



Food and Agriculture
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NATIONAL AQUACULTURE
DEVELOPMENT STRATEGY AND
ACTION PLAN OF BANGLADESH
2013–2020



Food and Agriculture
Organization of the
United Nations



National Aquaculture Development Strategy and Action Plan of Bangladesh

2013–2020

**MINISTRY OF FISHERIES AND LIVESTOCK
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH**

and

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
ROME, 2014**

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Minister

Ministry of Fisheries and Livestock

Government of the People's Republic of Bangladesh

Bangladesh Secretariat, Dhaka

Message

This Aquaculture Development Strategy and Action Plan of Bangladesh embodies the needs and aspirations of the sector and the nation as a whole, to which fulfilment the government is strongly committed to pursue. While the government will assume its expected role as the leading stakeholder in implementing the Strategy and Action Plan, it will do so in a manner that all the other stakeholders shall have equitable and responsible participation in the process. This multi-stakeholder participatory process has been demonstrated admirably in the formulation of this document. I congratulate and thank the agencies and personnel that have contributed their energy, thoughts, and experiences to the crafting of this Strategy and Action Plan. The Ministry pledges its full support to making the vision a reality for the people.

Muhammed Sayedul Hoque, MP



Minister of State
Ministry of Fisheries and Livestock
Government of the People's Republic of Bangladesh
Bangladesh Secretariat, Dhaka

Message

As a worker and a provider of food to my family, I am pleased to see that the Strategy and Action Plan effectively addresses the concerns of the average household of Bangladesh – food security, livelihood security, employment and better nutrition. As the State Minister in charge of the Ministry, I commit myself and the agency that I represent to the earnest and resolute implementation of the Strategy and Action Plan to improve the welfare of the rural households and the farmers of Bangladesh.

Narayon Chandra Chanda, MP



Secretary
Ministry of Fisheries and Livestock
Bangladesh Secretariat
Dhaka, Bangladesh

Message

Under the leadership of the Honourable Prime Minister Sheikh Hasina, the Government of the People's Republic of Bangladesh is pursuing a broad-based inclusive development strategy with poverty eradication and the sustainable development of Bangladesh as two of its core objectives. Developing the aquatic resources of Bangladesh forms an integral part of this strategy. The government has undertaken several legislative and policy initiatives as well as concrete programmes to develop the sector.

In recognition of the huge potential of the aquaculture sector to supply high-protein food and generate employment, income and foreign exchange for the country, the government took the initiative to formulate a National Aquaculture Development Strategy and Action Plan for the period 2013–2020.

This Strategy and Action Plan has been formulated in line with the Country Investment Plan (CIP) of 2010–2015, and the Sixth Five Year Plan of 2011–2015. It is a clear road map for realizing the full potential for the growth of the sector as a part of the national goal to attain food security, better nutrition, poverty alleviation and economic development of the country.

I commend this timely initiative of FAO for publication of this vital document, formulated by the Department of Fisheries with the technical expertise and assistance of FAO in consultation with all relevant stakeholders in the public and the private sectors, including the Bangladesh Shrimp and Fish Foundation. The document, will be of the utmost importance for policy-makers, practitioners and stakeholders, both in the public and the private sectors, with a useful framework of guidance for sustainable development of the aquaculture sector of Bangladesh. The Ministry of Fisheries and Livestock of the People's Republic of Bangladesh will continue to extend its full support to all future initiatives, programmes and actions in implementing the National Aquaculture Development Strategy and Action Plan of Bangladesh.

Selina Afroza, Ph.D.



Food and Agriculture Organization of the United Nations

FAO Representative in Bangladesh
Dhaka, Bangladesh

Message

As it charts a path towards Middle Income Country status, Bangladesh still faces challenges to ensure food and livelihood security for its young and rapidly growing population. Much has been achieved, but figures show that there remains a problem of under-nutrition, and stunting, which still affects two out of five children. Promoting sectors which provide affordable sources of dietary protein is one key weapon in this fight. Dairy, eggs, meat and fish are all essential components of a balanced diet. With regard to domestic fish consumption, the aquaculture sector has an important role to play, seen from both a livelihood and from a nutrition angle.

This National Aquaculture Development Strategy and Action Plan of Bangladesh 2013–2020 sets out a road map for sustained action to develop the sector; implementing it will now depend on the commitment and will of all stakeholders.

It has been our privilege to work with the Government of Bangladesh in the development of this important document. Our modest assistance in material and expertise has been an opportunity for the creative application of the country's own resources, rather than as a substitute for what the country lacks. More than this, we consider it as a contribution to the pool of development resources for the Government of Bangladesh and our other partners.

We express our appreciation to the Government of Bangladesh for continuing to consider FAO as a reliable partner. I take this opportunity to re-affirm our commitment to the sustained development of the food and agriculture sector in Bangladesh.

Mike Robson



Director General
Department of Fisheries
Government of the People's Republic
of Bangladesh

Foreword

The performance of the aquaculture sector of Bangladesh in recent years, during which the country has become the fifth-largest producer of aquaculture products in the world, is a clear sign of its increasingly important role in the nation's social and economic development. The numerous social and economic benefits that it has earned for the country are ample evidence that the efforts and resources that have been invested into its growth and development are providing dividends. It is the fastest-growing economic sector: farmed fish supply increased by more than 200 percent during the first decade of this century, more livelihoods and employment have been created for the rural communities, and incomes of, especially, the small farm households have increased. The nation has also earned a significant amount from the export of aquaculture products.

Sustaining the momentum of its growth and maintaining the gains from its development will be difficult and will require even more effort and investments as emerging problems pile into the old and persistent ones. In this regard, the Government of Bangladesh has strongly committed to sustain the growth and development of aquaculture. The government approved the National Fisheries Policy (NFP) in 1998 and consequently, the National Fisheries Strategy (NFS) in 2006 with eight building-block substrategies, which include Aquaculture and Aquaculture Extension substrategies. As it is a live document, it needs update from time to time. In this context, following the inherent features of the NFP and NFS, this National Aquaculture Development Strategy and Action Plan was developed by the stakeholders of the sector with the support and technical assistance of the Food and Agriculture Organization of the United Nations (FAO of the UN). This strategic document is the output to our strong commitment to sustainable and equitable aquaculture development.

We are proud to present this to the relevant stakeholders of Bangladesh and to our development partners.

Syed Arif Azad

Abstract

The National Aquaculture Development Strategy and Action Plan of Bangladesh 2013–2020 constitutes 16 outputs under four objectives. These are geared to pursuing the mission of the aquaculture sector that its stakeholders have charged it with: “To improve the welfare of the resource-poor people depending on the aquatic resources for livelihood, reduce poverty by stimulating employment and improving income, conserve if not enhance the natural resources on which livelihoods are based, promote the sustainable development of rural communities, increase export earnings, and contribute to the creation of wealth for the nation and improvement in the welfare of the people.”

The formulation of the Strategy and Action Plan has been informed by the National Fisheries Policy of 1998, the Country Investment Plan 2011–2015, the National Fisheries and Livestock Sector Development Plan, the FAO TCPF project “Identification and understanding of key technical, economic and social constraints to seed and feed production and management in Bangladesh”, and the preceding national fisheries strategy and action plan of 2006–2012. It thus updates the aquaculture substrategy and plan of action contained in this document.

The Strategy and Action Plan was formulated, based on a working paper prepared by the Aquaculture Branch of FAO, at a stakeholders’ consultation workshop held in 10 December 2012, then reviewed extensively for technical content and issues by experts at the Department of Fisheries and Aquaculture of FAO, and finally reviewed for the strategic and policy issues by the National Working Committee for the Sustainable Development of Aquaculture Industry during its first meeting on 4 September 2013. The Committee endorsed the Strategy and Action Plan at the same meeting. The Ministry of Fisheries and Livestock, Government of Bangladesh approved the document in November 2013.

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The leadership and staff of the FAO Fisheries and Aquaculture Department (Aquaculture Branch [FIRA], Marine and Inland Fisheries Branch [FIRF], Products, Trade and Marketing Service [FIPM]), and Statistics and Information Branch [FIPS] and the FAO Regional Office for Asia-Pacific (RAP) provided the technical review. The comments and suggestions of Cai Junning, Devin Bartley, Doris Soto, Iddy Karunasagar, Jiansan Jia, Jose Aguilar Manjarrez, Matthias Halwart, Weimin Miao, Rohana Subasinghe, Valerio Crespi and Xiaowei Zhou infused into the strategy a blend of broad international experience and focused technical expertise.

The staff of the Office of the FAO Representation in Bangladesh, particularly Begum Nurun Naher, ensured that the entire process was smooth and systematic. The officers and technical staff of the DoF saw to it that the content and thrust of the document were in line with the programmes of the Government. The individuals who represented the many stakeholder groups assured the relevance of this Strategy and Action Plan to the needs of the sector.

This workshop report was edited by J. Richard Arthur for its language quality. Tina Farmer and Marianne Guyonnet are acknowledged for their assistance in quality control and FAO house style. Koen Ivens prepared the layout design for printing. The publishing and distribution of the document were undertaken by FAO, Rome.

