

Proceedings of the Regional Workshop

Production and Conservation of Nutrient-rich Small Fish (SIS) in Ponds and Wetlands for Nutrition Security and Livelihoods in South Asia



RESEARCH
PROGRAM ON
Aquatic
Agricultural
Systems

Led by



Proceedings of the Regional Workshop
**Production and Conservation of Nutrient-rich Small Fish (SIS)
in Ponds and Wetlands for Nutrition Security and Livelihoods in South Asia**

1st - 2nd March 2014
Dhaka, Bangladesh

Editors
Shakuntala Haraksingh Thilsted
Senior Nutrition Scientist, WorldFish
and
Md. Abdul Wahab
Professor, Faculty of Fisheries, Bangladesh Agricultural University

Design and Layout: Farha Khan, Communications Specialist, WorldFish, Bangladesh Office

Printer: Steering ARC, Dhaka, Bangladesh

Citation:

Thilsted, S.H., & Wahab, M.A. (Eds.). (2014). Production and conservation of nutrient-rich small fish (SIS) in ponds and wetlands for nutrition security and livelihoods in South Asia. Proceedings of a World Bank/SA-FANSI Funded Regional Workshop on Small Fish and Nutrition. Dhaka, Bangladesh. 1st - 2nd March 2014, pp 47.

ISBN: 978-984-33-6860-7

Published: June 2014

Funded by: The World Bank / South Asia Food and Nutrition Security Initiative (SAFANSI)

Acknowledgements

These proceedings were prepared through financial support of the South Asia Food and Nutrition Security Initiative (SAFANSI). SAFANSI was established as a multi-donor trust fund by a joint undertaking of the World Bank, DfID and AusAID. SAFANSI is supported by both AusAID and UKaid from the Department for International Development; however, the views expressed do not necessarily reflect these departments' official policies.

The workshop organisers express their gratitude to Dr. Shelina Afroza, Honourable Secretary, Ministry of Fisheries and Livestock for gracing the inaugural session with her presence, delivering an inspiring address, and launching the policy briefs, brochures and TV spot focusing on the importance of nutrient-rich small fish and nutrition. Dr. Craig A. Meisner, Country Director, WorldFish, South Asia, and Syed Arif Azad, Director General, Department of Fisheries (DoF) are thanked for their support in holding the regional workshop. The workshop is a contribution to the CGIAR Research Program (CRP) on Aquatic Agricultural Systems (AAS).

Foreword

Fish is of utmost importance in the life and culture of the people of Bangladesh. The abundant freshwater sources of rivers, floodplains, lakes and ponds are the home of a large number of freshwater fishes. About 50% of the 260 freshwater species are small fishes, popularly known as “SIS”, small indigenous fish species. Research carried out by the Bangladesh Agricultural University (BAU), Bangladesh Fisheries Research Institute (BFRI) and University of Copenhagen, Denmark over the last two decades has established that some SIS are highly nutritious, containing large amounts of bioavailable micronutrients such as vitamin A, iron, zinc, and calcium.

In its continued endeavour to address hunger and malnutrition, WorldFish Bangladesh has promoted the development and nationwide dissemination of small fish production technologies, in collaboration with the Department of Fisheries and NGOs. Building on the successful adoption of carp-mola polyculture technologies in stand-alone household ponds and ponds connected to rice fields, efforts have been made to spread the knowledge and technologies among policy makers and relevant stakeholders in Bangladesh, as well as in the South and Southeast Asian region.

These proceedings of the very successful two day regional workshop on “Fish and Nutrition” which was held in Dhaka on 1st and 2nd March 2014, as well as the policy briefs, brochures and TV spot which were produced and disseminated will play an important role in promoting further research, knowledge sharing, and refinement and adoption of production technologies to increase the production and consumption of SIS in Bangladesh, as well as throughout the South and Southeast Asian region.

Craig A. Meisner
Country Director
WorldFish, South Asia
June 2014

Table of Contents

Foreword	iv
I. Introduction	1
II. Workshop Day 1	
a. Inaugural Session	2
Fish for better nutrition: Policies and strategies for increased production of nutrient-rich small fish in Bangladesh (Azad, S.A.)	
Improving nutrient-rich small fish availability, access and consumption within the framework of the Bangladesh Country Investment Plan (Banna, M.)	
b. Technical Session I	5
Integrating nutrition in aquaculture/agriculture interventions in Bangladesh (Thilsted, S.H.)	
Sustainable fish production and management to meet the requirements for micronutrient-rich small fish in Bangladesh (Wahab, Md.A.)	
c. Technical Session II	8
Integration of micronutrient-rich small fish in aquaculture systems for increased fish production and household nutrition in NW Bangladesh (Barman, B. & Golder, M.I.)	
Adoption of mola in community managed waterbodies enhanced productivity and bio-diversity in Sunamganj <i>haor</i> basin: An example of successful technology transfer in SCBRMP (Khan, A.K.M. F. & Mohsin, Sk.Md.)	
Fish-based products to improve nutrition in the first 1,000 days of life (Hother, A., Saha, M., Bogard, J. & Thilsted, S.H.)	
Dried fish production, consumption and trade in Bangladesh (Belton, B. & Hossain, M.A.R.)	
III. Workshop Day II	
a. Global Overview	16
Nutrition-sensitive Aquaculture/Agriculture for Improved Food and Nutrition Security (Thilsted, S.H.)	
b. Country Summaries	17
i. Bangladesh	
ii. Cambodia	
iii. India	
iv. Myanmar	
v. Nepal	
vi. Sri Lanka	
c. Outcomes of Group Discussions: Diagrams on Nutrition-sensitive Fisheries and Aquaculture	28
i. Bangladesh	
ii. Cambodia	
iii. India	
iv. Myanmar	
v. Nepal	
IV. Conclusions and Recommendations	31
V. Field Visit Photos	32
VI. Fish-based Products Demonstration	34
VII. Appendix I	37
a. Workshop Programme	
b. Invited Workshop Participants	
VIII. Appendix II	46
a. Policy Briefs	
b. Brochures	
c. TV Spot	
IX. Appendix III	46
a. Press Briefing	
b. TV Coverage	
c. Additional TV Programme	

I. Introduction

Small indigenous fish species (SIS) are an important source of essential macro- and micronutrients which can play an important role in the elimination of malnutrition and micronutrient deficiencies in the populations of many South and Southeast Asian countries. Of the 260 freshwater fish species in Bangladesh, over 140 are classified as SIS. SIS are an integral part of the rural Bangladeshi diet. As many SIS are eaten whole, with organs and bones, they contain high amounts of vitamins and minerals, including calcium, and iron and zinc. Some SIS, such as *mola*, are also rich in vitamin A. As SIS are cooked with vegetables and a little oil, they contribute to the food diversity of the rural poor.

The Department of Fisheries, researchers from Bangladesh Fisheries Research Institute (BFRI) and universities, and other extension agencies and NGOs have shown interest and participation in the promotion of SIS in different parts of Bangladesh as well as in neighboring countries. SIS are recognized as a major animal-source food group, contributing to improved food and nutrition security and livelihoods of the people of South and Southeast Asia. Over more than a decade BAU has been working with partners from Denmark and developed production technologies for pond culture, connected pond culture, and stock enhancement in wetlands. WorldFish has been implementing these technologies in collaboration with national institutions and NGOs.

The purpose of this workshop is to bring stakeholders: policy makers, extension agents, researchers, NGOs and development partners together to share knowledge of the contribution of small fish for better nutrition, production technologies, and policy briefs for formulation of strategies for wider dissemination of pond culture and wetland based production and conservation technologies. The workshop is expected to generate ideas for further research and development of sustainable technologies for production, management and conservation of SIS for the benefit of the people of Bangladesh as well as the South and Southeast Asian region. The workshop will also provide an opportunity to update knowledge and document the progress made since the last two workshops, held in 2003 and 2008, as well as formulate a future course of action for the promotion of production and conservation of nutrient-rich small fish.

II. Workshop Day I

a. Inaugural Session

Keynote Presentation

Fish for better nutrition: Policies and strategies for increased production of nutrient-rich small fish in Bangladesh

Syed Arif Azad

Director General, Department of Fisheries

Ministry of Fisheries and Livestock, People's Republic of Bangladesh

E-mail: dg@fisheries.gov.bd

The Department of Fisheries is the main extension agency of the Government of Bangladesh. It has the mandate to render extension services, conservation of fisheries resources, maintain quality of fish and fishery products, support policy framework, and contribute to human health and socio-economic improvement. The fisheries sector accounts for 4.37% of the GDP, about one fourth of the agricultural GDP and 2.01% of export earnings. It also contributes about 60% of the animal protein intake of the country. About 11% of the total population is directly or indirectly involved with this sector for their



livelihood. Bangladesh is ranked 5th in the world as an aquaculture producing country. In 2012-13, Bangladesh earned 4,169 crore Taka by exporting fish and fisheries products. This sector has been maintaining a very steady growth rate (> 6%) over last 10 years. Total fish production of the country in 2012-13 was 34.10 lac metric tonnes. Bangladesh has a rich fish biodiversity both in her freshwater and marine habitats. There are 260 freshwater fish species, 12 exotic fish species, 486 marine fish species, 24 freshwater shrimp species and 36 marine shrimp species. To develop and conserve the fisheries resources, the government has formulated several policies and different acts and regulations. The DoF has taken up various steps over the last decade for increased production, biodiversity conservation, and sustainable resource

management. The most important programmes undertaken and implemented by the Department of Fisheries are: Co-management/Community Based Fisheries Management, and Conservation and Management of Wetland Biodiversity: An Integrated Natural Management Approach. The major focus of the said programmes were habitat improvement and management, sanctuary establishment and management, conservation and management of fish breeding grounds, restoration and management of endangered fish broods, aquatic plantation and integrated farming, stocking of fish fry, construction of fish and agro-friendly structure and operation – management of sluice gates, establishment of fish pass and fish friendly regulators, and mass awareness campaigns.

The department has developed strategies for enhancement of small fishes in the floodplains and small water bodies. Production of small fish in floodplains using enhanced fisheries management by CBOs through stocking brood-fish of small fish, management of the floodplains and conservation of small fish. Efforts have also been made towards Community Based Fish Culture and Integrated Floodplain Management through public and private floodplains, establishment of good governance, and ensure access and benefits of poor people including landless, poor fishers. An important step towards better management has been the development of a database: Genuine Fishers for Sustainable Development of Fisheries Resources.

As a strategy for production of small fish in ponds, various activities such as stocking brood-fish of small fish, culture of carp and small fish in polyculture, use of effective strategies to harvest small fish, conservation of small fish in pond and development of micro-habitats in ponds useful for small fish. Additional measures for production of small fish in ponds connected to rice fields include stocking brood-fish of small fish, culture of carp and small fish, conservation of small fish in ponds and making provisions to allow small fish to enter rice fields. Policies that should be developed and implemented to increase the production and diversity of small fish in wetlands include: expand and restore fish habitats, re-stock *mola* and other micro-nutrient rich small fish, restore migratory routes and establish fish-friendly structure to allow movement of fish, support sustainable management of fisheries in wetlands using community based approach, provide support to carry out research on biology and nutrient composition of small fish, and select more species for stock enhancement. It is high time to formulate policy and strategy so that the technologies for ponds and ponds connected with rice fields for carp, and small fish production technology can be adopted by larger numbers of farming households in the country and region.

Link to presentation: <http://www.slideshare.net/worldfishcenter/fish-for-better-nutrition-policies-and-strategies-for-increased-production-of-nutrient-rich-small-fish-in-bangladesh-by-syed-arif-azad-department-of-fisheries-bangladesh>

Improving nutrient-rich small fish availability, access and consumption within the framework of the Bangladesh Country Investment Plan

Mostafa Faruq Al Banna
Associate Research Director
Food Planning and Monitoring Unit, Ministry of Food
E-mail: mostafa.banna@gmail.com

The Government of Bangladesh is committed to ensuring food security of the people in line with Article 15(a) of the constitution, where the State has been conferred with the fundamental responsibility to secure its citizens with a provision of food and other basic necessities.

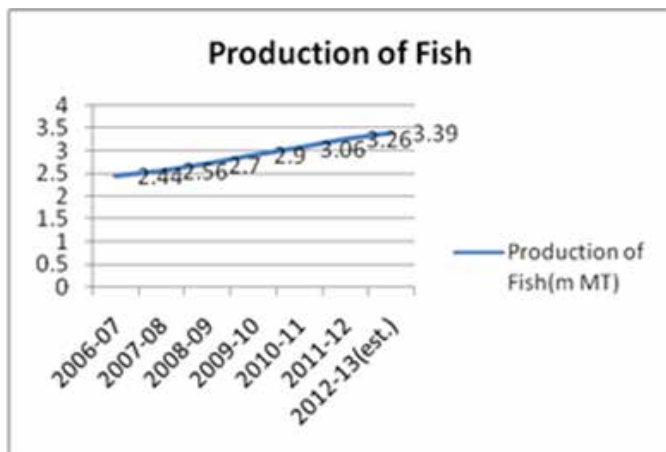
Bangladesh has formulated the Bangladesh Country Investment Plan (CIP) for Agriculture, Food Security and Nutrition in 2010 and revised the same in 2011. This effort was carried out in close collaboration with all the stakeholders including development partners. CIP has been incorporated in the 6th Five Year Plan. The CIP is a country led planning, fund mobilization and alignment tool¹. It supports increased effective public investment to increase and diversify food availability in a sustainable manner and improve access to food and nutrition security. Its interventions also aim to mobilize investment by smallholders and other private sector food security actors. Being a results based tool aimed to improve food security in a comprehensive manner, the CIP (i) is anchored in the existing national policy and planning frameworks; (ii) builds on past and on-going operations in support of food security, and (iii) reflects the diverse views of its many stakeholders as a result of a unique and inclusive consultation process, involving government agencies, academics, civil society, private sector, NGOs, UN agencies and Development Partners. The CIP also provides cost and finance gap evaluations as well as priority financing requirements. It explains how it will be used for fund mobilization and monitoring of progress in output delivery and impact. The CIP provides a set of 12 priority investment programmes to improve food and nutrition security in an integrated way which are as below:

Table 1. Programmes under the CIP

Component	CIP Programmes
Food Availability	<i>1. Sustainable and diversified agriculture through integrated research and extension</i>
	<i>2. Improved water management and infrastructure for irrigation purposes</i>
	<i>3. Improved quality of inputs and soil fertility</i>
	<i>4. Fisheries and aquaculture development</i>
	<i>5. Livestock development, with a focus on poultry and dairy production</i>
Food Access	<i>6. Improved access to market, value addition in agriculture and non farm incomes</i>
	<i>7. Strengthened capacities for implementation and monitoring of NFP and CIP actions</i>
	<i>8. Enhanced public food management system</i>
	<i>9. Institutional Development and Capacity Development for more effective safety nets</i>
Food Utilization	<i>10. Community based nutrition programmes and services</i>
	<i>11. Orient food and nutrition actions through data</i>
	<i>12. Food safety and quality improvement</i>

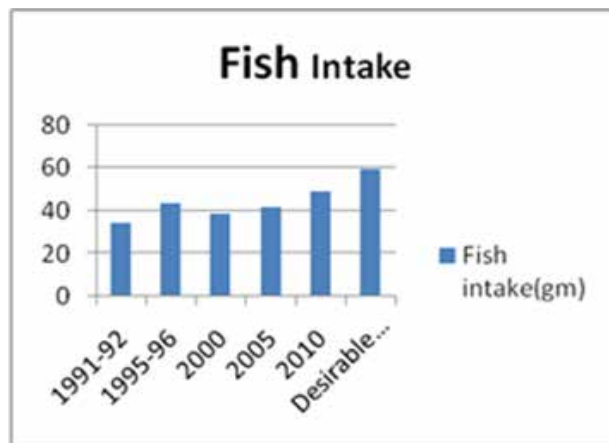
Agriculture plays a key role in Bangladesh economy as supplier of food, source of livelihoods, employment and growth. About 18.70% of Gross Domestic Product (GDP) still comes from agriculture (including crop & vegetables, fisheries, livestock and forestry) in 2012-13. GDP share from fisheries is 4.37% in 2012-13². Fish consumption per capita has increased in recent years as a result of rapid expansion of aquaculture. These needs to be accelerated to obtain desirable dietary level (Figure 1 and Figure 2).

Figure 1. Production of Fish



Source: Bangladesh Economic Review 2013 & DoF

Figure 2. Consumption of Fish



Source: BBS HIES³, BIRDEM 2013⁴

Fish is central to the Bangladeshi diet and small fish species are an important source of protein and micronutrient. Omega-3 fatty acids in fish also play an important role in supporting our skin, heart, blood pressure, brain, kidney and other body systems. As many small fish species are eaten whole with head, viscera and bones they are particularly rich in bioavailable calcium. Some are rich in vitamin A, vitamin B complex, iron and zinc⁵. Marine fish is also a good source of iodine. Small sized indigenous fishes are a valuable and easily available source of protein, oil, vitamin and minerals for the rural people in Bangladesh. Small fish can be purchased in small quantities and are relatively affordable and accessible for the rural poor people.

A research study shows that interventions which aim to improve nutrition by increasing fish production can be expected to leverage greater impacts in terms of improved nutritional equity by targeting captures fisheries rather than aquaculture⁶. Government and Development partners are promoting initiatives within the framework of CIP for the improving the food availability, accessibility and utilization of rural communities through integrated agriculture and health based interventions. Enhancing the community based production and consumption of fish for better nutrition is central to this initiative.

