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IMPROVED MANAGEMENT, INCREASED CULTURE AND CONSUMPTION OF SMALL FISH SPECIES CAN IMPROVE DIETS OF THE RURAL POOR

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Abstract

In many low-income countries with water resources, small fish species are important for the livelihoods, nutrition and income of the rural poor. The small size of fish favours frequent consumption by and nutrition of the rural poor, as these fish are captured, sold and bought in small quantities; used both raw and processed in traditional dishes; and are nutrient-rich. All small fish species are a rich source of animal protein, and – as they are eaten whole – have a very high content of bioavailable calcium. Some are rich in vitamin A, iron, zinc and essential fats. Measures to improve management and increase culture and consumption of small fish include community-based management of common water bodies; culture of small fish in ponds and rice fields; use of small marine fish for direct human consumption, especially in vulnerable population groups; and improved handling, transportation, processing – especially drying – and market chains to reduce loss and increase accessibility, especially in hard to reach population groups. Recent integrated initiatives such as Scaling Up Nutrition (SUN) Framework and Roadmap: 1,000 Days Global Effort, focusing on the linkages between agriculture and nutrition give good opportunities for promoting improved management, and increased culture and consumption of small fish species.

1. Introduction

In many low-income countries, with water resources, fish and fisheries are an integral part of the livelihoods, nutrition and income of the rural poor. In these population groups, a large proportion of the fish caught, bought and consumed is from capture fisheries, and made up of small fish species. However, as national statistics on fish production and consumption fail to capture data on these small fish species, their importance in diets is neglected (Roos *et al.*, 2006). Very few consumption surveys have reported on fish intake at species level. In Bangladesh, data from some rural surveys show that small freshwater fish species make up a large part of total household fish consumption; fish is a traditional and common food; the frequency of fish intake is high; and the amounts consumed are small. These surveys also show that fish is an irreplaceable animal source food for the rural poor; adding diversity to a diet dominated by one grain staple, rice. In addition, survey data show that the total fish consumption among the rural poor has decreased, as well as the proportion of small fish species of total fish consumption (Thompson *et al.*, 2002). In Bangladesh, small indigenous fish species are characterized as species growing to a maximum of 25 cm or less. In some African countries, for example, Malawi, Kenya, Tanzania and Zambia, the importance of small fish species, for example kapenta (*Limnothrissa* spp.) as a major animal source food in the diets of rural populations, living close to lakes is recognized (Haug *et al.*, 2010). In coastal communities, small marine fish species are also important in the diets of the poor.

2. Factors related to the small size of fish which benefit consumption

There are many factors related to the small size of fish species, which make them especially favourable for inclusion in the diets of the rural poor. In Bangladesh, the diversity of small fish species is large; and a large proportion of the over 267 freshwater and 400 species from the mangrove waters in the Sundarbans is of small size (Islam and Haque, 2004; Rahman, 1989). Capture fisheries continue to be an important source of fish. In the monsoon and post-monsoon periods (June–November), the floodplains are inundated, providing an ideal habitat for the many fish species, and people have access to these for consumption as well as local sale. Much of the small fish is sold in small rural markets, and this is the major source of fish for consumption by the rural population. Small fish are sold in small heaps of mixed species, can be bought in quantities which are affordable, and can be cooked for one meal or for daily consumption, favouring a high frequency of consumption (Roos, 2001). This is important, taking

into consideration that fish is highly perishable and the rural population does not have the possibility to keep foods cold or frozen. In northern Zambia, heaps of around 20 g raw chisense (many small fish species, dominated by *Poecilothrissa moeruensis*) are sold and bought. Fish capture and production are highly seasonal with peak and lean seasons, and processing of fish, especially sun-drying gives the possibility to make good use of small fish species which are plentiful and affordable in the peak season, reduce weight which eases transportation and storage, as well as extend the length of storage time and duration of intake. Traditional products such as dried, smoked, salted and fermented small fish, as well as fish paste and fish sauce are made at household level and bought in small quantities from local markets. Raw and processed small fish are normally cooked as a mixed curry or stew dish, with little oil, vegetables and spices. It is reported that these dishes are well-liked, easy to prepare, add taste and flavour to meals made up of large quantities of one staple, for example rice or maize, as well as contribute to dietary diversity. A dish with small fish and vegetables can be shared more equitably among household members, including women and young children (Roos et al., 2007b). Surveys of perceptions of small fish species in rural Bangladesh show that many are considered beneficial for well-being, nutrition and health, and women ranked small fish as the second most preferred food to buy – after fruits – if they had more income to spend on food (Deb and Haque, 2011; Nielsen *et al.*, 2003; Thilsted and Roos, 1999).