Abbreviations and acronyms

BARC	Bangladesh Agricultural Research Council
BDT	Bangladesh taka
BMP	better management practice
CIP	Country Investment Plan
DoF	Department of Fisheries
GDP	gross domestic product
ICT	information and communication technology
MoFL	Ministry of Fisheries and Livestock
NGO	non-governmental organization

Executive summary

Aquaculture has been one of the fastest-growing economic subsectors of the Bangladesh economy, providing high-protein food, income and employment and earning foreign exchange. More than 4 million fish farmers, mostly small-scale, and more than 8.5 million people derive a livelihood from it directly or indirectly. Export revenue in 2012 was estimated at US\$450 million. It has the potential to contribute more significantly to poverty alleviation. Its development, however, is now facing the constraints of increased pressure on natural, physical, human and financial resources, greater market competition, and the need to create more livelihood opportunities for a large and growing population. Experience in neighbouring countries in North Asia and Southeast Asia that have also seen rapid growth in their aquaculture sectors shows that productivity gains from very rapid growth can come with environmental and social costs that significantly reduce the gains from that growth. Repairing the damage to the environment and rectifying the social inequities that rapid growth may exacerbate have often been difficult and costly. However, recent lessons from the same countries have shown that the orderly development of aquaculture facilitates sustainable, socially responsible and environmentally benign growth. An important instrument to assure this is a National Aquaculture Development Strategy and Action Plan.

This National Aquaculture Development Strategy and Action Plan of Bangladesh 2013–2020 is aligned with and draws guidance from the Country Investment Plan of 2010–2015 and the Sixth Five Year Plan 2011–2015. The mission for aquaculture under this Strategy and Action Plan is that it shall improve the welfare of the resource-poor people dependent on aquatic resources for livelihood, create employment opportunities for the landless and the fishers who are poor, conserve and, as much as possible, enhance the natural resources on which livelihoods are based, promote the sustainable development of rural communities, increase export earnings and contribute to the creation of national wealth and improvement in peoples' welfare. It shall be inclusive of all stakeholders but place emphasis on the small and poorer constituents of the aquaculture subsector.

The Strategy and Action Plan has four Strategic Objectives, three of which are based on the pillars of sustainable development, the fourth on the need to enable the three. Thus:

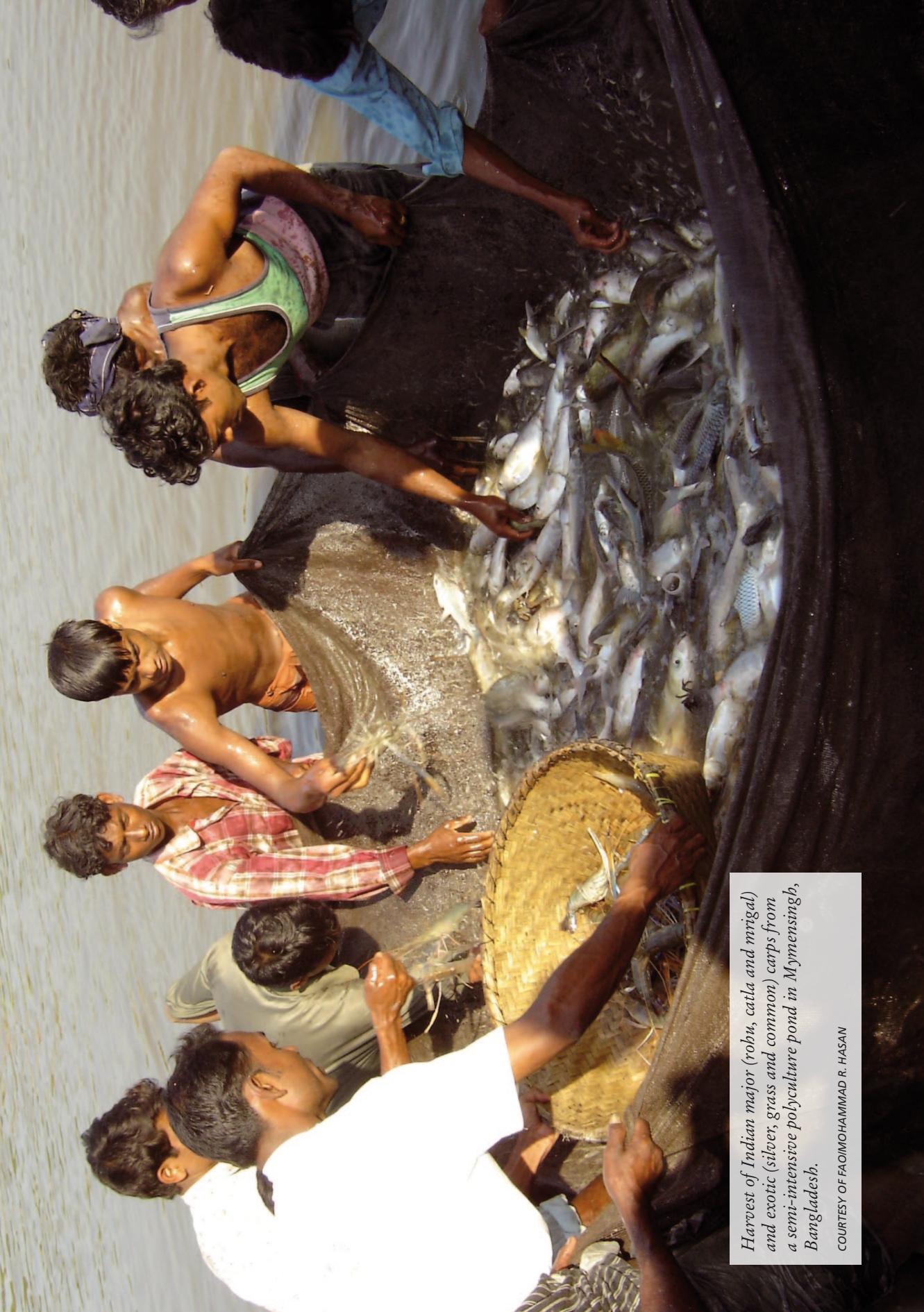
- Social: To enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods.
- Economic: To stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or earn foreign exchange through import substitution or more export earnings.

- Ecological: To promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience.
- Institutional: To establish the enabling environment and develop the capability to effectively manage the sector, provide the support services needed for sustainable and responsible development, and ensure equity and fairness in the allocation of production resources and distribution of benefits.

There are 16 outputs linked to these objectives. The five outputs linked to the social objective will contribute to food security and better nutrition through higher production and diversified production systems, more opportunities for livelihoods in rural areas, especially for the poor households and the landless and women-headed households, by developing suitable culture systems and exploiting the potential of the untapped resources such as coastal waters and floodplains. The four outputs linked to the economic objective will increase returns to input suppliers, farmers, processors and traders by improved raw material and product quality, value addition, and other means, as well as by enabling an equitable sharing of the value of the product with a better-managed and more efficient value chain. The four outputs linked to the ecological objective will contribute to the conservation of the land, water and genetic/biological resources on which aquaculture depends. They will seek to make aquaculture contribute to the conservation of natural resources, particularly fishery resources, rather than to their degradation. The three outputs linked to the institutional objective will: strengthen the capacity of public and private institutions (including academic institutions) and civil society that have a significant role in managing the aquaculture sector; build the capabilities and skills of fish-farming communities by organizing and training them, building linkages among them and with providers of services to expand their opportunities for access to knowledge, technology and innovations; and foster public-private partnerships in ventures that support aquaculture development.

The Department of Fisheries is the lead agency in the implementation of the Strategy and Action Plan. Mechanisms and arrangements for multi-institutional collaboration that will include government agencies, civil society organizations (including non-governmental organizations and foundations), private industry, and organizations of farmers, input producers and suppliers, traders, and the academic institutions will be designed for implementation of activities to produce the different outputs. Support to the implementation of the Strategy and Action Plan shall be from a mix of funding resources composed of funds from the national treasury, contributions from the private sector, and external assistance. The implementation of activities shall be project-based. The time frame is eight years beginning in 2013 with an

indicative budget of US\$170 million. The indicative budget comprises the estimated funding support to enable the production of the Strategy and Action Plan's 16 outputs comprising 76 activities.



Harvest of Indian major (robu, catla and mrigal) and exotic (silver, grass and common) carps from a semi-intensive polyculture pond in Mymensingh, Bangladesh.

COURTESY OF FAO/IMOHAMMAD R. HASAN

1. Introduction

The aquaculture sector of Bangladesh has been expanding rapidly. It is now ranked fifth in the world in output. From a production of 0.713 million tonnes in 2000–01, it had reached 1.726 million tonnes in 2011–12 (Table 1), a net increase of over 1.0 million tonnes (APR¹ = 8.37 percent/year) in 11 years (DoF, 2013). This is almost 50 percent of the total fish production of 3.12 million tonnes over the same period, but its contribution to gross domestic production (GDP) would be higher than that of capture fisheries. It is widely expected to expand further. However, experience in neighbouring countries in North and Southeast Asia that have seen a rapid growth in their aquaculture sectors has shown that productivity gains can be offset by environmental and social costs, which significantly reduce the net gain to society. Repairing the damage to the environment and rectifying the social inequities that rapid growth may exacerbate have been difficult and costly. However, recent lessons from the same countries have also shown that the orderly development of aquaculture facilitates sustainable, socially responsible and environmentally benign growth. An important instrument to assure this is a National Aquaculture Development Strategy and Action Plan, preferably formulated in a participatory manner by the major stakeholders of the sector.

