of the scientific/steering and organizing committees and the support of the Mekong River Commission and the Government of Cambodia are especially appreciated

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TCP/LAT/3001 "Improving aquatic animal health and quality and safety of aquatic products"

R. Van Anrooy, FAO

Rainbow trout pond at Silakas farm

In October 2004, the National Board of Fisheries of Latvia and FAO started off a new technical cooperation project titled "Improving aquatic animal health and quality and safety of aquatic products" (TCP/LAT/3001). Latvia, being one of the 10 countries which entered the European Union in early 2004, is a country that has some tradition in carp, salmon and trout culture (see photo above) and which initiated recently activities in crayfish culture. The total aquaculture production of crayfish, *Astacus astacus*, in Latvia in 2004 will be around 4 tonnes, which can easily be absorbed by the domestic market (a market which is estimated to be able to absorb at least 40 tonnes annually). Total aquaculture production of Latvia in 2003 was 608 tonnes. There are around 11 000 ha of aquaculture ponds in Latvia; most are cultured extensively. Having a 531 km long coastline bordering the Baltic Sea and a huge number of natural reservoirs, of which only less than 140 are being currently utilized, there appears to be a considerable potential for both coastal and inland aquaculture development in Latvia.

The technical cooperation project will try to achieve before the end of 2005 the following outputs:

1. a review of the current status of aquaculture in Latvia;
2. a strategy for sustainable aquaculture development in Latvia;
3. a national aquatic animal health strategy is developed for controlling diseases and reducing losses in aquaculture;
4. a review and update of the requirements for improving quality and safety of aquatic animal products;
5. improved national capacity for aquatic animal health management and quality and safety assurance of aquatic products; and
6. improved aquatic animal health and quality and safety of aquatic products to better engage in international trade in aquatic animals and animal products.

It is expected that in 2005, the review of the current status of aquaculture in Latvia, jointly being prepared by the newly formed Latvian Fish Resources Agency (LATFRA), the Latvian Crayfish and Fish Farmers Association, and the National Board of Fisheries, will be ready for publication. The review will be the starting point for the other activities that will be carried out by the project. More information on this project and its outcomes will be published in the next issue of FAN or can be obtained from Mr Rohana Subasinghe or Raymon van Anrooy.

R. Van Anrooy, FAO

Three-year old crayfish, Astacus astacus, *in tank*

Winner of Sustainable Fishing Award

The Food and Agriculture Organization of the United Nations

FAO receives the KUNGSFENAN, the Swedish Seafood Award 2004, for Sustainable Fishing

KUNGSFENAN, the Swedish Seafood Award, has the vision of highlighting Sweden as a guiding example when it comes to the future of the fishing industry and the promotion of food based on fish and fish products. Its over-all aim is to promote the development of trade and the fisheries, food production and restaurant industries by highlighting both efforts concerning the future as well as efforts towards increasing knowledge, at all levels, of the sea and lakes as a source of food. The long-term goal is to achieve a consensus on food safety and enjoyment of food in order to ensure that food based on fish and fish products keeps enjoying its excellent reputation in Sweden. The award should contribute towards making such occupations as fishermen, fish farmers, and the vocations within the food production, restaurant and large-scale catering trades more attractive. Since May 2001, the award is being administered through the organization Svensk Fisk. The prize money of 500 000 Swedish kroner is financed by ForeningsSparbanken AB and Sparbanksstifstelserna in western Sweden. The partners for the award are ForeningsSparbanken AB (main partner), SHR Sveriges Hotell-och Restaurangforetagare, Goteborg & Co, Domstein Enghav Sverige AB and ABA Seafood AB.

http://www.svenskfisk.se/eng/kungsfenan_04/jsp/pristagarna_fiskenaring.jsp
http://www.svenskfisk.se/eng/kungsfenan_04/jsp/main.jsp

Svensk Fisk

Assistant Director-General, Fisheries Department, FAO, Ichiro Nomura receives the Kungsfenan Award on Sustainable Fishing on behalf of FAO during the awarding ceremony held on 21 October 2004 in Gothenburg Opera

Winners of the Kungsfenan, the Seafood Award 2004.

Sustainable Fishing: FAO
The FAO has been awarded the KUNGSFENAN, the Swedish Seafood Award 2004, as a recognition of the work carried out by the Fisheries Department.

Maritime Gastronomy: Buhre Fisk of Kivik
Buhres fish have come to deserve their award in the best possible way by working towards their goal with commitment and a large measure of perseverance.

Innovator 2004: Lotta Rahme
The "Innovator of the Year" award goes to Lotta Rahme for her work using fish skins that is both creative and steeped in cultural and historical tradition.

Svensk Fisk

Svensk Fisk

Assistant Director-General, Ichiro Nomura (top right and bottom left) with the other winners of Kungsfenan Award 2004.

The Food and Agriculture Organization of the United Nations has been awarded the Kungsfenan, The Swedish Seafood Award 2004 as a recognition of the work with the **Code of Conduct for Responsible Fisheries** and Supporting Technical Guidelines carried out by the Fisheries Department.

The work of FAO, as a technical specialized UN agency for securing sustainable food production and rural development, has become more and more important with the development of fisheries and with the over-exploitation of fish stocks. FAO has, in a number of ways, already elaborated a general framework for the management of fisheries, reaching from the industrial scale to small scale fisheries.