3. Intake and nutritional contribution of small fish species

Some rural surveys have shown the effect of location, seasonality, year and household socio-economic status on fish consumption. In a survey conducted in 1997–98, in an area in northern Bangladesh with rich fisheries resources; the average fish intake in the peak fish production season (October), 82 g raw, edible parts/person/d was more than double that in the lean season (July); and five common small species made up 57 percent of the total intake (Roos *et al.*, 2003). The nutritional contribution of small fish species is high. It is well recognized that fish are a rich source of animal protein, and some marine fish have a high content of total fat and essential fats. Recently, some small freshwater fish species have been reported as being rich sources of fat and essential fats. Trey sloeuk russey (*Paralaubuca typus*) from Cambodia has a high fat content (12 g/100 g dried fish) (Roos *et al.*, 2010). Dried usipe (*Engraulicypris sardella*) from an area around Lake Malawi contains 1 700 mg docosahexaenoic acid (DHA) per 100 g dried fish, comparable to salmon. The DHA concentration in the breast milk of women from this area was found to be about 0.7 percent of fatty acids; about twice the global average (K. Dewey, personal communication, 7 April 2011).

However, the contribution of small fish species as a rich source of vitamins and minerals has not been widely documented and is overlooked. In the above-mentioned study from Bangladesh, small fish contributed 40 percent and 31 percent of the total recommended intakes of vitamin A and calcium, respectively, at household level, in the peak fish production season (Roos *et al.*, 2006). Some common small species, mola (*Amblypharyngodon mola*), chanda (*Parambassis* spp), dhela (*Ostreobrama cotio cotio*) and darkina (*Esomus danricus*) have high content of vitamin A. As most small fish species are eaten whole, with bones, they are also a very rich source of highly bioavailable calcium. Darkina, as well as trey changwa plieng (*Esomus longimanus*) from Cambodia have a high iron and zinc content (Roos *et al.*, 2007a). A traditional daily meal of rice and sour soup made with trey changwa plieng can meet 45 percent of the daily iron requirement of a Cambodian woman. In addition, fish enhances the bioavailability of iron and zinc from the other foods in a meal (Aung-Than-Batu *et al.*, 1976).

4. Measures to increase the availability and consumption of small fish species

With fast-growing populations in low-income countries, changing trends in use of land and water, overfishing, degradation of fish habitats and lack of management of water and fisheries resources, the availability of freshwater fish, especially small species has decreased. In some Asian countries, aquaculture of large, fast-growing fish species has been vigorously promoted in response to declining fish availability. In Bangladesh, pond polyculture of carps, and recently, monoculture of the introduced species, Nile tilapia (*Oreochromis niloticus*) and pangas (*Pangasius sutchi*), mainly for urban markets, have been very successful. The intake of silver carp (*Hypophthalmichthys molitrix*) – a large fish which is not well liked and makes up a large proportion of aquaculture production – has increased among the poor, as total fish intake has decreased. Due to species differences in nutrient content, as well as large fish not eaten whole as small fish – for example, the bones are plate waste – this production technology of large fish does not favour increased fish consumption by the poor or contribution to micronutrient intake (Roos *et al.*, 2007b).

Recognizing the decline in biodiversity of indigenous freshwater fish species in Bangladesh, as well as growing attention to the nutritional importance of small species, some measures have been taken to conserve, manage and culture indigenous fish.