Table 1.
Aquaculture growth in Bangladesh, from 2000–01 to 2011–12

Year	Production (million tonnes)	Growth rate (%/year)
2000–01	0.713	
2001–02	0.787	10.38
2002–03	0.857	8.89
2003–04	0.915	6.77
2004–05	0.882	-3.61
2005–06	0.892	1.13
2006–07	0.946	6.05
2007–08	1.006	6.34
2008–09	1.063	5.67
2009–10	1.352	27.19
2010–11	1.461	8.06
2011–12	1.726	18.14

Source: DoF (2013).

¹ Annual percentage growth rate

1.1 Rationale

Strategic: At this critical juncture in the economic development of Bangladesh when resources are increasingly strained from intensified demand and the hazards from climate change are building up, there are many compelling reasons to have a National Aquaculture Development Strategy and Action Plan of Bangladesh (hereafter referred to as "the Strategy and Action Plan") to guide the management of aquaculture. Among these are:

- 1) the urgent need to assure food and nutrition security and create more livelihood opportunities for a large and growing population;
- 2) the large number of fish farmers who are mostly small-scale (4.23 million farmers cultivating 4.5 million farms with a combined area of 670 000 ha) and the millions more (8.5 million people) who are directly or indirectly employed along the aquaculture value chain;
- 3) the close interaction between aquaculture and many other economic sectors, which includes competition for land, water and other resources but also integration with other uses such as crop and livestock farming and agroforestry;
- 4) the potential of aquaculture to enhance or damage livelihood capitals, especially natural and social capitals, depending on how it is managed and operated; and, related to this,
- 5) the national capacity to govern its orderly and sustainable development.

Operational: The operational reasons include better management of the sector, having priorities based on stakeholders' views and needs, and having to allocate scarce resources among competing sectors and uses. In addition, a Strategy and Action Plan is useful for determining public investments in development and support services and encouraging private investment in aquaculture enterprises, as well as in market-based support services.

2. Guidance for the Strategy and Action Plan

This document draws guidance from three sources: the Sixth Five Year Plan (MoP, 2011), the sectoral development plans (MoFL, 1998; DoF, 2006) and the Country Investment Plan (CIP) (GoB, 2011), which themselves are products of national and multistakeholder consultations. Key and current information on sector status was provided by the Project TCP/BDG/3301 “Identification and understanding of key technical, economic and social constraints to seed and feed production and management in Bangladesh” carried out from January to August 2012.

2.1 The Sixth Five Year Plan (2011–2015)

The Sixth Five Year Plan provides a strategic framework and guideline for reducing regional disparities, developing human capacity, managing land constraints, using natural resources, increasing agricultural productivity, household income and employment, and ensuring food security. The strategy for fisheries development emphasizes: open-water fisheries management, ensuring biodiversity and preserving natural breeding grounds; product diversification, value addition, capacity building and development of appropriate marketing infrastructure; dynamic and responsible capture fisheries; and sustainable aquaculture. The strategy would involve the key actors, e.g. non-governmental organizations (NGOs), private-sector entrepreneurs and community-based fishing. Special focus is given to increasing productivity in capture fisheries through good management practices, enhancing the productivity of shrimp culture through intensive shrimp farming, stock assessment and management of marine fisheries resources, and participation of communities in fisheries resource management.

2.2 National and sector development plans

The other guides for this Strategy and Action Plan are the national social and economic development goals (which are in line with the Millennium Development Goals) and, more specifically, the plans for the fisheries and livestock sector, the objectives (Planning Commission, 2014) of which are to:

- 1) increase fish and livestock production and improve nutritional level;
- 2) generate employment opportunities and alleviate poverty through promotion of fisheries and livestock production;
- 3) increase foreign earnings through increased export of shrimp, fish, fish products and leather products, and reduce imports of powdered milk;
- 4) increase research facilities for improving the quality of fish and livestock and increase production through improved technologies;
- 5) encourage the private sector in the production, research and marketing of fish, livestock and processed products.

2.3 Country Investment Plan

Finally, this Strategy and Action Plan derives directions from the CIP for Fisheries Resource Development covering the period 2010–15 (GoB, 2011).

2.3.1 Links with the Country Investment Plan

The CIP has three components: food availability, food access, and food utilization. Fisheries development is one of the six programmes under food availability.

This Strategy and Action Plan has links with the other five programmes in the food availability component,² and with two of the programmes of the food utilization component, namely: community-based nutrition activities through livelihood approaches; and food safety and quality improvement.

The fisheries programme of the CIP comprises four priorities for investment (Box 1). These emphasize the sustainable management and utilization of the aquatic resources for enhanced productivity, better nutrition, and improved incomes of the users of aquatic resources who are poor, as well as export earnings for the country. The social and economic goals of the investment plan are thus underpinned by environmental sustainability through the proper utilization and management of resources.

This Strategy and Action Plan covers the period 2013–2020 and is divided into two four-year planning periods. By 2016, a review shall be conducted and the necessary adjustments made on the Strategy and Action Plan.

² The six programmes under Food Availability are: (i) integrated research and extension to develop sustainable responses to climate change; (ii) improved water management and infrastructure for irrigation purposes; (iii) supply and sustainable use of agricultural inputs; (iv) fishery development programme; (v) livestock development programme; and (vi) access to markets, improved agricultural value added, and increased non-farm incomes.

Box 1. Investment priorities in fisheries development¹

- a) Improved management of inland and marine fisheries resources. Restoration of some open-water capture fisheries. This requires: stronger institutional arrangements and strengthening capacities for coordinated management involving users and communities; the development of community-based resource management, including support for fish sanctuaries through training, technical assistance and access to inputs and credit; and the potential development of community-based open-water culture-based fisheries. Research is needed that would focus on opportunities to increase capture production of small micronutrient-dense fish.
- b) Restoration of habitats through rehabilitation of degraded waterbodies; establishment of sanctuaries in suitable waterbodies; amendment of existing leasing policy from revenue oriented to biological management through public investment and community mobilization; conservation of hilsa fishery and alternative income generation for jatka² fishers.
- c) Increased productivity of small-scale inland aquaculture by: (i) developing low-cost aquaculture technologies, especially for smallholder farmers, and linking aquaculture business with insurance system; (ii) improving hatchery management practices and genetic quality of culture fish species; (iii) strengthening research and development with a focus on the needs of small farmers and opportunities to include micronutrient-dense small fish in culture systems; (iv) improving public and private advisory services for smallholder farmers willing to invest in aquaculture and in particular, in integrated aquaculture (fish–crops–livestock) systems; (v) providing advice and facilitating access to quality inputs (fingerlings, feed) and credit for business development; (vi) enhancing commercial aquaculture productivity under a public–private partnership; and (vii) reversing the genetic degradation in carps and other farmed fish species. In view of the increasing salinities in the south, supporting the integration of seasonal brackishwater culture including export-oriented shrimp and prawn culture with agriculture. This requires public-private partnerships that lead to improvements in the productivity of shrimp production, enhanced disease control, investments in a diagnostic laboratory, improved extension efforts supported by the private sector, capacity building and quality certification to comply with the requirements of the Hazard Analysis and Critical Control Points (HACCP) system and sanitary and phytosanitary standards; and the development, assistance and capacity building for co-management of wetlands.
- d) Mariculture of a few important species such as crab, mussel and oyster on coastal areas would be introduced where a substantial number of women can be involved. Owing to climate change, the acidification of the sea would be a deterrent to shrimp aquaculture; it might be an opportunity to introduce other species such as salt-tolerant tilapia, mullet and other marine fish.

¹ Only the items relevant to aquaculture are included in this list.

² Jatka is the local name for juvenile hilsa, which mostly belong to hilsa shad (*Tenualoza ilisha*) and elongate ilisha (*Ilisha elongata*), and fishers engaged in fishing of these juvenile hilsa are commonly known as jatka fishers.

Source: GoB (2011).

A striped catfish/pangas (*Pangasianodon hypophthalmus*) farm in Trishal, Mymensingh, Bangladesh. Aquaculture has been one of the fastest growing economic sub-sectors of the Bangladeshi economy. More than four million fishfarmers mostly small-scale and over 8.5 million people derive livelihood from it directly and indirectly. It provides 60 percent of the animal protein in the people's diet. Its share of the GDP is 4.4 percent. Export revenue in 2012 was estimated at US\$ 450 million.

COURTESY OF FAO/MOHAMMAD R. HASAN

3. The role of aquaculture in national development

The role of aquaculture is crystallized in the vision statement and specified in the mission statement.

3.1 The vision for the aquaculture sector

Based on the national social and economic goals, the fishery sector objectives, and the CIP priorities (GoB, 2011), the vision for aquaculture development is as follows:

“Aquaculture shall contribute to the societal objectives of equitable development and ecological sustainability, a healthy and productive society, and social and ecological resilience.”

3.2 The mission for aquaculture

To realize this vision, “Aquaculture development, encompassing all scales of operation from small to large, subsistence to industrial, shall be a means to improve the welfare of the many resource-poor people depending on the aquatic resources for livelihood, reduce poverty by stimulating employment and improving income, conserve and as much as possible enhance the natural resources on which livelihoods are based, promote the sustainable development of rural communities, increase export earnings and contribute to the creation of wealth for the nation and improvement in the welfare of the people.”

3.3 The pillars of sustainable aquaculture development

In harmony with the national goals, the objectives of aquaculture development are anchored on the three pillars of equitable social development, sustainable economic development and ecological health and biodiversity.