For that reason, a **Code of Conduct for Responsible Fisheries (CCRF)** has been elaborated during the early 1990 and has been endorsed by the FAO Conference. The Technical Guidelines are concerned with fishing operations (including vessel monitoring systems), precautionary approach to capture fisheries and species introductions, integration of fisheries into coastal area management, fisheries management (including the ecosystem approach to fisheries and conservation and management of sharks), aquaculture (and good aquaculture feed practice), inland fisheries, responsible fish utilization, indicators for sustainable development of marine capture fisheries, a plan of action to prevent, deter and eliminate illegal, unreported and unregulated fishing. In addition, the FAO Fisheries Department is working on four International Plans of Action (IPOA): the IPOA-seabirds, the International Plan for reducing incidental catch of seabirds in longline fisheries; the IPOA-sharks, the International Plan for the conservation and management of sharks; the IPOA-capacity, the International Plan of fishing capacity. The CCRF has been endorsed by all FAO member countries including those members of the European Union. The Code has been translated into a great number of languages. The Jury of Kungsfenan, the Swedish Seafood Award wants to recognise the excellent work of the Fisheries Department. The CCRF stipulates generally accepted norms of all kind of fisheries and aquaculture practices, at national and regional levels, as well as at small, medium and large scale operations, in inland coastal and marine environments which were needed for a better global and regional cooperation.

The Jury is hoping that the attention of the general public will be focused on the urgent need for all countries to increase their cooperation for a better fishery and aquaculture management. The prize now awarded should give further impulses to the Organization for making the contents of the Code known closer to the people.

The prize consists of a glass sculpture of a Swedish artist, a diploma and the sum of Swedish Kronor 300 000 (approximately US$44 700.00).

Mr John Valbo Jorgensen

John Valbo Jorgensen joined the Inland Water Resources and Aquaculture Service (FIRI) on 1st September 2004 as Fishery Resources Officer (Fisheries Ecology). John obtained a Master of Science (M. Sc.) degree in biology from the University of Copenhagen in 1994. His thesis work concerned the ecology of the fishes of the Orinoco floodplain (Venezuela). After his graduation, he was involved in research in Paraguay, and was on study tours to the Colombian Amazon and Peru. From 1997 to 2001, he shifted to Asia to work for the Mekong River Commission (MRC) as a fisheries biologist. During this time he was mainly working on a basin-wide study concerning the spawning and migration of commercially important fish species using local knowledge, and a survey of juvenile and larval fishes in the Mekong Delta. From 2001 until accepting the FAO job, he worked on various assignments as a freelance consultant for the Living Aquatic Resources Research Centre in the Lao People's Democratic Republic, Danida, and MRC, including the following projects:

- A study of Mekong deep pools and their role as fish refuges in Lao PDR and Cambodia. For this study the methods used involved both the collection of local knowledge, Catch Per Unit of Effort data and hydroacoustics.
- An assessment of the biological and socio-economic impacts of different fisheries management schemes and the development of a fish biodiversity collection system in various water bodies in Southern Bangladesh.

He finally provided information for and edited MRC's Mekong Fish Database, and he has written multiple publications aimed mainly at a general audience.

At FAO, John will be working with the environmental aspects of inland water development for fisheries and aquaculture. This will include elements such as the capture of juvenile fish for culture, responsible stocking schemes, species introductions, and the linkages between biodiversity, fisheries and food security. John can be reached at John.Jorgensen@fao.org; Room F517, ext. 56787.

Ms Melba G. Bondad- Reantaso

In September 15, 2004, Melba B. Reantaso joined the FIRI service as Fisheries Resources Officer (Aquaculture). A scholar of the Japanese Ministry of Education, Culture and Sports (Monbusho), Melba completed a Doctor of Philosophy (Ph.D.) degree in Fisheries Science in 1995 from the University of Tokyo and a one year post-doctoral research fellowship grant (1998-1999) funded by the Japanese Society for the Promotion of Science (JSPS) from the Japan Veterinary and Animal Science University, both in Tokyo. She obtained a Bachelor of Science (B.Sc.) in Zoology from the University of the Philippines (1981) and a M.Sc. in Biology from the De La Salle University (1989). In 2000, she retired from the Philippine Bureau of Fisheries and Aquatic Resources, Department of Agriculture, after 18 years working in various capacities starting as a Junior Fishery Biologist to Senior Fishery Biologist and Senior Aquaculturist (Aquaculture Division). She was on secondment to the Network of Aquaculture Centres in Asia-Pacific or NACA (Bangkok, Thailand) from 1999 until 2001 and as a regular staff member until 2002. In late 2002, Melba moved to the USA to work at Maryland's Department of Natural Resources. Outside the Philippines, Melba extensively travelled to 23 countries in pursuit of scholarly and career goals on aquaculture and aquatic animal health management; and stayed/lived in various periods from 1987 to 2004 in 5 of them (Canada, Japan, Israel, Thailand and USA). She has authored and co-authored more than 50 scientific and technical publications and has close to 20 years of combined experience in research, training, diagnostics, extension, international aid and project development in aquatic animal health, and aquaculture (freshwater and mariculture).