References

- [1] GOB (2011). Bangladesh Country Investment Plan: A road map towards investment in agriculture, food security and nutrition. Ministry of Food & Disaster Management.
- [2] GOB (2013). Bangladesh Economic Review (2013). Finance Division, Ministry of Finance.
- [3] BBS (2010 and 2005). Household Income Expenditure Survey. Ministry of Planning.
- [4] BIRDEM (2013). Dietary Guidelines for Bangladesh.
- [5] INFS & CARS (2013). Food composition table for Bangladesh. University of Dhaka.
- [6] Belton, B., van Asseldonk, I.J.M. & Thilsted, S.H. (2014). Faltering fisheries and ascendant aquaculture: Implication for food and nutrition security in Bangladesh. Food Policy "44, 77-87".

Link to presentation: <http://www.slideshare.net/worldfishcenter/improving-nutrientrich-small-fish-availability-access-and-consumption-within-the-framework-of>

b. Technical Session I

Integrating nutrition in aquaculture/agriculture interventions in Bangladesh

Shakuntala Haraksingh Thilsted, Rumana Akter, Anna Birkmose Andersen
WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh
E-mail: S.Thilsted@cgiar.org



In Bangladesh, in the last 15 years, there have been a series of field trials with household pond polyculture of carps and *mola*. The rationale for this was to increase production and productivity of household ponds and, at the same time, enhance the nutritional quality of the total fish production.

This production technology leads to an increased household income through the sale of the carps as well as increased household intake of *mola*. As *mola* breeds in the pond, adult *mola* must be harvested partially frequently in order to maintain the stock. This harvesting of small amounts of *mola* promotes regular household consumption, in contrast to that of carps which are harvested a few times as adults, 5-7 months after stocking as fingerlings. In addition, small fish, as they are eaten whole, with bones, viscera and organs are much richer in vitamins and minerals than the edible parts of large fish and, at the same time, some small fish species such as *mola* and *dhela* have been found to be particularly rich in vitamin A. Using household pond polyculture of carps and *mola* as an entry point and building on the framework and guiding principles of nutrition-sensitive agriculture, WorldFish has developed an aquaculture/agriculture - nutrition linkages component which includes: vegetable production, with focus on vitamin A-rich orange sweet potato (OSP) in the homestead garden and on pond dykes for home consumption and sale

of both roots and leaves; promotion of increased consumption of micronutrient-rich small fish, vegetables and fruits, especially in the first 1,000 days of life; behaviour change communication for improving knowledge and practice of essential nutrition and essential hygiene actions; and gender considerations, e.g. regarding norms, attitudes and practices in relation to food purchase, food preparation and processing, intra-household food distribution and distribution of work load among household members. Preliminary results from a three years' project with 1,500 households in north-west Bangladesh showed promising results with respect to fish production and productivity, as well as *mola* consumption in women and young children. This project engaged local women as lead farmers and field staff and focused on strong motivation, supervision and follow-up of staff.

This aquaculture/agriculture - nutrition linkages component is presently being scaled out in a much larger household pond polyculture project, with a shorter duration and lesser intensity of intervention, in which over 20,000 households have been introduced to carp - *mola* pond polyculture. Process evaluation and impact evaluations are planned in order to determine how best aquaculture/agriculture interventions at scale can be made nutrition-sensitive.

References

- FAO (2013). Synthesis of guiding principles on agriculture programming for nutrition. FAO, Rome.
<http://www.fao.org/docrep/017/aq194e/aq194e.pdf>
- Thilsted S.H. (2012). The potential of nutrient-rich small fish species in aquaculture to improve human nutrition and health. pp 57-73. In: RP Subasinghe, JR Arthur, DM Bartley, SS De Silva, M Halwart, N Hishamunda, CV Mohan, P Sorgeloos (eds.) Farming the Waters for People and Food. Proceedings of the Global Conference on Aquaculture (2010), Phuket, Thailand. FAO, Rome and NACA, Bangkok.
ftp://ftp.fao.org/FI/DOCUMENT/aquaculture/aq2010_11/root/global_conference/proceeding_global_conference.pdf

Link to presentation: <http://www.slideshare.net/worldfishcenter/integrating-nutrition-in-aquacultureagriculture-interventions-in-bangladesh-by-shakuntala-haraksingh-thilsted-rumana-akhter-anna-birkmose-andersen>
and

<http://www.slideshare.net/worldfishcenter/ll-akter-rumana-integrating-nutrition-in-aquaculture-in-ain>

Sustainable fish production and management to meet the requirements for micronutrient-rich small fish in Bangladesh

Md. Abdul Wahab

Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

E-mail: wahabma_bau2@yahoo.com



Introduction

Bangladesh, as a deltaic country of three large rivers, the Ganges, Brahmaputra and Meghna, with monsoon rain and favorable temperatures, is an ideal country to home a large number of fish and aquatic fauna and flora. She has been gifted with rich biodiversity of inland freshwater and marine fish. Fish are thus an integral part of life and livelihood of the people of Bangladesh for food, nutrition and income generation. In the past, the natural water resources in this country were abundant with fish and aquatic invertebrates and edible floras and contributed to about 80 percent of the total fish production. Fish production from natural fisheries have started to decline since the middle of the 1970s due to various manmade and natural

reasons, especially construction of barrages, installation of Flood Control Drainage (FCD) and Flood Control Drainage and Irrigation (FCDI) infrastructures for rice production, siltation, overfishing, use of agrochemicals, waste disposal from industries, and harmful means of fishing. Fish production from natural capture fisheries has declined to only 29 percent over the last 40 years. This declining trend in natural fisheries has a great impact on the poor people who used to live on capture fisheries for their daily nutrition as well as on the fishermen who used to live on fishing from common pool resources.

Aquaculture scenario

The gradual decline of natural fisheries has prompted aquaculture development in the country. Starting with small scale polyculture of Indian major carps in the late sixties, aquaculture has now been developed as an intensive, high tech-based industry and has become a largely diversified venture in terms of species and products. Besides semi-intensive composite culture of Indian major carps with Chinese carps and European common carps, Bangladesh has been very successful in her farming efforts of Vietnamese *pangasius* catfish and Nile tilapia. Aquaculture production has currently contributed to 53% of total fish production of 3.46 million metric tons. The consumption of fish has increased upto 18.7 kg per capita per year against the desired target of 20.5 kg.



Necessity for promotion of nutrient-rich small fish

In spite of this tremendous success in fish production, efforts have been limited to few varieties of large fish and some exotic species. The present trend towards aquaculture of only some large carps, *panagisus* catfishes, and tilapia, sustainable production and management of a large number of naturally available species remains unexplored. Some efforts in this direction have been recently put in place for conservation of biodiversity, restoration of habitats, establishment of sanctuaries and community-based fisheries management by government and donor agencies. Side by side, novel approaches of farming carps along with nutrient-rich small fish such as *mola*, *darkina*, *gulsa*, *punti*, *chela* and *dhela* have been tried to some extent as these and other small fishes are relatively rich in essential

micronutrients like vitamin A, iron, calcium and zinc. The initial on-station and on-farm trials have shown tremendous success with high levels of pond production through scientific management. Letting the small fish grow in ponds and ponds connected with rice-fields may provide micronutrient-rich fish supply for household consumption, especially for the rural women and young children who often suffer from malnutrition. If all seasonal and perennial ponds, except the intensively managed ones, are brought under carp-small fish polyculture, it may have tremendous impact in developing a nation of healthy children and productive manpower. While the requirement of total quantity of nutrient-rich small fish is not yet known, it may be assumed that ponds and ponds connected with rice-fields may not alone produce enough for sustainable supply of small nutrient-rich fish for all people of Bangladesh. Another approach of large scale stock enhancement in the natural wetlands, *beels*, *haors* and *baors* may be promoted for increasing biodiversity, production, and productivity so that fishing communities may directly benefit through access to resources as well as have the ability to sell their extra catch for income generation. The establishment of sanctuaries in the strategic locations of the water-bodies and community

participation through awareness building are the key to the success of sock enhancement programmes in the open inland water resources. The vast seasonal water bodies, e.g. *haors* in the Northwest may be utilized in several other ways through cage and pen culture, and raising of fingerlings in nylon netting *hapas*.

Major challenges ahead

The major challenges of sustainable production and management of inland fisheries resources to meet the requirements of the small fish, especially those micronutrient-rich ones, through aquaculture as well as conservation and management of natural resources are: lack of knowledge on the nutritional values of all small fishes, lack of knowledge on their biology, shortage of quality seed, land and water use conflicts, use of agro-chemical crop fields, weakness in the implementation of fish acts, lack of alternative income generation for the fishermen, lack of awareness and uncertainty of climate changes. We need to address some of these challenges, if not all, to harness the potentials of inland fisheries resources of Bangladesh for sustainable production and management of small fish to meet the requirement for the present and future generation.

Policy support

The policy support of the government for promotion of pond production and wetland production technologies and awareness building will be immensely helpful for increased production and consumption of nutrient-rich small fish by all groups of people, especially women and young children.

Link to presentation: <http://www.slideshare.net/worldfishcenter/III-wahab-md-a-sustainable-fish-production-and-management>

c. Technical Session II

Integration of micronutrient-rich small fish in aquaculture systems for increased fish production and household nutrition in NW Bangladesh

Benoy Kumar Barman, WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh

Md. Israil Golder, Department of Fisheries, Bangladesh

E-mail: B.Barman@cgiar.org



The total area of inland waters in Bangladesh is 4.7 million ha; inland open waters constitute 3.9 million ha (84%) and inland closed waters 0.8 million ha (16%). Of the open waters, floodplains account for 2.711 million ha (69%), rivers & estuaries 0.854 million ha (22%), *Beels* 0.1144 million ha (3%), Sundarbans 0.178 million ha and Kaptai lakes 0.068 million ha (2%). Production of fish from open waters is low, 0.097 million metric tons (28% of total fish production) as people do not choose to fish in these areas. Originally these open water resources were not used for aquaculture production but over the years the rapid development of aquaculture technologies, input supply (fish seed, feed) and the decrease in fish production from open waters, created demand to use some of these

resources for aquaculture production for more income. Over the years, of the open waters, floodplains and *beels* (natural depressions) were adapted for fish culture using different approaches; making them closed water bodies by putting in permanent structures or by using devices/fences in the inlets and outlets. People also tried adapting rivers or canals for use in cage and pen culture.

The development of roads, highways, and flood protection embankments prompts the aforementioned adaptations of water bodies as people expand upon the already established structures by installing fencing or other devices to enclose the open waters. In some cases people construct ponds within the floodplains through enclosures as an economically beneficial method of increasing fish production and income through these methods of commercial aquaculture production.

Although use of open waters for aquaculture is increasing fish production and earnings, mostly of those cultured in closed water bodies such as carps (exotic and endemic), it also showed negative impacts on production of natural fish, aquatic biodiversity, governance, access, and benefits to the poor, especially fisher populations. The production of natural fish, of which a large proportion are small fish (including many micronutrient-rich fish), was found to be greatly hampered.

To overcome these negative impacts and to increase use of open waters (especially *beels*, seasonal floodplains), WorldFish has, since 2005, along with other partners implemented participatory action research based projects using the Co-management/Community-Based Approach for Fish Culture in Seasonal Floodplains. The purpose of the research is to develop understandings on how to use the seasonal floodplains for fish culture by taking into account the following:

- Ensure access and increase benefits of the users of floodplains, especially the poor, by increasing its productivity through production of stocked and un-stocked fish including the small fish rich with micronutrients.
- Use of CBFC and Integrated Floodplain Management (IFM) approaches through establishment of good governance by implementing registration, transparency in accounting, participation and discussion through regular meetings with executive members and general members, sharing of benefits, and development of leadership capacity to manage and to establish networking with support providers for use of under private and public or public/private ownerships in sustainably by mitigating conflicts.
- Development of strategies on stocking and management of fish fingerlings (large size, suitable species, optimum stocking density, improved quality, locally availability); useful for getting a market able size within the shortest possible time from the floodplains.
- Develop strategies on production of natural fish including the micronutrient-rich small fish '*mola*' and '*darkina*' and others through by stocking its brood fish, and use of conservation and regulation measures through creation of sanctuaries, habitats (useful for the fish for their different stages of the life cycle to reproduce and to grow faster). The development of innovative techniques in collection, transportation and stocking of these small brood fish is very important for bringing success.
- Use of simple devices (large meshed bamboo fencing) in the inlet and outlets (which allows easy movement of water and the migration of small natural fish), the regulation in use of large gears during the breeding season (when it is disturbed in other open waters) are very effective in getting higher production of un-stocked natural fish.
- Use of effective strategies for harvesting the natural fish from the floodplains using netting with grader nets (allow small fish to grade from large fish without any stress), also harvest by use of local gears and open access for harvesting for household consumption or to sell.

- Use of effective marketing strategies by harvesting the fish based on local market demand (especially for small fish) can be beneficial in two ways: local consumers, including the poor, can buy fish regularly from the market, and the harvest of small fish as per market demand places the growth of the smaller fish in order to get good harvests on a regular basis.
- Simple water control structures.
- Integrated Floodplain Management Approach promotes growing of cash crops (water saving, and high potential for the involvement of women of poor households in farming) instead of cereal crops and conserving water in the deeper areas (ditches) within the floodplains for use in small fish conservation.
- Up-scale and out-scale of community based fish culture (CBFC) approach to communities through establishment of focal sites/floodplains/communities and sharing with the outreach sites/floodplains/communities throughout the country.
- Focus on CBFC using IFM and Co-management approach for bringing floodplains in Bangladesh and in the region into a state of higher productivity and income, and most importantly enabling a system that will support the production of small fish. In most cases, as compared to the typical aquaculture practices normally carried out in closed waterbodies, this system can be used as a cost reduction strategy by reducing cost of stocking fingerlings, cost of supplementary feeding (instead of using fertilization as a means to enrich water productivity). The low cost of investment in fish-based culture, with an integrated, enhanced fisheries management approach, will increase opportunities, and involvement of the poor in fish production in the floodplains.

Rather than financial capital requirements, these approaches demand increased development of knowledge, skills, learning and innovations for the affected population. It requires leaders to demonstrate among the members of communities surrounding the resources, the value of working together, following the saying 'UNITY IS STRENGTH'. With support from the CGIAR Challenge Program on Water and Food, WorldFish is implementing two projects (PN35 and RIU PN35) which have been successful in the latter endeavour. As part of the presentation on aquaculture systems, integrating production of micronutrient-rich small fish will be covered. In addition, the outcomes of other action research on the use of technologies by small scale farming households, and on culture of micronutrient-rich small fish '*mola*' in polyculture with carps in pond and pond connected rice fields, will be covered.

An increase in fish production through aquaculture has been occurring in Bangladesh, now ranked 5th in the world. Farmers want to improve production inputs and management through such actions as stocking fingerlings of cultured fish at a high density, and use of inputs such as improved seed and feed. Consequently such technologies need more investment to match the quickly progressing increases in proper knowledge and understanding about input and output market value chains. However, for small scale farming households with small ponds dependent on seasonal water availability, located in most of the districts of the NW including the Barind Tracts Region, aquaculture is mostly traditional with poor production and low income. In order to promote an aquaculture system with higher production and income, with more fish for household consumption focusing on micronutrient-rich small fish '*mola, darkina, dhela*', integrating carp polyculture as part of an action research project supported by IFAD has been implemented by WorldFish in collaboration with Department of Fisheries. The purpose of the research is to get an understanding on how small fish (*mola, dhela, darkina*) can be successfully cultured with carp through polyculture in ponds. Like the earlier aquaculture systems in open waters, an innovative closed water pond based aquaculture system has been successfully developed in NW Bangladesh. Because of its great success and innovation within a short period of time it has been taken up and promoted by DoF, and other WorldFish projects in Bangladesh, Nepal, India and Cambodia. The specific questions addressed in the development of this innovative aquaculture system include:

- Are the small seasonal ponds of poor farming households effective in producing small fish along with carps through a polyculture system?
- To what extent will the production of small fish (*mola*) have on market price and its consumption by poor farming households; and how will this influence use by pregnant women, lactating mothers, and young children of poor households for whom small fish are nutritionally valuable?
- What innovations are being developed and implemented in order to successfully culture carp with small fish?
- What is needed to disseminate carp polyculture with small fish to other farming households in a quick but efficient way?

Link to presentation: <http://www.slideshare.net/worldfishcenter/integration-of-micronutrient-rich-small-fish-in-aquaculture-systems-for-increased-fish-production-and-household-nutrition-in-nw-bangladesh-by-benoy-barman-world-fish-and-mi-golder-dof-bangladesh>

Adoption of *mola* in community managed waterbodies, enhanced productivity and bio-diversity in Sunamganj haor basin: An example of successful technology transfer in SCBRMP

Sk.Md. Mohsin, SCBRMP

A.K.M. Firoz Khan, WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh

E-mail: mohsin300964@yahoo.com

Summary

There are enormous inland capture fishery resources in Bangladesh, two thirds of capture fishery areas belong to several haor districts. Among those, Sunamganj district is the haor district with the most widespread floodplain areas. In these haor areas millions of poor people depend on fisheries resources, it plays an important role in their livelihoods through income earning, household protein consumption, employment generation, nutrition supply, and poverty alleviation. Bio-diversity and productivity of fisheries is at risk due to habitat degradation, siltation and conversion to agriculture, increasing fishing pressure, destructive fishing practices and an acute shortage of dry season habitats. In order to improve the fisheries situation, community based resource management project (CBRMP), an integrated poverty alleviation project, has been working in the Sunamganj district since 2003. Among other rural development components open water fisheries management is one of the important focuses of the CBRMP.