Harvest of striped catfish/pangas (*P. hypophthalmus*) in a homestead pond in Jamalpur, Bangladesh.

COURTESY OF FAO/JAYANTA SAHA

4. Objectives of the Strategy and Action Plan

The Strategy and Action Plan has four strategic objectives. The objectives are categorized under the three pillars of sustainability, namely, social, economic and environmental, and a fourth element to development, which is governance and institutional capacity, which enables the achievement of the other three objectives.

- 1) **Social development:** To enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods.
- 2) **Economic development:** To stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or earn foreign exchange through import substitution or more export earnings.
- 3) **Ecological health:** To promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience.
- 4) **Strong institutions:** To establish an enabling environment and develop the capability to effectively manage the sector, provide the support services needed for sustainable and responsible development, and help facilitate an equitable and fair allocation of resources and distribution of benefits.

The four objectives are interlinked in this manner:

- **Social:** social stability and equity are requisites for a conducive social climate that encourages investments in economic development and environmental management.
- **Economic:** economically developed communities tend to pay more attention to, and allocate resources to, improving their environment. Economic development fosters social stability and may encourage equity.
- **Ecological:** healthy and resilient ecological systems can better support economic development and contribute to social resilience.
- **Institutional:** effective governance underpins social accountability, orderly and equitable economic growth, and environmental responsibility.



*A farmer is preparing to feed his fish,
Mymensingh, Bangladesh.*

COURTESY OF FAO/NESAR AHMED

5. Outputs

The above objectives shall be achieved by the attainment of the outputs that are outlined below, under each goal. A number of the outputs address the challenges, gaps and government priorities indicated in the CIP Programme 4, Fisheries Development and revised by the stakeholders workshop that was held on 10 December 2012 (Box 2).

Box 2. Challenges, gaps and government priorities

From the Sixth Five Year Plan (2011–15), challenges include:

- construction of flood control embankments and roads;
- siltation;
- overfishing and fishing of undersized fish;
- discharge of chemical fertilizers and industrial effluents in the water;
- conflict between paddy cultivation and fish production;
- genetic degradation of carps;
- decline of floodplain fisheries;
- problems related to quality of feed and seed for inland aquaculture;
- rapid depletion of the stock of marine fisheries;
- complicated leasing of public wetlands, etc.

From the CIP 2010–15, challenges include:

- low productivity of fisheries (including aquaculture), wide yield gaps, increased environmental vulnerability and climate change impact, lack of organized market and low value addition;
- degraded public waterbodies and natural habitats that need urgent restoration and management, and regeneration of endangered indigenous fish species;
- improving the productivity of brackishwater shrimp;
- strengthening of human capacity for effective implementation of food safety measures, both for domestic consumption and export;
- strengthening of a weak national mainstream extension approach to assist in implementing the above challenges.

From the stakeholders workshop of 10 December 2012:

- production, distribution and management of quality key aquaculture inputs, especially seed and feed;
- strengthening and overseeing the regulatory framework to ensure quality control in the production of key aquaculture inputs such as feed and seed;
- updating the Fisheries Resource Survey Framework for inland and coastal aquaculture;
- improving food safety measures for aquatic products;
- strengthening extension capacity through training and institutional capacity building;
- developing indigenous marine, brackishwater and freshwater fish species for culture;
- strengthening conservation strategies by among others, establishing sanctuaries and protected areas.

From the National Working Committee Meeting of 4 May 2013:

- weakness in monitoring on-farm activities with reference to compliance with food safety, traceability and other import requirements;
- policy limitation in the management of common waterbodies that impinge on the ability of the aquaculture sector to access and utilize suitable water resources.

1. Social objective: Aquaculture shall enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods.

Outputs linked to the social objective:

- 1.1 Supply of cultured fish to rural and urban markets is increased by 50 percent by 2020.
- 1.2 An additional 200 000 fish farms, predominantly small scale, ranging from 0.15 ha (the current average area per farm) to 0.20 ha in size, are built on suitable lands and waterbodies; and existing extensive farms are semi-intensified and semi-intensive farms, if suitable, are intensified.
- 1.3 Culture-based fisheries and coastal aquaculture in suitable waterbodies are developed for the landless and for the coastal and marine fishers who are poor.
- 1.4 Low-input low-cost aquaculture systems, especially mariculture systems, are developed for the resource-poor and promoted as an alternative livelihood opportunity for poor fishers.
- 1.5 Integrated aquaculture-agriculture and aquaculture-silviculture systems are developed and promoted.

These outputs will contribute to food security and better nutrition from higher production and diversified production systems, more opportunities for livelihoods in rural areas, especially for poor households, the landless and women-headed households, and the fishers who may be displaced in the future. The outputs will include activities that develop suitable culture systems and exploit the potential of the currently untapped resources such as coastal waters for brackishwater aquaculture / mariculture, and floodplains for aquaculture and culture-based fishery.

2. Economic objective: Aquaculture shall stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or earn foreign exchange through import substitution or more export earnings

Outputs linked to the economic objective:

- 2.1 Productivity and corresponding profitability of fish farms are increased by 50 percent by 2020.
- 2.2 Five thousand additional rural markets with a fish and fish products section are established or improved by 2020.
- 2.3 Value-added products are developed and promoted that improve incomes of all stakeholders in the value chain, including small producers and processors.
- 2.4 Access of aquaculture products to local and international markets is facilitated and income raised for small producers, processors and traders.

These outputs will increase returns to input suppliers, farmers, processors and traders by improved raw material and product quality, value addition and other means, as well as by enabling an equitable sharing of the value of the product with a better-managed and more efficient value chain.

3. Ecological objective: Aquaculture shall promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience.

Outputs linked to the ecological objective:

- 3.1 Management programme for fisheries and habitats of freshwater fishes is established; management programme of inland waterbodies for aquaculture and fisheries use is jointly developed by the ministries with jurisdiction over such bodies and the Ministry of Fisheries and Livestock (MoFL).
- 3.2 Conservation programme for genetic resources of indigenous and exotic species is established.
- 3.3 Spatial planning for aquaculture development with an ecosystem approach is established.
- 3.4 An integrated environmental monitoring system is put in place to ensure aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.

These outputs will contribute to the conservation of the natural capital and biological resources upon which aquaculture depends. They will seek to make aquaculture a net contributor to the nation's natural capital – its land, water and genetic/biological resources.

4. Institutional objective: The national institutions dedicated to the governance of the fisheries subsector, as well as those involved in the management of aquaculture development, shall have the capability to manage the sector effectively, provide the support services needed for sustainable and responsible development, and help facilitate the universal objective of equitable and fair allocation of resources and distribution of benefits.

Outputs linked to the institutional objective:

- 4.1 Capacities of national and local government institutions, research and development and other institutions to provide technical support to planning, developing, managing, monitoring and regulating aquaculture and fisheries are strengthened.
- 4.2 Farmers clusters and associations are assisted to organize and members trained in management and technical skills and in better management practices (BMPs) in compliance with, among others, environmental standards, food safety standards and traceability.
- 4.3 Appropriate credit facilities and insurance schemes are developed for farmers associations and women's enterprises.

These outputs will strengthen the capacity of public and private institutions, academic institutions and civil society that have a significant role in managing the aquaculture sector. This institutional capacity building will be matched by building the capabilities and skills of fish-farming communities by organizing and training them and by building linkages among them and with service providers to expand their social capital. Reform or improvement in policies, regulations and procedures will be part of capacity building. Partnerships among organizations and agencies and between public agencies and private enterprises will be based on complementing one another's strengths and building on their respective results (rather than duplicating them), removing overlaps that waste public resources, and focusing on common issues so that their collective strength is applied to resolving the issues effectively.

6. Activities

To produce the outputs, the following activities, described under the respective outputs, shall be carried out:

6.1 Social objectives

Activities under Output 1.1: Supply of cultured fish to rural and urban markets is increased by 50 percent by 2020.³

- 1) Providing better-quality feed and seed at reasonable costs by improving the efficiencies and quality of outputs of government brood farms and private hatcheries and the medium- and small-scale feed manufacturers.
- 2) Improving transport systems from farm to market, post-harvest handling and quality preservation, food safety of aquatic products, and developing market infrastructure and marketing services.
- 3) Facilitating the formation of a national food safety authority.

Activities under Output 1.2: An additional 200 000 fish farms, predominately small-scale, ranging from 0.15 ha (the current average area per farm) to 0.20 ha in size, are built on suitable lands and waterbodies; and existing extensive farms are semi-intensified and semi-intensive farms, if suitable, are intensified.

- 1) Assessment and survey of fresh, brackish and coastal waterbodies for the suitability of space for aquaculture activities involving various species of fish and crustaceans, with due consideration of competing uses of resources and the impacts of aquaculture on other users.
- 2) Development of a land allocation and water lease regulation for the efficient use of public waterbodies in collaboration with Ministry of Lands and Ministry of Water Resources and other agencies with jurisdiction over public waters.
- 3) Pilot trials of systems and species in waterbodies – freshwater, brackishwater and coastal – that are identified as suitable for aquaculture.
- 4) Training of new and existing fish farmers in the successful aquaculture systems that have been piloted.
- 5) Establishment of technical assistance and credit programmes for new fish farmers.
- 6) Development of farming systems research and extension programmes that are focused on supporting the intensification of fish farming by

³ Between 2007 and 2010, aquaculture production increased from 0.946 million tonnes to 1.308 million tonnes (this seems to be under-reported, because tilapia production was probably four times higher than the reported production of 25 823 tonnes in 2010 [FAO, 2014]). Reported tilapia production in 2011 was 104 716 tonnes.

bringing currently extensive farms to semi-intensive levels, and currently semi-intensive farms that are suitable for further intensification to intensive levels.