Melba has been involved in several FAO projects in Asia and the Americas since 1997. She served as Regional Coordinator (1999-2002) of TCP/RAS 6714 (A) and 9065 (A) "Assistance for the Responsible Movement of Live Aquatic Animals" and served as consultant or resource expert to the following FAO projects: (a) UNDP Project VIE/98/009/01/NEX Aquaculture Development on Northern Uplands (2000); (b) FAO/CIFA/NACA Expert Consultation on the Intensification of Food Production in LIFDC's through Aquaculture (2001); (c) Nepal/FAO/NACA Symposium on Coldwater Fishes of the Trans-Himalayan Region (2001); (d) TCP/RLA/0071 "Assistance to health management of shrimp culture in Latin America"(2001, 2002); and (e) TCP/INS/2905 (A) – Health Management in Freshwater Aquaculture (2004). Melba's responsibility at FIRI includes development, implementation, review and evaluation of projects on aspects of aquaculture for rural development (including livelihood aspects, employment, income generation, gender and equity issues) and aquatic animal health management; editorial responsibilities for FAN and other duties as may be required. Her current assignment is on seed as a resource for aquaculture. She can be reached at Melba.Reantaso@fao.org; Room F514, ext. 54843.

Mr Mohammad R. Hasan

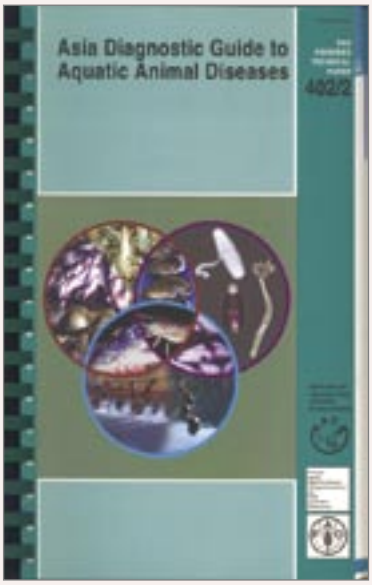
Mohammad R. Hasan joined FIRI in first week of October 2004 as Fisheries Resources Officer (Aquacuture). Prior to this new assignment, Mohamad (popularly known as Hasan) has been working at the Department of Aquaculture, Bagladesh Agricultural University (BAU), in Mymensingh. Hasan joins FAO with over 26 years of research experience in aquaculture and aquatic related science; particularly in freshwater aquaculture, fish nutrition and feed development and inland fisheries. His experience also includes over 17 years of post-doctoral research experience in the Asian region which resulted to more than 60 publications. Along with research skills, Hasan brings to FAO experiences in technical cooperation, international affairs and development work and field experiences in training and extension. Hasan developed and implemented several research projects on fish nutrition, feed development, aquaculture and inland fisheries funded by national of Bangladesh and international funding agencies.

Hasan studied at the University of Stirling in Scotland from 1982-1986 with a Commonwealth Scholarship and obtained a Ph.D. degree in Aquaculture with specialization in fish nutrition. He completed his B.Sc. in Fisheries Science from the University of Agricultural Sciences, Bangalore, India in 1977 and a M.Sc. degree from BAU in 1980. Hasan started his career as Lecturer in 1980 in Fisheries Biology & Limnology in BAU and continued until 1982 when he left for Ph.D. studies. Hasan came back to Bangladesh in 1986 and joined the same department at BAU as Assistant Professor until 1994 after which he joined the Oxbow Lakes Small Scale Fishermen Project (jointly funded by IFAD and Danida) based at Jessore, Bangladesh as a National Consultant until 1997. In 1997, he rejoined BAU and continued until September 2004. During this period, Hasan worked as consultant for the GEF-funded Aquatic Resources Development, Management & Conversation Studies of the Fourth Fisheries Project, Department of Fisheries, and as short-term consultant for the DFID-funded fisheries project in Bangladesh.

Hasan travelled to 17 countries to attend international and regional meetings/workshops/consultancy; these included prolonged stays in India (4 years: 1973-74) and United Kingdom (4 years: 1982-86). Hasan has been involved in different FAO activities in Asia since 1997 attending several FAO expert consultations and FAO/NACA workshops, served as consultant, written global review and was a contributor to Aquaculture Glossary (2004).

Hasan's technical responsibilities in FIRI will focus largely on inland aquaculture, including aquatic animal nutrition and feeds and on technical backstopping to field projects through assistance in the identification, formulation and review of project activities on inland aquaculture, aquatic animal nutrition and feeds. Hasan can be reached at Mohammad.Hasan@fao.org, Room F518, ext.56442.

Bondad-Reantaso, M.G., McGladdery, S.E., East, L & Subasinghe, R.P. (eds.) 2001. Asia Diagnostic Guide to Aquatic Animal Diseases. *FAO Fisheries Technical Paper* No. 402, Supplement 2. Rome, FAO. 2001. 240p.



