

Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity

Workshop

23-25 February 2010

Central Inland Fisheries Research Institute, Barrackpore, Kolkata, West Bengal

Organized by
**International Collective in
Support of Fishworkers
(ICSF)**

in collaboration with
**Inland Fisheries Society
of India (IFSI)**



Report



International Collective in Support of Fishworkers (ICSF)

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VISHWANATH WAIKHOM/UNIVERSITY OF MANIPUR



A dry fish market in the State of Manipur, with a variety of small indigenous freshwater fish species

List of Abbreviations

ADG	Assistant Director General	IPR	intellectual property rights
AIMS	Aquaculture of Indigenous Mekong Species	MDGs	millennium development goals
ASRB	Agricultural Scientists' Recruitment Board	mn	million
CFC	composite fish culture	MoA	Ministry of Agriculture
CIFA	Central Institute of Freshwater Aquaculture	MoEF	Ministry of Environment and Forests
CIFRI	Central Inland Fisheries Research Institute	MP	Madhya Pradesh
DoF	Department of Fisheries	mt	metric tones
FARD	Fisheries and Animal Resources Development Department, Government of Orissa	NATP	National Agricultural Technology Project
FAO	Food and Agriculture Organization of the United Nations	NBFGR	National Bureau of Fish Genetic Resources
GDP	gross domestic product	NFDB	National Fisheries Development Board
HUFAs	highly unsaturated fatty acids	NGO	non governmental organization
ICAR	Indian Council of Agricultural Research	NREGS	National Rural Employment Guarantee Scheme
ICSF	International Collective in Support of Fishworkers	PUFAs	polyunsaturated fatty acids
IFSI	Inland Fisheries Society of India	RKVY	Rashtriya Krishi Vikas Yojana
IMCs	Indian Major Carps	SIFFS	small indigenous freshwater fish species
		WFP	World Food Programme

CM MURALIDHARAN



Harvesting of *mola* from a freshwater fish pond in Sundarbans, West Bengal

Preface

In many parts of the south and Southeast Asia, including India, a large diversity of small indigenous fish species are found in freshwater systems. These small indigenous freshwater fish species (SIFFS) form a major component of food consumed by families, especially those living closer to freshwater resources. Among traditional communities indigenous knowledge about the health benefits of such species exists, for example, *mola* (*Amblypharyngodon mola*), commonly found in eastern and northeast India, is often included in the diet of pregnant and lactating mothers, for its nutritive value. Such knowledge is, however, poorly documented. The role of SIFFS in providing micronutrients is critical to take note of in a context where micronutrient deficiency is a big, if hidden, problem. One of the noted advantages of SIFFS is that people, even the poor, can buy them in quantities they can afford.

SIFFS found in the vast inland water resources, provide not only nutrition but also livelihood opportunities and income to a large number of fishers. Studies in India have shown that the profit accruing to fishers is actually higher in the case of SIFFS when compared to those from large cultured species.

However, such species have received insufficient attention in statistics, inland water fisheries policies and programmes in India, both at the national and State levels. To address this anomaly, the International Collective in Support of Fishworkers (ICSF) Trust, in collaboration with the Inland Fisheries Society of India (IFSI), organized a national workshop titled “Small Indigenous Species of Freshwater Fish: Their Role in Poverty Alleviation,

Food Security and Conservation of Biodiversity”, during 23-25 February 2010 at the Central Inland Fisheries Research Institute (CIFRI), Kolkata, West Bengal.

The workshop was organized as a forum for people working in freshwater fisheries and aquaculture to exchange views on the role of SIFFS in enhancing rural food and livelihood security and in conserving biodiversity. It was also to discuss the socioeconomic and cultural context for culture and capture of SIFFS with a view to enhancing access, especially of women, to better income, livelihood and nutritional security, and to propose policy spaces for sustainable management of SIFFS.

The workshop was made possible due to the financial and other support extended by the Ministry of Agriculture (MoA); the National Fisheries Development Board (NFDB); the Ministry of Environment and Forests (MoEF); the Government of West Bengal; the Indian Council of Agricultural Research (ICAR); the Inland Fisheries Society of India (IFSI); the Central Inland Fisheries Research Institute (CIFRI); and the Government of Orissa.

It is hoped that the workshop statement and report will be useful in providing fresh focus on SIFFS—till now considered as trash/ weed fish—by scientists, researchers and policy makers. It is also hoped that the proceedings will contribute towards developing policy and legislative measures to ensure the conservation and promotion of SIFFS, both in capture- and culture-fisheries-systems, as well as access of disadvantaged groups, particularly women, to such species, for purposes of nutrition, livelihoods, and conservation of biodiversity. 

VISHWANATH WAIKHOM/UNIVERSITY OF MANIPUR



A scene from a market in Manipur State.
Small indigenous freshwater fish species share space with other types of fish

Prospectus

Fish are often an important ingredient in the diet of people who live in the proximity of water bodies. People have traditionally depended on various varieties of indigenous fish species, easily available from nearby water bodies, as a source of nutrition. Daniels (2002) indicates that of 750 species of freshwater fish species found in India, a large number of them are familiar only to the local population. These species are better known to the rural population due to the importance they attach to these species as a vital and affordable source of nutrition. This is not only the case in India but also in other countries in Asia such as Laos, Cambodia, Viet Nam and China (Halwart & Bartley 2005).

A large diversity of indigenous species, an important component of aquatic biodiversity, are found in the water bodies that crisscross the Indian subcontinent. A significant number of these species are a rich source of nutrition for the rural poor either on a seasonal basis or round the year. These species are either caught from nearby water bodies or get naturally recruited to homestead/common village ponds which are then harvested by the pond owner or the local community. Many of these water rich areas are also well known for their fish-cum-paddy culture.

Complex patterns of access rights to such indigenous fish species have been documented in literature—for example, access to them even in privately-owned paddy fields is often enjoyed by the larger community, including landless people, with related food security and poverty alleviation benefits. This highlights the need to understand the local socioeconomic, cultural and institutional context that

determines who can access and benefit from fisheries resources from capture or culture fisheries.

Small indigenous fish species of freshwater origin are not only a source of vital protein to the rural poor but also of micro-nutrients such as calcium, zinc, iron and fatty acids (Roos et al, 2007; Halwart, 2008). Indigenous knowledge about these species and about their health benefits is high among rural population. For example, such species are often considered an essential part of the diet of pregnant women and lactating mothers. Research has proved that the bioavailability of calcium from these small indigenous freshwater fish species is at par with that derived from milk (Roos et al., 2007).

Significant production of small indigenous fish species of freshwater origin, from culture and capture fisheries, is reported from several water bodies. That these species tend to be sold and consumed locally could be one of the reasons why they remain invisible in national statistics—such statistics are largely based on catches reported at large/major landing centres (Halwart, 2008; Roos, 2007). This invisibility in statistics could account for their poor recognition in fisheries and aquaculture development policies.

Although the system of sewage-fed aquaculture in West Bengal had tried incorporating minor indigenous carp species such as *Labeo bata*, *Labeo fimbriatus*, *Cirrhinus reba*, and *Amblypharyngodon mola* (Ayyappan & Jena, 2003), there has not been any major effort to integrate these species into carp polyculture systems in India.

Before the introduction of hatchery-produced seeds, in the initial years of reservoir fisheries, water

bodies were stocked with naturally available seeds (Sugunan, 1992). It has been observed that a variety of indigenous fish species were stocked, for example, in reservoirs of Tamil Nadu and Kerala. After the introduction of hatchery-produced carp seeds, there was a shift in species used for stocking water bodies from indigenous varieties to a combination of *catla*, *rohu* and *mrigal*. Often small indigenous species were removed as vermin, with negative implications for conservation of biodiversity in freshwater ecosystems.

However, recent research in Bangladesh has demonstrated that integration of some of the small indigenous species into polyculture systems—for example, *Amblypharyngodon mola* along with carp species—has increased overall pond fish production (Roos et al, 2007). *Mola* reproduces several times and increases the productivity of the pond and enhances the local availability of fish. It has also been observed that these species command high prices, often higher, for example, than prices for Indian Major Carps (IMC's) (Ahmed, 2009; Saha, 2003), thus providing a source of supplementary income to rural households. Given the local demand for small indigenous fish species of freshwater origin, the FAO (1999) has also indicated the possibility of integrating such indigenous fish species into freshwater culture systems.

Considering the extent to which small indigenous species of freshwater fish play a role in providing nutrition to the rural poor and in maintaining biodiversity, it is important to consider promoting sustainable use of small indigenous species in both capture and culture fishery systems. Eastern India, for example, has a great potential for expanding freshwater aquaculture by integrating small indigenous species of fish into current production systems. Such integration can help better

achieve the objectives of increasing fish production, enhancing nutritional security of the rural poor, providing greater employment opportunities, and conserving biodiversity in freshwater ecosystems. These are all objectives of sustainable development as promoted by the Government of India through the Ministry of Agriculture and the Ministry of Environment and Forests.

It is, however, important to locate these efforts within specific cultural and socioeconomic contexts, looking also at critical issues of ownership and access rights over water bodies, and to formulate relevant strategies, as appropriate. If such factors are taken into consideration, the objectives of nutritional security, promotion of employment and conservation of biodiversity can be better met especially in some of the most disadvantaged areas of Eastern India showing poor human development indicators.

There is, therefore, need to throw light on sustainable use of small indigenous fish species, their role in food security, employment, income, poverty alleviation and conservation of biodiversity and also to actively establish the feasibility of polyculture using small indigenous species of fish. In this context, it is important to discuss the developing policy space for sustainable use of small indigenous species in culture and capture fisheries.

Workshop Objectives

It is against this backdrop that ICSF organized a three-day workshop in collaboration with Inland Fisheries Society of India (IFSI) titled “Workshop on *Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity*”, with the following objectives:

- Provide a forum for people working in freshwater fisheries

and aquaculture to exchange views about the role of small indigenous species of freshwater fish species (SIFFS) in enhancing rural food and livelihood security and in conserving biodiversity;

- Discuss the socioeconomic and cultural context for culture and capture of SIFFS with a view to enhancing access, especially of women, to better income, livelihood and nutritional security; and
- Propose developing policy space for sustainable use of small indigenous freshwater fish species in fisheries and aquaculture.

The workshop included two days of input sessions, group discussions and developing recommendations, and one day of field visit to farms practicing polyculture including small indigenous freshwater fish species.

Dates and venue

The workshop was held on 24 and 25 February 2010, at the Central Inland Fisheries Research Institute, Kolkata with a field trip on 23 February 2010.

Participants

The workshop brought together 58 participants who included researchers, policymakers, fish farmers and members of civil society. In addition to India, resource persons from Bangladesh and Denmark as well as from the WorldFish Centre were present at the workshop.

Outcomes

The workshop:

- Created an awareness amongst aquaculture farmers and policy makers about the benefits of integrating small indigenous freshwater fish species into aquaculture systems;
- Provided a platform to promote local livelihood and nutrition-sensitive aquaculture; and
- Reiterated the need for taking up action research to propose alternative practices for integrating small indigenous freshwater fish species into sustainable aquaculture and capture fisheries systems. 

NEENA KOSHY/ICSF



A fisherman in Bhubaneswar, Orissa, selling Indian Major Carps.
The bigger fishes are usually sold in the market by men

Declaration

We, scientists, researchers, policymakers, fish farmers and members of civil society, having participated in the Workshop: *Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity* organized jointly by the International Collective in Support of Fishworkers (ICSF) and the Inland Fisheries Society of India (IFSI), from 23 to 25 February, 2010 at the Central Inland Fisheries Research Institute (CIFRI), Barrackpore, Kolkata;

Being aware that the 61st Session of the United Nations General Assembly has declared 2010 as the International Year of Biodiversity;

Recognizing the importance of conserving biodiversity of small indigenous freshwater fish species in the context of climate change, sustainable development and aquatic biodiversity;

Taking note of the significant but invisible contribution of small indigenous freshwater fish species to culture and capture fishery production in India;

Being aware of the importance of small indigenous freshwater fish species as an affordable source of nutrition, particularly of micronutrients, to the rural poor;

Taking note of research and good practices in relation to small indigenous freshwater fish species, aquatic biodiversity and poverty alleviation, by national and international agencies;

Recommend the Department of Animal Husbandry, Dairying and Fisheries and Indian Council of Agricultural Research, Ministry of Agriculture, Government of India; Ministry of Environment and Forests, Government of India; State fisheries ministries and departments, and state environment and forest ministries and

departments, civil society organizations and other relevant and interested parties to:

- Conserve small indigenous freshwater fish species by protecting their natural habitat;
- Promote sustainable use of small indigenous freshwater fish species in both capture and culture fishery systems for enhancing nutritional security of the rural poor, providing greater employment opportunities;
- Actively examine the feasibility of incorporating small indigenous freshwater fish species into existing polyculture practices through research, development and extension programmes;
- Target studies on contribution of small indigenous freshwater fish species from different aquatic resources and farming systems;
- Evaluate the role of small indigenous freshwater fish species in nutritional security of vulnerable groups, such as pregnant and lactating women and children;
- Ensure that policy and legislation at different levels on capture fisheries, aquaculture and biodiversity conservation addresses the development needs and conservation requirements of small indigenous freshwater fish species;
- Protect access rights of local communities, especially women, to small indigenous freshwater fish species, particularly through appropriate policies and legislation that take into consideration the local socioeconomic, cultural and institutional context; and
- Document and protect traditional knowledge and farmers' innovation with regard to use of small indigenous freshwater fish species resources. 

SUJITH CHOWDHURI/CIFRI



(From Left to Right) Ms. Chandrika Sharma, Executive Secretary ICSP; Dr. G Mohan Kumar, Principal Secretary, FARD, Govt of Orissa; Dr. A P Sharma, Director, CIFRI; Dr. V V Sugunan, ADG (Fy), ICAR; Dr. P Das, Ex-Director, NBFGR; on the dais during the inaugural session of the workshop on small indigenous freshwater fish species held in CIFRI, Barrackpore, West Bengal

SUJITH CHOWDHURI/CIFRI



Dr. P K Mukhopadhyay, Principal Scientist, CIFA, making a presentation during the session on nutrition

Report of the Workshop

Day I: 24 February 2010

Inaugural Session

Chair: G Mohan Kumar, Principal Secretary, Fisheries and Animal Resource Development Department (FARD), Government of Orissa

Welcome Address

by Manas K Das, Principal Scientist & Head (FREM Division), CIFRI

Dr. Manas K Das said that the response to the workshop on “Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity”, organized by the International Collective in Support of Fishworkers (ICSF) Trust in collaboration with the Inland Fisheries Society of India (IFSI), bore testimony to the importance of the subject in the region. He welcomed Dr. Mohan Kumar, Principal Secretary, Fisheries and Animal Resource Development Department, Government of Orissa; Dr. V V Sugunan, Assistant Director General (ADG), Inland Fisheries, Indian Council of Agricultural Research (ICAR), well-known as an expert on reservoir fisheries; Dr. P Das, ex-Director, National Bureau of Fish Genetic Resources (NBFGR), the guest of honour; Ms. Chandrika Sharma, Executive Secretary, ICSF; and Prof. A P Sharma, President, IFSI, and Director, Central Inland Fisheries Research Institute (CIFRI). He also extended a warm welcome to all the other participants, including scientists, non-governmental organizations (NGOs), farmers, and the media.

Following the welcome address, Dr. N P Srivastava, Principal Scientist, CIFRI, recited a poem written by him in Hindi, which set the tone for the workshop. The poem emphasized

that small, native fish species, full of nutritional qualities, need to be recognized as the life-giver for the poor. These species need to be protected and propagated in India's waters, and their production increased through aquaculture, to ensure the food security of the poor.

Introduction to the Workshop

by Chandrika Sharma, Executive Secretary, ICSF

Introducing the workshop, Ms. Chandrika Sharma, Executive Secretary, ICSF, said that ICSF is committed to supporting sustainable small-scale fisheries and aquaculture and has, over the years, consistently drawn attention to the need to protect the range of biodiversity that fishing communities depend on for their livelihoods, as well as the rights of communities to access these resource. The workshop, said Ms. Sharma, should provide the opportunity to highlight the important role of small indigenous freshwater fish species (SIFFS) in providing a unique source of nutrition, especially to disadvantaged populations in the eastern and northeastern States of India. It should also provide the opportunity to debate on ways of ensuring that such species are better conserved and promoted, both in capture- and culture-fisheries systems, as well as on policy and legislative measures needed to ensure access of disadvantaged groups, and

particularly women, to such species, both for purposes of nutrition and livelihoods.

Ms. Sharma noted that the workshop had been made possible due to the financial and other support extended by the Ministry of Agriculture (MoA); the National Fisheries Development Board (NFDB); the Ministry of Environment and Forests (MoEF); the Government of West Bengal; ICAR; IFSI; CIFRI; and the Government of Orissa. She also thanked Dr. Shakuntala Thilsted from the Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Denmark, for her unique work in highlighting the nutritional perspective on small indigenous species, a major influence in the design of the workshop.

Inaugural Address

by A P Sharma, Director, CIFRI, and President, IFSI

Dr. A P Sharma, Director, CIFRI, and President, IFSI, pointing to the contemporary importance of the workshop, said that SIFFS, considered 'trash' fish until the 1980s, are slowly being recognized as valuable from economic, livelihood, nutritional and environmental perspectives. Adequate attention to their rational exploitation and conservation is needed, to maintain the health of the ecosystem and to ensure that such species continue to contribute to the livelihoods and nutritional wellbeing of disadvantaged populations. Dr. Sharma drew attention to the studies undertaken by CIFRI that have indicated that traditional fishers in the floodplain wetlands of the Ganga and Brahmaputra river basins depend, to a large extent, on small indigenous varieties of fish for their daily earnings, especially during the lean season and fishing holidays. It has been estimated that, on average, almost 30 per cent of daily income comes from sale proceeds of SIFFS, as these species have high market value and are preferred by consumers. Dr. Sharma stressed that

any amount of progress made in the aquaculture of large and fast-growing fish and prawn, however much it may lead to an increase in overall production, could not replace the utility, free accessibility and assured mass benefits that come from the large diversity of the country's SIFFS. The conservation of these species could not, therefore, be relegated to the backburner any longer. There is need to discuss the threats facing the habitat of these species, due to, among other things, dams and barrages, run-off of pesticides and chemicals from agricultural fields into aquatic systems, and encroachment of wetlands and other water bodies for human settlement and other developments. The impact of anthropogenic activities needs to be better understood in order to propose remedial measures. The debates during the workshop should pave way for formulating strong policy guidelines for the conservation and rational exploitation of these species, Dr. Sharma concluded.