Activities under Output 1.3: Culture-based fisheries and coastal aquaculture in suitable waterbodies are developed for the landless and for the coastal and marine fishers who are poor.

- 1) Activity "1" under Output 1.2 will include the assessment of open waterbodies and coastal waters suitable for culture-based fisheries and coastal aquaculture and enabling better access to the water resources by the users.
- 2) Access by communities to open waterbodies will be facilitated with regulations, and guidelines for community management of culture-based fisheries shall be developed based on the lessons learned from previous and ongoing activities; participation of women in the management of the systems shall be enhanced.
- 3) Communities around open waterbodies will be organized for community input and management of culture-based fisheries.
- 4) Suitable species will be stocked in these waterbodies and the arrangements for rearing, protecting and harvesting the fish and sharing the benefits among the members of the community association will be developed.
- 5) Farmers will be trained and assisted in stock enhancement and management and the coastal aquaculture of finfish and other species.
- 6) A suitable marine fisheries station will be strengthened into a coastal aquaculture/mariculture research and development centre.
- 7) The same activities: Activity 2 (improving transport systems from farm to market) of Output 1.1 and Activities 3 (pilot trials), 4 (training) and 5 (technical assistance and credit) of Output 1.2 will support Output 1.3.

Activities under Output 1.4: Low-input low-cost aquaculture systems, especially mariculture systems, are developed for the resource-poor and promoted as an alternative livelihood opportunity for poor fishers.

- 1) Adaptive research, training and extension programmes will be developed to focus on improving and promoting the adoption of low-cost low-input aquaculture systems suitable for families that are poor and especially for women-headed households.
- 2) Entry of resource-poor households into aquaculture will be facilitated through suitable input provision, credit, marketing and technical assistance programmes.

Activities under Output 1.5: Integrated aquaculture-agriculture and aquaculture-silviculture farming systems are developed and promoted.

- 1) An interdepartmental programme between fisheries, crops and forestry will be developed to revitalize and promote integrated aquaculture-agriculture, as well as aquaculture-silviculture farming systems for small-scale farmers.
- 2) Adaptive and farming systems research, training, extension and credit support components will be developed to assist small-scale farmers to properly manage integrated systems.

6.2 Economic objectives

Activities under Output 2.1: Productivity and corresponding profitability of fish farms are increased by 50 percent by 2020.

- 1) A breeding programme, through a government-private hatcheries partnership scheme, to develop faster growing and more feed-efficient varieties will be established.
- 2) Culture technology and farming systems will be developed and promoted to increase yields per decimal⁴ and keep the cost of production down.
- 3) The technical support services and provision and delivery of inputs including credit and crop insurance shall be strengthened.
- 4) Farmgate prices will be stabilized by a marketing support (not subsidies) for farmers to enable them to capture most of the benefit from the market chain.
- 5) The quality and efficacy of locally formulated feed by small- and medium-scale feed manufacturers shall be improved.
- 6) The inefficiencies in the market chain – such as technical and economic inefficiencies in feed and seed production and distribution and in farm production and product marketing, among others – will be addressed and resolved to stabilize prices of raw materials and market prices of farm products in order to improve the profitability of seed producers, feed manufacturers and farmers.
- 7) Product quality preservation (such as icing and refrigeration) will be improved and made accessible to all farmers.
- 8) Aquaculture-based enterprises will be developed, piloted and promoted for adoption by fish-farming households to provide more rural employment for women and to generate income for households.

⁴ 247 decimals = 1 ha.

Activities under Output 2.2: Five thousand additional rural markets with a fish and fish products section are established or improved by 2020.

- 1) A nationwide programme for developing market infrastructure, facilities and farm-to-market roads will be developed and implemented.
- 2) A public-private partnership in market development, operation and maintenance will be encouraged and given sufficient support.

Activities under Output 2.3: Value-added products are developed and promoted that improve incomes of all stakeholders in the value chain, including small producers and processors.

- 1) Rural enterprises in value addition of fish products, operated by organized women's groups will be encouraged to be formed and shall be supported with the appropriate technical advice and services, such as credit, training in production and product development and marketing.
- 2) Research, training, extension, technical advice and support in terms of equipment and access to operating capital on affordable terms will be provided to the processing enterprises.
- 3) Local and foreign markets will be developed for the processed products and a promotional campaign planned and organized for specific products.

Activities under Output 2.4: Access of aquaculture products to local and international markets is facilitated and income raised for small producers, processors and traders.

- 1) A real-time market information service, supported by the new information and communications technology, will be extended to farmers, who shall be organized into associations and trained to access the service.
- 2) Quality and food safety programmes that include certification schemes, on-farm monitoring and traceability for aquaculture products for local and export markets will be developed and promoted.
- 3) Value-added prawn and shrimp⁵ products will be developed and promoted for export.
- 4) Activity 3 (new market development and promotion) of Output 2.3 will also support Output 2.4.

⁵ Cultured crustacean species consists mainly of black tiger shrimp [*Penaeus monodon*], giant river prawn [*Macrobrachium rosenbergii*] and giant mud crab [*Scylla serrata*].

6.3 Ecological objectives

Activities under Output 3.1: Management programme for fisheries and habitats of freshwater fishes is established; management programme of inland waterbodies for aquaculture and fisheries use is jointly developed by the ministries with jurisdiction over such bodies and the MoFL.

- 1) Fish-farming communities will be organized and empowered to protect and conserve habitats and biodiversity in all waterbodies where aquaculture is possible within their jurisdictions under a co-management regime.
- 2) An interagency programme on inland freshwater fishery and coastal brackishwater fishery resources management will be developed. Key elements include: (a) the lease period of a waterbody for aquaculture use should be at least 25 years through a memorandum of understanding for biological management; and (b) a strong linkage should be developed among all agencies that have jurisdiction over waterbodies.
- 3) Rules and regulations will be developed or reformed to enhance the conservation of fishery resources.

Activities under Output 3.2: Conservation programme for genetic resources of indigenous and exotic fish species is established.

- 1) A selective breeding programme will be developed for Indian major carps and other indigenous species⁶ and suitable exotic species⁷ now being cultured or with potential for culture:
 - A national strategy for broodstock development will be established by the Government.
 - One or two large government fish hatcheries and farms will be used as nucleus breeding centres for selective breeding programmes; other farms will function as satellite stations for maintaining germplasm and distributing improved broodstock to the public- and private-sector hatcheries.

⁶ There are 13 cultured indigenous species of finfish consisting of three Indian major carps (catla [*Catla catla*], mrigal [*Cirrhinus cirrrosus*]) and rohu [*Labeo rohita*], five other carps or barbs (bata [*L. bata*], kuria labeo [*L. gonius*], olive barb [*Systomus sarana*], orangefin labeo/kalbasu [*L. calbasu*] and putitor mahseer [*Tor putitora*]), four catfishes (Gangetic mystus [*Mystus cavasius*], pabda catfish [*Ompok pabda*], stinging catfish [*Heteropneustes fossilis*]) and walking catfish [*Clarias batrachus*], and climbing perch [*Anabas testudineus*].

⁷ There are nine introduced (exotic) species of finfish being farmed: four Chinese carps (bighead carp [*Hypophthalmichthys nobilis*], black carp [*Mylopharyngodon piceus*], grass carp [*Ctenopharyngodon idella*] and silver carp [*H. molitrix*]), and common carp (including mirror carp) [*Cyprinus carpio*]), silver barb [*Barbomyrus gonionotus*], striped catfish [*Pangasianodon hypophthalmus*] and Nile tilapia [*Oreochromis niloticus*] and Thai variety of climbing perch [*Anabas testudineus*].

- A laboratory for genetic analysis for characterization of broodstock will be established at the nucleus breeding centres with the necessary technical expertise.
 - The feasibility of establishing one nucleus breeding centre (for quality broodstock development) in a private-sector hatchery, under the supervision of government staff, will be explored.
- 2) A genetic conservation programme will be developed both *in situ* (i.e. through sanctuaries and the restoration of habitats) and *ex situ*, the latter to be assisted by cryopreservation and other suitable technologies.
 - 3) In collaboration with other agencies, the broodstock farms of the government will be strengthened to provide more effective service in developing high-quality broodstock.
 - 4) The introduction and use of alien species will be carefully managed, including the establishment of a quarantine system and certification process following the provisions of the FAO Code of Conduct for Responsible Fisheries Articles 9.2⁸ and 9.3⁹ (FAO, 1995), the FAO Technical Guidelines for Responsible Fisheries on Genetic Resource Management (FAO, 2008) and the International Council for the Exploration of the Sea Code of Practice on the Introductions and Transfers of Live Aquatic Organisms 2005 (ICES, 2005).
 - 5) The use of the existing introduced species will be optimized and carefully managed to prevent their escape and establishment in natural waterbodies.
 - 6) An effective fish health management programme consisting of a strong surveillance, monitoring, prevention and control system will be developed.
 - 7) A programme to eradicate illegal and destructive fishing will be instituted to be implemented by a combination of mandatory and co-management schemes.