The Asia Diagnostic Guide to Aquatic Animal Diseases or 'Asia Diagnostic Guide' is a comprehensive, up datable diagnostic guide for the pathogens and diseases listed in the NACA/FAO/OIE Quarterly Aquatic Animal Disease Reporting System including a number of other diseases which are significant in the Asia region. It was developed from technical contributions of members of the Regional Working Group (RWG) and Technical Support Services (TSS) and other aquatic animal health scientists in the Asia Pacific region who supported the Asia PacificRegional Aquatic Animal Health Management Programme. The objective was to produce an Asia diagnostic guide, that could be of specific use in the region, for both farm and laboratory level diagnostics, to complement the Manual of Procedures for the implementation of the "Asia Regional Technical Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals". This Asia Diagnostic Guide could then be used to expand national and regional aquatic animal health diagnostic capabilities that will assist countries in upgrading technical capacities to meet the requirements in the OIE International Aquatic Animal Code (Third Edition) and the OIE Diagnostic Manual for Aquatic Animal Diseases (Third Edition) and WTO's Sanitary and Phytosanitary Agreement (SPS), and in support of relevant provisions in the FAO's Code of Conduct for Responsible Fisheries. The information in theAsia Diagnostic Guide is presented in a format that spans from gross observations at the pond or farm site (Level 1), to guidance for information on technologically advanced molecular or ultrastructural diagnostics and laboratory analyses (Levels II and III, and OIE aquatic animal health standards), thus, taking into account international, regional, and national variations in disease concerns, as well as varying levels of diagnostic capability between countries of the Asia Pacific region.

This CD on Health Management for the Responsible Movement of Live Aquatic Animals in Asia contains the 3 following technical papers in pdf.

FAO/NACA. 2000. Asia Regional Guidelines on Health Management for the Responsible Movement of Live Aquatic Animals and The Beijing Consensus and Implementation Strategy. *FAO Fisheries Technical Paper* No. 402.

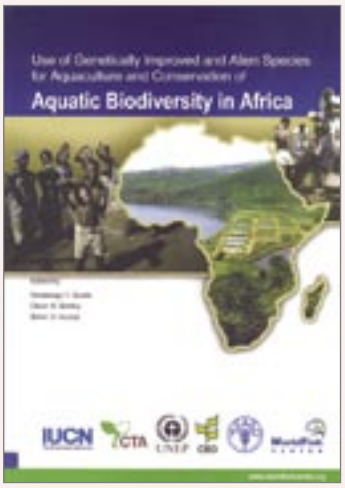
FAO/NACA. 2001. Manual of procedures for the implementation of the Asia Regional Technical guidelines on Health Management for the Responsible Movement of Live Aquatic Animals *FAO Fisheries Technical Paper* No. 402/1.

FAO/NACA. 2001. Asia Diagnostic Guide to Aquatic Animal Diseases. *FAO Fisheries Technical Paper* No. 402/2. *(see left column).*

Gupta, M.V., Bartley, D.M. & Acosta, B.O. (eds). 2004. Use of genetically improved and alien species for aquaculture and conservation of aquatic biodiversity in Africa. WorldFish Center Conference Proceedings 68, 113p.

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 in natural waters. This is especially important in Africa which is one of the world's repository of diverse freshwater fish fauna and home to native tilapias. Thus, this proceedings is a useful tool in bringing awareness among African institutions, agencies, planners of the issues involved in improving production through introductions of improved strains/alien species while sustaining the biodiversity.

See article on Quarantine procedures and their implementation by R. Subasinghe and Introduction of alien/Strains and their impact on biodiversity by D. Bartley and F. Marttin.



FAO Fisheries Technical Papers. A selected digital collection. Version 2
(CD-ROM) Rome, 2004, Trilingual (En/Fr/Es)
ISBN 92-5-005140-9
TC/C/Y5435/Tri

The FAO Fisheries Technical Papers form one of the main regular series publications of the FAO Fisheries Department. The first volume was published in 1958 and more than 400 volumes in this series have now been published. In order for the FAO Fisheries publications to reach a wider audience, particularly those titles which are no longer available in print and are still frequently requested, the Department has started work on retrospective digitization. This second release of the CD ROM includes the full-text of 180 FAO Fisheries Technical Papers in English, French and Spanish, depending upon the language/s of the original publication.

A copy of the CD may be requested from FAO Fisheries Library, V.le delle Terme di Caracalla, 00100 Rome - Italy, e-mail: fi-library@fao.org

Arthur, J.R. & Bondad-Reantaso M.G. (eds). 2004. Capacity and Awareness Building on Import Risk Analysis (IRA) for Aquatic Animals. Proceedings of the Workshops held 1-6 April 2002 in Bangkok, Thailand and 12-17 August 2002 in Mazatlan, Mexico. APEC FWG 01/2002. NACA, Bangkok, Thailand. 203p.

The Asia-Pacific Economic Cooperation, Fisheries Working Group project APEC FWG 01/2002 "Capacity and Awareness Building on Import Risk Analysis (IRA) for Aquatic Animals", proposed in 2000 during the 12th Meeting of the APEC FWG, was successfully implemented in 2002-2004. The two training/workshops were successfully conducted in Bangkok, Thailand (1-6 April 2002) and Mazatlan, Mexico (12-17 August 2002). A total of 130 participants comprised of regulatory authorities, administrators and aquatic animal health specialists responsible for trade of live aquatic animals participated in the two training/workshops. The participants represented 37 countries in the Asia-Pacific (i.e., Australia, Bangladesh, Cambodia, Canada, China, Taiwan Province of China, Hong Kong China, India, Indonesia, Japan, Korea RO, Malaysia, Myanmar, Nepal, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam) and the Americas (i.e., Belize, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru, the United States of America and Venezuela). These training/workshops not only provided a venue to raise awareness and enable better understanding of the concepts of IRA, they also fostered better communication between government representatives and aquatic animal health specialists on issues related to aquatic animal movement, and enhanced subregional, regional and international cooperation on issues related to aquaculture health and trade of aquatic animals.