Special Address

by P Das, Ex-Director, NBFGR

Dr. P Das, Ex-Director, NBFGR, said that the term 'conservation' was not new in an Indian context. Texts indicate that as early as 321 BC there was concern about conservation of some fish species. During the rule of Emperor Ashoka in 245 BC, conservation measures in the form of specific laws were in place. With respect to SIFFS, a recent study by NBFGR has documented their rapid decline, which could be indicative of degradation of their habitats. If urgent corrective measures are not taken, these species will disappear in due course, Dr. Das warned. He emphasized that for the purpose of the workshop, it is important to define SIFFS.

Dr. Das noted that India has been promoting composite fish culture. However, polyculture with SIFFS is viewed with caution due to the belief that these species will compete with commercially cultured fish, that is, the

IMCs, for space and feed, hampering the growth and production of the latter species. He pointed out that SIFFS fetch very high prices: while carps are sold for Rs60-80 per kg, a kilogram of *mola* (*Amblypharyngodon mola*) can fetch as much as Rs300-350 per kg. High prices make it a lucrative species for culture and the Central Institute of Freshwater Aquaculture (CIFA) should look into possible culture protocols for these species. Efforts could also be made to enhance their production in their natural environments, such as paddy fields and wetlands, he concluded.

Special Message

by Kiranmoy Nanda, Minister in Charge of Fisheries, Government of West Bengal (Delivered by Madhumita Mukherjee, Additional Director, Directorate of Fisheries, Government of West Bengal)

Shri Kiranmoy Nanda, Minister in Charge of Fisheries, Government of West Bengal, in his message, highlighted that SIFFS are traditionally known to contribute to the nutritional security of people living in the vicinity of water bodies. They are also known to play important roles in supporting the livelihoods and incomes of poor fishers, contributing to poverty alleviation. These species are also vital in sustaining biodiversity and maintaining environmental balance. However, due to growing urbanization and the indiscriminate use of pesticides and insecticides in agriculture, such freshwater fish species are being threatened and their habitats destroyed and limited. The workshop, the Honourable Minister's message stressed, should help to throw light on the prospects and problems of SIFFS.

Keynote Address

“Fisheries, a Driver for Livelihood and Nutritional Security in India”

by V V Sugunan, Assistant Director General, Inland Fisheries, ICAR

Dr. V V Sugunan, Assistant Director General, ICAR, provided a brief overview of the Indian fisheries sector,

touching upon its social and economic relevance, production systems and trends, the current research and development scenario, areas for future research, and the major issues facing the sector. India is the third-largest fish producer and second-largest inland fish producer in the world and the fisheries sector is estimated to contribute 1.07 per cent to the country's gross domestic product (GDP). This, however, is a glaring underestimate, given the poor valuation techniques currently employed, stressed Dr. Sugunan. Fish, whose per capita consumption in India is nine kg per head (as against one kg for meat), remains the most affordable form of protein for the people at large. Dr. Sugunan pointed to the importance of fish as food for the poor, since, unlike mutton and chicken, which are sold at a uniform price, different types of fish are available for different income groups at different price levels. The fisheries for SIFFS also provide an important livelihood safety net, he observed.

With respect to production, fish production in India has risen from 0.75 mn tonnes in 1950-51 to 7.6 mn tonnes in 2008-09. While in 1950-51, about 29 per cent of production was from inland fisheries, in 2008-09 the level had risen to 60 per cent. The increase in inland production is mainly due to the growth of inland aquaculture. According to projections, to meet growth in consumer demand, fish production needs to increase to 11.8 mn tonnes by 2020-21. Hopes for this huge jump in production are pinned on aquaculture in a scenario where production from capture fisheries is stagnating or decreasing. While production from freshwater aquaculture is expected to increase from 3.7 mn tonnes to 6.37 mn tonnes, the production from coastal aquaculture is expected to grow only from 0.10 mn tonnes to 0.40 mn tonnes.

The challenges in achieving the above targets are:

- attaining a growth rate of 6 per cent per annum—a difficult but accomplishable task;

- coping with the decreasing availability of natural water bodies and land, brought on by habitat degradation; and
- managing environmental concerns like climate change.

Dr. Sugunan said that the above targeted growth rate is achievable through increase in production from capture fisheries and aquaculture, and through the enhancement of fisheries and integrated farming systems. There is need, however, to ensure a balance between production enhancement and environmental sustainability. Aquaculture, for instance, could take the form of extensive, semi-intensive, intensive and hyper-intensive systems. While hyper-intensive aquaculture may help meet production targets fast, it could result in problems of sustainability. The coming years will see plans for horizontal and vertical expansion in aquaculture so as to increase fish production. It is planned to bring more area under culture, since currently only 40 per cent of the available potential of 2.4 mn ha for freshwater aquaculture is being utilized. It is also planned to include more species under culture. While there are 15 to 20 species that are available for commercial culture, about 87 per cent of freshwater aquaculture production in India is from only three species of IMCs (*catla*, *rohu* and *mrigal*).

Citing the example of the State of Andhra Pradesh, which, despite being one of the driest regions of India, tops inland fish production, Dr. Sugunan underscored the importance of having an enabling policy environment. He also underlined the importance of an effective governance regime that promoted the active participation of stakeholders within a co-management framework, ensuring a sustainable and equitable management system. Leasing policies for inland fisheries need attention, as in some States the benefits from fisheries accrue mainly to individual contractors, not fishers, he concluded.

Presidential Address

by G Mohan Kumar, Principal Secretary, Department of Fisheries and Animal Resources Development (FARD), Government of Orissa

Dr. G Mohan Kumar, Principal Secretary, Fisheries and Animal Resources Department (FARD), Government of Orissa, pointed out that the focus of culture has mainly been on well-known commercial varieties, such as carps. Indigenous varieties of fish have not been considered, though they are important from a nutritional and livelihoods perspective. Dr. Mohan Kumar drew attention to the example of China, where the diversity of species in culture is much higher. While trials are underway in Central Institute of Freshwater Aquaculture (CIFA) for incorporating small species in culture, there is still a long way to go before such practices can be widely propagated, he noted. There is need to discuss how the process of diversification in aquaculture can be accelerated. Drawing attention to practices commonly adopted during pond preparation—such as the use of pesticides, insecticides and piscicides to eradicate naturally occurring species from the water body—Dr. Mohan Kumar said there is need to review whether such practices should be continued or discontinued. The workshop should pave the way for fresh thinking in aquaculture, he observed. Dr. Mohan Kumar also stressed the importance of protecting SIFFS in their natural habitats.

Vote of Thanks

by Nalini Nayak, Member, ICSF

Thanking all the speakers at the inaugural session, Ms. Nalini Nayak, Member, ICSF, said that there are various challenges to increasing fish production, while keeping in mind social, scientific, technical, ecological and ethical issues. It is important to examine whose needs are going to be met and at what cost, she stressed. 

Technical Session I: Small Indigenous Freshwater Fish Species and Their Role in Ensuring Nutrition to the Local Community

Chair: Nalini Nayak, Member, ICSF

Rapporteurs: S K Manna and B K Behra, CIFRI

Presentation on “The Role of SIFFS in Improving Nutrition in Rural Populations”

by Shakuntala Haraksingh Thilsted, Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Denmark

Dr. Shakuntala Haraksingh Thilsted, Department of Human Nutrition, University of Copenhagen, Denmark, spoke about the importance of SIFFS as a source of nutrition. The importance of fish as a source of protein is often highlighted. While fish is undoubtedly an important source of animal protein, in south and Southeast Asia, where the diet is mainly cereal-based, the principal source of protein is actually rice, which contributes about 8-10 per cent of an individual's average protein intake. This, along with other foods like pulses, milk and milk products, is often adequate to meet the total protein requirement of an individual. By concentrating on fish as a source of protein, one really misses the point that it is an important source of micronutrients—minerals like calcium and zinc, and vitamins such as vitamin A. Dr. Thilsted pointed out that with respect to human nutrition, though protein is essential, it is not a limiting nutrient. Micronutrient deficiency, sometimes termed 'hidden hunger' since it is difficult to see, is a big problem in south and Southeast Asia. About 250 mn children worldwide, for example, are estimated to be at risk of vitamin A deficiency, and an equal or more number are at risk of deficiencies of other minerals like iron, zinc and calcium.

Experiments undertaken on the micronutrient content of locally available fish and cultured species in Bangladesh, found that *mola*, a locally available small indigenous fish, contained about 89 times more vitamin A than did grass carp, a fish that is widely cultured in Bangladesh. Most of the vitamin A found in *mola* occurs near the eye. Traditionally, *mola* is cooked whole, boiled along with vegetables to form a curry savoured by the local people. This form of cooking, where the fish is boiled and consumed whole, ensures maximum nutritional benefit. The process of cooking and cleaning, and which part of the fish is eaten or discarded, determines how much nutrition is actually derived from fish, noted Dr. Thilsted.

In countries of south and Southeast Asia, SIFFS form a major component of the food consumed by families, especially by those living closer to freshwater resources. This locally available, highly nutritious component adds diversity to the rice-based diet. National statistics, however, usually fail to take into account the production and consumption patterns of these species, as production and marketing take place at a very local level, carried out by family members. There is need for better information on the production, marketing and consumption of SIFFS. It is equally important to get information about intra-household consumption patterns, particularly on who consumes what within the household, with a particular focus on women and children.

Studies on 16 varieties of fish in Cambodia have shown that most of the indigenous varieties of fish have great iron content, which is also highly bioavailable. (Bioavailability is the degree to which an agent, such as a drug or nutrient, becomes available at the site of activity in the body.) Out of the 16 varieties screened, *Esomus longimanus* (Mekong flying barb) had the highest content of iron, with the highest bioavailability. Iron is one of the key essential limiting nutrients for humans. The same degree of bioavailability was also found for zinc. In Cambodia, the World Food Programme (WFP) is, therefore, promoting the use of *Esomus longimanus* as supplementary food for small children. Research has also shown that if one adds fish to rice (the way fish is usually consumed), the bioavailability of iron increases considerably.

Studies in Bangladesh have shown that a minimal production of 10 kg of *mola* per year from a pond, in a country where there are about 1.3 mn household ponds, could meet the vitamin A requirement of two million children. Though *mola* is only available seasonally, studies have shown that adequate intake of *mola* during the available months could meet the vitamin A requirements of an individual for the rest of the year.

Calcium is known to be important for children, and for pregnant and lactating women. All small fish are good sources of calcium, given that they are eaten whole (with the bones). Calcium is also available in bigger fish, though the bioavailability is not as high as in the case of small fish. Studies comparing *mola* and milk as sources of calcium have shown that though the bioavailability from both sources are almost the same, *mola* is a much better source because of the higher concentration of calcium.

The importance of SIFFS as a carrier for nutrients contained in other ingredients used in the fish preparation was also highlighted.

Taking these points into consideration, Dr. Thilsted proposed areas for future research on SIFFS:

- Data and analyses on fish consumption are needed to determine their contribution to micronutrient intakes.
- Advocacy, awareness raising and nutrition education at all levels on the importance of small, nutrient-dense fish to increase diet diversity and combat micronutrient malnutrition, and the importance of cleaning and cooking practices, should be promoted.
- Sustainable, low-cost, large-scale strategies to increase the management, conservation, production and accessibility of micronutrient-dense small fish species should be developed and implemented.

Dr. Thilsted pointed out that with increasing food prices, a higher proportion of household expenditure goes towards basic foodgrains like rice, while less money is spent on purchasing nutrient-rich food such as fish. This has a direct and adverse effect on the diet diversity of people, especially the poor, and could lead to micronutrient deficiencies. In such a context, it is very important to enhance poor people's accessibility to locally available and preferred fish species, so as to maintain the micronutrient intake of the population and prevent hidden hunger. It is important that policymakers concentrate on micronutrient availability, and not only on availability of proteins. Preventing micronutrient deficiencies will also help in meeting the Millennium Development Goals (MDGs) as well as

national development goals, concluded Dr. Thilsted.

Panel Discussion

P K Mukhopadhyay, Principal Scientist, CIFA, Rahara

Dr. P K Mukhopadhyay, Principal Scientist, CIFA, Rahara, said that fish is known to be an important source of myofibrillar proteins of high biological value. Fish also provides essential components for the human body, namely polyunsaturated fatty acids (PUFAs) and highly unsaturated fatty acids (HUFAs), which fight illnesses like cardiovascular disease and osteoporosis. Fish is also the only naturally available form of omega 3 fatty acids, essential for health. Small fish are also a rich source of potassium, with the highest concentration of potassium seen in small fish such as *mola*, murels, catfishes, climbing perch, etc. Efforts at enhancing fish production from freshwater aquaculture have mainly focused on increasing carp production, despite the fact that India has a very strong

gene pool of freshwater fish, which is virtually neglected. It is time that the possibility of culturing SIFFS is explored, given their contribution to food and nutritional security, biodiversity conservation and poverty alleviation, Dr. Mukhopadhyay concluded.

B P Mohanty, Senior Scientist (Biochemistry), CIFRI

Dr. B P Mohanty, Senior Scientist (Biochemistry), CIFRI, pointed to studies that have shown that minerals and vitamins contained in one kg of SIFFS are equivalent to those contained in 40 kg of big fishes, such as IMCs. It is traditional knowledge that some of these species are good for improved health and eyesight. Nutrient profiling of different fish species is now being undertaken by ICAR as part of a five-year study in the Eleventh Plan period. Studies are also being conducted on how to enhance the bioavailability of nutrients in fishes, for example, through appropriate cooking practices. 

SUJITH CHOWDHURI/CIFRI



Dr Shakuntala Thilsted, Dept of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Denmark, making her presentation

SUJITH CHOWDHURI/CIFRI



Dr Abdul Wahab, Professor, Bangladesh Agricultural University, making a presentation on livelihoods

Technical Session II: Conservation of Biodiversity and Small Indigenous Freshwater Fish Species

Chair: P Das, Ex-Director, NBFGR

Rapporteurs: B P Mohanty and A K Sahoo, CIFRI

Presentation on “Diversity and Conservation of Small Indigenous Freshwater Fish Species of India”

by U K Sarkar, Senior Scientist, NBFGR, Lucknow

The presentation by Dr. U K Sarkar, Senior Scientist, NBFGR, Lucknow, focused on the status and diversity of SIFFS in India, on the research carried out on SIFFS and on issues related to their conservation. India, noted Dr. Sarkar, is one of the 17 mega-biodiversity hotspots in the world. NBFGR has recorded about 2,246 species of finfish, of which 765 are freshwater fish. India has the largest number of endemic freshwater finfish species, contributing 27.8 per cent of the native fish fauna, followed by China, Indonesia and Myanmar. Of 765 freshwater fish species, about 450 could be classified as SIFFS, as they do not grow beyond 30 cm in length. Dr. Sarkar said that the definition of small indigenous species is still moot though, in general, they would include those fishes that grow up to a maximum of 25-30 cm in length. Of the 296 species recorded from the northeast, about 216 are SIFFS. In the Western Ghats, the proportion is 196 of 287 and in Central India, it is 120 of 175.

About 23 per cent of small indigenous fish species provide food and nutrition, and are of economic value as ornamental fish, supporting livelihoods and nutrition, especially for people of the eastern and northeastern parts of India. Of the 104 SIFFS studied by

NBFGR, 62 species were seen as important for food security, while 42 were seen to be good as ornamental species. Some of the fish species are also an important source of medicine. The northeastern parts of India and the Western Ghats are the biodiversity hotspots for SIFFS.

The threats to SIFFS include factors that threaten the biodiversity and ecosystem stability of aquatic environments, such as loss of habitats, overexploitation, agro-chemical and industrial and domestic pollution, illegal fishing methods such as poison fishing/dynamite fishing, siltation of water bodies, fish diseases and the introduction of exotic species of fishes.

It is important to prioritize SIFFS for conservation and restoration programmes or enhancement programmes, stressed Sarkar. NBFGR has prioritized a list of 100 SIFFS that are important for their food value and that need to be conserved. In terms of resilience, 62 per cent of SIFFS are highly resilient (in which the population doubling time is two years or less), while 38 per cent have medium resilience (with a population doubling time of over five years), making it important to consider conservation measures for these species.

Dr. Sarkar said that though there is a lot of traditional knowledge on the benefits of SIFFS, this is poorly documented. There are also major data gaps with regard to species distribution, abundance, endemism, etc. While SIFFS are important from livelihood, nutritional security, and biodiversity points of view, research on SIFFS in

India is very limited. There is need for research on, for example, the nutritional value of species other than *mola*, such as *Ompok pabda* (*pabda*, a catfish species) known to be nutrient-dense.

Lack of research and information has led to limited propagation of SIFFS, most of which are hardy in nature and adapt easily to shallow water conditions. It is also proved that these species can be cultured without any supplementary feed. Small-scale aquaculture of *Amblypharyngodon mola* (*mola*), *Puntius sophore* (*puti*), *Osteobrama cotio* (*dhela*), *Cirrihinus reba*, *Labeo bata* (*bata*), *Gudusia chapra* (*chapila*), along with IMCs, has been reported. There are also reports of successful captive breeding of some SIFFS.

Dr. Sarkar said that it is essential to maintain ecological, nutritional and socioeconomic equilibrium with respect to conservation and management of species. Species diversity and genetic variability are necessary for the long-term maintenance of stable, complex ecosystem and species, he emphasized. The current approach to conservation of SIFFS is substantially lacking in effectiveness—an integrated systems approach adopting in-situ and ex-situ measures including 'conservation aquaculture' is needed. The conservation policy should promote management practices that maintain the integrity of aquatic ecosystem. There should also be an effective legislative framework for the conservation of SIFFS, and coordinated action by different ministries and agencies, he concluded.