The ecosystem of the haor supports many wild fish species and the haor fishery is also a key economic resource for landless fishers. In the wet-season all of the adjacent waterbodies become a single floodplain. The freshwater fish species in Bangladesh are comprised of 265 species, of which about 137 species are found in the Sunamganj haor area. Conversely about 140 small indigenous fish species (SIS) species are found in Bangladesh. In the past, SIS fishes were considered weed fish and eradicated from the fish ponds by fishing or pesticides. Only recently have these small indigenous fish species been considered an important source of essential macro- and micro-nutrients which can play an important role in the elimination of malnutrition in this country. *Mola* fish is one of the most important micronutrient rich SIS.

Mola fish (*Amblypharyngodon mola*) is one of the small indigenous species (SIS) rich in micronutrients (vitamin A, calcium, iron, zinc and phosphorus) that are required for the development stages of babies, especially the crucial first 1,000 days. Malnutrition levels in the Sunamganj district are higher than other parts of Bangladesh. In Sunamganj, much of the population lives below the food poverty line and the dietary intake of both children and adults is severely deficient in key vitamins and minerals. The Community Based Resource Management Project (CBRMP-LGED) promotes innovative new technologies designed to increase the production of mola fish in open waterbodies on an experimental basis. A total of 14 waterbodies are included in SIS production along with regular fisheries management practices. *Mola* fish are a nutrient rich multi-breeder which breeds 2-3 times in a year and fecundity is 1000-8000; this species can enhance the productivity of waterbodies along with other species very rapidly. The stocking of broods of *mola* fish in waterbodies supported by a variety of best management interventions, such as observing closed fishing season, developing fish sanctuaries, controlling destructive gears, controlling fisher access, fishing efforts and awareness campaigns. Furthermore, emphasis is placed on a transfer to technology solutions to increase productivity without financial contribution of the CBRMP-LGED and WorldFish; Beel User Groups (BUG) contribute to, and accomplish the steps of management. *Mola* fish promotion maybe used as an innovation technology that, along with other species, can be used for consumption, which helps target malnutrition, as well as for production for sale to improve the livelihoods of the poor.

WorldFish has been supporting CBRMP by conducting bio-diversity impact monitoring of the fisheries component of CBRMP. This will cover changes in fish catch, improvement of biodiversity and livelihood gains of the fisher households. This study highlights the promotion of *mola*, and other SIS fish in haor-beels under CBRMP in the Sunamganj district through involvement of community organizations (BUGs) along with other technologies and self-motivation. CBRMP waterbodies are located in deeply flooded areas of the Sunamganj district, so all adjacent water bodies connected during monsoon were in fact treated as a single cluster. The FRS project targeted 60 randomly selected water bodies of the CBRMP to work in, of which 14 water bodies were selected for technologies transfer of *mola* fish promotion in 3 Upazila of Sunamganj district. WorldFish provided technical assistance to CBRMP to adopt *mola* fish along with other indigenous fish, and with community based fisheries management. This innovation technology is able to increase *mola* fish production and BUG members actively propel the process of technology. BUG members of the sample waterbodies were oriented about the process by the CBRMP-LGED and WorldFish and a total of 343 kg of *mola* broods were stocked in the 14 waterbodies in March-April 2013 just before flooding, so that the SIS could breed in the haor during rainy season. It was a very tough job to collect and transport the *mola* broods; in this process the WorldFish team used the proven technology of using sodium bi-carbonate was mixed with fresh tube-well water in a carrier tank to enrich the dissolved oxygen available to the broods during transportation. In addition, netting was conducted several times in the brood stocked pond.

The baseline fish production is obtained by combining the catch and harvest from the open catch last year, and from the open catch monitoring data. The total fish production was 1686 kg in 14 sampled waterbodies in 2012-13, of which 903 kg were

from an organized catch and 783 kg were from open catch monitoring. After technology adoption total fish production obtained by combining open catch and harvest from organized catch. The total fish production was 4036 kg in 14 sampled waterbodies in 2013-14 of which 2129 kg was from the organized catch and 1907 kg from open catch monitoring (organized *mola* catch reported as partial harvests as of 26th February 2014).

Stocking of *mola* not only enhanced productivity but also provided knowledge on the micro-nutrient requirements of adults, child bearing women, lactating mothers, babies (first 1000 days) as well as other family members through coordination and awareness meetings.

Link to presentation: <http://www.slideshare.net/worldfishcenter/adoption-of-mola-in-community-managed-waterbodies-enhanced-productivity-and-biodiversity-in-sunamganj-haor-basin-an-example-of-successful-technology-transfer-in-scrmp-by-sk-md-mohsin-and-firoz-khan>

Fish-based products to improve nutrition in the first 1,000 days of life

Anne-Louise Hother, Manika Saha, Jessica Bogard, Shakuntala Haraksingh Thilsted
WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh
E-mail: a.nielsen@cgiar.org



In Bangladesh, more than 20 million people, particularly women and young children suffer from chronic malnutrition. When children do not eat enough micronutrients, they become malnourished, their growth is stunted and they do not develop to their full potential. This also affects their brain development, making it difficult for them to learn in school and perform well at work in later life. The damage done early in life is irreversible but can be prevented by eating a nutritious diet which includes micronutrient-rich foods.

Most of the growth faltering in Bangladesh occurs from 6-23 months of age [1]. This growth faltering coincides with the period when complementary foods (CFs) are recommended to be introduced and constitute an increasing part of the child's diet. In addition, poor maternal nutritional status during pregnancy and lactation leads to suboptimal supply of nutrients to the foetus and through breast milk, which may also affect the child's growth. Even if the amounts of nutrients

delivered to infants via breast milk are unaffected by maternal malnutrition, there may be adverse effects on the mother's health. When a mother's health and ability to function are compromised, her child's nutrition and health are also compromised, thus resulting in a two-fold negative effect.

The first 1,000 days of a child's life, from the start of a woman's pregnancy until the child's second birthday offers a unique window of opportunity to shape healthier and more prosperous futures. The child's nutrition and health depend on the woman's diet being rich in micronutrients during pregnancy and lactation. In the first half year of life, breast milk provides the optimal food, but at about 6 months of age, the supplies of energy and some nutrients in breast milk are no longer sufficient to meet an infant's high needs and therefore they should be fed complementary foods together with continued breastfeeding. As the child's stomach is small, only small amounts of foods other than breast milk can be consumed. Consequently, CFs need to be nutrient-rich, i.e. a high amount of each nutrient per 100 kcal of food. Thus, the infant should receive the most nutrient-rich foods available in the household. Yet, in Bangladesh the opposite is often the case, with infants typically being fed nutrient-poor diets, consisting mainly of a thin rice porridge. While rice provides energy, it does not provide adequate nutrients.

Studies in Bangladesh show very low adequacy of micronutrient intakes in young children and women in rural areas, primarily explained by low food intake and limited dietary diversity [2]. CFs are often introduced too late, and are of poor nutritional quality [1, 3].

Why should fish consumption be increased in the 1,000 days?

Inclusion of small amounts of animal-source foods in a plant-based diet can substantially increase nutrient adequacy. It is therefore recommended that infants and young children and pregnant and lactating women are fed animal-source foods every day.

In Bangladesh, fish is by far the most commonly consumed animal-source food, though the amounts consumed by the poor are low. Small indigenous fish are particularly nutritious as they are eaten whole, with head, bones and viscera, and provide a rich source of animal protein, iron, zinc, calcium and vitamin A.

Although fish is generally considered by mothers and caregivers as a healthy food, good for growth, and is available in the household, fish is often introduced to the child only after 9 months of age, as it is not perceived to be suitable for infants due to the bones [4] and when it is introduced, the frequency and amount consumed are low. Hence, there is a great potential for increased fish consumption and thereby increased nutrient intake in the complementary feeding period, if barriers to introduction of fish are overcome.

Fish-based products

Using locally available dried small fish, WorldFish has developed three fish-based products for improving nutrition in the 1,000 day critical window of opportunity: a fish chutney for pregnant and lactating women; a fish-based CF product for infants and young children, particularly suitable for the initiation of complementary feeding; and a dried fish powder to be added to family foods to increase their nutrient density, and thereby render them more appropriate for the complementary feeding period.

The fish chutney for women is made with dried small fish, onion, garlic, chili and oil and should be used as a condiment consumed with daily meals. Dried small fish is



a rich source of animal protein, fish is a rich source of animal protein, iron, calcium and zinc. Oil increases the energy density of the product and provides essential fats. Onion provides flavour and texture, and garlic and chili enhance the taste of the product. Adding one spoon of the fish chutney to a meal is equivalent to eating 60 g of raw fish. The acceptability of the fish chutney eaten with rice was tested in women and found to be well-liked.

The fish-based CF is based on the traditional rice porridge with additional locally available nutrient-rich ingredients. *Darkina*, a small indigenous fish, is a rich source of iron, calcium and zinc. Orange sweet potato is a rich source of vitamin A and improves product acceptability due to its sweet flavour and pleasing colour. Soybean oil increases energy density of the product and provides essential fats. In the home, the pre-mixed product is mixed with clean water and boiled for approximately 10 minutes to make a porridge. The daily recommended ration for infants, 6-11 months, is one serve (30 g) and for young children, aged 12-23 months, two serves (60 g). This ration is specifically designed as a supplement to the diet and to be given in addition to continued breastfeeding and family foods. The following criteria were used to guide product development: a high content of micronutrients, high energy density, inclusion of an animal-source food, low content of anti-nutritional factors, cultural acceptability, acceptable taste and texture, easy to prepare, affordable, accessible and hygienically safe.

Fish powder is a concentrated source of fish, with onion and garlic added to enhance taste. Preparation involves frying dried fish, garlic and onion in oil then grinding into a fine powder. In the home, fish powder can easily be added to family foods such as rice, *khichuri*, *dhal* and vegetable curry. Addition of fish powder enhances the nutritional value of family foods in two ways: firstly by increasing fish intake and thereby nutrient intake; and secondly, the inclusion of fish increases the availability of other nutrients in the meal. The acceptability of fish powder added to *khichuri*, was tested and was found to be well-liked by children and their mothers. In addition, the ease of use and minimal time for preparation had great appeal to the mothers.

References

- [1] National Institute of Population, Research and Training (NIPORT), Mitra and Associates, ICF International. Bangladesh Demographic and Health Survey 2011. Dhaka, Bangladesh and Calverton, Maryland, USA; 2011.
- [2] Arsenault JE, Yakes EA, Islam MM, et al. (2012) Very low adequacy of micronutrient intakes by young children and women in rural Bangladesh is primarily explained by low food intake and limited diversity. *J Nutr* 143:197–203.
- [3] Ahmed A, Ahmad K, Chou V, et al. (2013) The status of food security in the Feed the Future Zone and other regions of Bangladesh: Results from the 2011-2012 Bangladesh integrated household survey. IFPRI.
- [4] Rasheed S, Haider R, Hassan N, et al. (2011) Why does nutrition deteriorate rapidly among children under 2 years of age?. *Food Nutr Bull* 32:192–200.

Link to presentation: <http://www.slideshare.net/worldfishcenter/fishbased-products-to-improve-nutrition-in-the-first-1000-days-of-life-by-a-hother-m-saha-and-j-bogard>

Dried fish production, consumption and trade in Bangladesh

Ben Belton¹, Mostafa A R Hossain², Md. Mofizur Rahman¹, Shakuntala Haraksingh Thilsted¹

¹WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh

²Bangladesh Agricultural University

E-mail: B.Belton@cgiar.org



Introduction

Dried fish (*shutki*) and fermented fish (*chapa* or *shidol*) are among the most frequently consumed types of fish in Chittagong, Sylhet, Mymensingh and Rangpur divisions of Bangladesh, where annual consumption per capita averages close to 1 kg. On average, 4 kg of fresh fish are used to produce 1 kg of dried fish so, when wet weight equivalent is considered, dried fish makes an important contribution to total fish consumption in these areas. Dried fish products are particularly important for poorer consumers because, unlike large fresh fish, they are easily divisible and can be purchased in very small quantities (e.g. 25-100 g), at a low nominal cost per individual portion. *Shutki* or *shidol* is usually cooked with oil, spices and vegetables and served as a nutritious side dish. Despite its

importance, little is known about the conditions under which dried fish is produced and marketed in Bangladesh. In order to try to understand these better, WorldFish and Bangladesh Agricultural University have begun a programme of market value chain research aimed at documenting all stages of dried marine and freshwater production, consumption and trade in Bangladesh. Some initial findings are presented below.

Sectoral overview:

Marine drying sites are found all along the Bay of Bengal coastline. Some of the largest concentrations are found in Dublarchar (Khulna) and Nazirartek (Cox's Bazar). Large freshwater drying operations are found in Lalpur (Bhramanbaria) and Kuliarchar (Krishoreganj). Smaller scattered operations are found throughout Sunamganj and the *haor* basin, as well as in Faridpur and around Chalan Beel and Kaptai Lake. The timing and duration of the fish drying season varies from place to place, but the most drying takes place between the late monsoon (September) and end of the dry season (April). Typically, high market value fish are sold fresh, while lower market value or quality fish are dried. We estimate that dried marine fish accounts for roughly 85% of total dried fish production. Volume wise, *loitya* (*Harpadon nehereus*), *chhuri* (*Eupleurogrammus muticus*) and *phaisa* (*Setipinna spp.*) are among the most important marine species dried, but almost all marine fishes are dried to some extent. It is probable that the majority of marine fish landed in Bangladesh are dried. A wide variety of freshwater fishes are also dried. *Puti* (*Puntius spp.*) accounts for as much as 75% of production of dried small freshwater fish. Most dried *puti* is used to produce *chapa/shidol*. This is popular with consumers in Sylhet and Dhaka divisions, but is not traditionally eaten elsewhere in the country. We estimate that fermented products may account for as much as 20% of all dried fish consumed.

Labour: Owners of fish drying operations attempt to minimize labour costs and reduce cash outlays. This is achieved by recruiting labourers with few alternative opportunities, and offering payment in kind wherever possible. As a result, in most inland areas and much of the Cox's Bazar coastal belt, approximately 80% of the workforce in fish drying is comprised of women and young children. On the remote island of Dublarchar, workers are exclusively male, but a significant proportion work under conditions of bonded or forced labour. In Cox's Bazar, many workers are unregistered Rohingya refugees. All these groups receive wages which are lower than those of adult men in the open labour market. Many women receive part or all of their payment in the form of fish processing by products or fresh fish. For instance, women employed in processing *puti* receive only the guts, which they boil to produce oil which is subsequently sold. The numbers of people employed throughout the dried fish market value chain are cumulatively high, totaling in the tens of thousands.



Trade: A substantial undocumented trans-continental trade in dried fish exists. India and Myanmar are the two main countries of imports, but some dried marine fish is imported from as far away as Pakistan and the Persian Gulf. It is probable that at least 20% of all the dried fish consumed in Bangladesh is imported. Bangladesh also exports dried *puti* to north-east India, where it is used to produce *shidol*. High market value freshwater fish and *shidol* are shipped from Sylhet to the U.K., and dried marine fish is exported to the Middle East, Malaysia and other countries for consumption by non-resident Bangladeshis and migrant workers.

Contaminants: The use of pesticides appears to be widespread, during both drying and storage. Pesticide application during drying is most common with large fish when high levels of atmospheric moisture slow down the drying process.

Pesticides are also applied to dried fish while stored by traders. Pesticides used during drying prevent fly eggs from hatching, while chemicals are applied during storage to control infestation by weevil and other insects. The effects of exposure to these substances

on fish workers and regular consumers of dried fish are unknown.

Fish feeds: Small crabs and other marine invertebrates, fish which are considered unfit for human consumption and food fish which has become spoiled, are dried and used as ingredients in fish and poultry feeds. This represents a significant portion of marine landings. Utilization of these organisms in animal feeds does not compete directly with their utilization as human food at present, but fishing practices used to capture them (mainly estuarine set bag nets with small mesh sizes) appear unsustainable.

Conclusion: Dried and fermented fish is a particularly important food for poor consumers, and its production provides a livelihood or source of income for large numbers of poor women and men with few alternative options. Further research is needed to better understand the production and consumption of dried fish and to support policies and interventions which can help to sustain the sector's important role with respect to livelihoods and food security, and to improve working conditions and food safety.

Link to presentation: <http://www.slideshare.net/worldfishcenter/III-belton-b-mostafa-h-dried-fish-production-consumption-and-trade>

III. Workshop Day II

a. Global Overview

Theme: Nutrition-sensitive Aquaculture/Agriculture for Improved Food and Nutrition Security

Global Overview: Shakuntala Haraksingh Thilsted, Senior Nutrition Scientist
WorldFish, Bangladesh and South Asia Office, Dhaka, Bangladesh
E-mail: S.Thilsted@cgiar.org

The overview is based on the following material which has been sent to all participants in preparation for the country presentations, group work and plenary discussions on nutrition-sensitive fisheries and nutrition-sensitive aquaculture:

FAO (2013) Synthesis of guiding principles on agriculture programming for nutrition.
<http://www.fao.org/docrep/017/aq194e/aq194e.pdf>

Presentations from Agriculture and Nutrition Global Learning and Evidence Exchange (AgN-GLEE), held in Bangkok, Thailand, 19th - 21st March 2013:
Herforth A., Harris J. (2013) From agriculture to nutrition: Pathways and principles.
<http://www.spring-nutrition.org/sites/default/files/1.6-Jody.Harris.pdf>

Thilsted S. H. (2013) Aquaculture - nutrition linkages in FTF Aqua, Bangladesh: A case study.
<http://www.slideshare.net/worldfishcenter/agriculture-and-nutrition-global-learning-and-evidence-exchange-agnglee-asia>

Link to presentations: <http://www.slideshare.net/worldfishcenter/pathways-and-principles-by-sh-thilsted>

b. Country Summaries

Bangladesh

Country overview on the importance of fish for nutrition and the current activities in fisheries and pond polyculture

Mrityunjay Kunda¹, Sarah Castine² and Shakuntala Haraksingh Thilsted²

¹Dept. of Aquatic Resource Management, Faculty of Fisheries, Sylhet Agricultural University, Tillagor, Sylhet 3100

²WorldFish

E-mail: kunda.sau@gmail.com

Bangladesh is blessed with abundant fishery resources and a climate conducive to aquaculture. It has 0.774 million hectares of inland closed water area, 3.925 million hectares of inland open waterbodies and 2.71 million hectares of marine water area. There are 260 fresh waterfish species, 24 prawn species, 475 marine fish species and 36 species of shrimp found in Bangladesh. Moreover, 12 exotic fish species have been introduced in this country in different times. Fisheries sector plays an important role in the economy of Bangladesh. In the year 2011-2012 fisheries sector contributes 2.76% export earning, 4.39% in GDP and 22.76% in Agricultural GDP. Average increment of fish production for last ten years is 5.61%. Total estimated fish production in 2011-12 was 3.262 million Mt in which culture fisheries contributed 53%, inland open water catch 29% and marine catch 18%. Around 11% of the total population directly or indirectly dependent on fisheries sector.

