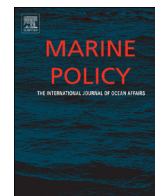




ELSEVIER

Contents lists available at ScienceDirect

## Marine Policy

journal homepage: [www.elsevier.com/locate/marpol](http://www.elsevier.com/locate/marpol)

# Economic incentives for sustainable hilsa fishing in Bangladesh: An analysis of the legal and institutional framework

Md Monirul Islam<sup>a,\*</sup>, Essam Yassin Mohammed<sup>b</sup>, Liaquat Ali<sup>c</sup><sup>a</sup> Department of Fisheries, University of Dhaka, Dhaka 1000, Bangladesh<sup>b</sup> International Institute for Environment and Development (IIED), 80–86 Gray's Inn Road, London WC1X 8NH, United Kingdom<sup>c</sup> Bangladesh Centre for Advance Studies (BCAS), House – 10, Road – 16/A, Gulshan – 1, Dhaka 1212, Bangladesh

## ARTICLE INFO

## Article history:

Received 21 November 2015

Received in revised form

3 February 2016

Accepted 3 February 2016

## Keywords:

Fish conservation

Economic incentives

Hilsa

*Tenulosa ilisha*

Sustainable fisheries

Bangladesh

Legal framework

Institutional framework

## ABSTRACT

Bangladesh's hilsa shad (*Tenulosa ilisha*) comprises the largest single-species fishery in the country, constituting 11 per cent of the total catch and employing 2.5 million people directly or indirectly. Since 2003, following a sharp decline in catch figures, the hilsa fish has been the subject of a government conservation programme offering fishers economic incentives or payments for ecosystem services (PES). While PES schemes are widely used to conserve natural resources such as forests and watersheds, Bangladesh's programme is a rare example of PES for sustainable fishery management. Catch figures have improved since the programme was introduced; but concerns remain about fishers' socioeconomic conditions and the long-term sustainability of Bangladesh's hilsa fishery. This paper analyses the conservation scheme's legal and institutional frameworks, identifying challenges to its design and implementation, and makes recommendations to overcome them.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

'Ecosystem services' are the benefits that people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as floods, drought and disease; supporting services such as soil formation, photosynthesis and nutrient cycling; and cultural services such as recreational and spiritual benefits [1]. In particular, ecosystem services provide livelihoods for millions of people, many of whom are poor and make a significant contribution to their economies. However, the world's ecosystems have dramatically declined over the past 50 years as more areas are used for agriculture, forestry, fisheries, industries, and urban growth [1]. Payment for ecosystem services (PES)<sup>1</sup> is an environmental management approach that offers cash payments or other compensation to encourage the conservation

and restoration of ecosystems. PES is a widespread tool and is increasingly used in diverse countries around the world where vulnerable ecosystems are under threat. Over the last decade several studies have found that ecosystem services have benefitted or could benefit the low-income sellers of these services [2–8]. Reviewing several studies, Milder et al. [9] concluded that PES is providing important livelihood benefits to poorer households or communities in the form of cash payments or noncash benefits, and could provide more: 'We estimate that by the year 2030, markets for biodiversity conservation could benefit 10–15 million low-income households in developing countries, carbon markets could benefit 25–50 million, markets for watershed protection could benefit 80–100 million, and markets for landscape beauty and recreation could benefit 5–8 million'.

While incentive-based approaches such as PES have gained popularity in terrestrial environments such as forest and watershed ecosystems, there are few examples in aquatic ecosystem and sustainable fisheries management [10]. Yet coastal and marine ecosystems generate some of the most important services to humankind; and they too are endangered by overexploitation and loss [11]. Mohammed and Wahab [10] infer that a well-designed economic incentive mechanism can play a major role in incentivising fishing communities to conserve and manage their resources.

The government of Bangladesh has introduced a PES scheme to

\* Corresponding author.

E-mail address: [monirulislam153@yahoo.com](mailto:monirulislam153@yahoo.com) (M.M. Islam).

<sup>1</sup> The term 'payments for ecosystem services' is not universally adopted. Depending on the cultural and political context, other terms such as 'recompense', 'compensation' or 'reward' may be used. PES projects are also referred to as 'improved management of hydrological resources' or 'reciprocal arrangements'. Payments for ecosystem services are sometimes called 'incentive-based cooperative agreements', 'stewardship payments', 'compensatory schemes' or even 'performance payments'.

conserve and sustainably manage hilsa shad fish (*Tenualosa ilisha*) populations. Hilsa comprises the largest single-species fishery of the country, providing 11 per cent of Bangladesh's total fish catch, and directly employing half a million fishers – most of whom are poor [12] and affected by climate variability and change [13,14]. A sharp drop in hilsa catch figures over the years 2001–2003 (having previously shown a steady increase) had a significant impact on the country's economy, particularly on livelihood in fishing-dependent communities. Most observations and surveys identified overfishing (of both adult and juvenile hilsa, or 'jatka') as the main reason for the dwindling catch. From 2003 onwards the government put several protection and conservation measures in place, including closing some areas to fishing, restrictions on fishing gear, restrictions on the fishing season and regulations for fishing vessels. These measures are designed to ensure a target production of hilsa, as well as to improve the socioeconomic conditions of the fishing communities. Under the PES scheme the fishers are given direct incentives during the fishing ban period: they receive food as well as some support for alternative income generation. After the scheme came into effect, the total hilsa catch level began to increase again in line with previous years. However, there has not yet been a rigorous evaluation of the scheme's impact on catch size, so the increased catch cannot be credited conclusively to PES. Siddique [15] found both positive and negative perceptions of hilsa conservation among civil societies and researchers. He reported that supporters of incentive-based hilsa conservation measures consider it an effective way to increase fish production, while those against it point to the socioeconomic losses to fishers, who mainly come from poorer social backgrounds.

Key to successfully establishing a PES scheme – and maximising its benefits – are legally binding environmental standards, judicial and compliance review mechanisms, enforcement procedures, and appropriate institutional frameworks. Law and policy create the basis for the institutional structure, especially public institutions, to function and support PES [16]. PES legislation should develop through practical experience, with local projects informing regional and national legislation; these in turn should provide greater legal certainty, and a framework that enables rather than restricts regional and local PES [16]. The institutional structure guides the practice, and ultimately the effectiveness, of a PES scheme [17,18]. Since they have the potential to either facilitate or hinder the development of PES schemes, there is a clear need to better understand these legal and institutional frameworks. This study's objective is to analyse the conservation scheme's legal and institutional framework to identify how the framework can be improved to best support the scheme. The findings have important implications for other PES schemes for fisheries management in similar settings.

Section 2 describes the study's methodology; Section 3 describes the characteristics and history of hilsa shad fishery; Section 4 reviews the existing legal institutional and policy framework for hilsa conservation; Section 5 outlines the existing hilsa conservation programme and its economic incentives; Section 6 critically assesses the legal and institutional challenges and opportunities for the hilsa conservation programme and economic incentives. Section 7 concludes by restating the rationale and findings of this study, and suggests policy implications.

## 2. Methodology

This study is based on a review of existing legal, policy and institutional documents, as well as recent literature relating to hilsa fishery and conservation. It also draws on primary information gathered from key informant interviews and focus group discussions described below, held between January and April 2014.

### 2.1. Key informant interviews

This study used the 'key informant' interview method, carrying out in-depth qualitative interviews with individuals who have direct specialist knowledge of the issues being researched. The key informants included individuals from both within and outside hilsa fishing communities. This study selected six fishers who are knowledgeable about PES from communities in Chandpur, an area included in the hilsa conservation programme. This study also selected ten government officials from different tiers of the Department of Fisheries (DoF) and Bangladesh Fisheries Research Institute (BFRI) who were directly involved in payments for the hilsa conservation programme. This study prepared a checklist for the interviews beforehand which included questions on hilsa fishing, PES related legislations, institutions, and enabling and disabling factors as well as the key informants' recommendations on these. For these interviews the East Midlands Oral History Archive (EMOHA) guidelines for key informant interviews were largely followed [19].

### 2.2. Focus group discussions

Two focus group discussions (FGDs) were conducted with fishers who receive compensation under the hilsa conservation project in Chandpur. A list of topics and possible questions for the participants were developed beforehand to ensure some structure and direction in the discussions. The emphasis was on clarifying issues that were raised in the key informant interviews. Each FGD session ran for about three hours and between five and eight issues were covered.

Between five and eight fishers took part in each FGD. These were fishers who had experience of the main issues under discussion, or who seemed able to explore the key concepts [20] and who appeared to be cooperative and enthusiastic. In facilitating the FGD sessions the authors aimed to ensure that the focus was kept, momentum maintained and that there was real participation and closure on questions [21]. Both the interviews and the FGDs were held in 'neutral' places, with no significance for the participants and no bearing on the subject under study. The facilitators also ensured that the meeting places were comfortable and that seating arrangements allowed participants to see and hear each other clearly.

## 3. Characteristics and history of hilsa shad fishery

Hilsa fish belong to the clupeid family, which includes herrings and sardines, found in South and Southeast Asian [22]. There are three separate species of hilsa shad in the Bay of Bengal: *Hilsa kelee*, *Hilsa toli* and *T. ilisha*. *T. ilisha* is an anadromous species, migrating from the sea up rivers to spawn, while the other two species are restricted to the marine environment. In this study, 'hilsa' generally refers to *T. ilisha*, as this species makes up 99 per cent of the hilsa catch in the Bay of Bengal [23]. It is found along the coasts of India and Myanmar as well as Bangladesh.

In Bangladesh the fisheries sector as a whole directly supports the livelihoods of about seven million fishers, contributing 4.43 per cent to GDP and 2.73 per cent to export earnings [12]. Most marine fishing (93 per cent) is small-scale in nature, supporting the livelihoods of over half a million fishers and their household members (ibid). The annual hilsa catch worldwide is approximately 0.3–0.4 million metric tonnes (t), of which 50–60 per cent is caught in Bangladesh [24]. Hilsa catches in Bangladesh were 298,921 t in 2008–2009 (95,970 t from inland waters and 202,951 t from marine waters) and accounted for 39 per cent of the total marine catch, 4 per cent of inland catches, and 11 per cent

**Table 1**  
Characteristics of hilsa fishery in Bangladesh.  
Source: [25–28]

Characteristics	Classifications
Activity	Boat owning and renting (usually male) Fishing as crew leader or captain (only male) Fishing as crew member (only male) Fish processing (both male and female) Fish trading (mainly male; some female) Boats and gear making and mending (both male and female)
Type of boat	Small manual boat Small mechanised boat Medium mechanised boat Large mechanised boat
Type of gear	Gill net Bag net
Scale of fishing	Full-time (9–12 months per year) Part-time (3–9 months) Occasional (less than 3 months)

of total fish production. Hilsa constitutes the largest single-species fishery in Bangladesh, employing half a million poor fishers directly and another 2–2.5 million people indirectly in distributions, sales and ancillary activities such as net and boat making, ice production, processing and export [12]. About 40 per cent of Bangladesh's fishers depend on hilsa fishing directly or indirectly [24]. The fish itself is moderately sized (up to 60 cm long and weighing up to 2.5 kg) and obtains a high price in local and international markets. Table 1 shows the characteristics of hilsa fishing in Bangladesh [25–28].