Activities under Output 3.3: Spatial planning for aquaculture development with an ecosystem approach is established.

- 1) Mapping of freshwater and coastal habitats, including floodplains and coastal tidelands, will be conducted to help fishery management and aquaculture site selection.
- 2) Aquaculture development will be supported through defining the needed institutional setup for and the mapping of suitable areas for the development of aquaculture.

⁸ Responsible development of aquaculture including culture-based fisheries within transboundary aquatic ecosystems.

⁹ Use of aquatic genetic resources for the purposes of aquaculture including culture-based fisheries.

- 3) Climatic and other risks for the sector, carrying capacities for maximum production and preservation of ecosystem services and social carrying capacity will be assessed.
- 4) Spatial planning capacities will be created through technical training to plan for the expansion of the aquaculture sector and to monitor and regulate existing aquaculture facilities.

Activities under Output 3.4: An integrated environmental monitoring system is put in place to ensure aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.

- 1) An integrated environmental monitoring system is created to ensure aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.
- 2) Monitoring capacities are created through technical training and capacity-building modules.

6.4 Institutional objectives

Activities under Output 4.1: Capacities of national and local government institutions, research and development and other institutions to provide technical support to planning, developing, managing, monitoring and regulating aquaculture and fisheries are strengthened.

- 1) Training institutions for fishers, fish farmers and fish traders, as well as for the personnel related to fish and fisheries will be developed for preparation of training modules, setting up of field laboratories and for solution of field problems (technical, ecological, financial, social, etc.).
- 2) Management and extension staff of the DoF and other agencies including NGOs will be trained in relevant competencies.
- 3) Systems and procedures for development of policy, regulations and directives and the issuance of licenses will be made more efficient, faster and transparent.
- 4) Capacity for information and statistics gathering, processing, analysis and dissemination at the national and local levels will be strengthened; a fisheries resource survey and database unit will be established in order to survey, update and digitize fisheries resources database for the use of information and communication technology (ICT) personnel and for national planning and development.
- 5) A communication support system for planning, management, enforcement and public information will be developed based on modern ICT and traditional media. Enforcement capacities will be strengthened, including monitoring and surveillance.

- 6) Codes of conduct and BMPs in fish farming, hatchery management and farm-made and semi-commercial feed formulation will be developed, and their adoption by farmers, input producers and suppliers, and processors encouraged.
- 7) Standards and certification systems will be developed or improved for inputs and products (formulated feed, seed, and marketable fish and shrimp) and processes (farm-made and semi-commercial feed production and storage, hatchery management and operation, nursery operation) and promoted for adoption.
- 8) Capacity for on-farm monitoring, with the active involvement of the farmer clusters and associations, will be strengthened for traceability and other purposes.
- 9) A set of technical implementing guidelines for the Fish Feed and Animal Feed Act, 2010 will be developed and made a provision of the act.
- 10) A pilot feed quality analytical laboratory will be established.
- 11) A post of fishery regulation officer will be created (Grade VI) at the district level. These officers will be specialized in the Fish Act, Seed Certification, Fish Hatchery Act, Fish Feed and Animal Feed Act, National Residue Control Plan, etc.
- 12) Existing fisheries educational and research institutions (e.g. Bangladesh Agricultural University, Bangladesh Fisheries Research Institute, quality control laboratories) will be strengthened in order to render more effective services to aquaculture and culture-based fisheries.
- 13) A national apex forum will be established with the mandate to protect and negotiate fisheries interests in case of conflicts over common resources and regional interests over shared waterbodies.
- 14) Support will be extended to the public-private partnership initiative (namely, the Aquaculture and Aquatic Food Safety Center) to reinforce national efforts aimed at achieving food security and food safety.

Activities under Output 4.2: Farmers clusters and associations are assisted to organize and members trained in management and technical skills and in better management practices (BMPs) in compliance with, among others, environmental standards, food safety standards and traceability.

- 1) Institutional forums will be encouraged and their formation assisted for small- and medium-scale feed manufacturers, fish traders, fish farmers and fishers development associations at the local level and through federations of specific groups (e.g. fish farmers, seed producers, small and medium-sized enterprises, feed manufacturers, fish traders, women in fisheries groups) at the national level for the advancement and protection of group interests, as well as for technology development and dissemination and coordination.

- 2) Public-private partnerships in technology development and enterprise development will be encouraged and facilitated with appropriate incentives and technical assistance.
- 3) Associations of fish farmers, seed producers, and small-and medium-scale feed manufacturers will be assisted to organize and their members trained in management and technical skills.
- 4) Special credit facilities and insurance schemes will be developed for associations.

Activities under Output 4.3: Appropriate credit facilities and insurance schemes are developed for farmers' associations and women's enterprises.

- 1) Public-private-civil-society partnerships in the provision of financial services will be established.
- 2) Institutions for public-private entrepreneurs will be developed and mainstreamed.
- 3) A strategy for raising capital for lending and provision of crop insurance will be developed.
- 4) Soft loans will be provided by the target group associations themselves with financial support from national donor agencies and banks or through their own savings.
- 5) A high-powered institution will be established in order to support insurance of aquaculture investors (e.g. fish farmers, traders, hatchery operators).

A close-up photograph showing two Nile tilapia (Oreochromis niloticus) being held by a person's hands. The fish are silver with a distinct blue tinge along their lateral lines and fins. They have large, prominent mouths and eyes. The background is a dark, textured surface, likely a pond or netting.

*Farmed Nile tilapia (*Oreochromis niloticus*) harvested from a pond in Jamalpur, Bangladesh.*

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7. Evaluation of Strategy and Action Plan

7.1 Key indicators of the achievement of outputs as well as targets are given in Appendix 1. Some of the key indicators are: per capita consumption of fish, yields per unit area, returns per unit farmed area, incomes of farm households, export revenue, increase in the number of farmers and farms, and expansion of area under culture.

7.2 Time frame of the plan period is eight years starting from 2013. Evaluation of achievements and necessary adjustments in the Strategy and Action Plan shall be carried out in the fourth year of the plan period in 2016 and at the end of the plan period in 2020.

Giant river prawn (*Macrobrachium rosenbergii*)
for sale in a local market in Mymensingh,
Bangladesh.

COURTESY OF FAQINESAR AHMED

8. Management and implementation

8.1 Management of the Strategy and Action Plan

The lead agency shall be the MoFL. It shall have primary responsibility for the management, implementation and evaluation of the Strategy and Action Plan.

8.2 Funding and indicative budget allocation

A priority-setting exercise will establish the priority rankings among the outputs. The stakeholders workshop identified seven project ideas for implementation in the first two years of the plan period. These are listed in Appendix 3.

Funding will be allocated by goal and subdivided among outputs. An indicative budget allocation is provided below (Table 2) based on a total investment of US\$170 million over eight years or an average of US\$21 million per year. The funding is envisioned to be from national funds, private-sector contributions and donor assistance. This indicative allocation is 1.68 percent of the estimated cost of the CIP, which is US\$10.1 billion (GoB, 2011).

Table 2.
Indicative budget allocation

Budget Allocation	2013–2016	2017–2020	Total
	US\$ million		
1. Social objective	20	20	40
Output 1.1 (3 activities) Supply of cultured fish to rural and urban markets is increased by 50 percent by 2020	4	4	8
Output 1.2 (6 activities) An additional 200 000 fish farms are built on suitable lands and waterbodies	6	4	10
Output 1.3 (7 activities) Culture-based fisheries and coastal aquaculture in suitable waterbodies are developed for the landless and for the poor fishers	6	4	10
Output 1.4 (2 activities) Low-input low-cost aquaculture systems are developed for the resource-poor	2	4	6
Output 1.5 (2 activities) Integrated aquaculture-agriculture and aquaculture-silviculture systems are developed and promoted	2	4	6
2. Economic objective	40	20	60
Output 2.1 (8 activities) Productivity and corresponding profitability of fish farms are increased by 50 percent by 2020	12	8	20

Budget Allocation	2013–2016	2017–2020	Total
	US\$ million		
Output 2.2 (2 activities) Five thousand additional rural markets are established or improved by 2020	12	6	18
Output 2.3 (3 activities) Value-added products are developed and promoted	8	4	12
Output 2.4 (4 activities) Market access of aquaculture products is facilitated	8	2	10
3. Ecological objective	15	15	30
Output 3.1 (3 activities) Management programme for fisheries and habitats of freshwater fishes is established	4	4	8
Output 3.2 (7 activities) Conservation programme for genetic resources of indigenous and exotic species is established	6	6	12
Output 3.3 (4 activities) Spatial planning for aquaculture development with an ecosystem approach is established	2	2	4
Output 3.4 (2 activities) An integrated environmental monitoring system is put in place to ensure aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems	3	3	6
4. Institutional objective	30	10	40
Output 4.1 (14 activities) Capacities of institutions are strengthened	18	4	22
Output 4.2 (4 activities) Farmers' clusters and associations are assisted to organize and members trained in management and technical skills	6	4	10
Output 4.3 (5 activities) Appropriate credit facilities and insurance schemes are developed for farmers' associations and women's enterprises	6	2	8
TOTAL	105	65	170

8.3 Funding sources and budget mechanism

- Funding sources will be from the national treasury (US\$40 million) and external assistance.
- Programmes and projects will be developed for external assistance (US\$100 million).
- Certain projects will be a public-private partnership (private-sector share US\$30 million).