Fish is the major source of animal protein in the national diet which contributes 60% of the total protein intake. Yearly average fish intake per person is 18.94 kg, whereas early requirement of fish per person is 20.44 kg. Aquaculture production is subsiding to meet up growing demand of fish through its tremendous development in culture system. A considerable amount of total fish production comes from small indigenous species (SIS) and that are mainly capture fishery. Most of the SIS is nutrient rich with high content of vitamins and minerals. More than 50 small indigenous species plays an important role in the national diet which may be brought under culture and management and 7 of them are already taken into consideration for pond poly culture or mono culture. *Mola* (*Amblypharyngodon mola*), *dhela* (*Osteobrama cotio cotio*), *darkina* (*Esomus danricus*), *puti* (*Puntius sp*), and *chela* (*Chela sp*) are more nutrient-rich than other small fish.

In recent years, introduction of SIS in the pond polyculture has drawn attention to the fish farmer. Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI), WorldFish and some other NGOs also paid attention for the development of culture system and dissemination of SIS through aquaculture both closed and open water. The initiative has been started through carrying out research on SIS and its potential to aquaculture from Faculty of Fisheries, Bangladesh Agricultural University (BAU), Mymensingh, Bangladesh during 1992, in collaboration with University of Copenhagen, Denmark. A lot of research has been done in BAU both on station and on farm research and developed carp-SIS polyculture technology. Simultaneously, Department of Fisheries also initiated a dissemination programme on SIS in different regions of Bangladesh. Afterward, BFRI, WorldFish and some other universities have taken initiatives to carry out research and dissemination programme.

Intervention of SIS especially *mola* in the floodplain has been initiated by WorldFish during 2011-2012 in the North-eastern region of Bangladesh. Stocking of micro-nutrient rich small fish (*mola*) in ditches during the dry season and enforcing regulation on harvesting of brood fish and small fry during breeding season showed rapid increase in production of both *mola* and other small fish from the floodplain. Before intervention of the project there were no *mola* in that floodplain, in the 1st year 5% of the total catch were *mola* and in the 2nd year of intervention 15% of the total catch came from *mola*. This has the potential to significantly contribute to household nutrition provided that those who need it most are the end consumers. Direct involvement of community based organization was paramount in ensuring the intervention was successful. Now SIS enhancement program is going on in Mymensingh, Rajshahi, Gaibandha and Sunamganj districts.

Aquaculture production in Bangladesh has seen a tremendous growth in recent years and is placed 5th in world aquaculture production ranking. Average aquaculture production is 2.23 mt/ha, but pond production is far ahead with 3.62 mt/ha. There are many polyculture packages being practiced in the country as extensive, improved extensive, semi-intensive and intensive culture systems. The species are commonly used in the pond aquaculture are *Rohu* (*Labeo rohita*), *Catla* (*Catla catla*), *Mrigal* (*Cirrhinus cirrhosus*), *Silver carp* (*Hypophthalmichthys molitrix*), *Silver barb* (*Puntius gonionotus*), *Carpio* (*Cyprinus carpio*), *Bata* (*Labeo bata*), *Reba* (*Cirrhinus reba*), *Bighead carp* (*Hypophthalmichthys nobilis*), *Grass carp* (*Ctenopharyngodon idella*), *Black carp* (*Mylopharyngodon sp*), *Pangus* (*Pangasius sutchi*), *Tilapia* (*Oreochromis niloticus*), *Koi* (*Anabas testudinus*), *Shing* (*Heteropneustes fossilis*) and *Magur* (*Clarias batrachus*). Presently, nutrient-rich small fish are a new addition in pond polyculture systems.

Bangladesh has made considerable progress in developing the aquaculture sector; however, it is also essential to conserve the natural biodiversity, use wetlands and floodplains to enhance fish production and promote integrated rice-fish culture system.

Link to presentation: <http://www.slideshare.net/worldfishcenter/country-overview-on-the-importance-of-fish-for-nutrition-and-the-current-activities-in-fisheries-and-aquaculture>

Cambodia

Country overview on the importance of fish for nutrition and the current activities in fisheries and pond polyculture in Cambodia

Chin Da¹, Lak Sophat², Ly Sokhoing², Hou Kroeun² and Aminuzzaman Talukder²

¹Fisheries Administration, Ministry of Agriculture, Forestry and Fisheries, Cambodia

²Helen Keller International, Cambodia

E-mail: chinda77@yahoo.com

Cambodia has made remarkable improvements in food security over the past decade. However, food insecurity at the household level in Cambodia remains high. The diet, which consists mainly of rice, provides sufficient energy but lacks protein and micronutrients. Stunting in children less than five years is among the highest in the region at 40% (CDHS 2010). Chronic malnutrition and anemia are high among women of reproductive age, at 20% and 40%, respectively (CDHS 2010). Fish is a vital component of the Cambodian diet. It plays a major role not only in the diet, but also in the economy of the Cambodian people. Traditionally, food security in Cambodia has two dimensions: rice and fish, with fish being a central aspect of rural livelihood strategies. More than 80% of the total animal protein in our diet is estimated to come from fish and other aquatic animals (Hortle, 2007). Cambodians are among the highest consumers of freshwater fish in the world, with annual per capita fish consumption estimated at 52.4 kg (Hortle, 2007).

Unfortunately, capture fisheries are declining due to high demand and environmental shocks. Promotion of aquaculture is a potential solution. The Cambodian Government has recognized the importance of aquaculture and has called for a fish pond for every poor family. Small and large fish can be raised together in family fish ponds as on-farm mixed pond aquaculture. Small fish are eaten whole and provide a rich source of protein and micronutrients. Large fish are consumed or sold for income generation. Incorporating mixed pond aquaculture into the 'one pond per farm' government strategy will improve household food security and nutrition.

To improve food security, nutrition, and livelihoods Helen Keller International (HKI), University of British Columbia (UBC), Fishery Administration (FiA), WorldFish and Organization to Development our Village (ODOV) have integrated household fishponds into existing homestead food production activities called "Fish on Farms" project.

The project seeks to increase the availability of micronutrient-rich foods through polyculture fish ponds thus improving household food security and nutrition outcomes, livelihoods and women's empowerment. It is a three-armed randomized control trial involving 960 households in Prey Veng province. The three treatment groups are HFP, HFP + aquaculture (polyculture fish pond), and a comparison group, and each contain about 330 households across 30 villages. Each village has one Village Model Farm (VMF) and ten household farms; the VMF serves as a site for training and demonstrations on aquaculture and horticulture techniques, and provides technical support. VMFs are also a local source for agricultural and technical inputs, including high quality, affordable seeds and small fish fingerlings. Essential nutrition actions (ENA) and behavior change communication (BCC) for nutrition is an important component of the Fish on Farms project. It is necessary for ensuring that increased food production and availability translate to an increase in consumption of nutritious foods among household members, particularly women and children. Participating mothers, fathers, and/or primary caretakers attend sessions that are organized by volunteers trained by HKI, and local partners. These interactive, participatory sessions touch on all the ENA, including nutrition during pregnancy and lactation, and the optimal feeding of infants and young children. In addition, training on gender issues, and on marketing HFP and aquaculture products has also been provided to beneficiaries to improve livelihood and gender status.

Based on findings from project records, the household fishponds have been very productive. The quantity of small and large fish produced by women farmers has increased over the course of the project. Since the beginning of the study, the median amount of small fish increased from 0.75 kg to 3 kg per month with all of this being consumed at the household level. Large fish harvested increased from 1.5 kg to 10 kg with half being consumed by the household and the remainder being sold for income. The fish ponds not only provide families with food for consumption, but also a source of income. Income generated by participating households through the sale of small and large fish increased throughout the project. At the beginning, households generated only 12,000 riel (US\$ 3) a month from fishponds but 12 months into the project that number increased to 42,000 riel (\$US 10.5). In general income from fish sales is being used to buy food (60%; meat, oil, eggs), agricultural inputs (20%; seeds, fertilizer) and for children's education (20%).

The Fish on Farms project seeks to build confidence in women's decision making through gender training and counseling and through greater income generation, and increase the decision is making influence of women. Women appear to be gaining more decision making influence. At the beginning, only 25% of the women reported that they had any money of their own that they could decide how to use without their husbands' permission. After 12 months later, 75% of the women reported having money they could spend at their discretion.

The project will have final evaluation results in August 2014. We plan to disseminate results and lessons learned from this project with all stakeholders.

Link to presentation: <http://www.slideshare.net/worldfishcenter/cambodia-overview-of-fish-on-farms-project-by-chin-da-fia-and-lek-sophat>

India

Country overview on small indigenous freshwater fishes of India

B. Vishnu Bhat
Fisheries Development Commissioner
Ministry of Agriculture
Government of India
E-mail: bhatbvishnu@gmail.com

Background

Almost half of India's children below 5 years of age are chronically malnourished (NFHS, 2005). Along with Bangladesh, such malnutrition prevalence among Indian children is almost constant in compared to China and Bhutan (World Bank). Equally, prevalence of anaemia among women from rural and urban is high and indifferent (Bansod and Pedgaonkar, 2014). States with the highest levels of food security in the form of carbohydrate and protein (e.g. Madhya Pradesh and Andhra Pradesh) are still recording severe anaemia among small children (NFHS, 2005). India's food policies at large target carbohydrate and protein demands of its population, rather than addressing micronutrient supplement as a core issue of infant mortality and premature death in adults. The most prevalent micronutrient deficient health problems in India are iron deficiency (anaemia), vitamin deficiency diseases, stunted growth, and wasting. Among all developing countries from South East Asia, these health problems and some others in India have resulted 53% death annually (Ray, 2011). What is more, India has rich micronutrient resources, including crops and animals, which can, if sustainably assessed, reverse the overall health scenario. Of these, the fishery sector has direct and massive impact on the livelihood, health and social well-being of populations throughout the country. India is second in overall and freshwater fish production in the world. The following outline briefly outlines how the fishery sector helps social re-building in India.

Fish and fishery - Indian scenario

- Fisheries sector occupies a very important place in the socio-economic development of the country. It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries, and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the source of livelihood for a large section of economically backward population of the country.
- Indian fisheries are increasingly contributing to the nutritional and livelihood security of the country. The present production is estimated at 9.00 million tonnes and is expected to increase to 15 million tonnes by 2015.
- India is known for its inland fishery resources and has very rich indigenous fishery resources with great biodiversity. The poor inland fishers and rural community depend for their livelihood and food security on these indigenous species.
- India is one of the 17 mega-biodiversity hotspots in the world.
- In India 2,319 species of fin fish have been recorded as per the database developed by NBFGR of which 838 from freshwater, 113 brackish water and 1,368 from marine environment.
- In India, out of native freshwater fish species documented by NBFGR, about 450 may be categorized as Small Indigenous Freshwater Fish Species (SIFFS). The maximum diversity of the SIFFS has been recorded from the North East region followed by Western Ghat and Central India.
- India has the largest number of endemic freshwater fin fish species, contributing 27.8% of the native fish fauna, followed by China, Indonesia and Myanmar. Of freshwater fish species, about 450 could be classified as SIFFS, as they do not grow beyond 30 cm in length.
- 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 north/eastern parts of India, adjoining areas of West Bengal to Bhutan and the Western Ghats are the biodiversity hotspots for SIFFS
- It is estimated in eastern and north-eastern states that SIFFS contribute about 15-20% 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.
- Though the Indian major carps and other exotic carps would have gone up in production and found its way to distant markets, the indigenous variety remained the income source of traditional fishers in the rural area mainly catering to subsistence, or local markets.
- National statistics, however, includes production of big fishes and usually fail to take into account the production and consumption patterns of these small species, as production and marketing take place at a very local level, carried out by family members.

Small freshwater fish species in Indian livelihood

- Fish is an important component of human diet. More than 50% of Indian population is fish eating and in some states like Assam and other North Eastern states, West Bengal, Odisha, Goa and Kerala, more than 90% of the population consume fish.
- Significant production of small indigenous fish species of freshwater origin, from culture and capture fisheries, is reported from several water bodies. These species tend to be sold and consumed locally and could be one of the reasons why they remain invisible in national statistics.
- 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 -1.6 t/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%. All major species reported to be rich sources of micronutrients are caught and consumed regularly by rural and semi urban populations. These species are *Puntius (puti)*, *Mola*, *Esomus*, *Channa* and *Colisa*. It is seen that the majority of SIFFS are caught indiscriminately, and in most cases before they are mature, which is a cause of concern.

- Besides the above major species, a large diversity of other indigenous species, are found in the water bodies that crisscross the Indian subcontinent. A significant number of these species are rich source of micronutrients 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 home-stead/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 (Das 2002).
- Before the introduction of hatchery-produced seeds, in the initial years of reservoir fisheries, water bodies were auto stocked with naturally available seeds. However, it has been observed that a variety of indigenous fish species were stocked, for example, in reservoirs of Tamil Nadu and Kerala. But, after the introduction of hatchery-produced carp seeds, there has been a shift in species composition 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.
- 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% of daily income comes from sale proceeds of SIFFS, as these species have high market value and are preferred by consumers. Indian local markets, especially in eastern and north eastern India also experience high consumer demand of small fishes at high price.
- 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.
- As a result of fish eating, in Kerala (at least five times a week, 35 g each time on an average), the incidence of low birth weight is less than half of that reported from rest of the Country and child health is far superior to that in the rest of the country. Similarly, in hilly north eastern States, the prevalence of anaemia is low in compared to rest of the country. West Bengal, though a major fish eating state, has 69-70% prevalence of anaemia, mostly because of selective food habits, especially the carps.
- Fish is particularly a good source of minerals like calcium, phosphorous, iron, copper and trace elements like selenium, and zinc. Besides salt water fishes contain high levels of iodine.
- Fish serves as a healthy food for the affluent populations owing to the fish oils which are rich in polyunsaturated fatty acids (PUFA), specifically omega 3, and at the same time, it is a health-food for the people in the other extreme of the nutritional scale owing to its proteins, oils, vitamins and minerals and the benefits associated with the consumption of small indigenous fishes.

Policies in action by the Government of India

- The Government of India is encouraging states for effective utilisation of natural resources for increasing fish production and productivity through special schemes like
 - (a) Establishment of National Fisheries Development Board to work towards a blue revolution with a focus on increasing the fish production of the country, to achieve doubling of exports and an additional direct employment to an extent of 3.5 million by extending assistance to various agencies for implementation of activities under Inland, Brackish water and Marine sectors. Further, NFDB is envisaged also to be a platform for public-private partnerships for fisheries and a mechanism for an end-end approach for ensuring efficiency in the process of fish production to consumption in the country.
 - (b) Development of reservoirs and cage culture under National Mission on Protein Supplement.
- Both the Central and the State Government have undertaken several policy initiatives and measures to boost the growth of fisheries sector in India.
- The Centrally Sponsored Schemes for development of fisheries Sector are:
 1. Scheme on Development of Inland Fisheries and Aquaculture - it is being implemented through the State Governments/ UT Administrations. Thus, the important components approved under the scheme are:-
 - ◆ Development of Freshwater Aquaculture
 - ◆ Development of Brackish water Aquaculture
 - ◆ Development of cold water Fisheries and Aquaculture in Hilly Regions
 - ◆ Development of Water-logged Areas into Aquaculture Estate
 - ◆ Productive Utilization of Inland Saline/Alkaline Soils for Aquaculture and Inland Capture Resources (reservoirs/rivers).
- At the State/UT level, the fisheries policies have also been framed, from time to time, for integrated development of fishing activities in the country. For example, State Reservoir Fishery Policy of Odisha; and Fishery Policy in Chhattisgarh.

Gaps in the knowledge and needs of concern

- Small freshwater fish species in India receives little attention in compared to organised carp based fishery. These fishes are caged as ornamental fish, rather than nutritious for human health. Identification of species with high food preferences and their intake frequencies among Indian families need to be assessed.
- Micronutrient profile (*calcium, iron, vitamin A*) with reference to Indian aquatic ecosystems in small freshwater fishes need to be analysed. Till now, only *Puntius sophore* from West Bengal has been evaluated for nutrient profile.
- Among traditional communities, indigenous knowledge about the health benefits of small fish 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. Further, methods of preparation of ethnic food with locally available small fish in these traditional communities add nutrient diversity for optimum health benefit from such fish. Such knowledge is, however, poorly documented.
- Most of the small fish species are endemic, and explore natural resources of the locality resulting huge difference in their micronutrient contents. India lacks such extensive resource guided nutrient profile databases for endemic small fish species. On the background of such studies, culture and grow out strategies of these fishes are to be developed, retaining nutrient quality and market preferences. At present, *A. mola* is being studied for its resource guided nutrient profile in Visva Bharati, West Bengal (Nandi and Saikia 2014).
- More studies on health diary in different states across the country on the line of Kerala-based study to strengthen the results on child health, low birth weight and their correlation with fish consumption.
- Small freshwater Fishery sector is still unorganised and voluntarily regulated fishery sector in India. Capacity building activities among fish farmers need urgent attention.