After landing their fish, small-scale fishers normally sell them at auction in local fish landing centres, in the local market or directly to local fish processors. Fish marketing is controlled by a group of intermediaries known as *aratdars* (commissioning agents) and *mohajans* (money lenders) both of whom are rich and powerful members of society; sometimes the same person can be both a commissioning agent and a money lender. The commissioning agents dominate the wholesale markets, each one with a chain of suppliers bringing in regular catches. They provide advance money (*dadon*) to boat owners to make boats and nets, on condition of getting the exclusive right to buy their catch. The agents charge 3–6 per cent commission and take 2–4 fish for every 80 fish sold [29]. Fishers tend to sell their fish as soon as possible to these agents after landing to avoid spoilage; cold storage facilities are inadequate and good quality ice is unavailable [30]. There are around 6500 fish markets scattered across the country of which 4500 are small primary village markets [29].

Several studies have found poor physical infrastructure in the fishing villages of Bangladesh, and most people living in poor socioeconomic conditions [25–27,31]. Most of the households cannot eat regularly, have little education, and have only moderate public health provision. Some get financial assistance from the government and international donors [26]. Local village leaders tend to make community decisions and resolve most family conflicts, although sometimes elected local government representatives such as the chairmen and members of the *union parishad* (a local government unit) resolve conflicts [31]. Women have less freedom both socially and economically than men, but most women can vote in national and local government elections (*ibid*).

### 3.1. Hilsa spawning and nursery grounds

Adult brood hilsa mainly spawn in Bangladesh's major deltaic rivers, estuaries and coastal areas. The four most important spawning grounds in the country are: Dhalerchar of Charfashion in Bhola (about 125 km<sup>2</sup>); Monpura in Bhola (about 80 km<sup>2</sup>); Moulavichar of Hatia in Noakhali (about 120 km<sup>2</sup>); and Kalirchar of Sandwip (about 194 km<sup>2</sup>) [32]. Hilsa spawn throughout the year but the peak season is September and October [32].

After hatching from free-floating eggs the fry remain in their nursery grounds to feed and grow. There are five main nursery grounds:

- A 100 km stretch of the Meghna River from Shatnol, Chandpur District to Char Alexander, Lakshimpur District
- 90 km of Shahbajpur Channel, a tributary of the Meghna River, from Madanpur/Char Ilisha to Char Pial, Bhola District
- 100 km of the Tentulia River from Bheduria, Bhola District to Char Rustom, Patuakhali District
- 40 km of the Andharmanik River route at Kalapara Upazila, Patuakhali District
- A 20 km stretch of the Padma River's lower basin from Narhira to Bhedarganj, Shariatpur District [24].

Four of these were declared hilsa sanctuary areas in 2005 and the fifth in 2011 (see Section 4). However, there are disagreements on whether the demarcation of these spawning and nursery grounds is accurate or not.

A mature female hilsa can be between 30 and 55 cm long and lays 0.1–2 million eggs in fresh water. Hatching takes between about 23–26 h at an average temperature of 23 °C [32]. The newly hatched larvae (about 2.3 mm long) make their way downstream to the sea through their freshwater nursery grounds, feeding and growing on the way. At this juvenile stage of their life cycle, a period of five or six months, they are known locally as *jatka*. They are abundant between February and May in the foreshore and riverine waters of Padma, Meghna and other deltaic rivers in Bangladesh [15].

Despite restrictions designed to protect *jatka* (see Section 4), they are caught illegally by artisanal fishers in large quantities with gillnets and seine nets of various mesh sizes during their grazing period in rivers, as well as on the seashore, to sell at local markets [15].<sup>2</sup> Table 2 shows that more than 19,000 t of *jatka* were caught from riverine and estuarine habitats in 2000. Although *jatka* are caught in rivers all year round, most (80–85 per cent) are caught between January and May, peaking in April (45 per cent) [33].<sup>3</sup> As *jatka* fishing is banned between November and June each year (see Section 4.1.3), most *jatka* are therefore caught illegally. Poor fishers fish illegally as they lack suitable alternative livelihood activities during the *jatka* fishing ban period [32]. This exploitation of the juvenile fish has serious consequences for overall hilsa production and conservation [34]. Allowing these *jatka* to reach maturity without harvesting them would boost total production by an additional 0.2 million tonnes per year [15]. Halder [35] suggests that effective enforcement measures in critical sites and during the breeding period could significantly contribute to

<sup>2</sup> According to FAO [37] artisanal fisheries are the 'traditional fisheries involving fishing households (as opposed to commercial companies), using relatively small amounts of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export. They are sometimes referred to as small-scale fisheries'.

<sup>3</sup> The *jatka* catch figures would be higher still if they included those caught on the foreshore. On the foreshore most *jatka* are caught between January and November, with a peak in January [33].

**Table 2**  
Catch of *jatka* in Bangladesh by district in 2000.

District	Main rivers and estuaries	Catch of <i>jatka</i> (tonnes)
Chandpur, Lakshmipur	Lower Meghna	18,403
Rajshahi, Pabna	Upper Padma	66
Rajbari, Faridpur, Manikganj	Lower Padma	466
Barishal	Tentulia, Kirtonkhola, Karkhana	43
Khulna	Rupsha, Shippa, Pashur	202
Patuakhali	Golachipa, Andharmanik, Payra	31
Borguna	Bishkhali, Burisshor, Kuakata	47
Total		19,258

Source: Bangladesh Fisheries Research Institute, Chandpur (cited in [33]).

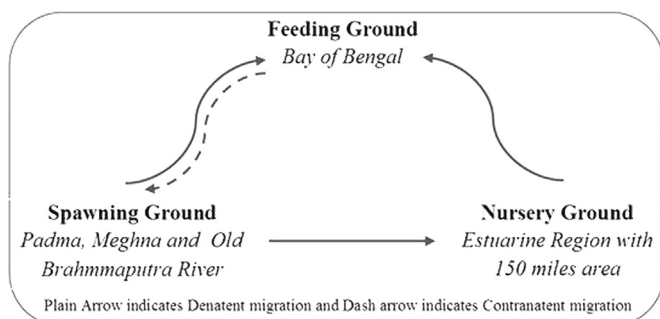
increasing hilsa production and maintaining biodiversity. These findings have prompted the Bangladesh government to further strengthen its hilsa conservation and management campaign by providing economic incentives [10]. Conservation and management of hilsa stocks in Bangladesh are thus increasingly taken seriously by government, both to optimise total production and ensure fishers' livelihoods.

### 3.2. Feeding and growing grounds

The *jatka* remain in the Bay of Bengal for one or two years, continuing to grow and develop [36], and reaching between 32 and 55 cm in length as adult fish [32]. Hilsa feed on plankton, mainly by filtering, but also by grubbing in muddy sediments. Its adult diet consists of algae (41.65 per cent), sand and debris (36.28 per cent), diatoms (15.36 per cent), rotifers (3.19 per cent), crustaceans (1.89 per cent), protozoans (1.22 per cent), and the remaining 0.41 per cent is miscellaneous [32]. On reaching sexual maturity at two to three years, they begin their journey to the estuary and upriver to spawn, and the cycle continues. The picture is not complete, however. Except for some biological information collected at certain parts of the migratory route or stages in the life cycle, there are significant gaps in our knowledge of the hilsa's breeding biology, environmental requirements, diet and feeding ecology at different stages of life, hydrological dynamics, and other key physical and biological information.

### 3.3. Hilsa migration

Two to three years into their life cycle the hilsa migrate into the freshwater rivers upstream from the Bay of Bengal in order to spawn (see Fig. 1). This takes place from May to November.



**Fig. 1.** Hilsa migration pattern (Note: 'denatent migration' means with the current (downstream); 'contranatent migration' means against the current (upstream); Source: Reproduced from Mondal (2013)).

Migration distances of 50–100 km are common, but hilsa have been known to migrate 1200 km upstream to spawn in the Ganges system [32]. Hilsa face a range of obstacles on their journey, including obstructive fishing nets on migratory routes, river siltation, construction of barrages, dams, sluice gates, industrial pollutant discharge, sewage, agricultural inputs, poison fishing, ship breaking, climate change, and natural disasters. However, there has been little research to date on these obstacles and their effects on the hilsa.

Generally, two seasons for hilsa migration have been observed in Bangladesh:

1. Southwest monsoon migration: the main period of migration between May and November, when monsoon rains flood the rivers.
2. Winter migration: a short migration season outside the monsoon period, during the winter months of February and March.

80 per cent of female hilsa harvested during upstream migration are found to be ripe and ready to spawn [36]. Evidence suggests that most hilsa populations in the Ganges and other large rivers are anadromous, migrating to the sea to feed and grow, but some hilsa populations remain in rivers and do not emigrate to the sea at all [38]. Similarly, there are marine populations that stay in coastal areas to spawn [15].

## 4. The legal, institutional and policy framework for hilsa fishery

### 4.1. Legal and policy framework

The government of Bangladesh has passed a number of acts, ordinances and rules<sup>4</sup> to provide a framework for the exploitation, development, management and conservation of its fisheries sector and aquatic resources. The Bangladesh fisheries authority has also taken several measures to conserve and manage artisanal hilsa fishing. As a migratory fish, both inland and marine fishery legislation are required for its management and conservation; and some legislation that is not related to fisheries also has an impact on hilsa conservation.

The basic act regulating hilsa fishery is the Protection and Conservation of Fish Act (1950), as amended by the Protection and Conservation (Amendment) Ordinance (1982),<sup>5</sup> while the main act regulating marine fisheries is the Marine Fisheries Ordinance (1983).<sup>6</sup> There are several protection and conservation measures for hilsa based on these two acts and other legislation. They include closing some areas to fishing, restrictions on fishing gear, restrictions on the fishing season and regulations for fishing vessels. These are described below.