The number of economies taking part in the two workshops and the participation of non-APEC economies, FAO and NACA member governments and collaborating partner organizations such as OIE, MRC, SPC, DANIDA, OIRSA and private-sector representatives demonstrate the great value of this APEC initiated activity and APEC's important role in supporting responsible aquaculture, trade and health management practices for better productivity, increased and stable contribution to food security, promotion of sustainable aquaculture and preservation of biodiversity.

This report, which contains 26 technical presentations, is divided into four parts: (a) Background for Risk Analysis, (b) The Risk Analysis Process, (c) Risk Analysis and the World Trade Organization: Country Experiences and (d) National Strategies for Aquatic Animal Health. Four annexes are also included containing the (a) Workshop Programs, (b) Lists of Participants, (c) Working Group Recommendations and (d) List of Acronyms and Abbreviations.

See articles by R. P. Subasinghe and D.M. Bartley on Risks of Species Introduction; R.P. Subasinghe on Risks of Chemical Usage in Aquaculture and M.G. Bondad-Reantaso on Transboundary Aquatic Animal Diseases/Pathogens and Development of National Strategies on Aquatic Animal Health in Asia-Pacific.

Arthur, J.R., Bondad-Reantaso, M.G., Baldock F.C. & Rodgers C.J. 2004. Manual on pathogen risk analysis for the safe movement of aquatic animals (FWG/01/2002). APEC/DoF/NACA/FAO, 59p.

Risk analysis for pathogens of aquatic animals is a relatively new field, and only a few countries have much experience in this area. The purpose of this manual is to provide a simplified overview of the risk analysis process to assist responsible individuals in developing countries to begin formulating national policies and approaches to conducting risk analyses. This manual should thus be useful to Competent Authorities, senior policy and management staff, and members of the private sector involved in regulating or conducting international and domestic trade in live aquatic animals and their products.

The initial sections of the manual provide information and guidance on how risk analysis facilitates trade while protecting national biological, social and economic resources; a brief review of pertinent international agreements and responsibilities; and a discussion of the issues surrounding the development of national policy and legislation. Following sections then provide a general overview of the process and the mechanisms needed (expertise, procedures, scoping an analysis, etc.) to begin a risk analysis. The individual components are then discussed in detail. These include risk communication, hazard identification, risk assessment and risk management. The remaining sections address some other important considerations, such as the use of "in house" vs more extensive risk analysis, the importance of good scientific review, qualitative and quantitative approaches to risk analysis, the precautionary approach, developing countries and risk analysis, and the role of politics and science in the risk analysis process. A list of the Literature Cited is given, and finally, two annexes provide a list of Internet resources related to risk analysis for aquatic animals (Annex I) and a list of national agencies with responsibilities for implementing risk analysis and other related aquatic animal health activities within participating Asia Pacific Economic Cooperation (APEC) Economies and Network of Aquaculture Centres in Asia Pacific (NACA) and FAO Member Countries (Annex II). Throughout the manual, hypothetical examples of various risk analysis scenarios are presented, with the primary goal of encouraging readers to consider how these scenarios might apply to their particular country situations.

These publications are available for free download at the Publication section at the NACA website at http://www.enaca.org

FAO Yearbook of fishery statistics: Aquaculture production. Vol.94/2. 2002. *FAO Fisheries Series No. 67. FAO Statistics Series No. 181.*

The FAO Yearbook of fisheries statistics: Aquaculture production is a compilation of statistics on world production of fish, crustaceans, molluscs and other aquatic animals and plants produced from all culture practices. The data were formerly published yearly in FAO Fishery Circular No. 815 (and following revisions up to No. 11). The Statistics, in quantity and value, are presented by country or territory, species, culture environment and year, and for various aggregations. In order to provide complete coverage of aquaculture production statistics throughout the world, where officially reported national statistics are lacking or are considered unreliable, FAO makes estimates based on the best information available. FAO gratefully acknowledges the cooperation received from nationals authorities and others providing statistics and information, and welcomes comments, suggestions and additional information from users of the statistics.

A CD Fishstat Plus (v. 2.30) is now available.
Fishstat Plus provides access to Fishery Statistics of various sorts. In this disk, the following datasets are available:
Aquaculture production) (quantities, tons) 1950-2002
Aquaculture production (values, thousands US$) 1984-2002
Capture production 1950-2002
Total production 1950-2002
Commodities trade and production 1976-2002
GFCM (Mediterranean and Black Sea) capture production 1970-2002
CECAF (Eastern Central Atlantic) capture production 1970-2002
Southeast Atlantic capture production 1975-2002.

Sugiyama, S., Staples, D. & Funge-Smith, S.J. 2004. Status and potential of fisheries and aquaculture in Asia and the Pacific. FAO Regional Office for Asia and the Pacific. RAP Publication 2004/25. 53p.

The fisheries and aquaculture sector is of fundamental importance to the Asia-Pacific region providing opportunities for revenue generation and employment, and contributing to food security. This document reviews the current status of inland and marine fisheries resources and their contribution to national economies

and food security. Regional fishery data and information stored in FAO databases are analysed to provide a comprehensive picture of production trends of fisheries and aquaculture in the Asia-Pacific region, which is further illustrated by a detailed view of sub-regions and aquaculture production by species groups. It also touches upon issues that require closer attention in order for the fisheries resources to be managed in a responsive and sustainable manner.

Introductions and movement of *Penaeus vannamei* and *Penaeus stylirostris* in Asia and the Pacific. RAP publication 2004/10. 92p.