Panel Discussion

B C Jha, Principal Scientist & Head (R&WF Division), CIFRI

Dr. B C Jha, Professor and Head, CIFRI, said that the greatest threat to biodiversity of indigenous fish is the introduction of exotic species. There is need to adopt extensive forms of fisheries enhancement in wetlands

and reservoirs to conserve endemic biodiversity. Promoting intensive carp culture in wetland areas to increase fish production should be avoided, as it may put undue pressure on indigenous varieties. A balance between the culture and indigenous species would be essential.

W Vishwanath, Professor, Life Sciences, University of Manipur, Manipur

The northeastern part of the country is a biodiversity hotspot, said Prof. W Vishwanath, Professor, Life Sciences, University of Manipur, with many of the small fish being very high in terms of nutritional value. Fish is a highly preferred food in the region, and is consumed in fresh and processed (sun-dried, smoked and fermented) forms. There is need to conserve biodiversity, also as a way to meet food-security needs, said Dr. Vishwanath. Measures adopted for the conservation of SIFFS should not have negative impacts on the food security and livelihoods of dependent populations. Conservation of biodiversity should ultimately aim for the sustainable utilization of the species.

Discussion

Commenting on the presentations, Dr. Sugunan said that the important contribution of SIFFS with respect to capture fisheries should not be overlooked when the option of its inclusion in aquaculture is mooted. Sharing his experience of working at the Nagarjuna Sagar reservoir, he said that official records showed a production of 140 tonnes. This included only the catch of big fish—catches of smaller species were not reflected in the official statistics, especially as the demand for them was very local. However, in economic terms, it was seen that these small species contributed about three times more income than the species accounted for in official records. This underlines the need to

take into account the existing contribution of these species, while discussing the need to integrate them into culture systems. If the actual contribution of these species is not fully appreciated, there is a danger that they, now seen as 'trash fish' by some, could be used for the aquafeed industry. This could lead to a 'protein trap' that would divert the protein and micronutrient sources of the poor to make protein-rich feed for the aquaculture industry.

Some participants at the workshop underlined the need for a proper definition of what constitutes small indigenous species. Some others proposed that the focus should be on all indigenous species, given that several of them—not only those that are small—are under threat. It was suggested that the focus could differ, based on whether the issue is being discussed from a biodiversity perspective, or from a livelihood and nutritional perspective. 

NEENA KOSHY/icsf



Houses in the floodplain regions of Orissa and West Bengal, built on raised mud platforms. The adjacent land, from where the mud has been excavated, forms a pond rich in SIFFS

NEENA KOSHY/icsf



A mother and child cleaning *mola*. This fish is usually cooked along with its head, which contains plenty of vitamin A. Small indigenous fish species are usually sold in the market by women and contributes to the family income

Technical Session III: Role of Small Indigenous Freshwater Fish Species in Ensuring Livelihoods

Chair: Dipankar Saha, Development Consultant
Rapporteurs: Anjana Ekka and M Aftabuddin, CIFRI

Presentation on “The Role of SIFFS in Livelihoods of Inland Fishers”

by P K Katihā, Principal Scientist,
CIFRI

Dr. P K Katihā, Principal Scientist, CIFRI, pointed out that the vast inland water resources of India provide immense livelihood opportunities for a large number of fishers. The common-pool nature of inland water bodies allows for multiple users; this has also led, in cases, to overexploitation and declining production of fisheries resources, particularly of commercially important fish species. SIFFS are very crucial for livelihoods, nutrition and employment. However, research and policy have mainly concentrated on commercially important species like the IMCs.

Dr. Katihā provided information on a study undertaken in selected rivers, floodplains and reservoirs with the objectives of: (i) investigating the contribution of SIFFS in the fisheries of rivers, reservoirs and floodplains; and (ii) comparing the fishers' remuneration for SIFFS with other commercially important fish species in these inland waters. The trend in riverine catch in Allahabad clearly indicated a shift towards SIFFS. Major carps, that were about 45 per cent of the total catch in the 1961-68 period, were drastically reduced to 11 per cent of the total catch in the 2001-2009 period. During the same period, the contribution of SIFFS showed an increase from 9 per cent to 36 per cent. However, when the data for 2004 and 2009 were compared, it was seen that the contribution of small fish species to the total catch reduced from 36.3 per cent in 2004 to 27.2 per

cent in 2009, even as catches of exotic species increased from 18.7 per cent to 40.3 per cent. This is due to fisheries enhancement programmes that gave prominence to the introduction of exotic species.

Dr. Katihā also drew attention to the case of the Pahuj reservoir, which had seen a drastic decline in the share of SIFFS—from 96.6 per cent in 1995-96 to 18.6 per cent in 2007-2008. That, again, was mainly due to enhancement procedures that heavily favoured the stocking of the reservoir with IMCs. Similar trends were observed in the Dahod reservoir.

In floodplain regions, the contribution of SIFFS to total catches is seen to be high. For example, in certain *beels* of Assam, where stocking of carps was either absent or negligible, SIFFS contributed between 53 and 83 per cent of the total fish catch. Katihā also gave the example of the Chandania *beel* (U-shaped oxbow lake) in West Bengal that supports about 250 fishers per day on an average. They fish for both stocked fish, mainly the IMCs, and SIFFS. It is seen that stocked species are fished for between 30 to 65 days, while SIFFS are fished throughout the year. The livelihoods of fishers are very dependent on the availability of SIFFS in these floodplain systems, as the price of SIFFS is very high in these parts of the country, he said. The water body yielded about 48.02 tonnes of stocked fish, valued at Rs21.91 lakhs, while the yield of SIFFS from the same water body was about 20 tonnes, valued at Rs24 lakhs. The data clearly indicates the high contribution of SIFFS to the livelihoods and incomes of fishers throughout the year.

Furthermore, it was seen that the fishers got better remuneration in the case of SIFFS, as compared to stocked species, i.e., profit to actual fishers is higher in case of SIFFS. It was also seen that the share of fishers in the Dahod reservoir, Uttar Pradesh, which is under a royalty system, was higher, as compared to the share of fishers in the Pahuj reservoir, which was under a private contractor system. Thus, the system of rights (whether it be royalty or contract system) that exists over a water body, plays an important role in the actual remuneration that the fishers get, he said. The profits accruing to fishers could be further improved through post-harvest interventions and appropriate institutional arrangements, concluded Dr. Katiha.

Presentation on “Small Fish Production through Aquaculture and Conservation Measures for Household Nutrition Security”

by Mohammed Abdul Wahab, Professor, Bangladesh Agricultural University

Prof. Mohammed Abdul Wahab of the Bangladesh Agricultural University provided an overview of freshwater aquaculture in Bangladesh, a country with immense water resources and high aquatic biodiversity. The aquaculture sector, he said, focuses on a few species, with a major emphasis on exotic fish species. There is also widespread use of chemicals for cleaning ponds before preparing them for commercial aquaculture. The above practices greatly affect the biodiversity of indigenous species in inland water bodies. At the same time, they deprive the poor of their source of food and livelihood, as locally available species, preferred for consumption, give way to exotic species that often cater to external/urban markets. The degradation of aquatic environments and loss of wetlands in Bangladesh is also affecting SIFFS in very adverse ways, and, in turn, local communities.

Prof. Wahab stressed the need for a new approach to aquaculture, with a focus on nutrient-dense fish. For this, it is important to screen and identify such nutrient-dense species, and to integrate large and small fish within the same culture system, while ensuring that access of rural households to such fish is secured. *Mola*, for example, can be considered a vitamin capsule, being rich in vitamin A and calcium. The use of piscicides to clear ponds off ‘weed species’ (usually SIFFS) needs to be phased out.

Prof. Wahab dwelt on laboratory and field experiments in Bangladesh that have shown SIFFS to be suitable for polyculture along with carps, and with minimal or no effect on commercial carp production. That calls for partial harvesting of SIFFS after breeding on a periodic basis, which will enhance the yield of SIFFS and minimize any effect on carp production. Given that SIFFS are self-recruiting, fish farmers are not required to invest money every year for fish seed. Even maintaining a small pond with a water depth of 1 m during the dry season is adequate in terms of providing refuge for SIFFS, for purposes of fish seed, said Prof. Wahab. It was also seen that consumption of *mola* in pond-owning households increased, as did its availability in rural and urban markets.

There is need to train governmental and nongovernmental agencies as well as rural stakeholders for increased acceptance of an integrated approach in aquaculture. Several technologies have been tried and tested in Bangladesh—for example, carp-*mola* polyculture, carp-*mola*-prawn polyculture and other SIFFS-based technologies. These need to be widely disseminated in south and Southeast Asia, where people are known to suffer from micronutrient deficiencies, concluded Wahab.

Panel Discussion

Bill Collis, Director, South Asia,
WorldFish Center

Dr. Bill Collis, Director, South Asia, WorldFish Center, said that in the early 1990s, when he started work in Bangladesh, it was seen that though fishers were making money from carp culture, most of them were malnourished as they were mainly selling the fish. Adding SIFFS to the culture system partly solved the problem, as these species were used for family consumption. The dilemma today is different. While in the 1990s SIFFS were valued at 15 to 20 *taka* per kg, they are now valued at double the price of carps. Selling at 250 to 300 *taka* per kg, they are now a rich man's food. Discussions at the workshop, said Collis, should concentrate on how to promote those species that are affordable, nutrient-rich and preferred by the rural poor.

A K Roy, Former Principal Scientist, CIFA

Prior to 1985, even carps, which were the major produce from aquaculture, were not documented systematically, noted Dr. A K Roy, Principal Scientist (Retd.), CIFA. In such a context, it is not surprising that SIFFS, which were not considered important from a market point of view, were largely invisible. Though the importance of SIFFS was mooted two decades ago by Dr. V Jhingran of CIFRI, work on these species has not been undertaken.

Discussion

Mr. Vivekanandan drew attention to the situation in the Bundelkhand region of Madhya Pradesh, where SIFFS species are almost exclusively earmarked for women, who are the ones who process and trade in SIFFS, supplying to local markets. Such species are thus very important in providing livelihoods to local women, and fish to local consumers. Dr. Mohan Kumar pointed out that SIFFS other than *mola* also need to be assessed for

their nutrient content and suitability for promotion in culture, capture and conservation.

On the question of hatchery technology for *mola*, Dr. Wahab stressed that since most SIFFS, including *mola* and *puti*, are self-recruiting, there is no need for hatcheries. *Mola* seeds are available in any natural water body, and to sustain *mola* in aquaculture, it should be ensured that there is at least one perennial pond in the village. There is also need to take policy decisions on better management, such as ending practices like using piscicides that eradicate SIFFS from aquaculture ponds and natural water bodies. Other workshop participants felt that a hatchery technology is important, especially if culture of such species, and demand for them, increases. Capturing seeds from the wild may not be sustainable as water resources are also dwindling, it was pointed out. Where hatchery technology is not available, a central pond that stocks seeds of SIFFS could be encouraged. State-run farms, now used only for breeding of carp, could dedicate a small unit for developing stocks of SIFFS that need specific conditions to breed, for example, the much-preferred *Ompok pabda*.

Dr. Biswas from the Department of Fisheries (DoF), West Bengal, said that in North 24 Parganas, a district that has many water bodies, there are many unidentified SIFFS. Fisher co-operatives catch at least 10-20 per cent of such fish, collectively called *raani machch*, a combination of different species that are not commercially valuable. *Raani machch* is given to workers as an incentive for dragging nets through the water bodies. Dr. Biswas also described how the National Rural Employment Guarantee Scheme (NREGS) was being used to clear ponds of water hyacinth, enhancing fish production and as well as local livelihoods. He stressed the need for scientific institutions to work together with fish farmers, fishers and departments of fisheries. 



A livelihood basket.
Small indigenous freshwater fish species can help meet the nutritional needs of poor communities



A catch of small indigenous freshwater fish species from a *beel* in Assam, India

Technical Session IV: Significance of Small Indigenous Freshwater Fish Species with respect to Capture Fisheries in Eastern and Northeastern States of India

Chair: A P Sharma, Director, CIFRI

Rapporteurs: R K Manna and A Roy, CIFRI

Presentation on “The Significance of Small Indigenous Freshwater Fish Species with respect to Capture Fisheries in Eastern and Northeastern States of India”

by B K Bhattacharjya, Senior Scientist, CIFRI Regional Centre, Guwahati

Dr. B K Bhattacharjya of the CIFRI Regional Centre, Guwahati, said that the northeastern States of India, with their immense water resources, were home to about 200 SIFFS. Almost the entire population ate fish, and most species, with the exception of two or three, are consumed. In that sense, there are no species considered as ‘weed species’. Demand for fish is high, as are prices.

It is common for local communities, including women and children, to catch fish for their own consumption. As a consequence, actual production is not reflected in official statistics. Little information is available on the riverine fish catches along the hill streams of the region owing to the inaccessible nature of the terrain, and the prevalence of clan ownership and absence of organized commercial fishing in most places. It is estimated, however, that SIFFS contribute about 15-20 per cent of the total output from water bodies. In larger rivers like Brahmaputra and Barak, the contribution of small indigenous fish species to total fish catch has shown an increase over the years. This could be due to the decline in resources of major carp and catfish species due to selective

overfishing and/or disruption of the natural stock replenishment process of major fishes. To counter this trend, IMCs and exotic carps have been used to stock *beels* and other water bodies. Dr. Bhattacharjya pointed out that exotic species pose a threat to the diversity of native fish fauna. For example bighead carp is being stocked in place of *catla*, as in the Raumari *beel*, Nagaon District, Assam. Catches of the highly carnivorous *Clarias gariepinus*, an exotic species, have been reported from a few open *beels* and from the Umiam reservoir in Meghalaya.

Traditionally, floodplain lakes were the mainstay of capture fisheries since these were either directly connected to their parent rivers or received floodwaters and natural fishes from the adjacent rivers, as is the case even now in open *beels*. However, after the construction of riverine floodplain embankments during 1954-56 and 1964-65, the majority of *beels* have lost their riverine connections and major riverine fish inflow. Over the past decade, stock enhancement is being practised in many *beels* mainly because of reduced auto-stocking, overfishing and increasing lease value arising from competitive bidding. Extensive field studies conducted during 2007 in 164 *beels* of Assam showed that stock enhancement was practised in 59 *beels* (36 per cent), out of which 33 were regularly stocked and 26 were occasionally stocked. In addition to IMCs (*catla*, *rohu*, *mrigal*) and exotic carps (grass, silver, common, bighead carp, silver barb), minor carps like *Labeo*

gonius and *L. bata* are also being stocked in *beels* in recent years. Fortunately, the small indigenous fishes have not been eradicated in the stocked *beels*, unlike in aquaculture ponds, for several reasons:

- In the northeast, these fishes are not considered as trash/weed fishes as they fetch good prices.
- They provide income to the lessees and fishers during the monsoon and post-monsoon seasons.
- *Beels* have sufficient and varied natural foods like detritus, submerged macrophytes, phytoplankton and benthos/macrophyte-associated fauna.
- The fishers' co-operative society/lessee does not have to spend money to get natural fishes, unlike for supplementary stocking. The only occasional expense incurred is for removing water hyacinths from the water body, especially for better catches of SIFFS like *Amblypharyngodon mola* or *Gadusia chapra*.
- The riparian communities can catch these small fishes for their own consumption, thereby avoiding conflict between lessees and local villagers.
- In seasonally open *beels* (like Samaguri, Baskandi and Damal), considerable quantities of small indigenous fishes, especially *Gudusia chapra*, are landed during August-September, which help the lessee in paying the first quarter's lease amount to the government and also to meet the cost of supplementary stocking.

Regarding threats to SIFFS, Dr. Bhattacharjya cautioned that stocking of water bodies with major carps and exotic species could have a negative effect on SIFFS in the long run. Other threats include the widespread use of destructive, small-meshed nets. At the CIFRI Regional

Centre in Guwahati, as part of an ecosystem-based approach to fisheries management, efforts are being made to strike a balance between production enhancement—for example, with pen aquaculture or stock enhancement with other species in seasonal enclosures—and conservation of SIFFS in the remaining areas.

Presentation on “The Fishery of Wetlands in West Bengal and Contribution of Wild Fish Stocks to Production and Fishers’ Income”

by V R Suresh, Principal Scientist, CIFRI

Dr. V R Suresh, Principal Scientist, CIFRI, presented the findings of a case study covering eight flood plain wetlands spread across three districts—Nadia, Hoogly and North 24 Parganas District. Fisheries in the wetlands of West Bengal can be grouped into two distinct components: unmanaged fisheries for wild fish stocks, which include SIFFS, and managed culture-based fisheries for major carps. Fishing of wild fish stock is carried out throughout the year, and supports the livelihoods of thousands of people. With respect to managed fisheries, fishery co-operatives stock the wetlands once or twice a year, usually with major carps such as *catla*, *rohu* and *mrigal*, as well as grass carp. These are harvested about two to three times a year.

Catches from unmanaged fisheries are diffused and, therefore, underestimated. Estimation is all the more difficult as the catch goes mainly for domestic consumption, rather than to the market. However, it is estimated that wild stocks contribute about 0.1-0.4 t/ha/yr, while stocked fish produces 0.4 -1.6t/ha/yr. In the eight wetlands studied, it was seen that in some of them the contribution of SIFFS to total catch is almost 50 per cent. The major species caught are *Puntius (puti)*, *channa*, *colisa* and *mola*. It is seen that the majority of SIFFS are caught before

they are mature, which is a cause for concern. The use of hundreds of small-meshed lift-nets, called *mayajal*, *puti jal* and *vassal jal*, to catch SIFFS is exerting high pressure on the resource.

Marketing chain of SIFFS: In some cases, fishers catching SIFFS sell to agents who then sell the produce in fish markets. When fishers take their catch to the market directly, they get a better deal. The catch is auctioned by an agent, to whom five per cent of the proceeds are given. It is seen that the difference between the farm gate price and the market price is, on average, 50 per cent in the case of wild stock (in the case of *Puntius spp.* the difference was almost 100 per cent) and 33 per cent in the case

of IMCs. When the incomes of fishers across the eight wetlands were compared, it was found that the income through sale of SIFFS varied from Rs9,000 to Rs39,000 a year. In the case of stocked fishes, the income ranged from Rs12,000 to Rs18,000 a year.

Discussion

On the issue of exotic species, a participant asked about the impact of these on biodiversity. There is little information or research on this aspect, it was pointed out. Exotic species find their way into water bodies in various ways. Some, for example, are brought in as ornamental fish, and accidentally escape into the wild. 