#### 4.1.1. Areas closed to fishing

In 2005 four important *jatka* nursery sites were declared hilsa sanctuaries under the amended Protection and Conservation of Fish Rules (1985), to improve hilsa fishery production. Another sanctuary was added in 2011, in another amendment of the Protection and Conservation of Fish Rules. Fishing of any type is banned in these five sanctuaries at certain times of the year (see Table 3 and Fig. 2). Four hilsa spawning grounds have also been demarcated where fishing is banned for an 11-day period in October each year to allow the gravid hilsa (female hilsa carrying

<sup>4</sup> 'Acts' are laws or statutes that have been enacted by the central government. 'Ordinances' are laws that are passed by lower-level jurisdictions in a country. 'Rules' define the guidelines that must be followed for the successful implementation of an act.

<sup>5</sup> Implemented by the Protection and Conservation of Fish Rules (1985).

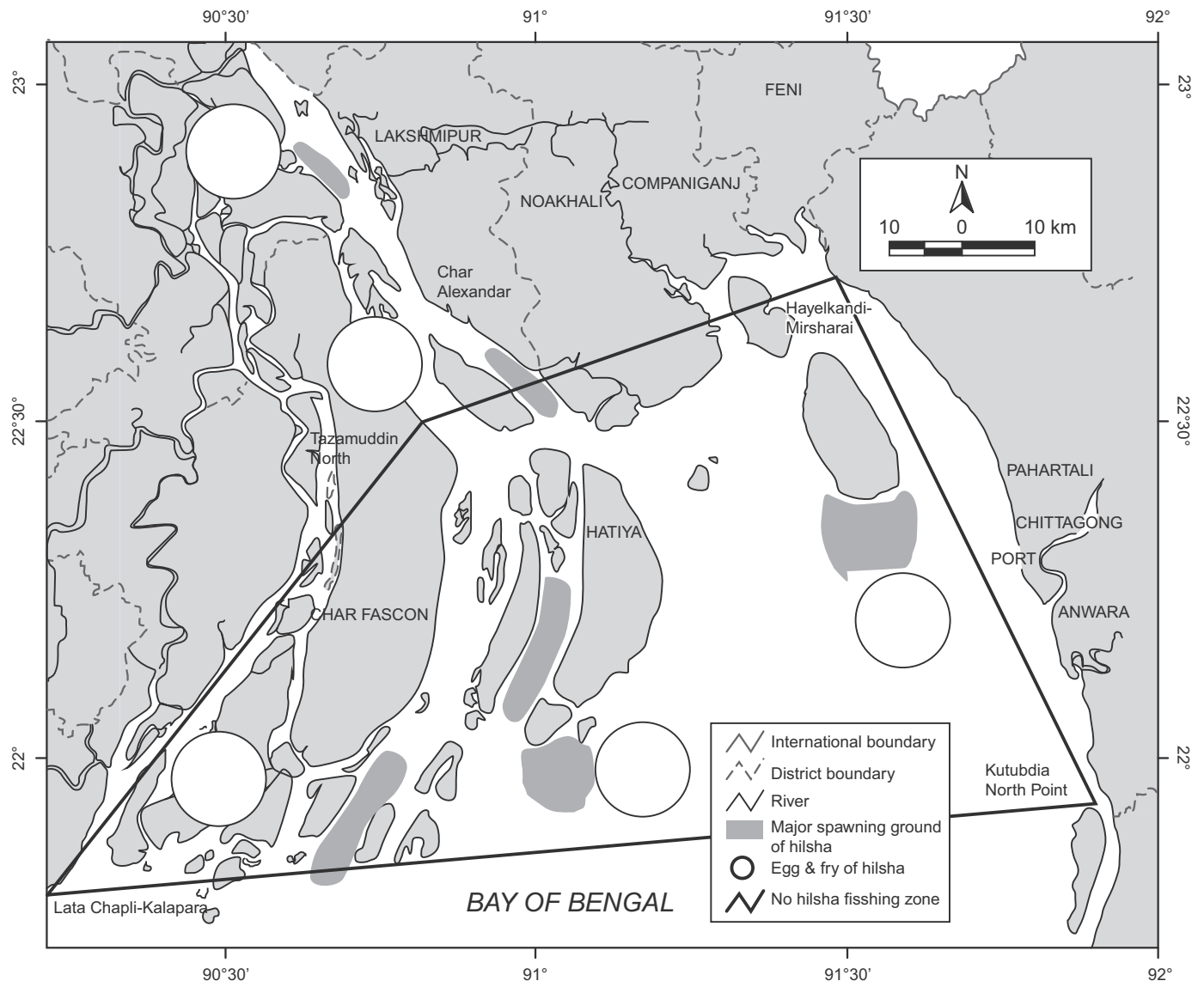
<sup>6</sup> Implemented by the Marine Fisheries Rules (1983).



**Table 3**  
Hilsa sanctuary areas and ban periods.  
Source: [39]

Hilsa sanctuary area	Boundary point	Ban period
100 km stretch of the lower Meghna River from Shatnol, Chandpur District, to Char Alexander, Laxmipur District	Shatnol Point (90° 37.12' E and 23° 28.19' N) Char Alexander Point (90° 49.30' E and 22° 40.92' N)	March–April
90 km stretch of Shahbazpur Channel, tributary of the Meghna River, Char Ilisha to Char Pial, Bhola District	Char Ilisha Mosque Point (90° 38.85' E and 22° 47.30' N) Char Pial Point (90° 44.81' E and 22° 5.10' N)	March–April
100 km stretch of the Tetulia River from Bheduria, Bhola District to Char Rustam, Patuakhali District	Bheduria Ferryghat Mosque Point (90° 33.89' E and 22° 42.31' N) Mandolbazar (Char Rustaih) (90° 31.40' E and 21° 56.32' N)	March–April
Whole 40 km stretch of the Andharmanik River in Kalapara Upazila, Patuakhali District	Golbunia Point (90° 19.20' E and 21° 57.68' N) Confluence of Bay of Bengal and Andhermanik River (90° 3.91' E and 21° 49.43' N)	November–January
20 km stretch of Lower Padilla River, between Nariaa and Bhedorganj Upazila, Shariatpur District in the north and Matlab Upazila, Chandpur District and Bhedorganj Upazila, Shariatpur District in the south.	Kachikata Point of Bhedorganj Upazila, Shariatpur District in the northeast (90° 32.6' E and 23° 19.8' N) Bhonikara point of Naria Upazila, Shariatpur District in the northwest (90° 28.8' E and 23° 18.4' N) Beparipara Point of Matlab Upazila, Chandpur District in the southeast (90° 37.7' E and 23° 15.9' N) Tarabunia Point of Bhedorganj Upazila, Shariatpur District in the southwest (90° 35.1' E and 23° 13.5' N)	March–April

Note: An upazila is a sub-district.



**Fig. 2.** Hilsa sanctuaries in Bangladesh  
(Source: Adapted from Mohammed, 2014) [47].

**Table 4**

Location of hilsa spawning grounds and fishing ban periods.

Source: [39]

Hilsa spawning ground boundary points	Peak spawning season (fishing ban period)
Mayani Point, Mirsarai, Chittagong District in the northeast (91°32.15' E and 22°42.59' N)	A period of 11 days around the full moon which first appears in the Bengali month of Aswin (October) – 5 days before, 5 days after and the day of the full moon itself.
Paschimsyed Awlia Point, Tajmuddin, Bhola District in the north-west (90°40.58' E and 22°31.16' N)	
North Kutubdia Point, Kutubdia, Cox's Bazar District in the south-east (90°52.51' E and 21°55.19' N)	
Lab Chapati Point, Kalapara, Patuakhali District in the southwest (90°12.59' E and 21°47.56' N)	

eggs) to spawn successfully (see Table 4). The amendment of the Protection and Conservation of Fish Rules (1985) states that any fish caught by using any kind of gear in sanctuaries or spawning areas during the ban period may be seized and forfeited.

#### 4.1.2. Restrictions on fishing gear

Use of a *current jal* (a fishing gillnet made of monofilament synthetic nylon fibre) with a mesh size of less than 4.5 cm was banned in 1988.<sup>7</sup> In artisanal hilsa fishery, using gillnets with a mesh size of less than 10 cm is prohibited by law. The 2002 amendment of the 1950 Fish Act states that 'no person shall manufacture, fabricate, import, market, store, carry, transport, own, possess or use a *current net*'. The penalty for violating this law is imprisonment and a fine. Government empowered fishery officers have the same powers of search, seizure and investigation in respect of an offence under this act as a police officer with the rank of Sub-Inspector. However, only a metropolitan or first class magistrate can try an offence under the Act; the implications for enforcing the regulations are discussed in Section 6.

#### 4.1.3. Restricting the fishing season

*Jatka* fishing was banned in Bangladesh between November and April each year under the 1950 Protection and Conservation of Fish Act. *Jatka* was originally defined as less than 23 cm long, but recently amended to 25 cm.<sup>8</sup> An amendment later extended the restricted period to between November and May, and in 2013 it was extended again to June<sup>9</sup> (these variations in the size of *jatka* and length of the ban period demonstrate the authorities' lack of reliable information and the need for more research, as discussed in Section 6.) All types of fishing including hilsa are banned in the four sanctuaries between March and April and in one sanctuary between November and January (Table 3).

In Bangladesh about 60–70 per cent of the year's hilsa catch is caught during the peak breeding season, of which almost 70 per cent are sexually mature [40]. To allow uninterrupted spawning, any catch of brood hilsa is banned in all the major spawning grounds named in Table 4 for an 11-day period around the full moon in October, the Bengali month of Aswin. This is stated in the 2011 amendment of the 1985 Protection and Conservation of Fish Rules. However, the timing and duration of the fishing ban do not always follow the above rules. In 2014, for instance, the ban period given in the fisheries authority circular was between 5 and 15 October. An Upazila Fisheries Officer in Bhola District observed that hilsa started spawning from 20 September in the Monpura area of Bhola District, well before the 5 October start of the ban [41]. A late start to the ban could allow gravid hilsa to be caught before spawning, while ending the ban period before spawning is

complete could have the same effect.