Beginning in 1996, P. vannamei was introduced into Asia on a commercial scale. This started in Mainland China and Taiwan Province of China and subsequently spread to the Philippines, Indonesia, Viet Nam, Thailand, Malaysia and India. These introductions, their advantages and disadvantages and potential problems are the focus of this report. China now has a large and flourishing industry for P. vannamei, with Mainland China producing more than 270 000 metric tonnes in 2002 and an estimated 300 000 metric tonnes (71 percent of the country's total shrimp production) in 2003, which is higher than the current production of the whole of the Americas. Other Asian countries with developing industries for this species include Thailand (120 000 metric tonnes estimated production for 2003), Viet Nam and Indonesia (30 000 metric tonnes estimated for 2003 each), with Taiwan Province of China, the Philippines, Malaysia and India together producing several thousand tonnes. Total production of P. vannamei in Asia was approximately 316 000 metric tonnes in 2002, and it has been estimated that this has increased to nearly 500 000 metric tonnes in 2003, which is worth approximately US$ 4 billion in terms of export income. However, not all the product is exported and a large local demand exists in some Asian countries. This report has attempted to gather all of the currently available data on the extent of P. vannamei and P. stylirostris importation and culture in Asia, its potential problems and benefits, and in this way serve as a source document from which to investigate further the means by which control over this issue might be re-established. Recommendations aimed at controlling the importation, testing and culture of these species have been made for all levels and are included in this report.

For further information please contact: The Aquaculture Officer, RAPI, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, 39 Pra At hit Road, Bangkok, 10200 Thailand; e-mail: FAO-RAP@fao.org

FAO-ASEAN strategic planning workshop on harmonization of stands for shimp export-import. Bangkok, Thailand, 4 to 6 November 2003. RAP publication 2004/07. 43p.

Owing to the increasing concerns regarding disparities in quality control and inspections standards among ASEAN countries and their ability to export seafood commodities (especially shrimp) to other regions, the ASEAN Sectoral Working Group on Fisheries (ASWGFi) meeting in Lao PDR in May 2003 formed an ASEAN Sectoral Task Force to harmonize quality and inspection standards for shrimp export and imports in the region. The first strategic planning workshop of the task force was held in Bangkok, Thailand from 4 to 6 November 2003. This document contains the report of the workshop as well as selected parts of the presentations. RAP 2004/07

For further information please contact: The Aquaculture Officer, RAPI, FAO Regional Office for Asia and the Pacific, Maliwan Mansion, 39 Pra At hit Road, Bangkok, 10200 Thailand; e-mail: FAO-RAP@fao.org

The FAO Fisheries Technical Paper No. 450 advertised in FAN 31 is now available in Spanish. Manejo sanitario y mantenimiento de la bioseguridad de los laboratorios de postlarvas de camarón blanco *(Penaeus vannamei)* en América Latina.

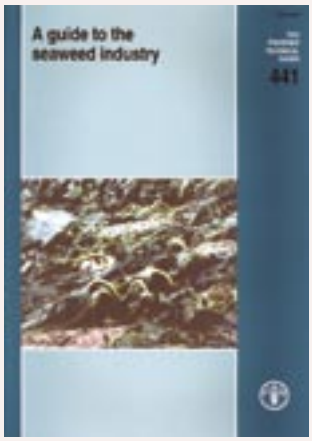
McHugh, D.J. A guide to the seaweed industry. *FAO Fisheries Technical Paper.* No. 441. Rome, FAO. 2003. 105p.

Seaweed can be collected from the wild but is now increasingly cultivated. It falls into three broad groups based on pigmentation; brown, red and green seaweed.

Use of seaweed as food has strong roots in Asian countries such as China, Japan and the Republic of Korea, but demand for seaweed as food has now also spread to North America, South America and Europe. China is by far the largest seaweed producer followed by the Republic of Korea and Japan but seaweeds are today produced in all continents.

Red and brown seaweeds are also used to produce hydrocolloids; alginate, agar and carrageenan, which are used as thickening and gelling agents. Today, approximately 1 million tonnes of wet seaweed are harvested and extracted to produce about 55 000 tonnes of hydrocolloids, valued at almost US$ 600 million.

This publication also includes the Resources Bank, a CD-ROM, which provides a large amount of additional information for the would-be risk assessor.



Villareal, L.V., Kelleher, V. & Tietze, U. (ed.). 2004. Guidelines on the collection of demographic and socio-economic information on fishing communities for use in coastal and aquatic resources management. *FAO Fisheries Technical Paper*. No. 439. Rome, FAO. 2004. 120p.

Article 10 of the *Code of Conduct for Responsible Fisheries* (CCRF) sets out principles and standards for the integration of fisheries in coastal management. Article 10.2.4 of the CCRF states: "States, in accordance with their capacities, should establish or promote the establishment of systems to monitor the coastal environment as part of the coastal management process using physical, chemical, biological, economic and social parameters."

The guidelines presented in Part 1 of this Fisheries Technical Paper attempt to identify empirically verifiable key indicators for the identification of socio-economic and demographic issues, problems and opportunities in coastal and aquatic resources management and for monitoring the impact of management measures on the socio-economic well-being of coastal and fishing communities. The guidelines also identify data sources and methods for the collection of data.