- Budget management and control will be by the MoFL.
- Direct responsibility for budget disbursement for projects will be devolved to the collaborating institutions, and agreements will be made as to which of the partners shall be the lead agency, and which shall be responsible for project coordination, including financial management.

8.4 Ownership: stakeholders in the Strategy and Action Plan

The institutions and groups that have a major stake in the Strategy and Action Plan are presented in Table 3.

Table 3.

Institutions and groups having a major stake in the Strategy and Action Plan

Primary stakeholders	Collaborating stakeholders
<ul style="list-style-type: none"> • Ministry of Livestock and Fisheries • Department of Fisheries • Bangladesh Fisheries Research Institute • Bangladesh Fisheries Development Corporation • Ministry of Planning • Ministry of Agriculture • Ministry of Environment and Forests • Ministry of Land • Ministry of Water Resources • Bangladesh Agricultural Research Council (BARC) • Relevant universities (e.g. Bangladesh Agricultural University, Dhaka University, Khulna University) • Relevant foundations/NGOs (i.e. BRAC, Bangladesh Shrimp and Fish Foundation, others) • Fish Farm Owners Association, Bangladesh • Bangladesh Aquaculture Alliance • Shrimp Hatchery Association of Bangladesh • Shrimp Farm Owners' Association • Bangladesh Fish and Shrimp Exporters Association • Bangladesh Frozen Foods Exporters Association 	<ul style="list-style-type: none"> • Network of Aquaculture Centres of Asia-Pacific • Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asian and Pacific Region • Bangladesh Rice Research Institute • Ministry of Commerce • Ministry of Labour and Employment • Ministry of Women and Children Affairs • Ministry of Food • Ministry of Disaster Management and Relief • Ministry of Health and Family Welfare • Rural Development & Cooperatives Division • Food and Agriculture Organization of the United Nations • WorldFish • Donor agencies

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Appendix 1

Indicators and targets, 2013–2020 (illustrative example)

Social objective: Aquaculture shall enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods¹

Indicators	Baseline 2012 (or latest year data are available)	By end of 2016	By end of 2020
Per capita fish consumption (kg/year)	18.90	19.50	20.00
Per capita fish demand (kg/person/year)	20.44	20.75	21.00
Number of farms operating			
(a) Farms (million) (fish, prawn and shrimp)	4.50	4.60	4.70
(b) Farmers (million) (fish, prawn and shrimp)	4.23	4.33	4.43
(c) Farming areas (million ha) (fish, prawn and shrimp)	0.67	0.68	0.70
No. of farmers trained (million)	0.40	0.45	0.50
Employment (direct and indirect) in aquaculture (million)	8.50	9.00	10.0

¹ average area of 0.15 ha per farm multiplied by 100 000 more farms in 2016 and 200 000 more farms in 2020.

Economic objective: Aquaculture shall stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or earn foreign exchange through import substitution or more export earnings

Indicators	Baseline 2011 ¹	By end of 2016	By end of 2020
Total output	1.46 million tonnes	2.15 million tonnes	2.93 million tonnes ¹
Yield per unit area (by species)	Tilapia: 40.5 kg/dec ² (9.8 tonnes/ha); striped catfish: 81 kg/dec (19.7 tonnes/ha) carps: 22 kg/dec (5.3 tonnes/ha); prawns/shrimp: 4 kg/dec (0.99 tonnes/ha)	Tilapia: 52 kg/dec (12.6 tonnes/ha); striped catfish: 90 kg/dec (21.9 tonnes/ha); carps: 30 kg/dec (7.3 tonnes/ha); prawns/shrimp: 6 kg/dec (1.5 tonnes/ha)	Tilapia: 60 kg/dec (14.6 tonnes/ha); striped catfish: 100 kg/dec (24.3 tonnes/ha); carps: 35 kg/dec (8.5 tonnes/ha); prawns/shrimp: 8 kg/dec (1.9 tonnes/ha)

Indicators	Baseline 2011 ¹	By end of 2016	By end of 2020
Total output	1.46 million tonnes	2.15 million tonnes	2.93 million tonnes ¹
Returns per decimal (small/medium/large farm; shrimp/prawn farm)	Small farm: BDT2 500 ³ (US\$31) Medium farm: BDT3 500 (US\$43) Large farm: BDT5 000 (US\$62) (also depends on species)	Small farm: BDT3 000 (US\$37) Medium farm: BDT4 500 (US\$56) Large farm: BDT6 000 (US\$74) (also depends on species)	Small farm: BDT4 000 (US\$49) Medium farm: BDT5 500 (US\$68) Large farm: BDT7 500 (US\$93) (also depends on species)
Export revenue	US\$450 million	US\$600 million	US\$800 million
Income of farm household from aquaculture	BDT84 000/year (US\$1 037)	BDT110 000/year (US\$1 358)	BDT125 000/year (US\$1 543)

¹ Based on average annual percentage growth rate of 8.06 percent (baseline 1.461 million tonnes in 2011 from Table 1) over nine years to 2020.

² 1 ha = 247 decimals (dec).

³ US\$1= Bangladesh Taka (BDT) 81.00 in 9 December 2012.

Ecological objective: Aquaculture shall promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience

Indicators	Baseline 2012	By end of 2016	By end of 2020
No. of private hatcheries producing seed of indigenous species	Fish: 845 Prawn: 67 Shrimp: 58 Total: 970	Fish: 950 Prawn: 75 Shrimp: 65 Total: 1 090	Fish: 1 100 Prawn: 90 Shrimp: 75 Total: 1 265
Total seed production	629 176 kg	800 000 kg	1 million kg
Quantity of seed of indigenous species produced	50% of above (314 600 kg)	400 000 kg	500 000 kg
Level of illegal and destructive fishing	30% illegal and destructive fishing	25% illegal and destructive fishing	20% illegal and destructive fishing

Institutional objective: The national institutions dedicated to the governance of the fisheries subsector, as well as those involved in the management of aquaculture development, shall have the capability to manage the sector effectively, provide the support services needed for sustainable and responsible development, and help facilitate the universal objective of equitable and fair allocation of resources and distribution of benefits.

Indicators	Baseline 2012	By end of 2016	By end of 2020
Trained staff in management, information, extension and enforcement		5 000 government managers and technical personnel	7 000 government managers and technical personnel
Fish Hatchery Act and Fish Feed and Animal Feed Act enforced	Acts already enacted and disseminated	Implementing guidelines developed and operational	Quality of seed achieved standards set by the act; Quality of feed achieved standards set by the act
Better practices guidelines developed and adopted	None, except for shrimp	BMPs for hatchery, better feed manufacturing practices, and BMPs for grow-out culture developed and promoted	All associations adopt and follow better practice guides
Aquaculture information system and communication support system strengthened		Established in DoF and half of local offices of DoF and all of them linked	Established in all local offices of DoF and associations and all of them linked
Associations established		1 national association of seed producers 1 national association of small- and medium-scale aquafeed manufacturers	1 national federation of small fish farmers organized Revolving fund of associations established and viable
Members of associations trained		100 000	100 000 more = 200 000 over 8 years
Credit and insurance established for members of associations	None	Credit service established and operational	Crop insurance established and operational



Landing of hilsa (hilsa shad *Tenualoa ilisha* and elongate ilisha *Ilisha elongata*) using a traditional country boat, Chandpur, Bangladesh.

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Appendix 2

Logical framework for the Strategy and Action Plan

1. Strategic objectives

Social objective	Objectively verifiable indicators	Means of verification	Assumptions and risks
Aquaculture shall enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods	Productive employment along the aquaculture value chain increases. Consumption of fish increases in inland communities.	Report of the Department of Labour and Department of Fisheries (DoF). Consumption surveys.	Livelihood options and farming systems must be sustainable and not based on subsidies for economic viability. Capacity of the DoF and other partners is crucial in developing and promoting sustainable livelihood options. Private-sector partnership with government will be a good enabler of this objective.

Economic objective	Objectively verifiable indicators	Means of verification	Assumption and risks
Aquaculture shall stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households and save or increase foreign exchange through import substitution or more export earnings.	Supply of fish increases in markets located in population centers. Income of fish farmers, processors, hatchery operators increases. Export revenues from aquaculture products increase (or decrease).	Market surveys. Economic surveys. Sample surveys of inland communities. Reports of government export volumes and receipts.	Economic returns or profitability is a central incentive but should not be pursued at the expense of the environment and social stability. At the same time, laws and regulations should be such that they do not stifle economic goals of fishing and farming enterprises.

Ecological objective	Objectively verifiable indicators	Means of verification	Assumption and risks
Aquaculture shall promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources and ecological resilience.	Catch from inland fisheries increases or does not decline. Incidence of illegal fishing declines.	Sample surveys, catch reports of fishers. Reports of the DoF.	The capacities and willingness to adopt the ecosystems approach to fisheries (and aquaculture) management should be increased. Political will and the technical expertise to achieve this objective are needed.