An old vendor selling small fishes in the village of Bhadrak in Orissa State

Technical Session V: Significance of Small Indigenous Freshwater Fish Species with respect to Culture Fisheries in Eastern and Northeastern States of India

Chair: V V Sugunan, Assistant Director General, ICAR

Rapporteurs: A K Sahoo and B P Mohanty

Presentation on “The Culture of Some Economically Important Small Fish: A Prospective Approach”

by A K Dutta, Principal Scientist, CIFA, Rahara Centre, Kolkata, West Bengal

Dr. A K Dutta, Principal Scientist, CIFA, Rahara, drew attention to India's ‘aquaplosion’—the vertical and horizontal expansion of aquaculture in the country. One million ha are under aquaculture and culture-based fisheries, which includes ponds, tanks, *beels*, *baors*—a *baor* is an abandoned meander isolated from the mainstream channel through deposition, and filled with water—and other water bodies. Small indigenous species can have production levels comparable to those of carp, he observed. Species such as *bata* and *reba* can be reared in composite fish culture (CFC), along with prawns. Low-cost fish culture, which includes locally important small fish, could be promoted. Such culture could be encouraged in States like Bengal, Orissa and Assam, where almost every rural household, especially those in the floodplain regions, has a small kitchen pond around 0.05 ha in area that can be stocked with species like *bata*, *reba* and *mola* at a stocking density rate of 150-200 per ha for *bata* and *reba*, and 100-200 per ha for *mola*. Assuming a survival rate of 80 per cent, this could result in a production that could meet the protein and micronutrient demands of a family, added Dr. Dutta.

If the low-lying fallow water resources of the country, presently largely unutilized, are brought under need-based culture practices, with a focus on locally important SIFFS, the food security of the country could be increased. Incorporation of medium carps (namely *bata* and *reba*) in such systems, using a double cropping pattern, may offer higher returns, with reduced risk factors. For this, it is important to initiate a mapping of the country's vast fallow low-lying areas, at the block or district level. Bringing them under need-based culture systems could enhance food security and employment, especially for rural people, including women, and lead to their socioeconomic upliftment. An appropriate policy framework is necessary to create an enabling environment. Extension work to increase awareness among marginal farmers about the advantages of incorporating local, economically important medium carps and minnows in home-based culture systems should be taken up, Dr. Dutta concluded.

Presentation on “Small Indigenous Fish Species Management in Orissa” by

Ishaque Khan, Department of Fisheries, Orissa

Dr. Ishaque Khan of the Department of Fisheries (DoF), Orissa, provided a brief outline of the present status of fisheries and aquaculture in the State. Giving a list of SIFFS found in Orissa, he said that SIFFS resources are declining mainly due to the degradation of their habitats,

and indiscriminate technologies used in modern aquaculture and agriculture. Though there are advantages in culturing SIFFS—such as greater economic benefits for fishers and minimal negative impact on the environment—no major research has been conducted on the topic so far. Efforts will be taken by the DoF to culture SIFFS and to gauge the economic viability of such practices. This could be first introduced in rural areas, he said.

Presentation by L Vaiphei, Project Officer, Department of Fisheries, Manipur

Local people in Manipur prefer indigenous fish species to carp species, pointed out L Vaiphei, Project Officer, DoF, Manipur. It is also seen that dry fish is more expensive than fresh fish. People also like fermented fish, which is considered of high medicinal value. The advantage of SIFFS is that people, even the poor, can buy them in quantities they can afford. However, these species seem to be declining, as compared to the past. For example, they are now no longer found in paddy fields, due to the use of pesticides and fertilizers. There is urgent need to enhance stocks of these species, said Vaiphei.

Presentation on “The Indigenous Freshwater Aquatic Species in West Bengal with Special Reference to North Bengal: The Complexities and Responsibilities”

by Saptarsi Biswas, Assistant Director, Directorate of Fisheries, Government of West Bengal

Resource diversification has already been taken up by the West Bengal government, said Dr. Biswas, Assistant Director, Directorate of Fisheries, Government of West Bengal. Many small indigenous species are already bred and successfully cultured at

various places in West Bengal. These include *pabda* (*Ompok pabda*), *nadosh* (*Nandus nandus*), *tangra* (*Mystus gulio*), *chela* (*Chela bacaila*), *sarpunti* (*Puntius sarana*), *mourala/mola* (*Amblypharyngodon mola*), *chanda* (*Chanda nama* and *Chanda ranga*), *koi* (*Anabas testudineus*), *magur* (*Clarias batrachus*) and *singhi* (*Heteropneustes fossilis*). The Directorate is also pushing for the creation of aqua-sanctuaries to build up a bank of indigenous fish species of the State, towards *in-situ* germplasm conservation. Since 1984 West Bengal has also been observing 2 February as Wetlands Day.

According to Dr. Biswas, the culture of indigenous species among progressive fish farmers of the State is popular, because these species are locally preferred for consumption and because they fetch good prices in the market.

Although small indigenous species are important, they are largely ignored. CIFA should be requested to develop a package for fish farmers for culture of small indigenous species, especially for integration of *bata* and *mola* in composite culture, Dr. Biswas suggested. Such packages could be implemented under the Rashtriya Krishi Vikas Yojana (RKVY) and NREGS, and with the assistance of NFDB.

Dr. Biswas pointed out that there is a good demand for several SIFFS as ornamental fish. Excessive pressure can threaten species biodiversity. There is need to strengthen management and conservation efforts that address the threats to biodiversity and livelihoods. He stressed the importance of a participatory approach for conservation and management of fisheries and biodiversity. People should be taken into confidence and should be encouraged to protect biodiversity. *Beel* co-operative societies, for example, could be an instrument for implementing conservation and management measures, Dr. Biswas concluded.

Presentation by Subul

Choudhury, Aquaculturist, Tripura

Subul Choudhury, a farmer practising small indigenous fish culture, shared his experience of culturing SIFFS species in Tripura. He has been culturing *mola* and *puti* for over 12 years. He was drawn into *mola* farming through a request from a local tribal community. In four months Choudhury can raise 10 kg of seed to 100 kg. Single stocking suffices for three to four years, he said. He uses rice bran as feed. *Mola* fetches high prices, earning him an income of Rs200,000/ha/yr. He said that, if done right, *mola* culture is a very successful business proposition. He said that occasional de-weeding of the pond is very essential for the healthy growth of small indigenous fish species.

To a question by a CIFRI scientist about the occasional mass mortality of *mola*, which Choudhury himself has witnessed in his ponds during the earlier years of his venture, he attributed it to the breeding behaviour of *mola*. He said that *mola* is a prolific breeder and breeds about two or three times a year. Successive breeding seasons weaken the *mola*, making them susceptible to mass mortality. A proper feeding regimen could help overcome this problem, he said. The CIFRI scientist applauded Choudhury's presentation and said that more such grassroots experiences should be brought into scientific forums.

Discussion

Dr. Sugunan noted that though the nutritive and livelihood importance of SIFFS is quite widely accepted, if SIFFS are to be introduced as part of polyculture systems along with carps, there should be a proper package of practices, with seed production technology and supply chains in place.

More clarity is needed on this issue. Species that need to be prioritized must be identified, and farmers need to be convinced about the feasibility of introducing such species in culture systems. Currently, SIFFS are found in natural water bodies; they are not part of culture systems. It is important to clarify the strategy with regard to SIFFS in water bodies. In reservoir systems, more money is generated from SIFFS than from stocked carp species. Therefore, rather than focusing on stocking, perhaps it is better to focus on protecting naturally available SIFFS in these water bodies, and to strengthen market linkages. For example, in Kerala, the species *Puntius sophore* (*puti*) is not popular, fetching only about Rs10 per kg; the same species would, however, cost Rs200-300 in the markets of Assam. Developing appropriate marketing linkages could help in the popularization and commercialization of SIFFS. Therefore, it could be proposed that in reservoirs and open-water systems, SIFFS species should be given importance, while in culture systems, a few species could be prioritized. Expertise from institutes like CIFA needs to be sought in developing a package of technologies and practices, Dr. Sugunan said.

It was noted that if the importance of SIFFS has to be appreciated, it is crucial to document their economic value and their nutritional benefits. Dr. Mohan Kumar highlighted the need for research to understand the feasibility of incorporating SIFFS in culture systems in India and to assess their profitability for farmers. The DoF, Orissa would be willing to take up exploratory work on this in the State, in collaboration with scientific institutions like CIFRI and CIFA. 



A traditional trap used to catch small indigenous freshwater fish species

Day II: 25 February 2010

Technical Session VI: Policy and Social Dimension of Small Indigenous Freshwater Fish Species in Fisheries and Aquaculture

Chair: Shakuntala Thilsted, University of Copenhagen

Rapporteurs: P K Katiha and B K Bhattacharjya, CIFRI

Presentation on “The Small Indigenous Freshwater Fish Species and their Role in Rural Lives in Orissa and West Bengal: Some Observations”

by Neena Koshy, Programme Associate, ICSF

Ms. Neena Koshy, Programme Associate, ICSF, presented her observations based on a study trip undertaken to Baleshwar, Orissa, and some parts of West Bengal, in preparation for the workshop. The trip was to get a better understanding of the importance of SIFFS in the lives of the rural people of the region. The visit included meetings with aquaculture farmers and officials of the departments of fisheries. It also included visits to various fish markets.

It was seen that large farmers undertaking freshwater culture on a commercial scale favoured IMCs to small indigenous species. This was also in keeping with the training and information imparted to the farmers, which focused mainly on IMCs. These farmers were largely hesitant about introducing SIFFS, even as part of a polyculture system, unless it proved profitable. Catches of SIFFS from their ponds were being given to the workers employed, for their own consumption, they said.

Farmers with small and medium holdings undertaking culture in their

household ponds, on the other hand, had a different orientation. They were found to be already culturing SIFFS due to the high local preference and large market for these species. SIFFS were seen to be providing a ready source of fish for family consumption. SIFFS catches sold to local markets also provided a source of income, whenever needed—a supplementary annual income of about Rs7,000-10,000 from the sales of SIFFS was reported. Women said that when the smaller species were cooked, they were assured of a share. This was not necessarily the case when the bigger species were cooked. The intra-household distribution of fish, depending on the kind of fish cooked, is another important dimension that needs to be taken into consideration when discussing access of women and children to adequate nutrition, stressed Ms. Koshy. It was also seen that small species, unlike the larger ones, were marketed locally within the villages, especially by women and children.

It was also seen that government extension programmes are currently oriented towards promoting IMCs. Documenting the dependence of local communities on small indigenous fish species is very important for better appreciation of the value of SIFFS, she concluded.

Presentation on “The Social and Policy Dimension of Small Indigenous Freshwater Fish Species in Inland Capture and Culture Fisheries in India”

by *C M Muralidharan, National Consultant, Food and Agriculture Organization of the United Nations (FAO)*

Anything which threatens biodiversity and the integrity of the ecosystem is a threat to small indigenous species as well, said Mr. C M Muralidharan, National Consultant, Food and Agriculture Organization of the United Nations (FAO). Freshwater aquaculture, as is currently practised, focuses on intensive culture of three IMCs and three exotic carps—there is no space for SIFFS. At the same time, the eradication of SIFFS from natural water bodies to prepare ponds for scientific aquaculture, as well as the practice of bringing open water bodies under limited-species composite fish culture, is leading to the systematic elimination of SIFFS. The current emphasis on eradicating 'weed' species in culture ponds should be reviewed.

Giving the example of Kolleru Lake in Andhra Pradesh, Mr. Muralidharan pointed out how pollution and eutrophication have eliminated indigenous fish species from the water bodies. There is no policy, as yet, in relation to maintaining river and environmental flow requirements in India. Chemical pollution from pesticides and fertilizers are not monitored on a regular basis.

With respect to access rights to fisheries resources, particularly SIFFS, there are no specific policies or legislation. The most relevant policies are the respective State-level inland fisheries Acts and the leasing and licensing policies related to water bodies. In most States, specific rules for specific types and sizes of water bodies exist. Most State policies give first priority to fishermen's co-operatives for leasing and licensing, but many of the so-called co-operatives

are defunct. At the same time, it is commonly observed that in the absence of efficient fisher co-operatives, the water bodies get leased out to non-fishers. This alienates the water resources and the fisheries from the local community, especially the traditional fishers. The recent inland fisheries policy of Madhya Pradesh (MP) is unique in that it gives first priority to traditional fishers and their co-operatives. MP has also made changes to the lease amount, making it affordable for local fishers, and has extended the lease period to 10 years. This is important as the lease amount is often a deterrent to many disadvantaged communities. The Tamil Nadu reservoir licensing policy allows fishers a 1:2 (fisher: government) share of larger fishes and a 1:1 share of smaller fishes. The policy in Assam also legally safeguards the customary rights of tribal people and other indigenous ethnic groups. Marginal areas of *beels*, where women fishers usually fish, are also recognized as open-access areas.

There is no comprehensive policy or legislation for the conservation and management of SIFFS. However, there are elements in existing policies that are relevant to indigenous fish and fisheries and to the dependent socioeconomic systems. For example, the Indian Fisheries Act of 1897 prohibits destructive fishing practices like poisoning and dynamite fishing. The provision to prohibit the use of certain fishing gears indirectly helps in the conservation of SIFFS. Under the United Province Fisheries Act of 1948, no polluted water was to be released into water bodies. The West Bengal Inland Fisheries Act makes a reference to “proper management” of inland fisheries.

It is important to develop new conservation and management legislation and policies for inland fisheries and aquaculture through a participatory approach, and to develop enforcement mechanisms

with community participation, Mr. Muralidharan concluded.

Discussion

Should all SIFFS species (around 20 to 25 species) be considered for culture or should the focus be on those that are nutritionally useful and commercially viable, queried Dr. M K Das. It is important to collect and collate baseline data on production, culture methods and consumption of these species. The habitat requirement of most species is not known, he added, and this needs to be researched on a priority basis. For example, it is not known why the production of *Gudusia chapra* or Indian river shad spikes in *beels*. Habitat and

water quality determinants of water bodies should be better understood.

A participant asked about the role of NFDB in promoting SIFFS. The culture of IMCs has brought about the 'blue revolution'—it needs to be explored whether the culture of SIFFS can complement composite fish culture. Issues related to whether or not to integrate small species into polyculture systems should be carefully considered. There are still concerns that SIFFS will compete with carps for food, affecting overall production. Currently, there is no existing protocol for the culture of these species; such a protocol should be developed on a priority basis, it was suggested. 



Dried fish on sale in a market in Bhubaneswar, Orissa.
Dried *mola* is often sold at over Rs160 a kilo

Technical Session VII: Community Knowledge and Intellectual Property Rights with Reference to Small Indigenous Freshwater Fish Species

Chair: A K Roy, Former Principal Scientist, CIFA
Rapporteurs: V R Suresh and R K Manna

Presentation on “The Strategy for Promoting Culture of Small Native Fish Species”

by A G Ponniah and J K Sundaray,
Central Institute of Brackishwater
Aquaculture (CIBA), Chennai

Small native fish species have not so far been included as part of aquaculture systems for a variety of reasons, said Dr. A G Ponniah of the Central Institute of Brackishwater Aquaculture (CIBA). Culturing native species is more difficult than culturing species like IMCs. Culture technology for native species is not available, and there is a lack of interest among the government and private agencies to promote it, as there is no export demand for these species. Farmers also doubt whether the culture of such species will be profitable.

Dr. Ponniah drew attention to some initiatives being taken, nationally and internationally. For example, the Aquaculture of Indigenous Mekong Species (AIMS), a four-country network, aims to develop nine indigenous species for aquaculture to reduce the need to introduce alien organisms. The Germplasm Inventory, Evaluation and Gene Banking of Freshwater Fishes, a project of ICAR-NBFGR-NATP (National Agricultural Technology Project), involving 12 local research institutions, aims to prioritize the endemic potential food and ornamental fishes in the Western Ghats and the northeast. There are also localized efforts, such as the sanctuary for *Etroplus*

in the Vembanad Lake in Kerala, which led to an increase in the natural fishery, benefiting the local community in terms of livelihood and food security. Breeding of yellow catfish has also been carried out by the Kerala Agricultural University, with natural stocking funded by local *panchayats*.

Dr. Ponniah explained why small native fish species should be included in aquaculture and outlined the strategies needed to promote these species. It is essential to put in place effective policies and programmes to support such strategies, he said.

There is a lot of traditional knowledge with respect to small native fish species. He highlighted CIBA's effort to document 80 indigenous traditional knowledge (ITK) systems. For example, there are specially designed 'holding ponds' for rearing brood-stock of *Puntius sarana* and *Clarias batrachus*. Seed production of *Puntius sarana* is undertaken in earthen pots in 24 Parganas (South) District, West Bengal; induced breeding of IMCs is done with herbal extracts in Manipur. The need for patenting these practices as intellectual property rights (IPR) needs to be explored, he said.

Regarding strategy for promotion of small native fish species, there is need for (i) planning and research to focus prioritization, (ii) further refinement of culture technology, (iii) market development and (iv) developing policy and support system (for example translocation of native species, IPR protection etc.)

Dr. Ponniah made the following recommendations:

- document and explore the nutritive value and therapeutic properties of small native fish species, also in relation to cooking and eating habits;
- profile these species under the ICAR network project on nutrition;
- prepare State-wise endemic and endangered status reports of small native species;
- ensure that the benefits flow to the local community in case of any commercial utilization of resources;
- compile, document, protect and reward farmers' innovations and traditional knowledge on seed production and culture of small native fish species;
- request the Honey Bee network to document innovations and traditional knowledge regarding native fish species;
- develop institutional mechanisms to promote culture, consumption and conservation of small native fish species; and
- encourage a network project along the lines of the AIMS project, for developing and promoting the culture of small native fish species.

*Presentation on “**The Miscellaneous Fish in Rural Food Baskets: Knowledge and Rights**” by R J Ranjit Daniels, Care Earth Trust*

Dr. R J Ranjit Daniels of Care Earth Trust highlighted the knowledge that local communities, particularly the poor, have about the therapeutic value of fish. For example, *Puntius sp.* with some herbs is used by tribal communities to cure gastric problems. This knowledge is not documented due to limited interaction with local communities. He also highlighted the ornamental value of some SIFFS,

for example, *Etroplus maculatus*. The introduction of exotic species represents a significant threat to indigenous species, he cautioned. Another significant threat is that of habitat loss of these fish species due to factors such as encroachment of wetlands by promoters and developers, and digging works under the NREGS programme.