#### 4.1.4. Regulations for fishing vessels

The Territorial Waters and Maritime Zones Act 1974 (Act XXVI) established various maritime zones such as territorial waters, contiguous zones, economic zones, conservation zones and the continental shelf. These specifically demarcate the hilsa (and other) fishing areas in the Bay of Bengal. The 1983 Marine Fisheries Ordinance deals with the management, conservation and development of marine fisheries in water bodies deeper than 40 m. Any body of water less than 40 m deep is reserved for the use of small-scale or artisanal fisheries. This is to avoid or minimise potential conflict between industrial vessels and artisanal fishers. All trawlers are required to obtain a fishing license for a year, which allows them to fish within the 200 nautical mile maritime boundary of Bangladesh. Each trawler must be granted sailing permission from the Department of Fisheries for every voyage. Mechanised boats require a license in accordance with Amendment 92 of the Marine Fisheries Ordinance, 1983. From January 2001, all non-mechanised boats were also included in the licensing system. Department of Fisheries officers are authorised to check boat size or take any other action required for surveillance and enforcing Ordinance rules. For artisanal hilsa fishing, all fishing vessels are subjected to registration fees to be paid when vessels are commissioned for the first time; vessel and fishing licences are then paid annually. Registration fees are designed to keep track of how many vessels enter the industry and to collect revenues; licence fees are also a means to collect revenues while exerting some control on entry to the industry and keeping track of how many vessels are actively engaged in fishing activities each year. In the case of artisanal fishery, registration is the only way to prevent unauthorised boats (both mechanised and non-mechanised) from entering the industry. The Mercantile Marine Department is responsible for vessel registration and monitoring during the fishing season. In artisanal gillnet hilsa fishery, every fishing unit needs a license on registration, which is renewable annually. If a license is not renewed within two years of issue a new license must be applied for. Fishing vessel licence rates vary with vessel size and engine capacity.

#### 4.1.5. Government policies relevant to hilsa fishery

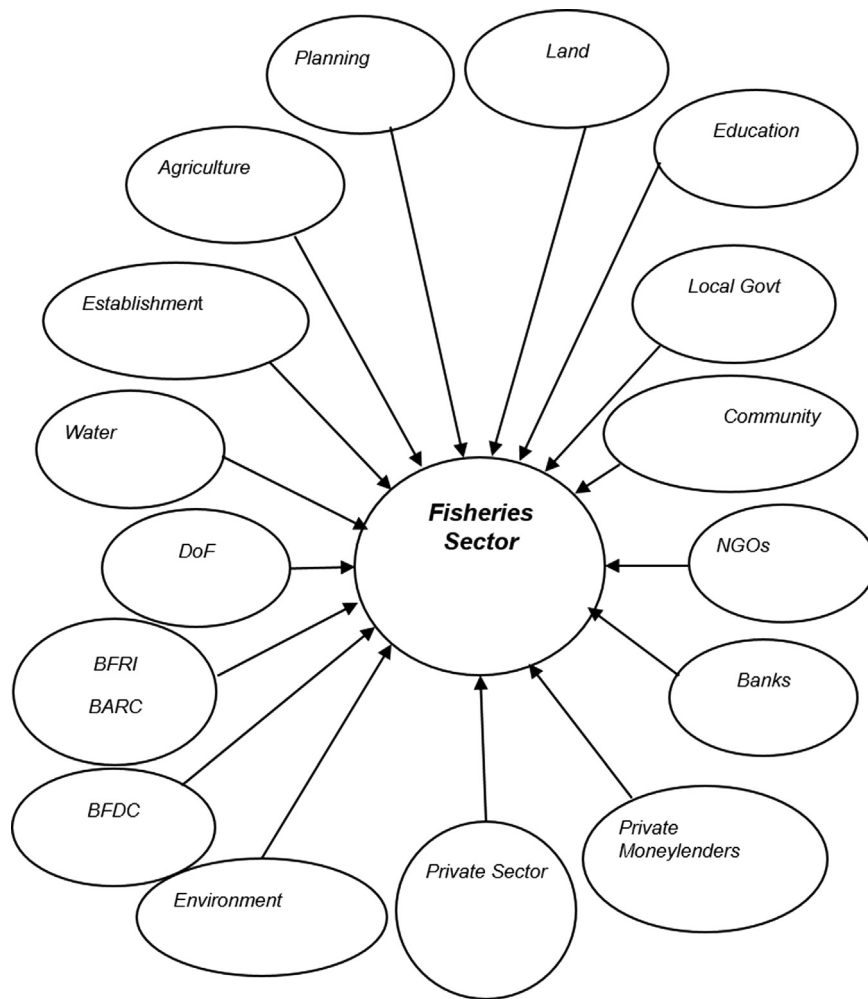
In 1986 the Ministry of Fisheries and Livestock (MoFL) signalled a major policy departure with its New Fisheries Management Policy, addressing the over-exploitation of resources and inequality of fishing rights. Although this policy did not specifically target hilsa, its objectives were to divert the maximum benefits of fish harvesting to genuine fishers instead of powerful elites, and to adopt conservation measures to ensure that resources are sustained.

The next major policy change came in 1998 with the National Fisheries Policy. It was adopted to develop and increase fish production through the optimum use of resources; to meet the

<sup>7</sup> A gillnet hangs vertically in the water, often with floats at the top and weights at the bottom.

<sup>8</sup> As of SRO no. 92-law/2013 of the Ministry of Fisheries and Livestock.

<sup>9</sup> In SRO no. 92-law/2013 of the Ministry of Fisheries and Livestock.



**Fig. 3.** Institutional links in the fisheries sector (Note: BFDC – Bangladesh Fisheries Development Corporation; BFRI – Bangladesh Fisheries Research Institute; DoF – Department of Fisheries; NGOs – non-governmental organisations).

demand for animal protein; to promote economic growth and earn foreign currency through fish exports and fishery products; to alleviate poverty by creating opportunities for self-employment and by improving socioeconomic conditions of fishers; to preserve environmental balance and biodiversity; and to improve public health. One of the policy's five main areas is a 'policy for exploitation, conservation and management of marine fisheries resources'. The National Fisheries Strategy, formulated to implement the National Fisheries Policy, has a 'marine sector sub-strategy' but no specific section for managing artisanal hilsa fishery. The government has taken some management measures to conserve hilsa fishery on the basis of this policy and other fishery regulations. The policy extends to all government organisations involved in fisheries and to all water bodies used for fisheries. The policy also deals with many other relevant issues such as quality control, industrial pollution and land use.

Some policies from outside the fisheries sector have consequences for hilsa conservation. For instance, the 1992 Environment Policy emphasises the conservation and development of fisheries and the evaluation of any projects likely to impact on these resources. And under the Mobile Court Ordinance 2007, a magistrate can operate a mobile court to deal with offences 'on the spot'. This mobile court operates during the fishing ban period, when it can punish those violating fishing bans following the 1898 Code of Criminal Procedure (Act V). It can also ask for support from police or other agencies.

#### 4.2. Institutional framework

The fishery sector is characterised by complex institutional and governance issues, engaging a mix of formal and informal institutions, public, private and civil society sector agents, and involving a range of linkages across sectors and areas of responsibility. The Ministry of Fisheries and Livestock (MoFL), through its Department of Fisheries (DoF), has overall responsibility for fisheries and aquaculture development, management and conservation. Its functions, which involve both regulation and development, are defined in Schedule 1 of the Rules of Business (1975) and include the preparation of schemes and the coordination of national policy in respect of fisheries, the prevention of fish disease, the conservation, management and development of fisheries resources, the management of fish farms and training and collecting information. The DoF's activities are supported by the Bangladesh Fisheries Research Institute (BFRI), which is responsible for fisheries research and coordination. In addition, the Bangladesh Fisheries Development Corporation (BFDC), established under the Bangladesh Fisheries Development Corporation Act (1973), supports DoF in developing the fishing industry. The BFDC's functions include establishing fishing units and preserving, processing, distributing and marketing fish and fishery products.

##### 4.2.1. The department of fisheries

The Department of Fisheries is overseen by the Ministry of Fisheries and Livestock. Its Director General is assisted by three

Directors and two Principal Scientific Officers (equivalent to Director). It has more than 1500 technical officers and supporting staff at various levels of its hierarchy. Bangladesh's administration divides the country into 7 divisions, 64 districts and 485 *upazilas* or sub-districts, and the Department of Fisheries has departments at each level; these are headed by a Deputy Director, District Fisheries Officer and Upazila Fisheries Officer respectively. Besides these, the DoF has fish inspection and quality control stations, marine fisheries stations, fisheries training centres, farms and hatcheries.

The Department's mandate includes:

- disseminating improved aquaculture technologies through training and demonstration and offering extension advisory services to key stakeholders
- enhancing fishery resources through conservation and management measures
- assisting the Ministry of Fisheries and Livestock to formulate policies, acts and so on
- enforcing quality control measures and issuing health certificates
- conducting fisheries resource surveys and assessing stock to develop a fisheries database for effective planning
- facilitating arrangements for institutional credit for fish and shrimp farmers, fishers and fish traders
- facilitating alternative income generating activities for rural poor and unemployed people in order to alleviate poverty
- formulating and implementing development projects towards the sustainable use of fisheries resources, ensuring food security.

The DoF's original role was to assess and manage traditional resources, with a strong focus on expanding fish yield. However, it is now faced with an expanding population with greater resource demands; more development needs that are complex from a technical, social and managerial perspective; a burgeoning private sector; increasing vulnerable aquatic resources – together with an increasing burden on limited staff resources. There is now wide multi-institution participation in controlling and developing the fisheries sector (see Fig. 3). It can therefore be argued that while the 1998 National Fisheries Policy gave the responsibility for conserving and managing resources to the DoF, it has not yet provided the necessary capacity or mechanisms to carry out this mandate. Focused on outputs, the fisheries policy may not have allowed for the changing multi-institutional dynamics of Bangladesh's governance.

#### 4.2.2. General institutional arrangements

Though the DoF can be seen as a key element in the institutional environment, many other institutions are directly or indirectly involved in or impact upon the fisheries sector, its resource base and associated livelihoods. These embrace public sector, private sector and civil society institutions. Fig. 3 provides a simplified outline of key formal institutions; to these must be added the many informal processes and interactions, customary or newly emerging, which constitute the wider institutional environment.