Link to presentation: <http://www.slideshare.net/worldfishcenter/india1-34372900>

Myanmar

Fisheries and finfish aquaculture in Myanmar

¹San Aung, ¹Nilar Shein, and ²Khin Maung Soe

¹Department of Fisheries, Myanmar

²MYFish National Project, Myanmar

E-mail: usanaung.usa@gmail.com

1. Rationale

In Myanmar, the fisheries sector plays a very important role in the state economy and also in the daily diet of Myanmar people: In 2010 per caput fish consumption was estimated to be between 21-39 kg/year in 2010 (FAO, 2010). Traditionally Myanmar people prefer freshwater to marine fish. Aquaculture started in 1953 with carp and tilapia: major carps with particular reference to *rohu*, *mrigal* and *catla* are native species to Myanmar, India, Pakistan and Bangladesh and they are dominant and target species in Myanmar aquaculture. According to the Department of Fisheries total fish pond area amount to 88068 hectares (Annual Statistic DoF, 2011-12) and over 95 percent corresponds to areas where those 3 carp species are grown in polyculture, *rohu* being the most preferred species and getting large volume of market in Bangladesh and Middle East countries. As aquaculture develops in Myanmar *rohu* (*Labeo rohita*) has become the most common species, mostly grown in commercial-sized ponds. In contrast, the small-scale operators are negligible. Marine/coastal aquaculture is still poorly developed in comparison to freshwater finfish culture. In 2011-12, the Department of Fisheries reported a fisheries production of 4.47 million tons (marine fishery 2.33 Mt; inland fishery 1.24 Mt; aquaculture 0.9 Mt). It is important to note that production data (DoF) does not take into account SSA production.

2. National policy on the fisheries sector

Government of the Union of Myanmar has laid down the national policy on fisheries sectors and they are:

1. To promote all-round development in the fisheries sector;
2. To increase fish production for domestic consumption and export surplus;
3. To encourage the expansion of marine and freshwater aquaculture;
4. To upgrade the socio-economic status of fishery communities.

The “Fisheries Development 30-years Plan of the Union of Myanmar” was formulated for the prospective of development of the fisheries sector from 2000-2001 till 2030-2031. The plan expects the increase of total fisheries production by the large expansion of the freshwater and marine aquaculture productions as well as from the capture fisheries so-called culture-based capture fisheries. Presently the Myanmar Government is now considering to expand paddy-cum fish integrated farming to enhance socio-economic situations of paddy farmers and rural people.

2. Current aquaculture

(A) Freshwater aquaculture: Currently over 20 species such as major and common carps, tilapia and striped catfishes are being cultured. *Rohu* (*Labeo rohita*), catfish (*Pangasius hypophthalmus*) and giant freshwater prawns (*Macrobrachium rosenbergii*) are the highest-value cultured species due to their popularity among domestic and foreign markets. Tilapia culture is also significantly growing in importance over the years but tilapia is now proliferating in many water bodies. Tilapia cage culture is being tested as well as mono-sex culture but proper brood stock management needs to take place. There are 27 freshwater fishery stations in all States and Regions conducting seed production and research works for freshwater aquaculture. Annual production of the fish seed in 2011-2012 has reached 750.37 million fingerlings whereas 39 private nurseries/hatcheries around Myanmar had produced an impressive amount of 3266.992 million fingerlings. Most farmers follow poly-culture system utilizing all available strata and natural food of pond water enriched with organic fertilizing and supplementary feeding. Farmers in the northern part of Myanmar, where local peoples traditionally prefer small sizes fish, usually stock their ponds with a high density of seeds 25,000 seeds/ha with an initial size (fingerling) of 2 to 5 cm. They usually grow out for 6 months and are harvested to a final size of about 20 to 25 cm. In the southern part of Myanmar, the stocking density is 5000 seeds/ha as the local peoples prefer larger size fishes. The sizes of seeds are bigger (over 20 cm) and cultured in ponds for one year until they reach their marketable size of 2 to 3 kg. Average productivity is around 12 tons/ha. Most of the aquaculture feeds are made up from locally available agricultural by-products such as rice bran, broken rice, oil cakes of groundnut, sesame, coconut and cotton seed. Rice bran and groundnut cakes are major ingredient of fish feed. Pellet forms are commonly used for giant fresh water prawn, catfish and tilapia culture.

(B) Marine aquaculture: Groupers, snapper and sea bass are found as the most common and popular species with high market value. Marine net cage farming is found to be lucrative despite the constraints of quality seed and technology requirement. In the development of marine finfish aquaculture, adequate seed supply is the main constraint: poor hatchery technology/ infrastructure. As a result, seeds are commonly being collected from the wild. However sea bass (*Lates calcarifer*) and grouper (*Epinephelus malabaricus*) seed production in pilot scale have been successful in 2004 and 2010 (Department of Fisheries). Attempts are made for Mud crab aquaculture in order to support booming industry as domestic consumption and export demand are growing rapidly. Soft-shell mud crab producing has become very popular as it commands high price. However, supply of crab

juveniles from nature is decreasing over years due to over exploitation, habitat deterioration caused by man impact and world climate change. Finally, grow-out culture of marine shrimp (*Penaeus monodon*) was initiated in the early 1980s practicing traditional trap and hold system particularly in western coastal area. In 2000, the State Level Committee (Shrimp Aquaculture Development Committee) formulated and implemented three years project plan of shrimp aquaculture development in Myanmar. As of 2011-2012, Myanmar accounted over 88667 hectares of shrimp ponds.

3. Constraints to the development of small scale aquaculture (SSA)

The Government has encouraged to expand the total fish pond area as well as to increase fish and fish seed production. The supports on aquaculture extension go to commercial aquaculture industries and/or big scale individual operators. There is no DoF extension service system for small scale fish farmers. As a result, there appear to be very few small (0.1 to 0.2 acres) fish pond operations. This is unusual relative to other countries of South East Asia, where small ponds are quite popular. In addition, the following issues and problems relating to SSA development have been identified:

- Difficult legal conversion of agriculture land (mostly rice) to fish ponds;
- Poor hatchery technologies/infrastructure (e.g. poor brood stock management);
- Lack of knowledge/interest in SSA;
- Farmers' organizations poorly developed;
- Lack of financial services for small-scale fish farming entrepreneurs;
- Lacking of basic knowledge on indigenous species for aquaculture.

Towards the sustainable development of the sector and in order to ensure the contribution of SSA to food security and quality nutrition for rural communities, the Government of Myanmar is willing to further explore the potential of SIS aquaculture, reason for which it is expected to learn a lot from other successful experiences in the region. Myanmar is actually blessed with substantial number of indigenous species (e.g. *mola fish*, *climbing perch*, *stingy catfish*. See list in Annex).

ANNEX. Some key aquaculture commodities in Myanmar

Common name	Scientific name	Indigenous/Exogenous
Rohu	<i>Labeo rohita</i>	Indigenous
Catla	<i>Catla catla</i>	Indigenous
Mrigal	<i>Cirrhinus mrigala</i>	Indigenous
Common carp	<i>Cyprinus carpio</i>	Exogenous
Grass carp	<i>Ctenopharyngodon idellus</i>	Exogenous
Silver carp	<i>Hypophthalmichthys molitrix</i>	Exogenous
Tilapia	<i>Oreochromis spp.</i>	Exogenous
Stripped catfish	<i>Pangasius hypothelmus</i>	Exogenous
Freshwater pomfret	<i>Piractus brachypomus</i>	Exogenous
Tarpian	<i>Puntius gonionotus</i>	Exogenous
Freshwater prawn	<i>Macrobrachium rosenbergii</i>	Indigenous
Marine shrimp	<i>Penaeus monodon</i>	Indigenous
Pacific white shrimp	<i>P. vannamei</i>	Exogenous
Seabass	<i>Lates calcarifer</i>	Indigenous
Grouper	<i>Epinephelus spp.</i>	Indigenous
Seaweed	<i>Eucaema cottonii</i>	Exogenous

Potential small indigenous species (SIS) for aquaculture

Common name	Scientific name	Local name
Catfish	<i>Clarias batrachus</i>	Nga Khu
Striped dwarf catfish	<i>Mystus spp.</i>	Nga Zin Yine
Carples	<i>Rohtee alfrediana</i>	Nga Phan Ma
Climbing perch	<i>Anabas testudeneus</i>	Nga Pyae Ma
Mola carp	<i>Amblypharyngodon mola</i>	Nga Be Phyu
Stinging catfish	<i>Heteropneustes fossilis</i>	Nga Kyee
Swamp barb (puntius)	<i>Puntius sophore</i>	Nga Khone Ma
Featherback	<i>Notopterus spp.</i>	Nga Phae
Butter catfish	<i>Ompok bimaculatus</i>	Nga Nu Than
Snakehead	<i>Channa spp.</i>	Nga Yant
Carples	<i>Amblypharyngodon atkinsoni</i>	Nga Pyat
Climbing perch	<i>Anabas testudineus</i>	Nga Pyay Ma
Freshwater garfish	<i>Xenentodon cancila</i>	Nga Phaung Yoe

References

- [1] Khin Maung Soe (2008): Trends of development of Myanmar fisheries: With references to Japanese experiences. Institute of Developing Economics. Japan International Trade Organization. V. R. F Series No. 433; Feb 2008
- [2] Khin Maung Soe (2010): Fisheries management and small-scale fishery in Wunbaik Reserve Forest. Report for the project "Sustainable Community-based Mangrove Management in Wunbaik Forest Reserve – FAO TCP/MYA/3204(D)" Yangon, Myanmar
- [3] FAO FishStat Plus, 2010
- [4] DOF, Myanmar, 2012: Fishery Statistics 2011-2012

Link to presentation:<http://www.slideshare.net/worldfishcenter/fishes-and-finish-aquaculture-in-myanmar-by-san-aung-nilar-shein-and-khin-maung-soe>

Nepal

Carp-SIS polyculture in Nepal: Present status and future prospects

Sunila Rai¹, Khop N. Shrestha²

¹Faculty of Animal Science, Veterinary Science and Fisheries, Agriculture and Forestry University, Rampur, Chitwan, Nepal

²Manohari Development Institute, Hetauda, Makwanpur, Nepal

E-mail: sunilarai@yahoo.com

Summary

Nepal is endowed with 218 native fish species (Shrestha, 2008). Among them, how many are small fish (SIS) is still unknown. *Dedhuwa* (*Esomus danricus*), *Faketa* (*Barilius sp.*), *Mara* (*Amblypharyngodon mola*) and *Pothi* (*Puntius sophore*) are common SIS in Terai. Micronutrient analysis done in 2010 revealed that *Mara* and *Dedhuwa* contains high vitamin A and iron, respectively (Table 1; Rai, 2011). Having known nutrient value of SIS, people are gradually becoming cautious on its availability and consumption.

Table 1. Vitamin A, iron and zinc content in four common SIS of Terai, Nepal

SIS	Vitamin A (RAE/100 g raw, clean parts)	Iron (mg/100 g raw, clean parts)	Zinc (mg/100 g raw, clean parts)
<i>Dedhuwa</i> (<i>Esomus danricus</i>)	107.5	6.2	4.5
<i>Faketa</i> (<i>Barilius sp.</i>)	84.5	1.0	3.6
<i>Mara</i> (<i>Amblypharyngodon mola</i>)	685.5	2.4	4.3
<i>Pothi</i> (<i>Puntius sophore</i>)	56.0	3.1	4.2
Carp			
Mrigal (<i>Cirrhinus cirrhosus</i>)*	< 30	2.5	-
Silver carp (<i>Hypophthalmichthys molitrix</i>)*	< 30	4.4	-

* Roos et al. (2007)

Proper culture of SIS (*Dedhuwa*, *Mara* and *Pothi*) with carp (*Rohu*: *Labeo rohita*, *Silver carp*: *Hypophthalmichthys molitrix*, *Bighead carp*: *Aristichthys nobilis*, *Mrigal*: *Cirrhinus mrigala*) and freshwater prawn (*Macrobrachium rosenbergii*) began as an on farm trial in 126 farmers' ponds in two districts (Chitwan and Kailali) in 2009. The Purpose of the initiative was to improve nutrition of rural poor women and children and household income through increased intake of SIS and sale of surplus carp, respectively. Though farmers obtained good production and return from carp-SIS-prawn polyculture but they could not continue the same due to unavailability of prawn juveniles in the country. Based on lessons learned, carp-SIS polyculture was developed and introduced to farmers in 2011. Since then carp-SIS polyculture has been replicated by university (Institute of Agriculture and Animal Science, Agriculture and Forestry University) and NGOs (Rural Integrated Development Society, Manohari Development Institute and Centre for Environmental and Agricultural Policy Research, Extension and Development) in five districts (Chitwan, Kailali, Kapilvastu, Makawanpur and Nawalparasi). Present carp-SIS polyculture includes semi-intensive farming of six carps (*Rohu*, *Silver carp*, *Bighead carp*, *Mrigal*, *Common carp*: *Cyprinus carpio*, *Grass carp*: *Ctenopharyngodon idella*) and SIS (*Dedhuwa*, *Mara* and *Pothi*) with mostly dike integration (vegetables) in household ponds.

Carp-SIS polyculture benefitted farmers through increased fish production, household consumption and income. Total fish production increased to 5.6 t/ha/y where SIS contributed 6.5% (Rai, 2013). Fish consumption rate also increased by two and half folds (4.7 kg/caput/y) of national average (Directorate of Fisheries Development, 2013) contributing to improved nutrition level of family. Farmers earned income of Rs. 8353/100 m²/270 days which they utilized in household expenses. Since the technology is simple, cost effective and environmentally sustainable, it is appropriate for small scale farmers. Hence, there is a need to upscale this technology to other areas. Though carp-SIS polyculture with vegetables on dikes is effective to provide food and nutrients year round and improve household income but efforts are needed to enhance overall fish production to attract more farmers.

References

- Directorate of Fisheries Development. 2013. Annual Reports. Balazu, Kathmandu, Nepal.
- Rai, S. 2013. Project Completion Report: Twinning support to women fish farmers' organizations in Nepal. Institute of Agriculture and Animal Science, Chitwan, Nepal.
- Rai, S. 2012. Project Completion Report: Improvement of women's livelihoods, income and nutrition through Carp-SIS polyculture in Terai, Nepal. Institute of Agriculture and Animal Science, Chitwan, Nepal.
- Roos, N., M.A. Wahab, M.A.R. Hossain, and S.H. Thilsted. 2007. Linking human nutrition and fisheries: incorporating micro-nutrient dense, small indigenous fish species in carp polyculture in Bangladesh. Food and Nutrition Bulletin.
- Shrestha, T.K. 2008. Ichthyology of Nepal: A study of fishes of the Himalayan waters.

Links to presentations: <http://www.slideshare.net/worldfishcenter/effort-of-mdinepal-in-promoting-the-carpsis-polyculture-at-the-foot-hills>
and
<http://www.slideshare.net/worldfishcenter/nepal-rai-s>