Panel Discussion

Utpal Bhaumik, Principal Scientist and Head (REF Division), CIFRI

Dr. Utpal Bhaumik said that there is need to look into the feasibility of patenting knowledge about the medicinal value of fish and of cooking systems that help retain the micronutrient content of small indigenous species. Dr. Bhaumik emphasized the need for awareness about SIFFS among consumers, fishers and the scientific community. He stressed the importance of utilizing seasonally flooded wetlands for culture of these fish species.

Discussion

Ms. Nalini Nayak, Member, ICSF, drew attention to women undertaking subsistence food production. Many women also practise aquaculture, and it is erroneous to assume that all aquaculture farmers are interested only in maximizing income. Ms. Chandrika Sharma, Executive Secretary, ICSF, said that existing knowledge and practices of farmers should be employed to promote the integration of small indigenous species into composite aquaculture or polyculture systems, given that farmers themselves are highly knowledgeable and innovative. The focus should be on promoting these species in culture systems by incrementally improving the existing practices employed by farmers, rather than aspiring for a ‘package’ designed by scientists. 

Group Discussion

Participants were requested to join one of three groups on (a) biodiversity, (b) nutrition or (c) poverty alleviation. The groups were asked to discuss the given topic and to suggest policy interventions that could better integrate SIFFS from the perspective of the topic.

Reporting Back

Chair: Saptarsi Biswas, Assistant Director, Directorate of Fisheries, Government of West Bengal

GROUP I: NUTRITION

The group made three proposals:

- undertake studies on intra-household consumption of fish by season;
- prioritize species to be cultured, in consultation with stakeholders; and
- popularize the consumption of nutrient-dense fish species through awareness programmes, and, at the same time, ensure that the access rights to these species remain with the local communities, by empowering local governments to take decisions on these issues.

The group also highlighted the need for policies to advocate for nutrient-dense species at all levels.

GROUP II: POVERTY ALLEVIATION

The group highlighted the importance of:

- recognizing the role of SIFFS in poverty alleviation, through assessment of their contribution to the economy and nutrition of disadvantaged populations, particularly women and children;
- ensuring protection/management of aquatic habitats, while ensuring that the rights of access of disadvantaged groups to aquatic resources are secured;

- ensuring that research and policy promote the integration of these species into culture-based fisheries and aquaculture systems; and
- strengthening appropriate community institutions to protect access rights, ensure responsible ecosystem management and equitable economic benefits.

GROUP III: BIODIVERSITY

The key recommendations were:

- assess freshwater habitat, species richness, endemism and causes of degradation, with a view to developing priorities for SIFFS conservation;
- review the adequacy of existing policies, identifying gaps, conflicts, etc., with a view to strengthening policies for conservation of these species; and
- develop local community awareness, evolve specific recovery programmes with local participation and develop management strategies/models for replication and upscaling.

A policy issue flagged by the biodiversity group was the lack of recognition of wetlands as a multiple-use system. There is need to find a balance between conservation measures and the livelihood and nutrition needs of local communities, the group said. There is also need to protect wetland commons from being taken over by powerful interests at the cost of local interests and fish diversity, to recognize and reward traditional knowledge and practices, and review culture policies. The inadequate, or lack of, representation of fishery interests in various bodies governing wetland habitat was also flagged by the group. NFDB funds should be channeled towards conservation and restoration activities of wetlands, the group proposed. 

NEENA KOSHY/ICF



A traditional trap used to catch small indigenous freshwater fish species

The Way Forward: Integrating Small Indigenous Freshwater Fish Species into Fisheries and Aquaculture Development Policies and Programmes

Chair: A G Ponniah, Director, CIBA

At this session, there were presentations from various State governments and from a representative of civil society. Small indigenous fish species are essentially poor peoples' fish, said the representative of the DoF, Government of West Bengal, and it is important to take steps to protect their habitat. The department would like to undertake a thorough study of the breeding biology of small indigenous species. It would have been useful to have invited fish farmers' co-operatives to the workshop, he added, as people for whom policies are made should be involved in such processes. The river basin protection programme of the Government of India should also have the representation of fisher people, he stressed.

The representative of the Orissa Department of Fisheries and Animal Resources Development said that SIFFS were in abundance in Orissa earlier. There is now a marked decline in the availability of these species, in paddy fields, for example. The habitat of these species should be protected to ensure their conservation. There is need to consider their introduction in paddy fields, particularly in starvation-affected areas. However, introduction of these species into polyculture or composite aquaculture should be undertaken only after careful consideration. Farmers

need to be assured that their production and income will not be affected if such species are introduced into existing culture systems.

The representative of the Manipur DoF pointed to the decline in fish populations due to, among other things, the use of pesticides. The cost of fish is increasing, and the poor are often not able to afford fish. There is need to improve management of ponds, rivers and other water bodies, and to clean lakes and ponds of vegetation that is leading to declines in fish production. He stressed the protection of SIFFS in their natural habitat. More information is needed before culture of SIFFS is undertaken, he concluded.

V. Vivekanandan, Member, ICSF, pointed out that co-operatives are the best institutions to manage the commons. Inland fishers have no national platform similar to the National Fishworkers' Forum (NFF) in marine fisheries. While inland fishers and farmers remain largely invisible, collective action has made the marine fisher people more visible, he noted. He highlighted the importance of local action and the need to identify appropriate models for co-operatives in the inland sector. Civil society organizations need to actively work at the state and national levels to facilitate proper linkages in the inland fisheries sector. 

VISHWANATH WAIKHOM/UNIVERSITY OF MANIPUR



Women selling fish, including small indigenous freshwater species, in a fish market in Manipur State

Closing Ceremony

Chair: N K Tyagi, Member, ASRB

In the concluding session of the workshop, a declaration was drafted, debated and finalized, based on inputs from all participants. Dr. N K Tyagi, Member, Agricultural Scientists' Recruitment Board (ASRB), referring to the potential for increasing fish production in India, pointed out that fish needs water but does not utilize water. India's immense water resources could be better used to enhance fish production, he said.

In his concluding remarks, Dr. A P Sharma, Director, CIFRI, observed that this was the first time the issue of SIFFS was being highlighted in India. He hoped that such workshops will help suggest different ways in which the MDGs can be achieved by 2015, by enhancing food and nutritional security, and by halving poverty. 

NEENA KOSHY/ICSF



Workshop participants were taken on a one-day field trip to the villages of Basanti in the Sundarbans

NEENA KOSHY/ICSF



The field trip allowed workshop participants to observe firsthand, farmers practising polyculture of small indigenous freshwater fish species

23 February 2010—Field Trip

The workshop started with a one-day field trip that included a visit to the villages of Basanti, Sundarbans. The aim was to observe firsthand, farmers practising polyculture with SIFFS, especially *mola*. The farmer whose farm was visited said that other than the annual harvest of big fishes like the IMCs, he harvests the ponds for small fishes once in three months and gets about 50 kg, which he sells in the market for about Rs150 a kg, which fetches him a good supplemental income. The fish is also caught for the consumption of his own family, he added.

The field trip also had a post-lunch session where the organization, Joygopalpur Gram Vikas Trust (JGVK), which promotes fish culture work in the villages of Basanti, shared its experience of experimenting with polyculture of SIFFS, involving 30 farmers. JGVK has been able to persuade about 80 farmers so far to take up polyculture of carps, including small indigenous fish, especially *mola*, a high-priced commodity in the local market. The JGVK presentation was followed by a presentation by Dr. Mrityunjoy Kunda, Farm Manager, DoF, Government of Bangladesh, whose research in Basanti on the inclusion of small indigenous fish culture along with carp polyculture initiated the project in the area.

Mr. Amit Das, an independent researcher for the organization, Aquaculture without Frontiers (AwF), made a presentation on “Small Indigenous Fish Species of Tripura: Role in Poverty Alleviation and Food Security and Potential for Aquaculture”. Sharing some statistics on the water resources of the State, Mr. Das said that out of the 21,196.24 ha, which is 2.02 per cent of the total area, 37 per cent are open water bodies and 63 per cent is suitable for aquaculture. About 98 per cent of the open water bodies are under

government ownership, while the rest is under the management of fisheries co-operatives. The region is rich in SIFFS, mostly from capture fisheries. Mr. Das shared some case studies of open water resources. He said that *mola*, *puti* and *mystus* enjoy great consumer preference in Tripura and sell for very high prices. He said that the rate varies with size; a one-inch *mola* fetches Rs120-150 per kg, while two-inch specimens fetch Rs 300-400 a kg; *puti* also fetches more or less the same price as *mola*, while the *mystus* species gets about Rs 400-500 per kg for two-inch samples. He also added that a project with AwF, titled “Use of *Amblypharyngodon mola* at a Self-recruiting Level for Extra Production in Composite Fish Culture Ponds in Tripura”, has shown promising results. Farmers who have stocked *mola* reportedly improved their production and productivity, and it was found that these species complement one another and do not compete. It was seen that SIFFS were a vital source of income for small and marginal fishermen, and contributed immensely to the socioeconomic uplift of poor farmers. He also said that the major threat for the future of SIFFS is the lack of legislation for open waters, especially with regard to SIFFS. He concluded by emphasizing the need for a policy to include the potential small species in mixed, composite fish culture systems.

The presentation from Tripura was followed by sharing of experiences by farmers associated with JGVK, who also emphasized the additional income and nutrition got by including SIFFS, mainly *mola*, in polyculture along with carps. The women of the group said they were aware of the importance of including these species in the diet, especially for lactating and expectant mothers. 

B K BHATTACHARJYA/CIFRI (ICAR), GUWAHATI CENTRE



A scene from the Charan *beel* in the State of Assam

B K BHATTACHARJYA/CIFRI (ICAR), GUWAHATI CENTRE



Community fishing in progress in a water body in Manipur

Appendix 1

International Collective in Support of Fishworkers (ICSF) Trust
in collaboration with
Inland Fisheries Society of India (IFSI)

Workshop on
"Small Indigenous Freshwater Fish Species:
Their Role in Poverty Alleviation, Food Security and Conservation of
Biodiversity"

23-25 February 2010

Central Inland Fisheries Research Institute, Barrackpore
Kolkata, West Bengal

Programme

Wednesday: 24 February 2010

0900 – 1100 hrs

Inaugural Session

Chair : Dr G Mohan Kumar, Principal Secretary (FARD), Government of Orissa

Welcome Address

Dr M K Das, Principal Scientist and Head (FREM Division), CIFRI

Introduction to the Workshop

Ms Chandrika Sharma, Executive Secretary, ICSF

Recital of Poem

Dr P Srivastava, Principal Scientist, CIFRI

Inaugural Address

Dr A P Sharma, President IFSI (Director CIFRI)

Special Address

Dr P Das, Ex Director, NBFGR, Lucknow

Felicitations

Dr Madhumita Mukherjee, Additional Director, DoF, West Bengal,
on behalf of Shri Kiranmoy Nanda, Minister of Fisheries,
Government of West Bengal

Keynote Address

Fisheries, A Driver for Livelihood and Nutritional Security in India
by Dr V V Sugunan, ADG, Inland Fisheries, ICAR

Chair's Address

Dr G Mohan Kumar, Principal Secretary (FARD), Government of Orissa

Vote of Thanks

Ms Nalini Nayak, Member, ICSF

1100 – 1130 hrs

Tea Break

1130 – 1230 hrs	<p>Technical Session I: Small Indigenous Freshwater Fish Species and its Role in Ensuring Nutrition to the Local Community</p> <p>Chair : Ms Nalini Nayak, Member, ICSF</p> <p>Rapporteurs : Dr S K Manna & Dr. B. K. Behra</p> <p>Presentation The Role of Small Indigenous Freshwater Fish Species in Improving Nutrition in Rural Populations by Dr Shakuntala Thilsted, Department of Human Nutrition, Faculty of Life Sciences, University of Copenhagen, Denmark</p> <p>Panel Discussion Panelists: Dr P K Mukhopadhyay, Principal Scientist, CIFA Dr B P Mohanty, Senior Scientist, CIFRI</p> <p>Discussion</p>
1230 – 1345 hrs	<p>Technical Session II: Conservation of Biodiversity and Small Indigenous Freshwater Fish Species</p> <p>Chair : Dr P Das Ex Director, NBFGR</p> <p>Rapporteurs : Dr B P Mohanty & Mr A K Sahoo</p> <p>Presentation Diversity and Conservation of Small Indigenous Freshwater Fish Species of India by Dr U K Sarkar, Senior Scientist, NBFGR</p> <p>Panel Discussion Panelists: Dr B C Jha, Principal Scientist and Head (R&WF Division), CIFRI Dr W Viswanath, Professor, Department of Life Sciences, University of Manipur</p> <p>Discussion</p>
1345 – 1430 hrs	Lunch
1430 – 1530 hrs	<p>Technical Session III: Role of Small Indigenous Freshwater Fish Species in Ensuring Livelihoods</p> <p>Chair : Dr Dipankar Saha, Development Consultant, West Bengal</p> <p>Rapporteurs : Ms Anjana Ekka & Dr M. Aftabuddin</p> <p>Presentation The Role of Small Indigenous Freshwater Fishes (SIFFS) in Livelihoods of Inland Fishers by Dr. Pradeep Katiha, Principal Scientist, CIFRI</p> <p>Small Fish Production through Aquaculture and Conservation Measures for Household Nutrition Security by Dr Md Abdul Wahab, Professor, Bangladesh Agricultural University</p> <p>Panel Discussion Panelists: Dr A K Roy, Former Principal Scientist, CIFA Dr William Collis, Director South Asia, WorldFish Center</p> <p>Discussion</p>
1530 – 1600 hrs	Tea Break
1600 – 1700 hrs	<p>Technical Session IV: Significance of Small Indigenous Freshwater Fish Species With Respect to Capture Fisheries in Eastern and Northeastern States of India</p> <p>Chair : Dr A P Sharma, Director, CIFRI</p> <p>Rapporteurs : Dr R K Manna & Dr A Roy</p> <p>Presentation Dr. B K Bhattacharjya, Senior Scientist, CIFRI Regional Centre, Guwahati</p> <p>The Fishery of Wetlands in West Bengal and Contribution of Wild Fish Stocks to Production and Fishers' Income by Dr V R Suresh, Principal Scientist, CIFRI</p> <p>Discussion</p>

1700 – 1815 hrs

Technical Session V: Significance of Small Indigenous Freshwater Fish Species with Respect to Culture Fisheries in Eastern and Northeastern States of India**Chair :** Dr V V Sugunan, ADG, ICAR**Rapporteurs :** Dr A K Sahoo & Dr B P Mohanty**Presentation**

Small Indigenous Fish Species Management in Orissa
by Dr Ishaque Khan, Deputy Director, Directorate of Fisheries
Government of Orissa

The Culture of Some Economically Important Small Fish- A Prospective
Approach
by Dr A K Datta, Principal Scientist, Rahara Centre, CIFA

Presentation from Manipur
Dr. L Vaiphei, Project Officer, Department of Fisheries, Manipur

The Indigenous Freshwater Aquatic Species in West Bengal with
Special Reference to North Bengal—the Complexities and Responsibilities
by Dr. Saptari Biswas, Assistant Director, Govt of West Bengal

Presentation
by Subul Chowdhury, Aquaculturist, Tripura

Thursday: 25 February 2010

0900 – 1015 hrs

Technical Session VI: Policy and Social Dimensions of Small Indigenous Freshwater Fish Species in Fisheries and Aquaculture**Chair :** Dr Shakuntala Thilsted, University of Copenhagen**Rapporteurs :** Dr P K Katiha & Dr B K Bhattacharjya**Presentation**

The Small Indigenous Freshwater Fish Species and their Role in
the Rural Lives in Orissa and West Bengal: Some Observations,
by Neena Koshy, Programme Associate, ICSF

The Social and Policy Dimension of Small Indigenous Freshwater Fish Species
in Inland Capture and Culture Fisheries in India
by Mr C M Muralidharan, FAO National Consultant

Panel Discussion**Panelist:**

Dr M K Das, Principal Scientist and Head (FREM Division), CIFRI

Discussion

1015 – 1130 hrs

Technical Session VII: Community Knowledge and Intellectual Property Rights with Reference to Small Indigenous Freshwater Fish Species**Chair :** Dr A K Roy, Former Principal Scientist, CIFA**Rapporteurs :** Dr V R Suresh & Dr R K Manna**Presentations**

The Strategy for Promoting Culture of Small Native Fish Species
by Dr A G Ponniah, Director, CIBA

The Miscellaneous Fish in Rural Food Baskets: Knowledge & Rights
by Dr Ranjit Daniels, CARE EARTH

Panel Discussion**Panelist:**

Dr Utpal Principal Scientist & Head (REF Division), CIFRI

Discussion

1130 – 1315 hrs

Tea Break and Group Discussion

1315 – 1415 hrs

Lunch Break

1615 – 1800 hrs	Closing Ceremony Chair : Dr N K Tyagi, Member, ASRB Panelists: Dr AP Sharma, Director, CIFRI Dr A G Ponniah, Director, CIBA Ms Nalini Nayak, Member, ICSF Mr V Vivekanandan, Member, ICSF
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Tuesday: 23 February 2010

0700 – 0730 hrs	Registration
0730 – 1100 hrs	Travel to Sundarbans Field Trip
1100- 1130 hrs	Tea Break
1130 – 1300 hrs	Visit to farms practicing small indigenous freshwater fish culture
1300 – 1400 hrs	Lunch Break
1400 – 1600 hrs	Sharing Session From the Field Mr. Biswajit, Joygopalpur Gram Vikas Kendra Dr Mrityunjoy Kunda, Department of Fisheries, Bangladesh Mr. Amit Das and Mr. Subul Chakraborty, Tripura Interaction with Farmers Associated with JGVK
1600 – 1930 hrs	Return to CIFRI campus

Appendix 2

International Collective in Support of Fishworkers (ICSF) Trust
in collaboration with
Inland Fisheries Society of India (IFSI)

Workshop on
"Small Indigenous Freshwater Fish Species:
Their Role in Poverty Alleviation, Food Security and Conservation of
Biodiversity"

23-25 February 2010

Central Inland Fisheries Research Institute, Barrackpore
Kolkata, West Bengal

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Appendix 3: Abstracts of Papers

Diversity and Conservation of Small Indigenous Freshwater Fish Species of India

W.S. Lakra and U.K. Sarkar

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Biodiversity conservation in general and fish genetic resources in particular have become an issues of great concern both globally and nationally. India is one of the 17 mega biodiversity hot spots contributing 60-70% of the world's biological resources. In India, out of 765 native freshwater fish recorded by NBFGR, about 450 may be categorized as small indigenous freshwater fish species (SIFFS) which grow to the size of 25-30 cm in mature or adult stage of their lifecycle. Of the 450 SIF about 23% are highly important as food and local significance and play a significant role in the aquarium trade and in providing local livelihood security. Although rural population depend highly on indigenous species of fish for nutrition in many parts of India, very little attention has been paid on their role in aquaculture enhancement, nutrition, biology, captive propagation and biodiversity conservation research. They are quite invisible, absent from statistics and indigenous knowledge about the SIFFS and their benefits has been poorly documented. Consequently, many small indigenous fishes have become threatened and endangered due to pollution, over exploitation coupled with habitat destruction, water abstraction, siltation, channel

fragmentation, diseases and introduction of exotic varieties. In order to achieve sustainable utilization, appropriate planning for conservation and management strategies are of utmost importance. The greatest challenge is to secure the IPRs related to SIFFS' so that the country is able to maintain its stake on its indigenous resource and their potential benefits. Conservation of SIFFS is also essential to maintain ecological/nutritional and socio-economic equilibrium. Species diversity and genetic variability are necessary for the long term maintenance of stable, complex ecosystem and species. The potential areas for future research includes integrated system approach and adopting *in-situ* and *ex-situ* measures including conservation aquaculture, live gene banking, tissue banking, valuation, evaluation and registration of the genetic resources, monitoring critical parameters and replacement of natural stocks through ranching, community participation, HRD and capacity building. This paper addresses the challenging issues for sustaining aquatic biodiversity, management of freshwater resources, and highlights the research priorities and needs to develop appropriate conservation strategies for small indigenous freshwater fish species. 