Part 2 contains a summary of the proceedings and recommendations of the *Regional Workshop on the Use of Demographic Data in Fisheries and Coastal Development and Management in the Philippines and other Southeast and South Asian Countries* held at the University of the Philippines in the Visayas, Miag-ao, Iloilo, Philippines from 18 to 21 March 2002, as well as selected papers from the workshop.
In Part 3, two case studies, one from the United States of America and the other from Italy, describe how socio-economic and demographic indicators are actually used in coastal and aquatic resources management.

Tietze U. & Villareal, L.V. 2003. Microfinance in fisheries and aquaculture. Guidelines and cases studies. *FAO Fisheries Technical Paper* No. 440. Rome, FAO. 2003. 103p.

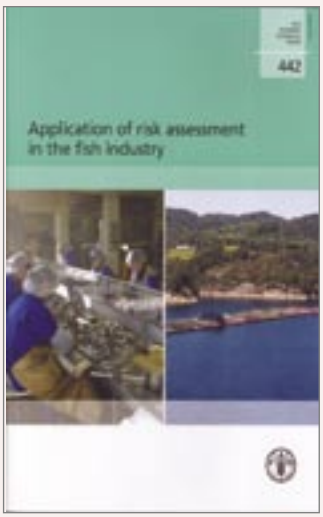
These guidelines provide general principles and basic considerations for those involved in providing microfinance services to fisheries and aquaculture and for those who intend to include fishing and fish farming communities as part of the client base of their operation. The guidelines further elaborate on lending models, methodologies and policies that have applicability to fisheries and address concerns that are particular to the sector, while adhering to best practices in the microfinance field.

The publication also contains a summary of the proceedings and recommendations of the Report of the Regional Workshop on Microfinance Programmes in Support of Responsible Aquaculture and Marine Capture Fisheries in Asia. The workshop was held in Chiang Mai, Thailand from 16 to 20 December 2002. An overview of recent experiences with microfinance programmes in fisheries and aquaculture in Asia is given and conclusions are drawn regarding future directions and initiatives in this field. The workshop was attended by 31 participants from eight South and Southeast Asian countries: Bangladesh, India, Malaysia, Nepal, the Philippines, Sri Lanka, Thailand and Viet Nam. It brought together experts representing fisheries government institutions, financial institutions, academic and research institutions, NGOs, cooperatives, women's unions, fishermen's associations and technical staff of foreign-assisted projects in aquaculture in the region.

The publication concludes with two examples of successful FAO-executed projects that incorporated microfinance programmes in fishing community development in the Philippines and in small-scale aquaculture development in Viet Nam, with a special focus on gender and poverty alleviation. The case studies provide practical examples of how microcredit can contribute to the empowerment of

women in fishing and fish farming communities, help alleviate poverty and contribute to the socio-economic wellbeing and food security of fishers and fish farmers

Sumner, J., Ross, T. & Ababouch, L. Application of risk assessment in the fish industry. *FAO Fisheries Technical Paper.* No. 442. Rome, FAO. 2004. 78p.



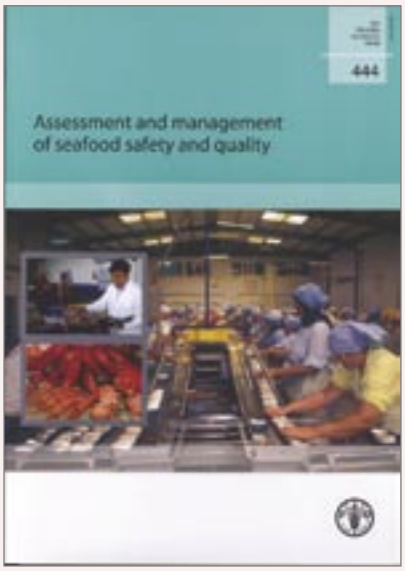
In recent years, the concept of risk has become paramount in international food regulation. Industries are increasingly required to undertake product risk assessment, particularly in the export arena. This publication has been developed as a complete "How to" package on risk assessment for seafood technologists, regulators and health professionals. It is designed in five parts and takes the user from a basic knowledge to being able to conduct credible risk assessments:

1. The basics of risk assessment: definitions and language of the discipline
2. How to perform risk assessments: stepwise progression
3. How to use risk assessments: risk management, Hazard Analysis Critical Control Point (HACCP), risk profiling
4. Risk Ranger - how to use it
5. Examples of risk assessments: an interactive setting for the reader

Seaweed is a very versatile product widely used for food in direct human consumption. It is also an ingredient for the global food and cosmetics industries and is used as fertilizer and as an animal feed additive. Total annual value of production is estimated at almost US$ 6 billion of which food products for human consumption represent US$ 5 billion. Total annual use by the global seaweed industry is about 8 million tonnes of wet seaweed.

Huss, H.H, Ababouch, L & Gram, L. Assessment and management of seafood safety and quality *FAO Fisheries Technical Paper. No.* 444. Rome, FAO. 2003. 230p.

This paper compiles the state of knowledge on fish safety and quality with the view to provide a succinct yet comprehensive resource book to risk and fish quality managers. After an introduction about world fish production and consumption and the developments in safety and quality systems, it provides a detailed review of the hazards causing public health concerns in fish and fish products. It devotes several Chapters to risk mitigation and management tools, with a detailed description of the requirements for the implementation of Good Hygienic and Manufacturing Practices (GHP/GMP), of the Hazard Analysis and Critical Control Point (HACCP) system and of the monitoring programmes to control biotoxins, pathogenic bacteria and viruses and chemical pollutants. Chapters on the use of microbiological criteria, the use of the HACCP approach to target quality aspects other than safety matters, predictive microbiology, traceability and examples of food safety objectives complete the document.