Institutional objective	Objectively verifiable indicators	Means of verification	Assumption and risks
The national institutions dedicated to the governance of the fisheries subsector, as well as those involved in the management of aquaculture development, shall have the capability to manage the sector effectively, provide the support services needed for sustainable and responsible development, and help facilitate the universal objective of equitable and fair allocation of resources and distribution of benefits.	Government allocates adequate resources to research, development, extension, training and regulatory enforcement. Producers associations are organized and professionally managed. Better practices are widely adopted by associations and their members.	Better services to aquaculture and increased efficiency of the DoF; annual reports. Monitoring report of the DoF and reports of associations.	Aquaculture subsectors must be governed by a good balance of mandatory (rules), market-based and voluntary or self-management mechanisms. This requires close collaboration or partnerships among public and private and civil society organizations.

2. Outputs

Outputs	Objectively verifiable indicators	Means of verification	Assumptions and risks
Social objective: Aquaculture shall enhance the health and well-being of the people through the production of nutritious food and the development of productive and secure livelihoods.			
1. Supply of cultured fish to rural and urban markets is increased by 50% by 2020.	Production reports of DoF field workers.	Statistics of production survey reports.	A strengthened information system within DoF, with links to the farmer associations would make data gathering faster and likely more reliable.
2. 200 000 more fish farms are built on suitable lands and waterbodies (average of 25 000 a year).	Actual number of farms built and operating.	Statistics. Registry of farms.	This is predicated on a reliable assessment of potential sites and an equitable land and water allocation system. The technical support services for new entries should be available in these new areas.
3. Culture-based fisheries and coastal aquaculture in suitable waterbodies are developed for the landless and for the poor fishers.	Cage units. Fingerlings stocked for culture-based fisheries.	Reports of DoF.	The same assumptions as above.
4. Low-input low-cost aquaculture systems are promoted for the resource-poor.	Adaptive research. Pilot trials. Farms adopting the farming systems.	Research reports. Field reports. Annual reports. Manuals produced.	A farming systems research and development and extension approach, with farm trials at some stage of the process, would increase relevance and adoption of the technology developed.
5. Integrated aquaculture-agriculture and aquaculture-silviculture systems will be developed and promoted.	Adaptive and farming systems research and extension. Pilot trials. Farms adopting the farming systems.	Research reports. Field reports. Annual reports. Manuals produced	Same as above.

Outputs	Objectively verifiable indicators	Means of verification	Assumptions and risks
Economic objective: Aquaculture shall stimulate more economic activities in rural communities, create more rural employment opportunities, increase incomes of rural households, and save or increase foreign exchange through import substitution or more export earnings.			
1. Productivity and corresponding profitability of fish farms are increased by 50% by 2020.	Production reports.	Sample surveys. Cost and return analysis of sample farms.	The important systems and species should be covered by an economic study. The factors that improve technical and economic efficiency should be identified. The results should be incorporated in training and extension programmes.
2. Five thousand additional rural markets are established or improved by 2020.	Actual number.	Reports of DoF and Department of Commerce.	The infrastructure development needs to be complemented by the promotion of hygienic, food safety and quality standards and procedures.
3. Value-added products are developed and promoted.	Actual products being introduced into the market. Enterprises producing the products.	Market survey. Reports of MoFL and Ministry of Commerce and Employment.	A market study should be done before any product form is promoted for production. Initial financial assistance followed by market-based financing should be developed to provide capital to the enterprises.
4. Market access of aquaculture products is facilitated.	Increase in product forms being sold locally and exported. Increase in the volume of aquaculture products. Adherence to product quality and safety standards.	A value-chain study. Sample market surveys/interviews with traders, processors and farmers. Economic cost and return studies.	A value-chain study should include a determination of the relative shares obtained by each player in the chain of the final value of the product. This will indicate the efficiency of the chain and an indication of equity.

Outputs	Objectively verifiable indicators	Means of verification	Assumptions and risks
Ecological objective: Aquaculture shall promote the conservation of aquatic biodiversity, enhancement of genetic resources, conservation of natural resources, and ecological resilience.			
1. Management programme for fisheries and habitats of freshwater fishes is established.	Regulations on habitat protection and illegal fishing and deliberate or inadvertent alteration of habitats. Projects on habitat rehabilitation. Sanctuaries and protected areas designated. Government allocation for protection and rehabilitation.	Regulations issued. Reports of Planning and Evaluation Cell of MoFL. Sanctuaries and protected areas declared.	Potential conflicts with fisher and other communities should be resolved; aquaculture itself can be a cause of habitat alteration. Programme's core should be community-based resource management.
2. Conservation programme for genetic resources of indigenous and exotic species is established.	Breeding programme for indigenous and exotic species. Broodstock farms and hatcheries implementing this programme.	Programme reports. Reports of DoF and actual inspection of farms. Implementation of the protocol on introduction of alien species (quarantine, certification, prevention of escapes, etc.).	This can be an activity for public-private partnership: partners could be a lead government broodstock farm, a number of private hatcheries, with technical input from a research institution in cryoseed banking and breeding.
3. Spatial planning for aquaculture development with an ecosystem approach is established.	Spatial planning for establishment and expansion of aquaculture farms adopted by agencies concerned (i.e. fisheries, forestry, environment, agriculture, water).	Maps of areas designated for expansion. Reports of site selection, zoning and carrying capacity studies.	Resource surveys will provide the basis for initiating the activities. Interagency collaboration is required. The risk is that potential resource use conflicts are not resolved among the various agencies.
4. An integrated environmental monitoring system is put in place to ensure aquaculture safety and to minimize aquaculture impacts on surrounding ecosystems.	An integrated environmental monitoring system for aquaculture safety and to minimize aquaculture impacts is developed with capacity building of stakeholders involved.	Monitoring system is in place. Training modules and materials produced. Technical training for stakeholders completed. Reports of DoF and other agencies.	Expertises in environmental monitoring system/agencies are available in the country. Inter-agency collaboration is required.

Outputs	Objectively verifiable indicators	Means of verification	Assumptions and risks
Institutional objective: The national institutions dedicated to the governance of the fisheries subsector, as well as those involved in the management of aquaculture development, shall have the capability to manage the sector effectively, provide the support services needed for sustainable and responsible development, and help facilitate the universal objective of equitable and fair allocation of resources and distribution of benefits.			
1. Capacities of national and local government institutions, R&D and other institutions to provide technical support to planning, development, management, monitoring and regulating aquaculture are strengthened.	Trained personnel in various skills at various levels. Management and operational procedures standardized and adopted within the system. Policies and regulations formulated, issued and communicated widely. Efficient information system. Technical and extension information developed and disseminated.	Reports of training. Policy and regulations issued. Annual reports of DoF. Improvement in speed of processing applications and licences. Improvement in the speed and quality of response to field problems.	A study of the capacity-building needs of the DoF based on the needs of the aquaculture sector should inform a national programme for capacity building. It should not be a piecemeal effort. The study could be done by a task force composed of representatives of the primary stakeholders.
2. Farmers' clusters and associations shall be assisted to organize and members trained in management and technical skills.	Actual number of associations formed	Registry of associations. Reports of association activities.	Associations need to be professionalized so that they manage themselves properly. Care should be taken that associations are formed, or farmers join an association, for the proper reasons.
3. Appropriate credit facilities and insurance schemes are developed for farmers' associations and women's enterprises.	Financial services developed and offered by banks, other credit institutions and financial as well as insurance service providers, including NGOs.	Reports of the credit institutions. Survey on credit access by farmers, hatchery owners, feed processors, others.	Microcredit services are strong and well developed in Bangladesh. A crop insurance scheme needs to be developed that might adopt a hybrid insurance scheme (government or public-market insurance) or some other scheme suitable to small farmers. The credit and insurance services could be leverage for convincing organized or associated groups to adopt BMPs.

Appendix 3

List of project ideas recommended for implementation in years 1–2

1. Better seed and feed production and management, as a follow up to the FAO Technical Cooperation Programme Facility Project on understanding the constraints of the seed and feed subsectors.
2. Promotion of sustainable aquaculture through improvement of appropriate Fisheries Resource Survey Framework.
3. Institutional capacity building to enable the aquaculture sector to comply with international norms and regulations for sustainable fisheries.
4. Stock improvement of commercially important fish species through a selective breeding programme.
5. Conservation of aquatic genetic resources under *in situ* and *ex situ* conditions in Bangladesh.
6. Capacity building for training institutions and development of training and extension materials.
7. Organization of associations of fish farmers, fish traders and hatchery operators at local and national levels.



*Left net fishing in a floodplain,
Kishoreganj, Bangladesh.*

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The National Aquaculture Development Strategy and Action Plan of Bangladesh 2013–2020 was formulated through a series of stakeholders' consultations that spanned a year between 2012 and 2013. It was reviewed and endorsed by the National Working Committee for the Sustainable Development of Aquaculture Industry at its first meeting held on 4 September 2013 and was approved by the Ministry of Fisheries and Livestock in November 2013.

It constitutes 16 outputs under four objectives geared towards "improving the welfare of the resource-poor people depending on aquatic resources for livelihood, reducing poverty by stimulating employment and improving income, conserving and enhancing the natural resources on which livelihoods are based, promoting the sustainable development of rural communities, increasing export earnings, and contributing to the creation of wealth for the nation". Its formulation, with FAO's technical assistance, was informed by the National Fisheries Policy of 1998, the Country Investment Plan 2011–2015, the National Fisheries and Livestock Sector Development Plan, the FAO TCPF project "Identification and understanding of key technical, economic and social constraints to seed and feed production and management in Bangladesh", and the preceding national fisheries strategy and action plan of 2006–2012.

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