Culture of Some Economically Important Small Fish – A Prospective Approach

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Composite culture today has taken a shape of industry for aquaculture from domestic level where small fish like medium carps viz., *Labeo bata* (*bata*) and *Cirrhinus reba* (*reba*), hardly get any chance to occupy place therein though they fetch higher market price even at smaller size compared to same size of major carps. The fate of highly priced minnow, *Amblypharyngodon mola* (*mola*) is still worse which is designated as trash or weed fish before carp culturists and supposed to eradicate during pond preparation with fish toxicants. Further, indiscriminate use of pesticides in agriculture fields is another cause to deplete the population of these palatable commercially important small fish from natural ecosystem.

Culture of medium carps and minnow conducted at the farm of Wastewater Aquaculture Centre of Central Institute of Freshwater Aquaculture, Rahara was initiated since 1984 in paddy fields as well as in pond. In pond culture system, these species can equally provide comparable production as observed with major carps. Experiments in monoculture with medium carps employing double cropping method indicated *bata* production of 6.2t/ha/yr and *reba* of 4.25t/ha/yr.

While assessing the performance of medium carps in composite culture with major carps through several trials, it has been observed that *bata* contributed 18.02% while *reba* shared 16.62% of the total production of 3.5–6.6t/ha/yr. More trials on production with major carps and medium carps together indicated about 24.6% higher

production over the production from major carps only (3.7t/ha/yr).

Successful rearing of these medium carps along with freshwater giant prawn (*Macrobrachium rosenbergii*) has also been achieved. Annual production of 2.8t/ha and 1.82t/ha was achieved where *bata* & *reba* fry were stocked respectively with prawn juvenile.

Further, culture of above mentioned species in paddy plots has shown promising results when they were cultured with other fish and prawn components. Fish production from modified paddy fields has been recorded as 543.5 to 948.5 kg/ha/yr of which medium carp shared 22.6 – 69.3%. Results focus comparatively higher revenue than that of obtained through culture of major carps alone from such unit area.

Mola, a carp minnow with extremely consumer's choice species especially in West Bengal, Orissa and Assam, may not be the right choice to culture in pond along with other carps as they are auto-breeder in confined water and take share for space, natural food as well as supplementary feed with major carps. With a view to avoid these factors, the species was introduced in modified paddy fields as need based culture system where major carps hardly grow normal size. Annual average fish production in paddy fields with *mola* and other fish species has been registered as 823.3 kg/ha of which *mola* contributed 6–9%, individual production being 43.4–75.8 kg/ha, averaging 55.5 kg/ha. Observations also reveal that the species offered 50–60 times number than the initial stocked number due to auto-breeding during monsoon in paddy plot.

Trials are also being made to propagate and culture of another most economically important small cat fish, *Ompok pabda* which has a tremendous demand with high market value and success has been achieved for its breeding and rearing.

India is bestowed with vast freshwater bodies apart from freshwater pond which are still unutilized. These water bodies can be utilized effectively in a remunerative

way through culture of such small fish species where major carps do not get congenial atmosphere to grow well. Therefore, culture of these species not only provides scope to enhance vertical and horizontal expansion of aquaculture but also offers protein especially to the protein deficient community. Culture will also help to conserve these species from the edge of extinction or vulnerable status. 

Introduction of Carps, Mola and Prawn Polyculture in the Sunderbans Region, India to Reduce Poverty and Improve Household Nutrition*

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Mola (*Amblypharyngodon mola*), a nutrient dense fish indigenous to Bengal, which was once abundant in both open waters and closed water bodies, declined drastically in recent years depriving poor people from getting A vitamin and other essential micronutrients. In order to revive its population to improve household nutrition, an on-farm trial was carried out to accommodate *mola* in carp-prawn polyculture in the Sunderbans region, West Bengal, India from July to December 2007. There were three treatments with eleven replications each. *Mola*, mrigal (*Cirrhinus cirrhosus*), rohu (*Labeo rohita*), and freshwater prawn (*Macrobrachium rosenbergii*) were stocked at 20,000ha⁻¹, 1,000ha⁻¹, 3,000ha⁻¹, and 3,750ha⁻¹ in all treatments. *Catla* (*Catla catla*) was stocked at 1,000ha⁻¹, 1,750ha⁻¹ and 2,500ha⁻¹ and silver carp (*Hypophthalmichthys molitrix*) at 2,500ha⁻¹, 1,750ha⁻¹ and 1,000ha⁻¹, in treatment I, treatment II and treatment III, respectively. Before stocking of the fish fingerlings, fertilization was done at the rate of urea: 50kgha⁻¹, TSP: 50kgha⁻¹ and cowdung: 1500kgha⁻¹. Prawn and fishes

were fed with mustard oil cake and rice bran (1:2 ratio) at the rate of 3% body weight. Two thirds of the total feed were spread in the morning and one third in the evening. Water quality parameters such as water temperature, dissolved oxygen, transparency and pH were measured fortnightly. There were no significant differences in water quality parameters among the treatments. The highest yields of *mola* and prawn were observed in treatment I. The *mola* production was not affected by the presence of *catla* and silver carp. The lowest density of *catla* (1,000ha⁻¹) with highest density of silver carp (2500ha⁻¹) resulted in the highest *mola* production. There was no significant difference in total production among the treatments, but comparatively better production was found in treatment I. Higher benefit-cost ratio was also obtained in treatment I. It may be concluded that *mola*-carp-prawn polyculture may be a good option for rural farmers of the Southern region of West Bengal to reduce poverty and improve household nutrition. 

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Table 1. Production (\pm SE) and economics of different treatments over a 155 days growth period

		Treatment I	Treatment II	Treatment III
Production (kg ha ⁻¹)	Mola	286.77 \pm 25.30	217.99 \pm 27.90	193.14 \pm 21.96
	Catla	297.31 \pm 33.76	339.61 \pm 44.47	399.07 \pm 48.72
	Mrigal	310.90 \pm 32.32	283.80 \pm 37.84	295.84 \pm 31.42
	Rohu	665.18 \pm 88.45	629.13 \pm 83.93	531.09 \pm 59.99
	Silver carp	712.77 \pm 123.4	525.10 \pm 70.18	318.67 \pm 56.57
	Prawn	184.47 \pm 9.73	144.68 \pm 7.86	145.69 \pm 9.62
	Total	2457.42 \pm 243.96	2140.31 \pm 193.39	1883.51 \pm 161.24
Economics	Total cost (INR)*	62,759.00	59,740.00	57,771.00
	Total return (INR)	135,455.00	114,260.00	103,835.00
	Benefit-cost ratio	2.16:1.00	1.91:1.00	1.80:1.00

* 40 INR = 1 USD

The Role of Small Indigenous Freshwater Fish Species in Improving Nutrition in Rural Populations

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Fisheries play an important role in the livelihoods and incomes of many people, especially rural populations living in riparian and coastal areas in some of the poorest countries in the world. Small fish is a commonly consumed food, and an integral part of the everyday carbohydrate-rich diets of all household members. Much of the small fish consumed by the rural poor are caught by household members and bought in local markets, and therefore do not appear in national statistics. Small fish, as well as the little oil, vegetables and spices which are used for cooking improve diet diversity. Small fish is a rich source of animal protein, fatty acids and essential vitamins and minerals. Studies in Bangladesh and Cambodia showed that small fish species make up 50 – 80 % of all fish eaten during the production season. Although consumed in small quantities, the frequency of intake was high.

As many small fish are eaten whole, with head, organs and bones, they are particularly rich in calcium, and some are also rich in vitamin A, iron and zinc. Vitamin A is present as dehydroretinol and retinol, found mainly in the eyes and viscera, and the proportions of these two preformed vitamin A compounds vary with species. Sun drying has been shown to destroy the vitamin A content. Analyses of some common small fish from Bangladesh and Cambodia showed that two species from the genus *Esomus*, darkina (*Esomus danricus*) and trey changwa plieng (*Esomus longimanus*) have a high iron content.

Iron is present in the forms of haem iron, a high molecular sub-pool of complex-bound non haem iron and inorganic iron, the proportions vary with species. The bioavailability of the first two iron fractions is estimated as high, 25 %, and 10 % for the third fraction. Both species also had a high zinc content. Studies have also shown that fish protein has a possible enhancing effect on non haem iron and zinc absorption from the diet in humans. All small fish which are eaten with bones are an extremely rich calcium source. In addition, studies in humans have shown that the bioavailability of calcium from small fish is as high as that from milk.

Thus, small fish species have a large, untapped potential to prevent and combat micronutrient deficiencies in rural populations. A production of only 10 kg/pond/year of the vitamin A rich small fish, *mola* (*Amblypharyngodon mola*) in the estimated 1.3 million ponds in Bangladesh can meet the annual recommended intake of two million children. A traditional daily meal of rice and sour soup, made with the iron rich fish, trey changwa plieng, with the head intact can meet 45 % of the daily iron requirement of Cambodian women.

To make use full use of this potential of small fish species for improving nutrition, further data on the consumption, nutrient analyses, cleaning, processing and cooking methods of small fish are needed. Advocacy, awareness and nutrition education of the role small fish can play in increasing diet diversity

and micronutrient intakes must be strengthened. Also, measures to develop and implement sustainable, low-cost technologies for management, conservation, production and accessibility of small fish must be undertaken.

The recent global hikes in food prices have resulted in a decrease in the intake of non-staple foods, including fish, in an effort to secure intakes of staple foods and energy.

Thus, even more focus on small fish is necessary to ensure diet diversity and micronutrient intakes in rural populations. Increased small fish intake, by reducing micronutrient deficiencies, can aid in attaining the Millennium Development Goals; reduction in extreme hunger and poverty, reduction in childhood mortality, and improvement in maternal health, and thereby contribute towards national development. 

Miscellaneous Fish in the Rural Food Baskets: Knowledge and Rights

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Around 750 species of fish that are known within Indian limits prefer inland freshwater habitats. Right habitat conditions and seasons aid the proliferation of some of these fish that they practically swarm our wetlands locally. Common examples of super-abundant species are amongst *Rasbora*, *Puntius*, *Esomus*, *Amblypharyngodon* and *Lepidocephalus*. These are also the fishes most relished by the rural people that have traditionally adopted ingenious techniques to harvest them in substantial quantities for domestic consumption and the local fish markets.

‘Of no interest to fisheries’ is a common statement that most of us who have used Talwar and Jhingran’s *Inland Fishes of India* might recognize. These and many other small-sized fish species are also branded as ‘miscellaneous’ in standard fishery literature. Rural people have however relied on the so-called miscellaneous species for their day-to-day protein needs and have nurtured their habitats. They have also preserved the knowledge that pertains to where, when and how these fish may be caught,

cleaned and cooked. They know how to process and store the surplus for lean seasons.

Many of these small fish have formidable bones that it requires great skill to eat one, without having tiny bones stuck in the throat. In fact, many urban fish-eaters prefer the larger species not for their taste, but for their less bony flesh. The willingness to pay a higher price for ‘safer-to-eat’ fish is one of the major factors that play against the popularity of miscellaneous fish. And driven by urban markets inland fishery is increasingly focused on fast-growing large species (including non-native species) that the natural habitats of hundreds of species of small native fish are being transformed and destroyed.

Local knowledge on the nutritional and medicinal value of inland fishes in India has not been given adequate importance. While there have been sporadic efforts (example the People’s Biodiversity Registers) to document people’s knowledge pertaining to fish, there is a greater focus on plants whenever the issue of indigenous knowledge and IPR is discussed. 

Fishery of Wetlands in West Bengal and Contribution of Wild Fish Stocks to Production and Fishers' Income

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Floodplain wetlands play a key-role in the life cycle and recruitment of several fish species that support the livelihoods of thousands of people through commercial and subsistence fishing. West Bengal has more than 150 floodplain wetlands spread across the districts of Nadia, 24 Parganas, Cooch-Bihar, Hooghly, Murshidabad, Malda and Midnapore, covering an effective area of 42500 ha, which is about 22% of the total freshwater area of the State. Majority of these wetlands have two distinct fishery components; capture fishery for wild fish stocks, which are unmanaged and culture based fisheries through stocking of major carps by fishers' co-operative societies. Our understanding on the resource size of wild fish stocks, their contribution to fish production and fishers' income in these wetlands are inadequate for suggesting management guidelines. Hence studies were conducted in eight representative wetlands (Chandania (50 ha), Beledanga (60 ha), Chamordaha (38 ha), Borthy (1405 ha) and Raja (45 ha) wetlands, situated at 24 Parganas North district; Khalsi (62 ha) and Bhomra (45 ha) at Nadia district and Kol (82 ha) at Hooghly district), spread across three districts of the State. The yield of wild fish stocks from these wetlands ranged from 0.1 to

0.4t/ha/year, while that of the stocked fishes was 0.45 to 1.6 t/ha/year across the systems. The stocked fishes are fished 2-3 times in a year; the rest of the period the fishers depend on the natural fish stocks. The annual fishing effort (fisher/day) for wild fish stocks ranged from 2940 to 19635 fishers and the CPUE was 0.8 to 5kg/fisher/day with higher values in wetlands having direct riverine connection. The number of wild fish species exploited from the wetlands ranged from 5 to 28. *Puntius* spp. were the major contributors to the catch (20%), followed by *Channa* spp. (18%) and prawns (12%). Among *Puntius* spp., *P. conchoni*, *P. sophore* and *P. ticto* were the major contributors. The management practices under culture based fisheries viz. stocking density, size and species stocked are not uniform among the wetlands studied. Fifty percent of the revenue from stocked fishes is distributed among fishers proportional to their catch. The income per fisher from stocked fishes varied from Rs. 6158 to 14000/year. The income from natural fish stocks worked out to be Rs. 15000-39000/year/fisher, spread across the year with daily earnings ranging from Rs. 25-50 to 105-520/fisher. A total of 79 species of fin fishes under 57 genera and 32 families have been identified, besides five species of prawns and one species of crab. 

The Social And Policy Dimensions Of Small And Indigenous Species in Inland Capture and Culture Fisheries in India

C.M.Muralidharan

India can be proud of the rich inland fishery resources and the biodiversity of the fish and fisheries. The capture fisheries in the rivers, lakes, canals, flood plain water bodies including beels, flood plains reservoirs, tanks and ponds, were always been one of the rural livelihoods and food security base. The traditional inland fishers depended largely in the capture fisheries and to some extent in the capture cum culture fisheries of which the small and Indigenous species (upto 25cm as mature adult) had been an important resource. The success of induced breeding of carps and composite fish culture shifted the focus to composite carp culture and now this forms the major production from inland sector. The SIS has been eradicated as weed or predatory fishes from culture systems. In spite of this, the SIS species such as *Ompok pabda*, *Clarius batrachus* or *Amblypharyngodon mola* have been highly preferred in capture as well as capture and culture fisheries along with carps in many parts of India and Bangladesh especially by local fishers and farmers. These are also known for its nutritional and medicinal values.

Apart from eradication from carp culture ponds, degradation of water bodies, not maintaining minimum environment water flow requirements, indiscriminate fishing including that of brooders and juveniles and pollution are other factors threatening SIS. The existing state inland fishery policies have regulations against

destructive fishing, and for protection of brooders and closed seasons and areas, there is nothing specific to SIS. The implementation is poor.

The existing policies give preference to fisher cooperatives for lease of water bodies for culture, capture and capture cum culture fisheries. Most of the cooperatives being weak, defunct, or without financial support, the lease often goes to those outside fishing communities. Madhya Pradesh is a good example where the first priority of leasing out water bodies is given to indigenous fishing communities. Certain policies as that of Assam, West Bengal and Tamil Nadu give fishers a better share of the small fishes.

Recommendations are put forth for comprehensive inland fishery policy and shifting priority to bringing more water resources under fish production with equal importance to indigenous species, from just increasing production and productivity of major carps and exotic carps. Emphasis should be given to ecosystem protection, biodiversity and above all socio economic benefit. Equal importance to be given to capture, capture cum culture and culture fisheries. Research to look into promoting more multi species composite culture including SIS. Importance of SIS in local food security and nutrition to be recognised and the concept promoted just not through the department of fisheries, but also through departments of health, women and child welfare. 