Sri Lanka

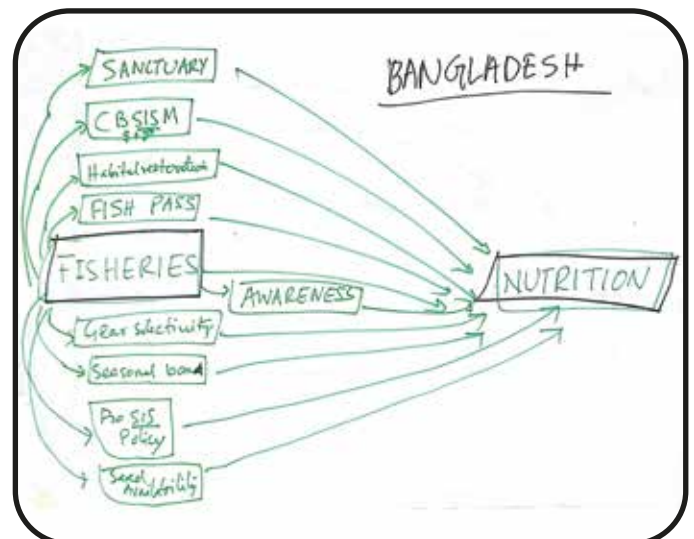
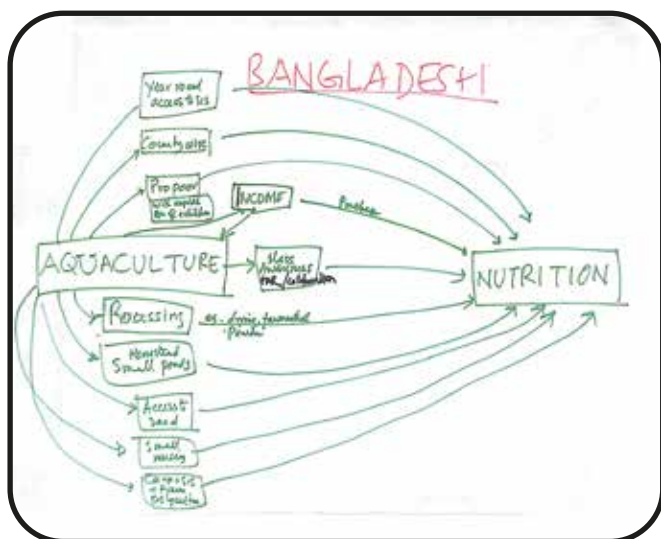
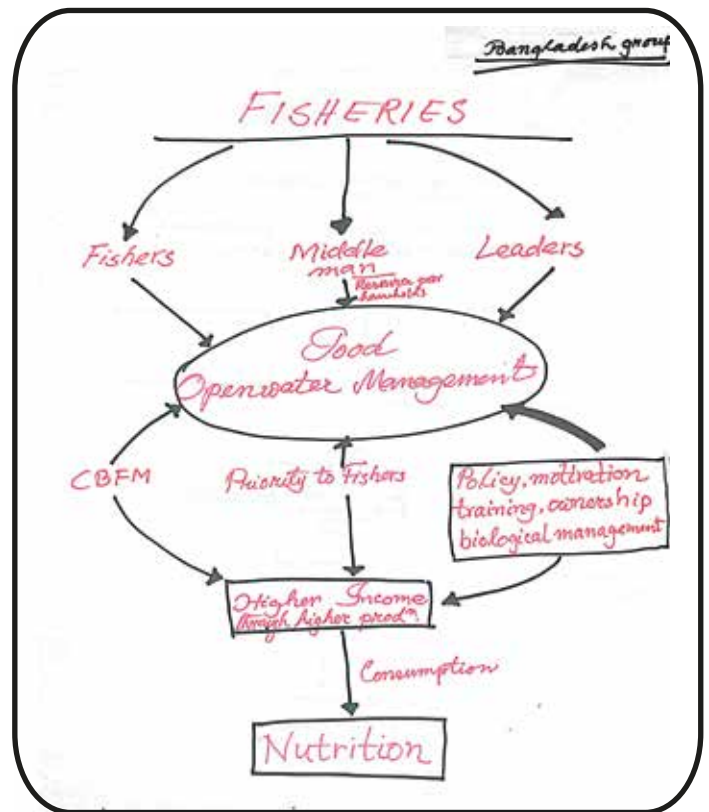
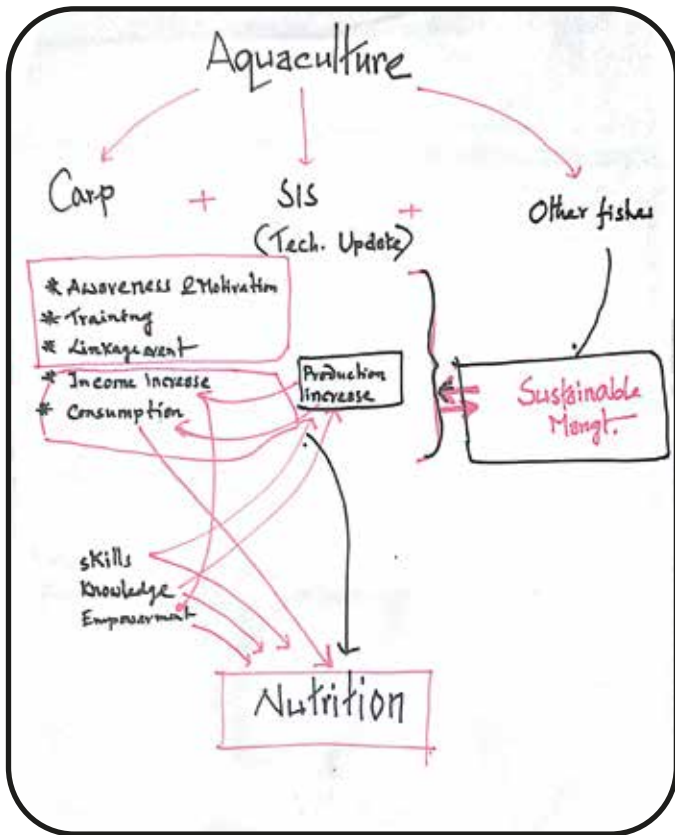
Potential for exploitation of small indigenous fish species in Sri Lankan reservoirs

Upali S. Amarasinghe
Department of Zoology, University of Kelaniya, Sri Lanka
E-mail: zoousa@kln.ac.lk

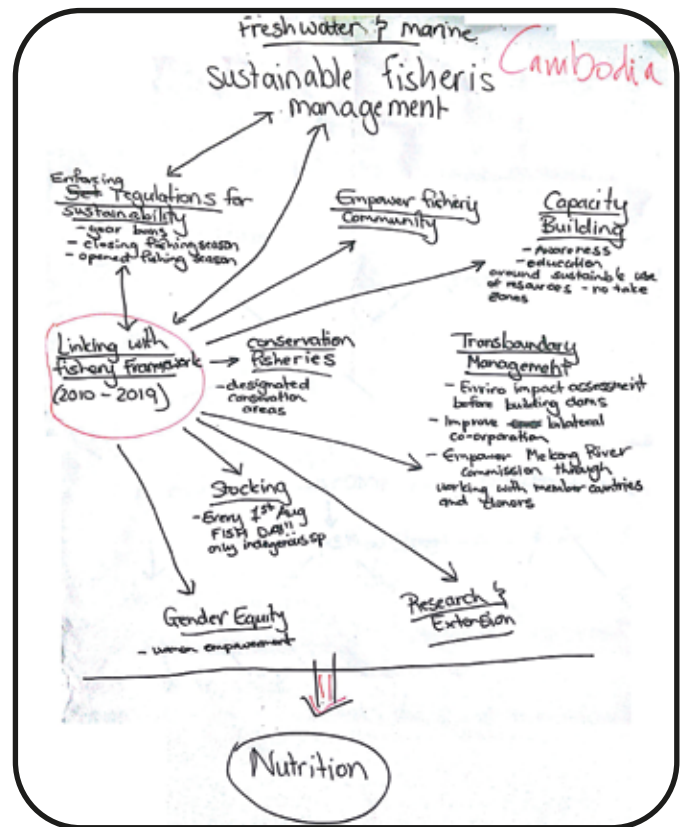
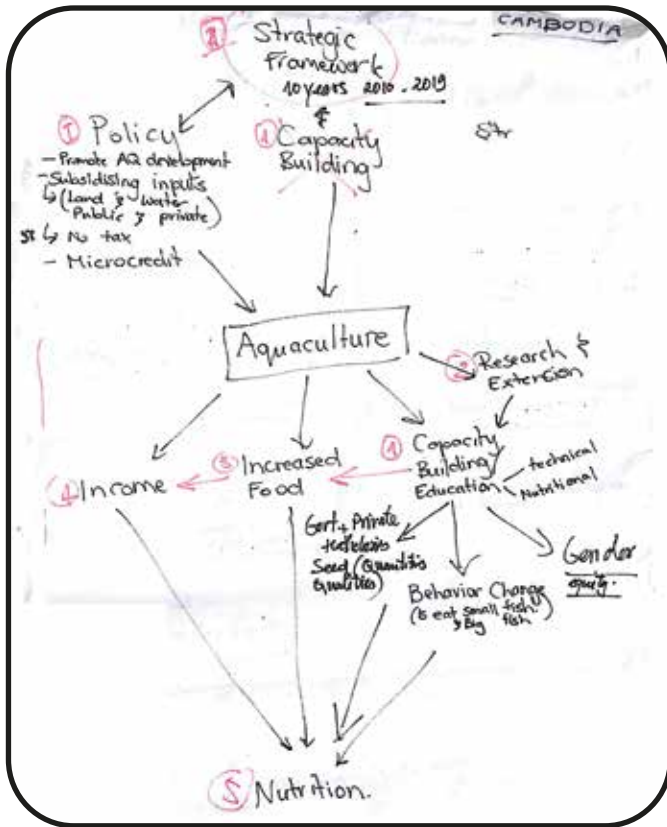
The reservoir fishery of Sri Lanka is highly productive and is mainly dependent on exotic cichlid species, *Oreochromis mossambicus* and *O. niloticus*. However, there are sizeable populations of minor cyprinids in these reservoirs, small sized with a short life cycle, which remain untapped due to low consumer preference and mesh restrictions of fishing gear imposed by the government. Research findings indicated that at least a 100% increase of inland fish production can be achieved if these untapped fishery resources are exploited. The recruitment of cichlids is not impacted upon as the young inhabit the littoral and sub-littoral areas, as opposed to the fully grown minor cyprinids that inhabit the open waters, as much as the adult exotic cichlids. Differential exploitation of minor cyprinids is possible using small mesh (15 mm to 37 mm) gillnets. In some reservoirs, minor cyprinids are exploited by fishers using small mesh (2.5 cm stretched mesh sizes) gillnets. About 10% of the catch is sold fresh and the rest is sundried and sold in bulk. The fishery potential of minor cyprinids in large and medium perennial reservoirs is about 22,000 t per year. Amendment of existing mesh regulations to permit selected fishers to use small mesh gillnets, and putting in place the appropriate management measures that would ensure sustainable exploitation are needed to introduce a commercial scale fishery for minor cyprinids, and these steps are being taken now.

c. Outcomes of Group Discussions: Diagrams on Nutrition-sensitive Fisheries and Aquaculture

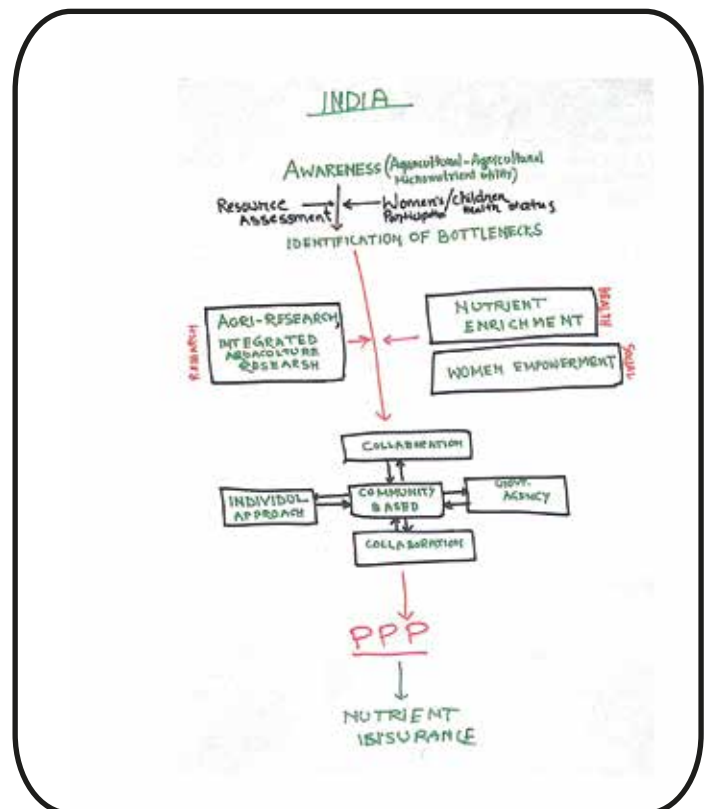
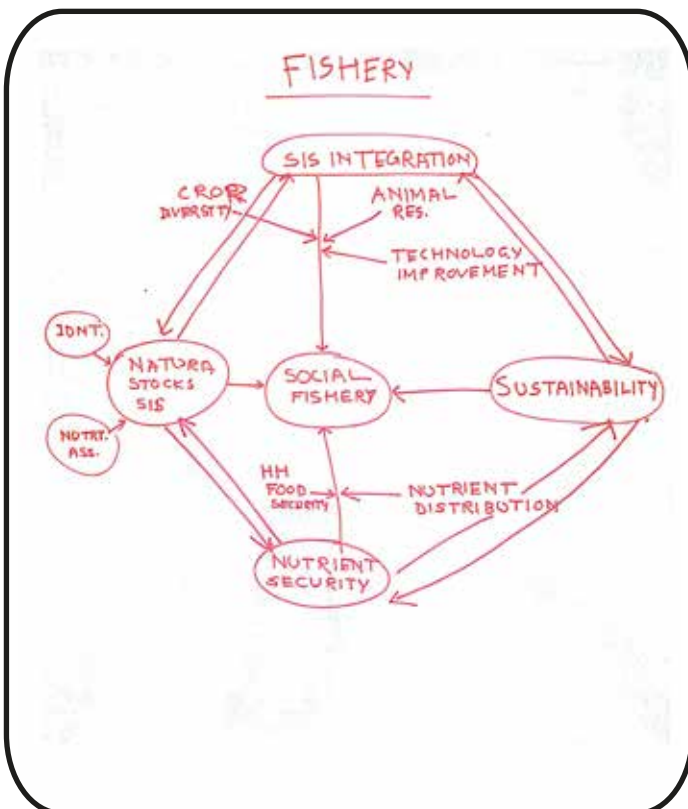
Bangladesh



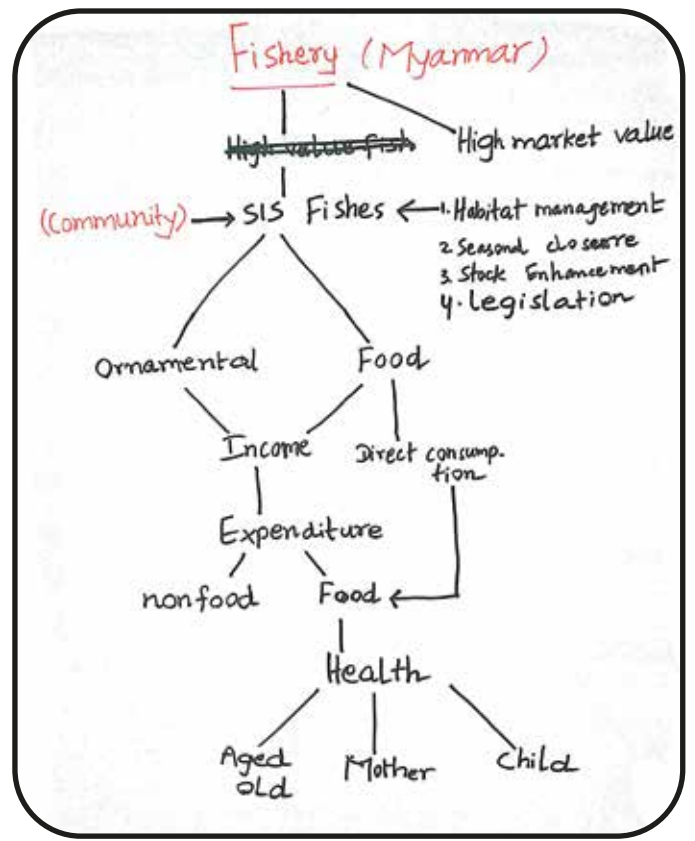
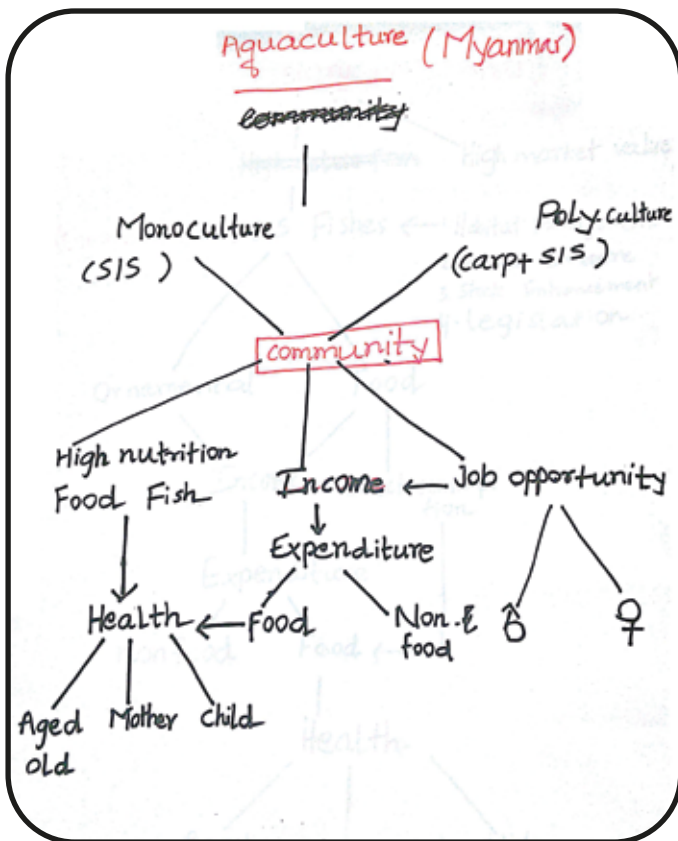
Cambodia