Conservation and management of common fisheries resources and fish migration routes through community-based and community-managed fisheries approaches have proved successful in increasing total fish production many times, the diversity of fish species, as well as the proportion of small fish species captured and consumed by landless and small farming households (Center for Natural Resource Studies, 1996). Similar positive results have been achieved in the Management of Aquatic Ecosystems through Community Husbandry (MACH) projects (1998–2003) which included interventions to restore three major wetlands habitats, ensure sustainable productivity and improve the livelihoods of the poor who depend on these wetlands, through community based co-management (Anonymous, 2003).

Pond polyculture of carps with the vitamin A rich small fish, mola was introduced in Bangladesh in the late 1990s. No significant difference in total fish production was seen between ponds stocked with carps and mola, and those with carps alone. However, the nutritional quality of the total fish production improved considerably in the ponds with mola. In this production system, the eradication of indigenous fish, the majority being small species, by repeated netting, dewatering, and the use of a piscicide, rotenone; prestocking of carp fingerlings – based on the rationale that competition exists between native and stocked fish – was stopped. As small fish species breed in ponds, frequent partial harvesting must be practised, and this favours home consumption. In addition to the production of carps, a small mola production of 10 kg/pond/y, in the estimated four million small, seasonal ponds in Bangladesh can meet the annual recommended vitamin A intake of six million children (Roos *et al.*, 2007b). This production technology of carp-small fish pond polyculture has gained wide acceptance by the Government of Bangladesh and development partners, and is also being practised in Sundarbans, West Bengal and Terai, Nepal. Carp production and management of indigenous fish species in beels (floodplain depressions and lakes) have also resulted in large increases in total fish production (over 0.6 tonnes/ha, in 6 months, of which 45 percent were non-stocked fish, mainly small species) (Rahman *et al.*, 2008). Depending on geographical location and season, different culture practices with fish and rice have shown to increase fish diversity, as well as the nutritional quality of the combined rice and fish production (Dewan *et al.*, 2003; Kunda *et al.*, 2009).

A central issue regarding the availability of small fish species for direct human consumption is the vast amounts of small marine fish (about 23.8 million tonnes in 2006) used to produce fish meal and fish oil, primarily for aquaculture (Tacon and Metian, 2009). There is growing concern of the dwindling supplies and population collapse of small marine fish species (Pinsky *et al.*, 2011). More focused advocacy and awareness, as well as development and implementation of policies, regulations and interventions are needed in order to significantly reduce this trend. Fish powder made from small marine fish can be used as an excellent source of essential nutrients in feeding programmes for pregnant and lactating women, young children, school children, the sick and elderly. In the WINFOOD project presently being conducted in Cambodia and Kenya, complementary foods for young children with powdered, nutrient-rich small fish species have been developed, and efficacy studies are being carried out (Roos *et al.*, 2010).

Improving handling and transportation, processing and market chains to reduce the large amounts of fish lost due to spoilage and waste can greatly increase the accessibility of small fish and fish products to the poor and population groups which are hard to reach. Recognizing that improvements in transportation and storage systems for raw fish can be difficult to achieve in low-income countries, much more efforts should be made to improve traditional sun-drying methods. In Mali, a simple, robust mobile fish dryer has been developed which eliminates contamination caused by spreading the fish on soil, and the use of insecticides to keep away flies during sun-drying. In addition, the time needed for drying is short, and the temperature used is controlled and lower than that reached from direct exposure to the sun, resulting in a product of high nutritional and food safety quality (Heilporn *et al.*, 2010).

5. Conclusion

Recent attention to linkages between agriculture, human nutrition and health gives new possibilities to focus on management and culture of small fish species for improved diets. There are initiatives such as the CGIAR Research Programmes; USAID funded Feed the Future; Scaling Up Nutrition (SUN) Framework and Roadmap: 1,000 Days Global Effort; Bill and Melinda Gates Foundation, Grand Challenges Explorations Rounds 7 and 8: Explore Nutrition for Healthy Growth of Infants and Young Children; and CIDA funded Grand Challenges Canada: Saving Brains focus on integrated approaches to improve nutrition. For implementing SUN: 1,000 Days Global Effort, recommendations for the increased availability, accessibility and intake of fish as a rich source of essential fats, crucial for cognitive development have been highlighted.

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