Appendix 4

Sommaire

Dans une bonne partie des pays en développement, notamment en Inde, les pauvres des campagnes qui vivent aux abords de plans d'eau douce ont traditionnellement recours aux diverses espèces de petits poissons autochtones qu'ils produisent afin de satisfaire leurs besoins alimentaires. Mais dans ce pays, les politiques et programmes des pêches intérieures, tant au niveau fédéral qu'au niveau des États, ne se sont pas intéressés suffisamment à elles. Dans le but de corriger cette anomalie, le Collectif international d'appui à la pêche artisanale (ICSF), en collaboration avec la Société indienne des pêches intérieures (IFSI), a organisé un atelier national sur le thème *Les petites espèces de poissons d'eau douce : leur rôle pour la lutte contre la pauvreté, pour la sécurité alimentaire et la conservation de la biodiversité*. Il s'est tenu à Kolkata, Bengale occidental, du 23 au 25 février 2010, à l'Institut central de recherche sur les pêches intérieures (CIFRI).

Il s'agissait de réunir des gens travaillant dans la pêche et l'aquaculture en eau douce pour qu'ils puissent échanger leurs idées sur le rôle potentiel de ces espèces dans l'amélioration de l'alimentation et des moyens d'existence en milieu rural, et pour la biodiversité biologique. Il s'agissait aussi de débattre du contexte socio-économique et culturel de l'élevage et de la capture de ces poissons afin que les gens concernés (en particulier les femmes) puissent améliorer leurs revenus et mieux assurer la sécurité de leur travail et de leur alimentation. Et on proposerait des politiques appropriées pour une exploitation durable de ces espèces.

Il y avait à cet atelier 58 participants : scientifiques, chercheurs, décideurs,

pisciculteurs, membres de la société civile. Ils ont reconnu qu'elles présentent un très grand intérêt du point de vue de l'économie, de l'emploi, de la nutrition, de l'écologie. Divers aspects ont été traités au cours des séances successives, dont voici un résumé :

Nutrition

1. Dans les pays de l'Asie du Sud et du Sud-Est, les petites espèces de poissons autochtones constituent un élément important de l'alimentation des familles, en particulier celles qui vivent à proximité de plans d'eau douce. L'un des avantages qu'on leur accorde est le fait que même les pauvres peuvent s'en procurer.
2. Dans les communautés traditionnelles, les gens savent qu'elles sont bonnes pour la santé, pour les femmes enceintes ou allaitantes notamment ; mais il n'y a pas beaucoup de documentation à ce sujet.
3. En Asie du Sud et du Sud-Est, les carences en micronutriments (qu'on appelle aussi la faim cachée) constituent un sérieux problème. Le rôle potentiel de ces espèces en est donc d'autant plus important. Il faut que les décideurs politiques concentrent leur attention sur les apports en micronutriments et pas seulement en protéines. Ces petits poissons sont une source très intéressante de micronutriments, de vitamine A et de minéraux (calcium, potassium, zinc...). Des tests effectués au Bangladesh sur le *mola* ont fait apparaître qu'il contient 89 fois plus de vitamines A que la carpe verte qui est abondamment élevée dans ce pays.

4. Il serait bon de déterminer les propriétés nutritionnelles des diverses espèces de petits poissons autochtones disponibles et de retenir celles qui sont particulièrement intéressantes sous cet aspect, et aussi appréciées dans les populations à faibles revenus, et d'un prix abordable. Ce travail est d'ailleurs en cours d'exécution à l'ICAR (Conseil indien de la recherche agricole) dans le cadre d'un programme quinquennal.
 5. Comme la production et la commercialisation de ces espèces restent le plus souvent dans un cadre très local, les statistiques nationales n'en rendent généralement pas compte. Il serait pourtant souhaitable d'avoir des données sur le sujet et sur les modes de consommation à l'intérieur des ménages : qui consomme quoi, avec une attention particulière pour les femmes et les enfants. Par exemple, on a constaté que, dans les familles pauvres, ces espèces étaient plus intéressantes pour les femmes car elles constituent des portions plus petites qu'il est plus aisé de répartir entre les différents membres de la famille.
 6. Il faudrait sensibiliser les gens à l'intérêt que présentent ces petits poissons pour combattre les carences en micronutriments, et leur apprendre les façons les plus avantageuses de les préparer. La valeur nutritive de cet aliment dépend en effet des modes de préparation et de cuisson, des parties qui sont consommées ou rejetées. L'apport maximal est obtenu par une cuisson du poisson entier dans l'eau.
 7. Il faudrait développer et mettre en œuvre des stratégies durables, économiques et ambitieuses pour assurer la gestion, la conservation, la production et la distribution de ces espèces, petites mais riches en nutriments.
- ## Biodiversité
8. Le Bureau national des ressources génétiques du poisson (NBFGR) a répertorié 2 246 espèces de poissons dans l'Union indienne, dont 765 d'eau douce. C'est en Inde qu'on trouve le plus grand nombre d'espèces endémiques d'eau douce : 27,8 % de la faune ichtyique locale. Sur ces 765 espèces, 450 peuvent être classées comme petits poissons, c'est-à-dire qui ne font pas plus de 30 cm.
 9. C'est surtout dans le sud-est du pays et dans les Ghats occidentaux qu'on observe la plus forte biodiversité pour ces petits poissons autochtones. Environ 23 % d'entre eux sont consommés et ont aussi une certaine valeur comme poissons d'ornement. Ils sont une source d'emplois et de nourriture, surtout dans l'est et le nord-est de l'Inde. Certains ont en plus des vertus médicinales.
 10. Sur le plan de la biodiversité, il importe de préserver diversité des espèces et variabilité génétique afin d'assurer l'équilibre d'écosystèmes complexes, l'équilibre entre les espèces. Le NBFGR a identifié une centaine de petits poissons qu'il faudrait conserver pour leur intérêt nutritionnel.
 - II. Ces poissons sont exposés aux mêmes dangers que ceux qui pèsent sur la biodiversité et la stabilité des écosystèmes aquatiques : disparition des habitats, surexploitation, pollution d'origine agricole, industrielle et domestique, méthodes de pêche illégales (poison, dynamite...), envasement des masses d'eau, maladies, introduction d'espèces allogènes. Ce dernier facteur a été signalé dans le nord-est du pays, et cela constitue aussi une menace pour la diversité des espèces autochtones. La carpe à grosse tête vient remplacer le catla dans les *beels* (étangs sur des

terres basses), comme à Raumari, district de Nagaon, en Assam. On a également trouvé le *Clarias gariepinus* très carnivore dans un certain nombre de beels ouverts et dans le barrage-réservoir d'Umiam au Meghalaya.

12. La démarche actuelle pour la conservation de ces espèces n'est pas efficace. On devrait se tourner vers un système intégré, avec des mesures appropriées in situ et ex situ, y compris des piscicultures-conservatoires. Il faudrait que les politiques de gestion se soucient de préserver l'intégrité des écosystèmes aquatiques. À cet égard, il faudrait sans tarder remettre en cause certaines pratiques qui consistent à faire disparaître ces petites espèces autochtones des bassins d'aquaculture, des réservoirs et des plans d'eau naturels.
13. La conservation devrait se faire dans un esprit d'utilisation durable de la ressource, c'est-à-dire qu'il faudrait éviter d'adopter des mesures susceptibles de porter atteinte à la sécurité alimentaire et aux moyens de subsistance de populations qui comptent sur ces espèces.
14. Très peu d'études sont réalisées sur ces espèces en Inde. Il serait pourtant bon d'en savoir plus sur divers aspects : habitats en eau douce, abondance des espèces, endémicité, causes de la dégradation, cela afin de déterminer les actions de conservation à entreprendre en priorité. Pour chaque État de l'Union indienne, il faudrait dresser un état des lieux des espèces endémiques et menacées.
15. Il importe de mettre en place un cadre législatif approprié et de coordonner l'action des ministères et organismes concernés. Les intérêts des pêcheurs devraient être représentés au sein des administrations et structures responsables des zones humides et des habitats aquatiques. Il

importe également de sensibiliser les communautés locales à cette question, d'élaborer des programmes de réhabilitation avec la participation des populations avoisinantes et des stratégies et modèles de gestion qui permettent de reproduire les expériences et d'améliorer les pratiques.

Moyens de subsistance

16. Les petites espèces autochtones présentes dans les vastes ressources aquatiques en eau douce de l'Inde mettent d'immenses moyens de subsistance à la disposition des pêcheurs. Mais, à cause des insuffisances des techniques d'évaluation, leur apport à la production globale de poisson dans le pays et à l'économie en général reste très largement sous-estimé. Par exemple, une étude portant sur le barrage-réservoir de Nagarjuna a démontré que ce petit poisson rapportait trois fois plus aux pêcheurs que le gros poisson ; et pourtant il n'apparaît même pas dans les statistiques officielles relatives à la production. Dans la région de Bundelkhand au Madhya Pradesh, le petit poisson est presque exclusivement l'affaire des femmes, qui le transforment et le vendent aux gens du coin. Dans les pêcheries des *beels* (étangs sur des terres basses) du Bengale occidental, on observe que les petites espèces autochtones apportent toute l'année un revenu régulier aux pêcheurs, la plus grande partie de ce revenu à vrai dire.
17. Les profits des pêcheurs dépendent aussi du système de droits d'accès en vigueur pour le plan d'eau exploité. Des études portant sur un certain nombre de réservoirs font apparaître que leurs gains sont plus importants lorsqu'ils paient une simple redevance sur les prises à l'autorité de tutelle que lorsqu'ils doivent passer par le concessionnaire privé

détenteur des droits de pêche dans cet endroit.

18. Le prix de ces petits poissons varie nettement selon la région concernée, suivant la demande. Dans le nord-est du pays, où 80-90 % de la population consomme du poisson, où le petit poisson est très prisé, les prix sont très élevés. Dans les États du Sud (Kerala par exemple), le *Puntius sophore* (barbeau d'Asie) n'est pas vraiment apprécié et se vend à moins de 10 roupies (0,17 €) le kg alors qu'il peut atteindre 200-300 roupies (3,5 €-5,35 €) le kg sur les marchés de l'Assam. Il serait donc souhaitable de décloisonner les marchés pour populariser le petit poisson et utiliser au mieux cette ressource.
19. Pour toute demande ou toute exécution d'intervention dans les pêcheries de capture ou la pisciculture, il faut prendre en compte ce que représente le petit poisson autochtone pour la vie et les moyens de subsistance des populations locales. À cet égard, il serait bon de réexaminer notamment certaines pratiques de développement des pêches qui traduisent un parti pris en faveur des grandes carpes indiennes et qui pénalisent la production des petites espèces autochtones et affectent donc l'activité des pêcheurs, des transformatrices et vendeuses.

Pêches de capture

20. Plusieurs menaces pèsent sur ces petites espèces et leurs habitats. Il faudrait des lignes directrices claires et vigoureuses pour définir des politiques de préservation et d'exploitation durables de ce poisson, de protection de son habitat naturel.
21. Il faudrait des systèmes de gouvernance appropriés qui permettent une participation active des diverses parties prenantes dans

des structures de cogestion garantant d'une exploitation durable et d'un partage équitable de la ressource.

Pisciculture

22. En Inde on s'est surtout intéressé à l'élevage composite des grandes carpes indiennes. Trois espèces (*catla*, *rohu*, *mrigal*) représentent environ 87 % de ce type de production en eau douce. Les exploitants hésitent à pratiquer la polyculture avec des petits poissons autochtones car on croit qu'ils disputeraient l'espace et la nourriture aux grandes carpes et que la croissance et la production de ces dernières s'en ressentiraient.
23. Des expériences de terrain menées au Bangladesh ont démontré que l'on peut fort bien élever ces petits poissons avec les carpes. Les répercussions sur la production commerciale des carpes sont minimes ou carrément inexistantes. Il faut pour cela effectuer périodiquement des prélèvements de petits poissons après la phase de maturation. Cela stimule les rendements pour les petits poissons et minimise toute incidence sur le rendement des carpes. Comme ces petites espèces assurent leur propre recrutement, l'éleveur n'a pas à dépenser pour se procurer chaque année des alevins.
24. L'Inde possède un patrimoine génétique très vigoureux de poissons d'eau douce mais il est pratiquement négligé. Il conviendrait d'accélérer le processus de diversification des espèces utilisées en pisciculture et d'étudier la possibilité de protocoles appropriés pour l'élevage de petits poissons autochtones. Peuvent-ils entrer en complément dans les élevages composites ? Il serait souhaitable de pouvoir disposer d'un ensemble de pratiques concrètes couvrant notamment les aspects techniques de la production de géniteurs et d'alevins et de la chaîne

d'approvisionnement. Il faudrait identifier les espèces qui méritent d'être prioritaires, et convaincre les exploitants qu'ils auraient intérêt à les introduire dans leurs élevages.

25. Il n'existe pas actuellement d'écloseries dotées de moyens techniques pour ces petites espèces de poissons autochtones. Comme la plupart d'entre elles (*mola* et *puti* notamment) assurent naturellement leur recrutement, le problème peut être résolu en faisant en sorte qu'il y ait à proximité de la région d'élevage un bassin permanent qui fournira au besoin les alevins nécessaires.
26. Dans les plaines d'inondation de l'Inde, ces espèces étaient traditionnellement présentes dans les étangs familiaux où se pratiquait un élevage extensif. Des expériences réalisées sur douze ans par un exploitant de Tripura avec le *mola* et le *puri* à côté d'autres espèces, et en utilisant du son de riz comme aliment, il ressort que les ventes de *mola* peuvent avoir une bonne rentabilité : jusqu'à 200 000 roupies (environ 3 600 €) par hectare et par an, dit-on.
27. On pourrait encourager des formes de pisciculture à faible coût, utilisant de petites espèces importantes localement. Cela conviendrait particulièrement au Bengale, en Orissa, en Assam où presque chaque ménage en zone rurale dispose d'un petit étang, surtout dans les plaines d'inondation. Il serait bon de prévoir des campagnes de vulgarisation pour sensibiliser les agriculteurs marginaux au sujet, pour leur dire qu'ils auraient intérêt à incorporer des carpes moyennes locales, économiquement importantes, et des vairons (*minnows*) dans leur élevage artisanal.
28. Pour encourager l'introduction de petites espèces autochtones dans la pisciculture composite ou

polyculture, on pourrait faire appel aux connaissances et aux pratiques actuelles des exploitants concernés, en améliorant progressivement leurs façons de faire, leurs innovations.

29. Il faut remettre en question certaines pratiques courantes de l'aquaculture commerciale et des programmes de développement, notamment l'usage de pesticides, insecticides et piscicides pour se débarrasser d'espèces naturellement présentes dans les étangs et autres masses d'eau. Il est à noter que, dans les systèmes aquatiques ouverts du nord-est du pays, on ne préconise pas l'éradication des espèces autochtones avant de repeupler avec des espèces commerciales de plus forte taille (grandes carpes indiennes, par exemple). C'est peut-être parce que, dans ces régions, le petit poisson local n'est pas considéré comme du poisson fourrage ou de rebut.
30. Dans les réservoirs, ces petits poissons génèrent souvent davantage d'argent que les carpes. Plutôt que d'avoir recours essentiellement à l'alevinage, il serait peut-être préférable de protéger les espèces de petits poissons autochtones présents naturellement dans ces masses d'eau et d'améliorer en même temps les circuits commerciaux.

Politiques et législation

31. Il n'existe aucune politique ou législation globale de conservation et de gestion de ces espèces. Dans les textes en vigueur, certains éléments restent cependant pertinents. Par exemple, la Loi de 1897 sur la pêche interdit des pratiques destructrices (recours à des substances toxiques, explosives, à certains engins de capture).
32. Il serait bon de s'intéresser à la question des locations dans les pêcheries intérieures. Dans certains États, les profits

vont essentiellement aux concessionnaires (contractors). Pour la pêche en eau douce, il n'existe aucune politique particulière susceptible de protéger les droits d'accès des communautés qui comptent sur le petit poisson pour se nourrir. Il y a bien sûr les législations et réglementations respectives en matière de pêcheries intérieures, et la plupart des États de l'Union indienne accordent certes la priorité aux coopératives de pêcheurs pour la location et les permis, mais beaucoup d'entre elles n'existent plus. Faute de coopératives en état de fonctionner, les masses d'eau sont louées à d'autres intervenants. Du coup, les communautés locales (à commencer par les pêcheurs traditionnels) sont éloignées des ressources aquatiques et de leurs pêcheries. Le Madhya Pradesh a adopté en 2008 une Politique relative aux pêches intérieures qui donne expressément la première préférence aux pêcheurs traditionnels et à leurs coopératives. La Politique de l'Assam dans ce même domaine préserve officiellement les droits coutumiers des tribus et autres groupes ethniques autochtones. Il est indispensable de renforcer l'organisation des pêcheurs (en particulier en eau douce) et des coopératives afin que leurs intérêts soient mieux défendus

et que l'on profite ainsi davantage des ressources ichtyiques.

33. Étant donné que les petits poissons autochtones restent comme invisibles, on ne s'est guère occupé d'eux dans les politiques et législations. Il est urgent d'entreprendre des études pour en savoir plus sur l'intérêt économique et autre de ce poisson. On pourrait ensuite fonder plus aisément des politiques appropriées sur ces données.

Savoir traditionnel

34. Il serait également souhaitable de se documenter sur les connaissances des communautés locales en matière de petits poissons autochtones : que savent-elles de leur intérêt nutritionnel et médicinal, quelles sont leurs pratiques et innovations en matière de production de géniteurs et alevins, quels sont leurs modes de cuisson pour ce produit ? Il faudrait aussi explorer la possibilité de faire breveter, le cas échéant, certaines de ces connaissances via les dispositions relatives aux droits de propriété intellectuelle afin que les communautés locales tirent quelque avantage de retombées commerciales éventuelles.

Les principales recommandations de l'Atelier sont reprises dans sa Déclaration. 