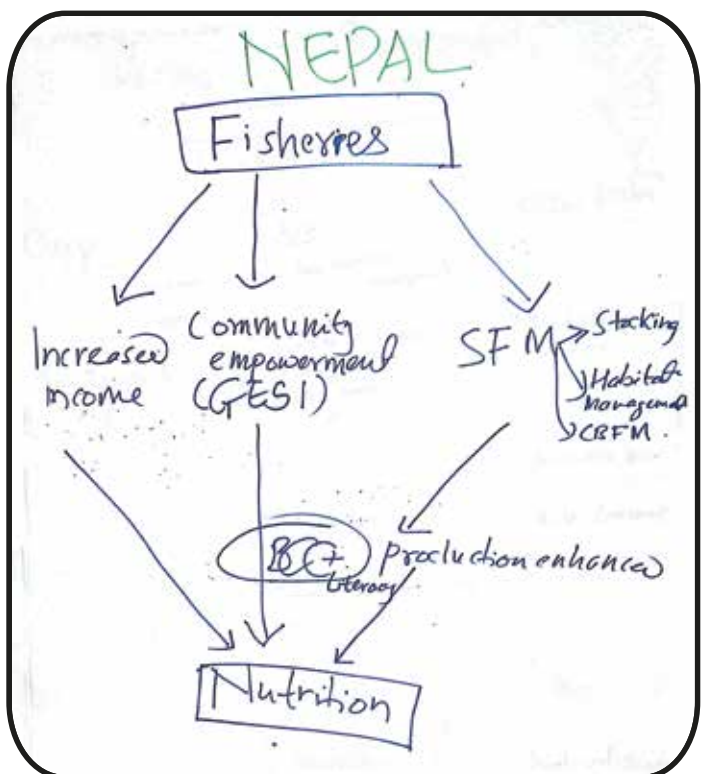
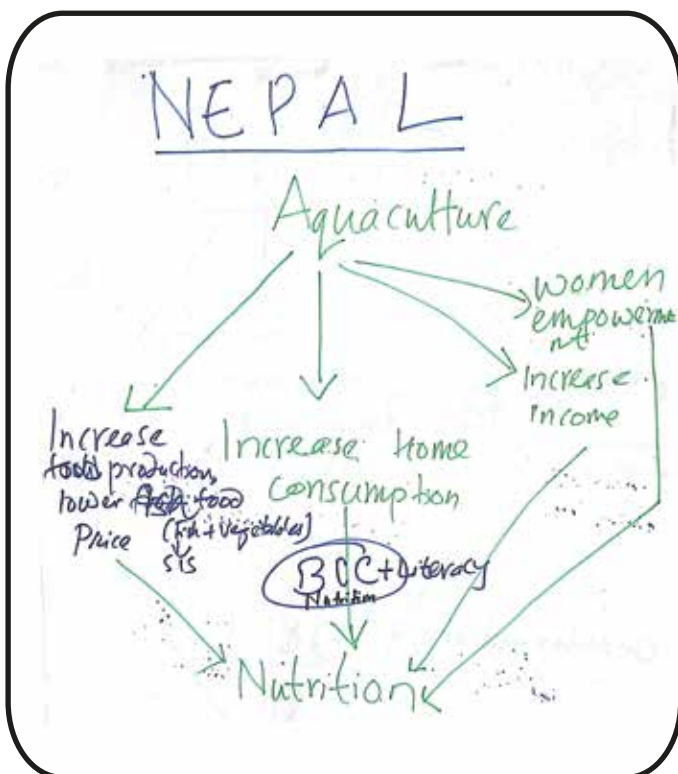
India



Myanmar



Nepal



IV. Conclusions and Recommendations

Fish is the most important animal-source food in Bangladesh and in many countries in the South and Southeast Asian region. Many countries in the region have a rich biodiversity of fish space, of which many are small and supply essential nutrients, especially to the poor. About 150 of the 260 freshwater fish species found in Bangladesh are considered as small indigenous fish species (SIS). Some SIS such as mola (*Amblypharyngodon mola*), dhela (*Osteobrama cotio cotio*), and darkina (*Esomus danricus*) are especially rich in vitamin A, zinc, iron and calcium. These SIS have been found to be suitable for both pond polyculture with carps and wetlands stock enhancement. Household pond polyculture is being promoted throughout rural Bangladesh, and has been introduced to the Sundarbans, West Bengal; Terai, Nepal and Cambodia.

At the workshop, three policy briefs: i) “Nourishing Bangladesh with micronutrient-rich small fish”; ii) “Increased production of small fish in wetlands combats micronutrient deficiencies in Bangladesh”; and iii) “Pond polyculture technologies combat micronutrient deficiencies and increase household income in Bangladesh”, two technology brochures, and a TV spot were launched.

Sixteen high level regional participants from Cambodia, India, Myanmar and Nepal participated in the workshop, together with policy makers, researchers and other stakeholders from Bangladesh. Dr. Shelina Afroza, Honourable Secretary, Ministry of Fisheries and Livestock and Mr. Ousmane Seck, Senior Rural Development Specialist, The World Bank, Dhaka Office graced the inaugural session of the workshop as the Chief Guest and Special Guest, respectively. Syed Arif Azad, Director General, Department of Fisheries presented the keynote paper, Dr. Craig A. Meisner, Country Director, WorldFish, South Asia chaired the inaugural session. A number of key relevant papers were presented in two technical sessions on day one. On day two, country status papers of all five countries were presented, and the participants carried out group work and held discussions on the theme “Aquaculture/fisheries - nutrition linkages and pathways”.

On day two of the workshop, the recommendations in the above-mentioned three policy briefs were discussed and endorsed by the participants. These recommendations are specific for relevant stakeholders in Bangladesh, in particular various ministries of the GoB to implement in order to strengthen awareness and advocacy of the role of fish in improving food and nutrition security, as well as the promotion of production technologies to increase availability, access and consumption of micronutrient-rich small fish. The regional participants all agreed to identify and influence the relevant channels in their respective countries to promote these recommendations.

In addition, the below recommendations, relevant for countries in South and Southeast Asia were given:

- Quantitative and qualitative assessment of SIS in relation to total fish production in all countries of the region should be undertaken;
- SIS should be analysed for composition of nutrients, including vitamins and minerals, in all countries in the South and Southeast Asian region;
- Robust cost benefit analyses of carp - SIS pond polyculture technologies should be carried out to accelerate scaling out;
- Value chains of SIS should be described and the social, economic and nutritional benefits evaluated;
- Increased awareness of the nutritional benefits of SIS should be carried out in all countries in the South and Southeast Asian region, using different media channels; and
- Regional initiatives should be developed and funding sought, in collaboration with international and regional partners (for example, international and regional financial institutions, relevant United Nations organisations, CGIAR centres) to share knowledge and lessons learnt on “Fish and Nutrition” between countries in the South and Southeast Asian region.

V. Field Visit Photos



Production of carps and small fish in pond connected to rice field, Nilphamari



Group discussion with households practising carp and small fish production in ponds connected with rice fields, Nilphamari



Fishermen demonstrating netting of fish in a shared household pond, Saidpur



Regional workshop participants observing freshly caught mola, Saidpur



Women showing freshly netted small fish, Saidpur



Group discussion on the success of carp-mola polyculture in household ponds, Saidpur



Displaying freshly caught *mola*, Shajahanpur



Signboard on collaboration with the Department of Fisheries on carp-*mola* pond poly culture, Shajahanpur



Symbolic release of small fish in a household pond, Shajahanpur



Regional guests and WorldFish staff at demonstration of carp-*mola* pond polyculture, Shajahanpur

Photo credit: Manos Kumar Saha

VI. Fish-based Products Demonstration

The demonstration of fish-based products at the workshop highlighted a fish powder, and fish chutney. The foods were set out in small bowls and made available to workshop participants as a follow up to the presentation titled: Fish-based products to improve nutrition in the first 1,000 days of life (Hother, A., Saha, M., & Bogard, J.). Participants were offered an optional questionnaire to provide feedback on the products. Questions included limited demographic information, a rating scale for the food, and a space for recommendations and comments.

Summaries of the responses on the fish-based products

Fish powder with khichuri

Of the 32 evaluations, most individuals who tasted the fish powder with khichuri liked it using words such as “nice”, “tasty”, and “good” to describe it. Thirty one individuals tasted this product, 18 of whom were male, 11 females, and two unspecified. There were zero “dislike a lot”, one “dislike”, two “neutral”, 12 “like”, and 16 “like a lot”. Thus, among those who tasted this product, most noted either liking it or liking it a lot. Few of the questionnaires had comments, but among those that did were suggestions based on personal taste preferences, as well as recommendations for future production and marketing. In regards to personal taste one mentioned using sea fish instead, and one mentioned the fish flavour was not strong enough; a few mentioned that it was good but could be made even better. Overall however comments tended to say the product was “nice” or “tasty” and did not mention a need for changes. Several comments noted that there needed to be increased marketing, and that this product needs to be made available commercially. Responses, as is evident were generally positive.

Fish chutney with rice

Fewer individuals tasted or commented on the fish chutney with rice. Thirteen individuals provided feedback; 6 males, five females, and two unspecified. The responses to this product were much more varied than those for the fish powder with khichuri. There were zero individuals that marked “dislike a lot”, one “dislike”, four “neutral”, four “like”, and four “like a lot”. Compared to the fish powder with khichuri questionnaire, there were fewer written comments; however the comments for the fish chutney with rice were mostly about taste. Three comments thought that the chutney was “too fishy” in “flavour”, recommending reducing or removing the strong fish flavour. Recipe change recommendations also included adding more lime, and including tomato. One response mentioned needing to make this product available in the market, and recommended establishing a value chain.

Recipes for fish products

Fish powder

Ingredients:

- 40 g dried fish
- 40 g chopped onion
- 10 g crushed garlic
- 10 g soybean oil

Final weight of cooked product = 75 g

Serve size = 10 g

Method:

1. Wash dried fish several times in water to clean. (Do not remove the eyes and head from the small fish during cleaning)
2. Keep the dried fish in a strainer to dry.
3. Pour oil in heated frying pan to warm it, add all the dried fish into the pan.
4. Stir continuously on a low flame for about 10-15 minutes until they become light brown.
5. Transfer the lightly fried dried fish to a bowl.
6. Warm oil in a frying pan and fry the onion and garlic together for 15 minutes on a low flame till they become brown, stirring continuously.
7. Cool the fried dry fish, onion and garlic.
8. Grind the fried dried fish on its own to make it a thick powder.
9. Grind the onion and garlic together to make a thick powder.
10. Combine the ground fried dried fish, onion and garlic and grind together to make a slightly coarse powder.
11. Let cool and keep the fish powder in an air tight plastic container.

Fish chutney

Ingredients

- 150 g shutki mach (dried fish)
- 150 g chopped onion
- 30 g fresh garlic
- 60 g soybean oil
- 1 heaped tablespoon red chili powder
- ½ teaspoon salt

Final weight of cooked product = 325 g

Serve size = 30 g

Method:

1. Rinse dried fish several times in water to clean.
2. Soak dried fish in water for 30 minutes to soften it before grinding.
3. Crush garlic into a paste.
4. Grind wet fish, using a little water to make into a lumpy paste.
5. Warm oil in a frying pan then fry onions for about 15 minutes until translucent.
6. Add ground fish and garlic paste to pan and fry.
7. Add salt and chili powder and about 100 ml of water and let simmer until most of the water is evaporated (about 20 minutes).
8. Let cool, then store in a plastic container.

Summary of fish-based products

Composition of fish powder

The fish powder can easily be made with locally available ingredients. The fish powder is a concentrated source of fish, with onion and garlic added for flavour in the product. Preparation includes frying the dried fish, garlic and onion in oil, and then grounding it into a fine powder.

This fish powder is made with dried small fish. For 100 g fish powder, the raw materials needed are 53 g dried fish, 53 g onion, 11 g garlic and 12 g soybean oil. The energy and nutrient composition of the fish powder per 100 g are: 317 kcal energy, 19 g protein, 22 g fat, 22 g iron, 4.5 g zinc and 1669 g calcium.

Consumption of fish powder

Fish powder could be added to different types of family foods. We encourage consumption of semi-solid foods after 6 months of age, for children. Fish powder can be added to foods such as: *khichuri*, dhal, green leafy vegetables, rice, mixed cooked vegetables, and noodles.

It can easily be added to food after it is cooked; the minimal preparation time and easy addition of the powder to foods are helpful to mothers.

Benefits of fish powder

Addition of fish powder to family foods will increase their nutrient density, and thereby make them more appropriate for the complementary feeding period.

Addition of fish powder enhances the nutritional value of family foods in two ways:

Firstly, by increasing fish intake (animal protein intake) and thereby increasing intake of nutrients such as calcium, iron, zinc, and essential fatty acids proper growth and brain development in children are enabled. The fish powder is also rich in phosphorus and potassium.

Secondly, the inclusion of fish in the diets of the target group increases the bioavailability of other nutrients in the meal. Fish helps the body to absorb the nutrients found from other foods in meal.

Composition of fish chutney

Fish chutney, like the fish powder, makes use of locally available ingredients to create a nutrient rich supplement for pregnant and lactating women. The fish chutney, like the fish powder, is designed as a supplement to daily meals to increase nutrient intake.

Fish chutney consists of dried small fish (37%), oil (15%), onion (37%), garlic (7%), and red chili (4%). Each of these ingredients adds to the nutrient composition and acceptability of the product. Nutrients acquired from the fish include protein, iron, zinc, and calcium; other ingredients add texture and flavour, and energy density.

Consumption of fish chutney

As a supplement, the recommendation for fish chutney is that it be consumed in addition to a standard meal. The current recommendation is to eat one heaped tablespoon of chutney which is equivalent to about 60 g of raw fish.

Benefits of fish chutney

Consumption of fish chutney as a supplement to a meal will increase pregnant and lactating women's (the recommended target group) nutrient intake.

The fish in the chutney provides an animal-source protein, as well as other nutrients such as iron, zinc, and calcium. The fish in the chutney will also increase the bioavailability of nutrients present in the other foods being consumed. This may vary depending on what foods are being used in daily meals.

The fish chutney is designed for pregnant and lactating women to ensure that they are getting enough nutrients to increase their nutrition, but also the nutrition of their children to encourage proper growth and development.



VII. Appendix I
a. Workshop Programme

Workshop Programme

Dates: 1st & 2nd March 2014

Venue: Hotel Sarina, Banani, Dhaka

Day 1 (1st March 2014)

- 09:00 Registration begins
- 09:30 Welcome address and goals of the workshop
Dr. Shakuntala Haraksingh Thilsted
Senior Nutrition Scientist, WorldFish
- 09:40 Keynote speech
Fish for better nutrition: Policies and strategies for increased production of nutrient-rich small fish in Bangladesh
Syed Arif Azad, Director General, Department of Fisheries
- 10:10 Launching of the TV spot on “Small Fish and Nutrition”
Ms. Farha Khan, Communications Specialist, WorldFish Bangladesh
- 10:20 Address by the Special Guest
Increasing nutrient-rich small fish availability, access and consumption within the framework of the Bangladesh Country Investment Plan
Mr. Mostafa Faruq Al Banna, Associate Research Director, Food Planning and Monitoring Unit, Ministry of Food
- 10:40 Address by the Guest of Honour
Mr. Ousmane Seck, Senior Rural Development Specialist, The World Bank, Dhaka Office
- 10:55 Address by the Chief Guest and
Launching of policy briefs and brochures
Dr. Shelina Afroza, Honourable Secretary
Ministry of Fisheries and Livestock
- 11:15 Address by the Chairperson
Dr. Craig A. Meisner, Country Director, WorldFish, South Asia
- 11:25-11:40 Tea break
- 11:40-13:00 Technical Session I
- 13:00-14:00 Lunch break
- 14:00-16:00 Technical Session II



Technical Session I

Chairperson: Dr. M. A. Sattar Mandal, former Vice Chancellor, Bangladesh Agricultural University (BAU) and Member of the Planning Commission

Presentation: 20 minutes; Discussion after each presentation: 5 minutes

Time	Presenter/s	Topic
11:40 - 12:05	Dr. Shakuntala Haraksingh Thilsted, Ms. Rumana Akter & Ms. Anna Birkmose Andersen	Integrating nutrition in aquaculture/agriculture interventions in Bangladesh
12:10 - 12:35	Dr. Md. Abdul Wahab	Sustainable fish production and management to meet the requirement for nutrient-rich small fish in Bangladesh
12:35 - 13:00	Dr. M. A. Sattar Mandal	Open discussion and Chairperson's remarks



Technical Session II

Chairperson: Dr. Akhter Ahmed, Chief of Party
 Bangladesh Policy Research and Strategy Support Programme
 International Food Policy Research Institute (IFPRI)

Presentation: 20 minutes; Discussion after each presentation: 5 minutes

Time	Presenter/s	Topic
14:00 - 14:25	Dr. Benoy K. Barman & Mr. M. I. Golder	Integration of micronutrient-rich small fish in aquaculture systems for increased fish production and household nutrition in Northwest Bangladesh
14:25 - 14:50	Mr. Sk. Md. Mohsin & Mr. A. K. M. Firoz Khan	Biodiversity conservation and stock enhancement in the <i>haors</i> of Sunamganj
14:50 - 15:15	Ms. Anne-Louise Hother, Ms. Manika Saha	Fish-based products to improve nutrition in the first 1,000 days of life
15:15 - 15:40	Dr. Ben Belton & Dr. Mostafa A. R. Hossain	Dried fish production, consumption and trade in Bangladesh
15:40 - 16:00	Dr. Akhter Ahmed	Open discussion and Chairperson's remarks



Day 2 (2nd March 2014)

Theme: Nutrition-sensitive Aquaculture/Agriculture for Improved Food and Nutrition Security

Chairperson: **Mr. B. Vishnu Bhat**, Fisheries Development Commissioner, Ministry of Agriculture, Government of India

The purpose, objectives and follow-up actions of the country participants will be discussed and agreed upon with each country team, beforehand. A team lead (1 or 2) will be selected beforehand to present the country overview. The country overview will be prepared beforehand, as a Summary and PowerPoint presentation. Before returning home, each country team will summarise the follow-up actions, in writing, and submit to the organizing committee.