At the macro level many formal institutions have an impact on the sector, broadly grouped into those with an overarching role across sectors, such as the Ministries of Finance and Planning, and those with a more direct impact such as the Ministries of Land and of Water Resources. Many other ministries, such as Health, Social Welfare and Education also have relevance to fisheries communities and their livelihoods. Their role has not been examined in depth in here, but their involvement in broader objectives related to the sector can be significant. Other ministries, such as Home Affairs (police), Defence and Shipping play a regulatory role but do

not influence fisheries policy or planning.

Below central government there is relatively little decentralisation; the fisheries officers based at divisional, district and *upazila* level report upwards through the formal government system rather than through locally elected local government bodies.

Many other government institutions control access rights to fisheries, or play other direct roles in fisheries development. The Ministry of Land and the Ministry of Youth and Sport between them control access rights to all *jalmohals* (publicly-owned bodies of water with fishing rights) larger than three acres, and local governments control smaller water bodies. The Ministry of Environment and Forests controls fisheries in the Sundarbans region, and the Ministry of Water Resources is responsible for water-related aspects of *haor* development.<sup>10</sup>

## 5. Hilsa shad conservation and economic incentives

Up until the financial year 2000–2001 annual hilsa catch figures showed a steady increase as fisher numbers grew and technology improved, such as mechanised boats (Fig. 4). In 2001–2002, despite a similar or greater number of fishers, there was a decrease in the catch. In 2002–2003 the catch dropped sharply, adversely affecting the country's economy as well as the livelihoods of the fishing communities. There was an urgent need for intervention to increase the hilsa catch level.

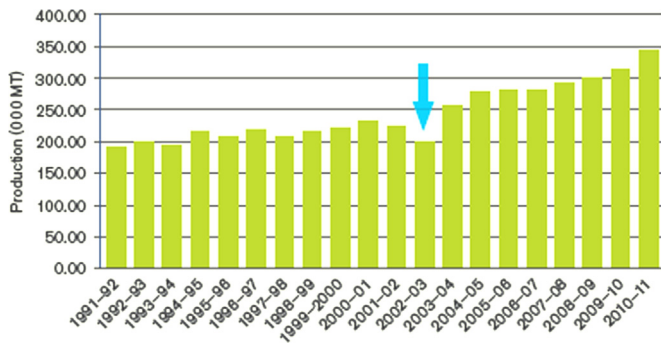
Most observations and surveys identified overfishing as the main reason for the reduced catch. Overfishing takes place both at the spawning season ('recruitment overfishing') when hilsa migrate from the sea to rivers; and during the grazing, feeding and development season, when juvenile *jatka* are less than 23–25 centimetres long ('growth overfishing'). From 2003 onwards, the government therefore took several protection and conservation measures to ensure that hilsa production reached target levels. As described in Section 4, these measures included closed fishing areas, restrictions on fishing gear, restricting the fishing season and regulations for fishing vessels.

### 5.1. Establishing the hilsa conservation programme

The first major project to target hilsa conservation was the Hilsa Fisheries Management Action Plan (HFMAP) in 2003. This plan outlined activities to protect *jatka*, developed the implementation strategy, ascertained the responsibility of relevant agencies and target communities, and fixed specific timeframes for carrying it out. The action plan's activities included involving public representatives, riverine rallies, raising awareness through the media, distributing leaflets and posters to protect *jatka*, enforcing the fish protection and conservation act, establishing hilsa sanctuaries, an 11-day fishing ban in major spawning grounds and offering alternative livelihoods for *jatka* fishers based on economic incentives. It is generally thought that the *jatka* protection programme has had a positive effect, since hilsa production increased by 56,807 metric tonnes (t) in the financial years of 2003–2004 and 76,831 t in 2004–2005. While there was no rigorous assessment of the relationship between hilsa production and the conservation programme, the government was encouraged by the rise in catch figures, and implemented a more detailed and strengthened conservation programme in 2005–2006 [15]. In 2008 the government launched an even bigger project for *jatka*

<sup>10</sup> A *haor* is a type of wetland ecosystem formed in a shallow bowl-like depression or basin that has a direct connection with a river – these are common in northeast Bangladesh.





**Fig. 4.** Total hilsa catch levels in Bangladesh, 1991–2011 (Note: MT=metric tonne; Source: Mohammed and Wahab (2013), based on DoF data).

conservation and alternative income generation for *jatka* fishers and research', which continues at the time of writing in 2014. The DoF is the project's lead agency under the MoFL, with the Bangladesh Fisheries Research Institute (BFRI) in Chandpur District as the partner agency. DoF is responsible for 'component A' of the project, with the following objectives:

- increase hilsa production by protecting *jatka* and brood hilsa
- provide support to strengthen and enhance hilsa sanctuary activities such as controlling illegal fishing
- reduce the pressure on *jatka* numbers caused by fishing in sanctuary areas within the fishing ban period
- create alternative job opportunities for *jatka*/hilsa fishers in order to improve socioeconomic conditions
- raise mass awareness about *jatka*/hilsa conservation.

The objectives of 'component B', led by the BFRI, are to:

- conduct broad-based research on biological and environmental aspects of hilsa fishery, both in riverine and coastal systems
- procure a medium-sized research vessel to carry out research in riverine and coastal waters
- modernise the research facilities at Riverine Station, Chandpur District
- build scientists' and support staff capacity at BFRI and develop skills for hilsa research.

The project was granted 188 million Bangladeshi taka or BDT (USD 2.4 million) at its inception in 2008,<sup>11</sup> increased later to USD 5.3 million. The project initially covered 10 districts (59 *upazilas*), then expanded to cover 15 districts (85 *upazilas*) with a significant increase in the number of beneficiary households. The project's main objective is to increase hilsa production by protecting *jatka* and brood hilsa, as well as to improve fishers' socioeconomic conditions. Its main activities are: providing food to fishing households, raising awareness about conservation, supporting alternative income generating activities (AIGA); and enforcing laws to prevent *jatka* and brood hilsa fishing during the ban period.

## 5.2. Economic incentives for hilsa conservation

Economic incentives are given to affected fisher households, in the form of food and AIGA, to compensate for their losses during short-term fishing bans and encourage them to comply with the regulations [32].

### 5.2.1. Economic incentives for fisher households

Hilsa fisher households affected by the fishing ban have been

**Table 5**  
Food grain distribution and AIGA programme, 2008–2014.  
Source: [42]

Financial year	No. of <i>upazila</i> (no. of districts)	Food grain distribution		AIGS programme	
		Allocated amount (tonnes)	No. of households	Allocated money per household (USD)	No. of households
2008–09	59 (10)	5730	143,252	–	–
2009–10	59 (10)	19,769	164,740	3.91	4388
2010–11	85 (15)	14,471	186,264	6.67	6869
2011–12	85 (15)	22,352	186,264	7.56	7785
2012–13	88 (16)	24,748	206,229	1.68	1743
2013–14	81 (15)	35,856	224,102	1.51	1165

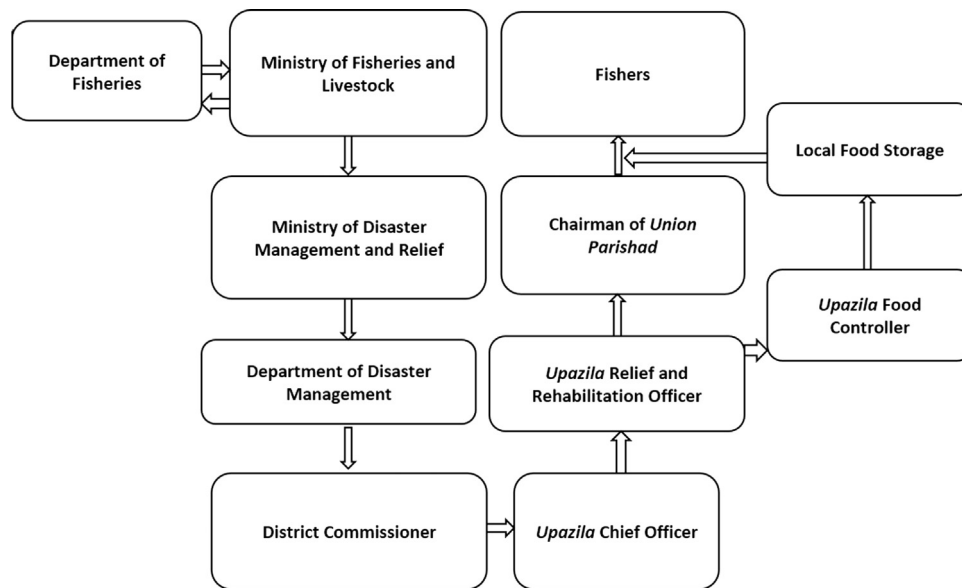
given 40 kg of rice per month since 2013 (an increase on the previous allowance) during the ban period. Table 5 shows the annual increase of the food grain distribution and AIGA programme between 2008 and 2014. In the financial year 2008–2009 rice was given to 143,252 households in 59 *upazilas*, covering 10 districts. The programme's reach has increased gradually over time and in 2013–2014 rice was given to 224,102 households in 81 *upazilas* across 15 districts.

Although DoF is the project's lead agency, its implementation is supported by various other government agencies. The district administration office, sub-district administration office, district and sub-district level disaster management office, local *union parishad* (the lowest tier of the administrative hierarchy) and local fishing communities help provide incentives to fishers during the fishing ban period, in the form of rice and alternative income generating support [42]. The country's navy, coast guard, police, Rapid Action Battalion, air force and Border Guard Bangladesh help run mobile courts to enforce the fisheries regulations [42]. The DoF implements the project through its three units: the central office (based in Dhaka), the district fisheries office and the *upazila* fisheries office. Fig. 5 shows the distribution of food grains from the top level of government to the hilsa fisher households. Based on the requirement of food grains produced by the DoF, the MoFL contacts and coordinates with other ministries or agencies in order to distribute food grain to the fishers.

### 5.2.2. Alternative income generation activities

The objective of the AIGA programme is to improve the livelihoods of households affected by fishing restrictions. The programme provides need-based training, refresher courses and microcredit to enable hilsa fishers to undertake effective AIGAs [10]. Some households have been provided with rickshaws, goats, cows (for fattening) or sewing machines, as well as cash for small businesses, net making, poultry, plant nurseries, kitchen gardening and cage culture [43]. The trainees are provided with a daily meal and about USD 6.50 to attend the training [10]. Table 5 shows the annual increase of food grain distribution and the AIGA programme between 2008 and 2014. In contrast to the grain distribution, the AIGA programme was only delivered to a small number of fisher households. In the financial year 2009–2010 AIGA (costing about USD 4 per household) was given to only 4388 households in 59 *upazilas*, covering 10 districts. In the following two years the coverage and amount increased gradually; however, the total number of recipient households and amount of support decreased sharply in the financial years 2012–2013 and 2013–14 (Table 5). The reasons for this lack of engagement are discussed in Section 6.