Appendix 5

Resumen Ejecutivo

En numerosos países en desarrollo, como la India, la alimentación de las poblaciones rurales pobres que viven en la cercanía de ríos y lagos depende tradicionalmente de varios tipos de pequeñas especies indígenas de agua dulce (PEI). Sin embargo, las políticas y programas de pesca continental de la Unión India y de sus estados nunca les han prestado hasta ahora la atención que merecen. A fin de subsanar esta situación anómala, el Colectivo Internacional de Apoyo al Pescador Artesanal (CIAPA), en colaboración con la Sociedad de Pesca Continental de la India (IFSI en sus siglas en inglés) organizó un seminario nacional titulado “Las pequeñas especies indígenas de agua dulce y su papel en la mitigación de la pobreza, la seguridad alimentaria y la conservación de la diversidad biológica”, celebrado del 23 al 25 de febrero en el Instituto Central de Investigación de Pesquerías Continentales (CIFRI) en Kolkata, Bengala Occidental.

El objetivo consistía en abrir un foro para que todos aquellos involucrados en la pesca y la acuicultura continentales pudiesen intercambiar impresiones acerca de la contribución de las PEI a la seguridad alimentaria, la preservación de los medios de vida de las poblaciones rurales y la conservación de la diversidad biológica. Pretendía asimismo discutir el contexto socioeconómico y cultural donde se desenvuelven las actividades de captura y cría de PEI con miras a facilitar el acceso de la población, y sobre todo de las mujeres, a una fuente de alimento y de ingresos, así como proponer un espacio político para el desarrollo

de pesquerías sostenibles de PEI. Participaron en el taller 58 delegados, entre científicos, investigadores, políticos, acuicultores y miembros de la sociedad civil.

La asamblea reconoció que hoy en día las PEI se consideran especies con gran valor económico, nutritivo y medioambiental, amén de un destacado papel como medio de sustento. Las sesiones del seminario abordaron varios aspectos relativos a estas especies de agua dulce que quedan recogidos a continuación de forma somera.

Nutrición

1. En los países del sur y el sureste de Asia las PEI representan un componente importante de la alimentación de muchas familias, sobre todo las que viven en las cercanías de los cursos de agua dulce. Una de las características de las PEI más destacadas consiste en que resultan asequibles aun para las poblaciones pobres.
2. Las comunidades tradicionales conocen los beneficios para la salud de dichas especies, como demuestra el hecho de que se recomienda su consumo a las mujeres embarazadas y lactantes, aunque este acervo tradicional apenas está documentado.
3. Merece la pena resaltar el aporte de oligoelementos de las PEI en un contexto en el que su escasez, la denominada “hambre oculta”, constituye un grave problema en el sur y el sureste asiáticos. Urge que las autoridades presten atención al aporte de oligoelementos y no sólo al de proteínas. Las PEI constituyen valiosas fuentes de micronutrientes,

vitamina A y minerales como el calcio, el potasio o el cinc. A guisa de ejemplo, algunos experimentos realizados en Bangladesh con la *mola*, una especie de agua dulce de pequeño porte y gran disponibilidad a escala local, indican que su contenido de vitamina A es 89 veces mayor que el de la carpa herbívora, una especie de uso generalizado en la acuicultura bengalí.

4. Resulta imprescindible analizar el aporte nutritivo de las PEI disponibles y promover aquellas con mayor densidad de nutrientes, que sean más asequibles y mejor aceptadas por la población pobre. El Consejo de Investigación Agrícola de la India (ICAR) está realizando el perfil nutritivo de varias especies dentro de un estudio de cinco años.
5. Las estadísticas nacionales no suelen tener en cuenta las pautas de producción y consumo de estas especies ya que los procesos de producción y comercialización tienen lugar a escala muy local. Sin embargo resulta importante conocer estos datos, así como recabar información sobre los patrones de consumo en el seno de los hogares, es decir, saber qué alimentos come cada miembro de la familia, sobre todo las mujeres y los niños. Se ha observado, por ejemplo, que en las familias pobres las PEI se destinan más a las mujeres, ya que vienen en porciones pequeñas que se comparten con facilidad.
6. Se necesitan campañas de defensa, concienciación y educación sobre la contribución de los pequeños peces con alto contenido nutritivo a la lucha contra las deficiencias de micronutrientes y sobre la importancia de una adecuada preparación culinaria. La limpieza del pescado, el momento en que se decide qué partes pueden comerse y cuáles deben descartarse, y el

cocinado, determinan en gran medida el nivel de su aporte alimentario. La práctica de cocer las piezas enteras parece ofrecer las máximas ventajas nutritivas.

7. Conviene asimismo desarrollar y ejecutar medidas sostenibles y económicas a gran escala con miras a reforzar la gestión, conservación, producción y asequibilidad de PEI con alto contenido de oligoelementos.

Diversidad biológica

8. La Oficina Nacional de Recursos Genéticos Ictiológicos (NBFGR) ha registrado 2.246 especies de peces óseos, que incluyen 765 de agua dulce. La India cuenta con un enorme número de especies endémicas de agua dulce que representan el 27,8% de la fauna ictiológica indígena. Unas 450 especies de las 765 registradas pueden ser catalogadas como PEI, especies que no superan los treinta centímetros de longitud.
9. El nordeste de la India y la cordillera de los Ghats occidentales son auténticos hervideros de biodiversidad de PEI. Alrededor del 23% de las PEI sirven como fuente de alimentación, de nutrición y de ingresos por su valor como especies ornamentales para las poblaciones de la región. Algunas tienen igualmente usos medicinales.
10. Desde la óptica de la biodiversidad, la conservación de la diversidad de las especies y de su variación genética cobra gran importancia con miras al mantenimiento a largo plazo de ecosistemas complejos. El NBFGR destaca por su valor nutritivo un centenar de PEI a cuya conservación da la máxima prioridad.
- II. Los factores que amenazan a las PEI son los mismos que ponen en peligro la biodiversidad y la estabilidad de los ecosistemas del

medio acuático, como la destrucción de hábitats, la explotación excesiva, la contaminación agroquímica, industrial y doméstica, las prácticas de pesca ilegal como el uso de venenos o explosivos, la sedimentación en los cursos de agua, las enfermedades de los peces y la introducción de variedades exóticas. Las especies exóticas, por ejemplo, se han detectado ya en el nordeste del país y su presencia supone una amenaza a la diversidad de especies endógenas. En los humedales (*beel*), como el de Raumarí, (distrito de Nagaon, estado de Assam) la carpa cabeza empieza a reemplazar a la *catla*, mientras que en el embalse de Umiam, estado de Meghalaya, se observa la presencia de *Clarias gariepinus*, una especie carnívora exótica.

12. El planteamiento actual de conservación de PEI no resulta eficaz y se necesita un sistema integrado con medidas in situ y ex situ que incluyan el concepto de “acuicultura de conservación”. Las iniciativas de gestión deben mantener la integridad del ecosistema acuático. Algunas prácticas, como la erradicación de las PEI de los estanques de las piscifactorías, los embalses y los cursos naturales de agua, deben corregirse sin dilación.
13. La conservación debe situarse en un marco de explotación sostenible, es decir, las medidas que se adopten no deben incidir negativamente en la seguridad alimentaria o los medios de vida de las poblaciones que dependen de estas especies.
14. En la India apenas se investigan las PEI. Se necesita investigar más a fin de conocer el estado de los hábitats de agua dulce, la riqueza de sus especies, su carácter endémico y las razones del deterioro, con miras a establecer prioridades para

la conservación de las PEI de agua dulce. Conviene crear a nivel estatal la figura de las PEI amenazadas.

15. Resulta necesario contar con un marco legislativo eficaz y una acción coordinada de todos los ministerios y órganos competentes. Los intereses de la pesca deben estar presentes en los órganos que gobiernan los humedales y los hábitats acuáticos. Igualmente necesario resulta crear una conciencia comunitaria del problema, establecer programas de recuperación específicos con la participación de las poblaciones locales y desarrollar modelos y estrategias de gestión que permitan la réplica a gran escala de las experiencias más interesantes.

Medios de vida

16. Las PEI presentes en la extensa red fluvial de la India constituyen el medio de vida de numerosos pescadores. Sin embargo, las carencias en los métodos de evaluación impiden un cálculo correcto de su contribución a la producción pesquera nacional. En el embalse de Nagarjuna se observó que los ingresos que pescadores obtienen de las PEI triplican los procedentes de especies de mayor tamaño, y a pesar de ello las capturas de PEI siguen siendo invisibles en las estadísticas oficiales sobre producción pesquera. En la región de Bundelkhand, estado de Madhya Pradesh, las PEI se destinan exclusivamente a las mujeres, que las transforman y venden a consumidores locales, brindando así un medio de vida para las vendedoras y una oferta de productos a los consumidores. En los humedales de Bengala Occidental se ha observado que las PEI representan una fuente de ingresos estable a lo largo de todo el año, aportando además mayores beneficios económicos que otras especies.

17. El régimen de derechos que regula un curso de agua determina en gran medida los beneficios que reciben los pescadores. Los estudios realizados en algunos embalses indican que un sistema de cánones aporta mayores beneficios a los pescadores que uno basado en contratos.
18. El precio de las PEI cambia de una región a otra y en función de la demanda. En el nordeste de la India, donde entre el 80 y el 90 por ciento de la población consume pescado y existe una gran demanda de PEI, los precios son altos. Por otra parte, especies como *Puntius sophore*, poco populares en los estados meridionales como Kerala, se venden a 10 rupias por kilogramo, mientras que en Assam alcanzan las 200 o 300 rupias. Abrir vías de contacto entre los mercados permitiría popularizar y aprovechar mejor las PEI.
19. La contribución actual de las PEI a los medios de sustento de las poblaciones locales debería tenerse en cuenta a la hora de prever o planificar cualquier intervención de captura o acuicultura. En este contexto interesa revisar los programas de refuerzo de la pesca que favorecen las carpas de gran tamaño, ya que estas prácticas inciden en la producción de PEI y consecuentemente los medios de sustento de los pescadores locales, sobre todo de las mujeres que las transforman y las comercializan.

Pesquerías de captura

20. Existen varios factores que amenazan a las PEI y a los hábitats donde viven. Se necesitan directrices políticas firmes para su conservación y explotación sostenible, así como para la protección de sus hábitats naturales.
21. Se necesitan igualmente regímenes de gobernanza eficaces favorables a la intervención activa de todas

las partes dentro de un marco de cogestión que permita una gestión sostenible y equitativa.

Acuicultura

22. La India ha fomentado sobre todo la acuicultura mixta de grandes carpas endémicas (GCE). Alrededor del 87% de la producción acuícola continental procede de tres especies de GCE (*catla*, *rohu* y *mrigal*). La acuicultura combinada con PEI se contempla con recelo ya que se piensa que las PEI compiten con las GCE por el espacio y el alimento, interfiriendo en su crecimiento y su producción.
23. En Bangladesh algunos experimentos de campo han mostrado que las PEI pueden criarse en acuicultura combinada con las carpas sin perjudicar en absoluto o mínimamente la producción comercial de éstas. Para que así sea es necesario realizar una cosecha parcial periódica de las PEI después de la cría, aumentando así el rendimiento de las PEI y reduciendo su impacto sobre la producción de carpas. Como las PEI se reproducen espontáneamente, los acuicultores no necesitan comprar semilla cada año.
24. La India cuenta con una abundante reserva genética de especies continentales a la que apenas se presta atención. Conviene explorar de qué forma se puede acelerar la diversificación de especies en la acuicultura y desarrollar protocolos para la cría de todas estas especies, amén de investigar si la acuicultura de PEI puede servir como complemento a la acuicultura combinada de carpas. Parece importante desarrollar un paquete de prácticas acuícolas que incluya la tecnología de producción de semilla y todas las fases de la cadena de abastecimiento. Habrá que identificar las especies que

- requieren una prioridad específica y concienciar a los acuicultores de la viabilidad de la introducción de las PEI en sus piscifactorías.
25. Todavía no existen tecnologías de incubación para PEI. No obstante, como la mayor parte se reproduce espontáneamente en cautividad, como ocurre con *mola* y *puti*, esta limitación puede subsanarse manteniendo en las zonas acuícolas al menos un estanque permanente con ejemplares de PEI que pueden utilizarse como semilla.
 26. Las PEI han estado presentes tradicionalmente en los sistemas de acuicultura extensiva basados en explotaciones familiares de las llanuras aluviales del país. Las experiencias de un acuicultor en Tripura, que lleva doce años cultivando *mola* y *puti* con otras especies, utilizando como pienso salvado de arroz, indican que la cría de *mola* puede resultar lucrativa, con rendimientos que podrían alcanzar hasta 200.000 rupias anuales por hectárea.
 27. Podría fomentarse la acuicultura de bajo coste, que incluye a numerosas especies de escasa talla y gran importancia local. Resultaría de gran utilidad en estados como Bengala, Orissa y Assam, donde casi todas las familias del medio rural, especialmente en las llanuras aluviales, poseen un pequeño estanque. Es recomendable iniciar trabajos de extensión agraria para concienciar a los acuicultores marginales de las ventajas de incorporar carpas de menor tamaño y otras especies pequeñas en sus pequeñas explotaciones acuícolas.
 28. Conviene aprovechar los conocimientos y prácticas actuales de los acuicultores a fin de promover la integración de las PEI en sistemas de acuicultura combinada o de múltiples especies, procurando mejorarlas y aprovechar sus innovaciones.
 29. Resulta imprescindible revisar prácticas adoptadas comúnmente en la acuicultura comercial y los programas de refuerzo, como el uso de plaguicidas, insecticidas y piscicidas destinado a suprimir la presencia natural de especies de los estanques y los cursos de agua. En los sistemas abiertos del nordeste no es costumbre erradicar las especies nativas antes de abastecer los tanques con especies de mayor tamaño y valor comercial como las grandes carpas indias. Probablemente la razón consiste en que en esas regiones las PEI no se consideran como “plagas” o peces sin interés.
 30. En los sistemas de embalses, las PEI generan más ingresos que las carpas cultivadas. Por esta razón, en vez de obsecarse en rellenar los tanques con especies exógenas, sería tal vez mejor centrarse en la protección de las PEI que se dan naturalmente en esos cursos de agua y reforzar los nexos entre mercados.

Políticas y legislación

31. No existe una normativa general destinada a la conservación y manejo de PEI. Sin embargo, sí existen algunos elementos de ordenación pertinentes en algunas políticas vigentes. Por ejemplo, la Ley Nacional de Pesca de 1897 prohíbe prácticas destructivas como la pesca con venenos o con dinamita, así como el uso de ciertos aparejos.
32. Las políticas de concesiones en pesquerías continentales reclaman cierta atención, ya que en algunos estados la pesca únicamente da beneficios a los operadores individuales. No existen medidas específicas para proteger el acceso de las comunidades que dependen de las PEI a los recursos pesqueros

continentales. Se aplican las políticas generales relativas a la pesca continental o a las licencias de pesca en aguas interiores. La mayor parte de las políticas estatales dan preferencia a las cooperativas de pescadores en la asignación de concesiones y licencias, aunque muchas de ellas no son operativas actualmente. Ante la ausencia de cooperativas dignas de ese nombre, las aguas continentales se ceden a otros actores, despojando a las poblaciones locales, y sobre todo a los pescadores tradicionales, de los recursos. En el estado de Madhya Pradesh acaba de aprobarse una normativa única en su género que da prioridad a los pescadores tradicionales y a sus cooperativas. En Assam se protegen asimismo los derechos consuetudinarios de los pueblos tribales y de otros grupos étnicos indígenas. Se impone reforzar las organizaciones de pescadores y acuicultores de aguas interiores, incluidas las cooperativas, a fin de que puedan defender sus intereses y extraigan el máximo beneficio posible de los recursos pesqueros.

33. La invisibilidad de las PEI ha provocado su escasa presencia en las medidas políticas y legislativas. Urge realizar estudios que documenten la contribución económica y de otro tipo de las PEI de agua dulce a fin de establecer una base objetiva para el desarrollo de políticas adecuadas.

Conocimiento tradicional

34. Se impone documentar el acervo tradicional relativo a las PEI, en particular los conocimientos e innovaciones en torno a la producción de semilla y cría, a su preparación culinaria, y a su valor nutritivo y medicinal. Conviene explorar la posibilidad de patentar algunos de estos conocimientos mediante el uso de los derechos de propiedad intelectual, a fin de asegurar que las comunidades locales se benefician de cualquier posible utilización comercial de este patrimonio.

Los participantes en el taller elaboraron una Declaración que recoge las principales recomendaciones acordadas. 

Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity

Workshop

Report

This is the report on the workshop on “Small Indigenous Freshwater Fish Species: Their Role in Poverty Alleviation, Food Security and Conservation of Biodiversity”, organized by the International Collective in Support of Fishworkers (ICSF) in collaboration with the Inland Fisheries Society of India (IFSI).

The workshop was a forum for exchange of views on the role of small indigenous freshwater fish species (SIFFS) in enhancing rural food supply and livelihood security, and in conserving biodiversity. The workshop also discussed the socioeconomic and cultural contexts for the culture and capture of SIFFS, and how to enhance access—especially for women—to better incomes, livelihoods and nutritional security, through appropriate policy spaces.

This report provides a fresh focus on SIFFS, usually regarded as ‘trash’ fish. It urges scientists, researchers and decisionmakers to develop policy and legislative measures to ensure the conservation and promotion of SIFFS, both in capture- and culture-fisheries systems.

This report will be useful for fishworker organizations, researchers, policymakers, fish farmers, members of civil society and anyone interested in fisheries and livelihoods.



The Inland Fisheries Society of India (IFSI) is dedicated to promoting the cause of inland fisheries in the country. It is a well-recognized scientific forum that was formed in 1969 at the Central Inland Fisheries Research Institute (CIFRI), Barrackpore. The Society publishes the ‘Journal of the Inland Fisheries Society of India’ as well as original research work, monographs, invited review articles and books on specialized subjects for exchange and dissemination of information both within the country and abroad. The Society also offers opportunities for infusing new interest in fisheries by organizing scientific meetings, symposia, seminars, workshops and lectures.



ICSF is an international NGO working on issues that concern fishworkers the world over. It is in status with the Economic and Social Council of the UN and is on ILO’s Special List of Non-Governmental International Organizations. It also has Liaison Status with FAO. As a global network of community organizers, teachers, technicians, researchers and scientists, ICSF’s activities encompass monitoring and research, exchange and training, campaigns and action, as well as communications.