- 09:00 Global Overview: Dr. Shakuntala Haraksingh Thilsted, Senior Nutrition Scientist, WorldFish
- 09:30 Country overview on the importance of fish for nutrition and the current activities in fisheries and pond polyculture (15 minutes each): Bangladesh, Cambodia, India, Myanmar, Nepal and Sri Lanka.
- 11:00 Group work: What actions should be taken/strengthened for making a) fisheries and b) aquaculture nutrition-sensitive in South and Southeast Asia? (6 groups)
- 12:00 Presentation by each group (10 minutes each)
- 12:40 Plenary discussions
- 13:15 Concluding remarks and presentation of follow up-actions: Dr. Shakuntala Haraksingh Thilsted
- 13:30 Vote of thanks: Dr. Craig A. Meisner, Country Director, WorldFish, South Asia
- 13:40 Lunch

b. Invited Workshop Participants

Name	Designation	Organisation	E-mail	Phone Number
Government of Bangladesh				
Dr. Shelina Afroza	Honourable Secretary	Ministry of Fisheries & Livestock	secmofl@gmail.com; shelina.afroza@gmail.com	9545700
Mr. Md. Anisur Rahman	Joint Secretary	Ministry of Fisheries & Livestock	anisur3112@yahoo.com; anisur3112@gmail.com	9514201
Syed Arif Azad	Director General	Department of Fisheries		01714746405
Prof. Subash C. Chakraborty	Director General	BFRI, Mymensingh	subhah55chakraborty@yahoo.co.uk	09165874
Dr. Md. Kamal Uddin	Executive Chairman	Bangladesh Agricultural Research Council	ec-barc@barc.gov.bd	9135587
Md. Abu Hanif Mia	Director General	Department of Agricultural Extension	da@dae.gov.bd	
Prof. Dr. Md. Akhtar Hossain	Member	University Grants Commission Agargaon Dhaka	akhtardso@yahoo.com	8181633
Mr. Naser Farid	Director General	Food Planning and Monitoring Unit		
Mr. Sk. Md. Mohsin	Project Director	SCBRM Project LGED, BhabanAgargaon Dhaka	mohsin300964@yahoo.com	88028155581
Mr. Md. Khalilur Rahman	Project Director	HILIP Project LGED BhabanAgargaon Dhaka	khalilpdhilip@yahoo.com	88028144578
Mr. Mostafa Faruq Al Banna	Associate Research Director	Food Planning and Monitoring Unit, Ministry of Food	mostafa.banna@gmail.com	1716080759
Professor Dr. Khandker Shefayet Ullah	Director General	Ministry of Health	info@dghs.gov.bd	
Nicholas Syed	Country Programme Officer	IFAD	n.syed@ifad.org	
Dr. Khandoker Azizul Islam	Director	Board of Investment		

Universities				
Dr. Khandker Anisul Huq	Professor	FMRT Discipline Diversity	huqka@yahoo.com	1914325047
Dr. Mostafa A. R. Hossain	Professor	Faculty of Fisheries BAU Mymensingh	marhossain@yahoo.com	1711045364
Dr. Md. Abdul Wahab	Professor	Faculty of Fisheries BAU Mymensingh	Wahabma_bau2@yahoo.com	1715099156
Dr. Nazma Shaheen	Professor	Institute of Nutrition & Food Science (INFS) University of Dhaka	nazmadoa@gmail.com, mnma@agni1.net	1718485554
Dr. Mritunjoy Kunda	Associate Professor	Faculty of Fisheries Sylhet Agricultural University Sylhet	mritunjoy68@yahoo.com	1712083003
Mr. M. A. Wahed	Health Adviser Nutrition and Management		wahed55@yahoo.com	

Partners				
Mr. Ousmane Seck	Senior Rural Development Specialist	World Bank, Bangladesh	oseck@worldbank.org	
Dr. Helen Leitch	Senior Agriculture Specialist	The World Bank, New Delhi, India		
Sumitro Roy	Deputy Director	Alive & Thrive	suroy@fhi360.org	
Mustafa Kamal Mujeri	Director General	BIDS	mujeri@bids.org.bd	
KaosarAfsana	Director, Health	BRAC	afsana.k@brac.net	
M. Anisul Islam	Director	CNRS	anis@cnrs.org.bd	
Ms. Melkamnesh Alemu	Nutrition Adviser	DFID	m-alemu@dfid.gov.uk	
Ms. Ferdousy Begum	Country Manager	FHI	fbegum@fhi360.org	
Ms. Erica Roy	Country Director	HKI	ekhetran@hki.org	
Ms. Jillian Waid	Analysis & Reporting Officer	HKI	jwaid@hki.org	
Mr. Richard Rose		iDE	richard.rose@ide-Bangladesh.org	
Dr. Tahmeed Ahmed	Sr. Scientist & Head Nutrition	ICDDRDB	tahmeed@icddrb.org	
Iftekhar Rashid	Un Research National Facilitator	UNICEF	iftekhar.rashid@one.un.org	
Abdul Awal Howlader	Additional Secretary	Ministry of Food	aawal@yahoo.com, addlsecretary@fd.gov.bd	
S M Mustafizur Rahman	Programme Manager	NNS	mmm09us@yahoo.com	

Manjurul Anwar	Joint Secretary	Planning Commission	badsha60@gmail.com	
Michael Foley	Director-Health & Nutrition	Save the Children	michael.foley@savethechildren.org	
Aaron Hawkins	Country Manager	Spring	ahawkins@spring-nutrition.org	
Mr. Mohammad Ali Reja	Deputy Country Manager	Spring		
Mr. S M Zafrullah Shamsul	Senior Technical Officer	Spring		
Noreen Prendiville	Chief of Nutrition	UNICEF	nprendiville@unicef.org	
Dr. Nazma Begum	Professor Economics Department	University of Dhaka	nazmadoa@gmail.com, mnma@agni1.net	88028118872
Dr. Shawkat A. Begum	Chief of Party	CIP	S.a.begum@cgiar.org	
Shahbuddin Ahmed	Sector Leader	CIP	shahbuddin.ahmad@worldveg.org	
Mr. Mustafa El Hamzaoui	Director, Office of Food and Disaster	USAID	melhamzaoui@usaid.gov	
Ms. Ramona El Hamzaoui	Director, Economic Growth Office	USAID	relhamzaoui@usaid.gov	
Dr. Shannon Young	Junior Health Officer	USAID	shyong@usaid.gov	
Dr. Monira Parveen	Head, Nutrition	WFP	monira.parveen@wfp.org	
Christa Rader	Country Representative	WFP	christa.rader@wfp.org	
Abdus Salam Khan	National DSF Coordinator	WHO	khanabdu@searo.who.int, ask0101@gmail.com	
Dr. Lalita Bhattacharjee	Nutritionist	National Food Policy Capacity Strengthening Programme Food and Agriculture Organization of the United Nations	lalita.bhattacharjee@fao.org	
Dr. Osagie Christopher Aimiwu	Agriculture Development Officer	Office of Economic Growth USAID / Bangladesh US Embassy Dhaka	oaimiwu@usaid.gov	
Mr. Sam Beckwith	Associate Programme Manager	Shiree	sam@shiree.org	
Dr. Julie Newton	Manager - Research, Policy & Practice, Food Security & Livelihood Sector	Save the Children	julie.newton@savethechildren.org	
Mr. Deepak Khadka	Country Director	iDE	deepak.khadka@ide-bangladesh.org	

WorldFish Bangladesh

Craig Meisner	Country Director	WorldFish	c.meisner@cgiar.org	
Kevin Kamp	Country Manager,AAS	WorldFish	k.kamp@cgiar.org	
Naseem Ahmed Aleem	Deputy ProgrammeLeader	WorldFish	n.aleem@cgiar.org	
Dr.Shakuntala Thilsted	Senior. Nutrition Scientist	WorldFish	s.thilsted@cgiar.org	
Dr. Murshed e Jahan	Scientist	WorldFish	k.jahan@cgiar.org	
Dr. Benjamin Belton	Scientist	WorldFish	b.belton@cgiar.org	
Mr. Md. Mokarram Hossain	Project Coordinator	WorldFish	md.hossain@cgiar.org	
Ms. Afrina Choudhury	Gender Specialist	WorldFish	a.choudhury@cgiar.org	
Ms. Rumana Akter	Nutrition Coordinator	WorldFish	r.akter@cgiar.org	
Dr. Manjurul Karim	Scientist	WorldFish	m.karim@cgiar.org	
Mr. Hendrik Jan Keus	Chief of Party	WorldFish	hj.keus@cgiar.org	
Dr. Benoy Kumar Barman	Senior Scientist	WorldFish	b.barman@cgiar.org	
Mr. A.K.M Firoz Khan	Project leader	WorldFish	f.khan@cgiar.org	
Ms. Farha Khan	Communication Specialist	WorldFish	fa.khan@cgiar.org	
Dr. Rita Sen	Gender Specialist	WorldFish	r.sen@cgiar.org	
Mr. Md. Emdad Hossain	Project leader	WorldFish	md.e.hossain@cgiar.org	
Mr. Nikhil Kumar Datta	Head of Operation	WorldFish	n.datta@cgiar.org	
Mr. Debnath Bijoy Bushan	Administrative Manager	WorldFish	b.debnath@cgiar.org	
Golam Mustafa	Project leader	WorldFish	g.mustafa@cgiar.org	
Mr. Jashim Uddin	Business Manager	WorldFish	j.uddin@cgiar.org	
Ms. Manika Shah	Research Assistant	WorldFish	m.saha@cgiar.org	
Ms. Anna-Louise Hother Nielsen	Consultant	WorldFish	a.neilsen@cgiar.org	

Department of Fisheries				
Md. Israil Golder	Deputy Director	DoF, Rajshahi		01715385124
Mr. Sk Mustafuzur Rahman	PSO, Fisheries Planning & Survey	DoF, Dhaka		01712521682
Dr. A.K.M Aminul Haque	Deputy Director	DoF, Barisal		
Mr. Joarder Md. Anowarul Haque	Deputy Director (Finance)	DoF, Dhaka		01711364160
Md. Monowar Hossain	District Fisheries Officer	DoF, Dhaka		
Dr. Kazi Iqbal Azam	Project Director	DoF, Dhaka		
Dr. Md. Fazlur Rahman	District Fisheries Officer	DoF, Dhaka		
Md. Abul Khair	District Fisheries Officer	DoF, Dhaka		
Mr. Subas Chandra Shah	PD, Greater Pabna Fisheries Development	DFO, Pabna		
Dr. Md. Sainar Alam	Assistant Director	DoF, Dhaka		
Dr. Benoy Kumar Chakraborty	Project Director	DoF, Dhaka		
Mr. Mohammad Mamunor Rashid	Assistant Director	DoF, Dhaka		
Bangladesh Fisheries Research Institute				
Dr. Md. Enamul Hoq	Chief Scientific Officer	BFRI	hoq_me@yahoo.com	01715132369
Dr. Md. Nurullah	Principal Scientific Officer	BFRI	nurullahbfri@yahoo.com	8801711045889
Dr. A. H. M Kohinoor	Senior Scientific Officer	BFRI		
Dr. Md. Zulfikar Ali	Senior Scientific Officer	BFRI	zulfikar_bfri@yahoo.com	
Media				
Mr. Emdad Ali Habib	Proprietor	Tele Track, ATN Bangla	teletrack@dhaka.net	
Iftexhar Mahmud	Senior Reporter	ProthomAlo	ifty1990@yahoo.com	
International Participants				
Mr. Alan C. Brooks	Director	Greater Mekong Region, WorldFish-Cambodia	A.brooks@cgiar.org	
Mr. Lek Sophat	Aquaculture specialist	HKI, Cambodia	SLek@hki.org	
Mr. Mak Sithirith	WorldFish	Cambodia	S.mak@cgiar.org	
Mr. Da Chin	WorldFish	Cambodia	chinda77@yahoo.com	
Mr. William Collis	Chief of Party	USAID KISAN Project Lalitpur, Nepal	bcollis@field.winrock.org	

VIII. Appendix II: Materials launched by Dr. Shelina Afroza, Honourable Secretary, Ministry of Fisheries and Livestock

Link to the three Policy Briefs, and the two Brochures:

<https://www.dropbox.com/sh/e1y2hbbjg9lg6t0/qwS2legDmq>

Policy brief “Nourishing Bangladesh with micronutrient-rich small fish”

Policy brief “Increased production of small fish in wetlands combats micronutrient deficiencies in Bangladesh”

Policy brief “Pond polyculture technologies combat micronutrient deficiencies and increase household income in Bangladesh”

Brochure “Sustainable production of small fish in wetlands of Bangladesh”

Brochure “Polyculture of carps and mola in ponds and ponds connected to rice fields”

Link to the TV spot:

https://www.youtube.com/watch?v=DkA2HdO4b4Y&list=UUW_XqLfc87jE0DYSIT6r5A

IX. Appendix III: Print and Digital Media Coverage from the Workshop

Press Briefing on the Regional Workshop

1st March 2014

“Small fish is more nutritious than large fish”

“Infants in Bangladesh are stunted and suffer from malnutrition”

“Women and young children are suffering from chronic malnutrition”

A two-day regional workshop: “Production and Conservation of Nutrient-rich Small Fish (SIS) in Ponds and Wetlands for Nutrition Security and Livelihoods in South Asia” has been held today at the Hotel Sarina, Banani, which was attended by 80 delegates from home and abroad. The Country Director, WorldFish, South Asia, Dr. Craig A. Meisner chaired the inaugural session. The Honourable Secretary, Ministry of Fisheries and Livestock, Dr. Shelina Afroza was the chief guest in the workshop. Other dignitaries, Dr. Shakuntala Haraksingh Thilsted, Senior Nutrition Scientist, WorldFish; Syed Arif Azad, Director General, Department of Fisheries; Mr. Ousmane Seck, World Bank Office, Dhaka and Dr. Mostafa Faruk Al Banna, Ministry of Food spoke at the regional workshop. There were 17 senior level delegates from Cambodia, India, Myanmar and Nepal.

The purpose of this workshop is to bring stakeholders: policy makers, extension agents, researchers, academicians, NGOs and development partners together to share knowledge of the contribution of small fish for improved nutrition, production technologies, and policies and strategies for wider dissemination of sustainable production through culture and wetlands management. The workshop will generate actions for further advocacy and awareness, and research and development of sustainable production technologies for small fish for the benefit of the people of Bangladesh as well as the South and Southeast Asian region.

In the keynote speech, Syed Arif Azad mentioned that SIS are an important source of essential macro- and micronutrients which play a vital role in combating malnutrition and micronutrient deficiencies in the populations of Bangladesh and other countries in South and Southeast Asia. Out of 260 freshwater fish species in Bangladesh, over 140 are small fishes, mostly found in the natural inland water bodies. Only 18 freshwater fishes, mostly large carps, pangasius catfish and tilapia are cultured. Although Bangladesh has made tremendous progress in freshwater fish culture, greater efforts should now be directed towards increased production and biodiversity conservation of SIS because many poor rural and fishers’ communities rely on these small fishes for their nutrition and livelihoods.

In the workshop, it was pointed out that 1 out of 4 women is underweight in Bangladesh and among children under 5 years, 41% are stunted. These alarming figures can be improved through increased consumption of nutrient-rich food, especially small fish, vegetables and fruits. Dr. Shakuntala Haraksingh Thilsted emphasized that micronutrient-rich small fish such as mola, dhela and darkina can be regularly fed to infants and young children and pregnant and lactating women to improve nutrition. She believes that increased production, access and consumption of small fish have a major role to play in the fight against malnutrition in Bangladesh. She urged the delegates from Bangladesh and other Asian countries to enhance their efforts towards increased production and productivity of SIS and maintenance of biodiversity. To this end, together with partners, she has formulated policy briefs and brochures for consideration of the Government of Bangladesh and relevant policy makers.

In his speech, Mr. Mostafa Faruq Al Banna highlighted the need for increasing nutrient-rich small fish availability, access and consumption within the framework of the Bangladesh Country Investment Plan (CIP). He highlighted the need to promote small fish biodiversity and production through integration with other farming systems.

Dr. Shelina Afroza expressed satisfaction at the existing collaboration between the Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI) and WorldFish in the development of the aquatic sector through increased promotion in aquaculture and natural resources management. She emphasized that their joint efforts have already brought significant contribution to the increased production and availability of fish in general, and some common nutrient-rich small fish in particular, in some regions of the country. She expressed that the technologies generated should be widely disseminated throughout the country. Dr. Afroza said that it was not only total fish production that was enough: the country needs production of good quality and safe fish, with high nutritional value to alleviate malnutrition in children and women, particularly in the rural areas. She showed great interest in the high quality of the policy briefs, technology brochures and TV spot which been developed, with support from The World Bank, through the South Asia Food and Nutrition Security Initiative (SAFANSI) and expressed the desire to see these products widely publicised and disseminated. She showed her willingness to do everything possible for their country-wide adoption from her part, and from the Ministry of Fisheries and Livestock, and suggested the DG of the DoF take the necessary actions for this. She wished to share today's experience and documents with the Minister in charge of Fisheries and Livestock as well as other Ministers so that they could promote these through their wide political coverage. She concluded by saying that the policy of the present government is to make Bangladesh self-sufficient in food production as well as ensure food and nutrition security for all.

Dr. Meisner emphasized the role of WorldFish in Bangladesh and the successes made in different areas, especially in the promotion of production of nutrient-rich small fish. He mentioned that he has visited the north-west and north-east regions and found that the people are very interested in carp-small fish polyculture and enhancement of stock of small fish in the haor areas through community participation. He lauded the cooperation of the DoF, BFRI and other national institutions in sharing and collaborating in the implementation of the innovative technologies for the benefit of the people of Bangladesh. He thanked the Secretary of the Ministry of Fisheries and Livestock for her continued support to the activities and initiatives of WorldFish.

TV Coverage

Link to the TV programme coverage of the workshop on ATN Bangla TV channel programme - Sonali Din (Golden Day) on 11th March 2014

Link: <http://youtu.be/Tb2lfCdBOHM>

Additional TV Programme

Link to an additional TV Agricultural Programme “Adhunik Biggyan O Amader Krishi” (Modern Science and Our Agriculture) from the national TV channel, BTV, on “Fish biodiversity and conservation, and human nutrition”.

This programme, of 25 minutes duration, was aired once during the National Fish Week (2nd - 8th July 2013), and subsequently thrice.

The total estimated reach was 10 million people.

Link: <https://www.youtube.com/watch?v=ISyJykkrluk>
and
<https://www.youtube.com/watch?v=heGfTOyO41w&feature=youtu.be>