<sup>11</sup> According to the exchange rate on 8 October 2014.



**Fig. 5.** Food grain distribution flow chart (Source: Modified after Habib (2014)).

**Table 6**  
Jatka conservation activities by law enforcing agencies.  
Source: Modified after [42]

Year	Mobile court sessions	Total number of operations	Jatka seized (tonnes)	Number of court cases	Number of prison sentences	Total amount in fines (USD)
2011–2012	1098	2832	123	275	167	8262
2012–2013	894	2910	123	398	104	9554
2013–2014 (6 months)	928	2925	164	543	338	22,077

**Table 7**  
Brood hilsa conservation activities by law enforcing agencies.  
Source: Modified after [42]

Year	Mobile court sessions	Total number of operations	Hilsa seized (tonnes)	Number of court cases	Number of prison sentences	Total amount in fines (USD)
2011	580	1440	215	454	477	16,525
2012	1020	4402	61	559	902	17,041
2013	1000	4843	27	954	474	33,050

### 5.3. Enforcing regulations

Tables 6 and 7 show the *jatka* and brood hilsa conservation activities respectively by law enforcement agencies. Each year law enforcement agencies run a number of mobile courts and other operations to seize illegal *jatka* or hilsa catches and file cases against offending fishers under the Mobile Court Ordinance 2007. Many of these fishers are given prison sentences, fines or both. Yet despite these efforts, the number of cases is increasing rather than decreasing year by year.

## 6. An assessment of the conservation programme

Perceptions of the hilsa conservation programme in general, and *jatka* conservation and its economic incentives in particular,

are both significantly positive and negative. Supporters see the conservation measures as an effective way to increase fish production, while those against it point to the socioeconomic losses to fishers, the vast majority of whom are poor [15]. This section offers a critical assessment of the legal and institutional challenges and opportunities for hilsa shad conservation, especially the economic incentives, based on interviews with key informants and focus group discussions (FGDs).

### 6.1. Challenges to the programme design

- Some hilsa sanctuaries are not accurately demarcated.** There are five sanctuaries in which fishing is prohibited at certain times of year (Section 4, Table 3) and incentives are given to fishers to compensate for the short-term loss of earnings during this ban. However, the sanctuary areas are not always accurately demarcated. For example, some key informants reported that a sandbar near Chandpur has restricted hilsa migration, resulting in very low hilsa numbers in surrounding areas; yet these areas are still included in the sanctuary and the local fishers are given incentives during the fishing ban period. The key informants argued that these incentives are wasted by being given to non-target fishers. They emphasised the need for more accurate demarcation and identification of sanctuaries in the near future, especially given changing environmental conditions caused by pollution, siltation, and climate change. Rokop [44], Chen et al. [45] and Hossain et al. [46] suggest that a more efficient and dynamic habitat model may further improve the process of

identifying critical habitats. It could incorporate variables such as bathymetry,<sup>12</sup> water currents, primary productivity,<sup>13</sup> abundance of food, turbidity,<sup>14</sup> numbers of egg and fry and tracking broods to help identify the hilsa's spawning, hatching, feeding and nursery grounds.

- **The fishing ban period in sanctuary areas is not properly enforced.** Some fishers still manage to catch hilsa in sanctuary areas during the ban period. Information gathered from focus group discussions (FGDs) suggested that in the Chandpur District, 5–8 per cent of fishers flout the ban. The key informants and FGDs reported that illegal fishing mainly takes place in the evening when law enforcement teams are less vigilant. This identifies a weakness in the way that institutions are enforcing the 1985 Marine Fisheries Rules; a more efficient arrangement is needed. A few key informants also said that sometimes fishers bribe local law enforcement officers in order to fish illegally, highlighting a weakness in local governance that is rooted in institutional culture nationally. Good governance at both local and national levels is therefore important for a fully successful hilsa conservation programme; accountability and the rule of law are keys in the context of effective PES [16].
- **Incentives are only given to hilsa fishing households.** All types of fishing are banned in the five sanctuary areas for the specific period but incentives are only given only to hilsa fisher households. Non-hilsa fisher households feel this discriminates against them since they too suffer from the ban. Some are now turning to hilsa fishing in order to receive the incentives, according to FGD participants. Excluding non-hilsa fishers from the incentive programme may lead to more overexploitation of hilsa, as well as increasing the number of hilsa fishers – which puts pressure on the incentives budget. Thus all fishers affected by the fishing ban need to be served by the incentive programme.
- **The banned monofilament net (current jal) used for jatka fishing is still openly produced and marketed.** Manufacturers of the net have filed a case against the 2002 amendment to the 1950 Fish Protection and Conservation Act, which banned production, storage and marketing of the net. This case has yet to be resolved by the High Court of Bangladesh. All the respondents in this study, including the commissioning agents (*aratdars*), agreed that the government needs to make every effort to get a verdict in their favour as soon as possible. One interviewee says that if this net can be fully banned at every level, illegal fishing will fall by 80 per cent.
- **Cases of illegal jatka fishing have increased.** The key informants from government departments claimed that people are now more aware of the need to conserve hilsa. Bhola (2012; cited in [10]) reported that compensation packages or economic incentives are highly effective in enforcing regulatory measures. The data show that during the first few years of the hilsa conservation project illegal *jatka* fishing cases decreased significantly due to the combined effect of the economic incentives, enforcement of fisheries regulations and raising awareness among fishers. After that, however, cases of illegal *jatka* fishing started to rise again (see Section 4, Table 6). This indicates that the effectiveness of any or all of the above – economic incentives, enforcement of fisheries regulations and

- raising awareness among fishers – is declining in recent years.
- **Incentives are not given during all fishing ban periods.** Currently, incentives are given during the *jatka* fishing ban period. But no incentive is given during the fishing ban period over the hilsa spawning season (11 days in October). Direct incentives during this period would be helpful for fishers, as one key interviewee emphasised.
- **Key players in the hilsa fishing industry do not support the conservation programme.** Boats owners, commissioning agents (*aratdars*) and big seine net operators are key fishery players who control most fishing activity; they provide boats, credit and large nets.<sup>15</sup> Currently they receive no incentives during the fishing ban period, and it emerged during focus group discussions that they do not support the hilsa conservation programme. One seine net owner said, 'although fishing is banned, some fishers still managed to catch *jatka* using low-cost *current jal* that can be easily removed if a law enforcing agency chases them. But we do not operate our big seine nets [during the fishing ban period] that need at least two hours to put in and haul out and are easily caught by the law enforcing agency.' An interviewee therefore argued that the boat owners, big seine net operators and *aratdars* should also be included in the programme.
- **Households receive inadequate incentives.** Each fishing household is allocated 40 kg of rice during the *jatka* fishing ban period. However, households report receiving only 25–32 kg each. DoF officers, on the other hand, say that each household receives 35–38 kg. DoF officers explained that the government does not provide all the money and resources required to distribute the rice, and so additional costs are met by selling a proportion of the rice intended for each household. All the fishers said that the amount of rice they receive (25–32 kg) is inadequate for a household for a month. They said that a full 50 kg per month would be enough. Thus the amount of food grain should be increased, as well as sufficient resources provided (both financial and institutional) to ensure proper distribution of the rice.
- **Household size is not taken into account when giving incentives.** A bigger household needs more rice than a smaller one, but currently all households receive the same amount of rice. Thus household size should be taken into consideration when allocating grain.
- **Few fishers engage with support for alternative income generating activities (AIGA) considering the number of eligible fishers, with a further decrease over the last two years.** While 186,000 households received rice in the financial year 2012–2013, only 7785 fishers engaged in AIGA – and this dropped to 1743 the following year (see Section 5, Table 5). Most of the key informants interviewed said that the AIGA support on offer was not helpful; fishers often lack the required skills or motivation to make use of any AIGA materials they are given (such as a sewing machine). This demonstrates a lack of stakeholder engagement in the AIGA needs assessment process. AIGA should only be given after properly assessing fishers' needs. Funding should also be increased.
- **During fishing ban period fish consumption falls to zero** in many fisher households, according to half of the FGD participants. During normal fishing periods, fishing households usually consume less commercially important fish caught along with the hilsa, but this is not possible during the fishing ban period, and fish available in the market goes up in price. This considerably reduces their nutritional intake. For children and

<sup>12</sup> Bathymetry is the study and mapping of seafloor topography.

<sup>13</sup> Primary productivity is a measure of the rate at which new organic matter is developed through photosynthesis and chemosynthesis in producer organisms based on the oxygen released and carbon taken in: the transformation of chemical or solar energy to biomass.

<sup>14</sup> Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates.

<sup>15</sup> These nets are typically more than 200 m long and operated by 20–35 people.

pregnant women, not having enough nutrition over a significant period may have a serious impact on their health. More research is needed into food consumption during this ban period, and if a risk of nutritional deficiency is found, fishing households will need to be compensated with other nutritious food as well as rice.

- **Fisher households need further financial support.** All the fishers pointed out that during the fishing ban period they also need to pay for other things, like groceries and children's schooling, for which no support is available. They would like support in those areas if possible.

## 6.2. Challenges for implementing agencies

Thus the conservation and economic incentive programme is facing some challenges. This is further complemented by the existing institutional capacity and framework of the planning and implementation agencies – DoF and BFRI.