Lovatelli, A. (comp./ed.), Conand, C., Purcell, S., Uthicke, S., Hamel, J.F. & Mercier, A. (eds.). Advances in sea cucumber aquaculture and management. *FAO Fisheries Technical Paper*. No. 463. Rome, FAO. 2004. 425p.

The December 2003 issue of the FAO Aquaculture Newsletter (FAN No. 30) reported on the organization and outcome of the international workshop on the "Advances in Sea Cucumber Aquaculture and Management" (ASCAM) organized by the FAO Fisheries Department and the Chinese Ministry of Fisheries. The proceedings of this activity has now been available for a few months and includes all the technical papers presented on the status of the resources and their utilization, on resource management and the on major aquaculture advances achieved in this specific aquaculture field. The recommendations concerning sea cucumber resource management and aquaculture deliberated by the participants appear in the introductory part of the report.

Further details can be obtained by writing to Mr Alessandro Lovatelli at FAO/HQ (e-mail: alessandro.lovatelli@fao.org).

Helm, M.M., Bourne, N., & Lovatelli, A. (comp./ed.). Hatchery culture of bivalves: a practical manual. *FAO Fisheries Technical Paper.* No. 471. Rome, FAO. 2004. 177p.

Bivalve mollusc culture is an important and rapidly expanding area of world aquaculture production. The majority of production is from natural populations although increasingly stocks are approaching or have exceeded maximum sustainable yields. Stock enhancement through the capture and relaying of natural seed in both extensive and intensive forms of culture is common practice worldwide but the reliability of natural recruitment can never be guaranteed. A solution to meeting the seed requirements of the bivalve industry, applicable to the production of high unit value species such as clams, oysters and scallops, is hatchery culture. The production of seed through hatchery propagation accounts at the present time for only a small percentage of the total seed requirement but it is likely to become increasingly important.

This manual is a synthesis of the current methodologies applicable to the intensive hatchery culture of bivalve molluscs covering similarities and differences in approach in rearing clams, oysters and scallops in different climatic regions. All aspects of the culture process are described, together with considerations in choosing a site for hatchery development and in the design of suitable facilities. The manual also includes the post-hatchery handling of "seed" bivalves in land- and sea-based nursery culture preparatory to on-growing. This publication is intended to assist both technicians entering this field as well as investors interested in evaluating the complexity of intensive hatchery production. The authors bring together a combined 80 years of experience in the biology, management and operation of hatcheries encompassing a range of the more commonly cultured bivalve species in different parts of the world.

Further details can be obtained by writing to Mr Alessandro Lovatelli at FAO/HQ (e-mail: alessandro.lovatelli@fao.org).

Farewell to Mr Benedict Satia

During the last days of November 2004, Mr Benedict P. Satia, Chief, International Institutions and Liaison Service (FIPL), retired after almost 13 years of service in the Organization.

Mr Satia, a Cameroon national, received a Ph.D. in Fisheries from the College of Fisheries, University of Washington, Seattle in 1973 and later worked in that University as Assistant Professor of Fisheries. On return to Cameroon, he was appointed Head of the Aquaculture Service in the Ministry of Agriculture and in 1979 was appointed Deputy-Director of Fisheries in the Ministry of Livestock, Fisheries and Animal Industries. He opted for early retirement from the Cameroon Public Service in February 1992.

He joined FAO in March 1992 as Programme Coordinator of the Regional Project "Programme for Integrated Development of Artisanal Fisheries in West Africa" which covered 20 countries from Mauritania to Angola.

In 1996, he was appointed Chief, International Institutions and Liaison Service at FAO headquarters.

In this capacity, he was also Secretary of the FAO Committee on Fisheries as well as of the Advisory Committee on Fisheries Research (ACFR). As an expert, he had already served as a member of ACFR, between 1980 and 1989.

During its Fifth Session, in October 2004, the Advisory Committee expressed particular praises for the work of Benedict Satia reflecting thus the views of his own colleagues and of the Department.

In addition to his solid formation, completed by comprehensive and variegated professional experience, Benedict Satia has always shown a high level of commitment, both as a team leader and as an expert in the matters dealt with by his Service and the Department. A man of high standards, good natured and cordial, he has been always well respected and liked by his colleagues, who will miss him very much after his retirement but are certain that he will continue contributing in other capacities to the work of the Organization and of the Fisheries Department.

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FAN

FAO Aquaculture Newsletter

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The FAO Aquaculture Newsletter (FAN) is issued two times a year by the Inland Water Resources and Aquaculture Service, Fishery Resources Division, of FAO's Fisheries Department, Rome, Italy. It presents articles and views from the FAO aquaculture programme and discusses various aspects of aquaculture as seen from the perspective of both headquarters and the field programme. Articles are contributed by FAO staff from within and outside the Fisheries Department, from FAO regional offices and field projects, by FAO consultants and, occasionally, by invitation from other sources. FAN is distributed free of charge to various institutions, scientists, planners and managers in member countries and has a current circulation of about 3 000 copies.

It is also available on the FAO Web site:
www.fao.org/fi/newslet/newslet.asp

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