### 6.2.1. Department of fisheries

- **The Department of Fisheries lacks crucial human resources,** according to almost all the government key informants. As outlined in Section 4.2, the lowest unit of the DoF's institutional structure is the Upazila Fisheries Office in each *upazila* or sub-district (apart from 10 *upazilas* in hilly areas). This office only has three main staff, excluding support staff: Upazila Fisheries Officer (UFO), Assistant Upazila Fisheries Officer (AUFO) and Field Assistant. The responsibilities of these staff include fisheries development, extension of fisheries technology, fishers' skills and capacities, and enforcement of fisheries regulations. The hilsa conservation programme requires a significant amount of their time, enforcing regulations and providing food grain and AIGA support, on top of their regular duties and responsibilities. In hilsa conservation areas the fisheries officers become too occupied with the conservation project to properly carry out their other duties. All the key informants from the DoF recommended creating a new post, 'Fisheries Regulations Officer' (FRO), for each of the *upazilas* in the sanctuary area, to focus solely on the hilsa conservation work of enforcing regulations and providing food grain and AIGA support. An FRO would need to be given sufficient training and authority to work in this role. This new post would not only help smooth the implementation and development of hilsa conservation programme but would also increase the overall strength of the DoF. It would, however, require additional funding.
- **In Upazila Fisheries Offices the three main posts described above are sometimes left vacant,** as the government tends not to fill them quickly. The absence of an Upazila Fisheries Officer or Senior Upazila Fisheries Officer (UFO or SUFO; the latter is the member secretary of the hilsa conservation programme) is especially harmful to the programme. Where the UFO is absent, the AUFO serves as an acting UFO. Unlike the UFO, a first-class officer post, the AUFO is a second-class non-officer post. In the absence of a UFO, it can be difficult for the AUFO to coordinate the hilsa conservation programme – both running the mobile courts and providing incentives to fishers – as it involves coordinating with mainly first class officers in other government agencies. Most key informants asked that vacant UFO posts be filled as soon as possible.
- **Gathering the 'mobile court' team in time to enforce fishery regulations is difficult.** The court operates under the Mobile Court Ordinance 2007, giving powers to the magistrate to punish offenders immediately at the site of the offence. This court can also ask for support from police or other agencies. However, to work effectively the mobile court needs a team of

six to eight people from different government bodies, but this does not happen in practice. For example, a magistrate needs to be present in the team in order to convict illegal fishers. But magistrates are rarely available during mobile court operations. If an illegal fisherman is caught at night, the team needs to wait until 9 am the following day to bring the offender before the magistrate. The team therefore has a tense and sleepless night, which discourages them from future nighttime operations. Key informants from the Department of Fisheries recommended giving magistracy powers (or at least partial powers, such as fining) to the fishery officer present in the team, so that no magistrate is needed. This would, however, require an amendment of the Mobile Court Ordinance 2007.

- **Police officers are not always available for the mobile court.** It also needs a police presence in order to operate. However, during the main fishing ban period (January–April) police in Bangladesh have examination duties at the secondary and higher secondary schools. As running a mobile court needs various people to be coordinated from different sources, the key informants from the DoF asked for a separate mobile court team to be appointed headed by the fishery regulation officer, especially during the fishing ban period.
- **The mobile court team lacks physical resources.** Currently the mobile court team hires motorboats to patrol the fishing ban area, and these are often less powerful than the fishers' boats. Motorboats are also not always available to hire. To avoid this problem the mobile court team should have their own boat with a powerful engine to pursue illegal fishers.
- **The mobile court team lacks financial resources.** The budget currently available for running the mobile court is inadequate. One interviewee said, 'We get only half of the money to run the courts. There are some de facto costs (such as providing the team with food) which are not covered'. Thus a larger budget is needed to run the mobile court.

### 6.2.2. Bangladesh Fisheries Research institute

The BFRI is not the agency responsible for carrying out the hilsa conservation programme, nor is it involved in distributing food or AIGA. The BFRI is, however, responsible for providing accurate information through its research in order to successfully implement and improve the conservation programme. For this project the BFRI has upgraded its laboratory and bought a new research vessel. However, the BFRI researchers identified other related capacity needs.

- **The BFRI lacks an adequate number of both research assistants and scientists.** The current staff also need better training on how to conduct research, especially research design, data collection and analysis, and report writing to a standard that could be published in scientific journals. Publication would help implement and improve the hilsa conservation programme by making research findings more accessible to peers in the field. As one of the key informants from BFRI said, 'Our young colleagues need training on research skills in order to conduct research properly'. Instead, they are obliged to spend a lot of time on logistics and administrative work. Support workers are needed to take on these duties.
- **The BFRI lacks adequate resources to conduct hilsa biology research.** As observed in earlier sections, one key to the conservation programme's success is the accurate identification of hilsa breeding grounds, *jatka* grazing grounds and hilsa migration routes. Although these areas have already been identified, levels of uncertainty remain – posing a challenge to the programme. For example, the focus group discussion reported earlier in this section highlighted that the fish sanctuary area in the Chandpur area was not properly demarcated. This



inaccuracy may be due to previous research proving unreliable, or changing environmental conditions. More sophisticated research will be needed in this area in the near future, as hilsa habitats are influenced by shifting hydrology, siltation, pollution and climate change. BFRI has limited capacity to conduct this kind of research. For example, one of the key informants said, 'in order to identify hilsa migration routes we need improved quality tags that we currently do not have.' BFRI's laboratory facilities are limited and there are few trained researchers available to conduct hilsa biology research; this has an indirect influence on payments for hilsa conservation.

- **Coordination between research bodies is lacking.** Some available research findings were used to frame the hilsa conservation programme and its payments. However, most hilsa research is not published in accessible sources such as journals, and is therefore not used. Coordination is also lacking between research carried out at government institutes (such as BFRI) and at other bodies such as universities. Although BFRI is a partner agency and responsible for research relating to the hilsa conservation programme, there are more than a dozen public government-funded university research institutions conducting research related to fisheries. Universities in Bangladesh currently carry out both basic and applied fisheries research according to their own agendas, and research on hilsa is sporadic. Given the importance of hilsa, its conservation programme and the limited capacity of the BFRI, universities and other research institutions should be asked to conduct research that will directly benefit the hilsa conservation programme. The government's MoFL, Ministry of Education and Ministry of Science and Technology could coordinate with universities and facilitate this research.

## 7. Conclusions and recommendations

Hilsa, the national fish of Bangladesh, generates employment and income for millions of people in Bangladesh, India and Myanmar; the hilsa fishery is worth over USD 2 billion. Hilsa also remains a subsistence food for many poor coastal communities. After increasing steadily until the last decade Bangladesh's hilsa catch started to decline – mainly due to overexploitation by poor fishers. To conserve and exploit hilsa sustainably, the government of Bangladesh took several regulatory measures from 2003 such as banning fishing for certain periods of the year and in certain areas. To compensate poor fisher households for lost earnings during the short-term fishing ban, as well as to encourage compliance with the conservation measures, each affected fisher household is given direct economic incentives in the form of food grain and support for alternative income generating activities (AIGA). Although the hilsa catch has increased since the conservation measures were taken, this does not necessarily mean that this payment for ecosystem services (PES) scheme is either equitable or sustainable in the long term. This study, based on secondary and primary information, sets out to provide an analysis of the legal and institutional framework. It helps to identify challenges and opportunities in order that an improved framework can better complement the conservation programme.

This study has identified a range of legal and institutional challenges both in the design and implementation of the economic incentives for the hilsa conservation programme. These include: lack of accurate demarcation and identification of the sanctuaries; inclusion of non-target fishers in the incentive programme, and exclusion of non-hilsa fishers; exclusion of powerful stakeholders such as boat owners, big seine nets operator and commissioning agents from the incentive programme; distribution of rice alone without more nutritious food; not taking household size into

consideration while distributing rice; a lack of stakeholder engagement in the AIGA needs assessment process; weak institutional arrangements for the enforcement of fisheries regulations; lack of good governance at the local level; a slow judiciary system to resolve cases related to hilsa fishing; and a lack of awareness among fishers about the long-term benefits of hilsa conservation. These challenges are accompanied by some institutional challenges for the Department of Fisheries (DoF) and the Bangladesh Fisheries Research Institute (BFRI). For the DoF the challenges are a lack of human resources to implement the conservation programme properly; a lack of human resources from other supporting agencies such as police and magistrates to operate the mobile courts and enforce regulations; a lack of power for fisheries officers to enforce the regulations; and inadequate physical and financial resources to carry out enforcement. For the BFRI the challenges are a shortage in number and quality of researchers to conduct rigorous research on hilsa conservation issues; a lack of adequate research facilities; and the absence of communication and coordination with other research institutes and universities to carry out such research.

### 7.1. Recommendations for programme design

To overcome the challenges to the design of the hilsa conservation and economic incentive programme, this study recommends:

- accurately demarcating and identifying hilsa sanctuaries
- excluding non-target fishers from the incentive programme
- including non-hilsa fishers in the incentive programme
- including powerful stakeholders such as boat owners, big seine net operators and commissioning agents in the incentive programme
- distributing other necessities such as nutritious food as well as rice
- taking household size into consideration while distributing incentives
- ensuring stakeholder engagement in the AIGA need assessment process.

Carrying out these recommendations would mean amending some of the existing legal frameworks and legislation. The Protection and Conservation of Fish Rules (1985) would need an amendment to revise the sanctuary area boundaries, exclude non-target fishers and include non-hilsa fishers and other key stakeholders in the economic incentives programme. However, carrying out the other recommendations would not require any changes to the existing legal framework.

### 7.2. Recommendations for programme implementation

The implementation of the hilsa conservation and economic incentive programme presents further challenges. To overcome them, this study recommends:

- putting effective institutional arrangements in place to enforce fisheries regulations
- ensuring good governance at both local and national level
- speeding up the judicial system to resolve cases related to hilsa fishing
- increasing awareness among fishers of the long-term benefits of hilsa conservation.

These recommendations also involve amending legislation: the Mobile Court Ordinance 2007 would need an amendment to provide magistracy powers to the fisheries officers. The other

recommendations do not involve changing the legal framework so much as ensuring that existing legislation is implemented properly.

### 7.3. Recommendations for agencies

To carry out the hilsa conservation and economic incentive programme effectively, the Department of Fisheries needs the support of additional human, physical and financial resources. It is particularly pressing to create a new post of 'Fisheries Regulation Officer', a role that would focus entirely on the conservation programme. Better institutional arrangements are needed so that the DoF officers can get the required manpower when necessary from supporting agencies to enforce regulations. BFRI capacity should be increased in terms of number and quality of researchers and better research facilities, in order to carry out rigorous research on hilsa conservation. The BFRI could also collaborate with universities and other research institutions. The MoFL, Ministry of Education and Ministry of Science and Technology could co-ordinate with the universities and facilitate this research.

### Acknowledgements

The authors would also like to thank to all the participants of the focus group discussions and interviews without whom none of this would have been possible. This research and publication was funded by Defra's Darwin Initiative (grant number 20-015) and the Department for International Development (DFID); however the views expressed do not necessarily reflect the views of the UK Government.

### References

- [1] Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being: General Synthesis*, Island Press, Washington, DC, 2005.
- [2] N. Landell-Mills, I.T. Porras, Silver Bullet or Fool's Gold? A Global Review of Markets for Forest Environmental Services and Their Impact on the Poor, International Institute for Environment and Development, London, 2002.
- [3] M. Grieg-Gran, I. Porras, S. Wunder, How can market mechanisms for forest environmental services help the poor? Preliminary lessons from Latin America, *World Dev.* 33 (9) (2005) 1511–1527.
- [4] S. Pagiola, A. Arcenas, G. Platais, Can payments for environmental services help reduce poverty? An exploration of the issues and the evidence to date from Latin America, *World Dev.* 33 (2) (2005) 237–253.
- [5] FAO (Food and Agriculture Organization of the United Nations), *The State of Food and Agriculture 2007: Paying Farmers for Environmental Services*. FAO Agriculture Series 38, FAO, Rome, 2007. <ftp://ftp.fao.org/docrep/fao/010/a1200e/a1200e00.pdf>.
- [6] S.J. Scherr, J.C. Milder, L. Lipper, M. Zurik, Payments for Ecosystem Services: Potential Contributions to Smallholder Agriculture in Developing Countries, *Ecoagriculture Partners and Food and Agriculture Organization*, Washington D.C. and Rome, 2007.
- [7] S. Pagiola, A.R. Rios, A. Arcenas, Can the poor participate in payments for environmental services? Lessons from the Silvopastoral Project in Nicaragua, *Environ. Dev. Econ.* 13 (3) (2008) 299–325.
- [8] L. Peskett, D. Huberman, E. Bowen-Jones, G. Edwards, J. Brown, Making REDD Work for the Poor. Poverty Environment Partnership, International Union for Conservation of Nature, Gland, Switzerland, 2008.
- [9] J.C. Milder, S.J. Scherr, C. Bracer, Trends and future potential of payment for ecosystem services to alleviate rural poverty in developing countries, *Ecol. Soc.* 15 (2) (2010) 4.
- [10] E.Y. Mohammed, M.A. Wahab, Direct Economic Incentives for Sustainable Fisheries Management: The Case of Hilsa Conservation in Bangladesh, International Institute for Environment and Development (IIED), London, 2013.
- [11] E.B. Barbier, Progress and challenges in valuing coastal and marine ecosystem services, *Rev. Environ. Econ. Policy* 6 (1) (2012) 1–19.
- [12] DoF (Department of Fisheries), National Fisheries Week 2012, Department of Fisheries, Government of Bangladesh, Dhaka, 2012.
- [13] M.M. Islam, S. Sallu, K. Hubacek, J. Paavola, Limits and barriers to adaptation to climate variability and change in Bangladeshi coastal fishing communities, *Mar. Policy* 43 (2014) 208–216.
- [14] M.M. Islam, S. Sallu, K. Hubacek, J. Paavola, Vulnerability of fishery-based livelihoods to the impacts of climate variability and change: insights from coastal Bangladesh, *Reg. Environ. Change* 14 (1) (2014) 281–294.
- [15] M.A.L. Siddique, Conservation of juvenile hilsa (*Jatka*) in Bangladesh: Need to address the livelihood of fishers, in: American Fisheries Society Symposium, vol. 69, 2009, pp. 757–768.
- [16] T. Greiber, Payments for Ecosystem Services: Legal and Institutional Frameworks, International Union for Conservation of Nature, Gland, Switzerland (2009), p. 296.
- [17] S. Engel, C. Palmer, Payments for environmental services as an alternative to logging under weak property rights: the case of Indonesia, *Ecol. Econ.* 65 (2008) 799–809.
- [18] E. Corbera, C.G. Soberanis, K. Brown, Institutional dimensions of payments for ecosystem services: an analysis of Mexico's carbon forestry programme, *Ecol. Econ.* 68 (2009) 743–761.
- [19] EMOHA (East Midlands Oral History Archive), How do I conduct an oral history interview? Information sheet no. 2, EMOHA, Leicester Centre for Urban History, University of Leicester, Leicester. ([www.le.ac.uk/emoha/training/no2.pdf](http://www.le.ac.uk/emoha/training/no2.pdf)) (accessed 09.01.11).
- [20] J.W. Creswell, V.L.P. Clark, *Designing and Conducting Mixed Methods Research*, Sage Publications, Thousand Oaks, California, 2007.
- [21] D. Coldwell, F. Herbst, Business Research, Juta Academic, Cape Town, 2004.
- [22] S.R. Pillay, H. Rosa, Synopsis of Biological Data on Hilsa, *Hilsa ilisha* (Hamilton) 1822. FAO Fisheries Synopsis no. 25, Food and Agriculture Organization of the United Nations, Rome, 1963.
- [23] M.A. Rahman, M.A. Alam, S.J. Hasan, M. Jaher, Hilsa fishery management in Bangladesh, in: Hilsa: Status of Fishery and Potential for Aquaculture, Anon (ed.), Proceedings of the Regional Workshop held in Dhaka, The WorldFish, Bangladesh and South Asia Office, Dhaka, 16–17 September 2012, pp 40–60.
- [24] DoF (Department of Fisheries), *Jatka Conservation Week*. DoF, Ministry of Fisheries and Livestock, Dhaka, 2013.
- [25] BOBP (Bay of Bengal Programme), *Marine Small-Scale Fisheries of Bangladesh: A General Description*, Development of Small-Scale Fisheries in the Bay of Bengal, BOBP, Madras, India, 1985.
- [26] M. Hasan, M.M. Billah, T.K. Roy, Tourism and fishing community of Kuakata: A remote coastal area of Bangladesh, Part 1, Support for University Fisheries Education and Research Project, Department for International Development, London, 2004.
- [27] N. Akter, K. Ahmed, M.S. Islam, S. Koo, An economic study on small-scale marine fishing in Teknaf of Cox's Bazar district of Bangladesh, *South Asia Res.* 15 (2009) 289–313.
- [28] DoF (Department of Fisheries), *Fisheries Statistical Yearbook of Bangladesh (2007–2008)*. Fisheries Resources Survey System, Department of Fisheries, Government of Bangladesh, Dhaka, 2009.
- [29] A.K.A. Rahman, *The Small-Scale Marine Fisheries of Bangladesh*, Department of Fisheries, Government of Bangladesh, Dhaka, 1994.
- [30] H. Ahmed, Pre- and post-harvest handling and processing procedures for the production of safe and high quality fresh fisheries products in Bangladesh: Final project 2007, Fisheries Training Program, United Nations University, Reykjavik, 2007.
- [31] M.S. Ahmed, M.S. Alam, H. Akther, Livelihood assessment of a jatka fishing community at north Srirumthi village, Chandpur, Bangladesh, *S. Pac. Stud.* 29 (2009) 1–12.
- [32] DoF (Department of Fisheries), *Jatka conservation, alternate income generation for the jatka fishers and research project*. Development project proposal, Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh, Dhaka, 2008.
- [33] G.C. Haldar, M.R. Islam, M.S.I. Akanda, Implementation Strategies of Hilsa Fisheries Conservation and Development Management (in Bengali). Fourth Fisheries Project, Department of Fisheries, Ministry of Fisheries and Livestock, Dhaka, 2004.
- [34] S.M.N. Amin, M.A. Rahman, G.C. Haldar, S. Nahar, S. Dewan, M.A. Mazid, Population Dynamics of Jatka (juvenile hilsa) in the Meghna River, 13, *Asian Fisheries Science*, Bangladesh (2000), pp. 383–389.
- [35] G.C. Haldar, Present Status of the Hilsa Fisheries in Bangladesh: A Report on Hilsa Management Development and Conservation Studies Conducted under the ARMDCS, GEF Component, Fourth Fisheries Project, Report no. 38.8, Department of Fisheries, Matshya Bhaban, Dhaka, 2004.
- [36] G.C. Haldar, A.U. Ahmed, A. Islam, Reclamation, Conservation and Development Techniques of Hilsa Habitat. In: Jatio Matshya Pakkha (National Fisheries Fortnight) 2005, Department of Fisheries, Ministry of Fisheries and Livestock, Dhaka, 2005.
- [37] FAO (Food and Agriculture Organization of the United Nations), *Small-scale and artisanal fisheries*. FAO, Rome, 2014. ([www.fao.org/fishery/topic/14753/en](http://www.fao.org/fishery/topic/14753/en)) (accessed 10.10.14).
- [38] M. Rahman, G. Naevdal, Population genetics studies of hilsa shad, *Tenualosa ilisha* (Hamilton), in Bangladesh waters: Evidence for the existence of separate gene pools, *Fish. Manag. Ecol.* 7 (2000) 401–412.
- [39] MoFL (Ministry of Fisheries and Livestock), Circular SRO No 301 Law/2011, Bangladesh Gazette (Extra), Ministry of Fisheries and Livestock, Government of Bangladesh, Dhaka, 2011.
- [40] M.A. Mome, The Potential of the Artisanal Hilsa Fishery in Bangladesh: An Economically Efficient Fisheries Policy, Fisheries Training Programme, Reykjavik, 2007.
- [41] S.R. Reza, Upazila Fisheries Officer, Monpura Upazila, Bhola District, Personal Communication, 21 September 2014.
- [42] A.B.M.Z. Habib, Determination and implementation of action plan for development and sustainable management of national fish hilsa. Paper presented (in Bengali) at Planning Commission workshop, Dhaka, 2014.

- [43] M.S. Alam, Hilsa fisheries management in Bangladesh: a paradigm in natural resources, in: Hilsa: Status of Fishery and Potential for Aquaculture, Anon (ed.), Proceedings of the Regional Workshop held in Dhaka, The WorldFish, Bangladesh and South Asia Office, Dhaka, 16–17 September 2012, pp. 224–238.
- [44] F.J. Rokop, Patterns of reproduction in the deep-sea benthic crustaceans: a revolution, *Deep-Sea Res.* 24 (1977) 683–692.
- [45] X. Chen, G. Li, B. Feng, S. Tian, Habitat suitability index of Chub Mackerel (*Scomber japonicus*) from July to September in the East China Sea, *J. Oceanogr.* 65 (2009) 93–102.
- [46] M.S. Hossain, S. Sarker, S. Chowdhury, S.M. Sharifuzzaman, Discovering spawning ground of Hilsa shad (*Tenualosa ilisha*) in the coastal waters of Bangladesh, *Ecol. Model.* 282 (2014) 59–68.
- [47] E.Y. Mohammed, (E.d.), 2014. Economic incentives for marine and coastal conservation: prospects, challenges and policy Implications. Routledge, Oxon.